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Aerospace Engineering and Mechanics

Contact Information—Chair, Graduate Admissions Committee, Department of Aerospace Engineering and Mechanics, University of Minnesota, 107 Akerman Hall, 110 Union Street S.E., Minneapolis, MN 55455 (612-625-8000; fax 612-626-1558; e-mail dept@aem.umn.edu; <www.aem.umn.edu>.

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James B. Serrin, Jr., (emeritus), Mathematics, FM

Professor

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Gary J. Balas, FM
Gordon S. Beavers, FM
Graham V. Candler, FM
Roger Fosdick, FM
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Associate Professor

Ellen K. Longmire, FM
Thomas W. Shield, FM
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Adjunct Associate Professor

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Assistant Professor

Ashley James, FM
Yohannes Ketema, AM
Krishnan Mahesh, FM
Ivan Marusic, FM
Krishnan Mahesh, FM
Mehran Mesbahi, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The department offers graduate study in two major fields, mechanics and aerospace engineering. The graduate programs emphasize engineering sciences that are basic to these fields: fluid mechanics, aerospace systems, and continuum and solid mechanics. Theoretical, analytical, experimental, and computational aspects of these fields are covered by the courses and research opportunities offered by the department.

Prerequisites for Admission—A four-year B.S. degree in an engineering, basic science, or mathematics program is required. Admission depends primarily on the applicant’s undergraduate record and letters of recommendation.

Special Application Requirements—GRE scores are not required but are strongly recommended for students applying for graduate fellowships. In all cases, these test scores are taken into account if provided.

Students are admitted fall semester only. Only under unusual circumstances are students allowed to begin their studies at another time during the academic year.

Use of 4xxx Courses—Programs can contain no more than 2 courses at 4xxx.

Courses—Please refer to Aerospace Engineering and Mechanics (AEM) in the course section of this catalog for courses pertaining to the program.

M.Aero.E. Coursework Only and Design Project Degree Requirements

The M.Aero.E. program emphasizes applications of fluid mechanics, aerospace systems, and continuum and solid mechanics in aerospace engineering. The program must include at least 12 credits of 5xxx or 8xxx courses. In addition to the minimum credit requirement, the student must demonstrate an understanding of aerodynamics and aerospace vehicle mechanics, either from previous study or from additional coursework in the graduate program.

Language Requirements—None.

Final Exam—The final exam is oral.

M.S.Aero.E. Degree Requirements

This program emphasizes coursework in engineering sciences that are basic to this field: fluid mechanics, aerospace systems, and continuum and solid mechanics. Plan A requires 30 graduate credits, a minimum of 20 course credits and 10 thesis credits. No seminar credits can be used to satisfy the 20-course credit requirement. Plan B requires 30 credits including the 3 credit plan B project course. Of the remaining 27 credits a minimum of 24 credits of coursework is required and no seminar credits can be used to satisfy this 24-credit requirement. If seminar credits are used to meet the 30 credit requirement, they must be in one-credit modules.

For both Plan A and Plan B, the program must include at least one sequence of 8xxx courses in aerospace engineering and no more than 8 credits of 4xxx courses. Also, the student must demonstrate an understanding of aerodynamics and aerospace vehicle mechanics, either from prior study or from additional coursework beyond the 30-credit minimum.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—At least one sequence of two 8xxx courses in aerospace engineering is required.

M.S. Degree Requirements—Mechanics

The M.S. program in mechanics emphasizes coursework in fluid mechanics, aerospace systems, and continuum and solid mechanics. Theoretical, analytical, experimental, and computational aspects of these subjects are covered by the courses and research opportunities offered by the department.
Plan A requires 30 credits; a minimum of 20 course credits and 10 thesis credits. No seminar credits can be used to satisfy the 20-course credit requirement.

Plan B requires 30 credits for the degree. This total includes the 3 credit Plan B project course. Of the remaining 27 credits, a minimum of 24 credits of coursework is required and no seminar credits can be used to satisfy this 24 credit requirement. If seminar credits are used to meet the 30 credit requirement for the degree, the seminar credits must be in one-credit modules.

For both the Plan A and Plan B, the program must include at least one sequence of 8xxx courses in mechanics and no more than 8 credits of 4xxx courses. The student must also demonstrate a breadth of knowledge in mechanics, either from previous study or from coursework in more than one M.S. subfield of mechanics.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—At least one sequence of two 8xxx courses in mechanics is required.

Ph.D. Degree Requirements—Aerospace Engineering

The Ph.D. program emphasizes coursework and research in engineering sciences that are basic to this field. Many of the courses offered by the department serve both major fields: aerospace engineering and mechanics. The difference between these major fields is most apparent in the thesis topics, which for aerospace engineering concern aerodynamics and aerospace systems.

The Ph.D. requires about two years of coursework, but the heart of the program is the thesis research. The program must contain a minimum of 42 credits of approved courses and four semesters of colloquium attendance. Of the 42 credits, a minimum of 36 credits must be in approved coursework, not including seminar credits. If seminar credits are used to meet the 42 minimum credit requirement they must be in one-credit modules. The program also must include at least four 8xxx courses in aerospace engineering (at least four 8xxx courses in mechanics for the Ph.D. in mechanics—see below) and can contain no more than two 4xxx courses. The first year of the Ph.D. program is similar to the master’s program and most Ph.D. students receive the master’s degree. The second year is devoted to more advanced courses and beginning research. Subsequent years include some coursework with increased focus on research. The time required to complete a research project varies, but most students finish the Ph.D. within five years after the bachelor’s degree.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—At least 12 credits in aerospace engineering are required, including at least one sequence of two 8xxx courses.

Ph.D. Degree Requirements—Mechanics

The Ph.D. program in mechanics emphasizes coursework and research in the subfields of fluid mechanics, aerospace systems, and continuum and solid mechanics. Many courses offered by the department serve both major fields: aerospace engineering and mechanics. The thesis topics for mechanics concern fundamental aspects of dynamical systems, material properties, and fluid and solid behavior.

Ph.D. coursework and credit requirements are the same as those listed for aerospace engineering in the second paragraph above.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—At least 12 credits in mechanics is required, including at least one sequence of two 8xxx courses.

Agricultural and Applied Economics

Contact Information—Department of Applied Economics, University of Minnesota, 231 Classroom-Office Building, 1994 Buford Ave., St. Paul, MN 55108 (612-625-2758; e-mail dgs@apecn.umn.edu; <www.apecn.agri.umn.edu/>)

Regents’ Professor Vernon W. Ruttan (emeritus), FM
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Robert P. King, FM
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Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Graduate study requires an operational knowledge of economic theory and modern methods of quantitative analysis as well as practical application in specialized fields of inquiry, which include agricultural policy, consumption economics, development economics and trade, natural resource and environmental economics, prices and marketing, and production and managerial economics.

Prerequisites for Admission—A grade point average of 3.00 in an undergraduate program and in graduate level work is the minimum standard for admission. Applicants with a bachelor’s degree are, except in a few special cases, considered only for admission to the M.S. program. The following coursework is considered the minimum preparation for admission to the M.S. program: intermediate-level microeconomic and macroeconomic theory, statistics, calculus, and linear algebra. Applicants to the Ph.D. program should also have completed courses in microeconomic and macroeconomic theory at the master’s level. Students lacking background in economics or quantitative methods may be required to complete deficiencies before being accepted into the program.

Special Application Requirements—GRE scores are required for all students. A minimum TOEFL score of 550 (213 on computer-based exam) is required for applicants whose native language is not English, including those with other academic study in the United States. Applicants should provide evidence of superior scholarship, professional experience, and general aptitude for graduate study. Students are admitted any semester but should keep in mind that most assistantships are allocated by the end of February for the following fall semester. Applicants seeking fellowships should submit all application materials by December 15.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is not permitted.

Courses—Please refer to Applied Economics (ApEc) in the course section of this catalog for courses pertaining to the program.
M.S. Degree Requirements

The M.S. prepares students for employment opportunities in the public and private sector and for further graduate study. M.S. students are required to complete graduate level courses in microeconomic theory, macroeconomic theory, and econometrics or statistics, or to have completed equivalent courses prior to entry into the program. Students are also required to participate in a 1 credit M.S. seminar. Both Plan A and B require at least 30 credits, of which at least 14 credits must be in the major field and at least 6 credits must be in a related field or minor. The major field must include a minimum of 7 credits in applied economics (excluding thesis and special topics, independent study, and the M.S. seminar). Plan A requires 10 thesis credits. Plan B requires a 4- to 6-credit project. A minimum GPA of 3.00 in program courses is required for graduation.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students

Majoring in Other Fields—M.S. students must complete at least 9 credits of 5xxx or 8xxx courses in applied economics. Courses for the minor are approved by the director of graduate studies in the Department of Applied Economics. All courses in the minor must be taken A-F and completed with a GPA of 3.00 or better.

Ph.D Degree Requirements

The Ph.D. degree program in agricultural and applied economics prepares students for research, teaching, and extension positions and for research and administrative posts in public and private sector organizations.

The only specific credit or course requirements for the Ph.D. in agricultural and applied economics are a 1 credit seminar and the Graduate School requirement of a supporting field or minor of 12 to 18 credits and registration for 24 doctoral thesis credits. Ph.D. students follow a study program that includes coursework in microeconomic theory, macroeconomic theory, econometrics, and two fields of specialization. One field may be replaced by the approval of the graduate faculty in another graduate program. Courses in economics must be taken in the major field or as part of the supporting field. A minimum GPA of 3.00 in program coursework is required for graduation. Preliminary written exams cover microeconomic theory and fields in agricultural and applied economics. Oral exams are required for approval of the dissertation proposal and for its defense.

Language Requirements—None.

Minor Requirements for Students

Majoring in Other Fields—Ph.D. students must complete at least 15 credits of 5xxx or 8xxx courses in applied economics. Courses for the minor are approved by the director of graduate studies in the Department of Applied Economics. All courses in the minor must be taken A-F and completed with a GPA of 3.00 or better.

Agricultural Engineering

See Biosystems and Agricultural Engineering.

American Studies

Contact Information—Program in American Studies, University of Minnesota, 104 Scott Hall, 72 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-4190; e-mail amstdy@umn.edu; <http://cla.umn.edu/american/american.html>.

Professor

Patricia C. Albers, American Indian Studies, FM
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Hazel Dicken-Garcia, Journalism and Mass Communication, FM
Mary G. Dietz, Political Science, FM
Sara M. Evans, History, FM
James Farr, Political Science, AM
Philip J. Germsn, Geography, FM
Edward M. Griffin, English, FM
John R. Howe, Jr., History, FM
Karen N. Hoyle, Library Collection Development/Management (Children’s Literature Research Collection), AM
Mary Jo Kane, Kinesiology and Leisure Studies, FM
Sally J. Kenney, HHIB Institute of Public Affairs, AM
Sally G. Kohlstedt, Geology and Geophysics, FM
Barbara Laskett, Sociology, FM
Richard D. Leppert, Cultural Studies and Comparative Literature, FM
Alex J. Lubet, Music, FM
Karl Ann R. Marling, Art History, FM
Judith A. Martin, Urban Regional Planning, FM
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Lary L. May, FM
Ronald C. McCurdy, Music, FM
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Russell R. Menard, History, FM
David W. Noble, FM
John A. Powell, Political Science, FM
Riv-Ellen Prell, FM
Paula Rabinowitz, English, FM
Nancy L. Roberts, Journalism and Mass Communication, FM
David Roediger, History, FM
Martin Roth, English, FM
Steven Ruggles, History, FM
Harvey B. Sarles, Cultural Studies and Comparative Literature, FM
Dennis N. Valdes, Chicano Studies, FM
Rudolph J. Vecoli, History, FM
Gayle Graham Yates, FM
Jack D. Zipes, German, Scandinavian, and Dutch, FM

Associate Professor

Lisa Albrecht, General College, FM
W. John Archer, Cultural Studies and Comparative Literature, FM
Rose M. Brewer, Afro-American and African Studies, FM
Brenda J. Child, FM
Marie Damon, English, FM
Lisa J. Dosch, Political Science, FM
John M. Dolan, Philosophy, AM
George D. Green, History, FM
March L. Krotee, Kinesiology and Leisure Studies, AM
Josephine D. Lee, English Language and Literature, AM
Ellen Messer-Davidow, English, FM

Carol A. Miller, FM
Roger P. Miller, Geography, FM
Gail K. Noble, General College, AM
Lisa A. Norling, History, FM
Jean M. Obrien-Kehoe, History, FM
Joanna O’Connell, Spanish and Portuguese, AM
Jennifer L. Pierce, FM
Guillermo Rojas, Chicano Studies, FM
Thomas M. Scanlan, Rhetoric, AM
Robert B. Silberman, Art History, FM
John S. Wright, English (Afro-American and African Studies), FM
Jacquelyn N. Zita, Women’s Studies, FM

Assistant Professor

Thomas Augst, English, AM
Catherine C. Choy, AM
Greg P. Choy, General College, AM
Roderick Ferguson, AM
Kirsten Fischer, History, AM
Douglas Hartmann, Sociology, AM
Daniel J. Philippin, Rhetoric, AM
Eden Torres, Women’s Studies, AM

Senior Fellow

Harry C. Boyte, HHH Institute of Public Affairs, AM

Other

William C. Beyer, AM
Colleen J Sheehy, Weisman Art Museum, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—American studies is an interdisciplinary, interdepartmental program. The American studies graduate faculty consists of American studies core faculty members and graduate faculty members drawn from a wide number of departments. Students create a field of concentration and also pursue broad training in analyzing the development of cultural and historical processes that shaped the nation and its diverse cultures, as well as analyzing contemporary practices.

Prerequisites for Admission—An undergraduate major in a field related to American studies or other preparation acceptable to the Admissions Committee for American studies is required.

Special Application Requirements—The following should be sent to the program office: a special application form available through the program office, a personal statement, three letters of recommendation, a writing sample, scores from the General (Aptitude) Test of the GRE, and transcripts of all college work. Applications must be submitted by December 15. Entry is only in fall semester.

Use of 4xxx Courses—One 4xxx course in American studies, English, history, or comparative studies in discourse and society may be included as one of the seminars to meet the one-semester specialty requirement in American studies.

Courses—Please refer to American Studies (AmSt) in the course section of this catalog for courses pertaining to the program.
M.A. Degree Requirements
The master’s degree is not designed as a terminal degree and students are not admitted to it. A Ph.D. student may elect to pursue the M.A. All coursework is applicable to the Ph.D.

Plan A and Plan B require American studies core seminars—AmSt 8201, 8202 (6 credits); a two-semester research course in American studies or in another department with approval of the director of graduate studies (6 credits); and a comparative cultural course covering international or non-U.S. subjects (3 credits).

Plan A requires two adviser-approved courses in the field of concentration, including one focused on cultural pluralism within the U.S. experience (6 credits); 10 thesis credits for a total of 31 credits; and a written thesis.

Plan B requires five adviser-approved courses in the field of concentration, including one focused on cultural pluralism within the U.S. experience (15 credits) for a total of 30 credits. The student is required to write three Plan B papers, each approved by a member of the graduate faculty. The papers are usually expanded seminar papers.

Language Requirements—Reading knowledge of one foreign language is required.

Minor Requirements for Students
Majoring in Other Fields—For a master’s degree minor, students are expected to choose courses consistent with or complementary to their major. Students should complete either AmSt 8201 or 8202 and two more courses in American studies or in an ethnic studies program.

Ph.D. Degree Requirements
A minimum of 45 credits (15 courses) is required, distributed as follows: introductory seminars AmSt 8201 and 8202 (6 credits); practicum in American studies 8401; dissertation seminar 8801; three one-semester courses from the American studies specialty seminars or from other units approved by the director of graduate studies (9 credits); one comparative culture course (3 credits); and 7 adviser-approved field of concentration courses, including 6 credits of cultural pluralism courses. Twenty-four thesis credits are also required.

Language Requirements—Reading knowledge of one foreign language is required.

Minor Requirements for Students
Majoring in Other Fields—For a doctoral degree minor, students must complete at least 12 credits of courses consistent with or complementary to their major, including four courses in American studies, one of which must be AmSt 8201 or 8202.

Anatomy
Contact the Graduate School for information about the status of this program.

Ancient and Medieval Art and Archaeology
See Classical and Near Eastern Studies.

Animal Sciences
Contact Information—Department of Animal Science, University of Minnesota, 305 Haecker Hall, 1364 Eckles Avenue, St. Paul, MN 55108 (612-624-3491; fax 612-625-5789; e-mail renox001@umn.edu; <www.ansei.umn.edu>).

Professor

Adjunct Professor
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Associate Professor

Assistant Professor
Sam K. Baidoo, FM Yang Da, Veterinary Pathobiology, FM Oladele O. Gazzal, FM William A. Head, Jr, FM Graham C. Lamb, AM Laura J. Mauro, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Students concentrate on one of the animal sciences subdisciplines: genetics, growth biology, nutrition, physiology, or production systems. Students have the option of tailoring their program to include study in more than one subdiscipline and to emphasize basic or applied science.

Prerequisites for Admission—A bachelor’s degree in agriculture or a biological field with training in biology, chemistry, physics, and mathematics is required.

Special Application Requirements—A complete set of transcripts in addition to that required by the Graduate School, three letters of recommendation evaluating the applicant’s potential, and a statement of career goals are required. The minimum GPA generally required for admission is 3.00 for the M.S. and 3.20 for the Ph.D. GRE scores are required. Applicants are admitted every semester.

Use of 4xxx Courses—Certain 4xxx courses may be included on the program form with prior approval by the student adviser and the director of graduate studies.

Courses—Please refer to Animal Science (AnSc) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements
The Plan A requires a minimum of 14 semester credits in the major and 6 credits in a designated minor, or related fields outside the major. Selection of courses to fulfill this requirement and development of the thesis project are primarily the responsibility of the student and faculty adviser. Students also must register for a minimum of 10 thesis credits. An official program of study, listing coursework to be completed and a thesis title, is submitted to a Graduate Faculty Program Committee and the Director of the Animal Sciences Graduate Program for review and then forwarded to the Graduate School for approval.

The Plan B requires a minimum of 30 credits. These must include 14 or more credits in the major area and at least 6 credits in one or more related fields outside the major. The balance of credits is chosen by agreement between the adviser and student. In addition to coursework, a project(s) is to be conducted that requires approximately 120 hours to complete. The nature and extent of the project is agreed upon in advance by the student and faculty adviser.

Language Requirements—None.

Final Exam—The final exam consists of a public seminar followed by an oral examination.

Major Requirements for Students
Majoring in Other Fields—Requirements are designed to fit the student’s needs. A master’s minor requires 6 credits in areas not closely related to the major; no more than 2 of these credits may be in research or special problems.

Ph.D. Degree Requirements
The Ph.D. degree is granted chiefly in recognition of the candidate’s achievements and knowledge in a specific field. Although there is no minimum number of credits required, students typically complete 40-50 credits to develop competency in their field of interest. Students must register for a
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minimum of 24 thesis credits. Appropriate graduate level courses taken at another university may be approved for transfer. Coursework completed under an M.S. program can be counted towards the Ph.D. degree. The student is expected to maintain a B average or better in all coursework.

Language Requirements—None.

Minor Requirements for Students

Majoring in Other Fields—Requirements are designed to fit the student’s needs. A doctoral minor requires 12 credits in areas not closely related to the major; no more than 3 of these credits may be in research or special problems.

Anthropology

Contact Information—Department of Anthropology, University of Minnesota, 395 Hubert H. Humphrey Center, 301-19th Ave. S., Minneapolis, MN 55455 (612-625-3400; fax 612-625-3095; e-mail wells001@umn.edu; <http://cla.umn.edu/anthropology/>).

Professor

Associate Professor
Daphne Berdahl, AM Timothy Dunnigan, FM David M. Lipset, FM Mischa Penn, FM Rv-Ellen Prell, American Studies, FM Janet D. Spector (emeritus), FM

Assistant Professor
Kathleen Barlow, FM Pradeep Jeganathan, AM Gregory Laden, AM Jean Langford, AM Sonia E. Patten, Family Practice and Community Health, E Martha Tappen, AM Thomas Wolfe, History, AM

Other
John M. Weeks, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The Department of Anthropology offers graduate education in sociocultural anthropology, anthropological archaeology, and biological anthropology. Major areas of faculty research and graduate student training in sociocultural anthropology include the politics and poetics of “tradition” and memory; gender and feminist anthropology; language and rhetorical practices; the cultural construction of economy; the politics of anthropological knowledge; colonialism and nationalism; transglobal processes; culture and consumption; and psychological anthropology. Regional specialization includes Melanesia, India, Europe, Latin America, and North America.

The program in biological anthropology offers training and research opportunities in paleoanthropology with a focus on faunal analysis and taphonomy, and behavioral biology with a focus on human foragers, evolutionary ecology, and evolutionary theory. Regional specializations include Africa and the Caucasus.

The program in anthropological archaeology offers perspectives on the nature of archaeological knowledge, paleoecology and evolutionary theory, and the use of sociocultural theories and interpretive strategies in the reconstruction of historic and prehistoric pasts. Regional specialization includes Africa, Europe, the Near East, and North America.

Prerequisites for Admission—None. Any necessary background work may be completed after admission.

Special Application Requirements—Three letters of recommendation on a form furnished by the department and scores from the General (Aptitude) Test of the GRE should be sent to the director of graduate studies. Admission is usually in fall semester; the deadline for all materials is January 15.

Use of 4xxx Courses—4xxx anthropology courses may be included on the degree program form as long as they are taught by members of the graduate faculty.

Courses—Please refer to Anthropology (Anth) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
Graduate students pursuing the M.A. degree must take a sequence of three seminars (3 credits each) during their first year in residence: during fall and spring semesters, all students take the seminars Anth 8001 and 8002; during spring semester, students also take a specialized seminar—Anth 8003 for sociocultural students or 8004 for archaeology students.

Plan A students must take an additional 9 course credits in anthropology, 6 credits in a minor or related field, and 10 thesis credits (34 credits total). Plan B students must take an additional 9 course credits in anthropology, 6 credits in a minor or related field, and 10 credits in a combination of anthropology and non-anthropology courses (34 credits total) determined with the student’s adviser and the director of graduate studies. All graduate students are also required to demonstrate proficiency in statistics.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students

Majoring in Other Fields—The minor program is individually designed by the student and the director of graduate studies. Minimally, students must take 6 credits in anthropology (5xxx courses or above).

Ph.D. Degree Requirements
All Ph.D. students must take the same sequence of three seminars outlined in the master’s program above. Ph.D. students must also take Anth 8217 and have completed a minimum of 18 course credits in anthropology and 12 credits in a minor or supporting program. The distribution of these courses is determined with the adviser and the director of graduate studies. All graduate students are also required to demonstrate proficiency in statistics.

Language Requirements—Ph.D. students must demonstrate a basic reading knowledge of one language other than English for which there is an anthropological literature or a long-standing literate tradition (e.g., Chinese, Hindi). The adviser and other members of a student’s advisory committee may require additional language training when circumstances warrant.

Minor Requirements for Students

Majoring in Other Fields—The minor program in anthropology is individually designed by the student and the director of graduate studies. A minimum of 12 credits in anthropology (5xxx or 8xxx courses) must be completed for the minor.

Applied Developmental Psychology


Professor
Herbert L. Pick, Jr., E
Richard Weinberg, E

Curriculum—The certificate in applied developmental psychology is a specialization for doctoral students in child psychology and related fields. The concentration allows graduate students to study and experience how basic developmental science applies to real life problems and issues concerning children and youth in our society.

Prerequisites for Admission—Applicants must be admitted to a doctoral program in child psychology or a related field.

Certificate Requirements
The core of the program consists of a seminar, basic and elective developmental coursework, and a field experience in an applied setting.
Applied Plant Sciences

Contact Information—Director of Graduate Studies, University of Minnesota, 411 Bovorg Hall, 1991 Upper Buford Circle, St. Paul, MN 55108 (612-625-1791; fax 612-625-1268; e-mail apsc@umn.edu).

Regents' Professor
Ronald L. Phillips, FM

Professor
Peter D. Ascher (emeritus), FM
Roger L. Becker, FM
Robert H. Busch (emeritus), FM
Vernon B. Cardwell, AM
Jerry D. Cohen, FM
Beverly R. Durgan, FM
Nancy J. Ethike, FM
Gary M. Gardner, FM
Barle G. Gengenbach, FM
Jeffrey L. Gunson, FM
Leland L. Hardman, AM
Dale R. Hicks, AM
Emily E. Hoover, FM
Robert J. Jones, FM
Pen Hsiang Li, FM
James J. Luby, FM
Albert H. Markhart III, FM
Ervin A. Olke (emeritus), FM
James H. Orf, FM
Peter J. Olin, AM
Harold M. Pellett, FM
David G. Pitt, Landscape Architecture, AM
Donald C. Rasmussen (emeritus), FM
Carl J. Rosen, Soil, Water, and Climate, FM
Craig C. Shaffer, FM
Steve R. Simmons, FM
David A. Somers, FM
Joseph R. Sowokinos, FM
Deon D. Stuthman, FM
Bert T. Swanson (emeritus), FM
Donald B. White, FM
David K. Wildung, FM
Donald L. Wyse, FM
Nevin D. Young, Plant Pathology, AM

Adjunct Professor
John W. Gronwald, FM
Hans-Joachim G Jung, FM
Howard W. Rines, FM
Carroll P. Vance, FM

Associate Professor
James A. Anderson, FM
Rex N. Bernardo, FM
Gregory Cuomo, FM
John E. Erwin, FM
Vincent A. Fritz, FM
Susan M. Galatowitsch, FM
Gregg A. Johnson, FM
Nicholas R. Jordan, FM
Bradley W. Pedersen, AM
Paul M. Porcher, FM
Alan G. Smith, FM
Cindy B. Tong, FM
John V. Wiersma, AM

Adjunct Associate Professor
Frank Forcella, FM

Assistant Professor
Neil O. Anderson, FM
Elizabeth A. Duck, FM
Lori K. Falkner, FM
Jeffrey H. Gillman, FM
Mary H. Meyer, FM
Gary J. Muehlbauer, FM
Seith L. Naeve, FM
Paul Peterson, FM
Kevin P. Smith, FM
Christian A. Thill, FM
Joehum J. Wiersma, FM

Adjunct Assistant Professor
JoAnn F. Lamb, FM
Helene Murray, AM

Other
Deborah L. Brown, AM
Raymond Porter, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Applied plant sciences is an interdisciplinary program for educating students to become professional scientists well grounded in the applied disciplines of agronomy/agroecology, horticulture, and plant breeding. Graduates of the program are able to provide innovative leadership and contribute to problem solving in their discipline in the public or private sector and within society at large. The program develops the quantitative and qualitative research skills necessary to conduct high quality research and scholarship. Students gain a broad familiarity with all the disciplines within the program and gain in-depth knowledge within their area of expertise. The program’s graduate faculty is drawn primarily from the Department of Agronomy and Plant Genetics and the Department of Horticultural Science, but also from the Departments of Plant Pathology: Soil, Water, and Climate; and Landscape Architecture and related departments. Students choose from among four specialization tracks—agronomy/agroecology, applied plant sciences, horticulture, or plant breeding/plant molecular genetics.

Agroecology/Agronomy Specialization—In this track, students conduct research to increase their knowledge of cropping systems and weed science including alternative approaches and management strategies. Emphasis is on improving production efficiency and profitability in an environmentally sound approach that benefits society. Mechanisms of crop physiology and ecology underlying plant responses to the environment are a particular emphasis of this track.

Applied Plant Sciences Specialization—Students create an integrated, individualized program combining a breadth of courses from several disciplines or areas including plant biology at the organismal level, genetics and plant breeding, cropping systems and communities, and courses relating to the production of agronomic and/ or horticultural commodities.

Horticulture Specialization—In this track, students conduct research to increase their knowledge of production practices, end use products, and the environmental impact of horticultural crop production systems. Students may focus on food, woody ornamental, floriculture, or turf crops with research opportunities ranging from cold hardiness of perennial plants to developing best management practices for horticultural systems using physiologic and/or genetic techniques.

Plant Breeding/Plant Molecular Genetics Specialization—This track allows students to select from genetic research projects ranging from applied plant breeding projects emphasizing breeding procedures and methodologies to molecular genetic projects doing biotechnology and genetic engineering in agronomic and horticultural crops. These research projects give students the opportunity to integrate the latest developments in the laboratory with applied applications in the field to reach the overarching goal of developing new germplasm that will improve the sustainability of our food and fiber systems.

Prerequisites for Admission—Students entering the program should have a foundation in the physical and biological sciences, preferably with some emphasis in plant science. A minimum of 10 credits of math and physics, 12 credits of chemistry and biochemistry, and 15 credits of biological and/or agricultural sciences are recommended for admission. In addition, students should have completed a B.S. or B.A. degree in agriculture, biology, or other related life sciences. Students with a B.S. or B.A. degree outside these areas may be admitted with the requirement that they take the prerequisite courses noted above at the undergraduate level in addition to their graduate coursework.

Special Application Requirements—Three letters of recommendation, a statement by the applicant outlining career objectives and experience, and GRE scores are required. Students may apply at any time; however, submission of all application materials by January 1 is strongly encouraged to ensure priority consideration for fellowships and teaching and research assistantships awarded for the next academic year. Students can be admitted any term.

Use of 4xxx Courses—Inclusion of 4xxx courses on the degree program form is subject to adviser and director of graduate studies approval.

Courses—Please refer to Agronomy (Agro), Applied Plant Sciences (APSc) and Horticulture (Hort) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements
The M.S. is offered under Plan A (with thesis) and Plan B (with project). Plan A requires a minimum of 20 course credits and 10 thesis credits; Plan B requires a minimum of 30 course credits. Students are encouraged to complete the courses in the common curriculum and the requirements for their specialization, and to present one graduate seminar. Additional course requirements are flexible and are determined in consultation with the student’s adviser(s) and advisory committee.

Language Requirements—None.

Final Exam—The final exam is oral.
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Ph.D. Degree Requirements
Ph.D. students are required to complete the courses in the common curriculum, the requirements for their respective specialization, and present two graduate seminars; 24 thesis credits are also required. Additional course requirements are flexible and are determined in consultation with the student’s adviser(s) and advisory committee.

Language Requirements—None.

Minor Requirements for Students

Majoring in Other Fields—A Ph.D. minor requires 12 credits from among 4xxx, 5xxx, and 8xxx courses in the areas of specialization, with only one 4xxx course allowed.

Arabic

No new students are being accepted for the Arabic major under present policy.

Contact Information—Arabic Program, Department of Afro-American and African Studies, University of Minnesota, 808 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-7866; fax 612-624-5743; e-mail calainfo@umn.edu).

Professor
Cesar E. Farah, AM

Assistant Professor
Charles A. Pike, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Note: No new students are currently being accepted to this program.

Contact the Graduate School for information on the status of the program.

The program focuses on the Arabic language and the literature and culture of the Arabic-speaking world.

M.A. Plan B Degree Requirements
The M.A. is offered under Plan B only. The minimum requirement is 33 credits, including 27 course credits and 6 credits for the Plan B research paper. The coursework must include 15 credits in Arabic literature or culture, including Arab/Afro 5001 (3 credits) and one 8xxx seminar (3 credits). Students also take 6 credits (2 courses) in related fields outside Arabic, depending on the student’s academic goals and subject to the approval of the director of graduate studies.

Language Requirements—Students must complete Arab/Afro 5102 (Advanced Arabic) or its equivalent, and must demonstrate reading knowledge of a classical or modern language appropriate to the field.

Final Exam—The final exam is oral.

Minor Requirements for Students

Majoring in Other Fields—A minimum of 12 graduate credits for a master’s minor is required. Students must possess an acceptable knowledge of Arabic, but may not apply language-specific courses toward the minor. A program of study must be arranged with the director of graduate studies of Arabic. No written exam is required for the minor.

Architecture

Contact information—Department of Architecture, University of Minnesota, 110 Architecture Building, 89 Church Street S.E., Minneapolis, MN 55455 (612-624-7866; fax 612-624-5743; e-mail calainfo@umn.edu).

Professor
Thomas Fisher, AM
Lance A. LaVine, AM
Julia Robinson, AM
Garth C. Rockcastle, AM
Leon G. Satkowski, AM

Adjunct Professor
Dale M. Multfinger, AM
Duane Thorbeck, AM

Associate Professor
Lee B. Anderson, AM
Arthur H. Chen, AM
William F. Conway, AM
Gunter A. Dittmar, AM
Mary M. Guzowski, AM
Cynthia Jara, AM
Andrezj Piotrowski, AM
Katherine M. Solomonson, AM
J. Stephen Weeks, AM

Adjunct Associate Professor
Victor Calandros, AM
Bruno M. Franck, AM
Vincent James, AM
Thomas Andrew Meyer, AM
Todd J. Rhoades, AM
Juliani V. Snow, AM
Lee E. Tollefson, AM
Gregory Watson, AM
Craig L. Wilkins, AM

Adjunct Assistant Professor
Robert Ferguson, E
Timothy J. Fuller, E
Ali Reza Heshmati, E
Douglas Lew, E
Robert C. Mack, E
Ralph Nelson, E
Bruce A. Parker, E
Timothy G. Quigley, E
Marcy Schulte, AM
Jennifer Yoos, E

Instructor
Kenneth D. Potts, E

Lecturer
William A. Bilanski, E
Mike Christianson, E
David H. Dimond, E
Nina Ebbighausen, E
Dawn Gilpin, E
Todd P. Hansen, E
Harold Kiewel, E
Carolyn Krall, E
Martha McQuade, E
Nancy Miller, E
Joshua Weinstein, E
Mark S. Wentzel, E
Thomas Westbrook, E
Thomas G. Whitcomb, E

Senior Research Fellow
John C. Carmody, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Architecture encompasses the making and study of the buildings and environment that we inhabit. The concerns of architecture involve a wide variety of areas of study, including the art of representing built projects through drawings and computer graphics; the technology of building structure, building materials, and natural and mechanical systems; the history, theory, and art of making, using, and understanding buildings as cultural artifacts for human use; and the practice of architecture in the context of urban form and business economics.

The M.Arch. program introduces students to the practice and discipline of architecture as a speculative, analytic, and investigative endeavor. It prepares students to enter architecture as both a profession and a field of knowledge. The program is organized around the design studio, incorporating coursework in the diverse areas of architectural knowledge: representation, technology, history, theory, urban design, and architectural practice.

The professional M.Arch. degree program is for those who have an undergraduate degree with a major or concentration in architecture and seek to become licensed architects. Because the admitted student will already have a broad educational background and will have completed fundamental courses, the program focus is on professional and disciplinary coursework, including required and elective lecture, seminar, and design studio courses.

Prerequisites for Admission—Applicants to the M.Arch. program must hold a baccalaureate degree and must have completed the equivalent of at least a year of preparatory work, including coursework in calculus, physics, architectural history, drawing, and architectural design.

Students are expected to have basic computer skills before beginning the program, including familiarity with either Macintosh or Windows operating systems, word processing, basic drawing or painting programs, and use of e-mail. Intermediate classes in computer methods in architecture (Arch 5371, 5372, 5373) are part of degree requirements during the first year; advanced classes (Arch 5374, 5375) are required during the second year.

In exceptional circumstances, students who have a nonprofessional baccalaureate degree in architecture and have completed the equivalent of the first year of the M.Arch. program requirements may qualify for advanced placement in the program.

Depending on their academic record, their previous coursework, and their portfolio review, these students could complete the M.Arch. degree in a minimum of two years.
A small number of students who hold a bachelor of architecture professional degree (B.Arch.) are admitted each year to pursue a second professional degree. Admission is based on the quality of the previous academic work and the quality of the portfolio. Depending on their background, these students could complete the M.Arch. degree in a minimum of three semesters.

For more complete information, please see the College of Architecture and Landscape Architecture Bulletin and contact the Department of Architecture.

Special Application Requirements—
Admission to the M.Arch. program is highly competitive. In addition to meeting Graduate School application requirements, students applying to the program must demonstrate design talent in a portfolio and must submit all of the following: a one-page statement of interest, transcripts of all coursework, three faculty recommendations, a recent paper written in English, and GRE scores. The portfolio should be a notebook no larger than 10" x 12" (other portfolio formats will be rejected). International students must submit scores from the TOEFL or the MELAB.

Use of 4xxx Courses—4xxx courses cannot be included on degree program forms without the permission of the adviser and director of graduate studies.

Courses—Please refer to Architecture (Arch) in the course section of this catalog for courses pertaining to the program.

M.Arch. Plan A Degree Requirements
The professional M.Arch.1 curriculum accredited by the National Architectural Accrediting Board (NAAB) consists of a minimum of 93 credits, including the thesis. The first-year integrated curriculum is followed by two years of less structured coursework culminating in the thesis. Students are required to take intermediate and advanced courses in computer methods in architecture.

Postprofessional M.Arch.2 (advanced standing) is offered for students with previous architectural education, a professional degree such as the bachelor of architecture (B.Arch.), or a professional master of architecture. Students entering with advanced standing plan an individualized curriculum, with faculty consultation, that will meet professional objectives and include a minimum of 30 credits, requiring at least 3 semesters of study.

Language Requirements—None.

Final Exam—Oral and visual presentation of the thesis is required.
Curriculum—By focusing on the curricular and instructional processes central to all educational endeavors, graduate programs within the Department of Curriculum and Instruction prepare students for professional roles in pre K-12 education, in postsecondary and research settings, and in educational service agencies.

The M.A. (Plan B only) in art education focuses on the application of research to practice in art education. Professionals in K-12 art education and other art-related fields work with advisers to construct a program of studies directed toward a specific professional research interest. Elective coursework can focus on studio arts, art history, and aesthetics, as well as on issues related to curriculum and instruction.

Prerequisites for Admission—Prerequisites vary among areas of emphasis or concentration. Generally a bachelor’s degree with licensure and/or teaching experience fulfills the requirement. For some areas, however, there is no equivalent undergraduate program. In that case, 15 to 20 credits of work at the undergraduate level determined acceptable by advisers and the director of graduate studies are adequate.

Special Application Requirements—Scores from the GRE are required. Master’s applications are reviewed by department faculty on continual basis throughout the academic year.

Use of 4xxx Courses—Inclusion of 4xxx courses on the degree program form is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program’s approval.

Courses—Please refer to Curriculum and Instruction (CI) and Education (Educ) in the course section of this catalog for courses pertaining to the program.

M.A. Plan B Degree Requirements

The M.A. program requires a minimum of 30 credits: 14 credits in the major, a minimum of 4 credits in research (including 3-6 credits applied to the Plan B research project), 6 credits from a related field chosen with the consent of the adviser, and 6 elective credits.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Students choosing a minor in art education elect courses appropriate to their research interest in consultation with program faculty. The minor requires a minimum of 6 credits. Coursework is determined on the basis of prior experiences, research competencies, interests, and the professional focus of each student.

Art History

Contact Information—Department of Art History, University of Minnesota, 338 Heller Hall, 271 19th Avenue South, Minneapolis, MN 55455 (612-624-0847 or 612-624-4500; fax 612-626-8679; e-mail arthist@umn.edu; <www.arthist.umn.edu>.

Professor

Frederick M. Asher, FM
Frederick A. Cooper, FM
Karal Ann R. Marling, FM
Sheila J. McNally, FM
Robert J. Poor, FM
Leon G. Satkowski, AM
Gabriel P. Weissberg, FM

Adjunct Professor

Evan M. Maurer, AM

Associate Professor

W. John Archer, AM
Catherine B. Asher, FM
Robert B. Silberman, FM
Katherine M. Solomonson, AM
John W. Steyeart, FM
Michael W. Stoughton, FM

Assistant Professor

Jane M. Blocker, FM
Patricia McDonnell, AM

Other

Lyndel I. King, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Areas of specialization are: American art, architecture, and popular culture; Baroque art; East Asian art and Bronze Age archaeology; Greek and Roman art and archaeology; Islamic art and architecture; Late Gothic and northern Renaissance art; modern art including film and photography studies as well as nineteenth through twenty-first century art; South Asian art and architecture.

Prerequisites for Admission—For the M.A. program, a bachelor’s degree is required, preferably in art history or a closely related field. Ability and scholarly promise must be demonstrated by a past record of academic excellence. For the Ph.D. program, an M.A. degree in art history or in a field closely related to the chosen area of specialization is required, as well as coursework or other experience indicating substantial background in art historical methods and knowledge.

Special Application Requirements—For the M.A. program, results from the GRE General Test, a M.A. thesis or a minimum of two substantial M.A. papers in art history, and three letters of recommendation from persons well acquainted with the applicant’s research and writing skills is required. In addition, M.A. applicants must provide a detailed statement describing previous experience and academic training as related to the projected course of study and academic goals.

For the Ph.D. program, results from the GRE General Test, a M.A. thesis or a minimum of two substantial M.A. papers in art history, and three letters of recommendation from persons well acquainted with the applicant’s research and writing skills is required. In addition, Ph.D. applicants must provide a statement describing previous experience and academic training as related to the projected course of study and academic goals. Ph.D. candidates are urged to contact the director of graduate studies before application.

Applications for the Ph.D. program (if not previously enrolled in the department) and M.A. program are reviewed in January for admission in the fall. For both of these, the application form, statement of purpose, official transcripts, and official GRE scores must reach the Graduate School by early January (contact the Department of Art History for the precise date). Duplicates of these materials, as well as three letters of recommendation and research paper(s), must reach the department by the same deadline. Internal Ph.D. applicants should contact the department for details and deadlines. All applications for financial aid are due on the same date as the applications for admission.

Use of 4xxx Courses—Inclusion of 4xxx art history courses on the degree program form is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program’s approval.

Courses—Please refer to the Art History (Arth) course section of this catalog for courses pertaining to the program.

M.A. Plan B Degree Requirements

A minimum of 36 course credits (about 12 courses) is required, including at least two 8xxx seminars in art history. A minimum of 21 credits must be art historical in content and drawn from courses in at least three of the following areas: American, ancient, medieval, Baroque, modern, East Asian, South Asian, Islamic. Of these, four courses must be in an area of primary concentration, two courses in an area of secondary concentration, and one course in a third area. Students focusing on Asian/Islamic art must take at least one course in western art.

Students focusing on western art must take at least one course in Asian/Islamic art. In addition, students must take 6 credits in courses that are not art historical in content. The remaining 9 credits may be either in art history or outside the discipline; this is decided in consultation with the adviser and the director of graduate studies. Two Plan B papers are required, the first of which should be completed by the end of the first year of full-time study.

Language Requirements—Students must attain reading proficiency in a second language directly related to their course of study.

Final Exam—The final exam is written. See the department’s Graduate Student Handbook for details.
Asian Languages and Literatures

No new students are being admitted to the Chinese, Japanese, and South Asian Languages graduate programs. New graduate degree programs under the department of Asian Languages and Literatures (ALL) will be formalized and approved in the near future.

Graduate students currently enrolled in any of these degree programs are to work with the Graduate School to complete their course requirements. Questions regarding curriculum options can be directed to the director of graduate studies of Asian Languages and Literatures, or to a member of the ALL administrative staff.

Chinese
Professor
Joseph R. Allen, FM
Yu-Shih Chen (emeritus), FM
Chun-Jo Liu (emeritus), FM
Richard B. Mather (emeritus), FM
Ann B. Waltner, History, AM
Stephen S. Wang (emeritus), FM

Japanese
Professor
Joseph R. Allen, FM

Associate Professor
Polly E. Sztawrowski, FM

South Asian Languages
Professor
Frederick M. Asher, Art History, FM
Iraj Bashiri, FM
Indira Y. Jungkare, FM

Associate Professor
William W. Malandra, Classical and Near Eastern Studies, FM

Librarian
Donald C. Johnson, Ames Library of South Asia, AM

Astrophysics

Contact Information—Department of Astronomy, University of Minnesota, 356 Tate Laboratory of Physics, 116 Church Street S.E., Minneapolis, MN 55455 (612-624-0211; fax 612-626-2029; e-mail grad-req@astro.umn.edu; <http://astro.umn.edu>.

Professor
Cynthia A. Cattell, Physics, FM
Kris D. Dawson, FM
John M. Dickey, FM
Robert D. Gehrz, FM
Roberta M. Humphreys, FM
Terry J. Jones, FM
Thomas W. Jones, FM
Leonard V. Kuhi, FM
Robert L. Lysak, Physics, FM
Keith A. Olive, Physics, FM
Robert O. Pepin, Physics, FM
Lawrence Rudnick, FM
Evan D. Skillman, FM
Cecil J. Waddington (emeritus), Physics, FM
Paul R. Woodward, FM

Associate Professor
Charles E. Woodward, FM
John R. Wygant, Physics, FM

Assistant Professor
Shaull Hanany, Physics, FM
Yong-zhong Qian, Physics, FM
Liliya L.R. Williams, FM

Senior Research Associate
David H. Porter, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Astrophysics is the study of the universe and its constituent parts. The program offers emphases in observational, theoretical, and computational astrophysics and in instrument development. The main research areas include properties and dynamics of normal and active galaxies, quasars, stellar evolution, interaction of stars with their environments, the interstellar medium, astrophysical magnetohydrodynamics, and galactic and cosmological structure. Observational research includes X-ray, ultraviolet, optical, infrared, and radio astronomy. Extensive research programs in space physics and the elementary particle-cosmology interface are also carried out in interdisciplinary connections with the graduate program in physics.

Prerequisites for Admission—For major work, an undergraduate degree in astronomy or physics or the equivalent is required. Contact the director of graduate studies for exceptions.

Special Application Requirements—A statement of career goals, scores from the GRE General (Aptitude) Test and Subject (Advanced) Test in physics, and three letters of recommendation are required. Applications for financial aid are due January 15. Applications are accepted for entry in fall semester only.

Facilities—The Department of Astronomy is purchasing a 5 percent share in the Large Binocular Telescope (LBT) on Mt. Graham in southeastern Arizona. The LBT is currently under construction through a consortium of universities and research institutes led by the University of Arizona and has an expected completion date of 2004. This purchase will allow the department to trade time on the LBT for time on several other telescopes—including the 6.5 meter upgraded Multiple Mirror Telescope, the two 6.5 meter Magellan telescopes in the southern hemisphere, and the 10 meter Heinrich Hertz millimeter radio telescope—that are part of the same research consortium, providing guaranteed access to multi-wavelength capabilities.

The University also operates a 60-inch telescope on Mt. Lemmon, near Tucson, Arizona, which is well equipped for both optical and infrared observations. A 30-inch telescope with a CCD camera and infrared instruments is maintained at the O’Brien Observatory about 40 miles from the Twin Cities campus. Both telescopes are fully computer controlled and can be operated remotely. Plans are under development for a major (3.5 meter) observatory. Excellent shop facilities support our instrument development for the telescopes at O’Brien and Mt. Lemmon, for the University of Wyoming’s infrared telescope, and for major national observatories such as the NASA Infrared Telescope Facility (IRTF) in Hawaii. The Automated Plate Scanner is based in the astronomy department and has been used to digitize the entire Palomar Sky Survey resulting in a massive catalog of star and galaxy positions, magnitudes, and colors. The associated computer reduction system can analyze 100,000 images per hour.

The astronomy department maintains a large network of linux-based computers used for the reduction and analysis of X-ray, ultraviolet, optical, and radio observations. The department is connected through an ethernet backbone to clusters of supercomputers and super-workstations at the University’s Supercomputer Institute and the Laboratory for Computational Science and Engineering. These facilities are available to faculty and students for their research.

In addition, members of the department regularly use such national facilities as the Kitt Peak National Observatory; Cerro Tololo Inter-American Observatory in Chile; National Radio Astronomy Observatory’s facilities in Green Bank and the VLA; Arecibo Radio Observatory; the NASA space based facilities such as the Hubble Space Telescope, the Far Ultraviolet Space Explorer, the Space Infrared Telescope Facility, the Chandra X-ray Space Telescope; and the IRTF in Hawaii.

Use of 4xxx Courses—A 4xxx astrophysics course may be counted toward the M.S. or Ph.D. degree programs.
Courses—Please refer to Astronomy (Ast) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements
The master’s degree requires a minimum of 30 credits, including one semester of classical physics (Phys 5011) and one year of the two-year-long sequences in introductory astrophysics (Ast 4011-4021 or Ast 5012-5022). Additional requirements depend on whether the student chooses the thesis (Plan A) or non-thesis (Plan B) option. Plan A requires 20 semester credits of coursework and 10 thesis credits. Plan B requires 30 semester credits of coursework. Completion of the degree normally takes two years.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students
Majoring in Other Fields—For the master’s minor, 8 credits in astrophysics are required, either the Ast 4011-4021 or Ast 5012-5022 sequence.

Ph.D. Degree Requirements
The Ph.D. degree requires a minimum of 40 course credits, including a year of classical physics (Phys 5011-5012), the two-year-long sequences in introductory astrophysics (Ast 4011-4021 and Ast 5012-5022), and 12 credits in a minor or supporting program; 24 thesis credits are also required. The graduate written examination, offered during the spring, must be passed on the second “real” attempt (first-year students are given a free trial). A second-year project must be defended by the end of the fall semester of the third year. The preliminary oral exam must be passed by the end of the third year.

Language Requirements—None.

Minor Requirements for Students
Majoring in Other Fields—For the Ph.D. minor, 12 credits in astrophysics are required, including either the Ast 4011-4021 or the Ast 5012-5022 sequence.

For information on the master’s and doctoral degree programs offered in conjunction with the University of Minnesota Duluth, contact the associate director of graduate studies, Department of Biochemistry and Molecular Biology, 251 School of Medicine, University of Minnesota, 10 University Drive, Duluth, MN 55812 (218-726-7922).

Professor
John S. Anderson, FM
Paul M. Anderson, Biochemistry and Molecular Biology, Duluth, FM
Ian M. Armitage, FM
Leonard J. Banaszak, FM
George Barany, Chemistry, FM
Bridgee A. Barry, FM
David A. Bernholz, FM
Victor A. Bloomfield, FM
Robert J. Brooker, Genetics, Cell Biology, and Development, FM
Bianca M. Conti-Fine, FM
Anat Har, FM
Mary E. Dempsey, FM
Lester R. Drewes, Biochemistry and Molecular Biology, Duluth, FM
Michael E. Eckkanger, FM
James A. Fuchs, FM
Harry P. C. Hogenkamp, FM
Alan B. Hooper, FM
James F. Koerner, FM
David C. LaPorte, FM
John D. Lipscomb, FM
Dennis M. Livingston, FM
Rex E. Lovrien, FM
Kevin H. Mayo, FM
Matthew F. Mescher, Laboratory Medicine and Pathology, FM
Gary L. Neale, FM
Michael B. O’Connor, Genetics, Cell Biology, and Development, FM
Theodore R. Oogsten, Jr., Orthopaedic Surgery, FM
Douglas H. Oehlendorf, FM
Harry T. Orr, Laboratory Medicine and Pathology, FM
Joseph R. Pohaska, Biochemistry and Molecular Biology, Duluth, FM
Lawrence Que, Chemistry, FM
Michael A. Rafferty, FM
Michael J. Sadowsky, Soil, Water, and Climate, FM
Michel M. Sanders, FM
Janet L. Schottel, FM
David H. Sherman, Microbiology, FM
David D. Thomas, FM
Howard C. Towle, FM
Tian Y. Tsong, FM
Brian G. Van Ness, FM
Lawrence P. Wackett, FM
Kendall B. Wallace, Biochemistry and Molecular Biology, Duluth, FM

Associate Professor
Kenneth W. Adolph, FM
Vivian J. Bardwell, Genetics, Cell Biology, and Development, FM
Benjamin L. Clarke, Medical Microbiology and Immunology, Duluth, FM
Stephan C. Ecker, Genetics, Cell Biology, and Development, FM
Cecilia Guivri, Chemistry, Duluth, FM
Thomas S. Hays, Genetics, Cell Biology, and Development, FM
Thomas E. hunley, FM
Alex J. Lange, FM
Sharon E. Murphy, FM
Karim Musser-Forsyth, Chemistry, FM
Merry Jo Oursler, Biology, Duluth, FM
Robert J. Roon, FM
Ann E. Rougvie, Genetics, Cell Biology and Development, FM
Paul G. Sillciano, FM
Jeffrey A. Simon, Genetics, Cell Biology, and Development, FM
David A. Zarkower, Genetics, Cell Biology, and Development, FM

Assistant Professor
Annette L. Boman, Biochemistry and Molecular Biology, Duluth, FM
Antony M. Dean, Ecology, Evolution, and Behavior, FM
Deborah A. Ferrington, Ophthalmology, FM
Julio E. Herrera, FM
Laura J. Mauro, Animal Science, FM
Lincoln R. Potter, FM
Claudia Schmidt-Dannert, FM
Robert J. Sheaff, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The biochemistry, molecular biology, and biophysics program focuses on an explanation at the molecular level of the structures and processes that occur in living organisms. In the broadest sense, the program encompasses the chemistry, physics, and biology of living systems. Included is the study of the structure and function of biomolecules (proteins, nucleic acids, lipids, and carbohydrates), enzyme catalysis, metabolic pathways, bioenergetics, and the biochemical nature of genetic information storage and transmission, as well as the control, regulation, and integration of these processes. The program has four areas of emphasis: regulatory biochemistry, molecular biology, microbial biotechnology, and molecular biophysics. All students are expected to demonstrate a minimum level of competence in these areas but emphasize that area most related to their thesis project. The program involves faculty from the Department of Biochemistry, Molecular Biology, and Biophysics, as well as many faculty members from several other departments in the College of Biological Sciences, Medical School, Institute of Technology, and College of Veterinary Medicine.

Prerequisites for Admission—The program is flexible enough to accommodate students with a wide variety of educational backgrounds. Applications from students with undergraduate or master’s degrees in the biological, chemical, or physical sciences are encouraged. Recommended academic preparation includes one year each of calculus, organic chemistry, and basic biology, including biochemistry and genetics. For students of demonstrated ability, background deficiencies can be made up during the first year of graduate study.

Special Application Requirements—Applicants must submit three letters of recommendation from persons familiar with their academic and research capabilities. A statement of interests and goals, a complete set of transcripts, and official scores from the General Test of the GRE are required. The GRE Subject Test in biochemistry, cell and molecular biology, biology, or ecology recommended, but not required. The recommended date for receipt of completed applications is January 15. Completed files are reviewed between January and March. Graduate studies typically begin fall term.
Information about an early start program involving participation in laboratory research beginning on July 1 may be obtained from the director of graduate studies.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted with written approval from a director of graduate studies.

Courses—Please refer to Biochemistry (BioC) in the course section of this catalog for courses pertaining to the program.

M.S. Plan A Degree Requirements
Requirements for the M.S. degree include core coursework and laboratory experiences taken by all students, followed by one or more courses in one of the areas of specialization. In addition all students are expected to participate in the seminar involving student reports on current literature and research. A thesis based on original laboratory research is required.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Students electing a master’s minor are required to complete 6 credits of general graduate level coursework which may be selected (with approval by the director of graduate studies) from the 5xxx and 8xxx courses offered by the program. BioC 4331 and 4332 may also be considered if approved by the directors of graduate studies of both the major and minor programs.

Ph.D. Degree Requirements
Requirements for the doctoral degree include core coursework and laboratory experiences taken by all students, followed by one or more courses in one of the areas of specialization. In addition all students are expected to participate in two continuing series of seminars: one involving student reports on current literature and research and the other involving prominent national and international scientists.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Students electing a doctoral minor are required to complete BioC 8001 (5 credits), 8002 (2 credits), and 2 more courses in one of the areas of specialization. In addition all students are expected to participate in the seminar involving student reports on current literature and research. In extenuating cases, students may petition the director of graduate studies for substitution of one or both of the required courses.

Bioethics

Contact Information—Graduate Minor in Bioethics, Center for Bioethics, University of Minnesota, N-504 Boynton, 410 Church St. SE, Minneapolis MN 55455-0346 (612-624-9440; fax 612-624-9108; e-mail bioethics@umn.edu; <www.bioethics.umn.edu>).

Professor
Murrel J. Bebeau, Preventive Sciences, E Dan L. Burk, Law, F
Norman O. Dahl, Philosophy, E
John M. Eyer, History of Medicine, E
Jasper S. Hopkins, Philosophy, E
Jeffrey P. Kahn, Medicine, E
Rosalie A. Kane, Public Health, E
David J. Mayo, Philosophy, Duluth, E
Steven H. Miles, Medicine, E
Naomi B. Scheman, Philosophy, E
Susan M. Wolf, Law School, E

Associate Professor
John M. Dolan, Philosophy, E
Carl Elliott, Pediatrics, E
Gregory Plotnikoff, Medicine, E
Michael Root, Philosophy, E

Assistant Professor
John Song, Medicine, E
Beth Vinrigr, Health Services Research and Policy, E

Other
Ronald E. Cranford, Neurology, E

Curriculum—The Center for Bioethics, in close cooperation with the Department of Philosophy, offers a minor in bioethics for master’s (M.A. and M.S.) and doctoral students with approval of the director of graduate studies in bioethics. The minor provides a structured program of study as well as formal recognition for academic accomplishments in the field.

While recognizing that philosophy is the focal discipline for the study of bioethics, the minor offers numerous opportunities for multidisciplinary study, including in history and philosophy of medicine, health law and public policy, health-care economics, professional ethics, clinical ethics, medical humanities, and moral development.

Prerequisites for Admission—Admission is contingent upon prior admission to a master’s or doctoral degree-granting program within the Graduate School. Students are encouraged to have some previous exposure to philosophy or biomedical science. Graduate students in philosophy are expected to have successfully completed at least one graduate course in ethical theory.

Special Application Requirements—Contact the director of graduate studies in bioethics for an Intent to Enroll form, which should be submitted by the middle of the spring semester the year before initiating coursework in the minor. Enrollment is contingent upon approval by the director of graduate studies for bioethics.

Use of 4xxx Courses—Some 4xxx courses are allowed as indicated in the guidelines for the bioethics minor, available from the director of graduate studies.

Courses—Please contact the minor program office for information on relevant coursework.

Freestanding Minor Requirements

Students Majoring in Philosophy—Master’s students (M.A. and M.S.) must complete a minimum of 8 graduate credits in bioethics: 6 credits of required courses and 2 credits of electives outside the Department of Philosophy.

Doctoral students must complete a minimum of 14 graduate credits in bioethics: 8 credits of required courses and 6 credits of electives outside the Department of Philosophy.

Students Majoring in a Field Other Than Philosophy—Master’s students (M.A. and M.S.) must complete a minimum of 8 graduate credits in bioethics outside the student’s major. Master’s students are not required to take electives in bioethics and cognate areas, but are encouraged to do so.

Doctoral students must complete a minimum of 14 graduate credits in bioethics outside the student’s major: 8 credits of required courses and 6 credits of electives.

Biological Science

Contact Information—Master of Biological Science. Professional Program, College of Biological Sciences, 123 Snyder Hall, 1475 Gortner Avenue, St. Paul, MN 55108 (612-625-3133; fax 612-624-2785; e-mail bio@cbio.umn.edu; <www.cbio.umn.edu/biolink/mbs.html>.

Professor
Judith G. Berman, Molecular, Cellular, Developmental Biology and Genetics, AM
David A. Bernlohr, Biochemistry, Molecular Biology, and Biophysics, AM
Linda J. Brady, Food Science and Nutrition, AM
Robert M. Bramb, Plant Biology, AM
Paul P. Cleary, Microbiology, AM
Gary M. Dunny, Microbiology, AM
James A. Fuchs, Biochemistry, Molecular Biology, and Biophysics, AM
Ross G. Johnson, Molecular, Cellular, Developmental Biology, and Genetics, AM
Youngki Kim, Pediatrics, AM
Mindy S. Kiser, Food Science and Nutrition, AM
Paul T. Magee, Microbiology, AM
Sheldon M. Mauer, Pediatrics, AM
Gary A. Reineccius, Food Science and Nutrition, AM
Patrick M. Schievvert, Microbiology, AM
Michael J. Simmons, Molecular, Cellular, Developmental Biology, and Genetics, AM
Donald B. Siniff, Ecology, Evolution, and Behavior, AM
Joanne L. Slavin, Food Science and Nutrition, AM
Lawrence P. Wackett, Biological Process Technology Institute, AM
Chester B. Whitley, Pediatrics, AM

Associate Professor
Wei Chen, Pediatrics, AM
Joellen Feirtag, Food Science and Nutrition, AM
Susan M. Galatowitsch, Horticultural Science, AM
Daniel D. Gallaher, Food Science and Nutrition, AM
Shanh J. Han, Molecular, Cellular, Developmental Biology, AM
Muriel J. Bebeau, Preventive Sciences, E
Beth Vinrigr, Health Services Research and Policy, E

Other
Ronald E. Cranford, Neurology, E

Curriculum—The Center for Bioethics, in close cooperation with the Department of Philosophy, offers a minor in bioethics for master’s (M.A. and M.S.) and doctoral students with approval of the director of graduate studies in bioethics. The minor provides a structured program of study as well as formal recognition for academic accomplishments in the field.

While recognizing that philosophy is the focal discipline for the study of bioethics, the minor offers numerous opportunities for multidisciplinary study, including in history and philosophy of medicine, health law and public policy, health-care economics, professional ethics, clinical ethics, medical humanities, and moral development.

Prerequisites for Admission—Admission is contingent upon prior admission to a master’s or doctoral degree-granting program within the Graduate School. Students are encouraged to have some previous exposure to philosophy or biomedical science. Graduate students in philosophy are expected to have successfully completed at least one graduate course in ethical theory.

Special Application Requirements—Contact the director of graduate studies in bioethics for an Intent to Enroll form, which should be submitted by the middle of the spring semester the year before initiating coursework in the minor. Enrollment is contingent upon approval by the director of graduate studies for bioethics.

Use of 4xxx Courses—Some 4xxx courses are allowed as indicated in the guidelines for the bioethics minor, available from the director of graduate studies.

Courses—Please contact the minor program office for information on relevant coursework.

Freestanding Minor Requirements

Students Majoring in Philosophy—Master’s students (M.A. and M.S.) must complete a minimum of 8 graduate credits in bioethics: 6 credits of required courses and 2 credits of electives outside the Department of Philosophy.

Doctoral students must complete a minimum of 14 graduate credits in bioethics: 8 credits of required courses and 6 credits of electives outside the Department of Philosophy.

Students Majoring in a Field Other Than Philosophy—Master’s students (M.A. and M.S.) must complete a minimum of 8 graduate credits in bioethics outside the student’s major. Master’s students are not required to take electives in bioethics and cognate areas, but are encouraged to do so.

Doctoral students must complete a minimum of 14 graduate credits in bioethics outside the student’s major: 8 credits of required courses and 6 credits of electives.
Assistant Professor
Cheryl A. Gale, Pediatrics, AM

Research Associate
Nicole Kirchhof, Surgery, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—A professional master of biological science (M.B.S.) degree is offered with concentrations in areas such as biochemistry, basic biology (animal, plant, cell, applied, and general), biotechnology, biophysics, ecology, environment, evolution, food science and nutrition, genetics, microbiology, molecular biology, and neuroscience. It is a multicollege, cooperative degree program among the Colleges of Biological Sciences, Veterinary Medicine, and Agricultural, Food, and Environmental Sciences. The program is administered by the College of Biological Sciences and the degree is conferred by the Graduate School. The M.B.S. is a highly flexible graduate-level practitioner-based program offered to meet the needs of a substantial portion of the working community who wish or need to increase their knowledge in areas related to modern biology. The program provides educational opportunities beyond those that aim at maintaining and improving productivity within the professions. It fills a gap in the present educational system for those who have neither the time nor the flexibility to earn a graduate degree through more traditional channels. It also provides this population with the most current information and advanced skills in their areas of professional interest, and gives them acknowledgment for their achievement. The degree enables recipients to learn new job skills, change professional emphasis, or provide added value to their present job.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please contact the program office for information on relevant coursework.

M.B.S. Coursework Only Degree Requirements

The program includes coursework, seminars, independent study, workshops, and a capstone project. With guidance from faculty advisers, students complete 30 credits. M.B.S. candidates may transfer up to 8 credits into the program. Core credits may be waived or substituted if the student can show proficiency in the subject area, pending advisory committee approval. If a core credit is waived, the credits must still be earned in an elective course. Coursework will be taken from the regular curriculum in the participating colleges, as well as from other approved credit-bearing courses (e.g., intensive short courses and Internet courses).

The overall GPA of a candidate must be a minimum of 3.00 for the degree to be awarded. A student with 8 or more credits of incomplete (I) coursework will not be allowed to register for additional courses until the I’s are completed.

Language Requirements—None.

Final Exam—A capstone project is required.

Biomedical Engineering

Contact Information—Department of Biomedical Engineering, University of Minnesota, 7-105 BS&B, 312 Church Street S.E., Minneapolis, MN 55455 (612-624-8396; fax 612-624-1120; e-mail bmemepg@umn.edu; <www.bme.umn.edu/>).

Program office is located in room 187 Shepherd Labs, 100 Union Street S.E., Minneapolis campus.

Professor
Robert J. Bache, Medicine, FM
David G. Benditt, Medicine, FM
Frank B. Cerra, Surgery, FM
Jay N. Cohn, Medicine, FM
Max Donath, Mechanical Engineering, FM
William K. Darfee, Mechanical Engineering, FM
Arthur G. Erdman, Mechanical Engineering, FM
Stanley M. Finkelstein, Laboratory Medicine and Pathology, FM
Martha Flanders, Neuroscience, FM
John E. Foker, Surgery, FM
Leo T. Furcht, Laboratory Medicine and Pathology, FM
James R. Gage, Orthopaedic Surgery, AM
Michael G. Garwood, Radiology, AM
Robert P. Hebbel, Medicine, FR
Wei-Shou Hu, Chemical Engineering and Materials Science, FM
Xiaoping Hu, Radiology, FM
Paul A. Izauz, Anesthesiology, FM
Kenneth Keller, HHH Institute of Public Affairs, FM
Seong-gi Kim, Radiology, FM
Taral O. Kvalseth, Mechanical Engineering, FM
Paul C. Letourneau, Cell Biology and Neuroanatomy, FM
David G. Levitt, Physiology, FM
Jack L. Lewis, Orthopaedic Surgery, FM
Rex E. Lovrien, Biochemistry, FM
James B. McCarthy, Laboratory Medicine and Pathology, FM
Wilmer G. Miller, Chemistry, FM
David A. Nelson, Otolaryngology, FM
Robert P. Patterson, Physical Medicine and Rehabilitation, FM
Dennis L. Polia, FM
Richard E. Poppe, Neuroscience, FM
Gundu H. R. Rao, Laboratory Medicine and Pathology, FM
William F. Robbins, Electrical and Computer Engineering, AM
Ronald A. Siegel, Pharmaceuticals, FM
Ephraim M. Sparrow, Mechanical Engineering, FM
Ahmed H. Tewfik, Orthopaedic Surgery, FM
Robert T. Tranquillo, FM
Charles L. Truwit, Neurology, AM
Neil F. Viemerster, Psychology, FM
Robert F. Wilson, Medicine, AM

Associate Professor
Jerome H. Abrams, Surgery, FM
Alan J. Bank, Medicine, AM
John C. Bischof, Mechanical Engineering, FM
Wei Chen, Radiology, AM
William B. Gleason, Laboratory Medicine and Pathology, AM

Bruce E. Hammer, Radiology, FM
Ramesh Harjani, Electrical and Computer Engineering, AM
James E. Holte, Electrical Engineering, FM
Keith Lurie, Medicine, AM
Ronald C. McGlenen, Laboratory Medicine and Pathology, AM
David J. Odde, FM
A. David Redish, Neuroscience, AM
Clara M. Smith II, Pediatrics, FM
Stephen C. Strother, Radiology, AM
J. Thomas Vaughan, Radiology, FM
Jay Zhang, Medicine, FM
Cheryl L. Zimmerman, Pharmaceutics, AM

Assistant Professor
Victor H. Barocas, FM
Joan E. Bechtold, Orthopaedic Surgery, AM
Linda K. Hansen, Laboratory Medicine and Pathology, AM
Allison Hubel, Laboratory Medicine and Pathology, AM
Haiying Liu, Radiology, AM
David B. Masters, Pharmaceutics, AM
Michael H. Schwartz, Orthopedic Surgery, FM
Carl S. Smith, Urologic Surgery, AM
Joseph J. Tahglhader, Electrical and Computer Engineering, AM
Babak Ziaie, Electrical and Computer Engineering, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Biomedical engineering is the application of engineering principles and methods to problems in biology and medicine. The discipline includes the study of fundamental processes in biology and physiology, the study of the diagnosis and treatment of disease and injury, and the design and development of medical devices and techniques. Students take courses in mathematics, biology, biomedical engineering, and engineering emphasis areas. The engineering emphasis areas include biomaterials, biomechanics, cell/matrix science and tissue engineering, biomedical microdevices and instruments, biomedical instrumentation, medical information systems, medical devices, and biomedical heat and mass transfer.

Prerequisites for Admission—A baccalaureate degree in engineering or in a physical or biological science is required. Successful applicants without an engineering degree are required to complete appropriate coursework to provide preparation for graduate-level engineering courses before being admitted as a candidate for the degree. In most cases, this coursework is not considered part of the degree program.

Special Application Requirements—Three letters of recommendation and GRE scores are required of all applicants. For international students, the TOEFL with a minimum score of 575 is required.

Use of 4xxx Courses—No more than 3 credits of 4xxx courses may be included. These courses require approval of the adviser and director of graduate studies.
Courses—Please refer to Biomedical Engineering (BME) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements
The M.S. is offered under two plans: Plan A (with a thesis) and Plan B (with a project). Each program requires courses in mathematics, biology, biomedical engineering, an engineering emphasis area, and a minor or related field. Plan A requires completion of 25 course credits. Plan B requires completion of 35 course credits, including the research project. Coursework in a minor or supporting field must include a minimum of 6 credits for both Plan A and Plan B.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students
Majoring in Other Fields—The master’s minor requires 6 to 8 course credits, including two BME core courses.

Ph.D. Degree Requirements
The Ph.D. program requires coursework in mathematics, biology, biomedical engineering, and engineering emphasis areas (typically 40 credits, including those satisfying a required minor field), a written preliminary exam, an oral preliminary exam, a dissertation, and a final oral exam.

Language Requirements—None.

Minor Requirements for Students
Majoring in Other Fields—The doctoral minor requires 12 credits, including two BME core courses and courses from an engineering emphasis area.

Biomedical Science

Contact Information—Program Administrator, Combined M.D./Ph.D. Training Program, University of Minnesota, MMC 293, 420 Delaware St. S.E., Minneapolis, MN 55455 (612-625-3680; <http://mdphd.med.umn.edu>).

Regents’ Professor
Ashley T. Haase, Microbiology, FM
Alfred F. Michael, Pediatrics, FM
James G. White, Laboratory Medicine and Pathology, FM

Professor
Dwight L. Anderson, Oral Sciences, FM
Robert J. Bache, Medicine, FM
Leonard J. Banazak, Biochemistry, FM
Bruce R. Biazar, Pediatrics, FM
Frank B. Cerra, Surgery, FM
Paul P. Cleary, Microbiology, FM
Bianca M. Conti-Fine, Biochemistry, FM
Bruce L. Dunn, Surgery, FM
Timothy J. Ebner, Neuroscience, FM
Robert P. Elde, Biological Sciences, FM
Esam E. El-Fakahany, Psychiatry, FM
Stanley L. Erlandsen, Genetics, Cell Biology, and Development, FM
David P. Fan, Genetics, Cell Biology, and Development, FM
Anthony J. Faras, Microbiology, FM
Stanley M Finkelstein, Laboratory Medicine and Pathology, FM
Leo T. Furcht, Laboratory Medicine and Pathology, FM
Apostolos P. Georgopoulos, Neuroscience, FM
Glenn J. Giesler, Jr., Neuroscience, FM
Gary Gray, Chemistry, FM
Perry B. Hackett, Genetics, Cell Biology, and Development, FM
David W. Hamilton, Genetics, Cell Biology, and Development, FM
Stephen S. Hecht, Cancer Center, FM
Robert Herman, Genetics, Cell Biology, and Development, FM
Jordan L. Holtzman, Medicine, FM
Thomas H. Hostetter, Medicine, FM
Costantino Iadeoca, Neurology, FM
David H. Inghar, Medicine, FM
Harry S. Jacob, Medicine, FM
Ross G. Johnson, Genetics, Cell Biology, and Development, FM
Russell Johnson, Microbiology, FM
Marc Jenkins, Microbiology, FM
James F. Koerner, Biochemistry, FM
Yoko Karuiyama, Genetics, Cell Biology, and Development, FM
David C. LaPorte, Biochemistry, FM
Alice A. Larson, Virology, FM
Tucker W. LeBien, Laboratory Medicine and Pathology, FM
Hon Cheung Lee, Pharmacology, FM
Paul C. Letourneau, Neuroscience, FM
Jack L. Lewis, Orthopaedic Surgery, FM
Richard W. Linck, Genetics, Cell Biology, and Development, FM
John D. Lipscomb, Biochemistry, FM
Horace H. Loh, Pharmacology, FM
Walter C. Low, Neurosurgery, FM
James B. McCarthy, Laboratory Medicine and Pathology, FM
R. Scott McIvor, Genetics, Cell Biology, and Development, FM
Steven C. McLoon, Neuroscience, FM
Matthew F. Mescher, Laboratory Medicine and Pathology, FM
Jeffrey S. Miller, Medicine, FM
Eric Newman, Neuroscience, FM
Theodore, Jr. Oegema, Orthopaedic Surgery, FM
Harry T. Orr, Laboratory Medicine and Pathology, FM
Peter G. W. Plageman, Microbiology, FM
Richard Poppele, Neuroscience, FM
Sunaram Ramakrishnan, Pharmacology, FM
M. Elizabeth Ross, Neurology, FM
Michel M. Sanders, Biochemistry, FM
Patrick Schlauter, Microbiology, FM
Virginia S. Seybold, Neurosurgery, FM
Norman E. Sladek, Pharmacology, FM
John F. Spector, Neuroscience, FM
Chang W. Song, Therapeutic Radiology, FM
Robert Sorenson, Genetics, Cell Biology, and Development, FM
Sheldon B. Sparber, Pharmacology, FM
David D. Thomas, Biochemistry, FM
Howard C. Towle, Biochemistry, FM
Kamil Ugurbil, Radiology, FM
Daniel A. Valleria, Therapeutic Radiology, FM
Brian G. Van Ness, Genetics, Cell Biology, and Development, FM
Carol L. Wells, Laboratory Medicine and Pathology, FM
Susan M. Wick, Plant Biology, FM
Douglas Yee, Medicine, FM
Ben G. Zimmerman, Pharmacology, FM

Associate Professor
James Ashe, Neuroscience, FM
Vivian J. Bardwell, Genetics, Cell Biology, and Development, FM
John C. Bischof, Mechanical Engineering, FM
Kathleen F. Conklin, Microbiology, FM
Christopher M. Gomez, Neurology, FM
Kristin A. Hogquist, Laboratory Medicine and Pathology, FM
Victoria Iwanju, Genetics, Cell Biology, and Development, FM
Stephen C. Jameson, Laboratory Medicine and Pathology, FM
Ronald R. Jemmerson, Microbiology, FM
Jose V. Parodi, Psychiatry, FM
Lisa A. Peterson, Cancer Center, FM
Mary E. Porter, Genetics, Cell Biology, and Development, FM
Stephen J. Restorfer, AM
Paul G. Siliciano, Biochemistry, FM
Amy P. N. Skubitz, Laboratory Medicine and Pathology, FM
Peter J. Southern, Microbiology, FM
Stanley A. Thyayer, Pharmacology, FM
R. Carston Wagner, College of Pharmacy, FM

Ph.D. Degree Requirements
This interdisciplinary program enables M.D./Ph.D. students to custom design their Ph.D. program. The goal is to train scientists who will be at the interface of research in several disciplines and to provide an alternative when a traditional graduate program will not satisfy the student’s needs or intentions. Despite the interdisciplinary quality of biomedical science, each student’s program will contain a coherent and cohesive core of individualized course material.

Language Requirements—None.

Biophysical Sciences and Medical Physics

Contact Information—Biophysical Sciences and Medical Physics Program, Department of Radiology, University of Minnesota, MMC 292, Room B230 Mayo Building, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-6638; e-mail hansel032@umn.edu).

Professor
Dwight L. Anderson, Oral Sciences, FM
Victor A. Bloomfield, Biochemistry, FM
Bianca M. Conti-Fine, Biochemistry, FM
Ralph DeLong, Oral Sciences, AM
William H. Douglas, Oral Sciences, FM
Stanley M. Finkelstein, Laboratory Medicine and Pathology, FM
John E. Foker, Surgery, FM
Michael G. Garwood, Radiology, FM
Russell K. Hobbs, (emeritus), Physics and Astronomy, FM
Xiaoping Hu, Radiology, FM
Faiz M. Khan, Therapeutic Radiology, FM
Seong-ky Kim, Radiation Therapy, FM
Merle K. Loken, (emeritus), Radiology, FM
Rex E. Lovrien, Biochemistry, FM
Robert H. Margolis, Otolaryngology, FM
Scott M. O'Grady, Animal Science, FM
Robert P. Patterson, Physical Medicine and Rehabilitation, FM
Richard E. Poppele, Physiology, FM
E. Russell Ritenour, Radiology, FM
Chang W. Song, Therapeutic Radiology, FM
David D. Thomas, Biochemistry, FM
Kamil Ugarbli, Radiology, FM
Warren J. Warwick, Pediatrics, FM

Associate Professor
Alan J. Bank, Medicine, AM
Richard A. Geise, Radiology, FM
Bruce J. Gerbi, Therapeutic Radiology, FM
Rolf Grue, Radiology, FM
Bruce E. Hammer, Radiology, FM
Patrick Higgins, Therapeutic Radiology, AM
James E. Holte, Electrical Engineering, FM
Michael Jerosch-Herold, Radiology, AM
Arthur E. Stillman, Radiology, AM
Stephen C. Strother, Radiology, AM

Assistant Professor
Vincent A. Barnett, Physiology, AM
Mark J. Conroy, Radiology, AM
Bruce E. Hasselquist, Radiology, AM
Jeh-Sun Low, Radiology, AM
Haiying Liu, Radiology, AM
Kelly Rehm, Radiology, AM

Senior Research Associate
David H. Live, Biochemistry, Molecular Biology, and Biophysics, AM
Ching-Change Ko, Oral Science, AM

Other
Firmin C. Deibel, AM
Christopher C. Kuni, AM
Kevin G. Waddick, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This interdisciplinary program includes faculty members who have primary appointments in fields such as radiobiology, physics, engineering, computer science, physiology, dentistry, genetics, and biochemistry. Students concentrate in research areas such as molecular biophysics, medical imaging, magnetic resonance imaging and spectroscopy, radiobiology, radiation therapy physics, and mathematical biophysics and computation. A limited number of students prepare for employment as hospital-based medical physicists through a program that includes opportunities for coursework, laboratory work, and directed study to provide experience in areas such as purchase specification, acceptance testing, quality assurance, and radiation safety.

Prerequisites for Admission—All students should have some familiarity with physical chemistry, intermediate physics, intermediate mathematics, biostatistics, computer programming, biology, physiology, and biochemistry. This may be demonstrated by coursework completed at the undergraduate level or as part of the graduate program; by reading or practical experience; or by informal competency examinations.

Special Application Requirements—Three letters of recommendation and scores from the General Test of the GRE are required. Applicants are considered for admission in both semesters.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Biophysical Sciences (BPhy) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements
The M.S. is offered under two plans: Plan A, which includes a thesis, and Plan B, which includes a project. Plan A is considered suitable for students with full-time employment whose thesis can be related to their work assignments. Plan B is more suitable for students planning to work in government or hospital settings where technical knowledge is more germane than research experience. Plan B students complete a project under the direction of a faculty member and present the work to their faculty committee in an oral exam. A total of 30 credits is required, including 14 in the major and 6 in a related field or minor.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Programs are arranged on an individual basis and must consist of courses that represent a subfield of the discipline, e.g., radiobiology or medical physics. At least 6 credits of BPhy courses are required.

Ph.D. Degree Requirements
Ph.D. students take preliminary written exams at the end of the first year of study or as soon as possible after completing the core course sequence in topics in physics for medicine and biology. An oral preliminary exam focuses on the plan for thesis research and the student’s grasp of related information and is taken by the fall of the third year of full-time registration or its equivalent. At least 12 credits are required in a minor or supporting program. Additionally, 24 thesis credits are required.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Programs are arranged on an individual basis and must consist of courses that represent a subfield of the discipline, e.g., radiobiology or medical physics.

Biostatistics

Contact Information—Student Services Center, School of Public Health, University of Minnesota, Mayo Mail Code S19, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-3500 or 1-800-774-8636; fax 612-626-6911; e-mail sph-ssc@umn.edu; <www.sph.umn.edu>).

Professor
Bradley P. Carlin, FM
Katheryn M. Chaloner, Statistics, FM
John E. Connett, FM
William T.M. Dunsmuir, FM
Anne I. Goldman, FM
Chap T. Le, FM
Thomas A. Louis, FM
James D. Neaton, FM
Richard Lewis Tweedie, FM

Associate Professor
Patricia M. Grambsch, FM
William Thomas, AM

Assistant Professor
Sudipto Banerjee, AM
Hegang Chen, AM
Lynn E. Eberly, AM
Wei Pan, AM
Cavan Reilly, AM
Melanie Wall, AM

Senior Research Associate
James S. Hodges, FM

Research Associate
Judith Bebchuk, AM
Li Chen, AM
Katherine Huppler Hullsiek, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Biostatistics combines statistics, biomedical science, and computing to advance health research. Biostatisticians design, direct, and analyze clinical trials; develop new statistical methods; and analyze data from observational studies, laboratory experiments, and health surveys. This is an ideal field for students who have strong mathematical backgrounds and who enjoy working with computers, collaborating with investigators, and want to participate in health research. Students take courses in biostatistical methods, theory of statistics, clinical trials, statistical computing, categorical data, survival analysis, and health sciences.

Prerequisites for Admission—For the M.S., multivariable calculus and linear algebra, an introductory course in applied statistics, and programming in C or Fortran are required. For the Ph.D., an M.S. in statistics, biostatistics, or mathematics, with coursework in applied and theoretical statistics, and graduate level real analysis is required.

Three letters of recommendation and the GRE are required. Applicants should have a GPA of at least 3.10 on a 4.00 scale. Applicants to the M.S. program should have a GPA of 3.40 in quantitative courses, 450 on
the verbal GRE, and 550 on the quantitative and analytical GRE. Applicants to the Ph.D. program should have a GPA of 3.70 in quantitative courses, 550 on the verbal GRE, and 650 on the quantitative and analytical GRE. Non-native speakers of English applying to either program should have a TOEFL score of at least 600 (paper version) or 250 (computer version).

**Special Application Requirements**—
Students should apply for admission during fall semester only. New students generally are not admitted in spring semester.

**Use of 4xxx Courses**—No 4xxx courses may be included on degree program forms in biostatistics.

**Courses**—
Please refer to Public Health (PubH), where most biostatistics courses are numbered 54xx or 84xx.

**M.S. Degree Requirements**
For the M.S. Plan B degree, students must complete at least 36 credits with a GPA of 3.00, pass a written exam, complete the Plan B project and a final oral exam. Most students need two years of full time study to finish the degree. The required credits are divided among three areas: 1) nine required courses in statistical theory, biostatistics methods, and computing; 2) 3 credits in health science; 3) 3 credits in biostatistics. Details of the program are in the Student Handbook at [www.biostat.umn.edu](http://www.biostat.umn.edu). The M.S. Plan A thesis degree is for those who have completed advanced work, such as a Ph.D. in a mathematical science and who want to begin dissertation research in biostatistics methodology after only one year of coursework. Students complete at least 20 credits, 14 in biostatistics and 6 in related fields.

**Language Requirements**—None.

**Final Exam**—The final exam is oral.

**Minor Requirements for Students Majoring in Other Fields**—The minor for M.S. students majoring in statistics consists of at least 6 credits selected from the following: PubH 5421—Statistical Computing II (2 cr), PubH 5462—Clinical Trials (3 cr), PubH 5467—Analysis of Categorical Data (3 cr), PubH 8420—Survival Analysis (3 cr). The master's minor for nonstatistics majors consists of PubH 5450—Biostatistics I (4 cr), PubH 5462—Clinical Trials (3 cr).

**Ph.D. Degree Requirements**
The Ph.D. program requires at least 24 credits of coursework, a comprehensive written examination on the material from some of the required courses, a preliminary oral examination, writing the dissertation, and defending the dissertation in a final oral examination. This usually requires three years of full time study after the M.S. degree. The required courses include mathematical statistics, linear models, longitudinal data analysis, probability models, and Bayesian methodology.

**Language Requirements**—None.

**Minor Requirements for Students Majoring in Other Fields**—A minor for Ph.D. students majoring in statistics consists of at least 12 credits selected from the following: PubH 5462—Clinical Trials (3 cr), PubH 5467—Analysis of Categorical Data (3 cr), PubH 8420—Survival Analysis (3 cr), PubH 8430—Sequential Analysis (2 cr), PubH 8431—Bayesian Decision Theory (4 cr), PubH 8433—Analysis of Longitudinal Data (3 cr), PubH 8434—Advanced Survival Analysis (2 cr), PubH 8436—Spatial Biostatistics (2 cr).

A minor for Ph.D. students in programs other than statistics consists of PubH 5465—Biostatistical Inference I (4 cr) and PubH 5466—Biostatistical Inference II (4 cr), plus 6 credits selected from the following: PubH 5421—Statistical Computing II (2 cr), PubH 5462—Clinical Trials (3 cr), PubH 5467—Analysis of Categorical Data (3 cr), PubH 8420—Survival Analysis (3 cr). Prerequisites for these courses include multivariate calculus, linear algebra, and statistical theory (Stat 5101-5102).

**Biosystems and Agricultural Engineering**

**Contact Information**—
Director of Graduate Studies, Department of Biosystems and Agricultural Engineering, University of Minnesota, 1390 Eckles Avenue, St. Paul, MN 55108-6005 (612-625-7733; fax 612-624-3005; e-mail baeg@gaia.bae.umn.edu; [www.bae.umn.edu](http://www.bae.umn.edu)).

**Professor**
Mrinal Bhattacharya, FM
Charles J. Clanton, FM
Larry D. Jacobson, FM
Kevin A. Jann, FM
Theodore P. Labuza, Food Science and Nutrition, FM
R. Vance Morey, FM
John L. Nieber, FM
Rongsheng R. Ruan, FM
William F. Wilcke, FM

**Associate Professor**
James J. Boedeker, AM
Jonathan Chaplin, FM
Philip R. Goodrich, FM
John M. Shustke, AM
Bruce N. Wilson, FM

**Assistant Professor**
Gary R. Sands, AM
Jun Zhu, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

**Curriculum**—Areas of emphasis include bioprocessing; food engineering; livestock environment; water quality, surface and subsurface flow, contaminant transport; waste management and resource utilization; terramechanics; safety; and grain quality. With approval from the department faculty, supporting courses in other fields of engineering and the physical, biological, or agricultural sciences may be included in the major.

The M.B.A.E. is primarily a design-oriented professional degree intended for students who are already employed in engineering design positions, but the degree is also open to students who are not currently employed and students may select a coursework only option. The M.B.A.E. is normally considered to be a terminal degree; students who think they might pursue a Ph.D. would usually take the M.S., Plan A.

Graduate education in biosystems and agricultural engineering develops a strong foundation in engineering principles that are applied to important problems involving biological and agricultural systems. The master of science in biosystems and agricultural engineering (M.S.B.A.E.) degree is for students with a bachelor’s degree in a biological, biosystems, agricultural, or related engineering field. Emphases are outlined above. Programs usually include study in at least one other engineering discipline as well as study or research in a biological or agricultural discipline.

The Ph.D. degree is for students with exceptional research and problem-solving capabilities. It should build upon a strong undergraduate program in engineering, biology, and agricultural systems, and progress in rigor to prepare the student to research advanced biosystems and agricultural engineering problems. Emphases are outlined above. Programs usually include study in at least one other engineering discipline as well as study or research in a biological or agricultural discipline.

**Prerequisites for Admission**—A B.S. degree in biological, agricultural, or related field of engineering, or equivalent coursework in mathematics, physics, engineering science, and engineering design is required. A strong academic record is also required.

**Special Application Requirements**—The GRE is not required, but GRE scores are highly recommended for students who do not have engineering degrees, have degrees from institutions outside the U.S., or have a low grade point average. Students are admitted each semester.

**Use of 4xxx Courses**—Degree programs are expected to include mostly 5xxx and 8xxx courses. If the program contains more than three 4xxx courses in the M.S. program, or more than two 4xxx courses beyond the courses taken for the master’s degree in the doctoral program, students and their advisers are asked to include a letter of explanation when the degree program is submitted for approval.

**Courses**—Please refer to Biosystems and Agricultural Engineering (BAE) and Agricultural Engineering Technology (AgET) in the course section of this catalog for courses pertaining to the program.
Degree Programs and Faculty

M.B.A.E Degree Requirements
Students are required to complete a minimum of 14 course credits in the major field, 6 course credits in a related field or a minor, and a design project of a minimum of 10 credits. The design project is expected to be of professional caliber. Alternately, students may opt for a coursework (30 credits) only program. The coursework program must be approved by the biosystems and agricultural engineering director of graduate studies and the chair of the graduate program committee.

Language Requirements—None.

Final Exam—Students must present a seminar and pass a final oral exam. Students must also meet all Graduate School requirements regarding the final exam.

Minor Requirements for Students Majoring in Other Fields—A minor consists of at least 6 credits of BAE courses numbered 4xxx or higher.

M.S.B.A.E Degree Requirements
The M.S.B.A.E. may be completed as either a Plan A (thesis) or Plan B (project). Plan A students must complete a minimum of 14 course credits in the major field, 6 course credits in a related field or a minor, and 10 thesis credits. Plan B students must complete a minimum of 14 course credits in the major field, 6 course credits in a related field or a minor, 10 other credits, and at least one Plan B project. All coursework programs must be approved by the biosystems and agricultural engineering director of graduate studies and the chair of the graduate program committee.

Language Requirements—None.

Final Exam—Students must present a seminar and pass a final oral exam. Students must also meet all Graduate School requirements regarding the final exam.

Minor Requirements for Students Majoring in Other Fields—A minor consists of at least 6 credits of BAE courses numbered 4xxx or higher.

Ph.D. Degree Requirements
This degree is intended to move students to the cutting edge of research in their subject matter area. Students develop skills that enable them to define problems or research questions, plan research, conduct research and/or lead research efforts, analyze data, and communicate research results to a variety of audiences. All Ph.D. degree programs must include a minimum of 45 graduate course credits beyond the B.S. and a minimum of 24 doctoral thesis credits (BAE 8888). A minimum of 12 course credits must be in a minor field or in a supporting program. Ph.D. degree programs should contain a minimum of 9 course credits in a concentrated area of scientific or mathematical theoretical development that is related to the student’s research.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A minor consists of at least 12 credits of BAE courses numbered 4xxx or higher.

Business Administration

Contact Information—Ph.D. Program in Business Administration, Carlson School of Management, University of Minnesota, Room 4-201, 321 19th Avenue S., Minneapolis, MN 55455 (612-624-0875 or 612-624-5065; fax 612-624-8221; e-mail ebronson@csom.umn.edu; <http://CarlsonSchool.umn.edu/CSom/Phdprop/Index.html>.

Master of Business Administration—Graduate School students who wish to take M.B.A. courses must contact the Carlson School of Management MBA Office, 2-210 Carlson School of Management, Minneapolis, MN 55455 (612-625-5555; fax 612-626-7785).

Regents’ Professor
Edward C. Prescott, Economics and Finance, FM

Professor
Carl R. Adams, Information and Decision Sciences, FM
Dennis A. Ahlburg, Human Resources and Industrial Relations, AM
Gordon J. Alexander, Finance, FM
Ann H. Amershi, Accounting, FM
John C. Anderson, Operations and Management Science, FM
Richard D. Arvey, Human Resources and Industrial Relations, FM
Frederick J. Beier, Marketing and Logistics Management, FM
Lawrence M. Benveniste, Finance, FM
Glen Berryman, Accounting, FM
Mario F. Bognano, Human Resources and Industrial Relations, FM
Norman E. Bowie, Strategic Management and Organization, FM
John H. Boyd, Finance, FM
Philip Bromley, Strategic Management and Organization, FM
John M. Bryson, Public Affairs and Strategic Management and Organization, AM
Richard N. Cardozo, Marketing and Logistics Management, FM
Balaji S. Chakravarthy, Strategic Management and Organization, FM
Chun Chang, Finance, FM
Norman L. Chervany, Information and Decision Sciences, FM
Terry L. Childers, Marketing and Logistics Management, FM
Shawn P. Curley, Information and Decision Sciences, FM
Gordon B. Davis, Information and Decision Sciences, FM
John W. Dickhaut, Accounting, FM
W. Bruce Erickson, Strategic Management and Organization, FM
John A. Fossum, Human Resources and Industrial Relations, FM
Joseph Galaskiewicz, Sociology and Strategic Management and Organization, FM
Arthur V. Hill, Operations and Management Science, FM
Thomas R. Hoffman, Information and Decision Sciences, FM
Michael J. Houston, Marketing and Logistics Management, FM
Deborah R. John, Marketing and Logistics Management, FM
George John, Marketing and Logistics Management, FM
Paul E. Johnson, Information and Decision Sciences, FM
Edward J. Joyce, Accounting, FM
Chandra S. Kanodia, Accounting, FM
Robert J. Kauffman, Information and Decision Sciences, FM
Stefanie A. Lenway, Strategic Management and Organization, FM
Ross Levine, Finance, FM
Barbara J. Loken, Marketing and Logistics Management, FM
Ian H. Matland, Strategic Management and Organization, FM
Salvatore T. March, Information and Decision Sciences, FM
Alfred A. Marcus, Strategic Management and Organization, FM
Joan Meyers-Levy, Marketing and Logistics Management, FM
Christopher J. Nachtisheim, Operations and Management Science, FM
Timothy J. Nantell, Finance, FM
Mary L. Nichols, Strategic Management and Organization, FM
Margaret A. Peteraf, Strategic Management and Organization, FM
Judy D. Rayburn, Accounting, FM
Kenneth J. Roering, Marketing and Logistics Management, FM
Robert W. Ruekert, Marketing and Logistics Management, FM
David E. Runke, Finance, AM
Roger G. Schroeder, Operations and Management Science, FM
James G. Scoville, Human Resources and Industrial Relations, FM
Shaker B. Srinivasan, Strategic Management and Organization, FM
Andrew H. Van de Ven, Strategic Management and Organization, FM
Orville C. Walker, Marketing and Logistics Management, FM
Jan Werner, Economics and Finance, FM
Andrew F. Whitman, Human Resources and Industrial Relations, FM
Mahmood A. Zaidi, Human Resources and Industrial Relations, FM

Associate Professor
Stuart Albert, Strategic Management and Organization, FM
Ross E. Azevedo, Human Resources and Industrial Relations, FM
Mark E. Bergen, Marketing and Logistics Management, FM
Gordon L. Duke, Accounting, FM
Gordon C. Everest, Information and Decision Sciences, FM
Robert A. Hansen, Marketing and Logistics Management, FM
John J. Mauriel, Strategic Management and Organization, FM
Thomas P. Murtha, Strategic Management and Organization, FM
J. David Naumann, Information and Decision Sciences, FM
Akshay R. Rao, Marketing and Logistics Management, FM
Peter Rosko, Finance, AM
Paul J. Seguin, Finance, FM
Priti P. Shah, Strategic Management and Organization, AM
Kingshuk K. Sinha, Operations and Management Science, FM
Michael R. Taaffe, Operations and Management Science, FM
Andrew Winton, Finance, FM
Akbar Zaheer, Strategic Management and Organization, FM
Srilata Zaheer, Strategic Management and Organization, FM

Assistant Professor
Regina M. Ancil, Accounting, AM
Rajesh Chandy, Marketing and Logistics Management, AM
Alvaro Cuervo-Cazurra, Strategic Management and Organization, AM
Yan Dong, Marketing and Logistics Management, AM
Degree Programs and Faculty

Karen L. Donohue, Operations and Management Science, AM
Daniel Forbes, Strategic Management and Organization, AM
G. Scott Gibson IV, Finance, AM
Ioulia Joffe, Finance, AM
William W. Li, Operations and Management Science, AM
Kevin Linderman, Operations and Management Science, AM
Debashis Mallick, Operations and Management Science, AM
Susan M. Meyer, Operations and Management Science, AM
Jimsoo Park, Information and Decision Sciences, AM
Valery Polkovnikchenko, Finance, AM
Paul Povel, Finance, AM
Baba Prasad, Information and Decision Sciences, AM
Balkrishna Radhakrishna, Accounting, AM
Karen A. Schnatterly, Strategic Management and Organization, AM
Brian P. Shapiro, Accounting, AM
Raj Singh, Finance, AM
Pervin Shroff, Accounting, AM
Andrew Spero, Accounting, AM
Mani R. Subramani, Information and Decision Sciences, AM
Weidong Xia, Information and Decision Sciences, AM
Mary E. Zellner-Bruhn, Strategic Management and Organization, AM

Coordinator: Frederick R. Jacobs, AM
Lecturer: Gary W. Carter, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This program offers full-time advanced graduate education for students seeking academic placement at leading universities or research-oriented positions in business or government. The program is for individuals who have the intellectual capacity for advanced study, enjoy independent research and analytical thinking, and who wish to master a discipline within business administration.

Students choose to concentrate in one of six areas of specialization: accounting; finance; information and decision sciences (including the management information systems and decision science subfields); marketing and logistics management; operations and management science; and strategic management and organization (covering the subfields of strategy, organization behavior, entrepreneurship and business-government-society, all of which includes an international focus).

Prerequisites for Admission—Applicants must have completed an undergraduate degree, in any field, and have successfully completed college courses in microeconomics and finite mathematics or calculus. Scores from the GMAT or GRE test taken no more than five years prior to admission must be submitted.

Special Application Requirements—Applicants must submit the Graduate School application, GMAT or GRE scores, TOEFL scores (international applicants), three letters of recommendation, complete official transcripts from each college or university attended, and a clearly written statement of purpose. These materials are to be sent directly to the program office to ensure proper processing. Graduate study begins in fall semester only.

Use of 4XXX Courses—Inclusion of 4xxx courses on degree program forms is subject to the approval of the adviser and director of graduate studies.

Courses—Please refer to Accounting (Acct); Business Administration (BA); Business, Government, and Society (BGS); Business Law (BLaw); Entrepreneurship (Entr), Finance (Fina); Information and Decision Sciences (IDSc); Insurance (Ins); Logistics Management (LM); Management (Mgmt); Marketing (Mktg); and Operations and Management Science (OMS) in the course section of this catalog for courses pertaining to the program.

Ph.D. Degree Requirements
Degree requirements vary by area of concentration. Each student’s degree coursework is determined in consultation with an adviser, but in general it includes courses in the field of specialization, in research methodology, and in a minor or supporting program.

Accounting—Requires a minimum of 12 credits from accounting Ph.D. seminars. In addition, students take a minimum of 16 credits in a minor area outside the Carlson School of Management, or at least 16 credits in supporting programs taken across relevant fields (minimum of two courses from any one area). Students are expected to supplement these required credits with coursework in fields related to their research interests, e.g., finance, economics, statistics, or psychology, but there is no minimum requirement.

Finance—Students must take all three finance classes (Fina 8801, 8811, 8821), for 12 credits, plus the microeconomics sequence (Econ 8101, 8102, 8103, 8104) for 8 credits. The 8-credit microeconomics and applied econometrics sequences are also highly recommended. Students should take a minimum of 8 additional elective credits in economics, statistics, accounting, etc.

Information and Decision Sciences—Students are required to take 12 courses over a two-year period (a minimum of 40 credits total). Courses must include IDSc 8511 and 8521, and two experimental design and regression analysis courses (OMS 8651 and 8652 recommended). An additional eight courses can be taken as electives and supporting coursework, determined by the student in consultation with an adviser, but in general at least two of these being methodology courses.

Marketing and Logistics Management—The department requires students to take its five seminars (total 20 credits) plus a minimum of 12 credits of research methodology courses outside the department. Minor or supporting program coursework is determined by the student and adviser, and must total at least 16 credits.

Operations and Management Science—Students are required to take a minimum of ten courses (approximately 40 credits), including eight OMS Ph.D. courses, Mgmt 8101, and one graduate level course in linear programming (either OMS 8661 or Math 5711). Students should supplement this with at least 16 credits from outside the department for a minor or supporting program.

Strategic Management and Organization—Students are required to take at least five of seven core Ph.D. courses (20 credits), which must include one course from each of three areas (strategic organization behavior, business-government-society), plus two in the student’s area of specialization. The student should take at least five additional classes outside the department (approximately 20 credits) in supporting fields.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—For a doctoral minor, students must complete a cohesive program of at least 16 credits (at least four courses) of graduate work in one of the six areas of concentration. This program of study is developed in consultation with an adviser who is a full member of the graduate faculty in business administration.

Business Taxation

Contact Information—Master of Business Taxation Degree Program, Department of Accounting, University of Minnesota, 3-108 Carlson School of Management, Minneapolis, MN 55455 (612-624-7511; fax 612-626-7795; e-mail mbt@umn.edu; <www.ccc.umn.edu/mbt>).

Professor R. Glen Berryman (emeritus), Accounting and Business Law, AM
W. Bruce Erickson, Strategic Management, AM

Lecturer Charles Caliendo, AM
Gary W. Carter, AM
Paul G. Gutterman, AM
Frederick R. Jacobs, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This program helps students acquire a conceptual understanding of taxation and develop technical competence in the practical application of the rules of taxation in business and personal decision making.

Offered only in the evenings, the program accommodates both part-time and full-time students. Historically, more than 80 percent of students are employed in the business community and take courses on a part-time basis. Graduates of the program possess a common body of knowledge in traditional
business areas such as accounting, finance, and marketing. In addition, courses in business, government, and economic tax policy provide breadth to complement the technical tax courses that make up the majority of credits. Students enrolled part-time can expect to complete the program in approximately two to three years. Students enrolled full-time can complete the program in a shorter period.

Special Application Requirements—Results of the GMAT or the Law School Admission Test (LSAT) are required. Applicants are considered for admission for fall, spring, and summer terms.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Accounting (Aect); Business, Government, and Society (BGS); Business Law (BLaw); Finance (Fina); Information and Decision Sciences (IDScs); Insurance (Ins); Logistics Management (LM); Management (Mgmt); Marketing (Mktg); Master of Business Taxation (MBT); and Operations and Management Science (OMS) in the course section of this catalog for courses pertaining to the program.

M.B.T. Plan B Degree Requirements
The M.B.T. requires 30 credits, including 6 credits in specified courses dealing with business and economic tax policy, 10 credits in specified tax courses, and 14 credits of elective tax courses. All students must have completed coursework in finance, marketing, accounting, economics, statistics, management, business law, operations management, information and decision sciences, and strategic management. It is expected that students with business degrees will have few, if any, deficiencies in these areas. Students with deficiencies may make them up before being awarded the degree and may do so while enrolled in program courses.

Final Exam—None.

Language Requirements—None.

Cellular and Integrative Physiology

Cellular and Integrative Physiology

Contact Information—Department of Physiology, University of Minnesota, 6-125 Jackson Hall, 321 Church Street S.E., Minneapolis, MN 55455 (612-625-9178; fax 612-625-5149; e-mail katzx001@umn.edu; <http://physiology.med.umn.edu/grad/ge IDX.htm>).

Additional information concerning the Duluth campus (master’s program) is available by contacting the Associate Director of Graduate Studies, Department of Medical and Molecular Physiology, School of Medicine, University of Minnesota, 10 University Drive, Duluth, MN 55812 (218-726-7969; e-mail ehaller@d.umn.edu; <www.d.umn.edu/medweb/phsl/physiology/>).

Professor
Peter B. Bitterman, Medicine, FM
Dwight A. Burkhardt, Psychology, FM
Frank B. Cerra, Surgery, FM
Joseph DiSalvo, Physiology, FM
Timothy J. Ebner, Neuroscience, FM
William C. Engelstad, Surgery, FM
John E. Foker, Surgery, FM
Esther M. Gallant, Veterinary Pathobiology, FM
Robert P. Hebbel, Medicine, FM
Lois J. Heller, School of Medicine, Duluth, FM
Paul A. Izazio, Anesthesiology, FM
David H. Ingbar, Medicine, FM
Hon Chung Lee, Pharmacology, FM
Arthur S. Leon, Kinesiology and Leisure Studies, FM
David G. Levitt, Physiology, FM
Walter C. Low, Neurosurgery, FM
Robert F. Miller, Neuroscience, FM
Eric A. Newman, Neuroscience, FM
Scott M. O’Grady, Animal Science, FM
John W. Osborn, Animal Science, FM
Richard E. Poppele, Neuroscience, FM
O. Douglas Wangensteen, Physiology, FM

Associate Professor
W. Dale Branton, Neuroscience, FM
Jurgen F. Fohlmeister, Physiology, FM
Edwin W. Haller, School of Medicine, Duluth, AM
Stephen A. Katz, Physiology, or other people already working in a graduate faculty laboratory may be good candidates for the Ph.D. program. An additional route of admission is application with the aid of a graduate faculty sponsor.

Students enter the M.S. program from one of two sites. On the Duluth campus, students can enroll in coursework and participate in research in several basic areas. Students may pursue studies in muscle, cardiovascular, respiratory, and endocrine physiology, as well as in membrane transport, temperature regulation, and several areas of neuroscience. In addition, the Twin Cities campus has started a special masters program that focuses on training people in local private industries who are engaged in relevant physiological projects. For instance, there are persons working in various biotechnology, biomedical and bioengineering companies in the Twin Cities area that are already doing work in physiology, and who may benefit from formal training. The curriculum can be blended into a part-time graduate program,
allowing continued employment in the Twin Cities area while working for the M.S. degree.

Prerequisites for Admission—For the major, an undergraduate degree with at least one year (three quarters or two semesters) of calculus, one year of physics, one year of biology, and two years of chemistry. For the minor, a background in mathematics, physics, chemistry, and biology acceptable to the graduate faculty.

Special Application Requirements—For the Ph.D., applicants must take either the General Test of the GRE or the Medical College Admission Test. For all applicants, three letters of recommendation must be submitted. Admission can be at the start of either fall or spring semester.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to both adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program’s approval.

Courses—Please refer to Physiology (Phsl) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements
DuLaTh: All course requirements for the M.S. degree can be completed on the Duluth campus. Students are expected to fulfill all degree requirements over a period of two to three calendar years. The program includes at least 20 credits in physiology and 6 credits in a minor or related field of study. Incoming students are required to undertake at least two laboratory rotations in faculty research laboratories of their choice. Fulfillment of degree requirements also includes the presentation and defense of a thesis (Plan A). The final written examination and oral defense of the thesis takes place with participation of appropriate faculty from either campus.

Twin Cities campus: A special Plan A degree for individuals involved in research and employed at local companies requires 14 credits in physiology and 6 credits outside of physiology. The degree is based on laboratory research off or on campus, and requires a written thesis and an oral presentation of the work for the final exam. Plan B is primarily for Ph.D. students who, after about two years in the Ph.D. program, cannot or do not wish to complete the Ph.D. program. For Plan B, the final exam is oral.

Language Requirements—None.

Minor Requirements for Students

Majoring in Other Fields—A minimum of 6 graduate credits in cellular and integrative physiology is required.

Ph.D. Degree Requirements
The Ph.D. program requires courses in medical physiology and human neuroscience. No other specific courses are required, although some graduate level courses in cellular or molecular biology must be completed. The coursework is tailored to the student’s interests with input from the director of graduate studies or the adviser. During the first year, students rotate through three laboratories, pick an adviser, and begin a research project. A preliminary written exam in physiology and neuroscience is taken before the preliminary oral exam. The preliminary oral exam is given to test the student’s ability to apply principles of both physiology and the minor or supporting program to a proposed research based thesis. A minimum of 12 credits must be completed in the minor field or supporting program.

Language Requirements—None.

Minor Requirements for Students

Majoring in Other Fields—Ph.D. students are expected to take Phsl 6101 or the equivalent.

Chemical Engineering and Materials Science and Engineering

Contact Information—Department of Chemical Engineering and Materials Science, University of Minnesota, 151 Amundson Hall, 421 Washington Avenue S.E., Minneapolis, MN 55455 (612-625-0382; fax 612-626-7246; e-mail cemsgrad@umn.edu; <www.cems.umn.edu/>).

Regents’ Professor
Rutherford Aris, (emeritus), FM
H. Ted Davis, Chemistry, FM
L. E. Scriven, FM

Professor
Frank S. Bates, FM
Raul Caretta, FM
Robert W. Carr, Jr., FM
C. Barry Carter, FM
James R. Chelchowski, FM
Philip I. Cohen, Electrical and Computer Engineering, FM
Edward L. Cussler, FM
John S. Dahler, FM
Jeffrey J. Derby, FM
D. Fennell Evans, FM
Michael C. Flickinger, Biological Process Technology Institute, FM
Arnold G. Fredrickson, FM
Christie J. Geankoplis, FM
William W. Gerberich, FM
Wayne L. Gladfelter, Chemistry, FM
Allen M. Goldman, Physics and Astronomy, FM
J. Woods Halley, Physics and Astronomy, FM
Wei-Shou Hu, FM
Kenneth H. Keller, FM
David L. Kohlsstedt, Geology and Geophysics, FM
Timothy P. Lodge, FM
John S. Lowengrub, Mathematics, FM
Christopher W. Macosko, FM
Alon V. McCormick, FM
Wilmer G. Miller, Chemistry, FM
Christopher J. Palmstrom, FM
Dennis L. Polla, Biomedical Engineering, FM
Lanny D. Schmidt, FM
David A. Shores, FM
Ronald A. Siegel, Pharmacy, FM
William H. Smyrl, FM
Friedrich Sienc, FM
Robert T. Tranquillo, FM
Michael D. Ward, FM

Associate Professor
Robert F. Cook, FM
Prodromos Daoutidis, FM
Alfonso Franciosi, FM
Lorraine F. Francis, FM
C. Daniel Frisbie, FM
David J. Odde, Biomedical Engineering, FM
J. Ilja Siepmann, Chemistry FM
Renata M. Wentzcovitch, FM
Kewen Yin, Wood and Paper Science, FM

Assistant Professor
Victor H. Barocas, Biomedical Engineering, FM
Marc A. Hillmyer, Chemistry, FM
Satish Kumar, FM
Christopher Leighton, FM
Richard B. McClung, FM
David C. Morse, FM

Research Associate
Daniel M. Kroll, Medicinal Chemistry, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Research activities are broadly organized in the areas of: theory and computation; reaction engineering and chemical process synthesis; biotechnology and bioengineering; polymers; ceramics and metals; electronic and magnetic materials; and coating processes and interfacial engineering.

The graduate courses offered cover core areas of chemical engineering (fluid mechanics, applied mathematics, linear and non-linear analysis, transport, chemical thermodynamics, statistical thermodynamics and kinetics, and analysis of chemical reactors) and core areas of materials science (structure and symmetry of materials, thermodynamics and kinetics, electronic properties of materials, and mechanical properties of materials). In addition, several specialized topics are offered including biochemical engineering, biological transport processes, food processing technology, colloids, principles of mass transfer in engineering and biological engineering, rheology, coating process fundamentals, process control, finite elements methods of computer-aided analysis, ceramics, polymers, materials design and performance, materials processing, corrosion, introduction to polymer chemistry, polymer laboratory, contact and fracture properties of materials, electron microscopy, thin films and interfaces, composites, electrochemical engineering, physical chemistry of polymers, solid state reaction kinetics, electronic structure of materials, electronic properties and applications of organic materials, electronic ceramics, dislocations and interfaces, epitaxial thin film growth, and science of porous media.

Prerequisites for Admission—A bachelor’s degree in chemical engineering, materials science, metallurgy, ceramics, polymer engineering, chemistry, physics, mechanical engineering, or electrical engineering is required. Applicants may be accepted without this prerequisite, but may be required to complete additional preparatory studies.
prescribed by their adviser or the director of graduate studies after admission.

Special Application Requirements— Applicants must submit scores from the General Test of the GRE, three letters of recommendation from persons familiar with their scholarship and research potential, a complete set of official transcripts, and a clearly written statement of career interests, goals, and objectives. International students are required to provide scores of at least 560 on the paper-based or 220 on the computer-based TOEFL. Students may apply at any time; submission of all application materials by January 1 is strongly encouraged to ensure priority consideration for fellowships and assistantships; late applications are considered if space is available.

Research Centers and Facilities, Professional Courses, and Major Collaborating Programs— A number of outstanding interdisciplinary centers supplement the department, including the National Science Foundation Materials Research Science and Engineering Center, the Corrosion Research Center, the Industrial Partnership for Research in Interfacial and Materials Engineering, the Army High Performance Computing Research Center, the Biological Process Technology Institute, the Institute for Theoretical Physics, the Minnesota Supercomputer Institute, the Institute for Mathematics and its Applications, and the Regional Instrumentation Facility for Surface Analysis. Department faculty and students participate in all of these centers, creating powerful facilities and many opportunities to explore interdisciplinary research interests.

Use of 4xxx Courses— Chemical engineering will allow MatS 4212 to be taken for graduate credit. Materials science will allow MatS 4212—Ceramics, 4214—Polymer Physical Properties, MatS 4221—Materials Design and Performance, MatS 4301—Materials Processing, and MatS 4511—Corrosion to be taken for graduate credit. All other ChEn or MatS 4xxx courses must have adviser and director of graduate studies approval.

Courses— Please refer to Chemical Engineering (ChEn) and Materials Science (MatS) in the course section of this catalog for courses pertaining to these programs.

M.Ch.E or M.Mat.S.E. Design Project Degree Requirements— This professional master’s in engineering degree is designed for employees of local industries who wish to pursue their studies on a part-time basis. It is intended to provide a fifth year of professional work and is offered under the design project track. No financial support is available from the program. The M.Ch.E. and M.Mat.S.E. are terminal degrees. Only under exceptional circumstances is a student allowed to transfer to an M.S. program.

Both degrees require a minimum of 14 course credits in the major field and a minimum of 6 credits in the minor or related fields. The work-related design project consists of an in-depth study of an engineering design. It need not represent a publishable research project. While the amount of work should be the same as for an M.S. thesis, the project can contain elements that the thesis would not, such as economic considerations, design consultation, and social relevance.

Language Requirements— None.

Final Exam— A final oral exam focused on the design project is required.

Minor Requirements for Students Majoring in Other Fields— Approval of the chemical engineering or materials science director of graduate studies is required for a master’s minor.

M.S.Ch.E. and M.S.Mat.S.E. Plan A Degree Requirements— The M.S.Ch.E. and M.S.Mat.S.E. are offered only under Plan A (with thesis). The degrees require a minimum of 14 course credits in the major and a minimum of 6 credits in a minor or in one or more related fields. The program normally is completed in about 18 months. Students interested in a degree without a thesis should consider the professional master’s in chemical engineering or materials science degree outlined above.

Many students entering these programs change to the Ph.D. program before or after completing the M.S. degree. Application for a change of status is done in consultation with the adviser and the director of graduate studies.

Language Requirements— None.

Final Exam— The final exam is oral.

Minor Requirements for Students Majoring in Other Fields— Approval of the chemical engineering or materials science director of graduate studies is required for a master’s minor.

Ph.D. Degree Requirements— The Ph.D. is primarily a research degree and performance that leads to a research thesis is emphasized. Supporting coursework is planned in consultation with the adviser. The Ph.D. requires a minimum of 21 course credits within the major, and 12 course credits in a minor or supporting program.

Language Requirements— None.

Minor Requirements for Students Majoring in Other Fields— For a minor in chemical engineering or materials science, students must successfully complete at least four of the core graduate courses in the minor program and obtain approval by the director of graduate studies.

Chemical Physics

Contact Information— Chemical Physics Program, Department of Chemistry, University of Minnesota, 137 Smith Hall, 207 Pleasant Street S.E., Minneapolis, MN 55455 (612-626-7444; fax 612-626-7541; e-mail inquiry@chem.umn.edu; <www.chem.umn.edu>.

Regents’ Professor— H. Ted Davis, Chemical Engineering and Materials Science, FM

Professor— Victor A. Bloomfield, Biochemistry, FM
Charles E. Campbell, Physics, FM
Barry C. Carter, Chemical Engineering and Materials Science, FM
James R. Chelikowsky, Chemical Engineering and Materials Science, FM
Christopher J. Cramer, Chemistry, FM
John S. Dahler, Chemical Engineering and Materials Science, FM
Jiali Gao, Chemistry, FM
William R. Gentry, Chemistry, FM
Clayton F. Giese, Physics, FM
Allen M. Goldman, Physics, FM
J. Woods Halley, Physics, FM
Cheng-Cher Huang, Physics, FM
Kenneth R. Leopold, Chemistry, FM
Sanford Lipsky, Chemistry, FM
Wilmer G. Miller, Chemistry, FM
Lanny D. Schmidt, Chemical Engineering and Materials Science, FM
David D. Thomas, Biochemistry, FM
Donald G. Truhlar, Chemistry, FM

Associate Professor— David M. Ferguson, Medicinal Chemistry and Pharmacognosy, FM
Doreen G. Leopold, Chemistry, FM
Karim Musier-Forsyth, Chemistry, FM
Jeffrey T. Roberts, Chemistry, FM
J. Ilja Siepmann, Chemistry, FM
Renata M. Wentzovitch, Chemical Engineering and Materials Science, FM
Xiaoyang Zhu, Chemistry, FM

Assistant Professor— David A. Blank, Chemistry, FM
Richard M. McClurg, Chemical Engineering and Materials Science, FM
David C. Morse, Chemical Engineering and Materials Science, FM
Darrin M. York, Chemistry, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Chemical physics focuses on areas where the techniques of chemistry and physics are brought together for the study of atoms and molecules; their interactions in gases, liquids, and solids; and the detailed structure and dynamics of material changes. Areas of research and specialization include spectroscopy, optical properties, laser applications, molecular collisions, chemical dynamics, quantum mechanics, computational chemistry, statistical mechanics, thermodynamics, low-temperature behavior, polymers and macromolecules, surface science, biochemistry, and biochemical and heterogeneous catalysis.
Prerequisites for Admission—Applicants should have adequate preparation in mathematics, physics, and chemistry. For financial support, applicants should apply either to the Department of Chemistry or the Department of Physics. Applicants not requiring financial support have their academic qualifications reviewed by the director of graduate studies in chemical physics.

Special Application Requirements—Three letters of recommendation are required.

Use of 4xxx Courses—Inclusion of any 4xxx courses on degree program forms is subject to approval by the director of graduate studies.

Courses—Please refer to Chemistry (Chem), Physics (Phys), Chemical Engineering (ChEn), Materials Science (MatS), Mathematics (Math), Chemical Physics (ChPh) and Scientific Computation (ScC) in the course section of this catalog for courses pertaining to the program.

M.S. Plan A Degree Requirements

The M.S. degree is offered Plan A (with thesis) and requires at least 20 course credits and 10 or more thesis credits. The course credits must include at least 6 credits each in chemistry, physics, and quantum mechanics, and at least 3 credits in thermodynamics, statistical mechanics, or statistical physics. There is no minor or related field requirement.

Language Requirements—None.

Final Exam—The final exam is oral.

Ph.D. Degree Requirements

A proficiency exam in physical chemistry is required. The Ph.D. program ordinarily consists of at least 24 course credits that include coursework in chemistry and/or physics with options for coursework in quantum mechanics, thermodynamics, statistical physics, and chemical dynamics. There is no minor or supporting program requirement. Students must also complete 24 thesis credits.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Ph.D. minor requirements are determined by the director of graduate studies, the student, and the adviser.

Chemistry

Contact Information—Assistant to the Director of Graduate Studies, Department of Chemistry, University of Minnesota, 137 Smith Hall, 207 Pleasant Street S.E., Minneapolis, MN 55455 (612-626-7444 or 1-800-777-2431; fax 612-626-7541; e-mail inquiry@chem.umn.edu; <www.chem.umn.edu/>

Regents’ Professor

H. Ted Davis, FM

Professor

George Barany, FM
Bridgette A. Barry, Biochemistry, FM
Frank S. Bates, Chemical Engineering and Materials Science, FM
Victor A. Bloomfield, Biochemistry, FM
Peter W. Carr, FM
Christopher J. Cramer, FM
John E. Ellis, FM
Jiali Guo, FM
Ronald W. Gentry, FM
Wayne L. Gladfelter, FM
Gary R. Gray, FM
Thomas R. Hoye, FM
Steven R. Kass, FM
Kenneth R. Leopold, FM
John D. Lipscomb, Biochemistry, FM
Sanford Lipsky, FM
Timothy P. Lodge, FM
Kent R. Mann, FM
Larry L. Miller, FM
Wayland E. Noland, FM
Louis H. Pignolet, FM
Lawrence Que, Jr., FM
Michael A. Raftery, FM
Marian Stankovich, FM
William B. Tolman, FM
Donald G. Truhlar, FM
Michael D. Ward, Chemical Engineering and Materials Science, FM

Associate Professor

Mark D. Dostefano, FM
Craig J. Forsyth, FM
William B. Gleason, Laboratory Medicine and Pathology, FM
Doreen G. Leopold, FM
Karin Musier-Forsyth, FM
Jeffrey T. Roberts, FM
J. Ija Steppmann, FM
Andreas Stein, FM
Michael R. Zachariah, Mechanical Engineering, FM
Xiaoang Zhu, FM

Assistant Professor

Edgar A. Arriaga, FM
David A. Blank, FM
Michael T. Bowser, FM
Philippe Bühlmann, FM
Marc A. Hillmyer, FM
Richard Huang, FM
Christopher McNeill, FM
George A. O Doherty, FM
R. Lee Penn, FM
Gianluigi Veglia, FM
Darrin M. York, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Graduate work in the Department of Chemistry is organized into six specialty areas: analytical chemistry, biological chemistry, inorganic chemistry, materials chemistry, organic chemistry, and physical chemistry. Interdisciplinary work is also an option.

Prerequisites for Admission—Applicants must offer the substantial equivalent of the courses in analytical, inorganic, organic, and physical chemistry required of undergraduate majors in the Minnesota chemistry curriculum. They must also have at least one year of college physics plus college mathematics through calculus.

Special Application Requirements—Three letters of recommendation are required for all applications. Scores from General (Aptitude) and Subject (Advanced) Tests of the GRE are required for fellowship consideration and are strongly recommended for all other applicants. International applicants are expected to provide scores of at least 580 on the TOEFL, as well as GRE scores.

Proficiency Examination—Students working toward the M.S. or Ph.D. in chemistry are required to take a set of four proficiency examinations, one each in analytical, inorganic, organic, and physical chemistry. These examinations are taken on entrance; the results are used for guidance. Ph.D. students are expected to satisfy the proficiency requirements in all four fields during their first academic year in residence. M.S. students are expected to pass the proficiency examination in their specialty area during their first academic year in residence.

Use of 4xxx Courses—One of the following courses may be allowed: Chem 4150 or Chem 4701.

Courses—Please refer to Chemistry (Chem) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

M.S. students are expected to pass the proficiency exam (see above) in their specialty area in their first academic year in residence. Plan A requires 20 course credits and 10 thesis credits; Plan B requires 30 course credits (and one or two Plan B papers).

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students

Majoring in Other Fields—Six course credits from graduate-level chemistry courses are required for a master’s minor.

Ph.D. Degree Requirements

The Ph.D. program requires 24 course credits and 24 thesis credits. Students are also required to take four proficiency exams (see above) by the end of their first academic year in residence.

Language Requirements—None.

Minor Requirements for Students

Majoring in Other Fields—Ph.D. minor requirements are determined by the director of graduate studies, the student, and the adviser. Chem 4701 may be used.
Child Psychology

Degree Programs and Faculty

Contact Information—Child Psychology Program, University of Minnesota, 156 Child Development Building, 51 East River Road, Minneapolis, MN 55455 (612-624-0526; fax 612-624-6373; <http://icd.coled.umn.edu/ >).

See the College of Education and Human Development Professional Studies Catalog for information on the master of education (M.Ed.) program in early childhood education.

Regents’ Professor
Willard W. Hartup (emeritus), FM

Professor
Dale A. Blyth, 4H Youth Development Center, AM
Patricia J. Bauer, FM
Sandra L. Christenson, Educational Psychology, AM
W. Andrew Collins, FM
Nicki R. Crick, FM
Byron Egeland, FM
Norman Garmezy (emeritus), FM
Michael K. Georgieff, Pediatrics, FM
Harold D. Grotevant, Family Social Science, FM
Megan R. Gunnar, FM
Susan C. Hupp, Educational Psychology, FM
William G. Iacono, Psychology, FM
Gloria R. Leon, Psychology, FM
Michael P. Maratos, FM
Ann S. Masten, FM
Scott R. McConnell, Educational Psychology, FM
Charles A. Nelson, FM
Anne D. Pick, FM
Herbert L. Pick, Jr., FM
Elsa G. Shapiro, Pediatrics, AM
L. Alan Stroufe, FM
Auke Tellegen, Psychology, FM
Paulus W. van den Broek, Educational Psychology, FM
Richard A. Weinberg, FM
Carolyn L. Williams, Epidemiology, AM
Albert Yonas, FM
Steven R. Yussen, FM

Associate Professor
Carrie M. Borchardt, Psychiatry, AM
Mathra Erickson, AM
Marla D. Serak, FM

Assistant Professor
Canan Karatekin, FM
Monica Luciana, Psychology, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The Ph.D. in child psychology focuses primarily on training for research in normal human development, and most students take positions in academic or research settings. The goal of the program is to train all students for careers in research and college teaching in child psychology, and to prepare students in the joint program options for careers in applied areas of child psychology. General program students may choose to specialize in an area such as cognitive neuroscience, language, learning, personality, memory, perception, psychobiology, or social development. Students interested in applied areas may specialize in developmental psychopathology and clinical science or school psychology.

The developmental psychopathology and clinical science program is a cooperative effort between the Institute of Child Development and the Department of Psychology to train leaders in research and teaching. Training draws on the unique strengths of each program. Students are admitted to the Ph.D. program in child psychology through the Institute of Child Development and to this joint training program by the agreement of program faculty in both departments.

The APA-approved school psychology program is a cooperative program of the Institute of Child Development, the Department of Psychology, and the Department of Educational Psychology. Students are admitted jointly to one of the cooperating departments and to the school psychology program. Students must meet the standards and requirements of both the admitting department and the school psychology program.

Prerequisites for Admission—At least 8 semester credits in psychology and one course in statistics are required.

Special Application Requirements—New students are normally admitted in fall semester. Application deadline is in December of the preceding year. Applicants must submit scores from the General Test of the GRE that are less than five years old, three letters of recommendation from persons familiar with their scholarship and research potential, a complete set of official transcripts, a clearly written statement of career interests, goals, and objectives. The three letters of recommendation also must be received by the deadline.

Use of 4xxx Courses—Inclusion of 4xxx child psychology courses on degree program forms is approved with the following stipulations: child psychology Ph.D. students may include 4xxx courses as part of a supporting program with director of graduate studies’ approval and if the course is taught by a member of the graduate faculty in the supporting program. Students from other majors may include 4xxx CPsy courses subject to their own program’s approval.

Courses—Please refer to Child Psychology (CPsy) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The Institute of Child Development does not offer admission for a master’s degree. On occasion, students complete a master’s degree (typically Plan B) during their progress toward the Ph.D. Requirements for the M.A. are met through either Plan A or Plan B. Both require a full academic year of coursework.

Plan A requires a minimum of 20 course credits (a minimum of 14 in the major and 6 in the minor/related field) and 10 thesis credits. Plan B requires 30 course credits, of which 14 credits must be in child psychology and 6 credits in one or more related fields. A project equivalent to 120 hours of work (may be satisfied by completing a first-year project) is also required.

Language Requirements—None.

Final Exam—The final exam for Plan A is oral; the final exam for Plan B is written.

Ph.D. Degree Requirements

The Ph.D. degree usually requires four years of graduate work. Major program components include coursework, research activities, and teaching experience. Coursework requirements are specialization specific, but all students are required to take 44 credits in the major, 14 credits in a supporting program, and 24 thesis credits. Each student specializes in an area such as social and personality development, learning, cognitive development, cognitive neuroscience, language development, psychobiology or perceptual development. Required courses include CPsy 8301, 8302, 8304, 8311, 8321, 8360, 8888, 8994, and statistics through EPsy 8263 or equivalent.

Language Requirements—None.

Minor Requirements for Students

Majoring in Other Fields—A Ph.D. minor requires 12 credits in child psychology, to include CPsy 8301 (4 credits), CPsy 8302 (4 credits), and CPsy 8996 (1-6 credits). Remaining credits can be taken from 4xxx (subject to their own program’s approval) or 8xxx courses.

Chinese

See Asian Languages and Literatures.

Civil Engineering

Contact Information—Department of Civil Engineering, University of Minnesota, 122 Civil Engineering Building, 500 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-625-5522; fax 612-626-7750; e-mail gradsec@ce.umn.edu; <www.ce.umn.edu>).

Professor
Roger E. A. Arndt, FM
Patrick L. Brezonik, FM
Steven L. Crouch, FM
Emmanuel M. Detournay, FM
Andrew Drescher, FM
Efi Foufoula-Georgiou, FM
Catherine E. French, FM
Theodore V. Galambos, FM
John S. Gulliver, FM
Panos Michalopoulos, FM
John L. Nieber, Biosystems and Agricultural Engineering, FM
Gary Parker, FM
Michael J. Semmens, FM
Charles C. S. Song, FM
Heinz G. Stefan, FM
Henry K. Stolarski, FM
Otto D. L. Stack, FM
Vaughan R. Voller, FM
Degree Programs and Faculty

**Adjunct Professor**
Peter A. Cundall, FM

**Associate Professor**
Randal J. Barnes, FM
Gary A. Davis, FM
Robert J. Dexter, FM
Jerome F. Hajjar, FM
Miki Honzko, FM
Gerald W. Johnson, AM
Joseph F. Labuz, FM
Arturo E. Schultz, FM
Carol K. Shield, FM
Karl A. Smith, FM

**Associate Adjunct Professor**
Paul D. Capel, AM

**Assistant Professor**
William A. Arnold, FM
Bojan B. Guzina, FM
Raymond M. Hoalski, FM
Timothy M. LaPara, FM
David M. Levinson, FM
Mihai O. Marasteansu, FM
Paige J. Novak, FM
Fernando Porté-Agel, FM

**Assistant Adjunct Professor**
Eui Kwon, AM

**Senior Research Associate**
Sofia G. Mogilevskaya, AM
Eugene L. Skok Jr., AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

**Curriculum**—Emphases are available in environmental engineering (e.g. pollutant fate and transport, process modeling, soil and groundwater remediation, water and wastewater treatment), geomechanics engineering (e.g. fracture and localization, groundwater flow, stability and liquefaction, wave and shock propagation), structural engineering (e.g. computational and structural mechanics, earthquake engineering, infrastructure performance and durability, new systems and materials), transportation engineering (e.g. intelligent transportation systems, pavement design and materials, transportation economics), and water resources engineering (e.g. earthscape processes, environmental and biological systems, hydrologic and climate dynamics, hydrodynamics, and turbulence.)

**Prerequisites for Admission**—A bachelor's degree in an engineering, basic science, or mathematics program is preferred. Admission depends primarily on the applicant’s academic record and letters of recommendation. Applicants who lack civil engineering training are often required to complete one or more appropriate courses from the undergraduate civil engineering program. Graduate credit is not awarded for such preparatory work. For the M.C.E. program, an ABET-accredited bachelor's degree in civil engineering is required.

**Special Application Requirements**—Applicants are required to submit results of the GRE in support of their applications. The TOEFL is required of foreign applicants from non-English-speaking countries. A minimum TOEFL score of 550 is required for admission. Applicants who take the computer-based TOEFL are required to have a score of 213. Admission requirements also include three letters of recommendation and a statement of purpose that outlines the prospective student’s research interests, reasons for pursuing graduate studies, and career plans after graduation. Students are admitted each semester, but applicants are strongly encouraged to submit their applications by December 31 in order to begin the following fall semester.

**Use of 4xxx Courses**—Inclusion of 4xxx departmental courses is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program’s approval.

**Course**—Please refer to Civil Engineering (CE) in the course section of this catalog for courses pertaining to the program.

**M.C.E. Coursework Only and Design Project Degree Requirements**
The master of civil engineering (M.C.E.) degree is designed for the practicing engineer who would like to obtain an advanced degree on a part-time or full-time basis. Students who intend to proceed to the Ph.D. program or think they may later wish to be admitted to the Ph.D. program should apply for the master of science program. Students are expected to follow a coherent program of coursework in one of the following subareas of civil engineering: environmental, geomechanics, structural, transportation, or water resources engineering. The program is selected with the help of a faculty adviser and approved by the director of graduate studies. In addition to completing graduate level courses, students must demonstrate professional competence either by carrying out and defending a design project or by taking a coursework-related final oral exam (without a project). The degree typically takes 12 to 18 months to complete on a full-time basis.

The M.C.E. degree requires 30 credits and is offered under two plans. One requires a minimum of 20 course credits and preparation of a design project (10 credits); the design project must be carried out by the student in consultation with a faculty adviser. The other plan is a coursework-only degree requiring 30 course credits. At least 6 of the course credits must be taken outside the department for either Plan A or Plan B.

**M.S. Degree Requirements**
The master of science (M.S.) degree balances education in engineering fundamentals and design with research and development. The M.S. degree provides preparation for students wishing to pursue a career in industry or to continue studies toward a Ph.D. degree. Students are expected to follow a coherent program of coursework and research in one of the following subareas: environmental, geomechanics, structural, transportation, or water resources engineering. The program is selected with the help of a faculty adviser and approved by the director of graduate studies and typically takes 18 to 24 months to complete.

The M.S. degree requires 30 credits and is offered under two plans. Plan A emphasizes research and preparation of a thesis and Plan B emphasizes coursework. The thesis must be written on a research project carried out in consultation with a faculty adviser and should result in a scientific or technical contribution to the field. Under Plan B, the student must demonstrate the ability to work independently and present the results of such work effectively by completing one to three Plan B papers as determined by the faculty adviser. A wide variety of studies have been submitted as Plan B papers, including computer programs, annotated bibliographies, field or laboratory investigations, and the analysis/design of special engineering problems. Plan A requires 20 course credits and 10 thesis credits. Plan B requires 30 course credits. At least 6 of the course credits must be taken outside the department for either Plan A or Plan B.

**Language Requirements**—None.

**Final Exam**—The final exam is oral.

**Minor Requirements for Students Majoring in Other Fields**—For a master’s minor, two or more 5xxx or 8xxx courses from the same subarea of civil engineering are required, for a total of 6 or more credits.

**Ph.D. Degree Requirements**
The Ph.D. degree couples independent research with coursework in a comprehensive program for those wishing to attain mastery of their field. The Ph.D. degree demands the ability and desire to pursue independent and original studies and can be earned with emphasis in environmental, geomechanics, structural, transportation, or water resources engineering. Research performance, as judged by preparation of a dissertation on an independently pursued research topic, is the primary requirement for the Ph.D. degree. Students enter the Ph.D. program normally after completing the M.S. degree. The Ph.D. program is typically completed in five to six years following the bachelor’s degree.

Each program of study is designed in consultation with a faculty adviser to meet the special needs of the student, although programs must be approved by the director of graduate studies. A typical program consists of 45 credits of coursework beyond the
bachelor’s degree, plus 24 thesis credits. A supporting program or minor consisting of at least 12 credits taken outside the department must be included. Credits earned in an M.S. program may be presented in partial fulfillment of the Ph.D. requirements. Rigid requirements for the number of 8xxx courses appropriate for Ph.D. programs have not been set, nonetheless, the Ph.D. represents the highest level of scholarly achievement and coursework should be selected accordingly.

Language Requirements—None.

Minor Requirements for Students

Majoring in Other Fields—For a Ph.D. minor, four or more 5xxx to 8xxx courses from one or two subareas of civil engineering are required for a total of 12 or more credits.

Classical and Near Eastern Studies

Contact Information—Department of Classical and Near Eastern Studies, University of Minnesota, 305 Folwell Hall, 9 pleasant St. S.E., Minneapolis, MN 55455 (612-625-5353; fax 612-624-4894; e-mail cnes@umn.edu; <http://cnes.cla.umn.edu/>).

Professor

Elizabeth Belfiore, Ancient and Medieval Art and Archaeology, Classics, Classical and Near Eastern Studies, FM
Frederick Cooper, Ancient and Medieval Art and Archaeology, FM
Sheila McNally, Ancient and Medieval Art and Archaeology, FM
S. Douglas Olson, Classics, Classical and Near Eastern Studies, FM

Associate Professor

Andrea Berlin, Ancient and Medieval Art and Archaeology, Classical and Near Eastern Studies, AM
Nita Krevans, Ancient and Medieval Art and Archaeology, Classics, Classical and Near Eastern Studies, AM
Bernard Levinson, Classics, Classical and Near Eastern Studies, FM
William Malandra, Classics, Classical and Near Eastern Studies, FM
Oliver Nicholson, Ancient and Medieval Art and Archaeology, Classics, Classical and Near Eastern Studies, FM
Jonathan Paradise, Ancient and Medieval Art and Archaeology, Classical and Near Eastern Studies, FM
Philip Sellew, Ancient and Medieval Art and Archaeology, Classical and Near Eastern Studies, FM
George Sheets, Ancient and Medieval Art and Archaeology, Classics, Classical and Near Eastern Studies, FM

Assistant Professor

André Lardinois, Classics, Classical and Near Eastern Studies, AM
Christopher Nappa, Classics, Classical and Near Eastern Studies, AM
Eva Von Dassow, Ancient and Medieval Art and Archaeology, Classics, Classical and Near Eastern Studies, AM
Aziz Yadin, Ancient and Medieval Art and Archaeology, Classics, Classical and Near Eastern Studies, AM

Adjunct Professor

Thomas Clayton, English, Ancient and Medieval Art and Archaeology, FM
Sandra Peterson, Philosophy, Ancient and Medieval Art and Archaeology, FM
Theofanis G. Stavrou, History, Ancient and Medieval Art and Archaeology, FM
Peter Wells, Anthropology, Ancient and Medieval Art and Archaeology, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—In addition to classical Greek and Latin literary studies, flexible degree programs permit minors or supporting programs in other disciplinary areas such as archaeology, linguistics, modern Greek and Hellenic studies, Medieval and Renaissance Latin, philosophy, and religious studies. The art and archaeology degree includes a variety of programs ranging broadly over ancient and medieval periods, with flexible emphases on languages and textual studies. While full faculty participation from a wide variety of fields provides differing coursework, all students take a common core of courses to promote optimum collegiality and intellectual exchange. Related special facilities include the Center for Medieval Studies and the Center for Modern Greek Studies.

Prerequisites for Admission—Prerequisites for admission without restrictions to majors in classics or classical and Near Eastern studies include sufficient knowledge to begin graduate reading courses in either Greek or Latin and at least intermediate ability in the other language. For a major in ancient and medieval art and archaeology, a background in archaeology, art history, and history sufficient for beginning graduate level studies, and evidence of language acquisition ability are required for admission without restrictions. Some course prerequisites can be made up on provisional admission. Applications from students with undergraduate majors are welcomed in such fields as English, history, Greek and Latin, Near Eastern languages, philosophy, comparative literature, anthropology, theatre, religious studies, art history, political science, the modern languages, and linguistics.

Special Application Requirements—Applicants must send the following directly to the Department of Classical and Near Eastern Studies: copy of transcripts; copy of the GRE; three letters of recommendation from persons well acquainted with their academic work and professional experience; and a two-page statement describing previous experience and academic training as related to the intended course of study and professional goals; and for non-native speakers of English a copy of TOEFL. Students may be admitted in any academic term, but financial assistance is normally available only to applicants admitted in fall semester (deadline: January 15).

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to prior approval by the adviser and director of graduate studies.

Courses—Please refer to Akkadian (Akka), Ancient Near Eastern (ANE), Aramaic (Arm), Classics (Clas), Greek (Grk), Hebrew (Hebr), Latin (Lat), Religions in Antiquity (RelA), and Sumerian (Sum) in the course section of this catalog for courses pertaining to the program.

Ancient and Medieval Art and Archaeology

M.A. Degree Requirements

The art and archaeology degree includes a variety of programs ranging broadly over ancient and medieval periods. While these programs concentrate on both art historical and archaeological approaches, they have flexible emphases in languages and textual studies. Students take a common core of courses.

This program includes not only core courses and seminars in the Department of Classical and Near Eastern Studies, but also work in related fields in this and other departments. It is offered in cooperation with the Department of Art History, and the Center for Medieval Studies. The minimum requirement for Plan A is 38 credits (including 10 thesis credits), and for Plan B, 32 credits (including directed study registrations for the Plan B papers).

Language Requirements—For the M.A. degree, reading knowledge of one modern foreign language appropriate to the student’s program is required (normally German or French).

Final Exam—The final exams are written and oral.

Minor Requirements for Students

Majoring in Other Fields—Students must complete Clas 5794, as well as 9 credits in graduate art/archaeology courses with a Clas designator.

Ph.D. Degree Requirements

The art and archaeology degree includes a variety of programs ranging broadly over ancient and medieval periods, with flexible emphases in languages and textual studies. Students take a common core of courses. At the Ph.D. level, the four foci are art and archaeology, an ancient textual component, a complementary area (e.g., history, geology, anthropology), and a special (elective) topic.

This program includes not only core courses and seminars in the Department of Classical and Near Eastern Studies, but also work in related fields in this or other departments. It is offered in cooperation with the Department of Art History, and the Center for Medieval Studies. An extensive supporting program in either art history or classical studies is required. Students who continue from the M.A. program may apply those credits toward the degree, and students entering with an M.A. can usually receive credit for some
earlier coursework, subject to director of graduate studies approval and graduate school requirements. A typical Ph.D. program is 71 credits including at least 21 credits in the major, 12 in the supporting program, and 24 thesis credits.

Language Requirements—Reading proficiency in German and in a second modern research language as appropriate (usually French), and research knowledge of an ancient language as demonstrated by satisfactory performance in a graduate-level reading course is required.

Minor Requirements for Students Majoring in Other Fields—Students must complete Clas 5794, as well as 12 credits in graduate art/archaeology courses with a Clas designator.

Classics

M.A. Degree Requirements
This program provides students with a broad background in the literature of ancient Greece and Rome in its cultural context. Extensive work in both Greek and Latin is supplemented with courses in history, archaeology, or religion. The program requires nearly equal emphasis on courses and seminars in Greek and in Latin, as well as supporting work in related fields. The minimum requirement for Plan A is 47 credits (including 10 thesis credits), and for Plan B, 41 credits (including directed study registrations for the Plan B papers).

Language Requirements—One modern research language as appropriate (normally French or German) and proficiency in reading Greek and Latin as certified by a department exam on previously unseen passages is required.

Final Exam—The final exams are written and oral.

Minor Requirements for Students Majoring in Other Fields—Students must complete Clas 5794, as well as 6 credits in graduate Latin courses, excluding Lat 8120, and 6 credits in graduate Greek courses, excluding Grk 8120.

Ph.D. Degree Requirements
This program requires extensive advanced work in both Latin and Greek, together with interdisciplinary studies in fields such as archaeology, history, and religion, to provide a comprehensive understanding of the ancient world.

The program requires nearly equal emphasis on courses and seminars in Greek and in Latin, as well as supporting work in related fields. Students must take at least three seminars in the major and a two-semester sequence in ancient history, in addition to completing all M.A. course requirements. Students who continue from the M.A. program may apply those credits toward the degree, and students entering with an M.A. can usually receive credit for some earlier coursework, subject to director of graduate studies approval and graduate school requirements. A typical Ph.D. program is 77 credits, including at least 35 credits in the major, 12 in the supporting program, and 24 thesis credits.

Language Requirements—German, plus another modern language, preferably French, and proficiency in reading Greek and Latin as demonstrated by a department exam on previously unseen passages is required.

Minor Requirements for Students Majoring in Other Fields—Students must complete Clas 5794, as well as 9 graduate credits of Greek (excluding Grk 8120) and 9 graduate credits of Latin (excluding Lat 8120).

Classical and Near Eastern Studies

Greek Track

M.A. Degree Requirements
A core of advanced work in Greek is supplemented by a minor or a supporting program in another field such as archaeology, linguistics, modern Greek studies, philosophy, and religious studies. The minimum requirement for Plan A is 47 credits (including 10 thesis credits), and for Plan B, 41 credits (including directed study registration for Plan B papers).

Language Requirements—One modern research language as appropriate, preferably French or German, is required.

Final Exam—The final exams are written (Greek reading proficiency) and oral (general).

Minor Requirements for Students Majoring in Other Fields—Students must complete Clas 5794, as well as 9 graduate credits of Greek (excluding Grk 8120).

Ph.D. Degree Requirements
Extensive advanced coursework in Greek is combined with a minor or a rigorous supporting program in another field such as archaeology, linguistics, modern Greek studies, philosophy, or religion. Students must take at least three seminars in the major and a two-semester sequence of ancient history in addition to completing all M.A. course requirements. Students who continue from the M.A. program may apply those credits toward the degree, and students entering with an M.A. can usually receive credit for some earlier coursework, subject to director of graduate studies approval and Graduate School requirements. A typical Ph.D. program is 77 credits, including at least 15 credits in Latin, 15 credits in the supporting program, and 24 thesis credits.

Language Requirements—German and a second modern research language, preferably French, and reading proficiency in Latin as demonstrated by a department exam on previously unseen passages is required.

Minor Requirements for Students Majoring in Other Fields—Students must complete Clas 5794 and 15 graduate credits of Latin (excluding Lat 8120).

Latin Track

M.A. Degree Requirements
A core of advanced work in Latin is supplemented by a minor or a supporting program in another field such as archaeology, linguistics, medieval studies, and religious studies. The minimum requirement for Plan A is 47 credits (including 10 thesis credits), and for Plan B, 41 credits (including directed study registration for Plan B papers).

Language Requirements—One modern research language as appropriate, preferably German or French, and reading proficiency in Latin as demonstrated by a department exam on previously unseen passages is required.

Final Exam—The final exams are written (language) and oral (general).

Minor Requirements for Students Majoring in Other Fields—Students must complete Clas 5794, as well as 9 graduate credits of Latin (excluding Lat 8120).

Ph.D. Degree Requirements
A series of advanced courses in Latin are combined with a minor or a rigorous supporting program in another field such as archaeology, linguistics, medieval studies, oral performance, or religious studies. Students must take at least three seminars in the major and a two-semester sequence in ancient history, in addition to completing all M.A. course requirements. Students who continue from the M.A. program may apply those credits towards the degree, and students entering with an M.A. can usually receive credit for some earlier coursework, subject to director of graduate studies approval and Graduate School requirements. A typical Ph.D. program is 77 credits, including at least 15 credits in Latin, 15 credits in the supporting program, and 24 thesis credits.

Language Requirements—German and a second modern research language, preferably French, and reading proficiency in Latin as demonstrated by a department exam on previously unseen passages is required.

Minor Requirements for Students Majoring in Other Fields—Students must complete Clas 5794 and 15 graduate credits of Latin (excluding Lat 8120).

Religions in Antiquity Track

M.A. Degree Requirements
The religions in antiquity track is fundamentally comparative in both method and content. Although students may focus on a particular religious tradition, they will nonetheless study several ancient religions. The Plan B requires 26 credits in the major plus 9 credits in related field. The Plan A requires 22 credits in the major, 9 credits in related field, plus 10 thesis credits.

Language Requirements—Proficiency in one modern language (normally German) and M.A.-level proficiency in at least one ancient language is required.

Final Exam—The final exam is oral.
Minor for Students Majoring in Other Fields—Not offered.

Classics
See Classical and Near Eastern Studies.

Clinical Laboratory Science

Contact Information—Clinical Laboratory Science Program, Department of Laboratory Medicine and Pathology, University of Minnesota Medical School, MMC 609, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-625-8952; fax 612-625-5901; e-mail cls@umn.edu; <http://pathology.umn.edu/simplehome.htm>).

Professor
Fred S. Apple, Laboratory Medicine and Pathology, AM
Henry H. Balfour, Jr., Laboratory Medicine and Pathology, AM
Paul P. Cleary, Microbiology, AM
Agustin P. Dalmasso, Laboratory Medicine and Pathology, AM
Gary M. Dunny, Microbiology, AM
John H. Eckfield, Laboratory Medicine and Pathology, AM
Stanley L. Erlandsen, Cell Biology and Neuroanatomy, AM
Patricia Ferrieri, Laboratory Medicine and Pathology, AM
Robert P. Hebel, Medicine, AM
Stephen S. Hecht, Laboratory Medicine and Pathology, AM
Marc K. Jenkins, Microbiology, AM
Russell C. Johnson, Microbiology, AM
John H. Kersey, Laboratory Medicine and Pathology, AM
Tucker W. LeBien, Laboratory Medicine and Pathology, AM
J. Jeffrey McCullough, Laboratory Medicine and Pathology, AM
R. Scott McVor, Laboratory Medicine and Pathology, AM
Gary L. Nelsestuen, Biochemistry, AM
Harry T. Orr, Laboratory Medicine and Pathology, AM
Peter G. W. Plagemann, Microbiology, AM
Gundu H. R. Rao, Laboratory Medicine and Pathology, AM
Michael Y. Tsai, Laboratory Medicine and Pathology, AM
Daniel A. Varella, Therapeutic Radiology, AM
Catherine M. Verfaillie, Medicine, AM
Carol L. Wells, Laboratory Medicine and Pathology, AM

Associate Professor
Ronald R. Burger, Laboratory Medicine and Pathology, AM
Charles P. Cartwright, Laboratory Medicine and Pathology, AM
Angela Panoskaltsis-Mortari, Pediatrics, AM

Instructor
Elizabeth G. Ingulli, Pediatrics, AM

Research Associate
Connie J. Gebhart, Research Animal Resources, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This program offers students with basic science or medical technology backgrounds the opportunity to gain competence in a specialized area of laboratory medicine. It provides training in the research, supervisory, and teaching aspects of the field. Students pursue investigative work in one of five specialty areas: chemistry, genetics, hematology, immunology, and microbiology.

Prerequisites for Admission—A bachelor’s degree in a basic science or in medical technology, including standard college courses in organic/inorganic chemistry, biochemistry, quantitative analysis, physics, and mathematics, is required. Previous laboratory experience is desirable.

Special Application Requirements—Applicants must forward to the Department of Laboratory Medicine and Pathology three letters of recommendation, an autobiographical outline that includes a statement of career goals, and scores from the General Test of the GRE. A minimum score of 550 on the TOEFL is required for applicants whose native language is not English.

Use of 4xxx Courses—The program accepts MedT 4xxx courses when cross-listed with CSL 5xxx courses and approved by the adviser and/or director of graduate studies, (e.g. CSL 5102—Principles of Diagnostic Microbiology, CSL 5251—Hematology I: Basic Techniques, CSL 5310 and 5311—Clinical Chemistry I and II: Lecture and Lab). However, credit will not be granted if the MedT equivalent of these CSL courses was taken as part of an undergraduate degree.

Courses—Please see Clinical Laboratory Science (CLS) for courses pertaining to the program.

M.S. Plan A Degree Requirements

The M.S. is a multidisciplinary program that prepares the medical technologist or basic science undergraduate for a career in research, teaching, or industry within a specialized area of laboratory medicine. Students pursue investigative work in one of five specialty areas: clinical chemistry, genetics/molecular genetics, hematology, immunology, or microbiology. Each area has required courses, but flexibility is maintained to allow students to choose some coursework that meets individual requirements and research interests.

Requirements include at least 17 credits in the specialty area, at least 6 credits in a minor or in related fields outside the specialty area, 10 thesis credits, and 2 student seminar credits.

Language Requirements—None.
Final Exam—The final exam is oral.

Clinical Research

Contact Information—Student Services Center, School of Public Health, University of Minnesota, MMC 819, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-3500; fax 612-626-6931; e-mail sph-ssc@umn.edu; <www.epi.umn.edu/epi_pages/academic/ms_cr.html>).

Professor
Linda H. Bearinger, Nursing, AM
David M. Brown, Laboratory Medicine and Pathology, AM
James C. Floyd III, Pharmacy Practice, AM
John H. Eckfield, Laboratory Medicine and Pathology, AM
G. Scott Giebink, Pediatrics, AM
Stephen P. Glasser, Epidemiology, AM
Richard H. Grimm, Medicine, AM
Joseph T. Hanlon, Health Services Research and Policy, AM
Dorothy Hatsuakami, Psychiatry, AM
Robert P. Hebel, Medicine, AM
Marshall I. Hertz, Medicine, AM
Thomas H. Hostetter, Medicine, AM
Jeffrey P. Kahn, Health Services Research and Policy, AM
Richard A. King, Pediatrics, AM
Russell V. Luepker, Epidemiology, AM
Nicole Lurie, Medicine, AM
Jeffrey McCullough, Laboratory Medicine and Pathology, AM
James H. Moller, Pediatrics, AM
Jim D. Neaton, Biostatistics, AM
Mark S. Paller, Medicine, AM
Bruce A. Peterson, Medicine, AM
Bruce L. Phlisterm, Preventive Sciences, AM
Norma K. Ramos, Pediatrics, AM
Leslie L. Robison, Pediatrics, AM
Hanna B. Rubins, Medicine, AM
Charles Schachtele, Oral Sciences, AM
Harvey L. Sharp, Pediatrics, AM
John E. Wagner, Pediatrics, AM
Daniel J. Weisdorf, Medicine, AM

Associate Professor
Gregory J. Beilman, Surgery, AM
Donna Z. Bliss, Nursing, AM
Stella M. Davies, Pediatrics, AM
Kristine E. Ensrud, Medicine, AM
Martin L. Freeman, Medicine, AM
Timothy D. Henry, Medicine, AM
James E. Hinrichs, Preventive Sciences, AM
Nigel S. Key, Medicine, AM
Tom W. Korioth, Oral Sciences, AM
Bryan S. Michalowicz, Preventive Sciences, AM
Antonette Moran, Pediatrics, AM
James H. Moller, Pediatrics, AM
Elizabeth R. Reeve, Medicine, AM
John William Thomas, Biostatistics, AM

Assistant Professor
Edward W. Greeno, Medicine, AM
Gary H. Hildebrandt, Continuing Dental Education, AM
Karen L. Margolis, Medicine, AM
Timothy W. Schaecker, Medicine, AM

Senior Research Associate
James S. Hodges, Biostatistics, AM
Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This interdisciplinary program trains health professionals to design, implement, and manage research in clinical populations. Because the field is fast becoming more complex, sophisticated, and regulated, there is an emerging recognition of, and demand for, formalized training. This program focuses primarily on patient-oriented health research including mechanisms of human disease, therapeutic interventions, clinical trials, and development of new techniques. It focuses less on epidemiologic and behavioral studies, or on outcomes research and health services research; students interested in these areas might better be served by seeking a master of public health (M.P.H.) degree.

Prerequisites for Admission—The program is designed for individuals interested in a research career in academia, industry, research institutes, health agencies, or regulatory agencies. Applicants must have an advanced health professional degree such as M.D., D.D.S., D.V.M., Pharm.D., Ph.D., or advanced doctoral degree in a clinical biomedical field; or advanced nursing degree (e.g., M.S. in nursing, M.S.N., or nurse practitioner). Students must have completed or be at an advanced stage of their clinical practice training. The admissions committee will consider exceptions.

Special Application Requirements—In addition to the School of Public Health requirements listed in their catalog, the M.S. has specific application requirements including a health science professional degree, and training sufficient to be eligible for a license to practice as supported in the form of an official transcript. An official TOEFL score of at least 600 (written) or 250 (computer) is required of international students who have earned all of their degrees from non-native English speaking countries. There are three exceptions: 1) if you have taken and successfully passed the ECFMG or USMLE exams, you do not need to submit a TOEFL score; 2) University of Minnesota Medical Fellows or Medical Fellow Specialists who have taken at least 24 credits as part of their University fellowship will be exempt from providing an official TOEFL score if they provide a transcript of these credits; 3) The MELAB is an alternative exam to the TOEFL. The GRE is not required. One of the three required recommendation letters (and completed School of Public Health Recommendation Form) should be from the clinical director of training supporting the applicant's potential as a clinical researcher. Note: if you are a faculty member at the University of Minnesota above the rank of instructor, there are additional administrative procedures required by the Graduate School. Contact the Graduate School Admissions Office early in the process.

Use of 4xxx Courses—Inclusion of any 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to the Clinical Research curriculum sheet available on the School of Public Health Web site at <www.sph.umn.edu/ssc/App_Info/CR.pdf> for courses pertaining to the program.

M.S. Plan A Requirements
The M.S. requires 38 credits, including 2 elective credits and 10 thesis credits. Coursework in biostatistics, epidemiology, clinical trials, data collection, grant writing, and ethics is provided. Elective courses are chosen in consultation with an adviser. The thesis may take the form of any approved clinical research project in which the student is involved in the design, implementation, and analysis.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Requirements for a minor are under development. Contact the director of graduate studies for information on the status of the minor program.

Cognitive Science

Contact Information—Center for Cognitive Sciences, University of Minnesota, 205 Elliott Hall, 75 East River Road, Minneapolis, MN 55455 (612-625-9367; fax 612-626-7253; e-mail ccs@cogsci.umn.edu; http://cogsci.umn.edu/).


Associate Professor Charles R. Fletcher, Psychology, E Maria D. Sera, Child Development, E

Clinical Associate Professor Mary Jo Nissen, Psychology, E

Curriculum—Cognitive science is a field of inquiry at the interface of cognitive psychology, computer science, linguistics, neuroscience, and philosophy. Cognitive science is concerned with the acquisition, representation, and use of knowledge by humans and machines. The curriculum provides students with a broad foundation in psychological, philosophical, and computational approaches to the study of cognition.

Prerequisites for Admissions—Admission is contingent upon prior admission to a master’s or doctoral degree-granting program within the Graduate School. Admission is limited and only by permission of the director of graduate studies in cognitive science.

Special Application Requirements—Contact the director of graduate studies in cognitive science for an Intent to Enroll form that students are encouraged to submit by the end of fall semester the year before initiating coursework. Later submissions are considered as space permits.

Use of 4xxx Courses—4xxx courses may not be included on degree program forms for the cognitive science minor.

Courses—Please refer to the minor program office for coursework pertaining to the program.

Freestanding Minor Requirements
The minor in cognitive science is available to master’s (M.A. and M.S.) and doctoral students. Both a master’s and doctoral minor require the following core courses outside the student’s major department: CgSc 8000—Philosophy of Cognitive Science, CSci 5511—Artificial Intelligence I, and Psy 5015—Cognition, Computation, and Brain. Substitutions for these courses are permitted only with prior permission from the director of graduate studies for cognitive science. In addition, CgSc 8001—Proseminar in Cognitive Science is required for the doctoral minor. The master’s minor requires a minimum of 8 graduate credits; the doctoral minor requires 14 graduate credits. Additional courses beyond those required must be taught by faculty in the minor program or approved in advance by the cognitive science director of graduate studies. Courses in the student’s major department do not count toward the minor.

Communication Disorders

Contact Information—Department of Communication Disorders, University of Minnesota, 115 Shevlin Hall, 164 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-3322; fax 612-624-7586).


Adjunct Professor Robert Brookshire, FM Timothy N. Doyle, AM Diianne Van Tasel, FM
Degree Programs and Faculty

Associate Professor
Robert S. Schlauch, AM

Adjunct Associate Professor
David A. Fabry, AM
David A. Preves, AM

Assistant Professor
Mary R. T. Kennedy, AM
Kathryn Kohnert, AM
Benjamin Munson, AM
Peggy B. Nelson, AM
Nancy Pearl Solomon, AM

Adjunct Assistant Professor
Timothy D. Trine, AM

Associate Clinical Specialist
Leslie E. Glaze, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Emphases in the master’s program are speech-language pathology and audiology. Emphases in the doctoral program are speech-language pathology, speech science, audition, and hearing science.

Prerequisites for Admission—Prospective students must have completed an undergraduate degree. Individuals from both communication disorders and other academic areas are welcome. Students entering the M.A. program with minimal background in communication disorders should expect their program to extend beyond the usual two years.

Special Application Requirements—Three letters of recommendation evaluating the applicant’s scholarship (two from professorial-rank faculty are recommended), a complete set of transcripts (in addition to that required by the Graduate School), and GRE scores are required. Deadline for application to the master’s program is January 15; late applications are considered only if space is available. Master’s students ordinarily begin graduate study during fall or summer term.

Use of 4xxx Courses—Inclusion of 4xxx courses in degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Communications Disorders (CDis) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
Emphases in the master’s program are speech-language pathology and audiology, which are accredited by the American Speech-Language-Hearing Association’s Council on Academic Accreditation. Students who complete the M.A. are eligible for clinical certification by the Association. Students may select between two M.A. options. Plan A requires coursework and a thesis that is experimental in nature. Plan B requires coursework and one or more written projects that need not be experimental in nature but that should reflect rigorous scholarship.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A minimum of 6 credits, approved by the director of graduate studies, is required for a master’s minor.

Ph.D. Degree Requirements
Emphases in the doctoral program are speech-language pathology, audiology, speech science, language science, or hearing science. The program prepares students for careers in research, teaching, and advanced clinical applications. Most students entering the program have a master’s degree in speech-language pathology, audiology, or a related area. The Ph.D. degree usually requires three years of work beyond the master’s degree. In general, a student’s program is designed by the student in consultation with the adviser to satisfy the particular objectives of the student, but there are also some department and Graduate School requirements that must be satisfied. These include coursework, research activities, teaching experience, and preliminary and final exams.

A minimum of 12 course credits in a minor or supporting program and registration for 24 thesis credits are required. Also required is a statistics sequence, for which students typically register during their first two years. The written and oral preliminary exams are taken at the end of the second year.

Each student completes a seminar (CDis 8420) and a minimum of 4 credits of teaching experience that provide an opportunity for the student to develop and teach sections of department courses. Students also complete a seminar (CDis 8410) and a minimum of 4 credits of research under the direction of one or more faculty members in the department other than the adviser.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A minimum of 12 credits, approved by the director of graduate studies, is required for a doctoral minor.

Comparative Literature

Contact Information—Department of Cultural Studies and Comparative Literature, University of Minnesota, 350 Folwell Hall, 9 Pleasant Street S.E., Minneapolis, MN 55455 (612-625-5358; fax 612-626-0228; e-mail complit@umn.edu; <http://complit.cla.umn.edu> ).

Professor
Timothy A. Brennan, FM
Maria M. Brewer, French and Italian, FM
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Harvey B. Sarles, FM
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Nicholas Spadaccini, Spanish and Portuguese, AM
Hernan Vidal, Spanish and Portuguese, FM
Anthony N. Zahareas, Spanish and Portuguese, FM
Jack D. Zipes, German, Scandinavian, and Dutch, FM

Associate Professor
Cesare Casarino, AM
Keya Ganguly, FM
Catherine Liu, FM
Thomas A. Pepper, FM

Assistant Professor
Haidee Wasson, Cultural Studies and Comparative Literature, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Comparative literature is the oldest field of literary criticism, dating back to the eighteenth century. Among the wide range of studies currently conducted under the rubric of comparative literature nationwide and internationally, the University focuses on theories of literary criticism and its explanatory bases; indeed, the program is seen as one of the principal initiators of such fields of study. This program is likewise engaged in pushing the bounds of critical inquiry in related domains of literary inquiry, directing much of its energies toward women’s writing and emergent literatures, within both First- and Third-World cultures, as well as toward related problems ranging from narrative to postcolonial studies.

A major portion of coursework for degrees in comparative literature is cross-listed with the literature and language departments. Approval may also be given to take graduate courses in such areas as anthropology, art, architecture, history, music, philosophy, and sociology. In all cases, students should consult with an adviser concerning course selections.

Prerequisites for Admission—Although most students in the program have undergraduate majors in language or literature, applicants with other undergraduate backgrounds are considered.

Special Application Requirements—Applicants must submit scores from the GRE. The deadline for applying for admission and for financial aid is January 15. Admission is only for fall semester.

Use of 4xxx Courses—Use of 4xxx courses may be permitted in majors or minors for the M.A. or Ph.D. degree with the approval of the adviser and director of graduate studies.

Courses—Please refer to Comparative Literature (CLit) in the course section of this catalog, the current Class Schedule, and flyers available in the department office for courses pertaining to the program.

M.A. Plan B Degree Requirements
Students normally are not admitted to work toward the M.A. degree, but in certain circumstances where earning the M.A. degree is desirable, students already in the Ph.D. program may apply through the
Comparative Studies in Discourse and Society

Contact Information—Comparative Studies in Discourse and Society Program, University of Minnesota, 350 Folwell Hall, 9 Pleasant Street S.E., Minneapolis, MN 55455 (612-625-5358; fax 612-626-0228; e-mail csds@umn.edu; <http://csds.cla.umn.edu/>).

Professor Timothy Brennan, Cultural Studies and Comparative Literature, FM
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Harvey Sarles, Cultural Studies and Comparative Literature, FM
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Hernan Vidal, Spanish and Portuguese, FM
Jack D. Zipes, German, Scandinavian, and Dutch, FM

Associate Professor W. John Archer, Cultural Studies and Comparative Literature, FM
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Maria Damon, English, FM
Keya Ganguly, Cultural Studies and Comparative Literature, FM
Catherine Liu, Cultural Studies and Comparative Literature, FM
Ellen Messer-Davidow, English, FM
Roger P. Miller, Geography, FM
Thomas Pepper, Cultural Studies and Comparative Literature, FM
Katherine M. Solomonson, Architecture, AM
Gary C. Thomas, Cultural Studies and Comparative Literature, FM
Jacquelyn N. Zita, Women’s Studies, FM

Assistant Professor Elizabeth Kotz, Cultural Studies and Comparative Literature, AM
Haidee Wasson, Cultural Studies and Comparative Literature, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—While most traditional humanistic disciplines tend to focus either on a given mode of discourse, e.g., art history, musicology or a specific cultural context, e.g., American studies, European languages and literatures, this program engages a broader problematic—how discourse and cultural production both shape and are shaped by life in time, space, matter, and society. Drawing on a variety of theoretical positions, close attention is paid to various types of discourse, such as music, film, myth, ritual, architecture, landscape and urban design, painting, sculpture, and literature in elite, popular, folk, and mass culture, understanding these as both a site and an instrument of contestation and negotiation among social forces. More generally, the program seeks to reassociate intellectual and cultural history with social and political history, to set discourse of various sorts within a social context, and to consider specific social formations within the ongoing historical process. In all this, the program encourages work that is interdisciplinary (at times, even anti-disciplinary) as well as cross-cultural.

The curriculum emphasizes small seminars and directed research. The core requirement is a two-semester research seminar, a practicum that develops critical and analytic skills and introduces current theoretical perspectives with the study of historic problems. The majority of courses are non recurring and closely relate to current faculty research. In all cases, students should consult their advisers and the director of graduate studies concerning course selections. Each entering graduate student also enrolls in CSDS 8901—Pedagogy, which focuses on developing skills and experience in teaching, fellowship application, placement, and other professional concerns.

Prerequisites for Admission—Applicants are required to have a B.A. in a humanities or social science discipline or other relevant field with clear evidence of comparative work. Because the program involves broad, often interdisciplinary, courses of study and a variety of emphases, the graduate admissions committee carefully reviews each applicant’s background in terms of analytical skills, knowledge of subject matter, experience, language preparation, and especially, congruity with faculty interests and expertise.

Special Application Requirements—Scores from the General (Aptitude) Test of the GRE are required. The deadline for financial aid application is January 15 before the academic year for which aid is sought. Applications for admission are considered only at the January 15 deadline, except in certain cases for students already enrolled in a graduate degree program at the University of Minnesota. Consult the director of graduate studies for application requirements.

Use of 4xxx Courses—4xxx courses may be included in majors or minors for the M.A. or Ph.D. degree with the approval of the adviser and director of graduate studies.

Courses—Please refer to Comparative Studies in Discourse and Society (CSDS) in the course section of this catalog, the current Class Schedule, and fliers available in the department office for courses pertaining to the program.

M.A. Plan B Degree Requirements

Students normally are not admitted to work toward the M.A. degree, but in certain circumstances where earning the M.A. degree is desirable, students already in the Ph.D. program may apply through the director of graduate studies to pursue this degree. Thirty credits including 8 credits of research seminar (8001-2), 12 additional...
CSDS credits, 6 credits in courses in related fields outside comparative literature or in a formal minor in another program, and 4 credits either in CSDS courses or in the related minor field are required. One substantial Plan B paper is required.

Language Requirements—Reading knowledge of one foreign language appropriate to the student’s program is required.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A minimum of 12 credits is required for a master’s minor, which must include CSDS 8001 and 8002.

Ph.D. Degree Requirements
The Ph.D. requires 51 graduate credits, as follows: 8 credits of basic seminar (CSDS 8001-8002), 3 credits in CSDS 8901—Pedagogy of Cultural Studies and Comparative Literature, 28 credits in CSDS courses (with approval of the adviser and the director of graduate studies up to 4 credits of the 28-credit requirement may be taken in the field of the minor or supporting program), and 12 credits (or more, as necessary) to complete a formal minor in another Graduate School program, excluding comparative literature. If a formal minor is not pursued in another program, the student must complete 15 credits in coursework outside of CSDS, CSSC, or CLit courses, in a coherent and comprehensive program to be approved by the adviser and the director of graduate studies. Overall, the degree should include 16 credits of 8xxx courses (exclusive of CSDS 8001-8002 and 8901). 24 thesis credits are also required. A paper of publishable quality must be submitted to, and approved by, the student’s doctoral committee before proceeding with the preliminary examinations.

Language Requirements—Reading knowledge of two foreign languages appropriate to the program is required. Students must attain reading knowledge of at least one foreign language before taking the preliminary examination.

Minor Requirements for Students Majoring in Other Fields—A minimum of 16 credits is required for a Ph.D. minor and must include CSDS 8001 and 8002.

Complementary Therapies and Healing Practices

Contact Information—Center for Spirituality and Healing, Mayo Mail Code 505, 420 Delaware St. S.E., Minneapolis, MN 55455 (612-624-9459; fax 612-626-5280; <www.csh.umn.edu>.

Professor
Linda J. Brady, E
Francis F. Buista (emeritus), E
Barbara Leonard, E

Robert P. Patterson, E
Mariah Snyder, E
Marilyn Speedie, E
Mark S. Umbricht, E

Associate Professor
V. Lois Erickson, E
Craig A. Hassel, E
Ruth D. Lindquist, E
Gregory Plotnikoff, E
Janice Post-White, E

Assistant Professor
Linda L. Chlan, E
Linda Halcon, E
Kate M. Hathaway, E
Donald R. House (emeritus), E
Mary Jo Kreitzer, E

Lecturer
Pat Cullitton, E
Sue M. Towey, E

Research Associate
Ava J. Walker, E

Other
Lynne Mason, E

Curriculum—The graduate minor in complementary therapies and healing practices is an interdisciplinary program designed to expose students to the global range of complementary, cross-cultural, and spiritual healing practices. It will enhance the preparation of graduate students in health sciences and other disciplines by developing knowledge and skills in the emerging field of complementary and alternative healthcare. Specifically, the minor will provide students with a theoretical basis for applying complementary therapies and healing practices; prepare students to research complementary therapies and healing practices; prepare students to work collaboratively with other health professionals and patients in a multicultural, pluralistic healthcare system. The minor includes a set of core courses that provide the theoretical foundation for the program. Students may elect to take additional courses offered by the Center for Spirituality and Healing in clinical applications, spirituality, or cross-cultural health and healing. A number of other University courses also satisfy the course requirements of the minor. To apply other courses to the minor, contact the director of graduate studies.

Prerequisites for Admission—This graduate minor is available to master’s and doctoral students. To have the minor formally designated on a transcript students must be enrolled in a major in the Graduate School and have completed—or concurrently be enrolled in—a graduate research course upon beginning the first course in the minor. Note that the research course is in addition to the specified credits required for the minor. Students should work out their program of study with the director of graduate studies for the minor early in their graduate study.

Use of 4xxx Courses—Use of 4xxx courses in the degree program is permitted based on approval of the graduate faculty and the director of graduate studies.

Courses—Please contact the minor program office for information on relevant coursework pertaining to the program.

Freestanding Minor Requirements
Master’s and doctoral students will take CSpH 5100 and 1 credit in a 8xxx research critique course. Master’s students must take an additional 4 credits for a total of 8 credits: doctoral students must take one additional credit at 8xxx and an additional 7 credits for a total of 12 credits. Note that students cannot use course credits to satisfy requirements for both a major and the minor.

Composition, Literary, and Rhetorical Studies

Contact Information—Center for Interdisciplinary Studies of Writing, University of Minnesota, 227 Lind Hall, 207 Church Street S.E., Minneapolis, MN 55455 (612-626-7579; fax 612-626-7580; e-mail cisw@umn.edu; <http://cisw.cla.umn.edu/minorinfo.html>).

Professor
Josef L. Altholz, History, E
Ayers Bagley, Educational Policy and Administration, E
Richard W. Beach, Curriculum and Instruction, E
Lillian S. Bridwell-Bowles, English, E
Karyn K. Campbell, Speech-Communication, E
Andrew D. Cohen, Linguistics and Asian and Slavic Languages and Literatures, E
Terence G. Collins, General College, E
Hazel Decken-Garcia, Journalism and Mass Communication, E
Edward M. Griffin, English, E
Alan G. Gross, Rhetoric, E
Michael Hancher, English, E
Ruth-Ellen B. Jores, German, Scandinavian, and Dutch, E
Mary M. Lay, Rhetoric, E
Earl E. McDowell, Rhetoric, E
Toni A. H. McNaron, English, E
Nancy L. Roberts, Journalism and Mass Communication, E
Donald J. Ross, Jr., English, E
Edward Schiappa, Speech-Communication, E
Amy L. Sheldon, Speech-Communication, E
Elaine E. Tarone, Linguistics and Asian and Slavic Languages and Literatures, E
Barbara M. Taylor, Curriculum and Instruction, E
Paulus W. van den Broek, Educational Psychology, E
Billie J. Wahlstrom, Rhetoric, E

Associate Professor
Lisa Albrecht, General College, E
Daniel Brewer, French and Italian, E
Robert L. Brown, Jr., Cultural Studies and Comparative Literature, E
Laura J. Gurak, Rhetoric, E
Amy M. Lee, General College, E
Carol A. Miller, American Studies, E
Rosemarie J. Park, Work, Community, and Family Education, E
Geoffrey Sirc, General College, E
Diane J. Tedick, Curriculum and Instruction, E
Constance L. Walker, Curriculum and Instruction, E
Arthur E. Walzer, Rhetoric, E
Susan M. Watts-Taffe, Curriculum and Instruction, E

Assistant Professor
Thomas E. August, English, E
Lee-Ann Kastman Brueren, Rhetoric, E
Patrick Bruch, General College, E
Curriculum—The minor in composition, literacy, and rhetorical studies (CLRS) was created to provide a forum for students and faculty interested in various facets of writing and communication. By crafting an individualized program of study including theory, pedagogy, and research, often in a historical context, students can complement their disciplinary degree and thereby open up new perspectives for their teaching and research. Students develop an interdisciplinary program of study in consultation with their major adviser (preferably one of the faculty above), the director of graduate studies in their major, and the director of graduate studies in composition, literacy, and rhetorical studies.

Prerequisites for Admission—Admission is contingent upon enrollment in good standing in a relevant doctoral or master’s program within the Graduate School of the University. Prior teaching experience (at any level) is desirable but not required.

Special Application Requirements—Admission is competitive and restricted to a number that will allow for a quality experience. Entrance to the minor is granted only by permission of the director of graduate studies in CLRS and the faculty selection committee. Application materials include a completed application form, statement of purpose, curriculum vitae, relevant post-secondary transcripts, and two letters of recommendation. Deadlines for application materials are October 15 and March 15, although applications will be reviewed on a rolling basis.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted by director of graduate studies approval.

Courses—Please contact the minor program office for information on relevant coursework pertaining to the program.

Freestanding Minor Requirements
A master’s minor (e.g., M.A. M.F.A.) requires three graduate courses or seminars (9 credits minimum), one from each of the following categories: literacy theory or practice, including pedagogy; research methods and practices in one of the areas of the minor; and a historical topic, e.g., history of the book, or rhetoric, or literacy. Students must also write a substantial paper that emerges from one of the three courses. A doctoral minor requires four graduate courses or seminars (12 credits minimum). Three courses must be in each of the categories enumerated above for the master’s minor. In addition, after those three courses have been completed, students must take either a capstone writing seminar specifically offered for the minor, or a seminar that involves a substantial term paper or a completed dissertation chapter on a topic related to the minor.

In order to make the minor interdisciplinary, no more than one of the three courses at the master’s level, or two of the four courses at the doctoral level may be from the student’s home department.

Language Requirements—None specific to the minor program.

Computer and Information Sciences

Contact Information—Department of Computer Science and Engineering, University of Minnesota, 4-192 Electrical Engineering/Computer Science, 200 Union Street S.E., Minneapolis, MN 55455 (612-625-4002; fax 612-625-0572; e-mail dgs@cs.umn.edu; <www.cs.umn.edu>.

Professor
Daniel L. Boley, FM
Gordon B. Davis, Information and Decision Sciences, FM
David H. Du, FM
Ding-Zhu Du, FM
David W. Fox, (emeritus), FM
Laill C. Gateswood, Laboratory Medicine and Pathology, AM
Maria Gini, FM
Ravi Janardan, FM
Paul E. Johnson, Information and Decision Sciences, AM
Michael B. Kac, Philosophy, AM
Daniel J. Kersten, Psychology, AM
Larry L. Kinney, Electrical Engineering, FM
K. S. P. Kumar, Electrical Engineering, FM
Vipin Kumar, FM
E. Bruce Lee, Electrical Engineering, FM
David J. Lilja, Electrical Engineering, FM
Arthur L. Norberg, AM
Nikolaos P. Papanikolopoulos, FM
Haeun Park, FM
Marian B. Pour-El, Mathematics, FM
J. Ben Rosen (emeritus), FM
Yousef Saad, FM
Shashi Shekhar, FM
Eugene B. Shragowitz, FM
James R. Slagle (emeritus), FM
Jaideep Srivastava, FM
Anand R. Tripathi, FM
Paul R. Woodward, Astronomy, AM
Pen-Chung Yew, FM

Associate Professor
John V. Carlisle, FM
Vladimir Cherkassky, Electrical Engineering, AM
Mats P. E. Heimdahl, AM
Wei-Chung Hsu, FM
Joseph A. Konstan, FM
Gopalan Nadarath, FM
J. David Naumann, Information and Decision Sciences, AM
Matthew T. O’Keefe, Electrical Engineering, AM
John T. Riedl, FM
Gerald E. Sobelman, Electrical Engineering, AM
Baprjaui Vinmokata, Electrical Engineering, AM

Assistant Professor
Baoquan Chen, AM
Victoria Interverante, AM
George Karypis, AM
Richard M. Voyles, AM
Jon Weissman, AM
Zhi-Li Zhang, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The faculty of the Department of Computer Science and Engineering conducts research in a broad spectrum of the computer sciences and interdisciplinary fields. Graduate students may pursue research and study with faculty on topics such as theory of computation and algorithms, numerical algorithms, parallel and distributed computing, languages and compilers, operating systems, databases, graphics, human-computer interaction, data mining, artificial intelligence and robotics, computer architecture and networks, computer-aided design, software engineering, and history of computing. In addition, students may choose a course of study that combines a portion of one of these major areas with an entirely different field.

The computer and information sciences degrees include a Ph.D., an M.S. (either Plan A with thesis or Plan B with project), and an M.C.I.S. The M.C.I.S. is a coursework-only degree and is intended to be a terminal degree.

The Department of Computer Science and Engineering also supports a master of science in software engineering (M.S.S.E.) degree. This department and the Department of Electrical and Computer Engineering jointly offer a computer engineering program, and many faculty from the computer science department participate in the scientific computation program.

Prerequisites for Admission—A degree in any major with a substantial background in computer science is required; a computer science major is preferred. Applicants with an inadequate background must resolve any deficiencies before applying to the program.

Special Application Requirements—Three letters of recommendation are required. Scores from the General (Aptitude) Test of the GRE are required for M.S. and Ph.D. program applicants. The Subject Test is optional, although highly recommended, especially for those seeking financial assistance. If taken, it should be in the undergraduate major field or, if it is not offered in that field, in computer science, mathematics, or engineering. Masters and Ph.D. students are accepted for fall admission only. The application deadline is May 1. Students seeking financial aid must apply by December 15. Before applying, M.C.I.S. students must have the equivalent of six months full-time computer-related industrial experience in the United States and should contact the department before applying.

Research Facilities—Graduate students have access to today’s most powerful supercomputers through the Minnesota Supercomputer Center and Army High Performance Computing Research Center.
The Department of Computer Science and Engineering also provides computing facilities through its various laboratories, such as the Graduate Research Laboratory, the Software Engineering Laboratory, the Artificial Intelligence/Robotics/Vision Laboratory, High Performance Computing Laboratory, Distributed Systems Laboratory, Collaborative Systems Laboratory, Database Laboratory, Scientific Computing Laboratory and Distributed Multimedia Laboratory.

Use of 4xxx Courses—Use of CSci 4xxx courses on degree program forms is not permitted. Credits from 4xxx courses from an outside department may be used for related field course requirements if the course grants graduate credit.

Courses—Please refer to Computer Science (CSci) in the course section of this catalog for courses pertaining to the program.

M.C.I.S. Coursework Only Degree Requirements
The M.C.I.S. is a coursework-only degree. It requires 31 credits of graduate work, with the following conditions: 1) at least 18 of the credits must be from CSci classes; 2) students must fulfill a breadth requirement of four courses in four of the five designated areas (computer engineering, artificial intelligence, numerical computing, theory, and systems); 3) at least 6 credits must be from outside the department; 4) at least 6 credits must be from 8xxx courses; and 5) students must take 1 credit of CSci colloquium, which cannot be counted toward any of the other requirements. Students must maintain a GPA above 3.00 after completing 8 credits.

Language Requirements—None.

Final Exam—There is no final exam.

Minor Requirements for Students Majoring in Other Fields—A minor consists of at least 6 credits in 4xxx CSci courses or higher.

M.S. Degree Requirements
The M.S. requires a minimum of 31 credits, with at least 14 of these from CSci courses (at least 3 of which must be 8xxx courses) and 6 from outside the department. There is a breadth requirement of four courses in four of the five areas (systems, computer engineering, artificial intelligence, numerical computing, and theory). For Plan A, at least 10 thesis credits are required; for Plan B, three Plan B project credits and 6 additional course credits are required. Students must also take 1 credit of CSci colloquium, which cannot be counted toward the other requirements. Students are expected to maintain a GPA of at least 3.25 for all courses listed on their degree program.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master’s minor consists of at least 6 credits of 4xxx CSci courses or higher.

Ph.D. Degree Requirements
The Ph.D. requires at least 43 course credits of which 13 must be in CSci courses and at least 12 in a minor or supporting program. Additionally, at least 24 thesis credits are required. Students are expected to complete all courses in their degree program with a GPA of at least 3.45.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—At least 12 credits are required for a doctoral minor.

Computer Engineering

Contact Information—Graduate Program in Computer Engineering, University of Minnesota, 4-178 Electrical Engineering/Computer Science, 200 Union Street S.E., Minneapolis, MN 55455 (612-625-3300; fax 612-625-4583; e-mail gradinfo@compengr.umn.edu; <www.compengr.umn.edu/>).

Professor
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Vipin Kumar, AM
David J. Lilja, Electrical Engineering, AM
Nikolaos Papanikolopoulos, AM
Shashi Shenkar, AM
Eugene B. Shragowitz, AM
Anand Tripatha, AM
Pen-Chung Yew, AM

Associate Professor
Vladimir Cherkassky, Electrical Engineering, AM
Mats P. E. Heimdahl, AM
Matthew T. O’Keefe, Electrical Engineering, AM
John Riedl, AM
Sachin Sapatnekar, Electrical Engineering, AM
Gerald E. Sobelman, Electrical Engineering, AM
Jaideep Srivastava, AM
Bapuji Vinnakota, Electrical Engineering, AM

Assistant Professor
Kiarash Bazargan, AM
Richard M. Voyles, AM
Zhi-Li Zhang, AM

Other
Farnaz Mounes-Toussi, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Computer engineering is an interdisciplinary graduate program offered jointly by the Department of Electrical and Computer Engineering and the Department of Computer Science and Engineering. Students in this program develop a broad understanding of both hardware and software design issues. The M.S. is a traditional research-oriented degree that prepares graduates to work in industry or to continue with their graduate studies in either electrical engineering or computer science. The M.Comp.E. is a coursework-only professional engineering degree tailored primarily for working professionals. Students have access to a wide variety of computational and laboratory equipment. Students can focus their studies in several different areas, including computer architecture and system design, compilers, computer-aided design, databases, networks, operating systems, parallel computing, software engineering, and VLSI design and testing.

Prerequisites for Admission—Graduate study in computer engineering is open to students with an undergraduate degree in computer engineering, electrical engineering, computer science, or a closely related field, such as mathematics or physics. In some instances, additional preparatory work may be required.

Special Application Requirements—All applicants are required to submit three letters of recommendation. Scores from the GRE General Test are required of all students seeking financial aid. Applicants whose native language is not English must also submit TOEFL scores.

Use of 4xxx Courses—Use of 4xxx courses is not allowed on any computer engineering degree program form.

Courses—Please refer to Computer Engineering (CompE), Computer Science (CSci), and Electrical Engineering (EE) in the course section of this catalog for courses pertaining to the program.

M.Comp.E. Coursework Only Degree Requirements
The M.Comp.E. degree requires 30 credits of graduate work distributed as follows: 1) at least 15 credits must be from the approved list of major field courses (of which at least 6 credits must be taken in electrical engineering and at least 6 credits in computer and information sciences); 2) at least 3 of the major field credits must be in 8xxx courses; 3) at least 6 credits must be from a minor or related field; 4) students take a breadth requirement of three courses in three of the four designated areas (system software; computer architecture and networking; VLSI and digital design; and data structures, algorithms, and software engineering); and 5) a maximum of 60 percent of coursework credit may be taken from a single department. Also, students must maintain a GPA of at least 3.00 to continue registration in any master’s program in computer engineering (this standard must also be met at the time of graduation). All coursework in the degree program must be taken A-F.

Language Requirements—None.

Final Exam—None.

M.S. Degree Requirements
The M.S. degree requires 31 credits for Plan A or 30 credits for Plan B. Coursework distribution is the same as that of the M.Comp.E. degree above. In addition, Plan A, students must complete 10 thesis credits and Plan B students must complete 3 credits of a Plan B project. Students must maintain a GPA of at least 3.00 to continue registration
in any computer engineering master’s program (this standard must also be met at the time of graduation). All coursework listed on the degree program must be taken A-F.

Language Requirements—None.

Final Exam—The final exam is oral.

Conflict Management

Contact Information—Director of Graduate Studies, Graduate Minor in Conflict Management, Conflict and Change Center, University of Minnesota, Hubert H. Humphrey Center, 301 19th Avenue S., Minneapolis, MN 55455 (612-625-0362; fax 612-625-3513; e-mail conflictmin@umn.edu).

Professor
Mario F. Bognanno, Industrial Relations, E
Eugene Borgia, Psychology, E
Paul V. Ellefson, Forest Resources, E

Associate Professor
Mark S. Umholtz, Social Work, E

Lecturer
Thomas R. Fiutak, Independent Study, E

Curriculum—The conflict management minor, which is available to master’s (M.A. and M.S.) and doctoral students, promotes inquiry into the origins, processes, dynamics, and consequences of social conflict and its management through various forms of dispute resolution procedures. The origins of this multidisciplinary field include but are not contained by the disciplines of sociology, psychology, socio-psychology, anthropology, management, organizational behavior, and communication.

Prerequisites for Admission—Admission is contingent upon prior admission to a master’s or doctoral degree-granting program within the Graduate School.

Special Application Requirements—None.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted with the approval of the program, the adviser, and the conflict management minor director of graduate studies.

Courses—Please contact the minor program office for information on relevant coursework.

Freestanding Minor Requirements
A master’s minor requires 9 credits, including 1 credit of the Proseminar in Conflict Management. A doctoral minor requires 15 credits, including 2 credits of the Proseminar in Conflict Management. It is recommended that courses be selected according to the need to develop theory, practical applications, and skills in conflict management.

Conservation Biology

Contact Information—Director of Graduate Studies, Conservation Biology Graduate Program, Program 199 McNeal Hall, University of Minnesota, 1985 Buford Avenue, St. Paul, MN 55108 (612-624-7751; e-mail cb-program@fw.umn.edu; <www.consbio.umn.edu>).

Professor
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Donald N. Altstad, Ecology, Evolution, and Behavior, FM
Dorothy H. Anderson, Forest Resources, FM
David A. Andow, Entomology, FM
Sandra O. Archibald, HHH Institute of Public Affairs, FM
Franklin H. Barnwell, Ecology, Evolution, and Behavior, FM
Marvin E. Bauer, Forest Resources, FM
John H. Beauty, Ecology, Evolution and Behavior, FM
Charles R. Blinn, Forest Resources, FM
James L. Bowyer, Wood and Paper Science, FM
Kenneth N. Brooks, Forest Resources, FM
Dwight A. Brown, Geography, FM
Thomas E. Burky, Forest Resources, FM
Vernon B. Cardwell, Agronomy and Plant Genetics, FM
Yosef Cohen, Fisheries and Wildlife, FM
Kendall W. Corbin, Evolution, and Behavior, FM
William P. Cunningham, Genetics and Cell Biology, FM
James W. Curtsinger, Ecology, Evolution, and Behavior, FM
Edward J. Cushing, Ecology, Evolution, and Behavior, FM
Francesca J. Cuthbert, Fisheries and Wildlife, FM
Gary E. Duke, Veterinary Pathobiology, FM
K. William Easter, Applied Economics, FM
Mohamed E.-Al-Halawani, Animal Science, FM
Paul V. Ellefson, Forest Resources, FM
Robert T. Holt, Political Science, FM
Ralph W. Holzenthal, Entomology, AM
Anne R. D. Kapuscinski, Fisheries and Wildlife, FM
Scott M. Lanyon, Bell Museum of Natural History, FM
Patrice A. Morrow, Ecology, Evolution, and Behavior, FM
Claudia Neuhauer, Ecology, Evolution, and Behavior, FM
Gerald J. Niemi, Biology, Duluth, FM
James A. Perry, Forest Resources, FM
Stephen Polasky, Applied Economics, FM
Anne E. Pusey, Ecology, Evolution, and Behavior, FM
Patrick T. Redig, Small Animal Clinical Sciences, AM
Philip J. Regal, Ecology, Evolution, and Behavior, FM
Peter B. Reich, Forest Resources, FM
Carlisle F. Runge, Applied Economics, FM
Abdi I. Samatar, Geography, FM
Ruth G. Shaw, Ecology, Evolution, and Behavior, FM
Steve R. Simmons, Applied Plant Sciences, FM
Donald B. Smift, Ecology, Evolution, and Behavior, FM
J.L. David Smith, Fisheries and Wildlife, FM
Peter W. Sorensen, Fisheries and Wildlife, FM
George R. Spangler, Fisheries and Wildlife, FM
Anthony M. Starfield, Ecology, Evolution, and Behavior, FM
Robert W. Sterner, Ecology, Evolution, and Behavior, FM
G. David Tilman, Ecology, Evolution and Behavior, FM
Robert M. Zink, Ecology, Evolution, and Behavior, FM

Adjunct Professor
David E. Andersen, Fisheries and Wildlife, AM
L. David Mech, Fisheries and Wildlife, FM

Associate Professor
James C. Bell, Soil, Water, and Climate, AM
Paul V. Bolstad, Forest Resources, FM
Jay S. Coggins, Applied Economics, FM
Susan M. Galatowitsch, Horticultural Science, FM
Frances R. Homans, Applied Economics, FM
Peter A. Jordan, Fisheries and Wildlife, FM
Raymond M. Newman, Fisheries and Wildlife, FM
Roderick H. Squires, Geography, FM

Adjunct Associate Professor
David L. Garshelis, Fisheries and Wildlife, FM
Frederick J. Jannett, Jr., Fisheries and Wildlife, FM
Ronald E. Tilson, Fisheries and Wildlife, E
Bruce C. Vondracek, Fisheries and Wildlife, FM

Assistant Professor
David C. Fulton, Fisheries and Wildlife, FM
Kristen C. Nelson, Forest Resources, FM
Daniel J. Philpon, Rhetoric, FM
Andrew M. Simons, Fisheries and Wildlife, FM

Adjunct Assistant Professor
David N. Bengston, Forest Resources, FM
Diane L. Larson, Ecology, Evolution, and Behavior, AM
Karen S. Oberhauser, Ecology, Evolution, and Behavior, AM

Lecturer
Thomas R. Fiutak, Independent Study, FM

Research Associate
Lee E. Felich, Forest Resources, FM
Catherine C. Reed, Entomology, E

Other
Robert G. Haight, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The conservation biology program has two complementary objectives leading to a unique multidisciplinary program. The first is to provide students with sound graduate training in the biological sciences relevant to the global conservation of plants, animals, and ecosystems. The second objective promotes the study of social, political, and economic sciences that relate to recognition and solution of conservation problems. The overall goal of the program is to prepare students to develop solutions or approaches to address problems that are scientifically and environmentally sound and likely to be acted upon or implemented within their social and political context.

Prerequisites for Admission—A B.S. degree in biology or a closely related field is preferred. Applicants with a baccalaureate degree in another field are accepted, but these individuals may be required to take selected courses in biology. In general, Ph.D. applicants holding a baccalaureate degree are expected first to complete a master’s degree.

Special Application Requirements—A statement of career goals and three letters of recommendation evaluating the applicant’s potential for graduate study are required. Letters of recommendation should be sent directly to the Conservation Biology Program Office. Scores less than five years old from the General Test of the GRE are required. TOEFL is required for applicants who speak...
English as a second language. Deadline for application is January 1; earlier application is encouraged for individuals seeking financial aid. Typically students are admitted to begin only in fall semester.

**Use of 4xxx Courses**—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

**Courses**—Conservation biology students take courses offered by a variety of colleges and departments across the University, including but not limited to fisheries and wildlife; ecology, evolution, and behavior; soil, water, and climate; forest resources; geography; sociology; and the Hubert Humphrey Institute of Public Affairs. Acceptable courses for the degree are chosen in consultation with the adviser.

**M.S. Degree Requirements**

Students must complete a minimum of 30 credits in the biological and social aspects of conservation biology. For Plan A students, 10 of these credits are thesis credits; for Plan B students, 10 of these credits are for Plan B papers.

**Language Requirements**—None.

**Final Exam**—The final exam is oral.

**Minor Requirements for Students Majoring in Other Fields**—A minor in conservation biology may be earned by completing the two required courses for a major, plus participating in one semester of the conservation biology seminar.

**Ph.D. Degree Requirements**

Ph.D. students complete 46 credits, including 10 credits courses required as part of the major, 12 credits in a minor or supporting program, and 24 thesis credits. Students take core courses and are expected to show competency in both the biological and social sciences. With their advisory committee, students develop a program that emphasizes the ecological and social aspects of conservation biology. Dissertation research may require proficiency in supporting areas (e.g., statistics, computing, communications).

**Language Requirements**—None.

**Minor Requirements for Students Majoring in Other Fields**—A minor in conservation biology may be earned by completing the two required courses for a major, participating in one semester of the conservation biology seminar, and completing six elective credits. Electives are determined in consultation with the director of graduate studies and the student’s advisory committee.

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**Control Science and Dynamical Systems**

**Contact Information**—Control Science and Dynamical Systems Center, University of Minnesota, 107 Akerman Hall, 110 Union Street S.E., Minneapolis, MN 55455 (612-625-3364; e-mail csdy@aem.umn.edu; <www.aem.umn.edu/csdy/>).

**Regents’ Professor**

Daniel D. Joseph, Aerospace Engineering and Mechanics, FM

**Professor**

Donald G. Aronson, Mathematics, FM
Gary J. Balas, Aerospace Engineering and Mechanics, FM
Daniel L. Boley, Computer Science, FM
Max Donath, Mechanical Engineering, FM
David P. Fan, Genetics and Cell Biology, FM
William L. Garrard, Aerospace Engineering and Mechanics, FM
Tryphon T. Georgiou, Electrical Engineering, FM
Maria Gini, Computer Science, FM
Mostafa Kaveh, Electrical Engineering, FM
John C. Kieffer, Electrical Engineering, FM
Larry L. Kinney, Electrical Engineering, FM
K. S. P. Kumar, Electrical Engineering, FM
E. Bruce Lee, Electrical Engineering, FM
Walter Littman, Mathematics, FM
Richard P. McGehee, Mathematics, FM
Katsuhiro Ogata, Mechanical Engineering, FM
Nikolaos P. Papankopoulois, Computer Science, AM
George R. Sell, Mathematics, FM
Yaotaka Sibuya, Mathematics, FM
Kim A. Stelson, Mechanical Engineering, FM
Allen R. Tennenbaum, Electrical Engineering, FM
Ahmed H. Tewﬁk, Electrical Engineering, FM

**Associate Professor**

Prodromos Daoutidis, Chemical Engineering and Materials Science, AM
Yiyuan Zhao, Aerospace Engineering and Mechanics, AM

**Adjunct Associate Professor**

Dale F. Enns, Aerospace Engineering and Mechanics, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

**Curriculum**—Student programs must emphasize modeling (mathematical and physical analyses of control or dynamical systems, with some computational or numerical expertise) and two areas selected from the following three: control theory for deterministic processes; stability theory and general analysis of dynamical systems; stochastic processes and information theory.

**Prerequisites for Admission**—Applicants must have completed a master’s degree in one of the related fields of engineering, computer science, mathematics, statistics, or physics. Master’s degrees will have an emphasis in control science and/or dynamical systems can be earned in any of these fields at the University of Minnesota. An applicant with a master’s degree in another area whose scientific, mathematical, and/or engineering background is adequate to pursue the program also is considered. A high level of proficiency in mathematics is necessary to successfully complete the Ph.D. program. Applicants are strongly encouraged to obtain a faculty adviser before formally applying to the program.

**Special Application Requirements**—Three letters of recommendation evaluating the applicant’s scholarship and a complete set of transcripts are required. At least one letter of recommendation must be from a faculty member familiar with the applicant’s previous graduate work. Because the faculty is drawn from a number of disciplines and students’ programs can reflect a variety of emphases, it is important for applicants to clearly specify career goals and program emphasis desired in their application materials. Submission of GRE scores is strongly encouraged.

**Use of 4xxx Courses**—No 4xxx courses may be used for this program.

**Ph.D. Degree Requirements**

Programs are designed by the student and the adviser. Coursework is usually selected from those science, mathematics, engineering, and related fields that are relevant to control science and dynamical systems. Students can prepare for the written preliminary exam by completing three 8xxx or suitably advanced courses in three of the four areas of emphasis. In addition, students typically take substantial coursework in advanced mathematics.

**Language Requirements**—None.

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**Counseling and Student Personnel**

See Educational Psychology.

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**Creative Writing**

**Contact Information**—See English.

**Regents’ Professor**

Patricia M. Hamp!, AM

**Professor**

Michael Dennis Browne, AM
Valerie Miner, AM
Madelon M. Sprengnether, AM

**Associate Professor**

Maria J. Fitzgerald, AM
Julie Schumacher, AM
Ray Gonzalez, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

**Curriculum**—The Department of English offers the master of fine arts degree for students committed to pursuing the writing life. This three-year degree provides advanced, graduate level coursework in writing, language, and literature, as well as study in a related field. The third year of the
program focuses on the final development of a book-length manuscript suitable for publication. At the heart of the program are writing workshops in poetry, fiction, and literary nonfiction, and courses in the Reading as Writers and Topics in Advanced Writing series, which enable writers to explore a variety of issues relating to contemporary themes in American and world literature. The program encourages experimentation across genres, fostering the discovery of new and varied forms for a developing voice.

**Use of 4xxx Courses**—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

**Courses**—Please refer to English Composition (EngC), English: Creative and Professional Writing (EngW), and English Language and Literature (EngL) in the course section of this catalog for courses pertaining to the program.

**M.F.A. Degree Requirements**

The M.F.A. requires 45 credits distributed over a three-year period, culminating in a book-length manuscript and a public reading from the work. An M.F.A. essay is also required, generally completed in the spring of the second year.

Required coursework includes EngW 8101 (4 credits); four writing workshops (16 credits), three of which must be in the student’s genre of choice and include one 8xxx course, and one of which must be outside the student’s primary genre; language and literature courses (9 credits); related field (6 credits); and a creative project, a book-length manuscript suitable for publication (12 credits, 4 of which are for manuscript preparation and 8 for creative project registration).

**Language Requirements**—None.

**Final Exam**—The M.F.A. essay is a weeklong, take-home exam based on 20 texts designated by program faculty.

**Dentistry**

**Contact Information**—School of Dentistry, University of Minnesota, 15-136 Malcolm Moos Health Sciences Tower, 515 Delaware Street S.E., Minneapolis, MN 55455 (612-624-7934; fax 612-626-6096; e-mail wegme099@umn.edu; www.dent.umn.edu)

**Professor**

Dwight L. Anderson, Oral Sciences, AM  
Leslie V. Martens, Preventive Sciences, AM  
Karlin T. Moller, Preventive Sciences, AM  
Bruce L. Philstrom, Preventive Sciences, AM  
Peter J. Polverini, Oral Sciences, AM  
Charles F. Schachtele, Oral Sciences, AM  
Burton L. Shapiro, Oral Sciences, AM  
T. Michael Spiedel, Diagnosti/Surgical Sciences, AM  
Michael J. Tilt, Preventive Sciences, AM  
Larry F. Wolff, Preventive Sciences, AM  
Frank W. Worms, Diagnosti/Surgical Sciences, AM

**Clinical Professor**

Gerald D. Cavanaugh, Diagnosti/Surgical Sciences, E

**Associate Professor**

Gary C. Anderson, Restorative Sciences, AM  
James L. Baker, Restorative Sciences, E  
Mahmoud E. ElDeeb, Restorative Sciences, AM  
Pamela R. Erickson, Preventive Sciences, AM  
James E. Hinrichs, Preventive Sciences, AM  
James R. Holtan, Restorative Sciences, AM  
Tom W. Koriath, Oral Sciences, AM  
Ramesh K. Kuba, Diagnosti/Surgical Sciences, E  
Thomas D. Larson, Restorative Sciences, E  
Bryan S. Michalowicz, Preventive Sciences, AM  
Kathleen J. Newell, Preventive Sciences, AM  
Paul Olin, Restorative Sciences, AM  
Joy B. Osborn, Preventive Sciences, AM  
Jorge M. Perdigão, Restorative Sciences, AM  
Igor J. Pesun, Restorative Sciences, AM  
Maria R. Pintado, Oral Sciences, AM  
Nelson L. Rhodus, Diagnosti/Surgical Sciences, AM  
Eric L. Schiffman, Diagnosti/Surgical Sciences, AM  
John K. Schulte, Diagnosti/Surgical Sciences, AM  
Stephen K. Shuman, Oral Sciences, AM  
Jill L. Stoltenberg, Preventive Sciences, AM  
James Q. Swift, Diagnosti/Surgical Sciences, AM  
Omar A. Zidan, Restorative Sciences, AM

**Assistant Professor**

John P. Beyer, Diagnosti/Surgical Sciences, AM  
Walter R. Bowers, Restorative Sciences, AM  
Kate M. Hathaway, Diagnosti/Surgical Sciences, E

**Research Associate**

John O. C. Look, Diagnosti/Surgical Sciences, AM

**Clinical Specialist**

Chester J. Schultz, Jr., Restorative Sciences, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

**Curriculum**—The M.S. program in dentistry prepares dentists and dental hygienists with clinical expertise for positions of leadership in education, research, and program administration in the oral health field. A multidisciplinary faculty of dental and dental hygiene educators, researchers, and clinicians teach the program, which is housed in the School of Dentistry. All students complete core coursework in teaching and evaluation in dentistry, research methods, and health-care administration. Additional advanced coursework is offered in these same focus areas as well as in selected clinical and oral science topics with interdisciplinary impact, including conscious sedation, craniofacial pain, geriatrics, oral biology, oral medicine and radiology, preventive, practice administration, and psychology. Students have flexibility in planning individualized programs to accommodate their specific areas of interest, and courses from other disciplines may be included for credit in the major area.

Students enrolled in an advanced clinical dental training program may be admitted to the dentistry graduate program for concurrent study, but must carefully plan their curriculum with their faculty adviser and the director of graduate studies so that their residency and M.S. programs are appropriately integrated and satisfy Graduate School registration requirements. American Dental Association-accredited programs in the School of Dentistry enrolling students for the M.S. degree include endodontics, orthodontics, pediatric dentistry, periodontics, prosthetic dentistry, dental hygiene (with baccalaureate degree), and residencies in general practice dentistry (AEGD and GPR). Other dental school clinical and postdoctoral programs enrolling students for the M.S. degree include those in TMJ disorders/craniofacial pain, geriatric dentistry, and the Dentist Scientist Award.

The Dentist Scientist Award (DSA) training program provides for Ph.D. training in basic sciences and advanced education in a clinical specialty of dentistry. Other advanced research training options are possible. Admission is competitive and financial support will be dependent on the strength of the applicant and the availability of funds from several possible sources. Information about the DSA may be obtained from the director, Dr. Mark Herzberg, or the director of graduate studies.

**Clinical Instruments**—The School of Dentistry clinics maintain a centralized instrument usage and sterilization system that provides clinical instrumentation and related services for graduate students enrolled in advanced clinical training programs. Usage fees, where applicable, are listed in the Class Schedule.

**Prerequisites for Admission**—Applicants must have received a D.D.S. or D.M.D. degree from an accredited U.S. institution or completed a dental hygiene program along with a baccalaureate degree from an accredited U.S. institution. Students with comparable foreign degrees from recognized colleges or universities may also apply. Applications from individuals who have already completed or are enrolled in an advanced clinical training program (e.g., general dentistry or specialty residency program) are encouraged. A GPA of 3.00 or academic standing in the top one quarter of graduating class is required for admission. Applicants for whom English is a second language must also take the TOEFL.

**Special Application Requirements**—Applicants must submit three letters of recommendation directly to the department from persons familiar with their academic capabilities, along with a complete set of official transcripts and a clearly written, brief statement (under 500 words) which relates the applicant’s career goals to the goals of the program. Applicants who are planning concurrent studies in an advanced clinical training program (i.e., dental specialty
residency) must contact that program for specific application deadlines and additional application requirements.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Dentistry (Dent) in the course section of this catalog for courses that pertain to this program.

M.S. Degree Requirements
The M.S. degree, which usually requires at least 18 months to complete, is offered under Plan A (with thesis) and Plan B (without thesis). Students in both plans must complete 14 credits in the major, including four core courses: 1) teaching and evaluation in dentistry, 2) basic research methodology, 3) introductory biostatistics, and 4) fundamentals of health-care administration. Courses from other disciplines may also be taken for credit in the major with the approval of the student's adviser and the director of graduate studies. All students must complete a minor or related field consisting of at least 6 credits as well as program requirements for training in the responsible conduct of research. Additionally, Plan A students must complete 10 thesis credits; Plan B students must instead complete 10 additional credits of coursework and submit three Plan B papers, one of which must involve the analysis and reporting of research data. Students must maintain a cumulative GPA of at least 3.00 in the program.

Language Requirements—None.

Final Exam—The final exam is oral.

Design, Housing, and Apparel

Contact Information—Director of Graduate Studies, Design, Housing, and Apparel, University of Minnesota, 240 McNeal Hall, 1985 Buford Avenue, St. Paul, MN 55108 (612-626-1219; fax 612-624-2750; e-mail dhagradinfo@che.umn.edu; <www.che.umn.edu/dha/>).

Regents’ Professor
Joanne B. Eicher, FM

Professor
William J. Angell, AM
Marielyn R. DeLong, FM
Denise A. Guerin, FM
Kim K. P. Johnson, FM

Associate Professor
Jeffrey R. Crump, AM
Sherri A. Galbrug, AM
Delores A. Gintliner, AM
Karen L. LaBat, FM
Barbara E. Martinson, FM
Steven McCarthy, AM
Gloria M. Williams, AM
Becky L. Yust, FM
Ann Ziebarth, FM

Adjunct Associate Professor
Margaret K. DiBlasio, FM
Edward G. Goeter, FM
David T. Grimsrud, AM

Assistant Professor
Marilyn Brunin, AM
Sauman Chu, AM
Stephanie A. Watson, AM

Lecturer
James Boyd-Brent, AM
Elizabeth Bye, AM

Other
Brad Hokanson, AM
Fiona L. Shen, AM
Carol C. Waldron, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The design, housing, and apparel graduate program focuses on the study of relationships between humans and their designed environments. This focus is based on the assumption that design and analysis of environments contributes to the improvement of the human condition. The program addresses theory, research, and application, using a shared disciplinary base from the social and behavioral sciences. The goal of the program is for students to analyze, evaluate, and integrate theoretical frameworks related to humans and their designed environments.

The M.A., M.S., and Ph.D. degrees are available with four areas of emphasis: apparel, design communication, housing, and interior design. The M.F.A. and M.A. degrees are available with an emphasis in multimedia. The emphasis in apparel advances both theoretical and practical knowledge of textile and apparel products related to human behavior. Students may focus on design, aesthetics, historic costume, or social science aspects of apparel, retailing, or apparel product analysis. The emphasis in design communication focuses on design theory, design process and methodology, visual communication (design and analysis), and color systems and perception. The emphasis in housing studies advances both theoretical and applied knowledge in the housing field. Through research, students are prepared to assist people and communities in addressing their housing-related problems. Courses emphasize human needs and behavior, analysis of designed environments and technology, policy and community development, and housing for special populations such as the elderly or low-income households. The emphasis in interior design includes study of the theory, research, and specialized practice components of design as applied to the interior environment. The emphasis in multimedia provides students with experience in designing for the electronic environment. The program integrates theory with practice in the application of emerging technologies and software to digital design solutions. Students complete a creative thesis.

Prerequisites for Admission—Individuals must have adequate undergraduate education in the area of emphasis and background in the basic disciplines of art, social science, physical science, and biological science appropriate to the area of emphasis. To pursue a degree with interior design as the emphasis area, a first professional degree in interior design is required. Students interested in pursuing a Ph.D. must first complete a master’s degree. Specific requirements may be obtained by contacting the director of graduate studies.

Special Application Requirements—Consult the director of graduate studies; scores from the GRE are required. Students pursuing a degree in an emphasis related to design are required to submit a portfolio consisting of 15-20 slides. Students are admitted fall and spring semesters.

Use of 4xxx Courses—No more than 30 percent of a student's official degree program may be comprised of 4xxx courses. Not all of the department's 4xxx courses are available for graduate credit. Appropriate courses are selected in consultation with the student’s adviser.

Courses—Please refer to Design, Housing, and Apparel (DHA) in the course section of this catalog for courses that pertain to this program.

M.A. Degree Requirements
Minimum requirements for the M.A. include 4 credits in courses that focus on theory building and the theoretical and philosophical bases of inquiry in the discipline; 6 credits in courses on qualitative or quantitative methods of research and evaluation; 8 credits for Plan A students, and 18 credits for Plan B students in the area of emphasis; 10 thesis credits for Plan A students; and 6 credits in a related field. Students may be required to complete additional credits upon recommendation of their committee.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—For a master’s minor, a minimum of 9 credits in design, housing, and apparel is required, including DHA 8101. Courses are selected in consultation with the director of graduate studies.

M.F.A. Degree Requirements
Minimum requirements for the M.F.A. include 6 credits in courses that focus on theory building and the theoretical and philosophical bases of inquiry in the discipline; 6 credits in evaluation and analysis, including DHA 5388—Design Planning and Analysis and a 3-credit course in graduate level statistics; 28 credits in the area of emphasis; 12 credits of M.F.A. creative thesis; and 8 credits in a related field. Students may be required to complete additional credits upon recommendation of their committee.
Language Requirements—None.

Final Exam—The final exam is oral.

M.S. Degree Requirements
Minimum requirements for the M.S. include 4 credits in courses that focus on theory building and the theoretical and philosophical bases of inquiry in the discipline; 6 credits in courses on qualitative and quantitative methods of research and evaluation; 8 credits for Plan A students, and 18 credits for Plan B students in the area of emphasis; 10 thesis credits for Plan A students; and 6 credits in a related field. Students may be required to complete additional credits upon recommendation of their committee.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—For a master’s minor, a minimum of 9 credits in design, housing, and apparel is required, including DHA 8101. Courses are selected in consultation with the director of graduate studies.

Ph.D. Degree Requirements
Minimum requirements for the Ph.D. include 6 credits in courses that focus on theory building and the theoretical and philosophical bases of inquiry in the discipline; 9 credits in courses on qualitative and quantitative methods of research and evaluation; 12 credits in the area of emphasis; 24 thesis credits; and 12 credits in a supporting program. Students may be required to complete additional credits upon recommendation of their committee.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—For a doctoral minor, a minimum of 12 credits in design, housing, and apparel is required, including DHA 8101—Philosophical Foundations of Design, Housing, and Apparel. Courses are selected in consultation with the director of graduate studies.

Development Studies and Social Change

Contact Information—MacArthur Interdisciplinary Program on Global Change, Sustainability and Justice, University of Minnesota, 260 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-0832; fax 612-626-2242; e-mail macarthur@umn.edu; <www.icgc.umn.edu>)

Regents’ Professor
Allen F. Isaacman, History, E
G. Edward Schub, Public Affairs, E
John Sullivan, Political Science, E

Professor
Dennis A. Ahlburg, Industrial Relations, E
Ronald R. Aminzade, Sociology, E
Vernon B. Cardwell, Agronomy and Plant Genetics, E
William P. Cunningham, Genetics and Cell Biology, E
Raymond D. Duvall, Political Science, E

Lawrence Jacobs, Political Science, E
Amy K. Kaminsky, Women’s Studies, E
Anne R. D. Kapuscinski, Fisheries and Wildlife, E
Sally Kenney, Public Affairs, E
Helga Leitner, Geography, E
John W. Mosswit, Cultural Studies and Comparative Literature, E
August H. Nintz, Jr., Political Science, E
James A. Perry, Forest Resources, E
Philip J. Regal, Ecology, Evolution, and Behavior, E
Terry L. Roe, Applied Economics, E
David Roediger, History, E
Abdi I. Samatar, Geography, E
Eric S. Shepard, Geography, E
Kathryn A. Sikkink, Political Science, E
George R. Spangler, Fisheries and Wildlife, E
Dennis N. Valdes, Chicano Studies, E
Ann B. Walter, History, E
Donald Wyse, Agronomy and Plant Genetics, E

Associate Professor
Jean M. Allman, History, E
Fernando E. Arenas, Spanish and Portuguese, E
Ragu A. Assaad, Public Affairs, E
Kelotio E. Aitkins, Afro-American and African Studies, E
Daphne J. Berdahl, Anthropology, E
Jeffrey P. Broadbent, Sociology, E
Sarah C. Chambers, History, E
Jay S. Coggins, Applied Economics, E
Lisa J. Disch, Political Science, E
Daniel Kelliher, Political Science, E
Deborah Levison, Public Affairs, E
Carol A Miller, American Studies, E
Rica Nagar, Women’s Studies, E
Jean M. O’Brien-Kehoe, History, E
Joanna O’Connell, Spanish and Portuguese, E
Jennifer L. Pierce, Sociology, E
Richard Price, Political Science, E
Angelita D. Reyes, Afro-American and African Studies, E
Ajay Skaria, History, E
Charles J. Sagnet, English, E
John S. Wright, African American and African Studies, E

Assistant Professor
Elizabeth H. Boyle, Sociology, E
Bruce P. Braun, Geography, E
Catherine C. Choy, American Studies
Vinay Gidwani, Geography, E
Douglas R. Hartmann, Sociology, E
Qadri Ismail, English, E

Adjunct Assistant Professor
Helene Murray, Agronomy and Plant Genetics, E

Curriculum—This structured interdisciplinary doctoral minor is offered in conjunction with the MacArthur Interdisciplinary Program on Global Change, Sustainability, and Justice. By focusing on the social bases of change in the developing world, the program engages a wide range of academic disciplines including the social sciences, humanities, and biological sciences. The minor focuses on three areas: 1) the relationships between macroscopic processes of political, economic, and social change, and the microscopic conditions of lived experience in the developing world; 2) specifically interdisciplinary perspectives (encompassing the social sciences, the biological sciences, and the humanities) on this general thematic concern; and 3) preparation of doctoral students for research on the developing world.

Prerequisites for Admission—Admission is contingent upon prior admission to a doctoral degree-granting program within the Graduate School and upon affiliation with the MacArthur Program.

Special Application Requirements—Students enrolled in a doctoral degree-granting program may apply for the minor at any time during the academic year; acceptance will take effect the following term.

Use of 4xxx Courses—Courses used to fulfill minor requirements must be 5xxx or above.

Courses—Please contact the minor program office for information on relevant coursework pertaining to the program.

Freestanding Minor Requirements
The doctoral minor requires a sequence of three core seminars (DSSC 8111, 8211-12, 8310) for 9 credits total (8310 is taken twice). Students also take one or two courses (minimum 3 credits total) chosen from an approved list of courses from across the Graduate School curriculum that are relevant to the field of development studies and social change.

East Asian Studies

Contact Information—East Asian Studies, Area Studies Programs, University of Minnesota, 214 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-8543).

Professor
Edward L. Farmer, AM
Chin-Chuan Lee, Journalism and Mass Communication, AM
Robert J. Poor, Art History, AM
Ann B. Walter, History, AM

Associate Professor
Yanjie Bian, Sociology, AM
Jeffrey P. Broadbent, AM
Tsan-Kuo Chang, Journalism and Mass Communication, AM
Daniel Kelliher, AM
Tahirih V. Lee, Law School, AM

Assistant Professor
Christopher M. Isett, History, AM
Liping Wang, History, AM

Associate Librarian
Yuan Zhou, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The program offers an entry point for interdisciplinary study of East Asia, particularly China and Japan. It serves both as a stepping stone to advanced academic work and as a terminal degree for those with non-academic career goals related to East Asia.

Prerequisites for Admission—Ideally, an applicant’s background should include undergraduate study in fields related to East Asia or East Asian languages. Students from other academic areas may be admitted, however, with the provision that prerequisite coursework be made up after admission.
Special Application Requirements—Three letters of recommendation and statement of purpose should be submitted to the department. GRE test scores are required. Students are admitted each semester.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to East Asian Studies (EAS) and Global Studies (GloS) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
The program uses an interdisciplinary approach that emphasizes the humanities and social sciences and requires proficiency in a foreign language, a theoretical framework, broad knowledge of the area in question, and a concise understanding of a topical theme to be developed in the Plan A thesis or Plan B papers.

Plan A requires 36 credits: a minimum of 21 course credits (7 courses), including 15 credits (5 courses) in the major and 6 credits (2 courses) in one or more fields outside the major, and 10 thesis credits. Coursework must include the 3-credit introductory scope and methods course (Area 8061) and three proseminars/seminars. A Plan A thesis must be written.

Plan B requires 30 course credits in order to provide a broader knowledge of the chosen field and allied subjects. It requires at least 15 credits (5 courses) in the major field and 12 credits (4 courses) in one or more related fields outside of the major, which must include three proseminars/seminars. Students must also take the 3-credit introductory scope and methods course (Area 8061). Three Plan B papers must be written, at least one of them outside of the major.

Language Requirements—The language requirement may be fulfilled by successful completion of either three years (six semesters) of a Chinese or Japanese language sequence, or at least four semesters of Chinese or Japanese language study and an approved study abroad experience in East Asia. For a Korean focus, it is possible to have a comparable level of Korean language in lieu of the Chinese or Japanese requirement. (Note: Proficiency exams and evaluations are provided by relevant language departments.)

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master’s minor requires two years of language study or equivalent proficiency, plus at least three courses (minimum of 9 credits) in the field that include at least two semesters of seminars/proseminars.

Ecology, Evolution, and Behavior

Contact Information—Department of Ecology, Evolution, and Behavior, University of Minnesota, 100 Ecology Building, 1987 Upper Buford Circle, St. Paul, MN 55108-6097 (612-625-5700; fax 612-624-6777; e-mail EEBGrad@biosci.cbs.umn.edu; <http://biosci.cbs.umn.edu/eeb/graduate.html>).

Professor
Donald N. Alstad, FM
David A. Andow, Entomology, FM
Franklin H. Barnwell, FM
John H. Beatty, FM
Patrick L. Breznik, Civil Engineering, FM
Kendall W. Corbin, FM
James W. Curtsinger, FM
Edward J. Cushing, FM
Stuart F. Goldstein, FM
Ralph W. Holzenthall, FM
Linda L. Kinkel, Plant Pathology, AM
Scott M. Lanyon, FM
D. Frank McKinney (emeritus), FM
Robert O. Megard, FM
Patrice A. Morrow, FM
Claudia Neukomper, FM
Craig Packer, FM
John Pastor, University of Minnesota, Duluth, FM
Stephen Polasky, FM
Anne E. Pusey, FM
Philip J. Regal, FM
Peter B. Reich, Forest Resources, FM
Michael J. Sadowsky, Soil, Water, and Climate, FM
Ruth G. Shaw, FM
Michael J. Simmons, Genetics and Cell Biology, FM
Akhour Sinha, Genetics and Cell Biology, FM
Donald B. Simff, FM
Peter W. Sorensen, Fisheries and Wildlife, FM
Anthony M. Starfield, FM
Robert W. Steimer, FM
Bert E. Stromberg, JF, FM
G. David Tilman, FM
Robert M. Zink, FM

Adjunct Professor
Lee E. Frelich, FM
L. David Mech, Fisheries and Wildlife, FM
Diane L. Larson, AM
Karen S. Oberhauser, FM

Associate Professor
James B. Conner, FM
Susan M. Galatowitsch, Horticultural Science, FM
Georgiana May, FM
Raymond M. Newman, FM
Andrew M. Simons, FM
David W. Stephens, FM
Susan J. Weller, AM

Assistant Professor
Antony M. Dean, FM
Sarah E. Hobbie, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The graduate program in ecology, evolution, and behavior links faculty and students interested in the biology of organisms and their environments; how organisms interact in social groups, populations, communities and ecosystems; and how those interactions influence their distribution, abundance and evolution in space and time. The program provides broad training in the general areas of ecology, evolution, and animal behavior, and specialized courses and research in vertebrate and invertebrate zoology; behavior and ethology; evolution; population genetics; population, community and ecosystem ecology; limnology and paleoecology. Opportunities for field research are available in Africa, Antarctica, Central America and worldwide, as well as in local ecosystems. Seminars and individually designed tutorials are an important part of student programs.

Prerequisites for Admission—Incoming graduate students are ordinarily expected to have completed coursework in inorganic chemistry, organic chemistry, and general physics; one year of college calculus; and at least one course each in animal biology, biochemistry, genetics, physiology, and plant biology. Proficiency in a foreign language is recommended. Deficiencies must be made up early in the graduate program.

Special Application Requirements—Students are admitted only in fall semester. Deadline for application is January 7; earlier application is encouraged for individuals seeking financial aid. Three letters of recommendation evaluating the applicant’s scholarship are required, plus GRE scores (including the Subject Test). Successful applicants are encouraged to participate in the Lake Itasca Biology Session during the summer before their first semester in residence.

Use of 4xxx Courses—As preparation for their preliminary examinations, Ph.D. students are expected to acquire basic knowledge in ecology, evolution, behavior, and organismal biology, typically by taking graduate courses. One of these courses can be an advanced undergraduate or 4xxx course.

Courses—Please refer to Ecology, Evolution, and Behavior (EEB) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements
The M.S. is offered under both Plan A (with thesis) and Plan B (without thesis). Both plans require a minimum of 14 course credits in the major and a minimum of 6 course credits in one or more related fields outside the major; Plan A also requires 10 thesis credits, and Plan B requires 10 additional course credits and one to three research papers, which may be written in conjunction with graduate courses. Significant field experience and competence in statistics, to include hypothesis testing, regression, and correlation are required. Degree programs are planned by the student and an advisory committee of three faculty members to meet the student’s interests and needs.

Language Requirements—None.

Final Exam—The final exam is oral.
Minor Requirements for Students Majoring in Other Fields—A minimum of 7 credits of EEB 4xxx, 5xxx, and 8xxx courses is required for a master’s minor in ecology.

Ph.D. Degree Requirements
A minimum of 3 course credits and 24 thesis credits are required in the major, and at least 12 course credits are required for either a minor in another field or a supporting program from several relevant fields. Significant field experience, proficiency in using computers in research, and competence in statistics, including experimental design, are required. Degree programs are planned by the student and an advisory committee of three to five faculty members.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A minimum of 12 credits of EEB 4xxx, 5xxx, and 8xxx courses is required for a doctoral minor in ecology.

Economics

Contact Information—Director of Graduate Studies, Department of Economics, University of Minnesota, 1035 Heller Hall, 271 19th Avenue S., Minneapolis, MN 55455 (612-625-6833; fax 612-624-0209; e-mail econgrads@econ.umn.edu; <www.econ.umn.edu>).

Regents’ Professor
John S. Chapman, FM
Edward C. Prescott, FM
G. Edward Schuh, Public Affairs, FM

Professor
Beth E. Allen, FM
Michele Boldrin, FM
Varadarajan V. Chari, FM
Roger D. Feldman, Public Health, FM
Edward M. Foster, FM
Thomas J. Holmes, FM
Larry E. Jones, FM
Timothy Kohoe, FM
Narayana Kocherlakota, FM
Gerard McCullough, Agricultural and Applied Economics, AM
Andrew McLennan, FM
Marcel K. Richter, FM
Aldo Rustichini, FM
Craig E. Swan, FM
Jan Werner, FM

Adjunct Professor
Patrick J. Kohoe, AM
Ellen McGrattan, AM
Christopher Phelan, AM
David E. Runkle, Finance, AM
James A. Schmitz, AM
Warren E. Weber, AM

Associate Professor
George D. Green, History, AM
Erzo G.J. Luttmer, FM

Adjunct Associate Professor
Melvin L. Burstien, Law School, AM

Assistant Professor
Marco Bassetto, AM
Mariacristina DeNardi, AM
Gautam Gowrisankaran, AM
Matthew F. Mitchell, AM
Andrea Momo, AM
Julia K. Thomas, AM

Other
Samnan Sahi, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The economics graduate program offers degree work in both theoretical and applied fields of economics. It is possible to pursue thesis research in microeconomic or macroeconomic theory. In addition, the following fields of specialization are offered: econometrics, economic growth and development, financial economics, game theory, industrial organization, international economics, labor economics, mathematical economics, monetary economics, and public economics. Students are admitted only for the Ph.D.; the M.A. is an optional part of the Ph.D. program.

Prerequisites for Admission—The general requirement is the capability to pursue Ph.D.-level work. Normally a student should have an undergraduate record from a recognized college that includes coursework in economic theory and mathematics (multivariate calculus and linear algebra).

Special Application Requirements—Students should submit their applications, including a record of GRE scores and three letters of recommendation, to the director of graduate studies. Applicants who would like financial aid should submit their materials no later than December 15. Students are admitted in fall semester only.

Use of 4xxx Courses—4xxx or 5xxx economics courses may not be included on degree program form for the economics Ph.D. program. Students may include 4xxx, 5xxx, and 8xxx courses outside economics in the economics Ph.D. program. Approval of the student’s adviser and the director of graduate studies are needed to use 4xxx and 5xxx courses.

Courses—Please refer to Economics (Econ) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
The M.A. is offered under Plan A (with thesis) or Plan B (without thesis). Coursework for the M.A. is drawn from the Ph.D. program and must include at least 10 credits of economic theory from the first-year Ph.D. sequences in theory (for majors) or microeconomic analysis (for minors) and macroeconomics, plus at least 3 credits in quantitative economics or econometrics. Beyond these restrictions, the general Graduate School requirements govern. For the Plan B degree, a Ph.D. student will have completed requirements for the M.A. when the written preliminary exams have been completed. Two Plan B projects consisting of research papers or literature reviews are required; the Ph.D. written preliminary exams required in two fields outside of economic theory (“field exams”) may be used to satisfy either or both of the Plan B projects. Because the standards used to judge whether a preliminary exam has satisfied the requirement for the M.A. are less rigorous than those for the Ph.D., students may qualify for the master’s Plan B without having satisfied all requirements for the Ph.D. written preliminary exams.

Language Requirements—None.

Final Exam—The final exam is oral for Plan A, written for Plan B.

Minor Requirements for Students Majoring in Other Fields—A master’s minor consists of 6 credits in 4xxx, 5xxx, or 8xxx economics courses, all taken A-F and completed with grades of B or better (one 8xxx course may carry a grade of C). The 6 credits include Econ 5151 and Econ 5152 or more advanced courses in economic theory. The economic theory requirement may be waived if, in the judgment of the director of graduate studies, the student’s previous work in economics has included courses equivalent to Econ 5151 and 5152, though the requirement to complete 6 credits would still stand.

Ph.D. Degree Requirements
Emphasis in all aspects of the program is on careful development of the theoretical basis for the work, whether the work is theoretical or applied, and whether the relevant theory is drawn from economics, econometrics, mathematics, statistics, or other related disciplines.

Before undertaking research for a doctoral thesis, the student must pass written preliminary exams in micro- and macroeconomic theory, plus in two of the fields listed under the curriculum section above. A research paper may be substituted for one of the field examinations; see the Economics Graduate Student Handbook. The program does not specify a minimum number of courses for the major; rather, the courses taken to help prepare for the preliminary exams constitute the major program. In addition, students must complete 12 credits outside the major for a supporting program, which may include economics courses not included in the major.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Requirements for a doctoral minor include five or more from among the following courses: Econ 8001-2-3-4 or 8101-2-3-4, and 8105-6-7-8; plus completion of at least two 8xxx courses in economics other than those listed above. All courses must be taken A-F, with no grade lower than C and no more than two course grades of C.
In addition, students must pass the microeconomics preliminary exam for minors or majors and either the macrosociology preliminary exam for minors or majors, or a preliminary exam for majors in one of the fields listed under the program description above.

**Education**

Advanced work leading to the professional degree of master of education (M.Ed.) is offered in several areas of study. For more information, see the College of Education and Human Development Professional Studies Catalog. This catalog can be found online at [www.education.umn.edu](http://www.education.umn.edu) (catalog/catalog_intro.html).

**Education Emphases (Twin Cities campus)**—

At the Ph.D. level, the education major is divided into three emphases. Faculty associated with these doctoral programs are identified using the following abbreviations: Curriculum and Instruction, C&I; Recreation, Park, and Leisure Studies, RPLS; Work, Community, and Family Education, WCFE.

At the M.A. level, the education major is divided into two emphases. Faculty associated with these master’s programs are identified using the following abbreviations: Curriculum and Instruction, C&I; Work, Community, and Family Education, WCFE.

**Professor**

Dorothy H. Anderson, RPLS, Forest Resources, FM
Patricia G. Avery, C&I, FM
Richard W. Beach, C&I, FM
James M. Brown, WCFE, FM
Carol A. Carrier, C&I, FM
John J. Cogan, C&I, FM
Kerry J. Freedman, C&I, FM
Lee Gould, C&I, FM
Michael P. Graves, C&I, FM
Ilene B. Harris, C&I, FM
Roger T. Johnson, C&I, FM
Mary Jo Kane, RPLS, FM
Judith L. Lambrecht, C&I, WCFE, FM
Frances P. Lawrenz, C&I, Educational Psychology, FM
Darrell R. Lewis, C&I, Educational Policy and Administration, FM
Theodore Lewis, WCFE, FM
John C. Manning, C&I, FM
Leo H. McAvoy, Jr., RPLS, FM
Gary N. McLean, WCFE, FM
Roland L. Peterson, WCFE, FM
Thomas R. Post, C&I, FM
David J. Pucel, WCFE, FM
S. Jay Samuels, C&I, Educational Psychology, FM
Richard A. Swanson, WCFE, FM
Barbara M. Taylor, C&I, FM
Ruth G. Thomas, C&I, AM; WCFE, FM
Michael G. Wade, RPLS, FM

**Adjunct Professor**

Richard A. Krueger, WCFE, FM

**Associate Professor**

Bruce D. Anderson, RPLS, FM
Kathleen Cramer, C&I, AM
Margaret K. DiBlasio, C&I, FM
Fred N. Finley, C&I, FM
Patricia A. Hele, C&I, FM
Simon R. Hooper, C&I, FM
Jean A. King, C&I, Educational Policy and Administration, AM
Gary W. Leske, WCFE, FM
Jerry McElveen, WCFE, FM
R. Michael Paige, C&I, Educational Policy and Administration, FM
Rosemarie J. Park, C&I, WCFE, FM
Jane E. Pihal, WCFE, FM
Marilyn A. M. Rossmann, WCFE, FM
James R. Stone III, WCFE, FM
Carla E.S. Tabourne, RPLS, FM
Diane J. Tedick, C&I, FM
Constance L. Walker, C&I, FM
Susan M. Watts-Taffe, C&I, FM
Diane M. Wiese-Bjornstal, RPLS, FM

**Assistant Professor**

Kenneth R. Bartlett, WCFE, AM
Martha H. Bigelow, C&I, AM
Deborah Cegielski, C&I, AM
Douglas W. Huffman, C&I, AM
Joan E. Hughes, C&I, AM
Patricia A. James, C&I, General College, E
Richard M. Joerger, WCFE, AM
Jeremy Kahan, C&I, AM
Julie Kahn, C&I, AM
W. Corliss Outley, RPLS, AM
Shari L. Peterson, WCFE, FM
Shelia K. Ruhland, WCFE, AM

**Lecturer**

Mary Bents, C&I, AM
L. Joanne Buggage, C&I, AM
Faith M. Clover, AM
Maurice K. Fahnstock, RPLS, AM
H. Michael Hartoonian, C&I, AM
Robert D. Shamer, WCFE, College of Continuing Education, AM
John R. Vreyens, WCFE, AM

**Other**

Jeanette R. Daines, WCFE, AM
Sara Dexter, C&I, AM
Marie J. Maher, WCFE, AM
Richard D. Namisebely, C&I, AM
Thomas D. Peacock, Education, Duluth, WCFE, AM
Jerome A. Stein, WCFE, AM
Joyce Walker, WCFE, AM
Barbara A. Warren, WCFE, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

**Education—Curriculum and Instruction**

**Contact Information**—Department of Curriculum and Instruction, University of Minnesota, 125 Peik Hall, 159 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-625-2545; e-mail cips@umn.edu).

**Curriculum**—By focusing on the curricular and instructional processes central to all educational endeavors, graduate programs within the Department of Curriculum and Instruction prepare students for professional roles in pre-K-12 education, in postsecondary and research settings, and in educational service agencies.

The M.A. (Plan B only) includes concentrations in early childhood education; instructional systems and technology; literacy education (including children’s literature, English education, language arts education, reading education, and writing education); science education; second languages and cultures education; and social studies education.

**M.A. Plan B Degree Requirements**

The M.A. degree requires a minimum of 30 credits, which includes 14 credits in the major, at least 4 credits in research (with at least 3 credits applied to the Plan B research paper), and 6 credits in a related area chosen in consultation with the adviser. Core and research course requirements are specified in accord with each area of concentration.

**Language Requirements**—Although language requirements for second languages and cultures (SLC) students are not specified in terms of degrees or coursework, each SLC student must give evidence of proficiency in communicating within the second language of choice.

**Language Requirement**—None.

**Final Exam**—The final exam is oral.

**Minor Requirements for Students Majoring in Other Fields**—A master’s minor requires a minimum of 6 credits, selected according to the student’s needs and research interests.
Ph.D. Degree Requirements

A total of 78 credits is required for the Ph.D. Requirements include three core courses (9 credits) and at least 15 other credits in an area of concentration. Students must also complete 12 credits in research methodology; 6 credits in educational foundations; 12 credits in a minor or supporting program; and 24 thesis credits. Specific courses and additional work vary depending upon the area of concentration and are planned with the adviser.

Language Requirements—Although language requirements for second languages and cultures (SLC) students are not specified in terms of degrees or coursework, each SLC student must give evidence of proficiency in communicating within the second language of choice.

Minor Requirements for Students

Majoring in Other Fields—A minimum of 12 credits is required for a minor. A demonstrated understanding of foundational knowledge related to curriculum and instruction is required.

Education—Recreation, Park, and Leisure Studies

Contact Information—Linda Estrem, Office of the Director of Graduate Studies, School of Kinesiology and Leisure Studies, University of Minnesota, 220 Cooke Hall, 1900 University Avenue S.E., Minneapolis, MN 55455 (612-624-5017; 612-625-5300; fax 612-626-7700; e-mail rpls@umn.edu; <www.kls.coled.umn.edu/>).

Curriculum—Ph.D. students in education with an emphasis in recreation, park, and leisure studies (RPLS) pursue an individualized program specializing in leisure services management, outdoor education/recreation, sport management, or therapeutic recreation.

Prerequisites for Admission—Although prospective students generally have completed undergraduate and masters’ degrees in recreation, park, and leisure studies, others with a baccalaureate degree may be admitted who have related preparation and a significant background and interest in the subject. Admitted students may be required by their adviser to complete background preparation in undergraduate and graduate recreation and related coursework.

Special Application Requirements—Applicants must submit a completed application form including a clearly written statement of academic interests, goals, and objectives, scores from the General Test of the GRE (verbal and quantitative) or Miller Analogies Test that are less than five years old, three letters of recommendation from persons familiar with their scholarship and research potential, a scholarly paper, and copies of official transcripts. Students may apply at any time; however, submission of all application materials by January 15 is strongly encouraged to ensure priority consideration for admission as well as teaching and research assistantships awarded for the next academic year. Students can be admitted any term.

Research Facilities—Research facilities include the Institute on Community Integration and the Tucker Center for Research on Girls and Women in Sport.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Recreation, Park, and Leisure Studies (Rec) and Education (Edu) in the course section of this catalog for courses pertaining to the program.

Ph.D. Degree Requirements

The Ph.D. requires at least 86 credits, which must include 12 credits in an RPLS common core (including one course from Educational Policy and Administration (EdPA) or the Preparing Future Faculty Program (GRAD)), 21 credits in an RPLS emphasis area, 17 credits in research development, 12 credits in a supporting program or minor, and 24 thesis credits (Edu 8888). A minimum GPA of 3.00 is required to maintain good standing and to graduate.

Language Requirements—None.

Minor Requirements for Students

Majoring in Other Fields—A doctoral minor requires at least 12 credits of graduate level courses in RPLS, including Rec 5101 (3 cr) and Rec 8980 (2 cr).

Education—Work, Community, and Family Education

Contact Information—Gary Leske, Director of Graduate Studies, Department of Work, Community, and Family Education, University of Minnesota, R-350 Vocational and Technical Education Building, 1954 Buford Avenue, St. Paul, MN 55108 (612-624-1221; fax 612-625-8041; e-mail aded.mae@umn.edu; <www.wcfe.coled.umn.edu/>).

Curriculum—The program offers specializations in adult education, agricultural education and extension, business and industry education, family education, human resource development, and comprehensive work, community, and family education. Students combine study and related experiences to develop, apply, analyze, synthesize, and evaluate knowledge of the purposes, practices, issues, and problems of work, community, and family education; social, economic, historical, political, cultural, educational, technological, and psychological contexts within which work, community, and family education exist; and types of research that contribute to or apply that knowledge to the specialization. See also Work, Community, and Family Education for information about the Ed.D. degree.

Prerequisites for Admission—Prospective students generally have completed an undergraduate degree or extensive coursework in the specialization area. Prospective doctoral degree students should have academic background and experience in at least one specialization area.

Special Application Requirements—Scores from the GRE General Test are required for applicants with a bachelor’s degree from a U.S. institution. Applicants should designate the specific specialization to which they seek admission in their goal statement. A current resume is required. Students are admitted each term.

Use of 4xxx Courses—A maximum of 15 credits of 4xxx courses may be used in the related field or supporting program. Students who plan to use any 4xxx courses in their program are responsible for determining that the course is available for graduate credit.

Degree programs must include rationale for the use of 4xxx course credits.

Courses—Please refer to Adult Education (AdEd), Agricultural, Food, and Environmental Education (AFEE), Business and Industry Education (BIE), Education (Edu), Family Education (FE), Human Resource Development (HRD), and Work, Community, and Family Education (WCFE) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. is offered under Plan A and Plan B. Students in either plan complete a minimum of 30 credits of 5xxx courses, including 14 credits in the major and 6 credits in the related field. Plan A students also take 10 thesis credits; Plan B students complete a 3- to 6-credit project or paper, with remaining credits taken in either the major or related field.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students

Majoring in Other Fields—The master’s minor requires a minimum of 6 credits in one of the specializations, approved by the director of graduate studies.

Ph.D. Degree Requirements

The Ph.D. requires 60 course credits and 24 thesis credits. Course credits include a minimum of 16 credits in general aspects, a minimum of 16 credits in research, and a minimum of 16 credits in the specialization. Course credits must also include 12 elective credits and 12 credits from outside the department, which may overlap with those in general aspects, research, and the specialization.

Language Requirements—None.

Minor Requirements for Students

Majoring in Other Fields—The doctoral minor requires a minimum of 12 credits in one of the specializations, approved by the director of graduate studies.
Degree Programs and Faculty

Educational Administration

Certificate of Specialist
Applications are not accepted for the Certificate of Specialist in this program. Students in the program are drawn from currently enrolled doctoral students who apply by submitting a Change of Status Application.

Educational Policy and Administration

Contact Information—Department of Educational Policy and Administration, University of Minnesota, 330 Walling Hall, 86 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-1006; fax 612-624-3377; e-mail edpagrad@umn.edu).

Professor
William M. Ammentorp, FM
Ayers Bagley, FM
Robert H. Bruninks, Educational Psychology, FM
David W. Chapman, FM
John J. Cogan, Curriculum and Instruction, FM
Philip T. K. Daniel, FM
Gerald W. Fry, FM
James C. Hearn, Jr., FM
Stephen A. Honeck, Public Affairs, AM
Darrell R. Lewis, FM
Theodore Lewis, Work, Community, and Family
Education, AM
Karen S. Louis, FM
Tim M. Mazzoni (emeritus), FM
Josef A. Mestenhauser (emeritus), FM
Van Dyck Mueller (emeritus), FM
Neal C. Nickerson (emeritus), FM
Robert D. Tennyson, Educational Psychology, FM
Caroline S. V. Turner, FM
James E. Ysseldyke, Educational Psychology, FM

Associate Professor
Melissa S. Anderson, FM
C. Cyress Brouwer, FM
Arthur M. Harkins, FM
Darwin D. Hendel, FM
David R. Johnson, FM
Jean A. King, FM
R. Michael Paige, FM
Thomass D. Peacock, Education, Duluth, FM
Barbara B. Pilling, AM
Byron J. Schneider, AM
James R. Stone III, Work, Community, and Family
Education, AM
Jennifer York-Barr, FM

Assistant Professor
Nicola A. Alexander, AM

Lecturer
Jessica L. Bailey, E
Laura L. Bloomberg, E
Michael Courtney, E
Deanne L. Magnusson, AM
Joseph H. Nathan, AM
Richard Nunnally, E
Lynn R. Scarey, AM
Patricia S. Seppanen, AM
Alice M. Thomas, AM
Kyla L. Wahnstrom, AM
Ann Z. Werner, E

Other
Carol M. Boyer, AM

Neil E. Christenson, AM
Timothy T. Delmont, AM
Gerald G. Mansergh, AM
Thomas F. Morgan, AM
Joyce Ann Walker, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The Department of Educational Policy and Administration prepares administrators, scholars, and analysts for leadership roles in education. The department is committed to the preparation of leaders who can act effectively and ethically within the structures, processes, and cultural contexts of organized education. Students in the M.A. and Ph.D. programs choose from one of four complementary but distinct program tracks: educational administration, evaluation studies, higher education, and comparative and international development education. In addition, the department offers a variety of Ed.D. programs for practicing professionals. The department also cooperates with other departments within the College of Education and Human Development and the University to offer various certificate programs, an individualized concentration in youth leadership development, and verstating minors in international education and program evaluation (see separate sections in this catalog for each minor).

These graduate programs incorporate relevant knowledge from the behavioral and social sciences and the humanities, with primary reliance on sociology, management science, political science, psychology, public affairs, economics, philosophy, history, and anthropology.

Prerequisites for Admission—Applicants must have completed appropriate undergraduate and graduate study. In some cases, where previous coursework or degrees are marginally related, otherwise qualified applicants will be asked to complete additional background courses after admission. Applications are encouraged from individuals who may have completed undergraduate and/or master's programs in related areas such as curriculum studies, public affairs, sociology, psychology, economics, political science, international relations, management science, measurement and statistics, and educational psychology. The department has study opportunities for professionals who are employed full time as well as for those who wish to pursue graduate studies full time.

Special Application Requirements—Applicants must submit scores from the General Test of the GRE, two letters of recommendation from persons familiar with their scholarship and research potential, a complete set of official transcripts, and three brief essays (personal statement, educational interest of career goals). International students must also submit a TOEFL score, but international applicants to the M.A. program are exempt from the GRE.

Applications are reviewed throughout the year; however, submission of all application materials by February 15 is strongly encouraged to ensure priority consideration for teaching and research assistantships awarded for the next academic year. All new students begin in fall semester unless permission to start earlier is granted by the program coordinator. The department application, letters of recommendation, and essays are sent directly to the department. The Graduate School application, GRE scores, transcripts, and TOEFL score are sent to the Graduate School.

Centers—College centers directed by department faculty include the Center for Applied Research and Educational Improvement (CAREI) and the Institute on Community Integration (ICI). These college centers and the department center.

Postsecondary Education Policy Studies Center (PEPSC), provides research and graduate assistantship opportunities for department graduate students.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Educational Policy and Administration (EdPA) and Education (Edu) in the course section of this catalog for courses pertaining to the M.A. degree. Refer to EdPA and Education and Human Development (EdHD) for courses pertaining to the Ph.D. and Ed.D. degrees.

M.A. Plan B Degree Requirements
The master's is available under four program tracks: educational administration, evaluation studies, higher education, and comparative and international development education. All M.A. programs require 12 or more credits in program core courses, 6 or more credits in a related field, 6 or more credits of research methodology courses, 2-6 credits for the Plan B paper, and an oral exam. Within the general framework for M.A. requirements, the degree program is developed by the student and his or her adviser and is subject to approval by the department's director of graduate studies and the Graduate School.

Language Requirements—None
Final Exam—The final exam is oral.

Ph.D. Degree Requirements
The Ph.D. is available in four program tracks: educational administration, evaluation studies, higher education, or comparative and international development education. All Ph.D. programs include 10 credits in department core courses, 12 or more credits in program core courses, 6 or more credits in other program courses, 12 or more credits of research methodology courses, 12 or more course credits in a supporting program or minor, and 24 thesis credits. Preliminary written and oral exams are required and students must complete a dissertation and a
Degree Programs and Faculty

Educational Psychology

Contact Information—Director of Graduate Studies Assistant, Department of Educational Psychology, University of Minnesota, 204 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-1698; fax 612-624-0301; e-mail warho040@umn.edu; www.education.umn.edu/EdPsych/default.html).

For specific program materials, contact the program areas as follows: Counseling and Student Personnel Psychology, University of Minnesota, 129 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-6827; fax 612-625-4063; e-mail cspp-adm@umn.edu); Psychological Foundations of Education, University of Minnesota, 206 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-0042; fax 612-624-8241; e-mail psyf-adm@umn.edu); School Psychology, University of Minnesota, 344 Elliott Hall, 75 E. River Road, Minneapolis, MN 55455 (612-624-4156; fax 612-624-0879; e-mail schpsy@umn.edu); Special Education, University of Minnesota, 227 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-5064; fax 612-626-9627; e-mail sped-adm@umn.edu).

Prerequisites for Admission—Applicants must submit a department application (with clear indication of the desired program area), a statement of goals and interests, three letters of recommendation, and a Graduate School application accompanied by official transcripts from all colleges and universities attended. These test scores are required: the GRE and later an interview for those who make the initial cut. Applicants to the CSPP doctoral program should hold either a bachelor’s or master’s degree with a major in psychology, education, counseling, or a related field. CSPP applicants interested in earning the specialist certificate should hold an M.A. degree; if not, they should apply to both the M.A. and specialist certificate programs.

Special Application Requirements—Applicants must submit a department application (with clear indication of the desired program area), a statement of goals and interests, three letters of recommendation, and a Graduate School application accompanied by official transcripts from all colleges and universities attended. These test scores are required: the GRE and later an interview for those who make the initial cut. Applications to CSPP, school psychology, and special education are accepted for fall admission only. Applications to psychological foundations are accepted throughout the year. Please check directly with the program offices for current deadlines.

Use of 4xxx Courses—None of the four programs allow 4xxx or 6xxx coursework to be counted toward Graduate School degree program requirements.

Courses—Please refer to Educational Psychology (EPsy) in the course section of this catalog for courses pertaining to the program.

Edward M. McIntyre, Assistant Professor

Richard J. Spicuzza, AM
Kay A. Thomas, AM
Teresa L. Wallace, E
Joyce D. Weinheimer, AM

Other
Annie P. Baldwin, E
Ronald P. Matross, E
Martha L. Thurlow, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Program areas are counseling and student personnel psychology (CSPP); school psychology; special education; and psychological foundations of education (including research methodology, learning and cognition, human relations, personality and social psychology, and educational technology).

Language Requirements—None.

Final Exam—The final exam is oral.

Educational Psychology

Contact Information—Director of Graduate Studies Assistant, Department of Educational Psychology, University of Minnesota, 204 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-1698; fax 612-624-0301; e-mail warho040@umn.edu; www.education.umn.edu/EdPsych/default.html).

For specific program materials, contact the program areas as follows: Counseling and Student Personnel Psychology, University of Minnesota, 129 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-6827; fax 612-625-4063; e-mail cspp-adm@umn.edu); Psychological Foundations of Education, University of Minnesota, 206 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-0042; fax 612-624-8241; e-mail psyf-adm@umn.edu); School Psychology, University of Minnesota, 344 Elliott Hall, 75 E. River Road, Minneapolis, MN 55455 (612-624-4156; fax 612-624-0879; e-mail schpsy@umn.edu); Special Education, University of Minnesota, 227 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-5064; fax 612-626-9627; e-mail sped-adm@umn.edu).

Prerequisites for Admission—Applicants must submit a department application (with clear indication of the desired program area), a statement of goals and interests, three letters of recommendation, and a Graduate School application accompanied by official transcripts from all colleges and universities attended. These test scores are required: the GRE and later an interview for those who make the initial cut. Applicants to the CSPP doctoral program should hold either a bachelor’s or master’s degree with a major in psychology, education, counseling, or a related field. CSPP applicants interested in earning the specialist certificate should hold an M.A. degree; if not, they should apply to both the M.A. and specialist certificate programs.

Special Application Requirements—Applicants must submit a department application (with clear indication of the desired program area), a statement of goals and interests, three letters of recommendation, and a Graduate School application accompanied by official transcripts from all colleges and universities attended. These test scores are required: the GRE and later an interview for those who make the initial cut. Applications to CSPP, school psychology, and special education are accepted for fall admission only. Applications to psychological foundations are accepted throughout the year. Please check directly with the program offices for current deadlines.

Use of 4xxx Courses—None of the four programs allow 4xxx or 6xxx coursework to be counted toward Graduate School degree program requirements.

Courses—Please refer to Educational Psychology (EPsy) in the course section of this catalog for courses pertaining to the program.

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Other
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Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Program areas are counseling and student personnel psychology (CSPP); school psychology; special education; and psychological foundations of education (including research methodology, learning and cognition, human relations, personality and social psychology, and educational technology).

Language Requirements—None.

Final Exam—The final exam is oral.

Educational Psychology

Contact Information—Director of Graduate Studies Assistant, Department of Educational Psychology, University of Minnesota, 204 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-1698; fax 612-624-0301; e-mail warho040@umn.edu; www.education.umn.edu/EdPsych/default.html).

For specific program materials, contact the program areas as follows: Counseling and Student Personnel Psychology, University of Minnesota, 129 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-6827; fax 612-625-4063; e-mail cspp-adm@umn.edu); Psychological Foundations of Education, University of Minnesota, 206 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-0042; fax 612-624-8241; e-mail psyf-adm@umn.edu); School Psychology, University of Minnesota, 344 Elliott Hall, 75 E. River Road, Minneapolis, MN 55455 (612-624-4156; fax 612-624-0879; e-mail schpsy@umn.edu); Special Education, University of Minnesota, 227 Burton Hall, 178 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-5064; fax 612-626-9627; e-mail sped-adm@umn.edu).

Prerequisites for Admission—Applicants must submit a department application (with clear indication of the desired program area), a statement of goals and interests, three letters of recommendation, and a Graduate School application accompanied by official transcripts from all colleges and universities attended. These test scores are required: the GRE and later an interview for those who make the initial cut. Applicants to the CSPP doctoral program should hold either a bachelor’s or master’s degree with a major in psychology, education, counseling, or a related field. CSPP applicants interested in earning the specialist certificate should hold an M.A. degree; if not, they should apply to both the M.A. and specialist certificate programs.

Special Application Requirements—Applicants must submit a department application (with clear indication of the desired program area), a statement of goals and interests, three letters of recommendation, and a Graduate School application accompanied by official transcripts from all colleges and universities attended. These test scores are required: the GRE and later an interview for those who make the initial cut. Applications to CSPP, school psychology, and special education are accepted for fall admission only. Applications to psychological foundations are accepted throughout the year. Please check directly with the program offices for current deadlines.

Use of 4xxx Courses—None of the four programs allow 4xxx or 6xxx coursework to be counted toward Graduate School degree program requirements.

Courses—Please refer to Educational Psychology (EPsy) in the course section of this catalog for courses pertaining to the program.

Edward M. McIntyre, Assistant Professor

Richard J. Spicuzza, AM
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Other
Annie P. Baldwin, E
Ronald P. Matross, E
Martha L. Thurlow, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Program areas are counseling and student personnel psychology (CSPP); school psychology; special education; and psychological foundations of education (including research methodology, learning and cognition, human relations, personality and social psychology, and educational technology).

Language Requirements—None.

Final Exam—The final exam is oral.
Degree Programs and Faculty

Educational Psychology—Counseling/Personnel

The counseling and student personnel psychology (CSPPP) program subscribes to the scientist/practitioner model, which assumes that scholarly inquiry and counseling practice are interdependent and complementary. The program prepares counseling psychologists who will use their professional training to apply psychological and educational knowledge as skilled clinicians and critical producers and users of qualitative and quantitative research.

Certificate of Specialist Requirements

Students must complete at least 60 credits, including 11 credits in EPsy core courses (statistics, measurement, learning, social psychology, and personality), 26 credits in counseling theory and practice, and at least 10 additional credits within educational psychology.

Language Requirements—None.
Final Exam—The final exam is oral.

M.A. Degree Requirements

Students must complete at least 43 credits, including 11 credits in EPsy core courses (statistics, measurement, learning, social psychology, and personality), 26 credits in counseling theory and practice, and at least 6 credits in a related field or minor.

Language Requirements—None.
Final Exam—The final exam is written; students must also submit a portfolio.

Minor Requirements for Students

Majoring in Other Fields—A master’s minor requires at least 6 credits of graduate-level EPsy courses.

Ph.D. Degree Requirements

Students must complete 26 credits in EPsy core courses (statistics, measurement, learning, social psychology, personality, foundations, and research methods); 51 credits in counseling theory and practice, practica, and internships; 12 credits in a supporting program or minor; and 24 thesis credits.

Language Requirements—None.
Minor Requirements for Students

Majoring in Other Fields—A doctoral minor requires at least 14 credits of graduate-level EPsy courses: 8 credits in psychological foundations and 6 in applied areas, of which at least 8 credits must be in 8xxx courses. The minor is not covered in the preliminary exams.

Educational Psychology—School Psychology

School psychology is an interdepartmental program involving the Departments of Educational Psychology and Psychology and the Institute of Child Development. It is fully accredited by the American Psychological Association, the Minnesota Board of Teaching, and the National Association of School Psychologists. Through coursework and practica/internships, students develop the competencies in assessment, consultation, intervention and program development, research, and evaluation. Graduates are employed as psychologists in local schools, university clinics and hospitals, community mental health centers, and as trainers/researchers in universities. Since 1988, training has focused on the delivery of psychological services in schools and school communities to promote children’s and adolescent’s academic, social, and behavioral success.

The program integrates didactic and experiential components of training and applied research. Students develop specific competencies through a broad range of applied experiences, including field placements, practical assignments, and a full-year internship.

Certificate of Specialist Requirements

The specialist program is for students who want to become practitioners. It meets the Minnesota certification requirements for school psychologists.

Students must complete at least 60 credits, including 11 credits in EPsy core courses (statistics, measurement, learning, social psychology, and personality) and 21 credits in school psychology theory and practice and child development, followed by a year-long internship designed to first meet requirements for the M.A. degree in educational psychology, then the specialist certificate in school psychological services and certification under Minnesota state regulations.

Language Requirements—None.
Final Exam—The final exam is oral.

M.A. Degree Requirements

The M.A. is offered under Plan A (thesis) and Plan B (paper) and requires at least 30 credits: 11 credits in EPsy core courses (statistics, measurement, learning, social psychology, and personality), 12 credits of EPsy electives, 12 credits in a supporting program or minor, and 24 thesis credits.

Language Requirements—None.
Final Exam—The final exam is oral.

Minor Requirements for Students

Majoring in Other Fields—A master’s minor requires at least 6 credits of graduate-level EPsy courses.

Ph.D. Degree Requirements

Students must complete 26 credits in EPsy core courses (statistics, measurement, learning, social psychology, personality, foundations, and research methods), 12 credits of EPsy electives, 12 credits in a supporting program or minor, and 24 thesis credits.

Language Requirements—None.
Minor Requirements for Students

Majoring in Other Fields—A doctoral minor requires at least 14 credits of graduate-level EPsy courses: 8 credits in psychological foundations and 6 in applied areas, of which at least 8 credits must be in 8xxx courses. The minor is not covered in the preliminary exams.

Educational Psychology—Psychological Foundations

Graduate study in psychological foundations of education prepares students for research and teaching positions in colleges and universities, schools, private industry, human service organizations, health science units, government agencies, and other research and development centers. Graduates of the program are typically employed as professors, researchers, directors of testing, instructional designers, evaluation specialists, planning officers, statisticians, and computer programmers. Students may specialize in the methodological or psychological foundations of education.

The program offers M.A. and Ph.D. degrees with emphases in research methodology (with specializations in statistics, measurement, and evaluation), social psychology, personality, learning and cognition, human relations, and educational technology. Students typically choose one of these areas in addition to achieving broad competence in all aspects of the curriculum.

M.A. Degree Requirements

Students must complete at least 30 credits, including 11 credits in EPsy core courses (statistics, measurement, learning, social psychology, and personality) and 6 credits in a related field or minor. Plan A students must also take 10 thesis credits.

Language Requirements—None.
Final Exam—The final exam is oral.

Minor Requirements for Students

Majoring in Other Fields—A master’s minor requires at least 6 credits of graduate-level EPsy courses.

Ph.D. Degree Requirements

Students must complete 26 credits in EPsy core courses (statistics, measurement, learning, social psychology, personality, foundations, and research methods), 12 credits of EPsy electives, 12 credits in a supporting program or minor, and 24 thesis credits.

Language Requirements—None.
Minor Requirements for Students

Majoring in Other Fields—A doctoral minor requires at least 14 credits of graduate-level EPsy courses: 8 credits in psychological foundations and 6 in applied areas, of which at least 8 credits must be in 8xxx courses. The minor is not covered in the preliminary exams.
Further competencies may be achieved in students to assume professional leadership. Learning and guided experiences prepare and their families. Intensive course-related development of individuals with disabilities address problems related to the full state, and local legislation regarding perceptions about disabilities, and federal, psychological management, child development, and technology are encouraged. Special projects and training programs supplement academic studies. The program focuses on the attainment of core competencies and related skills, since special education professionals share many common concerns and goals. A complementary emphasis is placed on problems unique or extremely influential in the field, including social and cultural perceptions about disabilities, and federal, state, and local legislation regarding prevention and the care, treatment, education, training, and support of persons with disabilities.

Certificate of Specialist Requirements

Students must complete at least 60 credits, including 17 credits in EPsy core courses (statistics, measurement, learning, social psychology, personality, and research methods) and 6 credits of special education foundations. The remaining coursework usually focuses on two or more special education areas, determined in consultation with the adviser.

Language Requirements—None.

Final Exam—The final exam is oral.

M.A. Degree Requirements

Students may emphasize consulting, administration, college teaching, or research in one or more of the specializations. Students must complete at least 30 credits, including 11 credits in EPsy core courses (statistics, measurement, learning, social psychology, and personality), 6 credits in special education foundations, and 6 credits in a related field or minor. Plan A students must take 10 thesis credits.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master’s minor requires at least 6 credits of graduate-level EPsy courses.

Ph.D. Degree Requirements

The Ph.D. program trains graduates to address problems related to the full development of individuals with disabilities and their families. Intensive course-related learning and guided experiences prepare students to assume professional leadership. Further competencies may be achieved in four areas of emphasis: research, professional preparation, administration/policy, and clinical practice/community service. Students must complete 26 credits in EPsy core courses (statistics, measurement, learning, social psychology, personality, foundations, and research methods), 12 credits in special education (EPsy 8701 and 8702 and 6 additional credits, of which at least 2 must be from EPsy 86xx or 87xx offerings), 12 credits in a supporting program or minor, and 24 thesis credits.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires at least 14 credits of graduate-level EPsy courses: 8 credits in psychological foundations and 6 in applied areas, of which at least 8 credits must be in 8xxx courses. The minor is not covered in the preliminary exams.

Electrical Engineering

Contact Information—Director of Graduate Studies, Department of Electrical Engineering, University of Minnesota, 4-178 Electrical Engineering/Computer Science, 200 Union Street S.E., Minneapolis, MN 55455 (612-625-3564; fax 612-625-4583; e-mail graduate_studies@ece.umn.edu; <www.ece.umn.edu>).

Professor

Vernon D. Albertson, FM
Stephen A. Campbell, FM
Philip I. Cohen, FM
E. Dan Dahlberg, FM
David H. Du, FM
Gabriel C. Ejebe, AM
Tryphon T. Georgiou, FM
Georgios Giannakis, FM
Anand Gopinath, FM
Jack H. Judy, FM
Mostafa Kaveh, FM
John C. Kieffer, FM
Richard A. Kielb, FM
Larry L. Kinney, FM
K. S. P. Kumar, FM
Vipin Kumar, AM
E. Bruce Lee, FM
James R. Leger, FM
David J. Ljala, FM
Christine Maziar, FM
Ned Mohan, FM
Jiay Moon, FM
Marshall I. Nathan, FM
Nikolaos P. Papanikolopoulos, AM
Keshab K. Parhi, FM
Robert P. Patterson, Physical Medicine and Rehabilitation, FM
William T. Peria, FM
Dennis L. Polla, FM
William P. Robbins, FM
P. Paul Ruden, FM
James R. Slagle, FM
Allen R. Tannenbaum, FM
Ahmed H. Tewfik, FM
Randall H. Victoria, FM
Bruce F. Wollenberg, FM
Paul R. Woodward, FM
Pen-Chung Yew, FM

Associate Professor

Vladimir Cherkassky, FM
Emad Elbinni, FM
Douglas W. Ernie, FM
Ramesh Harjani, FM
Ted K. Higman, FM
James E. Holte, FM
Thomas S. Lee, FM
Bradley J. Nelson, Mechanical Engineering, FM
Matthew T. O’Keefe, FM
Sachin Sapatekar, FM
Guillermo Sapito, FM
Nicholas D. Sudropoulos, FM
Gerald E. Sobelman, FM
Bapiraju Vinakota, FM

Assistant Professor

Mohamed-Slim Alouini, FM
Kiaraish Bazargan, FM
Rhonda Drayton, FM
Joseph J. Talghader, FM
Richard M. Voyles, AM
Zhi-Li Zhang, AM
Babak Ziaie, FM

Other

Gregory T. Cibuza, AM
Barry K. Gilbert, FM
Robert A. Sannati, AM
Frank G. Soitis, AM
Marian S. Stachowiez, AM
Bethanie J. Stadler, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The Department of Electrical and Computer Engineering offers diverse educational programs that encompass nearly all aspects of modern electrical and computer engineering, ranging from the very theoretical system and information theory to highly experimental work in novel device research and microelectronics. Emphases in the major are solid state and physical electronics, surface physics, thin films, sputtering, noise and fluctuation phenomena, quantum electronics, plasma physics, automation, power systems and power electronics technology, wave propagation, communication systems and theory, optics, lasers, fiber optics, magnetism, semiconductor properties and devices, VLSI and WSI engineering in theory and practice, network theory, signal and image processing, and computer and systems engineering. Interdisciplinary work is also available in bioelectric sciences, control sciences, computer sciences, solar energy, applications of systems theory to urban transportation and economic planning, and biological modeling.

Prerequisites for Admission—Graduate work is open to students who have shown exceptional scholarship and ability in an accredited undergraduate curriculum in electrical engineering or physics. Consideration is given to students who have completed another curriculum in engineering, science, or mathematics that includes sufficient preparation to pursue a graduate program in electrical engineering. In some instances, additional preparatory studies may be required after admission. Students whose training is in engineering technology will not be considered for admission.
Special Application Requirements—Scores from the GRE (General Test only) are required of all students desiring financial aid. International students applying from within the country should furnish letters from United States faculty members attesting to their ability to understand technical instruction in English. Students submitting transcripts from non-American institutions should furnish letters of recommendation that verify their academic standing in a specific way (e.g., class rank). Entry other than in fall semester is not recommended. Applicants for fall semester admission interested in financial aid should file a completed admission application with the Graduate School by December 15 for admission the following September and should send a copy of their application materials directly to the department.

Use of 4xxx Courses—EE 4xxx courses acceptable for major field credit; EE 4301, 4541, 4701, 4721, and 4741. Non-EE 4xxx courses acceptable for supporting/related field credit: Math 4065, 4151, 4152, 4242, 4337, 4428, 4457, 4458, 4512, 4567, and 4606, and Stat 4101. All 4xxx physics courses are acceptable for graduate credit. No 4xxx computer science, mechanical engineering, or industrial engineering courses are acceptable for graduate credit.

Courses—Please refer to Electrical Engineering (EE) in the course section of this catalog for courses pertaining to the program.

M.E.E. Coursework Only Degree Requirements
The M.E.E. degree requires 30 credits, including at least 14 credits from EE courses at 5xxx and higher, at least 6 credits from courses numbered 4xxx and higher in a minor or related field, and 10 credits from EE or a supporting program. Colloquium and seminar credits cannot be used in any M.E.E. program.

Language Requirements—None.

Final Exam—No final exam is required.

Minor Requirements for Students Majoring in Other Fields—Credits for the master’s minor must be from classroom and laboratory courses graded A-F. In particular, colloquia, seminar, and special investigations credits do not count toward meeting the minor requirements.

Elementary Education

Contact Information—See Education: Curriculum and Instruction for M.A., and Ph.D. information.

Professor
Patricia G. Avery, AM
John J. Cogan, AM
Kerry J. Freedman, AM
Lee Galda, AM
Roger T. Johnson, AM
Francis P. Lawrenz, Curriculum and Instruction, Educational Psychology, AM
John C. Manning, AM
Thomas R. Post, AM
Barbara M. Taylor, AM

Associate Professor
Kathleen Cramer, AM
Fred N. Finley, AM
Patricia A. Heller, AM
Rosemarie J. Park, Work, Community, and Family Education, AM
Constance L. Walker, AM
Susan M. Watts-Taffe, AM

Assistant Professor
Deborah Ceglowski, AM

Lecturer
L. Joanne Buggey, AM
H. Michael Hartoonian, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—By focusing on the curricular and instructional processes central to all educational endeavors, graduate programs within the Department of Curriculum and Instruction prepare students for professional roles in pre K-12 education, in postsecondary and research settings, and in educational service agencies.

The M.A. in elementary education typically concentrates on one or two curriculum areas and includes foundational coursework in the area(s) of concentration, together with courses offering research review and preparation.

Prerequisites for Admission—Prerequisites vary among areas of emphasis or concentration. Generally a bachelor’s degree with licensure and/or teaching experience fulfills the requirement. For some areas, however, there is no equivalent undergraduate program. In that case, 15 to 20 credits of work at the undergraduate level determined acceptable by advisers and the director of graduate studies are adequate.

Special Application Requirements—Scores from the GRE are required. Master’s applications are reviewed by department faculty on continual basis throughout the academic year.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program’s approval.

Courses—Please refer to Curriculum and Instruction (CI) and Education (Educ) in the course section of this catalog for courses pertaining to the program.

M.A. Plan B Degree Requirements
The program requires 30 credits, which includes a minimum of 14 credits in the major, a minimum of 4 credits in research (including 3-6 credits applied to the Plan B research paper), and a minimum of 6 credits in a supporting program or minor. A balanced program of coursework is selected in curriculum and instructional research related to each student’s area of concentration.

Language Requirements—None.

Final Exam—The final exam is oral.
**English**

**Contact Information**—Director of Graduate Studies, Department of English, University of Minnesota, 204 Lind Hall, 207 Church Street S.E., Minneapolis, MN 55455 (612-625-3882; fax 612-624-8228; e-mail gradeng@umn.edu; <http://english.cla.umn.edu/graduateprogram/intro>).

**Regents’ Professor**
Thomas S. Clayton, FM
Patricia M. Hampl, FM

**Professor**
Kent R. Bales, FM
Timothy Brennan, Cultural Studies and Comparative Literature, FM
Lillian S. Bridwell-Bowles, FM
Michael D. Browne, FM
Andrew Ellenstein, FM
Genevieve J. Esarey, FM
Peter E. Firchow, FM
Shirley N. Garner, FM
Edward M. Griffin, FM
David B. Haley, FM
Michael Hancher, FM
Gordon D. Hirsch, FM
Karen A. Hoyle, Children’s Literature Research Collection, AM
Klaus P. Jankofsky, English, Duluth, FM
Richard J. Kelly, Library Collection Development: Arts & Humanities, AM
Calvin B. Kendall, FM
Tom A. H. McNaron, FM
Valerie J. Miner, FM
John W. Mowitt, Cultural Studies and Comparative Literature, FM
Marcia Pankake, Library Collection Development: Arts & Humanities, AM
Paula Rabinowitz, FM
Peter J. Reed, FM
Donald J. Ross, Jr., FM
Martin Roth, FM
Robert D. Solotaroff, FM
Madelon Sprengnether, FM
Joel C. Weinsheimer, FM

**Associate Professor**
Robert L. Brown, Jr., Cultural Studies and Comparative Literature, FM
Maria Damon, FM
Maria J. Fitzgerald, FM
Ray Gonzalez, AM
Josephine D. Lee, FM
Archibald I. Leyamsrey, AM
Ellen Messer-Davidow, FM
Angelita D. Reyes, Afro-American and African Studies, FM
Julie Schumacher, FM
Charles J. Sugnet, FM
John A. Watkins, FM
John S. Wright, FM

**Assistant Professor**
Thomson E. Armstrong, AM
Patricia A. Crain, AM
Lois B. Cucullu, AM
Launa H. Farber, AM
Brian B. Goldberg, AM
Qadir Ismail, AM
Rebecca L. Krug, AM
David B. Luke, AM
Daniel J. Phillips, Rhetoric, AM
Rita Raley, AM
Janette Scandura, AM
David R. Treuer, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

**Curriculum**—Over the past 20 years, the field of English studies has dramatically changed from a discipline concerned with studying the literary works produced by English speakers in Britain and the United States to encompass writings in English from around the globe. The concerns of literary scholars have broadened to include not only textual analyses but also cultural, social, political, and economic contexts. The field of literature itself now encompasses not only the traditional genres of poetry, prose (fiction and belles-lettres), and drama, but also extra-literary discourses: folklore, popular culture, film, television, legal documents, conduct books, and manifestoes. English as a field has moved to embrace its natural borders with cultural studies, feminist studies, and area studies. The department has been in the forefront of interdisciplinary projects, thanks to the efforts of a faculty committed to research in American studies, medieval studies, feminist studies, film studies, and cultural studies. At the same time, the department maintains the core concerns of the discipline—the traditional study of the literatures and languages in English—as well as develops writers for the present and future through the master of fine arts in creative writing degree. The department is engaged in two simultaneous projects: to preserve the core curriculum and to reimagine its future shape.

The Department of English offers two master’s degrees, the master of arts in English language and literature, and the master of fine arts in creative writing (see listing under Creative Writing). The M.A. offers training in the areas of literary history, literary theory and interpretation, language, linguistics, rhetoric, and composition. Students in the M.A. can develop specific concentrations through consultation with the director of graduate studies.

Course requirements for the Ph.D. and M.A. programs are broadly defined, allowing the student to shape a personal program of study. The English program encourages and supports interdisciplinary work. The M.F.A. program requires coursework in English and writing and emphasizes intensive work on a creative project.

**Admission to the Program**—Students with a bachelor’s degree may apply either to the master’s program or the doctoral program. An M.A. degree, but not an M.F.A. degree, can be gained en route to the Ph.D. degree. M.A. candidates who wish to continue their studies must formally apply for admission to the Ph.D. program.

**Prerequisites for Admission**—A minimum of four courses in English, three of which must be at the upper division level, is required for degree programs and the graduate minor. The courses should be widely distributed.

**Special Application Requirements**—Three letters of recommendation; scores from the General Test of the GRE; a short essay explaining scholarly, professional, and personal goals and reason(s) for choosing the University of Minnesota; and a writing sample, such as a course paper, are required. Applications to the M.F.A. in creative writing are reviewed by the writing faculty; these applications should include a substantial portfolio of writing. Candidates for all degrees are admitted fall semester only; all materials must be received by December 20.

**Use of 4xxx Courses**—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

**Courses**—Please refer to English: Creative and Professional Writing (EngW), and English Language and Literature (EngL) in the course section of this catalog for courses pertaining to the program.

**M.A. Plan B Degree Requirements**
The minimum requirement for the M.A. is 30 credits. Coursework must include at least 24 credits in English and 6 credits in related fields outside of English or in a minor field. All M.A. students must complete an introductory sequence EngL 5001-02 on methods and theory of literary study, and three Plan B papers.

**Language Requirements**—A reading knowledge of one classical or modern language, approved by the director of graduate studies, is required.

**Final Exam**—Oral.

**Minor Requirements for Students Majoring in Other Fields**—The master’s minor consists of 9 credits in English. Course selection is determined in consultation with the director of graduate studies.

**Ph.D. Degree Requirements**
A minimum of 66 credits, including 24 thesis credits, is required. Course requirements for the Ph.D. program are broadly defined, allowing students to shape a personal program of study. The following courses are required: EngL 5001 and 5002, preferably during the first year of doctoral study (6 credits); four English courses distributed among broad areas (minimum of 12 credits); four additional English courses in a focused area of emphasis (minimum of 12 credits); 12 credits in a supporting program. Students are encouraged to enroll in additional courses as appropriate.

**Language Requirements**—A reading knowledge of two languages, classical or modern, approved by the director of graduate studies, is required. Students specializing in medieval or early modern literature and culture are advised to include Latin as one of their languages.

**Minor Requirements for Students Majoring in Other Fields**—The Ph.D. minor consists of 12 credits in English. Course selection is determined in consultation with the director of graduate studies.
English as a Second Language

Contact Information—Director of Graduate Studies, English as a Second Language, University of Minnesota, 215 Nolle Center, 315 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-3331; fax 612-624-4579; e-mail iles@umn.edu; <www.iles.umn.edu/esl.htm>.

Professor
Andrew D. Cohen, AM
Elaine E. Tarone, AM

Assistant Professor
Anne Lazaraton, AM

Other
Jenise Rowekamp, EM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—the program in English as a second language (ESL) offers a course of study leading to an M.A. Degree holders are qualified to teach ESL to adults at the college or university level. The program emphasizes research in language analysis, language acquisition, teaching methodology, materials development, and uses of technology in language teaching. Students are expected to do independent and creative work in one or two of these areas with the aim of developing a more complete understanding of the issues facing professionals in the field of ESL today.

Prerequisites for Admission—A bachelor’s degree in the liberal arts or sciences with a strong academic record is required.

Special Application Requirements—Scores from the General (Apititude) Test of the GRE, three letters of reference, and a statement of the applicant’s research interests in the field are required. Non-native speakers of English must submit TOEFL scores (minimum 600). Students may begin the program fall semester or first summer session.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Teaching English as a Second Language (TESL) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
The M.A. program in ESL normally takes at least two years to complete. The Plan A option requires a thesis demonstrating original work in areas related to the field, familiarity with research methodology, and knowledge of the effective presentation of investigative study results. The Plan B option requires two qualifying papers, usually consisting of course papers which have been rewritten under the supervision of a faculty member. The same standards of excellence are applied to both Plan A and Plan B options.

Plan A and Plan B students must complete 24 credits in required coursework and 6 credits of elective coursework in related fields. Plan A students must complete an additional 10 thesis credits for a total of 40 credits and Plan B students must complete an additional 3 credits in elective coursework for a total of 33 credits. Elective and related field courses must be chosen with the help of an adviser to ensure the relevance of courses to students’ goals.

Language Requirements—Proficiency, demonstrated by exam or coursework, in one language not native to the student is required upon completion of the program.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—For a minor in ESL, students must take TESL 5721, 5401, and 5402, for a total of 11 credits.

Entomology
Contact Information—Director of Graduate Studies, Department of Entomology, University of Minnesota, 219A Hodson Hall, St. Paul, MN 55108 (612-624-3636; fax 612-625-5299; e-mail entodept@umn.edu; <www.entomology.umn.edu>.

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Timothy J. Kurtz, FM
Karen A. Mesce, FM
Roger D. Moon, FM
Kenneth R. Ostlie, FM
Edward B. Radcliffe, FM
David W. Ragsdale, FM
David D. Walgenbach, FM

Adjunct Professor
William E. Miller, FM

Associate Professor
Leonard C. Ferrington, FM
Vera Aber Kriscik, AM
Marla Spivak, FM
Susan J. Weller, AM

Adjunct Associate Professor
Susan Palchick-Silver, AM
Dharmendra Sreenivasan, E
Robert C. Venette, E

Assistant Professor
Colleen A. Cannon, AM
George E. Heimpel, AM
Ian V. MacRae, FM
Steven J. Seybold, FM

Adjunct Assistant Professor
Steven A. Katovich, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Entomology centers on the study of insects and includes specializations in ecology, behavior, molecular biology, microbiology, neurobiology, physiology, population dynamics, systematics, and taxonomy. Specialized or applied areas include apiculture, biological control, cell culture, insect conservation, insect-vector relations, integrated pest management, and modeling. Research programs are active in aquatic systems, crop and animal agriculture, human health, and the natural and urban environments.

Prerequisites for Admission—A bachelors degree with a major in a biological science is a prerequisite. Preference is given to students with a broad background in the basic sciences.

Special Application Requirements—Applicants must submit a complete set of official transcripts and a written statement of career interests, goals, and objectives. Three letters of recommendation are required from persons well acquainted with the student’s academic record. Although GRE scores are not required, they are highly recommended for applicants who may qualify for graduate school fellowships. For consideration for fellowships, applicants should submit materials by January 15. Applications are reviewed individually when all materials are complete. Students are admitted each semester.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Entomology (Ent) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements
Requirements for the M.S. include a minimum of 14 course credits in entomology including a core curriculum of fundamental entomology courses and 1 credit of graduate seminar. Additional requirements include credits from other programs to make a total of 20 course credits for Plan A or 30 course credits for Plan B students. These courses are flexible and are determined in consultation with the adviser and other members of the student’s advisory committee. Plan A students take an additional 10 thesis credits, and Plan B is recommended for students contemplating a career in entomological research. Written and oral preliminary exams, in addition to the final oral exam, are required for all entomology graduate degrees.

Language Requirements—None.

Final Exam—The final exam is oral.
Minor Requirements for Students Majoring in Other Fields—A master’s minor requires 6 credits in 4xxx, 5xxx, or 8xxx entomology courses.  

Ph.D. Degree Requirements  
Ph.D. requirements include a core curriculum of fundamental entomology courses and 2 credits of graduate seminar. Additional requirements are flexible and are determined in consultation with the adviser and other members of the student’s advisory committee.  

Language Requirements—None.  

Minor Requirements for Students Majoring in Other Fields—The doctoral minor requires 12 credits in 4xxx, 5xxx, or 8xxx entomology courses, including Ent 5021.

Environmental Health  
Contact Information—Student Services Center, School of Public Health, University of Minnesota, Mayo Mail Code 819, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-3500 or 1-800-774-8636; fax 612-624-4498; e-mail sph-ssc@umn.edu; <www.sph.umn.edu>).  

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Deborah L. Swackhamer, FM  
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Hillary M. Carpenter, AM  
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Jeffrey H. Mandal, AM  
Marina C. Marbury, AM  
Nicole V. McCullough, E  
David L. Parker, E  
Robert S. Skoglund, AM  
Fay M. Thompson, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.  

Curriculum—Environmental health is the study of how exposures to external hazards, including chemical, physical and biological agents, affect human health. Environmental health researchers and professionals seek to understand how to evaluate exposures that create risk to human health, how those exposures elicit biological responses that lead to disease and injury, and how policy is developed and used to prevent adverse health effects. This division offers academic programs at the master’s and doctoral levels, conducts research in diverse areas of environmental health, offers continuing education, and conducts outreach. The academic programs prepare students to be leaders in environmental health in academia, industry, consulting groups, and government agencies. The division’s training and research programs emphasize the importance of translating basic scientific knowledge into solutions for current societal problems and concerns. Applicants must indicate an interest in one of the following specialties within the major: environmental chemistry, environmental health policy, environmental microbiology, environmental and occupational epidemiology, environmental toxicology, the general environmental health program, occupational health nursing, occupational injury epidemiology and control, or work environments and industrial hygiene.  

Prerequisites for Admission—Minimum requirements include a baccalaureate degree with coursework in the basic sciences. Each specialty requires slightly different preparation.  

Special Application Requirements—GRE scores, a letter describing the applicant’s professional objectives, and three letters of recommendation are required.  

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to the approval of the adviser and the director of graduate studies. Students from other majors may include such courses subject to their own program’s approval.  

Courses—Please refer to Public Health (PubH), particularly numbers 51xx-52xx and 81xx-82xx, in the course section of this catalog for courses pertaining to the program.  

M.S. Degree Requirements  
The M.S. program prepares students for specialized careers in environmental and occupational health. M.S. students receive a solid technical background in their specialties and by graduation are proficient in applied or basic research.  
The minimum credits required for graduation depends on the chosen specialty area. Most specialty areas require a two-year program. M.S. students have the option of completing a Plan A with a thesis or a Plan B project.  

Language Requirements—None.  

Final Exam—The final exam is oral.  

Minor Requirements for Students Majoring in Other Fields—Students completing a minor in environmental health must complete 8 credits in environmental health, including PubH 5103—Exposure to Environmental Hazards (3 cr), PubH 5104—Environmental Health Effects: Introduction to Toxicology (2 cr), and PubH 5105—Environmental and Occupational Health Policy (3 cr).  

Ph.D. Degree Requirements  
The Ph.D. focuses on research, supplemented with advanced coursework developed under the guidance of a faculty adviser and a Ph.D. committee. Students are required to register for 24 thesis credits. Students usually need a minimum of two to three years beyond the master’s degree to complete a doctorate.  

Language Requirements—None.  

Minor Requirements for Students Majoring in Other Fields—Students are required to take a minimum of 12 credits in environmental health, including PubH 5103—Exposure to Environmental Hazards (3 cr), PubH 5104—Environmental Health Effects: Introduction to Toxicology (2 cr), and PubH 5105—Environmental and Occupational Health Policy (3 cr).  

Epidemiology  
Contact Information—Student Services Center, School of Public Health, University of Minnesota, Mayo Mail Code 819, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-3500 or 1-800-774-8636; fax 612-624-6931; e-mail sph-ssc@umn.edu; <www.sph.umn.edu>).  

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Laël C. Gatewood, Laboratory Medicine and Pathology, AM  
John H. Himes, FM  
David R. Jacobs, Jr., FM  
Robert W. Jeffery, FM  
Robert L. Kane, FM  
Russell V. Luepker, FM  
Leslie L. Lytle, FM  
A. Marshall McBean, AM  
Paul G. McGovern, AM  
Cheryl L. Perry, FM  
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Richard H. Grimm, Medicine, FM  
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Michael T. Osterholm, FM  
Leslie L. Robison, FM  

Associate Professor  
Donna K. Arnett, AM  
Charles E. Boult, AM
to complete a master’s degree in a related field. Applicants should have prior coursework in life or behavioral sciences. Applicants who have not completed a master’s degree in epidemiology or a related field are usually admitted to the master’s program in epidemiology, where they must demonstrate research capability. Because positions in the program are limited, selection is competitive with respect to academic background and experience.

Special Application Requirements—The following materials are required by the department: an acceptable score on the GRE (test results should be forwarded to the department); at least three recommendations (form and separate letter) from faculty or work supervisors with knowledge of the applicant’s scholastic and professional capabilities and potential; and a statement of goals and objectives (letter of intent) for seeking a career in epidemiology. In addition to the above materials, applicants for the Ph.D. program must submit a separate essay (statement of research interests) demonstrating evidence of their capability in or potential for original research in a specific epidemiologic area and, if possible, indicating interest in particular methodologies or study designs. Serious doctoral applicants are encouraged to contact the graduate studies coordinator before applying. M.S. and Ph.D. students should begin their studies in the fall semester. Applications must be completed by January 15 of the same year for the doctoral program; March 1 of the same year for the master’s program.

Use of 4XXX Courses—Inclusion of any 4XXX course in degree program forms of epidemiology majors or minors for the Ph.D. degree is subject to adviser and director of graduate studies approval.

Courses—Please refer to the Epidemiology Ph.D. curriculum sheet available on the School of Public Health Web site for courses pertaining to the program.

M.S. Degree Requirements
M.S. students gain the knowledge and skills needed either for a professional position in epidemiology or to proceed to a doctoral program in epidemiology or a related field. The M.S. program offers a 30-credit curriculum for students who have completed a M.D., D.D.S., D.V.M., or Ph.D. in a related field, and a 45-credit curriculum for students with backgrounds in other fields. Students complete a two-course sequence in epidemiology; a two-course sequence in biostatistics; public health core courses in management and environmental health; courses in statistical computing, data collection, behavioral science, and the epidemiology of cardiovascular disease, cancer, or infectious diseases; elective courses; and a master’s project presentation seminar. The 45-credit program also requires at least one course in human physiology and one in the pathobiology of human disease. Students in both programs also complete a master’s project and an internship.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—The master’s minor requires at least 7 credits.

Ph.D. Degree Requirements
Students select one of two field concentrations; both have an applied perspective that emphasizes study design, measurement, quantitative analysis, and interpretation. Behavioral epidemiology focuses on origins and development of human behavior patterns and how they are influenced and formed by personality, family, culture and environment. Etiologic epidemiology focuses on the biological causes of disease states, especially determinants of cardiovascular disease, cancer, and infectious diseases. The Ph.D. program includes a core curriculum of 62-72 credits. Students must pass written and oral preliminary exams, write and defend a dissertation, and prepare a first-authored manuscript for publication.

Coursework includes 16 credits in epidemiology and biostatistics core courses; 8 credits in advanced courses (epidemiological theory, teaching practicum, writing research grants, seminars on epidemiologic issues); 4-6 credits in Ph.D.-specific electives; 24 thesis credits; 6-8 credits (three courses) of epidemiologic-related interventions/methods taught taken from a menu of courses (e.g., cancer epidemiology, public health policy as a prevention strategy, smoking intervention); and 7-9 credits in advanced biologically or behaviorally related courses.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—The minor requires 20 credits: 16 credits in epidemiology and biostatistics, and 4 credits in epidemiology elective courses. The director of graduate studies must approve the student’s selection of elective credits. Contact the director of graduate studies in epidemiology for information.

Experimental Surgery

Contact Information and Faculty—See Surgery.

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The general surgery program trains medical doctors for the practice of surgery and for academic positions. See the Medical School Catalog for professional degree requirements; see below for academic degree requirements. Trainees spend two to
three years in laboratory research, either in a basic science or in surgery, after which they begin their senior residency and chief residency training. The Medical School’s laboratory departments offer many graduate courses closely related to surgery (see the graduate programs in biochemistry, molecular biology, and biophysics; cellular and integrative physiology; microbiology, immunology, and molecular pathobiology; and pharmacology). These fields also offer opportunities for research work. The Department of Surgery offers supervised work in its experimental research laboratories, as well as in its hospital and outpatient departments, in the areas of surgical diagnosis and operative surgery and in some surgical specialties (such as colon and rectal surgery, transplantation, thoracic and cardiovascular surgery, and pediatric surgery). The experimental surgery program provides an opportunity to gain practical research experience.

Prerequisites for Admission—Prospective students must be in the general surgery training program and have 2-3 clinical years of training completed.

Use of 4xxx Courses—4xxx courses are not permitted toward degree requirements.

Courses—For courses pertaining to the program, please refer to Surgery (Surg) in the course section of this catalog.

M.S. Exp. Surg. Plan A Degree Requirements
The M.S. Exp. Surg. is offered under Plan A only. At least 32 course credits (26 in the major and 6 in the minor or related fields) plus 10 thesis credits are required for a total of 42 credits.

Language Requirements—None.

Final Exam—The final exam is oral.

Family Social Science

Contact Information—Department of Family Social Science, University of Minnesota, 290 McNeal Hall, 1985 Buford Avenue, St. Paul, MN 55108-6140 (612-625-3116 or 612-625-1900; fax 612-625-4227; e-mail LHale@che.umn.edu: <http://fsos.che.umn.edu/graduate/>).

Professor
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Daniel F. Detzer, FM
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Clinical Assistant Professor
Philip L. Colgan, AM

Lecturer
Wayne A. Caron, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The program of study uses methods of social science to examine family systems and their interactions with various environments. The curriculum supports study in several broad theme areas: family therapy and family process, family economics and resource management, families and health, intergenerational relationships, families and diversity, and family policy.

Prerequisites for Admission—The master’s program requires two family courses; at least one course in economics, political science, government, or public policy; one course in sociology, anthropology, or human geography; one psychology course; and one statistics course. The doctoral program requires all requirements for the master’s program plus three additional social or behavioral science courses and two additional statistics or research methods courses. It is important that students, especially those applying for the Ph.D. program, present evidence of interest in research and that they have experience working with families through paid employment or volunteer work. Occasionally, the graduate faculty admits a student who lacks one or more required courses. This is done with the understanding that the missing course(s) will be made up soon, ideally before entering the program.

The marriage and family therapy program is accredited by the American Association for Marriage and Family Therapy. Admission to the program is available only to doctoral students with a clinical master's degree.

Students may apply for admission to the Ph.D. program after completing either a bachelor’s degree or a master’s degree. Students who enter the Ph.D. program with a bachelor’s degree are expected to fulfill the requirements for an M.A. degree in the process of working toward the Ph.D.

Admission to the accredited marriage and family therapy program is available only to doctoral students with a clinical master’s degree.

Special Application Requirements—Consult the Family Social Science Graduate Handbook or the director of graduate studies. The Graduate Handbook and all materials needed for the application process may be found at <http://fsos.che.umn.edu/graduate/>.

Applicants for the doctoral program and Plan A master’s program are reviewed only once per year. The application deadline is December 15 for admission fall semester of the following year. Applications for the Plan B master’s program are considered once they are complete, and students may begin graduate study the semester after the application is approved.

Use of 4xxx Courses—The inclusion of 4xxx family social science courses in degree programs of family social science majors or minors for the M.A. or the Ph.D. degree is subject to approval of the instructor, the student’s adviser, and the director of graduate studies. Students from other majors may take such courses with instructor approval and may include them on their degree programs subject to their own program's approval. 4xxx courses counted on graduate programs must be taught by a full member or associate member of the graduate faculty and must include assignments that are at the graduate level, as determined by the instructor.

Courses—Please refer to Family Social Science (FSOS) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
The M.A. program is offered under Plan A and Plan B. Plan A requires at least 30 credits, including at least 20 course credits, of which 6 credits are outside the department in a related field, and 10 thesis credits. The Plan A master’s is recommended for students who intend to pursue a Ph.D. degree.

Plan B requires at least 30 credits, including at least 26 course credits, of which 6 credits are outside the department in a related field, and at least 4 credits for a Plan B project. It is for students who wish to further their education so that they may hold positions of responsibility serving families. Although the instruction is based on research, the Plan B degree is not intended to provide intensive research training. Therefore, the Plan B program is understood to be a terminal degree and is thus not recommended for students who intend to pursue the Ph.D. degree. The Plan B program is available to students seeking one of several areas of specialization. The areas of study available are family economics and resource management and family policy. Consult the department for the most current information.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Major’s students must complete at least 6 credits of 5xxx or 8xxx in family social science. All courses must be taken A-F and completed with a GPA of at least 3.00.
Ph.D. Degree Requirements
The courses in a Ph.D. degree program must contribute to an organized program of study and research. The program includes at least 84 credits, including 60 course credits and 24 thesis credits. Coursework includes at least 12 credits in a minor or supporting program; the remaining 48 credits include at least 18 credits in research methods and statistics and at least 30 credits in family social science. An optional teaching internship program is recommended for students who are planning for careers in higher education.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires at least 12 credits of 8xxx in family social science. All courses for the minor must be taken A-F and completed with a GPA of at least 3.00. A written preliminary exam question is based on the minor.

Feminist Studies

Contact Information—Department of Women’s Studies, University of Minnesota, 425 Ford Hall, 224 Church Street S.E., Minneapolis, MN 55455; (612-626-0332; fax 612-624-3573; e-mail wostgrad@umn.edu; <http://womensstudy.cfa.umn.edu>.

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Sara M. Evans, History, AM
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Shirley N. Garner, English, AM
Jane F. Gilgud, Science, AM
Ruth-Elleen B. Joeres, German, Scandinavian, and Dutch, FM
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Lisa A. Nino, History, AM
Joanna O’Connell, Spanish and Portuguese, AM
Jennifer L. Pierce, American Studies, AM
Gloria Goodwin Raheja, Anthropology, AM
Angelita D. Reyes, Afro-American and African Studies, AM
Eileen B. Sivert, French and Italian, AM
Gary Thomas, Cultural Studies and Comparative Literature, AM
Monika Zagor, German, Scandinavian, and Dutch, AM
Jacquelyn N. Zita, Women’s Studies, FM

Assistant Professor
Catherine Choy, American Studies, AM
Jigna Desai, Women’s Studies, AM
Gwendolyn Pough, Women’s Studies, AM
Eden Torres, Women’s Studies, AM
Barbara Y. Welke, History, AM

Other
Karen Brown-Thompson, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The M.A. is available only to students admitted to the Ph.D. program who wish to secure this credential for ABD employment purposes or who must exit the program. It is similar to the Ph.D., but with fewer credits and no dissertation. The Ph.D. program is an interdisciplinary, multicultural, and international study of women and gender in which students develop competence in interdisciplinary and disciplinary feminist theories, research methods, and pedagogy. The program pays attention to all aspects of women’s diversity, nationally and globally. Students select a disciplinary focus from among feminist theory, literary studies, historical studies, social sciences and public policy, and gender in a global perspective. Students may, with the advice and consent of the director of graduate studies, design their own area of concentration.

Prerequisites for Admission—Admission to the graduate minor is contingent upon prior admission to a master’s or doctoral degree-granting program within the Graduate School.

Special Application Requirements—Students interested in the minor program must submit a completed application by March 1 to be considered for admission in fall semester. Applications received after March 1 are considered as space allows. It is expected that no more than 15 students will be admitted into the minor each year. Admission to the minor program does not require an undergraduate major or minor in women’s studies. However, applicants are expected to show general knowledge of feminist scholarship as evidenced, for example, in some combination of previous coursework, research, writing, or organizational experience.

Applicants for the Ph.D. program must submit scores from the General ( Aptitude) Test of the GRE, three letters of recommendation sent directly to the department, a writing sample, and a clearly written statement of career interests, goals, and objectives. Graduate study in the program begins in the fall semester. The application deadline is Friday of the first week in January; all applications are evaluated once each year in January.

Use of 4xxx Courses—Inclusion of 4xxx feminist studies courses on degree program forms of feminist studies majors or minors for the Ph.D. degree is discouraged; such courses are only considered in exceptional circumstances, subject to adviser and director of graduate studies approval.

Courses—Please refer to Women’s Studies (WoSt) in the course section of this catalog for courses pertaining to the program.

M.A. Plan B Degree Requirements
The courses required for the M.A. (which are the same as those required for the Ph.D.) fall into roughly two categories: interdisciplinary courses satisfying core requirements and courses constituting or enhancing a concentration. Students take 31 credits in required courses, including two elective courses that satisfy core requirements in cultural diversity and two courses that satisfy core requirements in research tools and methods. The remaining coursework includes 12 credits in an area of concentration and 12 credits in the minor field or supporting program (related to the concentration). Students are also expected to register for 4 credits of WoSt 8996 colloquium and to participate in a weekly or biweekly series of faculty, student, and guest lecturer presentations. In addition, three Plan B papers and a final oral exam are required (which are effectively identical to the Ph.D. preliminary written and oral exams).

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master’s minor requires WoSt 8108 and 8109 and two graduate-level electives approved by the director of graduate studies for feminist studies.

Ph.D. Degree Requirement
The course and credit requirements for the Ph.D. are the same as those required for the master’s. In addition, students are expected to register for 24 thesis credits while writing the dissertation.

Because some courses may fall into more than one category (e.g., courses in the concentration may also satisfy core course requirements), students are permitted to “double count” credits in the major program in consultation with the director of graduate studies. The minimum requirement of 42 graduate credits is therefore less than simple addition would suggest. Students entering the Ph.D. program with a master’s degree may
transfer credits from that degree and apply them to the Ph.D. requirements in consultation with the director of graduate studies. All students, however, must take W0St 8108 and 8109.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—The minor focuses on skills and competencies in four areas: interdisciplinary knowledge of women and gender; feminist theories and methods; feminist research in a specific field; feminist practice through teaching or internships. Students must apply for admission. To complete a Ph.D. minor, students must complete W0St 8108 and 8109 and three graduate-level electives (9 credits) from a list of courses determined by the director of graduate studies for feminist studies.

Fisheries

Contact Information—Kathleen Walter, College of Natural Resources, University of Minnesota, 135 Natural Resources Administration Building, 2003 Upper Buford Circle, St. Paul, MN 55108-6146 (612-624-2748; fax 612-624-6282; e-mail kwalter@forestry.umn.edu; <www.fw.umn.edu>.

Professor
Ira R. Adelman, FM
Yo-sef Cohen, FM
Anne R. D. Kapuscinski, FM
James A. Perry, FM
Peter W. Sorensen, FM
George R. Spangler, FM

Adjunct Professor
Carl Richards, Duluth, AM

Associate Professor
Jay T. Hatch, General College, FM
Raymond M. Newman, FM

Adjunct Associate Professor
Gerald T. Ankley, FM
Bruce C. Vondracek, FM

Assistant Professor
Kristen C. Nelson, FM
Andrew M. Simons, FM

Adjunct Assistant Professor
Charles S. Anderson, E
David C. Fulton, AM
Donald L. Pereira, AM

Other
Fred W. Allendorf, E
Clayton J. Edwards, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for courses pertaining to the program.

M.S. Degree Requirements
Both Plan A (with thesis) and Plan B (without thesis) programs are offered. Plan A and Plan B require at least 14 course credits in the major and 6 course credits in a minor or related field; Plan A also requires at least 10 thesis credits, and Plan B requires at least 10 additional course credits. The Plan A thesis should be in an area of specialization. Coursework requirements are flexible, but typically include courses in fisheries, limnology or aquatic biology, statistics and biometrics, computer science, and related subjects. Programs may include a traditional minor or coursework in a related field. An oral preliminary exam is required.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master’s minor requires at least 6 credits of courses approved by the director of graduate studies.

Ph.D. Degree Requirements
The doctoral program includes a major research effort in the areas of emphasis, resulting in a written dissertation. It also includes advanced coursework in fisheries, limnology or aquaculture, ecosystem, and related subjects.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires at least 12 credits of courses approved by the director of graduate studies.

Food Science

Contact Information—Graduate Program in Food Science, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, MN 55108 (612-624-1290; fax 612-625-5272; e-mail fsgrad@umn.edu; <http://fscn.che.umn.edu/fscigrad/default.html>.

Professor
Paul B. Addis, FM
Minal Bhattacharya, FM
Linda J. Brady, FM
Francis F. Busta (emeritus), FM
Agnes S. Csallany, FM
R. Gary Fulcher, FM
Theodore P. Labuza, FM
Larry L. McKay, FM
Howard A. Morris (emeritus), FM
Gary A. Reineccius, FM
Rongsheung R. Ruan, FM
Joanne L. Slavin, AM
David E. Smith, FM
Sita R. Tatini, FM
Zata M. Vickers, FM
Joseph J. Warthesen, FM

Associate Professor
Joellen M. Feirtag, FM
Craig A. Hassel, AM
Daniel J. O’Sullivan, FM
H. William Schafer, FM

Assistant Professor
Francisco Diez-Gonzalez, FM
Lloyd E. Metzger, FM

Adjunct Assistant Professor
Mary K. Schmidt, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for courses pertaining to the program.

Curriculum—Food science applies scientific principles to the manufacture, distribution, marketing, and consumer aspects of food. Food scientists apply the basic principles and techniques of many disciplines, including chemistry, physics, microbiology, and nutrition, to food processing and preservation, new product development, and food marketing. Food scientists are concerned with the theoretical and practical aspects of the food chain, from the production of raw materials to the use of food products by consumers. Students may emphasize the chemistry, engineering, microbiology, nutrition, or technology of food products.

Prerequisites for Admission—Applicants with an undergraduate major in any physical or biological science usually have completed the necessary prerequisites. The minimum requirements are general chemistry, organic chemistry with laboratory, physics with laboratory, and calculus. If preparation appears inadequate, certain additional courses may be required after admission.

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Degree Programs and Faculty

Special Application Requirements—Submission of scores from the General (Apitude) Test of the GRE is required. Submission of three letters of reference is also required whether or not the prospective student is applying for financial assistance.

Use of 4xxx Courses—Inclusion of 4xxx food science courses on degree program forms is permitted with adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program’s approval.

Courses—Please refer to Food Science and Nutrition (FScN) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements
The M.S. offers both Plan A (with thesis) and Plan B (without thesis) options. Both options require at least 14 course credits in the major and 6 course credits in the minor or related field. Plan A also requires at least 10 thesis credits. Plan B also requires at least an additional 10 graduate credits in approved courses and a Plan B paper. The minor may be chosen from fields such as biochemistry, chemistry, chemical engineering, microbiology, nutrition, and statistics.

M.S. students may exceed the 40 percent limit on transfer of College of Continuing Education credits customarily permitted in the Graduate School. Students wishing to do so must consult the director of graduate studies.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—For a master’s minor, two of the following courses must be taken: FScN 4111, 4121, or 4331. The minor must be approved by the food science director of graduate studies.

Ph.D. Degree Requirements
The number of credits required will vary depending on the research undertaken. Most students take a total of about 60 credits. Of these, at least 12 credits must be in the minor or related fields and 44 credits must be doctoral thesis credits. The student and the adviser, with the approval of the graduate studies committee, determine coursework in the major.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—For a Ph.D. minor, students must take FScN 4111, 4121, 4331, and other courses, for a total of 12 credits. The minor must be approved by the food science director of graduate studies.

Forestry

Contact Information—Kathleen Walter, College of Natural Resources, University of Minnesota, 135 Natural Resources Administration Building, 2003 Upper Buford Circle, St. Paul, MN 55108-6146 (612-624-2748; fax 612-624-6282; e-mail kwalter@forestry.umn.edu; <www.cnr.umn.edu/grad/FRgrad/index.html>.

Professor
Dorothy H. Anderson, FM
Mark E. Ascerno, Jr., Entomology, FM
Marvin E. Bauer, FM
Melvin J. Baughman, FM
Robert A. Blanchette, Plant Pathology, FM
Charles R. Blinn, FM
James L. Bowyer, FM
Kenneth N. Brooks, FM
Thomas E. Burk, FM
John J. Cogan, Curriculum and Instruction, AM
Edward J. Cushing, Ecology, Evolution, and Behavior, FM
Steven B. Daley Laursen, AM
Alan R. Ek, FM
Paul V. Ellefson, FM
Joseph G. Massey, FM
Leo H. McAvoy, Jr., Kinesiology and Leisure Studies, FM
Carl A. Mohn (emeritus), FM
John L. Nieber, Biosystems and Agricultural Engineering, FM
Michael E. Ostry, AM
James A. Perry, FM
Peter B. Reich, FM
Don E. Riemenschneider, E
Dietmar W. Rose, FM
C. Ford Runge, Applied Economics, FM
Simo Sarkaneen, FM
Elmer L. Schmidt, FM
J. L. David Smith, Fisheries and Wildlife, AM
Alfred D. Sullivan, AM

Adjunct Professor
William A. Befort, AM
Robert G. Haight, AM
William A. Hendrickson, E
Ronald E. McRoberts, AM
Elon S. Very, AM
Jerold E. Winandy, AM
John C. Zasada, AM

Associate Professor
Paul V. Bolstad, FM
Stephan P. Carlson, AM
Fred N. Finley, Curriculum and Instruction, AM
David T. Grimsrud, FM
Howard M. Hoganson, FM
Patrick H. Huelman, AM
Gary R. Johnson, AM
Shri Ramaswamy, FM
Steven J. Taff, Applied Economics, AM
Ulrike Tscherner, FM
Kewen Yin, FM

Adjunct Associate Professor
David N. Bengston, AM
Erwin R. Berghund, AM
Stephen M. Bratkovich, AM
Daniel L. Erkkila, AM
Mark H. Hansen, AM
J. G. Isbrandts, E
Pamela L. Jakse, AM
Brian J. Policak, AM
Michael J. Phillips, E
Thomas L. Schmidt, AM
Minor Requirements for Students Majoring in Other Fields—Students should contact the director of graduate studies. The selection of courses is influenced by the student’s background and educational objective. Minor field competence is evaluated in the oral exam.

Ph.D. Degree Requirements
The doctoral program varies from 30 to 60 credits, not including 24 thesis credits. Course selection and thesis proposals are developed by each student in consultation with the faculty adviser and are approved by the forestry graduate study committee.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Students should contact the director of graduate studies. The selection of courses is influenced by the student’s background and educational objective. Minor field competence is evaluated in the oral exam.

French and Italian

Contact Information—A department general information bulletin and a projection of graduate-level courses to be offered is available from the Department of French and Italian, University of Minnesota, 260 Folwell Hall, 9 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-4308; fax 612-624-6021; e-mail firgrad@umn.edu; <www.clas.umn.edu/frit/>).

Professor
F. Ronald P. Akehurst, FM
Susan J. Noakes, FM
Maria F. Paganini, FM

Associate Professor
Daniel Brewer, FM
Maria M. Brewer, FM
Susanna Ferlito, FM
Betsy K. Kerr, FM
Catherine Liu, Comparative Literature, FM
Ronald L. Martinez, FM
Judith L.leckshot, FM
Peter H. Robinson, FM
Eileen B. Sivert, FM

Assistant Professor
Juliette Cherubule, AM
Kevin P. Lemoine, AM
Alan K. Smith, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The French program, which offers M.A. and Ph.D. degrees, covers all areas of French literature and culture from the Middle Ages to the present. Traditional areas of study and scholarship are reflected by the faculty’s interests, expertise, and research in areas that have shaped—and continue to shape—the discipline of French studies. The program, which fosters interdisciplinary research, has particular strengths in literary and cultural studies, critical theory, feminist studies, medieval studies, and francophone studies.

The Italian M.A. program adopts an interdisciplinary approach to the study of the literatures and cultures of Italy. The curriculum emphasizes the study of cultural identities in Italy through literary and historical discourses. The program has special strengths in Dante and Early Modern studies, and in the Romantic and Modern periods.

Prerequisites for Admission—A B.A. in French or Italian (or equivalent), with a literary emphasis, is required for the M.A. programs. Prospective students whose undergraduate degree is in another field, but who have taken substantial coursework in French or Italian and are strongly motivated to pursue literary studies, are invited to contact the director of graduate studies. For the Ph.D. program, an M.A. in French (or equivalent) is required.

Special Application Requirements—Applicants must submit scores from the General Test of the GRE, three letters of recommendation from persons familiar with their scholarship and research potential, a complete set of official transcripts, a sample of their academic writing, an audio-tape of their spoken French or Italian, and a written statement of career interests and goals. International student applicants should also submit scores for the TOEFL. Students may apply at any time; however, submission of all application materials by January 15 is encouraged to ensure priority consideration for fellowships and research assistantships awarded for the next academic year. New teaching assistants and fellowship recipients are only admitted for fall semester; others may be admitted in mid-year.

Affiliated Research Centers—Students are encouraged to explore interdisciplinary approaches through outside coursework or participation in one of several academic centers with which the programs are affiliated. These centers include the Center for Advanced Feminist Studies, the Center for Advanced Research in Language Acquisition, the Center for German and European Studies, the Center for Medieval Studies, the Immigration History Research Center, and the University of Minnesota Humanities Institute. Students specializing in francophone literatures and cultures may pursue these interests through the Afro-American and African Studies program or the interdisciplinary MacArthur Program.

Use of 4xxx Courses—4xxx courses may, in exceptional cases, be used for graduate credit. Students should consult the director of graduate studies or adviser before registering.

Courses—Please refer to French (Fren), French and Italian (Frit), and Italian (Ital) in the course section of this catalog.

M.A. Degree Requirements
In French, students may pursue Plan A (with thesis) or Plan B (without thesis). Plan A requires at least 24 credits, Plan B at least 33 credits. Both plans require at least 18 credits in the major and 6 credits in related
fields or, in a minor, the number of credits required by the minor program (usually 6 credits). Plan A also requires at least 10 thesis credits. (More detailed information is available through the program office.)

In Italian, the M.A. is offered under Plan A (with thesis) or Plan B (with paper). Plan A requires at least 22 course credits and 10 thesis credits. Plan B requires at least 30 course credits. (More detailed information is available through program office.)

Final Exam—The final exams in both French and Italian programs are written and oral.

Language Requirements—For the M.A. degree in French, students must demonstrate proficiency in one foreign language besides English and French. For the M.A. in Italian, by the time of their final exam, students must demonstrate proficiency in one ancient or modern language besides Italian and English; French, Spanish, or Latin is recommended.

Minor Requirements for Students Majoring in Other Fields—A master’s minor in French requires at least 9 credits; a minor in Italian requires at least 6 credits.

Ph.D. Degree Requirements
The Ph.D. requires at least 57 course credits and 24 thesis credits. Coursework involves at least 45 credits in the major and at least 12 credits (usually four courses) in related fields or, in a minor, the number of credits required by the major program (usually 12 credits). Detailed information is available through program office.

Language Requirements—For the Ph.D., students must demonstrate proficiency in one foreign language besides English and French, at a level higher than for the M.A. and suitable for use in research. Doctoral students specializing in the Middle Ages, Renaissance, or Early Modern period (roughly to 1666) must also demonstrate knowledge of Latin.

Minor Requirements for Students Majoring in Other Fields—A Ph.D. minor requires at least 12 credits.

Genetics
See Molecular, Cellular, Developmental Biology, and Genetics.

Research Associate
John O. Look, Diagnostic/Surgical, AM

Geographic Information Science

Contact Information—See Geography.

Professor
John S. Adams, AM
Marvin E. Bauer, Forest Resources, AM
Dwight A. Brown, AM
Philip J. Gersmehl, AM
Robert B. McMaster, AM

Associate Professor
Paul V. Bolstad, Forest Resources, AM
Katherine Klink, AM
Roger P. Miller, AM
Roderick H. Squires, AM

Adjunct Assistant Professor
William J. Craig, AM

Teaching Specialist
Robert Maki, AM

Cartographer
Mark B. Lindberg, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The master of geographic information science (M.G.I.S.), offered by the Department of Geography, provides graduate-level work in the theory, applications, and technology of geographic information science (GIS). The degree is for students who are working in GIS or a related area (such as surveying or planning), have a bachelor’s degree but no formal work experience/education in GIS, or have recently obtained a B.A./B.S. in GIS. The program balances work in theoretical/conceptual aspects of GIS (core classes), technical aspects (software/hardware), and applications of GIS (applied project). The program emphasizes the societal impacts of such technologies.

Prerequisites for Admission—Prospective students should have completed a course in advanced algebra, a statistics course, and a beginning course in computer programming.

Special Application Requirements—Departmental application form, transcripts, statement of purpose, and three letters of recommendation must be sent to the department. All materials must be submitted by March 30 for fall semester entrance and by September 1 for spring semester entrance.

Use of 4xxx Courses—No more than two 4xxx courses may be included in the master’s degree program without consent of the adviser and director of graduate studies.

Courses—Please refer to Geography (Geog) and Geographic Information Science (GIS) in the course section of this catalog for courses pertaining to the program.

M.G.I.S. Plan B Degree Requirements
The degree is offered Plan B (nonthesis) and requires at least 35 credits, with 18 credits in core/technology classes (a minimum of 9 credits of core courses and 3 credits of technology courses), 6 credits of electives, and 3 credits of capstone seminar (GIS 8990). All students are required to take Geog 5561, 5563, GIS 5571 and an approved 8xxx seminar. Students must also take GIS 8501 during the fall semester of their first year in the program. At least 6 credits must be taken outside the geography department (Geog and GIS designators) but may include the core GIS classes (e.g., forestry and natural resources).

Language Requirements—None

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master’s minor is developed in consultation with a faculty adviser. Consult the M.G.I.S. director of graduate studies about selecting an adviser. The minor requires at least 9 credits (3 courses).

Geography

Contact Information—Department of Geography, University of Minnesota, 414 Social Sciences Building, 267 19th Avenue South, Minneapolis, MN 55455 (612-625-6080; fax 612-624-1044; e-mail willi046@umn.edu; <www.geog.umn.edu>.

Professor
John S. Adams, FM
Dwight A. Brown, FM
Philip J. Gersmehl, FM
John F. Hart, FM
Lawrence M. Knopp, Jr., Geography, Duluth, AM
Helga M. Leitner, FM
Judith A. Martin, FM
Robert B. McMaster, FM
Abdi I. Samatar, FM
Earl P. Scott, FM
Eric S. Sheppard, FM
Richard H. Skaggs, FM

Associate Professor
Katherine Klink, AM
Roger P. Miller, FM
Roderick H. Squires, FM
Connie H. Weil, FM

Assistant Professor
Bruce W. Braun, AM
Vinay K. Gidwani, AM
Karen E. Till, AM
Susy S. Ziegler, AM

Adjunct Assistant Professor
William J. Craig, AM

Other
Mark B. Lindberg, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.
Curriculum—Geography studies human-environment relations and their visual representation. It emphasizes the significance of place, location, and scale in understanding the complexity of biophysical phenomena, patterns and processes of natural resource use, human settlements, economic development, political organization, and cultural and social landscapes. The program emphasizes research and teaching in the following areas: urban systems, environmental systems, regional geography and international development, geography of population and health, geographic information systems and cartography, and history and philosophy of geography. It is a highly individualized program with a limited number of requirements. Students work with their advisers to design individual programs suited to their educational and professional goals.

Prerequisites for Admission—Prospective students should have completed the equivalent of introductory courses in physical and human geography and at least seven upper division courses in systematic and regional geography. Students who were not undergraduate geography majors are encouraged to apply but may be required to make up deficiencies.

Special Application Requirements—Three letters of recommendation must be sent to the department. Scores from the General (Aptitude) Test of the GRE that are less than 213 are required for admission. Applicants who lack geological engineering training are often required to complete at least one appropriate course from the undergraduate program. Graduate degree credit is not awarded for such preparatory work. For the M.Geo.E. program, an ABET-accredited bachelor’s degree in geological engineering is preferred.

Special Application Requirements—Applicants are required to submit results of the GRE in support of their applications. The TOEFL is required of foreign applicants from non-English-speaking countries. A TOEFL score of at least 550 is required for admission. Applicants who take the computer-based TOEFL are required to have a score of at least 213. Admission requirements also include three letters of recommendation and a statement of purpose that outlines the prospective student’s research interests, reasons for pursuing graduate studies, and career plans after graduation. Students are admitted each semester, but applicants are encouraged to begin fall semester and to submit their applications by December 31 before the year their studies are expected to begin.

Use of 4xxx Courses—No more than two 4xxx courses may be included on the degree program form without consent of the adviser and director of graduate studies.

Courses—Please refer to Geography (Geog) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
The M.A. is offered under Plan A (with thesis) and Plan B (without thesis). Plan A requires at least 21 course credits (plus 10 thesis credits); Plan B requires at least 31 course credits. All students must take at least two prosemesters and one research seminar in geography and two courses outside geography. The M.A. program is usually completed within two years.

Language Requirements—M.A. students are expected to acquire competency in the foreign language/research methodology necessary for their graduate research. This requirement is set by the advising committee, which is also responsible for certifying that the requirement has been met before the final exam.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master’s minor must be developed in consultation with a faculty adviser. Consult the director of graduate studies about selecting an adviser. The minor requires at least 6 credits (two courses).

Ph.D. Degree Requirements
Each student is required to take at least two prosemesters and two research seminars in geography, and four courses outside geography (at least one 8xxx). Students are also required to take 24 thesis credits and at least three elective courses. Course credits from the M.A. program may be transferred to the Ph.D. program. Further details on degree requirements may be found in the department publication The Graduate Program in Geography at the University of Minnesota.

Language Requirements—Ph.D. students are expected to acquire competency in the foreign language/research methodology necessary for their graduate research. This requirement is set by the advising committee, which is also responsible for certifying that the requirement has been met before the final exam.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor program must be developed in consultation with an appropriate faculty adviser. Consult the director of graduate studies about selecting an adviser. The minor requires at least 9 credits (three courses).

Geological Engineering

Contact Information—Geological Engineering Program, University of Minnesota, Civil Engineering Building, 500 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-626-5522; fax 612-626-7750; e-mail gradsec@ce.umn.edu; <www.ce.umn.edu>.

Professor
Steven L. Crouch, FM
Emmanuel M. Detournay, FM
Andrew Drescher, FM
Eli Foufoula-Georgiou, FM
Catherine E. French, FM
Theodore V. Galambos, FM
Gary Parker, FM
Henryk K. Stolarski, FM
Otto D. L. Strack, FM
Vaughan R. Voller, FM

Adjunct Professor
Peter A. Cundall, FM

Associate Professor
Randall J. Barnes, FM
Gary A. Davis, AM
Jerome F. Hajjar, FM
Miki Honzdó, AM
Joseph F. Labuz, FM
Carol K. Shield, FM
Karl A. Smith, FM

Assistant Professor
William A. Arnold, AM
Bojan B. Gузина, FM
Timothy M. LaPara, AM
Mihai O. Marasteanu, AM
Fernando Porté-Agel, AM

Senior Research Associate
Sofia G. Mogilevskaya, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Emphasizes in fundamental aspects of geomechanics and its applications. Research focuses on the use and development of discrete and continuum theories such as elasticity, plasticity, fracture mechanics, and poroelasticity for solving engineering problems. Numerical methods are being developed for obtaining solutions; experimental methods and novel apparatus are being developed for gathering physical evidence. Applications include processes of comminution, flow of granular materials, hydraulic fracturing, and nondestructive testing. The graduate program in geological engineering is administered in the Department of Civil Engineering.

Prerequisites for Admission—A bachelor’s degree in engineering, basic science, or mathematics is required. Admission depends primarily on the applicant’s academic record and letters of recommendation. Applicants who lack geological engineering training are often required to complete at least one appropriate course from the undergraduate program. Graduate degree credit is not awarded for such preparatory work. For the M.Geo.E. program, an ABET-accredited bachelor’s degree in geological engineering is preferred.

Special Application Requirements—Applicants are required to submit results of the GRE in support of their applications. A TOEFL score of at least 550 is required for admission. Applicants who take the computer-based TOEFL are required to have a score of at least 213. Admission requirements also include three letters of recommendation and a statement of purpose that outlines the prospective student’s research interests, reasons for pursuing graduate studies, and career plans after graduation. Students are admitted each semester, but applicants are encouraged to begin fall semester and to submit their applications by December 31 before the year their studies are expected to begin.

Use of 4xxx Courses—Inclusion of 4xxx departmental courses on degree program forms is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program’s approval.

Courses—Please refer to Geological Engineering (GeoE) in the course section of this catalog for courses pertaining to the program.
Degree Programs and Faculty

M.Geo.E. Design Project Degree Requirements
The master of geological engineering (M.Geo.E.) degree is for the practicing engineer who would like to obtain an advanced degree, enrolling part-time or full-time. Students who intend to proceed to the Ph.D. program or think they may later wish to be admitted to the Ph.D. program should apply for the master of science program. Students are expected to follow a coherent program of coursework selected with the help of a faculty adviser and approved by the director of graduate studies. Students also must demonstrate professional competence by carrying out and defending a design project. The degree typically takes 12 to 18 months, full-time, to complete.

The M.Geo.E. requires at least 30 credits and is offered under two plans. One requires at least 20 course credits and preparation of a design project (10 credits); the design project must be carried out by the student in consultation with a faculty adviser. The other plan is a coursework-only degree program and requires at least 30 course credits. At least 6 of the course credits must be taken outside the department for either plan.

Language Requirements—None.

Final Exam—A final oral exam is required of all M.Geo.E. students.

Minor Requirements for Students Majoring in Other Fields—For a master’s minor, two or more 5xxx to 8xxx courses from the same area of geological engineering are required, for a total of 6 or more credits.

M.S. Degree Requirements
The master of science (M.S.) degree balances education in engineering fundamentals and design with research and development. The M.S. degree is for students wishing to pursue a career in industry or to continue toward a Ph.D. degree. Students follow a program selected with the help of a faculty adviser and approved by the director of graduate studies. A program typically takes 18 to 24 months to complete.

The M.S. requires at least 30 credits and is offered under two plans. Plan A emphasizes research and preparation of a thesis; Plan B emphasizes coursework. The thesis is written on a research project carried out in consultation with a faculty adviser. Under Plan B, students complete one to three Plan B papers as determined by the faculty adviser. Plan B papers include computer programs, annotated bibliographies, field investigations, and analysis/design of special engineering problems. Plan A requires at least 20 course credits and 10 thesis credits. Plan B requires at least 30 course credits. At least 6 credits of coursework must be from outside the department for either Plan A or Plan B.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—For a master’s minor, two or more 5xxx to 8xxx courses from geological engineering are required, for a total of 6 or more credits.

Ph.D. Degree Requirements
The Ph.D. degree couples independent research with coursework in a comprehensive program. Research performance, as judged by preparation of a dissertation on an independently pursued research topic, is the primary requirement for the Ph.D. degree. Students usually enter the program after completing the M.S. degree. The program is typically completed in 5-6 years.

Each program of study is designed in consultation with a faculty adviser and must be approved by the director of graduate studies. A typical program consists of 45 credits of coursework and 24 thesis credits. A supporting program or minor of at least 12 credits outside the department must be included. Credits earned in a M.S. program may be presented in partial fulfillment of the Ph.D. requirements.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—For a Ph.D. minor, four or more 5xxx to 8xxx courses are required, for a total of at least 12 credits.

Geology

Contact Information—Department of Geology and Geophysics, University of Minnesota, 310 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-1333; fax 612-625-3819; e-mail geology@umn.edu; <www.geo.umn.edu>.

Regents’ Professor
Herbert E. Wright, Jr. (emeritus), FM

Professor
E. Calvin Alexander, Jr., FM
Subir K. Banerjee, AM
R. Lawrence Edwards, FM
Peter J. Hadleston, FM
Emi Ito, FM
Thomas C. Johnson, Geology, Duluth, FM
Ronald L. Morton, Geology, Duluth, FM
V. Rama Murthy, FM
Richard W. Ojakangas, Geology, Duluth, FM
Christopher Paola, FM
Mark A. Person, FM
Hans-Olav Pfannkuch, FM
William E. Seyfried, FM
Robert E. Sloan (emeritus), FM
David L. Southwick, AM
James H. Stout, FM
Christian P. Teyssier, FM
Paul W. Weiblen (emeritus), FM

Adjunct Professor
Val W. Chandler, AM
Daniel R. Engstrom, AM
Robert G. Johnson, AM
Peter L. McSwiggen, AM
James D. Miller, AM
Carrie J. Patterson, AM
Anthony C. Rankel, AM
Wayne C. Shanks III, AM

Associate Professor
Karen L. Klesper, FM
Howard D. Mooers, Geology, Duluth, FM
Nigel J. Watrous, Geology, Duluth, FM
Donna L. Whitney, FM

Assistant Professor
Christina Gallup, Duluth, FM
Marc Hirschmann, FM

Senior Research Associate
Michael E. Berndt, AM
Kang Ding, AM
Paul H. Glasier, AM
Linda C. K. Shane, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The geology major includes the areas of Quaternary studies, structural geology, stratigraphy, paleontology, mineralogy, economic geology, metamorphic geology, experimental and theoretical petrology, isotopic and aqueous geochemistry, experimental geochemistry, geomorphology, groundwater geology, hydrogeology, limnology, climate change, and sedimentology. Students may accommodate other areas of interest such as earth resources, engineering geology, environmental geology, materials science, soil science, and paleoecology by choosing a minor or supporting field from outside the department.

Prerequisites for Admission—Most candidates for advanced degrees have completed a bachelor’s degree in geology, geophysics or in the broad field of earth and material sciences. However, applications from students in fields such as chemistry, physics, or biology are encouraged. At least one year of study in calculus, chemistry, and physics; and a full-time geological field course of at least five weeks’ duration are required. In general, an outstanding academic record is expected.

Special Application Requirements—GRE scores are required for admission and financial aid consideration; three letters of recommendation are required for financial aid and admission consideration. Applications for admission are considered at any time, although applications for financial aid should be submitted to the Department by January 15 to ensure consideration. Studies may begin in any semester or summer session, although fall semester is preferable.

Use of 4xxx Courses—For both the MS and Ph.D., typically no more than 30 percent of the total course credits are 4xxx.

Courses—Please refer to Geology and Geophysics (Geo) in the course section of this catalog for courses pertaining to the program.
M.S. Plan A, Plan B, and Plan C Degree Requirements

The M.S. is offered Plan A (with thesis), Plan B (with project), and Plan C (coursework only with emphasis in hydrogeology and environmental geoscience). Plan A requires at least 14 course credits in the major, 6 course credits in the related field, and 10 thesis credits. Plan B requires at least 30 course credits, including 14 credits in the major (6 of which are in independent study leading to a Plan B project) and 6 credits in the related field. The coursework-only option requires at least 30 course credits, including 20 credits in the major and 10 credits in the related field or a minor. Courses in the minor and related field are normally taken from outside the department, although they may be taken from within in special cases.

Language Requirements—None.

Final Exam—Plan A and Plan B students must pass the final oral examination.

Minor Requirements for Students

Majoring in Other Fields—The master’s minor is established individually with approval by the graduate studies committee. Typically no more than 50 percent of the total course credits are 4xxx.

Ph.D. Degree Requirements

The Ph.D. requires at least 24 course credits in the major, 12 course credits in a supporting program, and 24 thesis credits. Courses in the minor and supporting program are normally taken from outside the department, although they may be taken from within in special cases.

Language Requirements—None.

Minor Requirements for Students

Majoring in Other Fields—The Ph.D. minor is established individually with approval by the graduate studies committee. Typically no more than 50 percent of the total course credits are 4xxx.

Geophysics

Contact Information—Department of Geology and Geophysics, University of Minnesota, 310 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-1333; fax 612-625-3819; e-mail geology@umn.edu; <www.geo.umn.edu>).

Professor

Subir K. Banerjee, FM
Shun-ichiro Karato, FM
David L. Kohlsedt, FM
Bruce M. Moskowitz, FM
V. Rama Murthy, FM
David L. Southwick, FM
James H. Stout, FM
Christian P. Teyssier, AM
David A. Yuan, FM

Associate Professor

Karen L. Kleinsehlen, AM
Renata M. Wentzcovich, Chemical Engineering and Materials Science Engineering, AM

Assistant Professor

Marc Hirschmann, AM

Other

Val W. Chandler, AM
Michael J. Jackson, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The geophysics major includes the areas of applied and theoretical geophysics, paleomagnetism and rock magnetism, and mineral and rock physics. Students may accommodate other areas of interest such as earth resources, engineering geology, environmental geology, materials science, soil science, and paleoecology by choosing a minor or supporting field from outside the department.

Prerequisites for Admission—Most candidates for advanced degrees have completed a bachelor’s degree in geology, geophysics or earth and material sciences. However, applications from students in fields such as chemistry, physics, or biology are encouraged. At least one year of calculus, chemistry, and physics and a full-time geological field course of at least five weeks’ duration are required. In general, an outstanding academic record is expected.

Special Application Requirements—GRE scores are required for admission and financial aid consideration; three letters of recommendation are required for financial aid and admission consideration. Applications for admission are considered at any time, although applications for financial aid should be submitted to the department by January 15 to ensure consideration. Studies may begin in any semester or summer session, although fall semester is preferable.

Use of 4xxx Courses—For both the M.S. and Ph.D., typically no more than 30 percent of the total course credits are 4xxx.

Courses—Please refer to Geology and Geophysics (Geo) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. is offered Plan A (with thesis) and Plan B (with project). Plan A requires at least 14 course credits in the major, 6 course credits in the related field, and 10 thesis credits. Plan B requires at least 30 course credits, including 14 credits in the major (6 of which are in independent study leading to a Plan B project) and 6 credits in the related field. Courses in the minor and related field are normally taken from outside the department, although they may be taken from within in special cases.

Language Requirements—None.

Final Exam—Plan A and Plan B students must pass a final oral exam.

Minor Requirements for Students

Majoring in Other Fields—The master’s minor is established individually with approval by the graduate studies committee. Typically no more than 50 percent of the total course credits are 4xxx.

Ph.D. Degree Requirements

The Ph.D. requires at least 24 course credits in the major, 12 course credits in a supporting program, and 24 thesis credits. Courses in the minor and supporting program are normally taken from outside the department, although they may be taken from within in special cases.

Language Requirements—None.

Minor Requirements for Students

Majoring in Other Fields—The Ph.D. minor is established individually with approval by the graduate studies committee. Typically no more than 50 percent of the total course credits are 4xxx.

Germanic Studies

Contact Information—Department of German, Scandinavian and Dutch, University of Minnesota, 205 Folwell Hall, 9 Pleasant St. SE, Minneapolis, MN 55455 (612-625-2080; fax 612-624-8297).

Professor

Evelyn S. Firchow, German, Germanic Medieval, FM
Poul Houe, Scandinavian, FM
Ruth-Ellen B. Joeres, German, FM
Ruth M. Karras, History, Scandinavian, AM
Anatoly Liberman, German, Germanic Medieval, Scandinavian, FM
James A. Parente, Jr., German, Scandinavian, Germanic Medieval, FM
Jochen Schulte-Sasse, German, FM
Goran K.N. Stockenstrom, Scandinavian, FM
Arlene A. Teraoka, German, FM
Gerhard H. Weiss (emersus), German, FM
Jack D. Zipes, German, FM

Associate Professor

Leonard L. Duroche, Sr., German, FM
G. Lee Fullerton, German, AM
Kaaren E. Grimstad, Scandinavian, Germanic Medieval, FM
Richard W. McCormick, German, FM
William E. Mishler, Scandinavian, FM
Gary C. Thomas, Cultural Studies and Comparative Literature, German, AM
Mariann Tiblin, Scandinavian, AM
Ray M. Wakefield, German, Germanic Medieval, FM
Monika Zagar, Scandinavian, AM

Assistant Professor

Patrizia C. McBride, German, AM
Charlotte A. Melin, German, AM
Leslie Morris, German, AM

Along with the program- and track-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—There are five tracks within the Germanic studies graduate program: German, Scandinavian Studies (M.A. only), Teaching (M.A. only), Germanic Medieval Studies, and German and Scandinavian Studies (Ph.D. only).

Prerequisites for Admission—For major work, a B.A. or equivalent concentration in German, Scandinavian, or related field (depending on the track to which one applies) is required. Applicants to the Scandinavian studies M.A. must have a strong competency in a Scandinavian language, and they should
have taken at least four Scandinavian literature courses or the equivalent. Candidates whose preparatory work evidences gaps may be asked to complete supplemental work before admission.

**Special Application Requirements**—The following must be forwarded to the department: three letters of recommendation; a complete set of transcripts (in addition to transcripts sent to the Graduate School); a copy of one or more papers representative of the applicant’s level of scholarly development; and a statement of professional goals describing the applicant’s intellectual development and plans for the future. For master’s program applicants, and for all students who wish to be considered for fellowships, the General (Aptitude) Text of the GRE is required; the GRE is optional for those applicants whose native language is not English and who are required to take the TOEFL. For the doctoral program, applicants must have a master’s degree from an accredited institution or present other evidence of adequate background and competence. Prospective students should contact the department for further information. Students are admitted in the fall semester only. All financial application materials for the Graduate School Fellowship, departmental fellowships, and teaching assistantships must be received by January 10.

**Use of 4XXX Courses**—Inclusion of 4xxx courses on degree program forms is subject to the approval of the director of graduate studies.

**Minor Requirements for Students Majoring in Other Fields**—M.A. minors are required to take the basic seminar in either German (Ger 8002) or Scandinavian (Scan 8002) and two other courses, for at least 9 credits. Ph.D. minors who have not completed one of the basic seminars in the M.A. level must fulfill this requirement at the Ph.D. level. In addition, Ph.D. minors must complete at least three other courses for a total of at least 12 credits (usually four courses).

**German Track**

**M.A. Plan B Degree Requirements**
The M.A. offers students the opportunity to do advanced work in German studies and prepares them with the theoretical and practical tools to enter the Ph.D. track and in German and Scandinavian at the University of Minnesota, to enter a Ph.D. program in Scandinavian at another university, or to embark on a career that requires specialized knowledge of Scandinavia. Students enrolled in the M.A. in the Scandinavian track emphasize one of the three Scandinavian languages and literatures while acquiring a general knowledge of the other two. The M.A. in the Scandinavian track may also include Finnish. The M.A. requires at least 35 credits, including a course in contemporary literary and cultural theory (CLit 8001), a course introducing students to graduate studies in Scandinavian (Scan 8002), five courses in different periods of Scandinavian literature/culture, a course in Old Norse or Scandinavian linguistics, a pedagogy course, and two courses outside the Scandinavian track.

**Courses**—Please refer to German (Ger); German, Scandinavian and Dutch (GSD); and Dutch (Dutch) in the course section of this catalog for courses pertaining to the track.

**Language Requirements**—German. Students who intend to continue in the Ph.D. program are encouraged to acquire a reading proficiency in one other foreign language during their M.A. program (refer to requirements for the Ph.D.).

**Ph.D. Degree Requirements**
The Ph.D. offers students the opportunity to do advanced work in German studies and prepares them with theoretical and practical tools to serve as researchers, scholars, and teachers.

The Ph.D. requires at least 39 credits, including six courses in German literature/culture, a course in Germanic philology, a pedagogy course (if it has not been taken before the M.A.), the dissertation seminars (one before and one after the Ph.D. preliminary exams), and three courses outside the German track. At least 24 thesis credits are required.

**Courses**—Please refer to German (Ger); German, Scandinavian and Dutch (GSD); and Dutch (Dutch) in the course section of this catalog for courses pertaining to the program.

**Language Requirements**—The program requires reading competence in at least two languages or a high degree of proficiency in one language other than German or English.

**Scandinavian Studies Track**

**M.A. Plan B Degree Requirements**
The M.A. offers students the opportunity to do advanced work and prepares them with the theoretical and practical tools to enter the Ph.D. track.

The M.A. requires at least 35 credits, including a course in contemporary literary and cultural theory (CLit 8001); a course introducing students to graduate studies in either German or Scandinavian (Ger 8002 or Scan 8002); 12 credits (usually 4 courses) in each of two medieval foundation languages, literatures, and cultures chosen from two of Middle High German, Old Norse, and Old and Middle English; 6 credits (usually 2 courses) in Germanic medieval studies; a pedagogy course; and at least 6 credits (usually two courses) in related fields or a designated minor.

**Courses**—Please refer to English (EngL, EngC), Dutch (Dutch), German (Ger), German, Scandinavian and Dutch (GSD), and Scandinavian (Scan) in the course section of this catalog for courses pertaining to the track.

**Language Requirement**—German and the courses listed above in the two medieval foundation languages are required, but students who intend to continue in the Ph.D. program are encouraged to acquire a reading proficiency in Dutch or a modern Scandinavian language.

**Ph.D. Degree Requirements**
The Ph.D. offers students the opportunity to do advanced work in Germanic medieval studies and prepares them with theoretical and practical tools to serve as researchers, scholars, and teachers. The Ph.D. requires at
least 39 credits, including 12 credits (usually 4 courses) in Germanic Medieval Studies, 6 credits (usually 2 courses) in a third medieval Germanic language (supplementing the two languages for the M.A.), a pedagogy course (if it has not been taken before the M.A.), the dissertation seminars (one before and one after the Ph.D. preliminary exams), and 12 credits (usually 4 courses) in a designated minor or supporting field. 24 thesis credits are also required.

Courses—Please refer to English (EngL, EngC), Dutch (Dutch), German (Ger), German, Scandinavian, and Dutch (GSD), and Scandinavian (Scan) in the course section of this catalog for courses pertaining to the track.

Language Requirement—Reading competence in Medieval Latin and one modern Germanic language other than German or English (e.g., Dutch or one of the Scandinavian languages).

German and Scandinavian Studies Track

Ph.D. Degree Requirements
The Ph.D. offers the student the opportunity to do advanced work in German and Scandinavian studies and prepares students with theoretical and practical tools to serve as researchers, scholars, and teachers in either German or Scandinavian studies, with a basic foundation in the other field as well. The Ph.D. requires at least 39 credits. The German emphasis requires at least four courses from the German list and one course from each of the three Scandinavian groups. The Scandinavian emphasis requires at least one course from each of the three Scandinavian groups plus an additional course from any of them and three courses from the German list. Students in both emphases are required to take a pedagogy course (if it has not been taken before the M.A.), the dissertation seminars (one before and one after the Ph.D. preliminary exams), and 12 credits (usually 4 courses) in a designated minor or supporting program. 24 thesis credits are required.

Courses—Please refer to Dutch (Dutch), German (Ger), German, Scandinavian, and Dutch (GSD), and Scandinavian (Scan) in the course section of this catalog for courses pertaining to the track.

Language Requirements—Near-native fluency in German or a Scandinavian language: if the former, an advanced level of proficiency in a Scandinavian language; if the latter, an advanced level of proficiency in German. Reading competence in two other Scandinavian languages.
Greek
See Classical and Near Eastern Studies.

Health Informatics

Contact Information—Director of Graduate Studies in Health Informatics, Division of Health Informatics, University of Minnesota, MMC 511, 420 Delaware Street S.E., Minneapolis, MN 55455 (mailing address) (612-625-8440; fax 612-625-7166; e-mail grad@email.labmed.umn.edu; <www.hinf.umn.edu>);

Professor
Christopher G. Chute, AM
Donald P. Connelly, FM
Lynda B. Ellis, FM
David P. Fan, Genetics and Cell Biology, FM
Stanley M. Finkelstein, FM
John R. Finnegan, Jr., Epidemiology, FM
James R. Fricton, Diagnostic/Surgical Sciences, FM
Lael C. Gatewood, FM
Ilene B. Harris, AM
Paul E. Johnson, Information and Decision Sciences, FM
George G. Klee, AM
Donald G. McQuarrie, Surgery, E
Robert P. Patterson, Physical Medicine and Rehabilitation, FM
Stuart M. Spedee, FM
Douglas R. Wholey, Health Research and Policy, FM
George L. Wilcox, Neuroscience, FM

Associate Professor
Sandra J. Pothoff, Healthcare Management, FM
Stephen C. Strother, Radiology, AM

Assistant Professor
Steven D. Hillson, Public Health, AM
Stephen T Parente, Healthcare Management, AM

Research Associate
Ernest F. Retzel, AM

Other
Denton R. Peterson, AM
Brian J. Westrich, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Health Informatics is an interdisciplinary field of scholarship that applies computer, information, and cognitive science to promote the effective and efficient use and analysis of information to improve the health, well being and economic functioning of society. Students take a core sequence in health sciences, and electives in technical and health science areas. Possible areas of emphasis include health information systems, telemedicine, user interface design, system impact evaluation, database construction and analysis, clinical decision-making, evaluation of health programs, image and signal processing, and physiological monitoring and control.

Prerequisites for Admission—Applicants are expected to have at least a bachelor of science or equivalent degree from a recognized institution of higher education. Although students are accepted into the program with different backgrounds and varying degrees of experience, some prerequisites are required, usually in the form of college coursework. Acceptance into the program is not precluded by minor deficiencies in background; rather it is conditional on these being made up before or during the first year of study. The prerequisites listed on the following page must be completed before admission to the program. Courses used to fulfill prerequisites are not given graduate credit. Courses in the curriculum assume that these prerequisite courses have been taken. Note: these prerequisites are subject to change. Please check our Web site for the current information on prerequisites.

Special Application Requirements—The GRE or similar professional examination (e.g., MCAT) is required. Three letters of recommendation and a statement of purpose must be submitted with the application.

Student are advised to apply for admission for fall semester, since spring semester admission may entail the student taking longer to complete the program.

Use of 4xxx Courses—4xxx courses in computer science may be used to satisfy the elective requirements for the Plan A or Plan B master’s degree, provided the student has not previously taken a computer science course in the same sub area (e.g., database design) at a higher level. Acceptance of 4xxx courses from other departments or programs requires the approval of the adviser and the director of graduate studies.

Use of 4xxx Courses

<table>
<thead>
<tr>
<th>Area Complete</th>
<th>Amount For M.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological or Life Sciences</td>
<td>1 year</td>
</tr>
<tr>
<td>Mathematics</td>
<td></td>
</tr>
<tr>
<td>Calculus</td>
<td>1 year</td>
</tr>
<tr>
<td>Linear Algebra</td>
<td>1 course</td>
</tr>
<tr>
<td>(qtr or sem)</td>
<td></td>
</tr>
<tr>
<td>Differential Equations</td>
<td>1 course</td>
</tr>
<tr>
<td>Computer Programming</td>
<td>1 course</td>
</tr>
<tr>
<td>(FORTRAN, C, JAVA, etc)</td>
<td></td>
</tr>
</tbody>
</table>

Ph.D. Degree Requirements

The Ph.D. program is for students who want to obtain advanced training and to conduct research. Students are expected to complete the same requirements as those for the Plan B master’s program (a survey of health informatics, biostatistics, selected health science areas and advanced training in selected informatics areas), as well as advanced coursework in health informatics and an area of concentration complementary to health informatics. The work is completed with an original research project reported in the doctoral dissertation. Students are expected to have earned the equivalent of at least 70 credits including 24 thesis credits.

Language Requirement—None.

Minor Requirements for Students Majoring in Other Fields—Master’s students majoring in other fields who wish to complete a minor in health informatics must successfully complete the introductory sequence in health informatics (5430 and 5431). Ph.D. students majoring in other fields who wish to complete such a minor must take the introductory sequence as well as medical decision support techniques (8434).
Health Services Research, Policy, and Administration

Contact Information—Division of Health Services Research and Policy (HSRP), School of Public Health, University of Minnesota, MMC 729 Mayo Building, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-3500; fax 612-624-4498; e-mail sph-ssc@umn.edu; <www.sph.umn.edu>).

Professor
James W. Begun, Carlson School of Management, FM
Jon B. Christianson, Public Health, FM
Bryan E. Dowd, Public Health, FM
Roger D. Feldman, Public Health, FM
Judith M. Garrard, Public Health, FM
Robert L. Kane, Public Health, FM
Rosalie A. Kane, Public Health, FM
John E. Kral, Public Health, FM
Nicole Lurie, Medicine, FM
A. Marshall McBean, Public Health, FM
Ira S. Moscovice, Public Health, FM
John A. Nyman, Public Health, FM
Michael D. Resnick, Pediatrics, FM
Vernon W. Weckworth, Management, FM
Douglas R. Wholey, Public Health, FM

Associate Professor
Kathleen T. Call, Public Health, FM
Robert A. Connor, Carlson School of Management, AM
Michael D. Finch, Public Health, FM

Assistant Professor
Boris Bershadsky, Public Health, AM
Lynn A. Blewett, AM
Leslie A. Grant, Carlson School of Management, AM
Jeremy L. Holtzman, AM
Sandra J. L. Potthoff, Management, AM
David M. Radosz, AM
Todd H. Rockwood, Public Health, AM
Beth A. Yurin, AM

Other
N. Tor Dahl, E
George O. Johnson, E
Stephen T. Parente, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Health services research focuses on the organization and delivery of cost-effective health services. It deals with policy issues related to costs, access, and quality of health services and equitable distribution of health resources. The M.S. program prepares health services researchers and health policy analysts to carry out empirical studies, formulate policy options, work in the political arena to shape and implement policies, and evaluate policies once implemented. The M.S. can serve as a terminal degree or as a first step toward the Ph.D.

Health services research at the Ph.D. level is for those interested in affecting public policy related to health-care systems. Students come from a variety of educational backgrounds, including economics, political science, sociology, and public affairs. Strong quantitative skills are essential. The program is primarily for students interested in academic careers or senior research positions in government or the private sector. The core curriculum is a multidisciplinary examination of the social, political, and economic forces that affect the organization, financing, and delivery of health-care services. The emphasis is on theory, modeling, and quantitative methods. Coursework is supported by the student’s involvement with faculty on research projects. The program provides further interchange with faculty through research seminars and doctoral colloquia.

Prerequisites for Admission—Calculus, statistics, and intermediate microeconomics. Applicants who have not completed the prerequisites, but are otherwise qualified for admission, are required to take relevant courses at the University or another accredited institution before beginning the program.

Special Application Requirements—Above average performance on the GRE is required for admission (minimum score of 1500 for the M.S., 1800 for Ph.D.). A statement indicating reasons for seeking the health services research, policy, and administration M.S. or Ph.D., plus three letters of reference attesting to the applicant’s academic ability and potential for a career in research or teaching, are required. Students are admitted in fall semester only. The program is full time.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements requires the approval of the director of graduate study.

Courses—Please refer to Public Health (PubH), particularly numbers 58xx and 88xx, in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements
The M.S. is offered under Plan A, for students with a professional degree in medicine, dentistry, nursing, or pharmacy, and Plan B, for students with a non-health professional background. Plan A requires a thesis (publishable research paper) and a final oral exam; Plan B requires an internship and a research proposal. A critique of the research proposal is required. Both Plan A and Plan B are full-time, two year programs.

Plan A requires 30 course credits, 6 credits in a minor, and 10 thesis credits; Plan B requires 38 course credits and 6 credits in a minor.

Ph.D. Degree Requirements
The Ph.D. requires at least 47 credits, including 35 credits in the major and 12 credits in the minor or supporting program; 24 thesis credits are also required. The minor or supporting program may be in areas such as economics, statistics, sociology, bioethics, gerontology, business administration, or epidemiology in the School of Public Health.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—The minor is developed uniquely for each student with the advice and counsel of the director of graduate studies. The proposed minor is then reviewed and approved by the full faculty.

Hispanic and Luso-Brazilian Literature and Linguistics

Contact Information—Department of Spanish and Portuguese, University of Minnesota, 34 Folwell Hall, 9 Pleasant Street S.E., Minneapolis, MN 55455 (612-625-3588; fax 612-625-3549).

Professor
René Jara, FM
Amy K. Kaminsky, Women’s Studies, FM
Antonio Ramos-García, FM
Nicholas Spadaccini, FM
Hernán Vidal, FM
Anthony N. Zaharias (emeritus), FM

Associate Professor
Fernando E. Arenas, AM
Carol A. Klee, FM
Francisco A. Ocampo, FM
Joanna O’Connell, FM
Constance A. Sullivan, FM

Assistant Professor
Alberto Egea Fernández-Montesinos, AM
Oféia Fernán, AM
Horacio Machín, AM
Elide Oliver, AM
Luis Ramos-García, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The department offers three M.A. programs: Hispanic literature, Luso-Brazilian literature, and Hispanic linguistics. The department offers a Ph.D. in Hispanic and Luso-Brazilian literatures and linguistics. The Ph.D. offers four areas of emphasis: Spanish peninsular literature, Spanish-American literature, Luso-Brazilian literatures, and Hispanic linguistics.

The department integrates cultural and language areas into each degree program. Students study the main problems, issues, topics, and polemics that constitute their various fields and develop skills, theories, and methodologies to research, analyze, organize, reproduce, and communicate the material. Ph.D. students are expected to make scholarly contributions based on a thorough understanding of the history of the field and of the approaches used to study it. The department encourages and promotes a diversity of philosophies, approaches, and methods.

Prerequisites for Admission—Prospective students generally have completed an undergraduate degree or substantial coursework in the field, although individuals with other backgrounds may be admitted.
The Graduate Studies Committee may require completion of background coursework, without graduate degree credit, for admitted students with insufficient preparation.

Special Application Requirements—Three letters of recommendation from previously attended institutions evaluating the applicant’s scholarship, a sample of a writing project, and a complete set of transcripts in addition to that required by the Graduate School should be sent to the director of graduate studies. The GRE is recommended, and is required for fellowship candidates. The deadline for application for admission and financial aid is January 15 for fall entry.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Portuguese (Port), Spanish (Span), and Spanish-Portuguese (SpPt) in the course section of this catalog for courses pertaining to the program.

Ph.D. Degree Requirements
The Ph.D. requires at least 54 course credits (seventeen courses, excluding SpPt 5999), including 39 credits in the major and 15 credits (five courses) in either a related field or a minor, depending on the requirements of the minor program. The program also requires 24 thesis credits.

Language Requirements—For the Ph.D., students must have proficiency in both Spanish and Portuguese. Proficiency is usually demonstrated by use of the language in written and oral forms (see the department’s Graduate Handbook).

Minor Requirements for Students Majoring in Other Fields—The doctoral minor requires at least 18 credits of 5xxx or 8xxx courses (six courses), to be determined in consultation with the director of graduate studies.

Hispanic Linguistics

Contact Information—See Hispanic and Luso-Brazilian Literature and Linguistics.

Associate Professor
Carol A. Klee, AM
Francisco A. Ocampo, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—See Hispanic and Luso-Brazilian Literatures and Linguistics for program description.

Prerequisites for Admission—Prospective students generally have completed an undergraduate degree or substantial coursework in the field, although individuals with other backgrounds may be admitted. The Graduate Studies Committee may require completion of background coursework, without graduate degree credit, for admitted students with insufficient preparation.

Special Application Requirements—Three letters of recommendation from previously attended institutions evaluating the applicant’s scholarship, a sample of a writing project, and a complete set of transcripts in addition to that required by the Graduate School should be sent to the director of graduate studies. The GRE is recommended, and is required for fellowship candidates. The deadline for application for admission and financial aid is January 15 for fall entry.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Portuguese (Port), Spanish (Span), and Spanish-Portuguese (SpPt) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
The M.A. is offered under Plan A and Plan B. Plan A requires at least 33 credits, including 15 credits in the major field taken from among designated 5xxx core courses, 6 credits outside the program, and 12 thesis credits. Plan B requires at least 33 course credits and two Plan B papers. Most students pursue Plan B.

Language Requirements—For the M.A., students must have a reading knowledge of English and at least one foreign language in addition to Spanish and Portuguese.

Final Exam—The final exams are written and oral.

Minor Requirements for Students Majoring in Other Fields—For a master’s minor, students may choose any 6 credits (two courses), preferably in related areas, in consultation with the director of graduate studies.

Hispanic Literature

Contact Information—See Hispanic and Luso-Brazilian Literature and Linguistics.

Professor
René Jara, AM
Antonio Ramos-Gascón, AM
Nicholas Spadaccini, AM
Hernán Vidal, AM
Anthony N. Zahareas (emeritus), AM

Associate Professor
Fernando E. Arenas, AM
Joanna O’Connell, AM
Constance A. Sullivan, AM

Assistant Professor
Alberto Egea Fernández-Montesinos, AM
Ofelia Ferrán, AM
Horacio Machín, AM
Elide Oliver, AM
Luis A. Ramos-García, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—See Hispanic and Luso-Brazilian Literatures and Linguistics for program description.

Prerequisites for Admission—Prospective students generally have completed an undergraduate degree or substantial coursework in the field, although individuals with other backgrounds may be admitted. The Graduate Studies Committee may require completion of background coursework, without graduate degree credit, for admitted students with insufficient preparation.

Special Application Requirements—Three letters of recommendation from previously attended institutions evaluating the applicant’s scholarship, a sample of a writing project, and a complete set of transcripts in addition to that required by the Graduate School should be sent to the director of graduate studies. The GRE is recommended, and is required for fellowship candidates. The deadline for application for admission and financial aid is January 15 for fall entry.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Portuguese (Port), Spanish (Span), and Spanish-Portuguese (SpPt) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
The M.A. is offered under both Plan A and Plan B. Plan A requires at least 33 credits, including 15 credits in the major field taken from among designated 5xxx core courses, 6 credits outside the program, and 12 thesis credits. Plan B requires at least 33 course credits and two Plan B papers. Most students pursue Plan B.

Language Requirements—For the M.A., students have a reading knowledge of English and at least one foreign language in addition to Spanish and Portuguese.

Final Exam—The final exams are written and oral.

Minor Requirements for Students Majoring in Other Fields—A master’s minor requires at least 6 credits.
History

Contact Information—Department of History, University of Minnesota, 646 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-5840; fax 612-624-7096; e-mail histdgs@umn.edu; <http://www.hist.umn.edu> ).

Regents' Professor
Allen F. Isaacman, FM

Professor
Josef L. Altholz, FM
Bernard S. Bachrach, FM
Hyman Berman, FM
Clarke A. Chambers (emeritus), FM
Anna K. Clark, FM
John K. Evans, FM
Sara M. Evans, FM
John M. Eyler, History of Medicine, FM
Caesar E. Farah, Afro-American and African Studies, FM
Edward L. Farmer, FM
Stephen C. Feinstein, Holocaust and Genocide Studies, AM
David F. Good, FM
Andrea Hinding, AM
John R. Howe, Jr. (emeritus), FM
Ruth M. Karras, FM
Sally G. Kohlstedt, History of Science and Technology, FM
Elaine Tyler May, American Studies, FM
Lary May, American Studies, FM
Mary J. Maynes, FM
Robert E. McCaa, FM
Russell R. Menard, FM
John K. Munholland, FM
David W. Noble, FM
Thomas S. Noonan, FM
Carla R. Phillips, FM
William D. Phillips, Jr., FM
Kathryn L. Reyerse, FM
David Roediger, FM
Steven Ruggles, FM
Joel B. Samaha, FM
Theofanis G. Stavrou, FM
John A. Thayer, FM
James D. Tracy, FM
Carol L. Urness, AM
Rudolph J. Vecoli, FM
Ann B. Walter, FM

Associate Professor
Jean M. Allman, FM
Keletso E. Atkins, Afro-American and African Studies, AM
Sarah C. Chambers, FM
George D. Green, FM
Lisa A. Norling, FM
Jean M. O'Brien-Kehoe, FM
Ajay Skaria, AM
Dennis N. Valdes, FM
Eric D. Weitz, FM

Assistant Professor
Jennifer Alexander, History of Science and Technology, AM
Brenda Child, AM, American Studies, AM
Catherine Choy, American Studies, AM
Victoria B. Coffman, Afro-American and African Studies, AM
Kirsten Fischer, AM
Christopher M. Isett, AM
Erika Lee, AM
Michael Lower, AM
Patrick J. McNamara, AM
J.B. Shank, AM
Michele Wagner, AM
Liping Wang, AM
Barbara Wolfe, AM
Thomas C. Wolff, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Areas of concentration include Africa; Asia; British Isles; comparative women's history; Medieval, early modern, and modern Europe; early modern world; Latin America; and the United States and its colonial background. Scholarly resources include Center for Austrian Studies, Center for Advanced Feminist Studies, Center for German and European Studies, Center for Medieval Studies, Immigration History Research Center, Minnesota Population Center, Modern Greek Studies, Center for Early Modern History, and Social Welfare History Archives.

Prerequisites for Admission—Applicants for the master’s degree normally should have completed general undergraduate survey courses in two or three broad areas of history, two years of advanced undergraduate work in two areas of history, and training in a foreign language. Some prerequisites may be made up after admission. In some circumstances, students without undergraduate history majors may be admitted to the M.A. program. Applicants for the Ph.D. program normally should have completed a master’s degree, but highly qualified applicants may apply without having completed an M.A. degree. In admitting students, priority is given to applicants who are likely to continue on to a doctoral degree even if they are originally admitted to the M.A. program.

Special Application Requirements—The following are required by the department: a statement of purpose, three letters of recommendation, a writing sample, training in a foreign language, a statement of specific areas and subareas of interest, and scores from the General (Aptitude) Test of the GRE. Deadline for financial aid applications is December 15. Forms and instructions should be requested from the department or may be downloaded from the Web site at <www.hist.umn.edu>.

Use of 4xxx Courses—4xxx history courses may not normally be included on degree program forms for the History graduate major or minor.

Courses—Please refer to History (Hist) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
The M.A. is offered under Plan A and Plan B. Both plans require six history courses (one of which is 8015) and two courses in other departments (at least 6 credits). Plan A also requires 10 thesis credits, for a total of at least 31 credits, and Plan B requires an additional two courses in history or another department, for a total of at least 30 credits.

Language Requirements—A reading knowledge of one foreign language is required before admission to the master’s exam.

Final Exam—The final exam is oral.

Minor Requirements for Students

Majoring in Other Fields—A master’s minor is offered for Plan A students only. At least two related courses in history (at least 6 credits) is required.

Ph.D. Degree Requirements
The Ph.D. requires 36 credits in 12 history courses (Hist 8015, nine courses in the major, and two courses in an outside subarea) plus 12 credits in four supporting program courses; 24 thesis credits are also required.

Language Requirements—A reading knowledge of two foreign languages is required before admission to the preliminary exam. Some areas of concentration may require additional foreign languages. In some cases, competence in quantitative methods may replace one of the foreign languages.

Minor Requirements for Students

Majoring in Other Fields—For the doctoral minor, at least four history courses, including a proseminar or seminar, are required, along with a written and oral exam.

History of Medicine
and Biological Sciences

Contact Information—Program in the History of Medicine, University of Minnesota, Mayo Mail Code 506, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-624-4416; fax: 612-625-7938; <www.med.umn.edu/history/home.htm> ).

Professor
John H. Beatty, Ecology and Behavioral Biology, FM
C. Carlyle Clawson, Pediatrics, E
John M. Eyler, FM
Sally Gregory Kohlstedt, History of Science and Technology, FM
Elaine Tyler May, American Studies, FM

Assistant Professor
Jennifer L. Gunn, FM

Adjunct Assistant Professor
David J. Rhees, AM
Jole Shackelford, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalogue for Graduate School requirements that apply to all major fields.

Curriculum—The history of medicine explores the changing ideas of health and disease, the evolution of health care, and the changing patterns of disease from antiquity to the present. It employs the methods of intellectual, social, and cultural history to explicate the forces that created the biomedical world in which we live. Students enter with diverse backgrounds, typically in medicine, science, or history. Some begin their graduate study immediately after receiving the bachelor’s degree. Others do their training in mid-career. The Ph.D.
Degree Programs and Faculty

program is for those who seek a career of historical research and teaching. The M.A. is especially suitable for those who intend to combine historical pursuits with a career in one of the health sciences.

Prerequisites for Admission—There are no universal prerequisites for admission, but some training in both history and the biological sciences is desirable.

Special Application Requirements—Applicants must submit scores from the General Test of the GRE and arrange to have three persons who know their academic work well submit letters of recommendation on their behalf to the director of graduate studies. Program in the History of Medicine and Biological Sciences. Applicants should submit a statement describing their historical interests and their goals for graduate study. They are also encouraged to submit a writing sample. New students are ordinarily admitted for fall semester. For an applicant to be considered for financial aid, the applicant’s materials must be received by January 15.

Use of 4xxx Courses—Use of 4xxx courses is not permitted toward degree requirements.

Courses—Please refer to History of Medicine (HMed) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. is offered under Plan A or Plan B. The degree is normally completed in two to three semesters of full-time study or its part-time equivalent.

For Plan A, twelve hours of required courses in the history of medicine, plus two elective hours in the history of medicine, 6 credits in a minor or related field, and ten hours of thesis credits.

For Plan B, twelve hours of required courses in the history of medicine, plus an approved program of twelve hours of electives in history of medicine and related subjects, and 6 credits in a minor or related field.

Language Requirements—M.A. students must demonstrate competence in one foreign language, preferably French or German.

Final Exam—The final exam is oral. For Plan A, the examination centers on the thesis. For Plan B, it focuses on two or more revised course or seminar papers.

Minor Requirements for Students Majoring in Other Fields—A master’s minor requires 6 credits in the history of medicine and biological sciences.

Ph.D. Degree Requirements

Twelve hours of required courses in the history of medicine, plus nine additional elective hours in history of medicine, a minor or related field of twelve hours, and twenty-four hours of thesis credits. A comprehensive written and oral preliminary examination precedes admission to candidacy.

Language Requirements—Ph.D. students must demonstrate competence in two foreign languages, preferably French and German. One language examination must be passed before the end of the first academic year.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A Ph.D. minor requires at least 12 credits in the history of medicine and biological sciences.

History of Science and Technology

Contact Information—Including the publication A Guide to Graduate Study in the History of Science and Technology, which supplies more detailed information about requirements, contact the Program in History of Science and Technology, University of Minnesota, 381 Tate Laboratory of Physics, 116 Church Street S.E., Minneapolis, MN 55455 (612-624-7069; fax 612-624-4578).

Professor

John Beatty, Ecology, Evolution, and Behavior, FM
John M. Eyler, History of Medicine, FM
Ronald N. Giere, Philosophy, AM
Sally G. Kohlstedt, Geology and Geophysics, FM
Helen E. Longino, Women’s Studies, AM
Arthur L. Norberg, Computer Science, FM
Robert W. Sedel, Chemical Engineering, FM
Alan E. Shapiro, Physics, FM
Roger H. Stuewer, (emeritus), Physics, FM

Assistant Professor

Jennifer Karns Alexander, Mechanical Engineering, FM
Michel H. P. Janssen, Physics, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The program offers opportunities for advanced research and study in three general areas: history of the physical sciences, history of the biological sciences, and history of technology. Students focus on the following approaches: conceptual development of the disciplinary fields; social, economic, and cultural contexts; the interaction among science, technology, and society; or a combination of these. The faculty’s interests span the period from the Scientific Revolution of the sixteenth and seventeenth centuries through twentieth-century developments.

Minor Requirements for Students Majoring in Other Fields—The master’s minor requires 6 credits and is structured for the student’s interests.

Ph.D. Degree Requirements

The Ph.D. is for those planning professional careers that require a high degree of scholarly competence, including teaching and research. Students must choose two of the general areas (history of the physical sciences, the biological sciences, or technology) in preparation for preliminary written and oral exams. Six courses (18 credits) must be taken in these two areas with at least two courses (6 credits) in any one area. Two courses (6 credits) must cover the pre-1800 period and two courses (6 credits) the post-1800 period. Courses used to satisfy the area requirements also can be used to satisfy these period requirements. Because of this possible overlap, these course credits may not add up to 18 credits. In addition, each student must take the historiography course (HSci 8111) and two courses (6 credits) in a minor related field. Under the Plan A option, students may also take 10 thesis credits. All of the courses selected for the requirements must be passed with a grade of B or better. HSci 4xxx courses may be included as appropriate for the area and period requirements.

Language Requirements—M.A. students must demonstrate reading proficiency in one foreign language, normally French or German.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—The master’s minor requires 6 credits and is structured for the student’s interests.

Ph.D. Degree Requirements

The Ph.D. is for those planning professional careers that require a high degree of scholarly competence, including teaching and research. Students must choose two of the general areas (history of the physical sciences, the biological sciences, or technology) in preparation for preliminary written and oral exams. Six courses (18 credits) must be taken in these two areas with at least two courses (6 credits) in any one area. Two courses (6 credits) must cover the pre-1800 period and two courses (6 credits) the post-1800 period. Courses used to satisfy the area requirements also can be used to satisfy these period requirements. In addition, each student must take the historiography course (HSci 8111) and a minor or supporting program consisting of four courses (12 credits). Students must also take 24 thesis credits. All of the courses selected for the requirements must be passed with a grade of B or better.
Language Requirements—Before taking the preliminary exams, students must demonstrate reading proficiency in two foreign languages, normally French and German.

Minor Requirements for Students Majoring in Other Fields—The doctoral minor requires 12 credits and is structured for the student’s interests.

Human Factors/ Ergonomics

Contact Information—Doctoral Minor Program in Human Factors/Ergonomics, Human Factors Research Laboratory, School of Kinesiology and Leisure Studies, College of Education and Human Development, University of Minnesota, 141 Mariucci Arena, 1901 Fourth Street S.E., Minneapolis, MN 55455 (612-625-5300).

Professor
Arthur G. Erdman, Mechanical Engineering, E
Lael C. Gateswood, Laboratory Medicine and Pathology, E
Susan G. Gerberich, E
Denise A. Guerin, Design, Housing, and Apparel, E
Peter A. Hancock, Kinesiology and Leisure Studies, E
Tarald O. Kvalseth, Mechanical Engineering, E
Gordon E. Legge, Psychology, E
Shashi Shekhar, Computer Science, E
Michael Wade, Kinesiology and Leisure Studies, E

Associate Professor
Karen L. LaBat, Design, Housing, and Apparel, E

Assistant Professor
Joseph A. Konstan, Computer Science, E

Senior Research Fellow
John C. Carmody, E

Curriculum—Human factors/ergonomics (HF/E) is an interdisciplinary area of study focusing on how human performance and behavior are influenced by design factors in the performance environment. HF/E has its roots in psychology, engineering, physiology, and sociology. The core courses consist of HumF 5001, 8001, and 8002. The minor is contingent upon prior admission to the Graduate School. Admission is limited and only by permission of the director of graduate studies in the human factors/ergonomics minor.

Use of 4xxx Courses—Use of 4xxx courses is permitted based on adviser and director of graduate studies approval.

Courses—Please refer to Human Factors/Ergonomics (HumF) in the course section of this catalog for courses pertaining to this program.

Freestanding Minor Requirements
A master’s minor requires 10 graduate credits, including 7-8 credits of core courses and 2-3 credits of electives. A doctoral minor requires 16 credits, including the three core courses (7-8 credits) and 8-9 credits of electives. The core courses consist of HumF 5001, 8001, and 8002.

Human Resources and Industrial Relations

Contact Information—Industrial Relations Center, University of Minnesota, 3-300 Carlson School of Management, 321 19th Avenue S., Minneapolis, MN 55455-0438 (612-624-5810; fax 612-624-8360; e-mail hrirgrad@umn.edu; <www.irc.csm.umn.edu>.

Professor
Dennis A. Alliberg, FM
Richard D. Arvey, FM
Avner Ben-Ner, FM
Hyman Berman, History, FM
Mario F. Bogmanno, FM
John P. Campbell, Psychology, FM
John A. Fossum, FM
Maria J. Hanraty, Public Affairs, FM
Jo-Ida C. Hansen, Psychology, FM
Morris M. Kleiner, Public Affairs, FM
Jeylan T. Mortimer, Sociology, FM
Denz S. Ones, Psychology, FM
John Remington, FM
Paul R. Sackett, Psychology, FM
James G. Scoville, FM
Andrew F. Whitman, FM
Mahmood A. Zaidi, FM

Associate Professor
Ross E. Azevedo, FM
John W. Budd, FM
Brian P. McCarr, FM
Connie R. Wanberg, FM
Yijiang Wang, FM

Assistant Professor
Theresa M. Glomb, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate Studies requirements that apply to all major fields.

Curriculum—Human resources and industrial relations studies the employment relationship. Teaching and research are guided by the belief that the employment relationship must be investigated through the lenses of different disciplines using systems thinking. The professional M.A. degree is for individuals interested in private and public sector careers in human resource management, labor relations, and related fields. The Ph.D. degree is a research degree for individuals interested in academic careers. The curriculum is structured around five areas: staffing, training, and development; organization behavior and theory; compensation and benefits; labor market analysis; and labor relations and collective bargaining. Research methods and quantitative analysis of employment problems and issues are also included. Specialization in two areas is required for Ph.D. candidates, while M.A. candidates are encouraged to choose electives to support a generalist orientation.

Prerequisites for Admission—An undergraduate course in microeconomics must be completed with a grade of at least C before enrolling.

Special Application Requirements—Applicants must submit three letters of recommendations, a complete set of transcripts, GRE scores, and a clearly written statement of career interests, goals, and objectives. M.A. applicants may substitute the GMAT for the GRE. M.A. applicants must also submit a resume. Applicants whose native language is not English must also submit score results from the TOEFL.

Entry in both the day and evening M.A. programs is in fall or spring semester, and the application deadlines are June 15 and October 15. The financial aid deadline for fall semester is February 1. Entry in the Ph.D. program is only in the fall, and the application deadline is February 1. Applicants for all programs are encouraged to apply early, particularly for fall semester.

Use of 4xxx Courses—4xxx courses are not permitted toward M.A. or Ph.D. degree requirements.

Courses—Please refer to Human Resources and Industrial Relations (HRIR) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. is offered under Plan A (thesis) and coursework only (capstone project) in day (full-time) and evening (part-time) programs. Coursework only requires at least 48 credits and a capstone project. Major coursework includes 8011, 8012, 8031, 8041, 8051, 8061, and 8071 and 14 credits of HRIR electives. At least 8 credits must be earned in related fields. Plan A requires at least 38 course credits and 10 thesis credits. Major coursework includes 8011 and 8012; three courses from among 8031, 8041, 8051, 8061, and 8071; and 10-14 additional HRIR credits. Also required are 6-10 credits in an approved field or fields of study related to human resources and industrial relations. Plan A is generally limited to students who have considerable related graduate coursework.
Commonly-selected related fields include accounting, finance, operations management, managerial communications, economics, human resource development, law, psychology, public affairs, sociology, and research methods.

Language Requirements—None.

Final Exam—The final exam is oral.

Ph.D. Degree Requirements
Students must complete at least 12 credits of research methods (most complete 18 or more credits); at least 6 credits of human resources and industrial relations doctoral seminars in each of two areas of specialization and other credits in these areas as needed; at least 3 credits in each of the other three subfields; and at least 12 credits in a minor or supporting program in one or more of the following behavioral sciences—anthropology, business administration, economics, history, political science, psychology, and sociology. Research methods courses taken outside the program may be applied toward the minor or supporting program requirement. Specific coursework is planned in consultation with the student’s adviser and the director of graduate studies. Students must pass preliminary exams in each of their subfields and research methods.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor or supporting program may be selected by students majoring in business administration, education, hospital and health-care administration, or the social and behavioral sciences. The minor must consist of at least 21 credits, including five courses in at least four subfields, plus a doctoral seminar.

Immunology
See Microbiology, Immunology, and Cancer Biology.

Industrial Engineering
Contact Information—Mechanical Engineering and Industrial Engineering Graduate Programs, University of Minnesota, 1120 Mechanical Engineering, 111 Church Street S.E., Minneapolis, MN 55455
(612-625-2009; fax 612-624-2010; e-mail gradinfo@me.umn.edu; <www.me.umn.edu>)

Professor
Sant Ram Arora, FM
Avram Bar-Cohen, FM
Taral P. Kvalseth, FM
Yechiel Shulman (emeritus), FM
Patrick J. Starr, FM

Associate Professor
Safiafalah Bengaafar, FM
Dwarkar Gupta, FM
Caroline C. Hayes, FM
Michael R. Taaffe, Opearations and Management Science, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Industrial engineering offers coursework and research in industrial engineering, operations research, and human factors. Special emphasis is on methodologies for design, planning, and management of manufacturing and production systems. Additional emphases are in logistics, transportation, computer-aided design and manufacturing, health systems, and management of technology.

Prerequisites for Admission—An undergraduate degree in engineering or in a closely related scientific field such as or mathematics, statistics, business or psychology, is required. Unusually well-qualified students with a baccalaureate degree may be admitted directly to the Ph.D. program.

Special Application Requirements—GRE General Test scores are required for admission and also are used in evaluating requests for financial aid. For the Ph.D. program, three letters of recommendation from senior faculty members at the previous educational institution are required, including one from the master’s degree adviser. Students are admitted in fall and spring semesters only, the departmental deadlines for which are December 15 and October 15, respectively.

Use of 4xxx Courses—Selected 4xxx courses from other departments may be applied toward the degree in consultation with the student’s adviser and the director of graduate studies. No 4xxx IE courses may be applied toward the degree.

Courses—Please refer to Industrial Engineering (IE) in the course section of this catalog for courses pertaining to the program.

M.S.I.E. Degree Requirements
The M.S.I.E. requires at least 30 credits, including at least 14 course credits in the major and 6 course credits in a minor or related field. At least 1 credit of graduate seminar is to be included in the 30 credits. Plan A (thesis) required courses include IE 5531, 5551, and 8532, along with 10 thesis credits.

Plan B (non-thesis) required courses include IE 5531, 5551, 5553, and 8532, along with one to three Plan B papers (the number in part depending on their length) determined in consultation with the adviser. The papers may derive from courses in the major or may address topics chosen by a graduate faculty member and the student.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—At least 6 credits in industrial engineering is required for a master’s minor.

Ph.D. Degree Requirements
The Ph.D. requires at least 44 course credits, including at least 12 course credits in a minor field or supporting program and at least 2 credits of graduate seminar; 24 thesis credits are also required. The following 4 courses are required for the Ph.D. degree: IE 5531, 5551, 5553, and 8532.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—At least 12 credits in industrial engineering is required for a doctoral minor.

Industrial Relations
See Human Resources and Industrial Relations.

Infrastructure Systems Engineering
Contact Information—Center for the Development of Technological Leadership, University of Minnesota, 1300 South Second Street, Suite 510, Minneapolis, MN 55454
(612-624-5474; fax 612-624-7510; e-mail degrees@cdtl.umn.edu; <www.cdtl.umn.edu>)

Professor
Andrew, Drescher, AM
Catherine E. French, AM
John S. Gulliver, AM
Panos G. Michalopoulos, AM
Michael J. Semmens, AM
Heinz G. Stefan, AM
Vaughn R. Voller, AM

Associate Professor
Randall J. Barnes, AM
Gary A. Davis, AM
Robert J. Dexter, AM
Joseph F. Labuz, AM
Arturo E. Schultz, AM
Carol K. Shield, AM
Karl A. Smith, AM

Assistant Professor
Rajmond M. Hotzalski, AM

Lecturer
Eil Kwon, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The master of science in the infrastructure systems engineering (M.S.I.E.) program focuses on developing management and engineering tools that address the issues in local, county and state infrastructure. It is an interdisciplinary program offered through the Institute of Technology’s Center for the Development of Technological Leadership and the
Department of Civil Engineering. The two-year, professional-format program integrates the fields of water systems, pavement, structures, mechanics modeling, traffic engineering, transportation policy, and environmental issues, among others.

Prerequisites for Admission—A B.S. degree in engineering plus a minimum of one year of professional work experience in an infrastructure area or a B.S. degree in a related science or technology field and a minimum of two years professional work experience in an infrastructure area are required.

Special Application Requirements—None.

Use of 4xxx Courses—Applying 4xxx courses toward degree requirements is extremely limited. Such requests will be reviewed on a case by case basis and will require director of graduate studies approval.

Courses—Please refer to Infrastructure Systems Engineering (ISE) in the course section of this catalog for courses pertaining to the program.

M.S.I.S.E. Plan B Degree Requirements

The M.S.I.S.E. in infrastructure systems engineering requires 30 credits with 23 semester credits in required core courses and seven semester credits in related fields, such as geography and public administration. In addition students must complete a capstone project to address an on-the-job issue or problem.

Language Requirements—None.

Final Exam—An oral presentation and defense of the capstone project is required.

Interdisciplinary
Archaeological Studies

Admissions have been suspended for this program.

International Education

Contact Information—Director of Graduate Studies, International Education Minor, R. Michael Paige, Comparative and International Development Education, Educational Policy and Administration, University of Minnesota, 330 Wulling Hall, 86 Pleasant Street S.E., Minneapolis, MN 55455 (612-626-7456 or 612-624-1006; e-mail rpaig@umn.edu).

Professor

Associate Professor
V. Lois Erickson, Educational Psychology, E Philip R. Goedrich, Biosystems and Agricultural Engineering, E March L. Krotee, Kinesiology and Leisure Studies, E R. Michael Paige, Educational Policy and Administration, E Jane E. Pihal, Work, Community, and Family Education, E

Lecturer
Kay A. Thomas, Educational Psychology, E

Curriculum—The interdisciplinary minor in international education is for students enrolled in any M.A. or doctoral program who wish to enter careers in research, consulting, administration, and teaching in an international context. The minor offers a coordinated set of courses from the Departments of Curriculum and Instruction; Educational Policy and Administration; Educational Psychology; Work, Community, and Family Education; School of Kinesiology and Leisure Studies; and Institute of Child Development.

Prerequisites for Admission—Admission to the international education minor is contingent upon prior admission to the Graduate School and to an M.A. or Ph.D. program at the University of Minnesota. Admission to the minor program is limited and only by permission of the International Education Committee and the director of graduate studies. Students interested in this option are welcome to consult with the director of graduate studies.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree programs is subject to adviser and director of graduate studies approval.

Courses—Please contact the minor program office for information on relevant coursework.

Freestanding Minor Requirements

At least 9 graduate credits at the master’s level, 12 at the doctoral level. Each program is developed in consultation with the student, the student’s adviser, major director of graduate studies, and director of graduate studies for international education. Requirements include critical issues in international education; foundations of international education (EdPA 5103, 5124; one for M.A., both for doctoral minor); research (EdPA 5121; for doctoral students only); and area-specific coursework (at least one course for M.A. and doctoral minors: AgEE 5351, CI 5055, 5403, 5747, EdHD 5001, EdPA 5032, 5048, 5080, 5101, 5121, 5132, EPsy 5101, 5112, 5113, 5401, 5431, 5432, 5461, 5403, HRD 5408, 5496, HRD/ WCPE 5821, Kin 5371, 8607, WCPE 8142).

Interpersonal Relationships Research

Contact Information—Doctoral Minor Program in Interpersonal Relationships Research, Institute of Child Development, University of Minnesota, 104 Child Development, 51 East River Road, Minneapolis, MN 55455 (612-624-2396; fax 612-624-6737; e-mail wcollins@umn.edu).

Regents’ Professor
Ellen S. Berscheid, Psychology, E

Professor

Associate Professor
Patricia A. Frazier, Psychology, E Assistant Professor
Terry A. Kinney, Speech-Communication, E

Curriculum—The minor in interpersonal relationships research provides doctoral students with a broad theoretical and methodological foundation for research on behavioral interaction patterns between two persons and the impact of these interactions. A recently recognized and rapidly advancing interdisciplinary field of scientific inquiry, interpersonal relationships research has its roots in psychology, sociology, family studies, communication, and nursing. The program brings together faculty and students from eight University departments and schools.

Prerequisites for Admission—Admission to the interpersonal relationships research graduate minor is contingent upon prior admission to the Graduate School and to a doctoral program in a degree-granting department. Admission to the minor program is limited and only by permission of the director of graduate studies in interpersonal relationships research.

Use of 4xxx Courses—4xxx courses, other than those required by the program, are permitted based on director of graduate studies approval.

Courses—Please refer to Interpersonal Relationships Research (IRel) in the course section of this catalog for courses pertaining to the program.

Freestanding Minor Requirements

The doctoral minor requires at least 14 graduate credits, including three required core courses and additional elective courses selected from an approved list. The required courses are 8001 (2 credits), 8021 (2 credits), and Psy 5204 (3 credits).
Degree Programs and Faculty

Italian
See French and Italian.

Japanese
See Asian Languages and Literatures.

Journalism
See Mass Communication.

Kinesiology
Contact Information—Linda Estrem, Office of the Director of Graduate Studies, School of Kinesiology and Leisure Studies, University of Minnesota, 220 Cooke Hall, 1900 University Avenue S.E., Minneapolis, MN 55455 (612-624-5017, 612-625-5300; fax 612-626-7700; e-mail <www.kls.coled.umn.edu/kin@umn.edu>).

Professor
Fred S. Apple, Laboratory Medicine and Pathology, FM
Allen W. Burton, FM
Richard S. Crow, Epidemiology, AM
Arthur Erdman, Mechanical Engineering, AM
Peter A. Hancock, FM
David W. Johnson, Educational Psychology, AM
Roger T. Johnson, Curriculum and Instruction, AM
Mary Jo Kane, FM
Arthur S. Leon, FM
Herbert L. Pick, Jr., Child Development, AM
Michael Wade, FM
Albert Yonas, Child Development, AM

Associate Professor
Bruce D. Anderson, FM
Jiurgen Konczak, AM
March L. Krotee, FM
Robert C. Serfass, FM
Diane M. Wiese-Bjornstal, FM

Assistant Professor
Donald Dengel, AM
Roger D. Harrold, Institutional Research and Reporting, AM
M. Kathryn Schmitz, Epidemiology, AM

Lecturer
JoAnn Buyse, AM
James Larson, AM
Aysnley Smith, AM
Thomas J. Smith, AM

Senior Fellow
Victor S. Koscheyev, AM

Research Associate
Carol Leitschuh, AM
Ava J. Walker, AM

Other
David W. Bacharach, E
Anthony Brown, Recreational Sports, AM
Glenn M. Street, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Emphasis areas in the master’s and doctoral programs are adapted physical education, biomechanics/neural control, exercise physiology, human factors/ergonomics, international/comparative sport, motor learning/development, sport management, sport psychology, or sport sociology.

Prerequisites for Admission—Although prospective masters students generally have an undergraduate degree in kinesiology, physical education, or sport and exercise science, others with a baccalaureate degree may be admitted who have related preparation and a significant background and interest in the scientific study of physical activity. Prospective doctoral students have generally completed a master’s degree in a field related to kinesiology. Admitted students may be required by their adviser to complete background preparation in undergraduate and graduate kinesiology and related coursework.

Special Application Requirements—Applicants must submit a completed kinesiology application form; written statement of academic interests, goals, and objectives; scores from the General Test of the GRE (verbal and quantitative) or Miller Analogies Test that are less than five years old; three letters of recommendation from persons familiar with their scholarship and research potential; scholarly paper; and copies of official transcripts. Students may apply at any time; however, submission of all application materials by January 15 is encouraged to ensure priority consideration for admission and for teaching and research assistantships awarded for the next academic year. Students can be admitted any term.

Research Facilities—Research facilities for graduate students in kinesiology include the following: Human Factors Research Laboratory; Human Sensorimotor Control Laboratory; Gait and Posture Laboratory, Laboratory of Physiological Hygiene and Exercise Science; Tucker Center for Research on Girls and Women in Sport.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Kinesiology (Kin) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
Kinesiology M.A. students select an emphasis in adapted physical education, biomechanics/neural control, exercise physiology, human factors/ergonomics, international/comparative sport, motor learning/development, sport management, sport psychology, or sport sociology.

The M.A. is offered under Plan A and Plan B. Plan A requires 30 credits, including at least 14 course credits in kinesiology, 6 course credits in a minor or related field, and 10 thesis credits (8777). Plan B also requires 30 credits, including at least 14 course credits in kinesiology, 6 course credits in a minor or related field, 4 credits of a research project (8995), and 6 additional credits in any of these areas. For both Plan A and Plan B, students must take 5981 (3 credits), 8980 (1 credit), and in the related field or minor, EPsy 5261 (3 credits) or 8261 (3 credits) or equivalent. A 3.00 GPA of at least is required to maintain good standing and to graduate.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master’s minor requires at least 6 credits of graduate-level kinesiology courses.

Ph.D. Degree Requirements
Kinesiology Ph.D. students pursue an individualized program with an emphasis in adapted physical education, biomechanics/neural control, exercise physiology, human factors/ergonomics, international/comparative sport, motor learning/development, sport management, sport psychology, or sport sociology.

The Ph.D. requires at least 48 course credits and 24 thesis credits, for a total of 72 credits. Course credits include 24 credits in kinesiology, 9 credits in statistical methods, 12 credits in a supporting program or minor (statistical methods courses may be included), and an additional 3 credits in any of these areas. Kinesiology course credits must include 5171 and 5981 (achieving a grade of A or B in each), 2 to 6 credits of 8980 and at least 12 credits of 8xxx.

Statistical methods courses must include EPsy 8261 or equivalent and EPsy 8262 or equivalent (achieving a grade of A or B in each). A GPA of at least 3.00 is required to maintain good standing and to graduate.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires at least 12 credits of graduate-level kinesiology courses, including 5171 (3 credits) and 8980 (1 credit).

Landscape Architecture
Contact Information—Department of Landscape Architecture, University of Minnesota, 125 Architecture Building, 89 Church Street S.E., Minneapolis, MN 55108 (612-625-6800; fax 612-625-0710; e-mail gsland@tc.umn.edu; <www.calac.umn.edu/landscape_architecture/>).

Professor
John F. Hart, Geography, AM
Roger B. Martin, AM
Lance M. Neckar, AM
Peter J. Olin, Horticultural Science, AM
David G. Pitt, AM

Associate Professor
Susan M. Galatowitsch, Horticultural Science, AM
John A. Koepke, AM
Robert D. Sykes, AM
Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

**Curriculum**—Landscape architecture is the design, planning, and management of the landscape to create environments that embody ecological function and realize human needs and aspirations. The department teaches students to be professional landscape architects who use ecological systems thinking as the basis for artistic design. The department offers the professional master of landscape architecture (M.L.A.), required to become a registered landscape architect, and the master of science (M.S.), a research-oriented degree allowing a specialized focus within landscape architecture.

**Prerequisites for Admission**—M.L.A. program applicants must have completed a baccalaureate degree. M.S. program applicants must have completed a baccalaureate degree in landscape architecture or a related discipline. All applicants are asked to explain the relationship of their previous academic work and work experience to their proposed graduate study.

**Special Application Requirements**—M.L.A. program applicants must apply by January 15 for fall entrance. The department requires a letter of intent that also indicates whether the applicant is interested in financial aid; three letters of reference; a copy of official transcripts; and examples of creative work. Applicants with degrees in related design professions such as architecture or planning should clearly indicate in their letter of intent an interest in being evaluated for advanced standing in design. The GRE is not required for entry but can be helpful to applicants applying for fellowships.

M.S. program applicants must apply by January 15 for entry the following fall. The department requires GRE scores; a statement of intent outlining research objectives that also indicates whether the applicant is interested in financial aid; and examples of research objectives that include 10 to 30 pages of writing, published or unpublished. Successful applicants will have secured the participation of a faculty adviser before completing their applications.

**Use of 4xxx Courses**—Inclusion of 4xxx courses in degree programs is subject to adviser and director of graduate studies approval.

**Courses**—Please refer to Landscape Architecture (LA) in the course section of this catalog for courses pertaining to the program.

**M.L.A. Plan B, Coursework Only Degree Requirements**

The M.L.A. program, which is accredited by the national Landscape Architecture Accreditation Board (LAAB), is for students who wish to become registered landscape architects. Areas of coursework within the program include design, technology and ecology, graphic and written communication, landscape history, and research methods. Students are encouraged to select from among graduate seminars to develop a special focus or particular point of view. To meet the LAAB standards, 90 graduate credits are required for students without previous design experience. Because coursework is organized in a sequential framework of design studios, commitment to the program for three successive years is important.

Students who hold an accredited professional bachelor’s degree in landscape architecture may complete the M.L.A. with 30 credits, including 12 credits of landscape architecture studio courses, 3 credits of landscape architecture research issues and methods, and 15 elective credits, 6 credits of which must be outside of the department. Up to 9 credits earned as part of the M.L.A. may be applied to the M.S.

**Language Requirements**—None.

**Final Exam**—The final examination is a design portfolio.

**M.S. Plan A Degree Requirements**

The M.S. is for students with a clear focus in research related to landscape architecture. M.S. students build expertise related to the practice of landscape architecture as they learn how to conduct research. Students specialize within areas of faculty expertise, which may include art and landscape architecture, landscape ecology, landscape architectural history and theory, park and recreation design, rural and suburban landscape planning, and transportation. Prospective students may request a summary of current faculty research for a description of potential specializations.

The M.S. requires 30 credits, including at least 6 credits within landscape architecture, 10 thesis credits, and at least 6 credits in an area of focus outside of landscape architecture.

**Language Requirements**—None.

**Final Exam**—The final exam is oral.

**Minor Requirements for Students Majoring in Other Fields**—Minor requirements are determined in consultation with the director of graduate studies.

**Latin**

See Classical and Near Eastern Studies.

**Law**

**Contact Information**—Meredith M. McQuaid, Associate Dean of Students and Director of International and Graduate Programs, Law School, University of Minnesota, 285 Law Building, 229 19th Avenue S., Minneapolis, MN 55455 (612-625-3025; fax 612-626-1874).

**Professor**

Stephen F. Befort, E
Karen B. Brown, E
David P. Bryden, E
Karen C. Burke, E
Laura Cooper, E
John J. Cound, E
Daniel A. Faber, E
Gary C. Feld, E
Mary L. Fellows, E
Richard S. Frase, E
Philip P. Frickey, E
Daniel J. Gifford, E
Joan S. Howland, E
Robert E. Hudec, E
William D. Kilbourn, Jr., E
K. Bart Koeppen, E
Robert J. Levy, E
Donald G. Marshall, E
John H. Matheson, E
C. Robert Morris, E
Fred L. Morrison, E
Steve H. Nickles, E
Roger C. Park, E
Michael S. Paulsen, E
John a. powell, E
M. Kathleen Price, E
Stephan B. Scallen, E
Ferdinand P. Schoettite, Jr., E
Suzanna Sherry, E
Robert A. Stein, E
Michael Torney, E
Gerald Torres, E
Thomas L. Waterbury, E
David Weisbordt, E
Judith T. Younger, E

**Associate Professor**

Edward S. Adams, E
Ann M. Burkhart, E
Jim C. Chen, E
Carol L. Chomsky, E
Tahrin V. Lee, E
Susan M. Wolf, E

**Other**

Carl Auerbach, E
Beverly Balos, E
Keith Bellairs, E
Victor H. Kramer, E
Maury S. Landsman, E
Kathryn J. Sedo, E
Stephen M. Simon, E
Carl M. Warren, E

**Curriculum**—A law minor is available to both master’s (M.A. and M.S.) and doctoral students and is individually tailored to their academic interests.
Prerequisites for Admission—Admission to the law graduate minor is contingent upon prior admission to a master’s or doctoral degree-granting program within the Graduate School.

Courses—Please contact the minor program office for information on relevant coursework.

Freestanding Minor Requirements
A master’s minor requires at least 6 graduate credits; a doctoral minor requires at least 12 graduate credits.

Liberal Studies

Contact Information—College of Continuing Education, University of Minnesota, 170 Westbrooke Hall, 77 Pleasant Street S.E., Minneapolis, Minnesota 55455 (612-626-8724; fax 612-626-0077; e-mail mlc@ecee.umn.edu).

Professor
William Ammentorp, Work, Community and Family Education, AM
Fred Amran, General College, AM
Kent R. Bales, English, AM
Laird H. Barber, Humanities Division, Morris, AM
Linda Brady, Food Science, AM
Frank Basta, Food Science, AM
Terrence Collins, General College, AM
Vasiliki Demos, Morris, AM
Stephen Feinstein, History, AM
Jill Gidmark, General College, AM
Maria Gini, Computer Science, AM
Stephen Granger, Morris, AM
William H. Hanson, Philosophy, AM
Roger S. Jones, Physics, AM
Peter Lock, AM
Paul Magee, Molecular, Cellular, Developmental Biology and Genetics, AM
Judith A. Martin, Geography, AM
Tony A. H. McNaron, English, AM
Frederick Peterson, Morris, AM
Dwight H. Purdy, Humanities Division, Morris, AM
Naomi B. Scheman, Philosophy, AM
John Wallace, Philosophy, AM
Jack Zipes, Germanic Studies, AM

Adjunct Professor
Aldo Rescigno, Pharmacy, AM

Associate Professor
Rose Brewer, Studies in Africa and the African Diaspora, AM
William Dikel, AM
George Green, History, AM
Arthur M. Harkins, Educational Policy and Administration, AM
Nicholas Hayes, AM
Carol A. Miller, American Studies, AM
William E. Mishler, German, Scandinavian, and Dutch, AM
Robert Silberman, Art History, AM
David Taylor, General College, AM
Jacquelyn N. Zita, Feminist Studies, AM

Assistant Professor
Stephen Gross, Morris, AM
Linda Halcón, Nursing, AM
John Hitchcock, AM
Richard Lee, Psychology, AM
Julie R. Patterson-Pratt, Humanities Division, Morris, AM
Peter Whelan, AM

Lecturer
J. Edward Anderson, College of Continuing Education, AM

Michael M. Andregg, College of Continuing Education, AM
Roberta Cordano, College of Continuing Education, AM
Stephen L. Daniel, College of Continuing Education, AM
Sarah Dennison, College of Continuing Education, AM
Brenda Fiala, College of Continuing Education, AM
Isabel Gomez, College of Continuing Education, AM
Donna Mae J. Gustafson, College of Continuing Education, AM
John Hasselberg, College of Continuing Education, AM
John R. Hustad, Social Sciences Division, Morris, AM
Jeremy F. Igers, College of Continuing Education, Duluth, AM
Jack Johnson, College of Continuing Education, AM
Alan R. Kahn, College of Continuing Education, AM
Judith Katz, College of Continuing Education, AM
Sherry Lee, College of Continuing Education, AM
Rosemary Lloyd, College of Continuing Education, AM
Nicholas Pease, College of Continuing Education, AM
David A. Shupe, College of Continuing Education, AM
Victor Sorell, College of Continuing Education, AM
Jack Stuart, College of Continuing Education, AM
Rosalyn Ulan, College of Continuing Education, AM
Sandria Wilson, College of Continuing Education, AM
D. Wayne Wright, College of Continuing Education, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The graduate major in liberal studies offers an interdisciplinary curriculum that includes an introductory seminar, a choice of liberal studies seminars, a choice of electives from disciplines throughout the Graduate School, and a final project seminar. Although seminars for the M.L.S. are scheduled mainly late afternoons and evenings, and some Saturday mornings, most graduate-level courses offered during the day are also open to M.L.S. students.

Prerequisites for Admission—In addition to a bachelor’s degree, students must indicate an ability to succeed in graduate study.

Special Application Requirements—A statement of purpose, letters of support, an undergraduate transcript, and examples of written work should accompany the application. GRE scores may also be submitted, but are not required. International students are required to achieve a passing score on the TOEFL.

Use of 4xxx Courses—A 4xxx course may be used as an elective, if the instructor is approved to teach at the graduate level.

Courses—Please refer to Liberal Studies (LS) in the course section of this catalog for courses pertaining to the program.

M.L.S. Plan B Degree Requirements
The M.L.S. is a specific variation of the master’s Plan B option. The program requires at least 30 credits. Required are the Introduction to Interdisciplinary Inquiry (3 credits) and the Final Project (3 credits) seminars. Students must take at least 9 credits of liberal studies seminars. The remaining 15 credits are composed of electives from disciplines throughout the Graduate School, or directed study, directed research, or additional liberal studies seminars. Courses are selected with the help of the student’s graduate faculty adviser.

Language Requirements—None.

Final Exam—The final project must be prepared as part of 8002 and must be approved by at least two faculty members.

Linguistics

Contact Information—Director of Graduate Studies, Linguistics, University of Minnesota, 315 Pillsbury Drive, S.E., Minneapolis, MN 55455 (612-624-3331; fax 612-624-4579; e-mail ILES@umn.edu).

Professor
Andrew D. Cohen, FM
Genevieve J. Escore, English, AM
Jeanette K. Gundel, FM
Michael B. Kac, Philosophy, FM
Michael P. Maratos, Child Development, AM
Amy L. Sheldon, Speech-Communication, FM
Joseph P. Stemberger, Communication Disorders, FM
Elaine E. Tarone, FM

Associate Professor
Bruce T. Downing, FM
Charles R. Fletcher, Psychology, AM
G. Lee Fullerton, German, Scandinavian, and Dutch, AM
Betsy K. Kerr, French and Italian, AM
Carol A. Klee, Spanish and Portuguese, AM
Maria D. Sera, Child Development, AM
Nancy J. Stenson, FM
Polly E. Szatrowski, AM

Assistant Professor
Hooi Ling Soh, AM

Other
Joan Bachenko, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Linguistics is the scientific study of human language. Investigation in phonology, syntax, and semantics/pragmatics seeks to determine general principles governing the structure of human language and the parameters that determine degree and manner of variation across languages. These core areas of language structure constitute the foundation for other subfields of linguistics, including psycholinguistics, sociolinguistics, historical linguistics, and computational linguistics.

Prerequisites for Admission—There are no specific prerequisites for admission. Students admitted normally have a broad undergraduate background that includes some linguistics courses.

Special Application Requirements—Applicants must submit a completed application, scores from the GRE, three letters of recommendation, and a supplementary questionnaire detailing background, interests, and accomplishments. Applicants wishing to be considered for financial support should apply no later than
January 15 of the preceding academic year. Entry is usually in fall semester but may be permitted in other semesters in exceptional cases.

Use of 4xxx Courses—Inclusion of 4xxx courses in degree programs is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program’s approval.

Courses—Please refer to Linguistics (Ling) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The requirements for the M.A. degree (both Plan A and Plan B) include eight required courses in the major: six courses covering core areas of language structure (phonetics, phonology, syntax, semantics/pragmatics); one course in field methods; and one research paper course. The total number of credits, assuming no prior coursework in linguistics, is 32 (including 6 credits in related fields). Students who have already taken required courses or their equivalents as undergraduates (or as graduates in another program), can substitute electives in the major or in related fields, in accordance with M.A. requirements set by the Graduate School. In addition to course requirements, Plan A requires a thesis and thesis credits; Plan B requires a Plan B paper.

Language Requirements—The M.A. program requires knowledge of one language not native to the student. Mechanisms for demonstrating such knowledge are described in the program’s Graduate Student Handbook.

Minor Requirements for Students Majoring in Other Fields—Courses required for a master’s minor in linguistics are Ling 5001 (4 credits); 5201 (3 credits); and 5301 (4 credits). Students who have had these courses or their equivalents as undergraduates can substitute other linguistics courses. The M.A. minor requires at least 9 credits.

Ph.D. Degree Requirements

The Ph.D. program focuses on language structure (phonology, syntax, semantics/pragmatics), language acquisition (first and second), and language/discourse processing (cognitive processes that underlie language use). The program especially emphasizes research that integrates core areas of theoretical linguistics with language acquisition or processing.

For the Ph.D., no minimum number of credits is required besides the 12 credits in related fields and 24 thesis credits. However, all Ph.D. students are expected to complete M.A. course requirements (15-26 credits in the major, depending on amount of prior coursework in linguistics), a second-semester course in field methods (4 credits), and an individualized plan of study (including at least three 8xxx courses) to be determined in consultation with the student’s committee. Upon completion of required coursework, students must pass a preliminary written exam in phonology, syntax, and their primary and secondary areas of concentration. Papers judged to be of near publishable quality by the student’s committee can be substituted for exam questions in any of these areas. The preliminary exam is a defense of a research paper-length dissertation prospectus, which introduces and motivates the student’s dissertation topic and provides a detailed plan for completion of the dissertation.

Language Requirements—The Ph.D. degree requires knowledge of two languages not native to the student. Mechanisms for demonstrating such knowledge are described in the program’s Graduate Student Handbook.

Minor Requirements for Students Majoring in Other Fields—The doctoral minor requires at least 15 credits (five courses). Students who have had no prior coursework in linguistics must take six courses approved by the director of graduate studies, including the three courses required for the M.A. minor: Ling 5001, 5201, and 5301. Students who have taken 5001 or its equivalent as undergraduates do not have to substitute another course. Students who have had 5301 can substitute a 3-credit linguistics course.

Luso-Brazilian Literature

Contact Information—See Hispanic and Luso-Brazilian Literatures and Linguistics.

Associate Professor
Fernando E. Arenas, AM

Assistant Professor
Elide Oliver, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Please see Hispanic and Luso-Brazilian Literature and Linguistics for program description

Prerequisites for Admission—Prospective students generally have completed an undergraduate degree or substantial coursework in the field, although individuals with other backgrounds may be admitted. The Graduate Studies Committee may require completion of background coursework, without graduate degree credit, for admitted students with insufficient preparation.

Special Application Requirements—Three letters of recommendation from previously attended institutions evaluating the applicant’s scholarship, a sample of a writing project, and a complete set of transcripts in addition to that required by the Graduate School should be sent to the director of graduate studies. The GRE is recommended, and is required for fellowship candidates. The deadline for application for admission and financial aid is January 15 for fall entry.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Portuguese (Port), Spanish (Span), and Spanish-Portuguese (SpPt) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. is offered under both Plan A and Plan B. Plan A requires at least 33 credits, including 15 credits in the major field taken from among designated 5xxx core courses, 6 credits outside the program, and 12 thesis credits. Plan B requires at least 33 course credits and two Plan B papers. Most students pursue Plan B.

Language Requirements—For the M.A., students must have a reading knowledge of English and at least one foreign language in addition to Spanish and Portuguese.

Final Exam—The final exams are written and oral.

Minor Requirements for Students Majoring in Other Fields—The master’s minor requires at least 6 credits.

Management of Technology

Contact Information—Management of Technology Graduate Program, Center for the Development of Technological Leadership, University of Minnesota, 510 West Bank Office Building, 1300 S. Second Street, Minneapolis, MN 55454-1082 (612-624-5747; fax 612-624-7510; e-mail MOT@cdllumn.edu; <www.cdllumn.edu>).

Professor
Avram Bar-Cohen, Mechanical Engineering, AM
Philip Bromiley, Strategic Management, AM
Balaji S. Chakravarthy, Strategic Management, AM
Norman L. Cherny, Information and Decision Sciences, AM
W. Bruce Erickson, Strategic Management, AM
Arthur V. Hill, Operations and Management Science, AM
George John, Marketing and Logistics Management, AM
Edward J. Joyce, Accounting and Business Law, AM
Kenneth H. Keller, Hubert H. Humphrey Institute of Public Affairs, AM
Ian H. Maitland, Strategic Management, AM
Edward J. Joyce, Accounting and Business Law, AM
Kenneth H. Keller, Hubert H. Humphrey Institute of Public Affairs, AM
Timothy J. Nantell, Finance, AM
Dennis L. Polla, Electrical Engineering, AM
Kenneth J. Roering, Marketing and Logistics Management, AM
Robert W. Ruekert, Marketing and Logistics Management, AM

Associate Professor
Karl A. Smith, Civil Engineering, AM

Other
Dilee Rao, AM
Rias J. van Wyk, AM
Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

**Curriculum**—The master of science in the management of technology (M.S.MOT.) program is administered by the Institute of Technology’s Center for the Development of Technological Leadership in partnership with the Carlson School of Management. The two-year, executive-format program integrates the fields of technology and management and provides working engineers and scientists with management knowledge and skills needed to assume a technical leadership role within their organizations. The program focuses on management in technology-based environments in traditional and emerging industries. The curriculum includes technical and advanced management courses such as manufacturing, pivotal technologies, technology forecasting, project management, quality engineering, management of innovation, and strategic management of technology. The core management curriculum includes areas such as finance, marketing, accounting, strategic planning and decision making, and conflict management. Students enter the program in the fall and advance as a cohort, taking a prescribed sequence of courses together. Case studies, class discussions, and study-group interaction stimulate the learning process. Students also participate in several off-campus residencies, including one in the Asia-Pacific region; complete individual and team projects; and develop final projects as part of a capstone course. Most students receive corporate financial support.

**Prerequisites for Admission**—A bachelor’s degree in engineering or in a natural science discipline from an accredited program. Applicants should also have completed coursework (or show proficiency) in economics, mathematical modeling, statistics, and computer literacy.

**Special Application Requirements**—At least five years of professional experience in the applicant’s technical field (in exceptional circumstances, promising candidates with less experience may be considered). Applicants must submit three letters of recommendation, a résumé, a statement of purpose, and GRE or Graduate Management Admission Test scores (if the applicant already holds a master’s or Ph.D. degree, this test requirement is waived). The professional track record of the applicant weighs heavily in the admissions process. A personal interview with the director of graduate studies is required. Admission is in fall semester only.

**Use of 4xxx Courses**—4xxx courses may not be included on degree program forms.

**M.S.MOT. Plan B Degree Requirements**

The M.S.MOT. requires 36 credits. In addition to course requirements, students must complete an oral exam and a written report for the capstone project (R234), which consists of an independent, original investigation requiring between 110 and 130 hours of effort.

**Language Requirements**—None.

**Final Exam**—An oral presentation of the capstone project is required.

**Manufacturing Systems Engineering**

**Contact Information**—Management of Technology Graduate Program, Center for the Development of Technological Leadership, University of Minnesota, 510 West Bank Office Building, 1300 S. Second Street, Minneapolis, MN 55454-1082 (612-624-5747; fax 612-624-7510; e-mail general@cdtl.umn.edu; <www.cdtl.umn.edu>).

**Professor**

Avram Bar-Cohen, AM
Arthur G. Erdman, AM
Barney E. Klamecki, AM
Karl Smith, AM
Kim A. Stelson, AM
Rias van Wyk, AM

**Associate Professor**

Safalilah Bengaafar, AM
Diwakar Gupta, AM
Caroline Hayes, AM
Susan C. Mantell, AM
Brad Nelson, AM
Michael Taddele, AM

**Assistant Professor**

William Cooper, AM
Frank Kelso, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

**Curriculum**—The master of science in manufacturing systems engineering (M.S.M.S.E) program is an interdisciplinary program offered through the Institute of Technology’s Center for the Development of Technological Leadership and the Department of Mechanical Engineering. Students gain familiarity with manufacturing systems and practices. The program emphasizes issues surrounding factory logistics and supply chain management, global markets and their implications for manufacturing, and manufacturing processes that are friendly to the environment.

**Use of 4xxx Courses**—4xxx courses may not be included on degree program forms for the M.S.M.S.E.

**Courses**—Please refer to Manufacturing Systems (MS) in the course section of this catalog for courses pertaining to the program.

**M.S.M.S.E. Plan B Degree Requirements**

At least 30 credits, including 23 credits from the manufacturing systems program, 4 credits from the capstone project, and 3 elective credits from systems and technology themes. The curriculum includes six core courses, four short courses, three elective short courses, and a capstone course (Plan B final project).

**Language Requirements**—None.

**Final Exam**—The final exam is oral. An oral presentation and written report on a final project are also required.

**Mass Communication**

**Contact Information**—Graduate Studies Office, School of Journalism and Mass Communication, University of Minnesota, 110 Murphy Hall, 206 Church Street S.E., Minneapolis, MN 55455 (612-625-4054; fax 612-626-8251; e-mail sjmcgrad@umn.edu; <www.sjmc.umn.edu/>).

**Professor**

Hazel Dicken-Garcia, FM
Ronald J. Faber, FM
Irving E. Fang, FM
Kathleen A. Hansen, FM
Jane E. Kirtley, FM
Chin-Chuan Lee, FM
Nancy L. Roberts, FM
Daniel J. Sullivan, FM
Daniel B. Wackman, FM

**Associate Professor**

William A. Babcock, FM
Tsao-Kuo Chang, FM
Kenneth O. Doyle, Jr., FM
Dona B. Schwartz, FM
Albert R. Tims, Jr., FM

**Assistant Professor**

Colette Gaiter, AM
Shelly L. Rodgers, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

**Curriculum**—The general mass communication M.A. emphasizes the theoretical study of mass communication and analysis of media systems. The degree is primarily for those who wish to pursue Ph.D. degrees or teaching and research careers, or to enter the communication industry. The general M.A. program does not offer professional skills training in journalism. Individuals who have extensive professional experience in mass communication or a B.A. degree in journalism are encouraged to enter the general M.A. program. Individuals with strong liberal arts backgrounds in areas such as political science, psychology, sociology, history, philosophy, and English also are encouraged to apply.

The Ph.D. offers training for academic careers primarily in communication instruction, research, or policy. Areas of specialization include media processes,
influences, and effects (strategic communication); media law, ethics, and history; international communication; and media management. All programs are suffused with the study of visual communication and new media communication.

Prerequisites for Admission—The minimum requirement for admission is the B.A. or equivalent.

Special Application Requirements—Applicants must submit an application; a written statement of career interests, goals, and objectives; three letters of recommendation from persons familiar with their scholarship and research potential; a complete set of transcripts; academic work samples in English; and scores from the General Test of the GRE. Students whose native language is not English are required to submit scores from the TOEFL, but not from the GRE. Admission is considered for fall semester only; the application deadline is December 30.

Special Facilities—Special facilities include Minnesota Journalism Center for Professional Studies, Silha Center for the Study of Media Ethics and Law, China Times Center, Institute for New Media Studies, Digital Information Resource Center (houses Eric Sevareid Library), and SJMC Research Division.

Use of 4xxx Courses—Use of 4xxx courses towards degree requirements is subject to adviser or director of graduate studies approval.

Courses—Please refer to Journalism and Mass Communication (Jour) in the course section of this catalog for courses pertaining to the program.

M.A. Plan A Degree Requirements
At least 27 course credits and 10 thesis credits are required. Coursework must include 12 credits in required core courses and 15 other credits (6-9 credits in other journalism and mass communication seminars or courses, and 6-9 credits in other departments). All coursework must be taken A-F.

Language Requirements—For the master’s program, foreign language study is recommended for students in international mass communication.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—Minor programs are planned in consultation with the director of graduate studies or another member of the mass communication graduate faculty. The master’s minor consists of at least 9 credits in a coherent area, with at least 6 credits of 8xxx.

Ph.D. Degree Requirements
At least 54 course credits and 24 thesis credits are required. Coursework must include 12 credits in required core courses, 24 credits in dissertation area courses, and at least 18 credits in other departments.

Language Requirements—Doctoral students pursuing international study are expected to have high language proficiency, or obtain it, in the appropriate area. Doctoral students in other areas are encouraged to consult advisers regarding the appropriateness of language study for their chosen specialization.

Minor Requirements for Students Majoring in Other Fields—A Ph.D. minor program consists of at least 14 credits in a coherent disciplinary area. Students completing a minor in mass communication are required to take a preliminary written exam covering their coursework.

Materials Science and Engineering
See Chemical Engineering and Material Science and Engineering.

Mathematics

Contact Information—School of Mathematics, University of Minnesota, 127 Vincent Hall, 206 Church Street S.E., Minneapolis, MN 55455 (612-625-1306; fax 612-626-2017; e-mail gradpro@math.umn.edu).

Regents’ Professor
Avner Friedman, FM

Professor
Scot Adams, FM
Stephen B. Agard, FM
Greg W. Anderson, FM
Donald G. Aronson, FM
John R. Baxter, FM
Sergei Bobkov, FM
Maury D. Bramson, FM
J. Bernardo Cockburn, FM
Mark F. Feshbach, FM
Berit E. Fristedt, FM
Paul B. Garrett, FM
Jay R. Goldman, FM
Lawrence F. Gray, FM
Robert D. Gulliver, FM
Morton E. Harris, FM
Dennis A. Hejhal, FM
Naresh C. Jain, FM
Max A. Jodeit, Jr., FM
Donald W. Kahn, FM
Harvey B. Keynes, FM
Nicola V. Krylov, FM
Walter Littman, FM
John S. Lowengrub, FM
Mitchell B. Luskin, FM
Gennady Lyubeznik, FM
Albert Marden, FM
Charles A. McCarthy, FM
Richard P. McGehee, FM
William Messing, FM
Norman G. Meyers, FM
Willard Miller, Jr., FM
Richard B. Moerckel, FM
Wei-Ming Ni, FM
Peter J. Olver, FM
Hans Othmer, FM
Marian Pour-El, FM
Karel L. Przytyk, FM
Victor Reiner, FM
Fernando Reitich, FM
Peter A. Rejto, FM
Joel L. Roberts, FM
Mikhail Safonov, FM
Fadil Santosa, FM
George R. Sell, FM
Yasutaka Sibuya, FM
Steven L. Sperber, FM
Dennis W. Stanton, FM
David A. Storvick, FM
Vladimir Sverak, FM
Allen R. Tannenbaum, Electrical Engineering, AM
Peter J. Webb, FM
Dennis E. White, FM

Associate Professor
Jack F. Conn, FM
David L. Frank, FM
Hilary H. Gershenson, FM
Dhruva Jiang, FM
Rachel A. Kaske, AM
Nai-Chung Leung, FM
Chester L. Miracle, FM
Wayne H. Richter, FM
Jiaping Wang, FM

Assistant Professor
Ionut Ciocan-Fontanine, FM
Jianhong Jackie Shen, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Special areas of research include ordinary and partial differential equations; probability; real, complex, harmonic, functional and numerical analysis; differential and algebraic geometry; topology; number theory; commutative algebra; group theory; logic; combinatorics; mathematical physics; and applied and industrial mathematics. The M.S. Plan A includes a program with emphasis in applied and industrial mathematics. The M.S. Plan B includes a program with emphasis in mathematics education.

See also control science and dynamical systems, and fluid mechanics, in this catalog for Ph.D. programs that rely heavily on mathematics.

Prerequisites for Admission—A solid background in undergraduate-level mathematics is expected. For students whose goal is the Ph.D. degree, background should include full-year courses in analysis, abstract algebra, and a semester of topology (roughly equivalent to 5615H-5616H, 5285H-5286H, and 5345).

Entering students are ordinarily admitted to the master’s degree program. Transfer to the Ph.D. program is made when the Ph.D. preliminary written examination is passed (and does not require earning a master’s degree).

Special Application Requirements—All applicants are expected to submit three letters of recommendation, a score from the GRE Subject (Advanced) Test in mathematics, and a supplementary application form available from the mathematics department. Applicants desiring financial assistance should submit their applications, including the departmental form, GRE scores, and letters of recommendation, to the director of graduate studies no later than January 15 to be considered for a fellowship, and no later than
February 15 to be considered for a teaching assistantship. Students normally are admitted fall semester only.

Use of 4xxx Courses—In exceptional cases 4xxx courses may be permitted as part of degree programs subject to director of graduate studies approval.

Courses—Please refer to Mathematics (Math) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements
The School of Mathematics offers a M.S. in mathematics. M.S. degrees are also offered with emphasis in applied and industrial mathematics, with emphasis in mathematics education, and with emphasis in actuarial science. For more information, see the Graduate Studies in Mathematics brochure.

The M.S. is offered under Plan A and Plan B. Plan A requires at least 20 course credits and 10 thesis credits. Plan B allows more breadth; students complete at least 30 course credits, half of which may be in areas outside of mathematics.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—The master’s minor requires a two-semester 8xxx or 4xxx sequence.

Ph.D. Degree Requirements
The School of Mathematics offers a general Ph.D. in mathematics and a Ph.D. in mathematics with emphasis in applied and industrial mathematics.

Special areas of research include ordinary and partial differential equations; probability; real, complex, harmonic, functional, and numerical analysis; differential and algebraic geometry; topology; number theory; commutative algebra; group theory; logic; combinatorics; mathematical physics; and applied and industrial mathematics.

The Ph.D. preliminary written examination, given twice each year, covers real analysis, complex analysis, algebra, and manifolds and topology. Students must pass the exam by the end of their second year. After passing the exam and completing the coursework, students may take the preliminary oral exam, which they must pass by the end of their fourth year. If a supporting program is chosen, it may consist partly or entirely of mathematics courses.

The choice of courses and exams for the emphasis in applied and industrial mathematics is different from those in the general program. In particular, applications are stressed early on.

For more information, see the program’s Graduate Studies in Mathematics brochure.

Language Requirements—Two foreign languages are required from among the following: French, German, Russian, and Italian.

Minor Requirements for Students Majoring in Other Fields—Two year-long sequences of 5xxx or 8xxx courses. Consult the director of graduate studies in mathematics.

Mathematics Education

Contact Information—See Education: Curriculum and Instruction for M.A. and Ph.D. information.

Professor
Thomas R. Post, AM

Associate Professor
Kathleen Cramer, AM

Assistant Professor
Jeremy Kahan, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—By focusing on the curricular and instructional processes central to all educational endeavors, graduate programs within the Department of Curriculum and Instruction prepare students for professional roles in pre-K-12 education, in postsecondary and research settings, and in educational service agencies.

The M.A. in mathematics education serves students interested in teaching at the elementary, middle grades, and secondary school levels. Students design their program of study in consultation with their adviser.

Prerequisites for Admission—Prerequisites vary among areas of emphasis or concentration. Generally a bachelor’s degree with licensure or teaching experience fulfills the requirement. For some areas, however, there is no equivalent undergraduate program. In that case, 15 to 20 credits of work at the undergraduate level determined acceptable by advisers and the director of graduate studies are adequate.

Special Application Requirements—Scores from the GRE are required. Master’s applications are reviewed by department faculty continually throughout the academic year.

Use of 4xxx—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program’s approval.

Courses—Please refer to Mathematics Education (MthEd), Curriculum and Instruction (CI), and Education (Educ) in the course section of this catalog for courses pertaining to the program.

M.A. Plan B Degree Requirements
The program requires 30 credits: at least 14 credits in the major, at least 7 credits in research (including a 6-credit Plan B research paper), and at least 6 credits from a related field chosen with the consent of the adviser. Typically courses also are taken in mathematics and educational psychology.

Language Requirements—None.

Final Exam—The final exam is oral.

Mechanical Engineering

Contact Information—Mechanical Engineering and Industrial Engineering Graduate Programs, University of Minnesota, 1120 Mechanical Engineering, 111 Church Street S.E., Minneapolis, MN 55455 (612-625-2009; fax 612-624-2010; e-mail radinfo@me.umn.edu; <www.me.umn.edu/>).

Regents’ Professor
Ernst R. G. Eckert (emeritus), FM
Richard J. Goldstein, FM
Benjamin Y. H. Liu, FM

Professor
Avram Bar-Cohen, FM
Perry L. Blackshear (emeritus), FM
Jane H. Davidson, FM
Max Donath, FM
William K. Durfee, FM
Arthur G. Erdman, FM
Edward A. Fletcher (emeritus), FM
Steven L. Girshick, FM
Peter A. Hancock, Kinesiology, AM
Joachim V. R. Heberlein, FM
Warren E. Ibele (emeritus), FM
David B. Kittelson, FM
Barney E. Klamecki, FM
Thomas H. Kuehn, FM
Francis A. Kulacki, FM
Tariq O. Kusalik, FM
Jack L. Lewis, FM
Virgil A. Marple, FM
Peter H. McMurry, FM
Katsuhiko Ogata, FM
Suhas V. Patankar (emeritus), FM
Emil Pfender (emeritus), FM
David Y. H. Pui, FM
Subbiah Ramalingam, FM
James W. Ramsey, FM
Terrence W. Simon, FM
Ephraim M. Sparrow, FM
Patrick J. Starr, FM
Kim A. Stelson, FM
Paul J. Strykowski, FM
Kumar K. Tamma, FM

Associate Professor
Saifallah Benjaafar, FM
John C. Bischof, FM
Thomas R. Chase, FM
Caroline C. Hayes, FM
Uwe R. Kortshagen, FM
Susan C. Mantell, FM
Bradley J. Nelson, FM
Michael R. Zachariah, FM

Assistant Professor
Sean C. Garrick, FM
Perry Y. Li, FM
Rajesh Rajamani, FM
Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Coursework and research for all graduate degrees are offered in bioengineering; biomechanics; combustion; computer-aided design; computer-aided manufacturing; computer graphics; control systems; design; energy conservation; environmental control; environmental engineering; fluid mechanics; heat and mass transfer; history of science and technology; human factors engineering; industrial engineering; innovative methodologies; integration of structural and environmental systems; lubrication; manufacturing engineering; particle technology; plasma chemistry; plasma heat transfer; power, propulsion, and applied thermodynamics; socioeconomic systems; solar energy; solar processing and thermochemistry; statistics; structures; systems dynamics; technology assessment; thermal energy storage; thermal environmental engineering; thermodynamics; transportation; tribology; vibration; and interdisciplinary finite element methodology. Additional instructional and research programs can be formulated.

Prerequisites for Admission—An undergraduate degree in engineering or in a closely related scientific field such as physics, chemistry, or mathematics, is required. Unusually well-qualified students may be admitted directly to the Ph.D. program with a baccalaureate degree.

Special Application Requirements—GRE General Test scores are required for admission and also are used in evaluating requests for financial aid. For the Ph.D. program, three letters of recommendation from senior faculty members at the previous educational institution are required, including one from the master’s degree adviser. Students are admitted in the fall and spring semesters only, the departmental deadlines for which are December 15 and October 15, respectively.

Use of 4xxx Courses—Selected 4xxx courses from other departments may be applied toward the degree in consultation with the student’s adviser and the director of graduate study. No 4xxx ME courses may be applied toward the degree.

Courses—Please refer to Mechanical Engineering (ME) in the course section of this catalog for courses pertaining to the program.

M.S.M.E. Degree Requirements
The M.S.M.E. requires at least 30 credits, including at least 14 course credits in the major and 6 course credits in a minor or related field. At least 1 credit of graduate seminar and 1 mathematics/numerical methods course from an approved list must be included in the 30 credits. Also, of the 30 credits, Plan A (thesis) students must enroll for 10 thesis credits. For Plan B (non-thesis), one to three Plan B papers are required (the number in part depending on their length), determined in consultation with the adviser. The papers may derive from courses in the major or may address topics chosen by a graduate faculty member and the student.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—At least 6 credits in mechanical engineering are required for a master’s minor.

Ph.D. Degree Requirements
The Ph.D. requires at least 44 course credits, including at least 12 course credits in a minor field or supporting program and at least 2 credits of graduate seminar, along with at least one mathematical/numerical methods course from an approved list; 24 thesis credits are also required.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—At least 12 credits in mechanical engineering is required for a doctoral minor.

Mechanics
See Aerospace Engineering and Mechanics.

Medical Physics
See Biophysical Sciences and Medical Physics.

Medicinal Chemistry
Contact Information—Department of Medicinal Chemistry, University of Minnesota, 8-101 Weaver-Densford Hall, 308 Harvard Street S.E., Minneapolis, MN 55455-0343 (612-624-9919; fax 612-624-0139; e-mail medchem@umn.edu; <www.pharmacy.umn.edu/grad/medchem/index.htm>.

Professor
Yusuf J. Abul-Hajj, FM
S. Mbua Ngale Efange, Radiology, FM
Patrick E. Hanna, FM
Stephen S. Hecht, Laboratory Medicine and Pathology, FM
Rodney L. Johnson, FM
Philip S. Portoghese, FM
Rory P. Remmel, FM
David H. Sherman, Microbiology, FM
W. Thomas Shier, FM
Marilyn K. Speedie, FM
Robert Vince, FM

Adjunct Professor
Herbert T. Nagasawa, FM

Associate Professor
David M. Ferguson, FM
Deborah A. Kallick, FM
Lisa A. Peterson, Environmental and Occupational Health, FM
Carston R. Wagner, FM

Assistant Professor
Natalia V. Tretyakova, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The program emphasizes the application of chemical principles to research on the action of drugs on biological systems. Courses offered by the program focus on general principles of medicinal chemistry, drug design and synthesis, chemical aspects of drug metabolism, chemical mechanisms of drug toxicity and carcinogenicity, computer-assisted drug design and receptor modeling, and combinatorial chemistry.

Prerequisites for Admission—Applicants should have a B.S. or M.S. degree in an appropriate related science field such as pharmacy, chemistry, or biology. Students majoring in other degree programs that encompass chemical, biochemical or biological fields of study are also encouraged to apply. All applicants should have completed undergraduate chemistry through elementary organic chemistry. Undergraduate coursework in biochemistry and physical chemistry also is a prerequisite, but under certain circumstances such coursework may be taken during the first year. Students usually are admitted fall semester only and admissions are generally for the Ph.D. program only.

Special Application Requirements—Scores from the General (Aptitude) Test of the GRE, three letters of recommendation from college-level faculty, a complete set of official transcripts, and a statement of immediate and long range career objectives are required. All application materials should be submitted by mid January to ensure priority consideration for fellowship, teaching and research assistantships awarded for the next academic year.

Use of 4xxx-level Courses—Use of 4xxx courses is not permitted toward degree requirements.

Courses—Please refer to Medicinal Chemistry (MedC) in the course section of this catalog for courses pertaining to the program.

M.S. Plan A Degree Requirements
Students must complete a core curriculum of advanced courses in organic chemistry (4 credits) medicinal chemistry (10 credits), and 6 credits in a minor or related field.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A minimum of 6 credits is required for a master’s minor.

Ph.D. Degree Requirements
All students must complete a core curriculum of advanced courses in organic chemistry (7 credits), biochemistry (8 credits), and medicinal chemistry (12 credits). Students
must also participate in the department seminar program, successfully complete a cumulative exam requirement that serves as the preliminary written exam, and prepare and defend an original research proposal which serves as the preliminary oral exam.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A minimum of 12 credits is required for the doctoral minor, including an introductory course (MedC 5600), advanced medicinal chemistry courses, and other courses in the medicinal chemistry core curriculum.

Medieval Studies

Contact Information—Center for Medieval Studies, University of Minnesota, 304 Walter Library, 117 Pleasant Street S.E., Minneapolis, MN 55455 (612-626-0805; fax 612-626-7735; e-mail cmestd@umn.edu).

Professor
Ronald F. Akehurst, French and Italian, E
Bernard S. Bachrach, History, E
Caesar E. Farah, Afro-American and African Studies, E
Evelyn S. Firchow, German, Scandinavian, and Dutch, E
Donna G. Cardamone Jackson, Music, E
Klaus P. Jankofsky, English, Duluth, E
Calvin B. Kendall, English, E
Anatoly Liberman, German, Scandinavian, and Dutch, E
Susan J. Noakes, French and Italian, E
Thomas S. Noonan, History, E
James A. Parente, Jr., German, Scandinavian, and Dutch, E
William D. Phillips, Jr., History, E
Kathryn L. Reyerson, History, E
Anthony N. Zahareas, Spanish and Portuguese, E

Associate Professor
G. Lee Fullerton, German, Scandinavian, and Dutch, E
Kaaren E. Grimstad, German, Scandinavian, and Dutch, E
Michal A. Kobialka, Theatre Arts, E
Nita Krevans, Classical and Near Eastern Studies, E
Ronald L. Martinez, French and Italian, E
Oliver Nicholson, Classical and Near Eastern Studies, E
John W. Steyaert, Art History, E
Ray M. Wakefield, German, Scandinavian, and Dutch, E
John A. Watkins, English, E

Curriculum—The medieval studies minor is available to master’s (M.A. and M.F.A.) and doctoral students. The Center for Medieval Studies (CMS) encourages collegial interaction and scholarly collaboration among faculty and students in all areas of medieval studies. CMS seeks to provide an opportunity for scholars of all disciplines and at all levels to focus intensively on historical, literary, anthropological, social, economic, religious, artistic, cultural, and methodological inquiries into the medieval period, which may fall within the chronology of roughly 300 to 1500 A.D. and may include the geographical area of Europe, the Middle East, and Russia. The primary emphasis of the program is on Latin, which is the most common learned and written language of the period, and secondarily on an interdisciplin- ary approach to medieval culture. The minor involves the Departments of History; Art History; Theatre Arts; Music; English; French and Italian; German, Scandinavian, and Dutch; Spanish and Portuguese; and Classical and Near Eastern Studies.

Prerequisites for Admission—Admission to a medieval studies graduate minor is contingent upon prior admission to a master’s or doctoral degree-granting program in the Graduate School.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted based on director of graduate study approval.

Courses—Please refer to Medieval Studies (MeSt) in the course section of this catalog for courses pertaining to the program.

Freestanding Minor Requirements
The master’s minor requires 6 graduate credits: two courses in medieval studies outside the student’s major department, including a Latin course (Latin 33xx or 34xx taken as 8120 or any Latin course at 5xxx or above) and either one MeSt core course (5610 or 8110) or another approved course with medieval or Latin content; if the latter option is chosen, MeSt 8010 (the medieval colloquium course) is also required.

The doctoral minor requires 12 graduate credits, comprising courses in medieval studies outside the student’s major department and including an additional Latin course at 5xxx or above. Students from Classical fields using Latin to satisfy requirements in those fields must substitute an equivalent quantity of a medieval vernacular language for the medieval studies Latin requirement.

Microbial Ecology

Contact Information—Michael Sadowsky, Microbial Ecology Minor Program, University of Minnesota, 258 Borlaug Hall, 1991 Upper Buford Circle, St. Paul, MN 55108 (612-624-2706; e-mail sadowsky@soils.umn.edu).

Professor
Iris D. Charvat, Plant Biology, E
Arnold G. Fredrickson, Chemical Engineering and Materials Science, E
Gregory R. Germaine, Oral Sciences, E
Richard S. Hanson, Microbiology, E
Linda L. Kinkel, Plant Pathology, E
Timothy J. Kurtz, Entomology, E
David J. McLaughlin, Plant Biology, E
Robert O. Megard, Ecology, Evolution, and Behavior, E
Jean-Alex E. Molina, Soil, Water, and Climate, E
Philip J. Regal, Ecology, Evolution, and Behavior, E
Michael J. Sadowsky, Soil, Water, and Climate, E
G. David Tilman, Ecology, Evolution, and Behavior, E
Lawrence P. Wackett, Biochemistry, E

Associate Professor
Randall E. Hicks, Biology, Duluth, E

Curriculum—This minor is available to master’s (M.S.) and doctoral (Ph.D.) students. Microbial ecology is an interdisciplinary research area concerned with the relationships of microorganisms to their natural environment. The microbial ecology minor offers core coursework in microbiology, microbial physiology, microbial genetics, and theoretical ecology as well as in microbial ecology. Additional courses and opportunities to interact with others interested in microbial ecology are also part of the minor. The microbial ecology/biotechnology seminar series allows students and faculty to interact with microbial ecologists from other universities. The curriculum encourages interdisciplinary interaction, communication, and synthesis.

Prerequisites for Admission—To be admitted to the minor, a student must be admitted to a master’s or doctoral degree-granting program within the Graduate School, should have broad training in the biological sciences, and must be accepted by the director of graduate studies of the microbial ecology minor program. All students are expected to have had the equivalent of introductory microbiology (MicB 5105) and general ecology, but may fulfill deficiencies in these areas by taking these courses while in the program.

Special Application Requirements—Consult the director of graduate studies. Students are admitted each semester.

Use of 4xxx Courses—Inclusion of more than one 4xxx course on degree program forms is subject to adviser and director of graduate study approval.

Courses—Please contact the minor program office for information on relevant coursework.

Freestanding Minor Requirements
The master’s minor requires 6 graduate credits, all of which must be outside the student’s major department and must include at least one laboratory course in microbiology (e.g., MicB 4215) and one ecology (EEB) course chosen from the list below. The remaining courses also are chosen from this list with the guidance and approval of the director of graduate studies in microbial ecology.

The doctoral minor requires 12 graduate credits, 9 credits of which must come from the core courses listed below (contact the director of graduate studies for potential alternatives to these courses). The remaining credits must come from at least two courses chosen from this list, but may not be in the student’s major.

Core Courses: EEB 5053—Ecology Theory and Concepts (4 cr); MicB 4111—Microbial Physiology and Diversity (3 cr); MicB 4211—Microbial Ecology and Applied Microbiology (3 cr); MIMP 8002—Structure, Function, and Genetics of Bacteria and Viruses (4 cr).
Microbial Engineering

Contact Information—M.S. Program in Microbial Engineering, Biological Process Technology Institute, University of Minnesota, 1479 Gortner Avenue, Suite 240, Technology Institute, University of Microbial Engineering, Biological Process Technology Institute (BPTI), involving faculty from ten departments and four institutes of the University.

Prerequisites for Admission—A baccalaureate degree in biological sciences, biochemistry, chemistry, or chemical engineering is preferred. Undergraduate coursework should include one year each of calculus, organic chemistry, physics, microbiology, and basic chemical engineering, as well as a background in basic microbiology, physical chemistry, biochemistry, and genetics. Deficiencies may be made up during the first year of graduate studies.

Special Application Requirements—Three letters of recommendation, scores from the General Test of the GRE, the TOEFL score for international applicants, transcripts, and an autobiographical statement including occupational goals must be submitted to the director of graduate studies. Applications are accepted at any time, but the majority of students are accepted for fall semester. To receive full consideration for financial aid, students must apply for fall semester admission by February 1.

Use of 4xxx Courses—A limited number of 4xxx courses are permitted toward degree requirements based on director of graduate studies approval.

Courses—Please refer to Microbial Engineering (MicE) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. requires 32 credits (including 10 thesis credits) for Plan A and 32 credits (including 1-3 research credits) for Plan B. The two-year program comprises coursework in a specialized program of microbiology, molecular biology, immunology, and chemical engineering. In addition, students present two seminars and teach one laboratory course in advanced microbiology, biochemistry, molecular biology, immunology, or chemical engineering. Students may choose supporting coursework (at least 6 credits) from specified fields, including biochemistry, food science, pharmacognosy, genetics, and cell biology and must demonstrate proficiency in computer programming and one computer language. Plan A students carry out a research project resulting in a thesis. Plan B students complete a summer preceptorship (about 2-1/2 months) in a private company research laboratory or at a research institute in the University and prepare a Plan B paper based on the research project. Presentation of the original laboratory research thesis/project to the graduate faculty is required at the end of the second year.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A minor in microbial engineering is offered at the doctoral level only. Students must complete at least 12 credits, selected in consultation with the director of graduate studies for microbial engineering.

Microbiology, Immunology, and Cancer Biology

Contact Information—Microbiology, Immunology, and Cancer Biology Program, University of Minnesota, Mayo Mail Code 196, 420 Delaware Street S.E., Minneapolis, MN 55455 (mailing address) (612-624-5947; fax: 612-626-0623; e-mail mica@mail.ahc.umn.edu).

Regents’ Professor

Ashley T. Haase, FM

Professor

Khalil Ahmed, Laboratory Medicine and Pathology, FM
Dwight L. Anderson, Oral Sciences, FM
Fred S. Apple, Laboratory Medicine and Pathology, FM
Timothy W. Behrens, Medicine, FM
Judith G. Berman, Genetics, Cell Biology, and Development, FM
Peter B. Bitterman, Medicine, FM
Bruce R. Blazar, Pediatrics, FM
Paul P. Cleary, FM
Anath Das, Biochemistry, FM
Gary M. Dunny, FM
Lynda B. Ellis, Laboratory Medicine and Pathology, FM
Anthony J. Faras, FM
Leo T. Furcht, Laboratory Medicine and Pathology, FM
Vincent F. Garry, Laboratory Medicine and Pathology, FM
Dale S. Gregerson, Ophthalmology, FM
Richard S. Hanson, FM
Robert P. Hebel, Medicine, FM
Alan B. Hooper, Biochemistry, FM
Harry S. Jacob, Medicine, FM
Marc K. Jenkins, FM
Russell C. Johnson, FM
John H. Kersey, Laboratory Medicine and Pathology, FM
Tucker W. LeBien, Laboratory Medicine and Pathology, FM
Walter C. Low, Neurosurgery, FM
Paul T. Magee, Genetics and Cell Biology, FM
James B. McCarthy, Laboratory Medicine and Pathology, FM
R. Scott Mclvor, Laboratory Medicine and Pathology, FM
Larry L. McKay, Food Science and Nutrition, FM
Matthew F. Mescher, Laboratory Medicine and Pathology, FM
Jeffrey S. Miller, Medicine, FM
Theodore R. Oegema, Jr., Orthopaedic Surgery, FM
Harry T. Orr, Laboratory Medicine and Pathology, FM
Peter G. W. Plagemann, FM
Sundaram Ramakrishnan, Pharmacology, FM
Gunda H. R. Rao, Laboratory Medicine and Pathology, FM
Michael J. Sadowsky, Soil, Water, and Climate, FM
Michel M. Sanders, Biochemistry, Molecular Biology, and Biophysics, FM
Patrick M. Schlievert, FM

Minor Requirements for Students Majoring in Other Fields—A minor in microbial engineering is offered at the doctoral level only. Students must complete at least 12 credits, selected in consultation with the director of graduate studies for microbial engineering.
Janet L. Schottel, Biochemistry, FM
David H. Sherman, FM
Yoji Shimizu, Laboratory Medicine and Pathology, FM
Keith M. Skubitz, Medicine, FM
Daniel A. Valler, Therapeutic Radiology, FM
Brian G. Van Ness, Biochemistry, FM
Gregory M. Vercellotti, Medicine, FM
Catherine M Verfaillie, Medicine, FM
Lawrence P. Wackett, Biochemistry, FM
Lee W. Wattenberg, Laboratory Medicine and Pathology, FM
Carol L. Wells, Laboratory Medicine and Pathology, FM

Associate Professor
Mitchell A. Abrahamsen, Veterinary Pathobiology, FM
Vivian J. Bardwell, Biochemistry, FM
Kathleen F. Conklin, FM
Alejo Erice, Laboratory Medicine and Pathology, FM
William B. Gleason, Laboratory Medicine and Pathology, FM
Betsy A. Hirsch, Laboratory Medicine and Pathology, FM
Kristin A. Hoggquist, Laboratory Medicine and Pathology, FM
Stephen C. Jameson, Laboratory Medicine and Pathology, FM
Ronald R. W. Jennerson, FM
Vivek Kapur, Veterinary Pathobiology, FM
Daniel L. Mueller, Medicine, FM
Christopher A. Pennell, Laboratory Medicine and Pathology, FM
Leslie A. Schiff, FM
Amy P. Skubitz, Laboratory Medicine and Pathology, FM
Peter Southern, FM
Carston R. Wagner, Medicinal Chemistry and Pharmacognosy, FM

Assistant Professor
Sandia K. Armstrong, FM
Paul Bohjanen, FM
Michael A. Farrar, Laboratory Medicine and Pathology, FM
Linda K. Hansen, Laboratory Medicine and Pathology, FM
Alexander Khoruts, FM
Carol A. Lange, Medicine, FM
David A. Largaespada, Laboratory Medicine and Pathology, FM
Christian D. Mohr, FM
Yun Qiu, Laboratory Medicine and Pathology, FM
Robert Saeft, Biochemistry, FM
Wufan Tao, Medicine, FM
Johannes van der Loo, Medicine, FM
Bruce K. Walcheck, Veterinary Pathobiology, FM
Jennifer J. Westendorf, Orthopedic Surgery, FM

Lecturer
Agustin P. Dalmasso, Medicine, FM

Research Associate
Rod M. Feddersen, Laboratory Medicine and Pathology, AM
Brett K. Leavy-Young, Surgery, FM
Stephen Rice, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Students prepare for careers in biomedical research and teaching by completing broad training in molecular biology or biological sciences, and focused specialization in one of three concentrations (microbiology, immunology, or cancer biology). The program offers exceptional research opportunities for graduate training in autoimmunity, biotechnology, cancer biology, environmental microbiology, genetic engineering of microorganisms, lymphocyte activation and development, microbial pathogenesis, molecular genetics of disease, superantigens, and vascular biology and inflammation.

Prerequisites for Admission—College coursework, including a year of general chemistry; organic chemistry; physics; calculus; and one academic year or the equivalent of courses in the biological sciences supplemented by courses in biochemistry and genetics. A course in microbiology, immunology, or histology is highly recommended but not required.

Special Application Requirements—The following must be submitted to the program: three letters of recommendation; scores from the General (Aptitude) Test of the GRE; a copy of your transcripts; a copy of the Graduate School application; and a brief description of reasons for seeking an advanced degree, areas of research interest and reasons for these interests, and career objectives. A minimum TOEFL score of 600 is required of applicants whose native language is not English. Applicants are encouraged to apply for fall semester admission only because the core curriculum begins in fall. Applications should be submitted by December 15; those received after that date are considered only if space in the desired program is available.

Use of 4xxx Courses—Use of 4xxx courses on degree program forms is permitted based on director of graduate study approval.

Courses—Please refer to Microbiology, Immunology, and Cancer Biology (MICa) in the course section of this catalog for courses pertaining to the program.

M.S. Plan A Degree Requirements
Students are not admitted directly into the master’s program; it is available only by special arrangement with the program. Students complete 14 MICa course credits, 6 credits in the minor or related field, and 10 thesis credits. Students must write and defend a thesis based on original research.

Language Requirements—None.

Final Exam—The final exam is oral.

Ph.D. Degree Requirements
The Ph.D. requires a minimum of 22 course credits in the major, 12 course credits in a minor or supporting program, and 24 thesis credits.

Beginning study in the fall, students spend their first year on major coursework, identifying an adviser by doing laboratory rotations, selecting a concentration, and initiating their thesis research project. All students take courses on the structure, function, and metabolism of microorganisms; molecular immunology; and cancer biology, as well as in their chosen concentration during their first two years.
Curriculum—This program provides scientific training in the basic life sciences, with emphasis on the molecular basis of genetics, development, and cell biology. Areas of specialization include membranes, receptors, and membrane transport; cell interactions; macromolecular structure; extracellular matrix; cytoskeleton and cell motility; regulation of gene expression; neuroscience; developmental mechanisms; human genetics; plant cell and molecular biology; genetic mechanisms; and genomics. The program is interdisciplinary and involves faculty from several departments in the College of Biological Sciences, the Medical School, the College of Agricultural, Food, and Environmental Sciences, the School of Dentistry, the College of Veterinary Medicine, and the School of Public Health. Special institutes in human genetics, plant molecular genetics, and biological process technology provide opportunities for graduate study, as does a specialty in genetic counseling.

Prerequisites for Admission—The program is sufficiently flexible to accommodate students with a wide range of backgrounds. Students with bachelor’s degrees in any of the biological, chemical, or physical sciences are encouraged to apply. Recommended academic preparation includes one year each of calculus, organic chemistry, and physics, and background in basic biology including genetics, cell biology, and genetics. Research experience is highly desirable. For students of demonstrated ability, background deficiencies can be made up during the first year of graduate study. Exceptional international applicants with TOEFL scores of 650 or better will be considered.

Special Application Requirements—Applicants are required to submit three letters of recommendation from persons familiar with their academic and research capabilities; scores from the General (Aptitude) Test of the GRE; and a statement of interests, goals, and research experience. The Subject (Advanced) Test (in biology; chemistry; or biochemistry, cell and molecular biology) of the GRE is not required but highly recommended. Recommended date for receipt of completed applications is January 15. Graduate studies typically begin in summer session or fall term.

Use of 4xxx Courses—Use of 4xxx courses is not permitted toward degree requirements.

Courses—Please refer to Molecular, Cellular, Developmental Biology and Genetics (MCDG) and Genetics, Cell Biology, and Development (GCD) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

Students are admitted to the M.S. program only under exceptional circumstances (e.g., if they can be in the area for only two years) or if they are accepted into the genetic counseling specialization; in both cases, applicants must also be competitive for admission at the Ph.D. level. The M.S. is offered under Plan A and Plan B. Plan A requires a minimum of 20 course credits and 10 thesis credits; Plan B requires a minimum of 30 course credits and the completion of Plan B papers. Students take a core curriculum, which is multidisciplinary and contributes to both the major and minor or related field requirements. Students may choose a concentration or specialization within the program such as cell biology, developmental biology, genetics, or human genetics. The M.S. on average takes two years to complete.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students

Majoring in Other Fields—A master’s minor requires 6 credits.

Ph.D. Degree Requirements

The Ph.D. program is designed by the student and the adviser to meet individual interests and goals. Advanced courses in genetics, molecular biology, cell biology, developmental biology, and biochemistry are required, in addition to special courses, topical seminar courses, laboratory research rotations, thesis research, student research seminars, departmental seminars, and journal clubs.

Language Requirements—None.

Minor Requirements for Students

Majoring in Other Fields—A doctoral minor typically includes the genetics core (GCD 8131 and 8121 or 4034), cell biology (GCD 8151 or 5036), and developmental biology (GCD 8161, 4151 or 4161), as appropriate to the student’s field of specialization.

Molecular Veterinary Biosciences

Contact Information—See Veterinary Medicine.

Professor

Trevor R. Ames, Clinical and Population Sciences, FM
Alvin J. Beitz, Veterinary Pathobiology, FM
Russell F. Bey, Veterinary Pathobiology, FM
David R. Brown, Veterinary Pathobiology, FM
James E. Collins, Veterinary Diagnostic Medicine, FM
Agustin P. Dalmasso, Medicine, FM
Mohamed Elhalawany, Animal Science, FM
Douglas N. Foster, Animal Science, FM
Esther M. Gallant, Veterinary Pathobiology, FM
Sagar Goyal, Veterinary Diagnostic Medicine, FM
Mathur S. Kannan, Veterinary Pathobiology, FM
Alice A. Larson, Veterinary Pathobiology, FM
Samuel K. Maheswaran, Veterinary Pathobiology, FM
Thomas W. Molitor, Clinical and Population Sciences, FM
Michael P. Murthaugh, Veterinary Pathobiology, FM
Scott M. O’Grady, Animal Science, FM
John W. Osborn, Animal Science, FM
Douglas J. Weiss, Veterinary Pathobiology, FM

Associate Professor

Mitchell S. Abrahamson, Veterinary Pathobiology, FM
Cathy Sue Carlson, Veterinary Diagnostic Medicine, FM
Vivek Kapur, Veterinary Pathobiology, FM
Ph.D. Degree Requirements
The Ph.D. requires a core curriculum of fundamental coursework and laboratory experiences followed by one or more courses in areas of special interest. Considerable flexibility is available for students to construct a program around their own interests. Students also take 12 credits in a minor or supporting program and 24 thesis credits. All students are expected to participate in two continuing series of seminars: one involving reports on current literature and research and the other involving seminars by prominent national and international scientists.

Language Requirements—None.

Museum Studies

Contact Information—Museum Studies Graduate Minor; 300 Bell Museum, 10 Church Street S.E., University of Minnesota, Minneapolis, MN 55455 (612-624-6380; fax 612-626-7704).

Regent’s Professor
Joanne B. Eicher, E

Professor
Kerry J. Freedman, E
Robert J. Poor, E
Peter S. Wells, E
Gayle Graham Yates, E

Associate Professor
Margaret K. DIBlasio, E

Assistant Professor
David J. Rhees, E

Lecturer
Anita F. Cholewa, E

Other
Robert D. Jacobsen, E
Lyndel I. King, E
Patricia J. McDonnell, E
Gordon R. Murdock, E
Colleen J. Sheehy, E

Curriculum—The museum studies minor offers a structured graduate curriculum for master’s (M.A. and M.S.) and doctoral students interested in museums. It provides students from a variety of disciplines with an introduction to the issues involved in museum practices (e.g., educational, curatorial, administrative, and conservation). The curriculum includes seminars and internships.

Prerequisites for Admission—A bachelor’s degree in biological sciences is required.

Use of 4xxx Courses—Use of 4xxx courses is not permitted toward degree requirements.

Courses—Please refer to Molecular Veterinary Biosciences (MVB) in the course section of this catalog for courses pertaining to the program.

M.S. Plan A Degree Requirements
The M.S. requires a core curriculum of fundamental coursework and laboratory experiences followed by one or more courses (6 credits) in the area of specialization. Students complete 20 course credits and 10 thesis credits; the thesis is based on original laboratory research.

Language Requirements—None.

Final Exam—The final exam is oral.
Degree Programs and Faculty

Charles Ullery, E  
Jeffrey W. Van, E  
Herbert E. Winslow, E

Other
Julia Bogorad, E  
Gary A. Bordner, E  
Christopher Brown, E  
Jonja Fleezanis, E  
Kathryn Greenbank, E  
Barbara G. Kierig, E  
Adam Kuenzel, E  
Timothy Paradise, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The School of Music offers a master of arts (M.A.) in music, a master of music (M.M.), a master of philosophy (Ph.D.), and a doctor of musical arts (D.M.A.), and an M.A. in musicology. The School of Music offers a curriculum—required for registration in all applied music programs. The credit totals for all degree emphases are as follows: 85 credits for piano, harpsichord, organ, voice, violin, viola, cello, double bass, flute, oboe, clarinet, saxophone, bassoon, French horn, trumpet, trombone, euphonium, tuba, percussion, harp, guitar, piano pedagogy, accompanying and coaching, orchestral conducting, wind ensemble and band conducting, choral conducting, and church music (choral and organ concentrations).

M.M. Plan B Degree Requirements
The master of music degree (Plan B only) offers emphases in piano, harpsichord, organ, voice, violin, viola, cello, double bass, flute, oboe, clarinet, saxophone, bassoon, French horn, trumpet, trombone, euphonium, tuba, percussion, harp, guitar, piano pedagogy, accompanying and coaching, orchestral conducting, wind ensemble and band conducting, choral conducting, and church music (choral and organ concentrations). The M.M. Plan B requires credit distribution among the following for each emphasis: applied music, study directly related to the emphasis (literature, pedagogy, performance practice, conducting, secondary instrument, chamber music, etc.), ensemble, and MUs 5xxx or 8xxx musicology/ethnomusicology and theory/composition, with a minimum of one 3-credit course in each area. At least one recital is required.

The minimum credit requirement for each emphasis is as follows: 30 credits are required for piano, instrumental performance, harp, guitar, piano pedagogy, orchestral conducting, wind ensemble and band conducting, and church music (choral concentration); 32 credits for choral conducting; 33 credits for organ and voice; 40 credits for church music (organ concentration); and 41 credits for accompanying and coaching (two recitals are required).

Language Requirements—None.

Final Exam—A final oral exam is required that covers coursework and the final project and/or recital.

D.M.A. Degree Requirements
For the doctor of musical arts (D.M.A.), emphases and minimum credit requirements are as follows: 85 credits for piano, instrumental performance, guitar, and conducting; 87 credits for organ and woodwinds; 89 credits for voice; and 93 credits for accompanying and coaching.

Beginning spring semester 2001, the School of Music will offer two ways of fulfilling D.M.A. degrees.

The first option for the D.M.A. requires a minimum of 85 credits: 32 credits of applied study; 12 credits in musicology/ethnomusicology and theory/composition, with at least one 3-credit course in each area; a minimum of 8 credits directly related to the emphasis (literature, pedagogy, performance practice, conducting, secondary instrument, chamber music, etc.); 9 credits in a supporting program outside of music; 20 recital credits for five recitals; and 4 thesis credits for the D.M.A. project document.

The M.M. and D.M.A. programs in performance, applicants living more than 200 miles from Minneapolis may submit a tape in lieu of a live audition. In the case of admission based on a taped recording, the appropriate level of study, including the possibility of remedial work, is determined by a live audition before registration. For the M.M. and D.M.A. in accompanying and coaching, a preliminary (audio) tape screening is required. For the M.M. and D.M.A. in orchestral conducting and the M.M. in wind ensemble/band conducting, a preliminary tape screening is required in both audio and video formats.

Although students may be admitted any semester, opportunities for financial assistance are maximized by applying before January 15 for fall admission. Applicants to the musicology/ethnomusicology, theory, and composition emphases maximize their chances for admission by completing their applications before March 1 for fall admission.

Diagnostic Tests—Music Theory and Music History Placement Tests are administered to all entering students. All graduate students in musicology must demonstrate proficiency in the material found in the undergraduate music theory and ear training sequences, including the form and structure of tonal music and twentieth-century music theory and ear training. Similarly, they must demonstrate proficiency in music history from the Middle Ages to the present. Students in musicology and ethnomusicology degree programs must take an additional discipline-specific diagnostic examination at the onset of their study; during the first year, a piano proficiency test is administered for the musicology specialization and a transcription proficiency test is administered for ethnomusicology. An audition is required for registration in all applied music courses.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is subject to adviser and/or director of graduate studies approval.

Courses—Please refer to Music (Mus), Music Applied (MusA), and Music Education (MuEd) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
The master of arts in music offers emphases in musicology and ethnomusicology (Plan A and Plan B), theory (Plan B only), and composition (Plan B only).

The M.A. in music with emphasis in musicology and ethnomusicology requires 34 credits (24 course credits and 10 thesis credits) for Plan A and 30 course credits for Plan B; the emphasis in composition requires 41 course credits (Plan B only), and the emphasis in music theory requires 30 course credits (Plan B only). The credit totals for all emphases include 6 credits required for courses outside the major field.

Degree Objective Additional Materials
Theory (M.A., Ph.D.) Original papers (tonal and post-tonal analysis)

Composition (M.A., Ph.D.) Original scores

Musicology/ Ethnomusicology (M.A., Ph.D.) Original paper(s)

Music Education/ Music Therapy (M.A.) None

Music Education/ Music Therapy (Ph.D.) Original paper(s)

Accompanying/Coaching (M.M., D.M.A.) Audition/ Repertoire list

Choral Conducting (M.M.) Audition/Interview

Church Music (M.M.) Audition/Interview

Orchestral Conducting (M.M., D.M.A.) Audition/Interview

Wind Ensemble/ Band Conducting (M.M.) Audition/Interview

Piano Pedagogy (M.M.) Audition/Interview

Performance (M.M., D.M.A.) Audition/ Repertoire list

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The second options allows students to choose a secondary area of concentration to become professionally prepared in an area that complements the performance major. The secondary area option requires the approval of the student’s adviser and of the director of graduate studies, and is limited to secondary areas approved by the Graduate Committee of the School of Music. Under this option, students perform three doctoral recitals instead of five (12 credits total, at 4 credits each). The remaining requirements are the same as in the first option for a D.M.A. Students must also fulfill the requirements for a secondary area as described below.

Criteria for Secondary Areas
A secondary area comprises a minimum of 15 credits in total—normally five 3-credit courses, at least two of which must be 8xxx courses. Students choosing this option apply the 8 credits that result from reducing the number of doctoral recitals from five to three toward the secondary area. The remaining credits are derived principally from the other areas of music study already built into the D.M.A.—the areas of musicology, theory, pedagogy, etc. The distribution of these credits depends upon the specific secondary area chosen.

A secondary area concentrates either on a single discipline—e.g., musicology, music theory, or composition—or on an interrelated body of courses—e.g., technology and music, or pedagogy. All 15 credits of a secondary area must be achieved at the University of Minnesota School of Music (i.e., no transfer credits or credits from outside of the School of Music can be used). Students who choose a secondary area are encouraged but not obligated to write their thesis in that area. A list of secondary areas and their course requirements is available upon request from the Graduate Studies Office of the School of Music.

Language Requirements—The D.M.A. with emphasis in accompanying and coaching requires two languages chosen from French, German, and Italian; the emphasis in conducting requires German and either French or Italian.

Ph.D. Degree Requirements
For the doctor of philosophy in music, emphases and minimum course credit requirements are as follows: 51 credits for musicology, ethnomusicology, and theory; 62 credits for composition; and 66 credits for music education. Programs are individualized and build on the core of coursework required for the corresponding master’s degrees. Coursework includes 12-18 credits outside the major. In addition, 24 thesis credits are required.

Language Requirements—The language requirement for each emphasis is as follows:

- Musicology, ethnomusicology, and composition—Two languages chosen from French, German, and Italian; substitution may be made when a different language is needed for the thesis. For composition, one language may also, with approval, be replaced by a collateral field of knowledge or a special research technique.

- Theory—German and either French or Italian (substitution may be made when a different language is needed for the thesis; with approval, the second language may also be replaced by a collateral field of knowledge or a special research technique).

Music education—None.

Music Education

Contact Information—See Music.

Professor
Paul A. Haack, AM
Jeffrey Kimpiton, AM

Associate Professor
Charles E. Furman, AM
Acosua Addo, AM
David J. Teachout, AM

Assistant Professor
Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The M.A. in music education offers two emphases: music education and music therapy. The music education emphasis involves planning, teaching, learning, and evaluating processes with musical content applied to formal schooling, kindergarten through college. While knowledge of acculturation phenomena is included, applications generally are directed toward formal educational settings. The music therapy emphasis furthers the preparation of professionals who use music to accomplish therapeutic aims. The two emphases are highly compatible and mutually enhancing. The M.A. is a research-oriented degree with coursework fairly evenly divided between scholarly skill development, musical knowledge and skills, theoretical music education content, and applications.

Prerequisites for Admission—See Music.

Special Application Requirements—See Music.

Use of 4xxx Courses—Use of 4xxx courses towards degree requirements is subject to adviser and/or director of graduate studies approval.

Courses—Please refer to Music (Mus), Music Applied (MusA), and Music Education (MuEd) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
The M.A. requires 30 course credits: 12 credits in music education for the major; 8 credits in music; 5 credits of electives from professional education, music, and music education; and a 5-credit research project (Plan B).

Language Requirements—None.

Final Exam—The final exam is oral.

Neuroscience

Contact Information—Neuroscience Program, University of Minnesota, D-610 Mayo Building, MMC 265, 420 Delaware St. S.E., Minneapolis, MN 55455 (612-626-5898; fax 612-626-6460; e-mail: neurosci@umn.edu; <www.neuroscience.umn.edu>).

Professor
Karen Hsiao Ashe, Neurology, FM
Alvin J. Beitz, Veterinary Pathobiology, FM
David R. Brown, Veterinary Pathobiology, FM
Dwight A. Burkhardt, Psychology, FM
Marilyn E. Carroll, Psychiatry, FM
H. Brent Clark, Laboratory Medicine and Pathology, FM
Janet M. Dubinsky, FM

John W. Day, Neurology, FM
William C. England, Surgery, FM
Martha Flanders, FM
William H. Frey, Pharmacy, FM
Apostolos P. Georgopoulos, FM
Glenn J. Giesler, Jr., FM
Boyd K. Hartman, Psychiatry, FM
William G. Iacono, Psychology, FM
Costantino Iadicola, Neurology, FM
Paul A. Iaizzo, Anesthesiology, FM
William R. Kennedy, Neurology, FM
Daniel J. Kersten, Psychology, FM
Seong-gi Kim, Radiology, AM
James F. Koerner, Biochemistry, FM
Alice A. Larson, Veterinary Pathobiology, FM
Ping-Yee Law, Pharmacology, FM
Gordon E. Legge, Psychology, FM
Paul C. Letourneau, FM
Allen S. Levine, Surgery, FM
Walter C. Low, Neurosurgery, FM
Patrick W. Mantyh, Preventive Sciences, FM
Steven C. McLoon, FM
Karen A. Mesce, Entomology, FM
Robert F. Miller, FM
Charles A. Nelson, Child Development, FM
Erie A. Newman, FM
Harry T. Orr, Laboratory Medicine and Pathology, FM
John W. Osborne, Animal Science, FM
J. Bruce Overmier, Psychology, FM
Richard E. Poppele, FM
Richard L. Purple, Physiology, FM
M. Elizabeth Ross, Neurology, FM
David A. Rotenberg, Neurology, FM
Peter A. Santi, Otolaryngology, FM
Ronald J. Sawchuk, Pharmaceutics, FM
Virginia S. Seybold, FM
John F. Soechting, FM
Peter W. Sorensen, Fisheries and Wildlife, FM
Sheldon B. Sparer, Pharmacology, FM
Stanley A. Thayer, Pharmacology, FM
David D. Thomas, Biochemistry, FM
Kamal Ugrubil, Radiology, FM
Govan T. Vatsarry, Psychiatry, FM
Neal F. Wiemeister, Psychology, FM
George L. Wilcox, Pharmacology, FM

Associate Professor
John H. Anderson, Otolaryngology, FM
James Ashe, Neurology, FM
W. Dale Branton, AM
John W. Day, Neurology, FM
Janet M. Dubinsky, FM
Patricia L. Faris, Psychiatry, FM
S. Hossenfatemi, Psychiatry, FM
Jurgen F. Fohlmeister, Physiology, FM
Christopher M. Gomez, Neurology, FM

John F. Soechting, FM
Peter W. Sorensen, Fisheries and Wildlife, FM
Sheldon B. Sparer, Pharmacology, FM
Stanley A. Thayer, Pharmacology, FM
David D. Thomas, Biochemistry, FM
Kamal Ugrubil, Radiology, FM
Govan T. Vatsarry, Psychiatry, FM
Neal F. Wiemeister, Psychology, FM
George L. Wilcox, Pharmacology, FM

Associate Professor
John H. Anderson, Otolaryngology, FM
James Ashe, Neurology, FM
W. Dale Branton, AM
John W. Day, Neurology, FM
Janet M. Dubinsky, FM
Patricia L. Faris, Psychiatry, FM
S. Hossenfatemi, Psychiatry, FM
Jurgen F. Fohlmeister, Physiology, FM
Christopher M. Gomez, Neurology, FM
Christopher N. Honda, FM
Eric Javel, Otolaryngology, FM
Juergen Konczak, Kinesiology and Leisure Studies, FM
Linda K. McLoon, Ophthalmology, FM
Jose V. Pardo, Psychiatry, FM
Laura P. W. Ranum, Molecular, Cellular, Developmental Biology, and Genetics, FM
John J. Sidits, Neurology, FM
Donald A. Simone, Psychiatry, FM
Richard L. Sutton, Neurosurgery, AM
Martin W. Wessendorf, FM

**Assistant Professor**

Bagrat Amirikian, AM
Vincent A. Barnett, Physiology, FM
Linda M. Boland, Physiology, FM
Frank H. Burton, Pharmacology, FM
Jian M. Ding, Medicine, FM
Janet I. Fitzakerley, Pharmacology UMD, FM
Jonathan Gewertz, Psychology, FM
Sheng He, Psychology, FM
Paulo Kofuji, FM
Scott M. Lewis, Neurology, AM
Paul G. Mermelstein, FM
Giuseppe Pellizzer, AM
A. David Redish, FM
Kevin D. Wickman, Pharmacology, FM

**Research Associate**

Rod M. Feldersen, Veterinary Pathobiology, AM
Jon Gottesman, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

**Curriculum**—Neuroscience is an interdisciplinary field of inquiry. The objects of this inquiry, the brain and nervous system, are sufficiently complex and unique among biological systems to require experimental and analytical approaches that cross the traditional boundaries of molecular and cell biology, behavioral biology, biochemistry, genetics, pharmacology, physiology, and psychology. In some instances, neuroscience inquiry may also encompass computer science, information processing, engineering, physics, and mathematics.

The neuroscience Ph.D. curriculum begins in the summer session with the intensive laboratory course in cellular and molecular neurobiology (NSc 5551), held at the Lake Itasca Biological Station. The core curriculum continues on the Twin Cities campus with NSc 5461, 5481, 5561, 5661, and 8211. While taking these courses, students explore research opportunities in the faculty’s laboratories (NSc 8334) and thereby select a thesis adviser. Most students take a course in cell biology (such as Biol 4004) in the first semester. Because thesis research is expected to include statistical analysis of data, a course in statistics (such as Stat 5021) is required.

Elective courses and at least 12 credits in a minor or supporting program are selected in consultation with the adviser (typical minors include cell biology, physiology, statistics, psychology, and medicine; medicine is primarily for students in the M.D./Ph.D. program). Students with sufficient background and previous course experience may apply for a waiver of specific requirements. Proficiency in at least one computer programming language is highly recommended.

Students are also expected to participate in teaching neuroscience and to attend the weekly colloquium as well as neuroscience seminars and sessions devoted to professional development. Students are strongly encouraged to attend seminars in other areas and departments that may interest them.

**Prerequisites for Admission**—Applicants to the Ph.D. program must have a bachelor’s degree or its foreign equivalent from a recognized college or university. Undergraduate coursework should include instruction in several of the following disciplines: biology, neuroscience, mathematics, physics, chemistry, and psychology.

**Special Application Requirements**—Applicants are required to take the GRE General Test. The Subject Test appropriate to their field of emphasis is optional. Foreign students must take the TOEFL and obtain a minimum score of 550.

**Use of 4xxx Courses**—Use of 4xxx courses toward degree requirements is permitted based on director of graduate studies approval.

**Courses**—Please refer to Neuroscience (NSc) in the course section of this catalog for courses pertaining to the program.

**M.S. Plan A Degree Requirements**

The course requirements for a master’s are the same as those for a Ph.D. degree. They are described under Curriculum (above).

**Ph.D. Degree Requirements**

The course requirements for a Ph.D. degree are described under Curriculum above. More detailed information may be found in the Neuroscience Student Handbook [www.neuroscience.umn.edu/CurStu/studHand.html].

**Language Requirements**—None.

**Minor Requirements for Students Majoring in Other Fields**—A doctoral minor program is developed in consultation with the director of graduate studies for neuroscience. Students must take one of NSc 5461, 5561, or 6111 and elective courses in neuroscience, for a minimum of 12 credits (including core courses).

**Nursing**

**Contact Information**—Jennifer Rosand, Recruiter, School of Nursing, University of Minnesota, 5-160 Weaver-Densford Hall, 308 Harvard Street S.E., Minneapolis, MN 55455 (612-624-4454; fax 612-624-3174; e-mail nursing.grad@umn.edu; [www.nursing.umn.edu](http://www.nursing.umn.edu/)).

**Professor**

Linda H. Bearinger, FM
Sandra R. Edwardson, FM
Barbara J. Leonard, FM

Mariah Snyder, FM
Jean Wyman, FM

**Associate Professor**

Donna Bliss, FM
Derryl E. Block, AM
Joanne Disch, E
Laura J. Duckett, FM
Ann Garwick, FM
Cynthia R. Gross, Pharmacy Practice, FM
Helen Hansen, FM
Susan Herly, FM
Felicia Hodge, AM
LaVohn Josten, AM
Merrine J. Kaas, AM
Kathleen Krichbaum, FM
Marsha Lewis, FM
Betty Lia-Hoagberg, FM
Linda L. Lindeke, FM
Ruth D. Lindquist, FM
Marilee A. Miller, E
Christine Mueller, AM
Carol Pederson, FM
Janice Post-White, FM

**Assistant Professor**

Melissa D. Avery, FM
Diame K. Bohn, AM
Donna J. Brauer, FM
Linda Chlan, AM
Karen S. Feldt, FM
Linda Gerdner, AM
Janis Gerkensmeyer, AM
Linda Halcon, AM
Madeline J. Kerr, FM
Elizabeth Kraatz, AM
Mary Jo Kreitzer, E
Margaret Moss, AM
Cynthia Peden-McAlpine, FM
Cheryl Robertson, AM
Elizabeth Saewyc, AM
Renee Sieving, E
Roxane Struthers, AM
Barbara Velinga, AM

**Adjunct Assistant Professor**

Kathleen A. Fagerlund, E
Jane Giedt, AM

**Other**

Karen Alaniz, E
Catherine Juve, AM
Carol O’Boyle, AM
Jennifer Peters, E
Sharon Ridgeway, E
Mary Rowan, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

**Curriculum**—Emphasizes in the M.S. program include nurse education, nurse administration, advanced clinical practice in psychiatric mental health nursing, child and family nursing, adult health nursing, gerontology nursing, oncology nursing, nursing for children with special health needs, and public health nursing; or practitioner preparation as a nurse midwife, pediatric nurse practitioner, gerontological nurse practitioner, women’s healthcare nurse practitioner, and family nurse practitioner. The Ph.D. program prepares creative and productive scholars in nursing. Students can gain a depth of knowledge and experience in one or more of these areas: the development and modification of health-related behaviors; human responses to environmental and life process events disruptive to health; phenomenon of health organization and
system of delivery of nursing knowledge; and organization and system of delivery of nursing care. An individualized program and independent research are planned by the student and advisor.

Prerequisites for Admission—in the M.S. program, a bachelor’s degree with a major in nursing or evidence of ability in health promotion, community health nursing, leadership/management, teaching/counseling, and systematic investigation, as well as licensure as a registered nurse, are required. For the Ph.D. program, a master’s degree with a strong background in the physical and/or behavioral sciences or a bachelor’s degree with an exceptionally strong background are required.

Special Application Requirements—For the M.S. degree, three letters of reference and a goal statement are required. GRE General Test scores are required for applicants with narrative transcripts from previous college work; the scores are recommended for students competing for a Graduate School Fellowship. For the Ph.D. degree, GRE General scores, two letters of reference, and a statement of goals, objectives, and research interest are required. The application deadlines for the M.S. program are August 15 (spring semester), December 15 (summer), and February 15 (fall semester). Acceptance into the Graduate School before February 1 is required for the nurse practitioner areas of study. The application deadline for the Ph.D. program is December 1 for the following fall semester deadline.

Use of 4xxx Courses—4xxx courses are not routinely accepted on degree program forms. However, CPsy 4307—Adolescent Psychology is used on M.S. programs for public health nursing-adolescent nursing.

Courses—Please refer to Nursing (Nurs) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The master’s program prepares students for advanced practice nursing positions that address complex health and illness issues. The program is offered under Plan A and Plan B. Plan A emphasizes research; Plan B prepares students to integrate research into advanced practice roles or leadership positions.

Coursework is offered in adult health nursing; child and family nursing; children with special health-care needs; family nurse practitioner; gerontological clinical nurse specialist; gerontological nurse practitioner; nurse midwifery; nursing administration; nurse education; oncology nursing; pediatric nurse practitioner; public health nursing with emphases in administration, adolescent health, older adult health, school health, and parent, child and family health; psychiatric-mental health nursing; and women’s health care nurse practitioner.

Plan A requires 30 credits: 14 credits in the major, including Nurs 8170—Research in Nursing (3 cr); Nurs 8100—The Discipline of Nursing (3 cr); Nurs 8140—Moral and Ethical Positions in Nursing (3 cr); 6 credits in a minor or related fields; and 10 thesis credits.

Plan B requires 30 credits: 9 credits of disciplinary core course; 12 credits of advanced nursing core courses, including Nurse 8194—Problems in Nursing (3 cr); 6 credits of specialty core courses; and 6 credits in related fields.

Language Requirements—None.

Final Exam—The final exam is oral.

Ph.D. Degree Requirements

The Ph.D. program prepares creative and productive scholars in nursing. Students can gain a depth of knowledge and experience in one or more of these areas: the development and modification of health-related behaviors; human responses to environmental and life process events disruptive to health; the phenomenon of health; and the organization and system of delivery of nursing knowledge and of nursing care.

Students plan with their advisers individualized programs of study and independent research. Subject to approval by a faculty committee. The Ph.D. requires 12 credits in a minor or supporting field, Nurs 8177—Advanced Nursing Research Practicum (4 cr), Nurs 8110—Developing Nursing Knowledge, and 24 thesis credits.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires 12 credits in nursing with at least 8 credits of 8xxx courses.

Nutrition

Contact Information—Nutrition Graduate Program, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, MN 55108 (612-624-1290; fax 612-625-5272; e-mail nutrgrad@umn.edu; <http://fscn.che.umn.edu/nutrgrad/>).

Professor


Associate Professor

Roderick A. Barke, Surgery, FM Margot F. Cleary, Hortem Institute, FM Daniel D. Gallaher, Food Science and Nutrition, FM Craig A. Hassel, Food Science and Nutrition, FM Marla M. Reicks, Food Science and Nutrition, FM Sally S. Weisflog, Pediatrics, FM

Adjunct Associate Professor

Mary K. Schmitt, Food Science and Nutrition, FM

Assistant Professor

Paul S. Brady, Food Science and Nutrition, AM Diane Neumark-Sztainer, Epidemiology, FM

Adjunct Assistant Professor

Mary C. Gannon, Food Science and Nutrition, FM Darlene G. Kelly, Food Science and Nutrition, FM Catherine M. Kotz, Food Science and Nutrition, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Nutrition is the study of how nutrients, both essential and non-essential, affect health and all life processes. Consequently, nutrition is an extremely broad field that encompasses physiology, biochemistry, education, public health, and public policy. The nutrition graduate program is interdisciplinary. Advisers and financial support may come from any of the departments or schools in which nutrition graduate faculty reside, including the Department of Food Science and Nutrition (College of Human Ecology and Agricultural, Food, and Environmental Sciences), Division of Epidemiology (School of Public Health), Department of Pediatrics (Medical School), Department of Surgery (Medical School), Department of Animal Science (College of Agricultural, Food, and Environmental Sciences), School of Kinesiology and Leisure Studies (College of Education and Human Development), Hormel Institute (Austin, MN), and Veterans Administration Hospital (Minneapolis, MN). Three subspecialty areas are offered in the doctoral degree program: human nutrition, nutritional biochemistry, and public health nutrition. Thesis work can be conducted in the laboratory, clinic, or field, locally or internationally.

Prerequisites for Admission—A strong foundation in the biological and physical sciences is required. This background includes college mathematics through calculus, physics, the equivalent of one year of general and one year of organic chemistry, general biology, biochemistry, physiology, and two additional courses in the biological sciences. If there is evidence that the applicant has a good background in the sciences, some of the prerequisites can be met after admission.

Applicants interested in the M.S. degree with clinical emphasis must offer as prerequisites courses in general biology, human nutrition, microbiology, college algebra, one year each of general and organic chemistry, 20 or more semester credits in food science and nutrition, and a dietetic internship or equivalent.
Applicants to the Ph.D. program who have completed the M.S. degree with a clinical emphasis must have completed the requirements described in the first paragraph above.

Special Application Requirements—GRE scores and three letters of recommendation evaluating the applicant’s scholarship must be submitted. At least two letters should be from professorial-rank faculty. The GRE Writing Assessment Test is recommended.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is subject to adviser and/or director of graduate studies approval.

Courses—Please refer to Nutrition (Nutr) and Food Science and Nutrition (FScN) in the course section of this catalog for courses pertaining to the program

M.S. Degree Requirements

The M.S. is offered under both Plan A (thesis) and Plan B (non-thesis). Plan A requires a minimum of 20 course credits and 10 thesis credits; Plan B requires a minimum of 30 course credits, including a Plan B project. General requirements include the graduate nutrition core series (three courses), an orientation and presentation skills class, graduate courses in biochemistry, physiology, statistics, an advanced topics course, and presentation of the thesis or project work. All students also are expected to obtain teaching experience, subject to the policies of the adviser’s department or division.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master’s minor requires a minimum of 6 course credits in nutrition, including FScN 5621.

Ph.D. Degree Requirements

The Ph.D. offers three areas of specialization: human nutrition, nutritional biochemistry, and public health nutrition. Thesis work may be conducted in the laboratory, clinic, or field, either locally or internationally. The Ph.D. requires the graduate nutrition core series (three courses), an orientation and presentation skills class, graduate level courses in biochemistry, physiology, statistics, two advanced topics courses, and presentation of the thesis. All students also are expected to obtain teaching experience, subject to the policies of the adviser’s department or division.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor may be completed by taking FScN 5621, 5622, 5623, and three additional credits in nutrition, including at least one 8xxx course.

Occupational Therapy

Contact Information—Program in Occupational Therapy, University of Minnesota, 388 Mayo Mail Code, 426 Church St. S.E., Minneapolis, MN 55455 (612-626-5887; fax 612-625-7192; e-mail otprog@umn.edu; www.med.umn.edu/ot). Program office is in 271 Children’s Rehabilitation Center, 426 Church St. S.E., Minneapolis MN, 55455.

Associate Professor
James R. Carey, AM
Virgil G. Mathiowetz, AM
Judith E. Reisman, AM
Erica B. Stern, AM

Assistant Professor
Diane R. Anderson, AM
Cheryl A. Meyers, AM
Deborah D. Roman, AM

Examiner
Rebecca B. Catterton, E
Jill L. Christenson, E
Margaret A. Christenson, E
Kay Dole, E
Barbara A. Larson, E
Sue Lasoff, E
Peggy Mueller, E
Marla A. Szwaja, E
Deborah J. Voydetich, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The program offers academic study and clinical education for preparing occupational therapy clinicians and researchers. Emphasis is on application of the critical thinking model to diverse areas of practice and to diagnostic groups in both clinical and community settings. Fieldwork education is available in such areas as physical, psychosocial, and developmental disabilities. Research emphasizes investigation of treatment effectiveness. The program is accredited by the Accreditation Council for Occupational Therapy Education (ACOTE) of the American Occupational Therapy Association. Graduates of the program may sit for the national certification exam administered by the National Board for Certification of Occupational Therapists. Most states require licensure in order to practice; however, state licenses are usually based on the results of this certification exam.

Prerequisites for Admission—Individuals with a bachelor’s degree in any field may apply.

Special Application Requirements—Applicants must submit a program application, including one to three letters of reference, GRE General Test scores (no minimum required for consideration), and evidence of work or volunteer experience in occupational therapy. International students must also submit TOEFL scores (550 minimum paper version, 213 minimum computer version) and TSE (Test of Spoken English) scores (50 minimum). Prerequisite coursework in statistics, the biological sciences, developmental and abnormal psychology, and related areas is also required.

Use of 4xxx Courses—Use of 4xxx courses is not permitted toward degree requirements.

Courses—Please refer to Occupational Therapy (OT) and Physical Medicine and Rehabilitation (PMed) in the course section of this catalog for courses pertaining to the program.

M.S. Plan B Degree Requirements

Students take credits of predetermined academic coursework, 12 credits of fieldwork education, and 4 project credits (Plan B). There is no minor or related field requirement.

Language Requirements—None

Final Exam—The final exam is oral.

Oral Biology

Contact Information—Oral Biology Graduate Program, University of Minnesota, 17-252 Moos Health Sciences Tower, 515 Delaware Street S.E., Minneapolis, MN 55455 (612-624-9123).

Professor
Alvin J. Beitz, Veterinary Pathobiology, FM
Edward C. Combe, Oral Sciences, FM
Ralph DeLong, Oral Sciences, FM
William H. Douglas, Oral Sciences, FM
Gregory R. Germaine, Oral Sciences, FM
Mark C. Herzberg, Preventive Sciences, FM
William F. Liljenmark, Oral Sciences, FM
Patrick W. Manth, Preventive Sciences, FM
Charles F. Schachtele, Oral Sciences, FM
Burton L. Shapiro, Oral Sciences, FM
Larry F. Wolff, Preventive Sciences, FM

Assistant Professor
Pamela R. Erickson, Preventive Sciences, FM
Tom W. Koroth, Oral Sciences, FM
Robert H. Ophaug, Oral Sciences, FM
Joel D. Rudney, Oral Sciences, FM
Donald A. Simon, Psychiatry, FM

Assistant Professor
Ching-Chang Ko, Oral Sciences, FM
Antheus Versluis, Oral Sciences, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This program is offered by the Department of Oral Science in the School of Dentistry and gives students a broad understanding of the development, structure, function, and pathology of the orofacial region. Advanced coursework and research emphasize specialized areas of interest, including salivary glands and secretions, oral microbial ecology and physiology, immunobiology, neurobiology, mineral metabolism and nutrition, pathobiology of oral structures, physical biology of the masticatory system, and development and evaluation of dental materials. Considerable flexibility is encouraged in planning
individual programs to accommodate the student’s specific areas of interest, and courses from other disciplines may be included as part of the major.

**Degree Programs and Faculty**

**Ph.D. Degree Requirements**
Coursework for the Ph.D. is selected to give students a broad background in oral biology plus advanced coursework directly related to students’ research interests. Although there is no Graduate School minimum credit requirement for the degree, most students are expected to complete a core curriculum of 23-25 credits; all students must satisfactorily complete 8 credits of oral biology topics courses (8021-8028) and participate in the oral biology student seminar series (8030) each semester. The remaining coursework is tailored to the student’s research interests and may be selected from departments/programs outside of the oral biology program with the approval of the adviser and director of graduate studies. A minor (minimum 12 credits) in a nonclinical discipline is also required. A cumulative GPA of at least 3.00 in both the major and minor is required. Only grades of A or B are acceptable in the core courses. The preliminary written exam consists of two research proposals, one representing the student’s anticipated thesis research and the other on a topic assigned by the graduate faculty. The preliminary oral exam consists primarily of a defense of the two research proposals described above. Students must also present a seminar describing their thesis research (which is attended by the final oral exam committee) no later than six months before defense of the thesis.

**Minor Requirements for Students Majoring in Other Fields**—A Ph.D. minor in oral biology consists of 12 credits and must include OBio 8011, at least two advanced courses in oral biology, and other coursework in consultation with the director of graduate studies.

**Otolaryngology**

**Contact Information**—Department of Otolaryngology, University of Minnesota, Mayo Mail Code 396, 420 Delaware Street S.E., Minneapolis, MN 55455 (mailing address) (612-625-3200; fax 612-625-2101; <www.med.umn.edu/otol>).

**Professor**

George L. Adams, AM  
Ardhi J. Duvall III, FM  
G. Scott Giebink, AM  
Sung K. Juhn, FM  
Frank M. Lassman (emeritus), FM  
Robert H. Maisel, AM  
Robert H. Margolis, FM  
David A. Nelson, FM  
Peter A. Santi, AM

**Clinical Professor**

Michael M. Paparella, FM

**Associate Professor**

John H. Anderson, AM  
Lawrence R. Boies, Jr., AM  
Kathleen Ann Daly, AM  
Markus Gagany, AM  
George S. Goding, Jr., AM  
Peter A. Hilger, AM  
David B. Hrom, AM  
Lisa L. Hunter, AM  
Eric Javel, FM  
Samuel C. Levine, AM

**Clinical Associate Professor**

Markos V. Goycoolea, AM  
Stephen L. Liston, AM

**Assistant Professor**

Gail S. Donaldson, AM  
David D. Hamlar, AM  
Jizhen Lin, AM  
Rick M. Odlund, AM  
Frank G. Ondrey, AM  
Franklin L. Rimell, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

**Curriculum**—This program prepares students in both clinical and experimental aspects of otolaryngology. The M.S., M.S.Otol., and Ph.D. degrees require a publishable thesis. Rotations at Fairview-University Medical Center, Minneapolis Veterans Administration Medical Center, Regions Hospital, and Hennepin County Medical Center provide a wide range of opportunity for clinical education and surgical experience. Opportunities for independent research are provided in the research laboratories of audiology, auditory electrophysiology, auditory neurophysiology, biochemistry, cancer biology, cell biology and genetics, electronmicroscopy, electrophysiology, histochemistry, morphometry, psychoacoustics, temporal bone pathology, tumor immunology, skin-flap physiology, laryngeal physiology, mandibular bone physiology, microvascular tissue transfer, and vestibular physiology. Each student selects an adviser and prepares a preliminary research proposal by February 1 of the first year. A full proposal in NIH style is expected by June 1. Both proposals must be reviewed by the graduate research committee. A minimum of six months in basic research begins in the second year. Graduates of the program have careers in teaching, research, and professional practice.

**Prerequisites for Admission**—The M.S. requires a bachelor’s degree from an accredited university or equivalent. The M.S.Otol. requires an M.D. degree and is usually pursued in conjunction with a residency in otolaryngology. The Ph.D.Otol. requires a bachelor’s or master’s degree, preferably in an area related to otolaryngology, or for those pursuing the degree in conjunction with a residency in otolaryngology, an M.D. degree.

**Use of 4xxx Courses**—Otolaryngology does not offer 4xxx courses. Use of 4xxx courses from other departments is permitted toward degree requirements with the permission of the director of graduate studies.

**Courses**—Please refer to Otolaryngology (Otol) in the course section of this catalog for courses pertaining to the program.

**Curriculum**—This program prepares students in both clinical and experimental aspects of otolaryngology. The M.S., M.S.Otol., and Ph.D. degrees require a publishable thesis. Rotations at Fairview-University Medical Center, Minneapolis Veterans Administration Medical Center, Regions Hospital, and Hennepin County Medical Center provide a wide range of opportunity for clinical education and surgical experience. Opportunities for independent research are provided in the research laboratories of audiology, auditory electrophysiology, auditory neurophysiology, biochemistry, cancer biology, cell biology and genetics, electronmicroscopy, electrophysiology, histochemistry, morphometry, psychoacoustics, temporal bone pathology, tumor immunology, skin-flap physiology, laryngeal physiology, mandibular bone physiology, microvascular tissue transfer, and vestibular physiology. Each student selects an adviser and prepares a preliminary research proposal by February 1 of the first year. A full proposal in NIH style is expected by June 1. Both proposals must be reviewed by the graduate research committee. A minimum of six months in basic research begins in the second year. Graduates of the program have careers in teaching, research, and professional practice.
M.S. Plan A Degree Requirements
The M.S. (Plan A only) requires a minimum of 30 credits: 20 course credits (14 in the major and 6 in the minor or related fields) and 10 thesis credits. Students are expected to complete and publish a research paper in a peer-reviewed journal or a presentation/poster at a national scientific meeting.

Language Requirements—None.
Final Exam—The final exam is oral. M.S. students also take a national exam. Those who receive less than 70 percent on the exam must complete a written exam for the degree.

M.S. Otol. Plan A Degree Requirements
The M.S.Otol. (Plan A only) requires a minimum of 35 credits, including 25 course credits (19 in the major and 6 in the minor or related fields) and 10 thesis credits. Some courses for the M.S.Otol. are more clinical than those for the M.S., and four years of academic preparation are expected. Students are expected to complete and publish a research paper in a peer-reviewed journal or a presentation/poster at a national scientific meeting.

Language Requirements—None.
Final Exam—The final exam is oral. Students also take a national exam. Those who receive less than 70 percent on the exam must complete a written exam for the degree.

Ph.D. Otol. Degree Requirements
For students concurrently completing an otolaryngology residency, the Ph.D.Otol. requires a minimum of 55 credits, including 31 course credits (19 in the major and 12 in the minor or supporting program) and 24 thesis credits. At least one seminar is selected from seminars such as Otol 8247, 8248, 8249, 8250. Most students concurrently in an otolaryngology residency take five to six years to complete research, course, and dissertation requirements.

For students not engaged in a residency, a minimum of 12 semester hours in the minor or supporting program, and 19 in the major are required plus courses and faculty chosen by the student, advisor, and director of graduate studies. All students are expected to publish a research paper in a peer-reviewed journal.

Language Requirements—None.
Minor Requirements for Students
Majoring in Other Fields—A minor is not available, but otolaryngology courses may be taken for related fields or supporting program credits.

Pharmacetics
Contact Information—Department of Pharmacetics, College of Pharmacy, University of Minnesota, 9-177 Weaver-Densford Hall, 308 Harvard Street S.E., Minneapolis, MN 55455 (612-624-5151; fax 612-626-2125; e-mail pceu@umn.edu; <www.pharmacy.umn.edu/resgrad/pceutics/pharmacetics/home.html>).

M.S. Degree Requirements
The M.S. requires 20 course credits, including 6 credits in a minor or related field. Students must take advanced courses in pharmacetics, chemistry, mathematics, statistics, and pharmacology. A complete list of degree requirements may be obtained from the director of graduate studies.

Language Requirements—None.
Final Exam—The final exam is oral.

Ph.D. Degree Requirements
The Ph.D. requires 33 course credits, including 12 credits in a minor or supporting program. Students must take advanced courses in pharmacetics, chemistry, mathematics, statistics, and pharmacology. A complete list of degree program requirements may be obtained from the director of graduate studies.

Contact Information—Graduate Program in Pharmacology, University of Minnesota, 6-120 Jackson Hall, 321 Church Street S.E., Minneapolis, MN 55455 (612-625-9997; fax 612-625-8408; e-mail fider@lenti.med.umn.edu; <www.pharmacology.med.umn.edu>).

Professor
Bianca M. Conti-Fine, FM
Richard M. Eisenberg, Duluth, FM
Robert P. Elde, FM
Esam E. El-Fakihany, FM
Patrick E. Hanna, FM
Stephen S. Hecht, FM
Jordan L. Holtzman, FM
Donald B. Hunninghake, FM
Ping-Yee Law, FM
Horace H. Loh, FM
Paul R. Pentel, FM
Philip S. Portoghese, FM
Michael A. Rafferty, FM
Jean F. Regal, Duluth, FM
Virginia S. Seybold, FM
Alan R. Sinako, AM
Norman E. Sladek, FM
Sheldon B. Sparber, FM
Sundaram Ramakrishnan, FM
Stanley A. Thayer, FM
George J. Trachte, Duluth, FM
Kendall B. Wallace, Duluth, FM
George L. Wilcox, FM
Wellington G. Wood III, FM
Ben G. Zimmerman, FM

Associate Professor
Colin R. Campbell, FM
Earl W. Dunham, FM
Edward T. Knych, Duluth, AM
Rita B. Messing, AM
Sabita Roy, FM
Timothy F. Walseth, FM
Elizabeth V. Wattenberg, E
Li-Na Wei, FM

Assistant Professor
Frank H. Burton, FM
Gregory J. Connell, FM
Hiroshi Hiassa, FM
Carol A Lange, FM
Duanqing Pei, FM
Yun Qiu, FM
Daniel P. Romero, FM
Kevin D. Wickman, FM
Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

**Curriculum**—Pharmacology is the study of the interactions of chemicals with biological systems. Courses and research training in biochemistry, biophysics, genetics, and molecular biology provide a solid foundation for performing original research in pharmacology, neuropharmacology, and cancer chemotheraphy.

**Prerequisites for Admission**—A four-year B.A. or B.S. degree (or its equivalent) in a basic science program is generally required. Candidates for admission are evaluated on the basis of undergraduate record, GRE score, previous research experience, and letters of recommendation.

**Special Application Requirements**—Applicants must submit scores from the General Test of the GRE, three letters of recommendation from persons familiar with their scholarship and research potential, a complete set of official transcripts, and a clearly written statement of career interests, goals, and objectives. Students may apply at any time; however, submission of all application materials by January 15 is strongly encouraged to ensure priority consideration for fellowships and research assistantships awarded for the next academic year. Students can be admitted any term.

**Research Facilities**—Graduate faculty members in the pharmacology program have state-of-the-art laboratories located in the Basic Sciences Biomedical Engineering Building, Moos Tower, and Jackson Hall. The Drug Abuse Research Center in Molecular and Cell Biology is comprised of pharmacology program graduate faculty.

**Use of 4xxx Courses**—Use of 4xxx courses on degree program forms is subject to adviser and/or director of graduate studies approval.

**Courses**—Please refer to Pharmacology (Phcl) in the course section of this catalog for courses pertaining to this program.

**M.S. Degree Requirements**
Plan A requires a minimum of 20 course credits (14 in pharmacology, and 6 in biochemistry and physiology) and 10 thesis credits. Plan B requires a minimum of 30 course credits (14 in pharmacology, and 16 in biochemistry, physiology, and/or other related areas) and a Plan B project.

Students are expected to maintain a 3.00 grade point average. Students who fail to maintain this standard must petition the director of graduate studies for permission to remain in the program.

For more detailed information, contact the director of graduate studies in pharmacology.

**Language Requirements**—None.

**Final Exam**—The final exam is oral.

**Minor Requirements for Students Majoring in Other Fields**—A master’s minor requires a minimum of 9 credits in pharmacology approved by the director of graduate studies in pharmacology.

**Ph.D. Degree Requirements**
The Ph.D. requires a minimum of 21 course credits in the major (excluding the required 24 thesis credits).

Students are expected to maintain a 3.00 grade point average. Students who fail to maintain this standard must petition the director of graduate studies for permission to remain in the program.

For more detailed information, contact the director of graduate studies in pharmacology.

**Language Requirements**—None.

**Minor Requirements for Students Majoring in Other Fields**—A doctoral minor requires a minimum of 12 credits in pharmacology approved by the director of graduate studies in pharmacology. There are no special requirements (e.g., specific courses, written examination).

**Philosophy**

**Contact Information**—Further details about the program are on the Department’s Web site at <www.philosophy.umn.edu>, and in two publications, Graduate Studies: Philosophy and Department Degree Programs: M.A. and Ph.D., available from the Department of Philosophy, University of Minnesota, 831 Walter Heller Hall, 271 19th Avenue South, Minneapolis, MN 55455 (612-625-6563; fax 612-626-8380; e-mail umphil@umn.edu).

**Professor**
Elizabeth S. Belfiore, Classical and Near Eastern Studies, FM
Norman E. Bowie, Strategic Management, FM
Norman O. Dahl, FM
Marcia M. Eaton, FM
Ronald N. Giere, FM
Jeanette K. Gundel, Linguistics and Asian and Slavic Languages and Literatures, AM
Keith Gunderson, FM
William H. Hanson, FM
Geoffrey Hellman, FM
Jasper S. Hopkins, FM
Michael B. Kac, FM
Jeffrey P. Kahn, Public Health, FM
Douglas E. Lewis, FM
Helen E. Longino, Women’s Studies, FM
H. E. Mason, emeritus, FM
Joseph I. Owens, FM
Sandra L. Peterson, FM
C. Wade Savage, FM
Naomi B. Scheman, FM
John R. Wallace, FM

**Associate Professor**
John H. Beatty, Ecology, Evolution, and Behavior, FM
John M. Dolan, FM
Carl Elliott, FM
Michael D. Root, FM
C. Kenneth Waterman, FM

**Assistant Professor**
Sarah W. Hoffman, AM
Michelle Mason, AM
Valerie Tiberius, AM
Byeong-Uk Yi, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

**Curriculum**—The Department of Philosophy offers both Ph.D. and M.A. degrees. Students are generally admitted to the Ph.D. program, while admission to the M.A. is generally intended for those with professional goals in other fields.

Philosophy is noteworthy for its emphasis on the individual student’s research interests. With the help of an adviser, students design their own program of study, which consists of the philosophy major and either a supporting program or a minor. The minor or supporting program, drawn at least in part from a department or departments other than philosophy, complements the student’s research focus. Students gain a broad base of knowledge through required coursework. Ph.D. students take courses from four main areas: history of philosophy, logic, ELMS (epistemology, philosophy of language, metaphysics, philosophy of science), and value theory. These areas provide a firm foundation for research and teaching beyond the Ph.D. program.

**Prerequisites for Admission**—Recognizing that evidence of ability to pursue graduate study in philosophy is diverse, the department does not specify prerequisites for admission. Normally, those admitted have a broad undergraduate background that includes some courses in philosophy.

**Special Application Requirements**—Students must apply to both the Graduate School and the Department of Philosophy. The Graduate School application is available online from the Graduate School Web site. Departmental applications for admissions and aid are available from the Committee on Admissions and Aid at the address listed above.

Department applications should include a completed application form, transcripts, scores from the GRE General Test, three letters of recommendation, and a writing sample. Students interested in Opportunity or MacArthur Fellowships should include a statement expressing their interest. Students interested in the MacArthur Fellowship should also contact the MacArthur Program. Applications, together with all supporting materials, must be received by January 7. The Philosophy Department generally admits students only for fall semester.

**Use of 4xxx Courses**—Students may take 4xxx courses for graduate credit only by enrolling concurrently in a related one credit 8xxx workshop course. Students from other majors are not required to register for the concurrent workshop, but are permitted to do so with the permission of the instructor of the 4xxx course. A rich array of 4xxx courses are suitable for graduate students in other fields.
Courses—Please refer to Philosophy (Phil) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
The M.A. is offered under two plans: Plan A requires 14 course credits in philosophy, 6 course credits outside the department, and 10 thesis credits. Plan B requires 24 course credits in philosophy, 6 course credits outside the department, and three Plan B papers.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master’s minor requires 6 course credits in philosophy approved by the director of graduate studies in philosophy. Programs are tailored to meet the interests and needs of the student.

Ph.D. Degree Requirements
No minimum credits are required for the Ph.D., though specific philosophy courses are required that total 26-28 credits; 24 thesis credits are also required. After a student has satisfied the logic and history course requirements, the student’s entire record is reviewed by the faculty. Successful review represents passing the preliminary written exam. Students then write a dissertation proposal, successful defense of which constitutes the final exam. The student’s entire record is reviewed by the faculty. Successful review represents passing the preliminary written exam. Students then write a dissertation proposal, successful defense of which constitutes the final exam. The Physical Therapy Program, a division within the Department of Physical Medicine and Rehabilitation, offers two M.S. programs: entry-level and postprofessional. The entry-level professional education program program takes two and a half years to complete and prepares students to become physical therapists. Graduates must pass a licensing exam to begin clinical practice. The postprofessional education program program trains physical therapists in research skills, teaching skills, and higher clinical skills.

Prerequisites for Admission—Applicants must have a baccalaureate degree with a major in any field. Students must be able to use word processing and spreadsheet software. Prerequisite courses that must be completed before enrolling in the program are listed at <www.physther.med.umn.edu>.

Special Application Requirements—Submission of GRE scores is required. For international students, a TOEFL score of at least 550 is required. The entry-level program accepts only applications completed on the Web at <www.physther.med.umn.edu>.

Use of 4xxx Courses—Use of 4xxx courses towards degree requirements is subject to adviser and director of graduate studies approval.

Courses—Please refer to Physical Therapy (PT) and Physical Medicine and Rehabilitation (PMed) in the course section of this catalog for courses pertaining to the program.

M.S. Plan B, Plan A and Plan B Degree Requirements

The entry-level program (Plan B only) requires 81 major field credits, of which 68 are core academic credits and 13 are clinical internship credits. Students must maintain a cumulative GPA of 2.80. Instead of a thesis, a scholarly research project is required (in connection with PMed 8193—Research Problems). No minor or related field is required for this program.

The postprofessional Plan A program requires 24 major field credits, of which 14 are core academic credits and 10 are thesis credits; 6 elective credits outside the major are also required.

The postprofessional Plan B program requires 24 major field credits, all of which are core academic credits; 6 elective credits outside the major are also required. Instead of a thesis, a scholarly research project is required (in connection with PMed 8193—Research Problems).

Language Requirements—None.

Final Exam—The final exam is oral.

Physics

Contact Information—Physics Program, School of Physics and Astronomy, University of Minnesota, 145 Tate Laboratory of Physics, 117 Church Street S.E., Minneapolis, MN 55455 (612-624-6366; fax 612-624-4578; e-mail grad@physics.spa.umn.edu: <www.spa.umn.edu>).

Professor
Benjamin F. Bayman (emeritus), FM
John H. Broadhurst, FM
Charles E. Campbell, FM
Cynthia A. Cattell, FM
James R. Chelikowsky, Chemical Engineering and Materials Science, FM
Hans W. Courant (emeritus), FM
Priscilla B. Cushman, FM
E. Dan Dahlberg, FM
Kris Davidson, Astronomy, FM
Dietrich K. Dehnhard, FM
Paul J. Ellis, FM
Robert D. Gehrz, Astronomy, FM
Clayton F. Giese, FM
Leonid Glazman, FM
Allen M. Goldman, FM
Annand Gopinath, Electrical and Computer Engineering, FM
J. Edwards Halley, FM
Kenneth Heller, FM
Cheng-Cher Huang, FM
Robert A. Humphreys, Astronomy, FM
Thomas W. Jones, Astronomy, FM
James Kakalios, FM
Joseph L. Kapusta, FM
Paul J. Kellogg (emeritus), FM
Anatoly Larkin, FM
Robert L. Lysak, FM
Marvin Marshak, FM
Keith A. Olive, FM
Robert O. Pepin, FM
Earl A. Peterson, FM
Ronald A. Poling, FM
Dennis L. Polla, Electrical Engineering, FM
Serge Rudaz, FM
Keith Ruedick, FM
Roger W. Rusack, FM
Nikolai Shchennikov, FM
Boris Shklovskii, FM
Robert S. Stuewer (emeritus), AM
David D. Thomas, Biochemistry, FM
Arkady Vainshtein, FM
Orad T. Valls, FM
Randall H. Victoria, Electrical Engineering, FM
Mikhail Voloshin, FM
Thomas F. Walsh, FM
William Zimmerman, Jr. (emeritus), FM

Associate Professor
Eric Ganz, FM
Uwe R. Kortshagen, Mechanical Engineering, FM
Yuichi Kubota, FM
John R. Wygant, FM

Assistant Professor
Paul A. Crowell, FM
Michael DuVernois, FM
Shaull Hanany, FM

Physical Education and Recreation

See Kinesiology and Leisure Studies.

Physical Therapy

Contact Information—Physical Therapy Program Office, MMC 388, University of Minnesota, Minneapolis, MN 55455 (612-626-5303; fax 612-625-7192; e-mail physther@umn.edu: <www.physther.med.umn.edu>.

Professor
Richard P. DiFabio, AM
Robert Patterson, AM

Associate Professor
James R. Carey, AM
Judith Reisman, AM
Glenn N. Scudder, E
LaDora V. Thompson, AM

Assistant Professor
Lisa L. Dorsey, E
Paula M. Ludewig, AM
Kirsten Ness, E
Degree Programs and Faculty

Joachim Mueller, FM
Yong-Zhong Qian, FM
Renata M. M. Wentzovich, Chemical Engineering and Materials Science, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Physics is the study of the fundamental structure and interactions of matter. Research areas in the program include elementary particle physics, condensed matter physics, nuclear physics, space physics, plasma physics, statistical mechanics, biophysics, atomic and molecular physics, astrophysics and cosmology. Interdisciplinary study is also available with the programs in astrophysics, chemical physics, and the history of science and technology. Research areas in experimental physics are biophysics, condensed matter, cosmic rays, cosmology, elementary particles, low temperature, molecular collisions, nuclear physics, space plasmas, solar system, and solid state. Research areas in theoretical physics are astrophysics, biophysics, elementary particles, low temperature, nuclear, space plasmas, solid state, and statistical mechanics.

Prerequisites for Admission—For major work, an undergraduate major in physics or a strong undergraduate minor in physics is required.

Special Application Requirements—Teaching assistantships and a few fellowships are available on application to the School of Physics and Astronomy; three letters of recommendation are required. Submission of GRE scores is strongly recommended. Fall semester entry is strongly recommended for students who have not completed previous graduate study.

Special Examination—During the week before the beginning of fall semester, new graduate students are expected to participate in the department orientation program.

Use of 4xxx Courses—Use of 4xxx physics courses is permitted for either major or minor degree requirements.

Courses—Please refer to Physics (Phys) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. requires a minimum of 20 course credits (Plan A) or 30 course credits (Plan B), including classical physics (Phys 5011-5012) or quantum mechanics (Phys 5001-5002) and a minimum of 6 credits in a minor or related field; Plan A also requires 10 thesis credits. The minor or related field requirement may be satisfied by completion of courses in one or two areas outside the specialization; some or all of these courses may be in physics.

Language Requirements—There is no language requirement. However, in some instances the thesis adviser may require a reading knowledge of one or more foreign languages if justified by the nature of the topic.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A physics minor requires a background in differential and integral calculus and one year of calculus-level college physics. For the master’s minor, students must complete a minimum of 6 credits in physics.

Ph.D. Degree Requirements

The Ph.D. requires a minimum of 40 credits, including classical physics (Phys 5011-5012), quantum mechanics (Phys 5001-5002), and two semesters of a seminar in the student’s research area. The minor or supporting program requirement may be satisfied by completion of courses in one or two areas outside the specialization; some or all of these courses may be in physics.

Language Requirements—There is no language requirement. However, in some instances the thesis adviser may require a reading knowledge of one or more foreign languages if justified by the nature of the topic.

Minor Requirements for Students Majoring in Other Fields—A physics minor requires a background in differential and integral calculus and one year of calculus-level college physics. For the doctoral minor, students must complete a minimum of 12 credits in physics, including either the classical physics sequence (Phys 5011-5012) or the quantum mechanics sequence (Phys 5001-5002).

Physiology

See Cellular and Integrative Physiology.

Planning

See Urban and Regional Planning.

Plant Biological Sciences

Contact Information—Plant Biological Sciences Graduate Program, University of Minnesota, 220 Biological Sciences Center, 1445 Gortner Avenue, St. Paul, MN 55108-1095 (612-625-4222; fax 612-625-1738).

Regents’ Professor

Ronald L. Phillips, Agronomy and Plant Genetics, FM

Professor

David D. Biesboer, Plant Biology, FM
Robert M. Brambl, Plant Biology, FM
Iris D. Charvat, Plant Biology, FM
Edward J. Cushing, Ecology, Evolution, and Behavior, FM
Anath Das, Biochemistry, FM
Gary M. Gardner, Horticultural Science, FM
Burle G. Gengenbach, Agronomy and Plant Genetics, FM
Florence K. Gleason, Plant Biology, FM
Peter H. Graham, Soil, Water, and Climate, FM
Robert J. Jones, Agronomy and Plant Genetics, FM
Willard L. Koukkari, Plant Biology, FM
Paul A. Lefebvre, Genetics, Cell Biology, and Development, FM
Pen Hsiang Li, Horticultural Science, FM
Albert H. Markhart III, Horticultural Science, FM
David J. McLaughlin, Plant Biology, FM
Neil E. Olzsiewski, Plant Biology, FM
James A. Perry, Forest Resources, FM
Peter B. Reich, Forest Resources, FM
Michael J. Sadowsky, Soil, Water, and Climate, FM
Carolyn D. Stifflow, Genetics, Cell Biology, and Development, FM
D. Peter Snustad, Genetics, Cell Biology, and Development, FM
David A. Somers, Agronomy and Plant Genetics, FM
Joseph R. Sowokinos, Horticultural Science, FM
Kate Vanden Bosch, Plant Biology, FM
Clifford M. Ventore, Plant Biology, FM
Susan M. Wick, Plant Biology, FM
Nevin D. Young, Plant Pathology, AM

Adjunct Professor

John W. Gronwaldb, Agronomy and Plant Genetics, FM
Carroll P. Vance, Agronomy and Plant Genetics, FM

Associate Professor

Deborah L. Allan, Soil, Water, and Climate, FM
Judith G. Berman, Genetics, Cell Biology, and Development, FM
Jerry D. Cohen, Plant Biology, FM
J. Stephen Gaunt, Plant Biology, FM
Michael D. Marks, Plant Biology, FM
Georgiana May, Plant Biology, FM
Ruth G. Shaw, Ecology, Evolution, and Behavior, FM
Alan G. Smith, Horticultural Science, FM
Thomas K. Soulé, Plant Biology, AM
Cindy B. Tong, Horticultural Science, AM

Adjunct Associate Professor

Deborah A. Samac, Plant Pathology, FM

Assistant Professor

Arun Goyal, Biology, Duluth, FM
Gary J. Muelhbrauer, Agronomy and Plant Genetics, FM
Min Ni, FM
John Ward, FM
George Weiblen, FM

Adjunct Assistant Professor

Les J. Szabo, Plant Pathology, FM

Lecturer

Anita F. Cholewa, College of Continuing Education, E

Other

Paula M. Pijut, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Plant biological sciences encompasses all aspects of the basic biology of both higher and lower plants. Major emphases include molecular and physiological approaches to development; physiological, structural, and functional studies at the cellular and organismal levels; systematic and evolutionary biology; and molecular genetics and applied biotechnology. Students study plants from the subcellular and molecular to the whole plant and community levels of biological organization. They also have opportunities for laboratory and field research at state, national, and international levels. Each student’s program is planned to meet individual requirements within the framework of a multidisciplinary core of coursework. Seminars are an integral part of the program.
Prerequisites for Admission—Prospective students are expected to have completed a year of coursework in at least three of the following four areas: differential and integral calculus; organic and inorganic chemistry; biology; and physics. For students of demonstrated ability, background deficiencies, as determined by the admissions committee, can be made up during the first year of graduate studies. All admitted students are assigned to an adviser in the graduate program before they begin their studies.

Special Application Requirements—Applicants must submit scores from the General Test of the GRE, three letters of recommendation from persons familiar with their scholarship and research potential, a complete set of official transcripts, and a clearly written statement of career interests, goals, and objectives. Students may apply at any time; however, submission of all application materials by January 15 is strongly encouraged to ensure priority consideration for fellowships and teaching and research assistantships awarded for the next academic year. Students can be admitted any semester.

Use of 4xx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Plant Biology (PBio) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements
Course programs are planned in consultation with an advisory committee. Students are expected to take a minimum of five courses in the major in addition to the two 1-credit current topics courses taken during their first year.

Students participate in a teacher-training program and then serve as a teaching assistant for one semester. Regular attendance at the weekly Plant Biological Sciences Colloquium seminar is expected.

Plan A students write a thesis proposal and present the results of their research at a colloquium seminar. Plan B students develop a thesis proposal.

Language Requirements—None, except as specified by a faculty adviser in consultation with the student.

Minor Requirements for Students Majoring in Other Fields—A master’s minor requires a minimum of 6 credits approved by the director of graduate studies.

Ph.D. Degree Requirements
Doctoral requirements are the same as those for a master’s degree. In addition, a dissertation proposal and the presentation of two noncredit seminars are required.

Language Requirements—None, except as specified by a faculty adviser in consultation with the student.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires a minimum of 12 credits approved by the director of graduate studies.

Plant Pathology

Contact Information—Department of Plant Pathology, University of Minnesota, 495 Borlaug Hall, 1991 Buford Circle, St. Paul, MN 55108 (612-625-8200; e-mail anna@umn.edu; <www.plpa.agri.umn.edu>).

Professor
Robert A. Blanchette, FM
James V. Groth, FM
Roger K. Jones, FM
Linda L. Kinkel, FM
Sagar V. Krupa, FM
Philip O. Larsen, FM
Benham E.L. Lockhart, FM
David H. MacDonald, FM
Robert F. Nyvall, FM
James A. Percich, FM
Francis L. Pfleger, FM
Carol E. Windels, FM
Nevin D. Young, FM
Richard J. Zeyer, FM

Adjunct Professor
H. Corby Kistler, FM
Kurt J. Leonard, FM

Associate Professor
Ruth Dill-Macky, AM
Brian J. Steffenson, FM

Adjunct Associate Professor
James Kolmer, AM
Donald V. McVey, AM
Deborah A. Samac, FM
Les J. Szabo, AM

Assistant Professor
Senyu Chen, AM
James E. Kurle, AM
Jon F. Powell, AM
Hala Toubia-Rattme, AM

Adjunct Assistant Professor
Jennifer Juzwik, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Plant pathology interfaces with all plant science disciplines and with food sciences and veterinary medicine. Areas of concentration include biological control of plant disease, forest pathology and microbial degradation of wood, microbial ecology, mycotoxicology, physiological and molecular plant-microbe interactions, disease resistance, environmental pollution and climate change, and virology. The course of study varies with the requirements of the area of concentration and interests of the student.

Prerequisites for Admission—Master’s degree applicants must have a sound college background in the basic biological and physical sciences and mathematics, including 35 semester credits in biology with at least one course in each of the following areas:

1. botany, zoology, genetics, plant physiology, and microbiology. Applicants must also have completed at least one course in inorganic chemistry, organic chemistry, biochemistry, and physics. If deficiencies exist in the prerequisites, they must be corrected during the first year of the graduate program. All students accepted into the department with a B.S. degree are admitted into the M.S. degree program. After a minimum of two semesters, students who qualify may elect to change their degree status to a Ph.D. program. Criteria for the change includes scholastic standing, potential for success in completing a Ph.D., and writing competency. Such a change in status must be approved by the appropriate departmental committees and the director of graduate studies. Ph.D. applicants must satisfy all the prerequisites for the master’s degree program in plant pathology or have a master’s degree in plant pathology or in a field of natural science.

Special Application Requirements—GRE scores are required for all students and TOEFL scores are required for international students. A statement of objectives and three letters of recommendation are required of all students and must be submitted to the department.

Use of 4xxx Courses—For M.S. Plan A and Ph.D. students, 4xxx courses are not permitted toward degree requirements.

Courses—Please refer to Plant Pathology (PlPa) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements
Plan A (thesis) and Plan B (non-thesis) both require a minimum of 16 course credits in plant pathology and 6 course credits in a minor or related field. In addition, Plan A requires 10 thesis credits and Plan B requires 8 project or elective credits.

Language Requirements—A foreign language is generally not required. However, knowledge of a foreign language may be necessary for students doing research in non-English-speaking countries.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A minimum of 6 credits is required for a master’s minor.

Ph.D. Degree Requirements
The Ph.D. requires a minimum of 21 course credits in plant pathology, 12 credits in a minor or supporting program, and 24 thesis credits.

Language Requirements—A foreign language is generally not required. However, knowledge of a foreign language may be necessary for students doing research in non-English-speaking countries.

Minor Requirements for Students Majoring in Other Fields—A minimum of 12 credits is required for a doctoral minor.
Policy Issues on Work and Pay

Contact Information—Policy Issues on Work and Pay, 101 Wesbrook Hall, 77 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-4000; e-mail adv@cce.umn.edu; <www.cce.umn.edu/pdm/bmcmain.shtml>.

Professor

Morris Kleiner, Hubert H. Humphrey Institute of Public Affairs, E

Associate Professor

John R. Lee, Human Resources and Industrial Relations, E

Maria Hanratty, Hubert H. Humphrey Institute of Public Affairs, E

Curriculum—This certificate provides an understanding of and the ability to evaluate federal, state, and local policies that affect the employment relationship. Students learn about the role of government in the employment relationship including statutes and how employers, unions, and the government interpret policies. Courses are drawn from the Humphrey Institute of Public Affairs as well as the Industrial Relations Center in the Carlson School of Management, with auxiliary courses in law, history, and sociology.

Prerequisites for Admission—Students must have a bachelor’s degree from an accredited U.S. university or its foreign equivalent. Applicants should have mathematics courses at least up through algebra and a course in microeconomics (Econ 1101—Principles of Economics: Microeconomics is offered via distance education at the University). A grade point average of 3.00 is required and, for international students, a TOEFL score consistent with the Graduate School’s requirements.

Use of 4xxx Courses—4xxx courses may not be used to meet certificate requirements.

Courses—Core courses (5 credits): PA 5431 (3 cr); HRIR 5053 (2 cr). Elective courses: HRIR 5021 (4 cr); HRIR 5025 (2 cr); HRIR 8071 (4 cr); HRIR 8021 (3 cr); HRIR 8024 (2 cr); PA 8386 (3 cr); PA 5401 (3 cr); Hist 5844 (3 cr); Law 6203 (3 cr); Law 6231 (3 cr).

Postbaccalaureate Certificate Requirements

The certificate consists of at least 15 credits: 5 credits in the core (required courses), and 10 credits of supporting electives. Courses are drawn primarily from the Humphrey Institute of Public Affairs and Industrial Relations Center in the Carlson School of Management, with additional courses from the College of Liberal Arts and the Law School. Courses are taught only at the post-baccalaureate level. Students complete 10 elective credits which allows them to focus on the area of public policy that is most relevant to their professional and educational goals and needs. Note that some elective courses require prerequisites which do not count toward the certificate.

Completion Requirements—Early in the program, each student should file a certificate program plan with the College of Continuing Education indicating the courses that will be taken, subject to change with faculty approval. Completion of the certificate program requires completion of the indicated courses with core courses requiring a grade of B or better and with an overall GPA in certificate coursework of 3.00 or better.

Political Psychology

Contact Information—Doctoral Minor in Political Psychology, Center for the Study of Political Psychology, University of Minnesota, 1227 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455; (612-624-0864; fax 612-626-7599; e-mail polipsyc@polisci.umn.edu; <www.polisci.umn.edu/polipsyc/index.html>.

Professor

Patricia A. Avery, Curriculum and Instruction, E

Eugene Borgida, Psychology, E

Karlyn K. Campbell, Speech Communication, E

Ronald J. Faber, Journalism and Mass Communication, E

William H. Flanagan, Political Science, E

David W. Johnson, Educational Psychology, E

Paul E. Johnson, Information and Decision Sciences, E

Geoffrey M. Manuyama, Educational Psychology, E

W. Phillips Shively, Political Science, E

Mark Snyder, Psychology, E

John L. Sullivan, Political Science, E

Daniel B. Wackman, Journalism and Mass Communication, E

Associate Professor

Guy Charles, Law, E

Martha H. Gonzales, Psychology, E

Michael Paige, Educational Policy and Administration, E

Wendy M. Rahn, Political Science, E

Martin W. Sampson III, Political Science, E

Albert R. Tims, Jr., Journalism and Mass Communication, E

Assistant Professor

James N. Druckman, Political Science, E

Joanne Miller, Political Science, E

Alexander J. Rothman, Psychology, E

Curriculum—This minor is available to doctoral students only. Political psychology is a rapidly advancing field of scientific inquiry concerned with psychological aspects of political behavior. It encompasses a variety of interdisciplinary research perspectives, drawing on the theories and methods of core disciplines such as psychology, political science, law, and sociology, as well as interdisciplinary fields such as mass communication and decision sciences. The minor’s structured curriculum provides a foundation in basic areas in political psychology: social attitudes and cognition, judgment and decision making, group relations, personality and leadership, mass communication, public opinion, mass political behavior, and political socialization. In addition to providing a background in political psychology, the program trains students in the theory and methods useful to this field, such as content analysis, survey analysis, and experimental design. The faculty is drawn from ten programs within the Graduate School and Law School.

Prerequisites for Admission—Admission is contingent upon formal admission to the Graduate School and a doctoral program in a degree-granting department. Applicants are required to demonstrate knowledge of research methods useful in the study of political psychology by successfully completing (grade of B or above) two or more of the following: EPsych 8261, 8262, or 8266; Pol 8101, 8123, or 8131; Psy 5862, or 8884; Soc 8811; or Stat 5021 or 5302. The director of graduate studies in political psychology must approve admission

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to director of graduate studies approval.

Courses—Please contact the minor program office for information on relevant coursework.

Freestanding Minor Requirements

The doctoral minor requires a minimum of 14 graduate credits, including 8 credits in required courses and 6 credits from at least two electives from outside the student’s department or program and from a minimum of two of the following four modules: 1) psychological aspects of political behavior; 2) political socialization and human development; 3) politics in sociocultural context; and 4) psychological approaches to political decision making: public policy and international relations. Students are able to tailor the minor to complement their major programs. The required courses are the Proseminar in Political Psychology (Pol 8307, 8308; 2 credits), Political Psychology and Socialization (Pol 8311; 3 credits), and Social Cognition (Psy 8201; 3 credits).

Political Science

Contact Information—Department of Political Science, University of Minnesota, 1414 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-4144; fax 612-626-7599; e-mail office@polisci.umn.edu; <www.polisci.umn.edu/graduate/>.

Professor

Mary G. Dietz, FM

Raymond D. Duvall, FM

James Farr, FM

William H. Flanagan, FM

Edwin Fogelman, FM

John R. Freeman, FM

Lawrence R. Jacobs, FM

Ethan B. Kapstein, FM

Robert B. Ktvik, FM

August H. Nimtz, Jr., FM

Steven J. Rosenstone, FM

Thomas M. Scott, FM

W. Phillips Shively, FM

Kathryn A. Sikkink, FM

John L. Sullivan, FM

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Degree Programs and Faculty

Associate Professor
Lisa J. DiSch, FM
Daniel Kellhier, FM
Richard M. Price, AM
Wendy M. Rahn, FM
Diana E. Richards, FM
Martin W. Sampson III, FM
William Scheuerman, FM
David E. Wilkins, AM

Assistant Professor
Timothy R. Johnson, AM
Colin H. Kahl, AM
Jeffrey D. Lomonaco, AM
Joane Miller, AM
David J. Samuels, AM
Gordon Silverstein, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The curriculum is divided into five subfields: formal models and methodology, political theory, American politics, international relations, and comparative politics.

Prerequisites for Admission—The department’s graduate admissions committee selects the strongest applicants it finds based upon consideration of all components of the application file. The committee accepts students who have or are completing B.A. or B.S. degrees and students who have or are completing M.A. degrees.

Special Application Requirements—All students, except those in the special master’s program, are admitted directly into the Ph.D. program. The following should be sent directly to the department: department application form; GRE scores; a complete set of transcripts in addition to that required by the Graduate School; a brief statement expressing the applicant’s purpose and goals in pursuing graduate work (in addition to and separate from the statement required as part of the Graduate School application form); three letters of recommendation from professors who know the applicant’s academic work, particularly in political science; and samples of the applicant’s written work (papers written for political science courses preferred). Send photocopies of written work; the department cannot guarantee that materials will be returned.

Graduate study in the Ph.D. program must begin in fall semester; the application deadline is January 1. Graduate study in the special M.A. program may begin in any semester; the application deadline for fall semester is May 1; spring semester is October 1.

The department and the Humphrey Institute of Public Affairs jointly offer a program that leads to an M.A. in public affairs and a Ph.D. in political science. To be eligible, students must be admitted separately by political science and public affairs. Normally, students begin their study in public affairs and later apply to the Ph.D. program in political science. However, students may begin in either program, so it is possible to apply initially to either program or both. Students interested in this joint degree program should contact the director of graduate studies.

Use of 4xxx Courses—4xxx and 5xxx courses usually are acceptable for supporting or minor programs with consideration of the stipulations of the department that teaches the course. Political science courses at these levels are generally not open to Ph.D. students, who are expected to take 8xxx seminars. They are open to professional M.A. students.

Courses—Please refer to Political Science (Pol) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements Plan B Only
This program is for secondary school teachers, journalists, government employees, political professionals, and others who would like to cover broad areas of study in political science and related disciplines without the depth and extensive research emphasized in the Ph.D. program. Students may choose among several subfields, including political theory, comparative politics, international relations, American politics, and formal models and methodology.

The M.A. degree, Plan B (without thesis), requires 34 credits, distributed between major courses and minor or related field courses; three research papers, usually written in connection with coursework, are also required.

Language Requirements—None.

Final Exam—The final exams are written and oral.

Ph.D. Degree Requirements
The program is divided into five subfields: American politics, comparative politics, political theory, international relations, and formal models and methodology. A joint M.A.-Ph.D. program is also available that leads to an M.A. in public affairs from the Hubert H. Humphrey Institute of Public Affairs and a Ph.D. in political science. Students concentrate in two of the five subfields and take a minimum of 10 political science seminars, including Pol 8101 and two of four core seminars in their subfields (Pol 8201, 8301, 8401, 8601). In addition, they take three advanced seminars in their first subfield and three in their second, or four advanced seminars in their first subfield and two in their second subfield (formal models and methodology can be used only as a second subfield).

Language Requirements—Students must demonstrate one of the following: a) high proficiency in one foreign language, b) high proficiency in research methodology, c) low proficiency in two foreign languages, d) low proficiency in one foreign language and low proficiency in research methodology.

Students who concentrate in comparative politics must have appropriate language competence in their area(s) of specialization.

Minor Requirements for Students
Majoring in Other Fields—A doctoral minor requires a minimum of 9 credits of graduate-level courses and an exam.

Portuguese
See Hispanic and Luso-Brazilian Literatures and Linguistics.

Program Evaluation
Contact Information—Director of Graduate Studies, Program Evaluation Program, University of Minnesota, 330 Wulling Hall, 86 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-1006; fax 612-624-3377; e-mail kingx004@umn.edu; <http://education.umn.edu/EdPA/>).

Professor
Michael Bazzerman, Social Work, Work, Community, and Family Education, Educational Policy and Administration, E
Judith Garrard, Health Services Research, Policy and Administration, E
Richard A. Krueger, Work, Community, and Family Education, E
Frances P. Lawrenz, Curriculum and Instruction, E
Darrell R. Lewis, Educational Policy and Administration, E

Associate Professor
Nancy N. Eustis, Hubert H. Humphrey Institute of Public Affairs, E
David R. Johnson, Institute on Community Integration, E
Jean A. King, Educational Policy and Administration, E

Curriculum—A minor in program evaluation may be pursued at both the doctoral and the master’s levels. The core of the curriculum consists of courses in the foundations of evaluation, evaluation theory, and internship experiences.

Prerequisites for Admission—Prior admission into an established M.A. or Ph.D. is required. Admission to the minor, therefore, will be contingent upon enrollment in good standing within a recognized degree-granting program of the University of Minnesota Graduate School.

Special Application Requirements—Students apply for admission through the director of graduate studies and faculty. Students must demonstrate relevant academic background, including research methodology, and experience in a field in which program evaluation is practiced (e.g., public health, social work, and education). Students from existing evaluation programs in EdPA and EPsy are not eligible for the minor.

Use of 4xxx Courses—Use of 4xxx courses is not permitted.

Courses—Please refer to Educational Policy and Administration (EdPA), Educational Psychology (EPsy), Family Social Science (FSoS), Public Health (PubH), and Work, Community, and Family Education (WCFE) in the course section of this catalog for courses pertaining to the program.
Freestanding Minor Requirements
Students need a minimum of 15 credits for the doctoral minor and the minimum of 9 credits for the master’s minor. Individual programs are designed through consultation among the student, the major adviser, and the director of graduate studies.

Psychological Foundations of Education
See Educational Psychology.

Psychology
Contact Information—Department of Psychology, University of Minnesota, 249 Elliott Hall, 75 East River Road, Minneapolis, MN 55455 (612-624-4181; fax 612-626-2079; e-mail psyapply@umn.edu; <www.psych.umn.edu>.

Regents’ Professor
Ellen S. Berscheid, FM

Professor
Richard D. Arvey, Human Resources and Industrial Relations, FM
Eugene Borgida, FM
Thomas J. Bouchard, Jr., FM
Dwight A.Burkhardt, FM
James N. Butcher, FM
John P. Campbell, FM
Marilyn E. Carroll, Psychiatry, FM
Robert A. Cudeck, FM
Mark L. Davison, Educational Psychology, FM
Byron Egeland, Child Development, FM
Paul W. Fox (emeritus), FM
William G. Iacono, FM
Dorothy K. Hatsukami, Psychiatry, FM
Paul W. Fox (emeritus), FM
Byron Egeland, Child Development, FM
Linda K. Van Egeren, AM

Associate Professor
Charles R. Fletcher, FM
Patricia A. Frazier, FM
Martha H. Gonzales, FM
William M. Grove, FM
Darwin D. Hendel, Educational Policy and Administration, AM

Clinical Associate Professor
James P. Cleary, AM

Assistant Professor
Kathy J. Christensen, Neurology, AM
Jonathan C. Gewirtz, AM
Theresa M. Glimb, Human Resources and Industrial Relations, AM
Harriett L. C. Haynes, University Counseling and Consulting Services, E
Robert F. Krueger, AM
Richard M. Lee, AM
Monica Luciana, AM
Shigehiro Oishi, AM
Alexander J. Rothman, FM

Clinical Assistant Professor
Celia W. Gershenson, AM
John C. Gonsiorek, AM
Scott R. Spoonheim, AM
Linda K. Van Egeren, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Except for the psychometric methods specialization and in special circumstances, students are admitted only for the Ph.D. However, a number of Ph.D. subareas require a Plan A master’s to ensure that research training starts early. Doctoral program specialties are offered in biological psychopathology, clinical science and psychology, clinical psychology research, cognitive and biological psychology, counseling psychology, differential psychology/behavior genetics, industrial/organizational psychology, personality research, psychometric methods, school psychology, and social psychology.

Prerequisites for Admission—Prospective students generally have completed 12 credits (three to four courses) of psychology work beyond introductory psychology, including one course in statistics or psychological measurement. For the clinical science program, a course in abnormal psychology is required. An undergraduate major in psychology is desirable, but not necessary.

Special Application Requirements—Applications are accepted for fall admission only; the deadline is January 5. A department application, a statement of career interests, goals, and objectives, three letters of recommendation from persons familiar with the applicant’s scholarship and research potential, and scores from the General Test of the GRE should accompany applications. The GRE Subject Test in psychology is recommended. Clinical science program applicants must submit a recently scored MMPI-2 profile. Although there are no specific required minimums for GPAs and GRE scores, the range of scores for those admitted in previous years, as well as other specific requirements, are available from the psychology graduate admissions office.

To ensure full consideration for fellowships and teaching and research assistantships, send the Graduate School application form, transcripts, and application fee to the Graduate School by December 1.

Use of 4xxx Courses—Certain 4xxx courses may be taken for graduate credit. Students should consult the instructor or director of graduate studies.

Courses—Please refer to Psychology (Psy) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
Each student’s program is planned in consultation with an adviser. Plan A requires a minimum of 14 credits in psychology and 6 credits in a minor/related field, and a research thesis. Plan B requires one to three review papers in lieu of a thesis, and a minimum of 30 course credits, of which 14 credits must be in psychology and 6 credits in one or more related fields. For Plan A, the final exam is oral; for Plan B, it may be written, oral, or both.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A master’s minor requires a minimum of 6 credits, with specific courses determined in consultation with an adviser and other faculty.

Ph.D. Degree Requirements
Students must satisfy the general area distribution requirement using selected courses in four areas outside their specialization. There are no other general departmental course requirements. Each student’s program is individually planned in consultation with an adviser to meet both the individual’s goals and the area requirements. The programs in clinical psychology and counseling psychology include specific requirements for applied coursework and practicum and internship experiences. Each specialization also requires completion of a series of Ph.D. seminars covering scholarship and research skills. Students also complete 12-15 credits in a minor or supporting program.

Language Requirement—None

Minor Requirements for Students Majoring in Other Fields—The doctoral minor requires a minimum of 12 credits and is designed according to student needs.
Public Affairs

Contact Information—Director of Admissions, Hubert H. Humphrey Institute of Public Affairs, University of Minnesota, 301 19th Avenue South, Minneapolis, MN 55455; (612-624-3800; fax 612-625-3513; e-mail admissions@hhh.umn.edu; <www.hhh.umn.edu>.

Regents’ Professor
G. Edward Schuh, AM

Professor
John S. Adams, AM
Sandra O. Archibald, AM
John E. Brandl, AM
John M. Bryson, AM
Nancy N. Eustis, AM
Katherine Fennelly, AM
Stephen A. Hoenack, AM
Ethan B. Kapstein, AM
Kenneth H. Keller, AM
Sally J. Kenney, AM
Morris M. Kleiner, AM
Robert T. Kudrle, AM
Ann R. Markusen, AM
George W. Morse, AM
Applied Economics, AM
Samuel L. Myers, AM
Carlisle F. Runge, AM
Applied Economics, AM
Esther Wattenberg, AM
Social Work, AM

Associate Professor
Ragui A. Assaad, AM
Robert A. Connor, Healthcare Management, AM
Edward G. Goetz, AM
Maria J. Hannatt, AM
Deborah Levison, AM
Melissa M. Stone, AM

Assistant Professor
Karen Chapelle, AM
Kenneth A. Kriz, AM

Other
Zbigniew M. Bochniarz, AM
Harry C. Boyte, AM
Barbara C. Crosby, AM
William A. Dzir, AM
Marsh A. Freeman, AM
Thomas F. Luce, AM
Barbara L. Lukermann, AM
Lee Munnich, AM
Joseph H. Nathan, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The master of public affairs (M.P.A.) is intended for mid-career professionals and working professionals seeking new skills and understandings. It is a broad, generalist program that emphasizes leadership and the study of specific policy and skill areas. Completion of degree requirements should be possible within a calendar year (two semesters and a summer) of full-time work, or two years of part-time work. Structured concentrations include advanced policy analysis methods; economic and community development; foreign policy and international affairs; public and nonprofit leadership and management; science and technology policy; social policy; women and public policy; land use/urban design planning; regional, economic and workforce development; housing and community development; environmental planning; and transportation planning.

Prerequisites for Admission—Ten years or more of career or public affairs experience and a U.S. bachelor’s degree or a comparable foreign degree from a recognized college or university are required.

Special Application Requirements—In addition to the materials submitted to the Graduate School, applicants must submit to the Humphrey Institute a photocopy of the Graduate School admission application, a Humphrey Institute Applicant Data form, copies of all transcripts, a statement of purpose, at least three letters of recommendation, and a work résumé. Entry is for fall semester.

Use of 4xxx Courses—Use of 4xxx courses on degree program forms is permitted with instructor’s and adviser’s permission.

Courses—Please refer to Public Affairs (PA) in the course section of this catalog for courses pertaining to the program.

M.P.A. Degree Requirements
The M.P.A. requires 30 credits, including PA 8001—Synthesis Seminar (4 cr, PA 8002—Synthesis Workshop (4 cr), and PA 5941—Leadership for the Common Good (4 cr); 9 credits in concentration electives such as economic development, foreign policy and international affairs, social policy, or other related courses; 6 credits in skills courses; and 3 credits of free electives. Participants have the option to pursue a minor or related field offered by another college within the University.

Language Requirements—None.

Final Exam—Projects in the synthesis seminar and workshop take the place of a Plan B paper and final oral exam.

Public Health

Contact Information—Student Services Center, School of Public Health, University of Minnesota, MMC 819, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-3500 or 1-800-774-8636; fax 612-626-6931; e-mail sph-uofm@greg2.sph.umn.edu; <www.sph.umn.edu>.

Professor
Michael Baizerman, Social Work, E
Robert W. Blum, Pediatrics, E
Judith E. Brown, E
Judith M. Garrard, E
Susan G. Gerberich, E
Robert W. Jeffery, E
Barbara J. Leonard, Nursing, E
A. Marshall McBean, E
Michael D. Resnick, Pediatrics, E
Robert L. Vertrees, E
Carolyn L. Williams, E

Associate Professor
Lester E. Block, E
Ann W. Garwick, E
Leslie A. Grant, Carlson School of Management, E
Wendy L. Hellestedt, E
Patricia M. McGovern, E
Joan M. Patterson, E
Barbara A. Spradley (emeritus), E

Other
Lee E. Schacht, E

Curriculum—The public health minor is available to master’s (M.A. and M.S.) and doctoral students.

Prerequisites for Admission—Admission is contingent upon prior admission to a master’s or doctoral degree-granting program within the Graduate School. Students enrolled in graduate programs within the School of Public Health are not eligible for this minor.

Special Application Requirements—Students declaring a minor in public health should contact the director of graduate studies in public health as early as possible. Enrollment is contingent upon approval of the application by the director of graduate studies, after which a minor program adviser(s) is assigned.

Use of 4xxx Courses—Use of 4xxx courses is not permitted.

Courses—Please refer to Public Health (PHB) in the course section of this catalog for courses pertaining to the program.

Freestanding Minor Requirements
The master’s minor requires a minimum of 8 graduate credits; the doctoral minor a minimum of 14 graduate credits. Courses for the minor must be selected from those offered by the School of Public Health. In order to meet the minor requirements, students must successfully complete graduate coursework in each of the following disciplines: biostatistics, epidemiology and environmental health. These courses should meet the content level of the School’s basic courses in those subjects: PubH 5414—Biostatistical Methods I, PubH 5320—Fundamentals of Epidemiology and PubH 5200—Environmental Health.

If students have already taken comparable graduate level courses in these disciplines, other public health courses could be used to complete the minor requirement with the approval of the public health adviser and the director of graduate studies. Since public health courses may have prerequisites or enrollment limitations, early planning with your adviser is suggested.

Language Requirements—None.

Public Policy

Contact Information—Director of Admissions, Hubert Humphrey Institute of Public Affairs, University of Minnesota, 301 19th Avenue South, Minneapolis, MN 55455 (612-624-3800; fax 612-625-313; e-mail admissions@hhh.umn.edu; <www.hhh.umn.edu>.

Regents’ Professor
G. Edward Schuh, AM

Professor
Dean E. Abrahamson, AM
John S. Adams, AM
Sandra O. Archibald, AM
Richard S. Bolan (emeritus), AM
John E. Brandl, AM
John M. Bryson, AM
Nancy N. Eustis, AM

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Degree Programs and Faculty

Katherine Fennelly, AM
Stephen A. Hoenack, AM
Ethan B. Kapstein, AM
Kenneth H. Keller, AM
Sally J. Kenney, AM
Morris M. Kleiner, AM
Robert T. Kudrle, AM
Ann R. Markussen, AM
George W. Morse, Applied Economics, AM
Samuel L. Myers, AM
Carlisle F. Runge, Applied Economics, AM
Esther Wattenberg, Social Work, AM

Associate Professor
Raguil A. Assaad, AM
Robert A. Connor, Healthcare Management, AM
Edward G. Goetz, AM
Maria J. Hartratty, AM
Deborah Levison, AM
Melissa Stone, AM

Assistant Professor
Karen Chapple, AM
Kenneth A. Kitz, AM

Other
Zhengwei M. Bochniarz, AM
Harry C. Boyte, AM
Barbara C. Crosby, AM
William A. Diaz, AM
Marsha A. Friedman, AM
Thomas F. Luce, AM
Barbara L. Lukermann, AM
Lee W. Munnich, AM
Joseph H. Nathan, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The master of public policy (M.P.P.) curriculum is built upon a core of required theoretical and methodological courses. In remaining courses, students choose either to emphasize more advanced study of analysis or management, or to focus on a particular substantive area of public policy. Structured concentrations include advanced policy analysis methods, economic and community development, foreign policy and international affairs, public and nonprofit leadership and management, science and technology policy, social policy, and women and public policy. Students have multiple opportunities to apply the concepts learned in their coursework to real-life policy problems—through cases presented in courses, through their internships, and in the capstone seminar or workshop.

Prerequisites for Admission—Students are expected to have completed the equivalent of an introductory course in microeconomics.

Special Application Requirements—In addition to the materials submitted to the Graduate School, applicants must submit to the Humphrey Institute a photocopy of the Graduate School admission application, the Humphrey Institute Applicant Data Form, copies of all academic transcripts, a statement of purpose, at least three letter of recommendation, and a GRE official score report. Students who wish to be considered for financial aid should apply no later than January 15 of the preceding academic year. Entry is for fall semester.

Use of 4xxx Courses—Use of 4xxx courses towards degree requirements is permitted with instructor’s and adviser’s permission.

Courses—Please refer to Public Affairs (PA) in the course section of this catalog for courses pertaining to the program.

M.P.P. Plan B Degree Requirements
The M.P.P. requires 45 credits including up to 21 credits in required core courses, a three-course concentration (9 credits minimum), and a 3-credit capstone seminar or workshop course. Remaining credits are taken in elective courses. A non-credit internship is also required, unless the student is exempted based on previous relevant employment.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A minor is constructed in consultation with the student’s minor adviser.

Quaternary Paleoecology

Contact Information—Emi Ito, Director of Graduate Studies, Quaternary Paleoecology Graduate Program, University of Minnesota, 108 Pillsbury Hall, 310 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-7881; fax 612-625-3819; e-mail qpmminor@umn.edu).

Regents’ Professor
Herbert E. Wright, Jr. (emeritus), Geology and Geophysics, E

Professor
Subir K. Banerjee, Geology and Geophysics, E
Dwight A. Brown, Geography, E
Edward J. Cushing, Ecology, Evolution, and Behavior, E
R. Lawrence Edwards, Geology and Geophysics, E
Guy E. Gibbon, Anthropology, E
Emi Ito, Geology and Geophysics, E
Thomas C. Johnson, Geology, E
Edward A. Nater, Soil, Water, and Climate, E
Richard H. Skaggs, Geography, E
Peter S. Wells, Anthropology, E

Associate Professor
James Cotter, Ecology, Evolution, and Behavior, E
Katherine Klink, Geography, E

Assistant Professor
Greg Laden, Anthropology, E
Martha Tappen, Anthropology, E

Curriculum—This minor offers a structured interdisciplinary graduate curriculum for students working in quaternary paleoecology. Students learn analytical techniques and research approaches that they can apply to their research from other disciplines. The minor in quaternary paleoecology is available to master’s (M.A. and M.S.) and doctoral students. Students benefit from the broad range of expertise and experience available from faculty at a large research university.

Prerequisites for Admission—Admission is contingent on prior admission to a Graduate School degree-granting program.

Special Application Requirements—Students apply by sending a letter of application to the director of graduate studies (qpminor@umn.edu) as well as a letter of recommendation from their current adviser. Application may be made at any time.

Use of 4xxx Courses—Any 4xxx course included in the published list at <http://lrc.geo.umn.edu/QP/> may be used to satisfy the minor requirement.

Courses—See <http://lrc.geo.umn.edu/QP/> and contact the director of graduate studies at qpminor@umn.edu for information on relevant coursework.

Freestanding Minor Requirements
Students develop their program in consultation with their major adviser and the director of graduate studies in quaternary paleoecology. Students must take a series of required courses, but some requirements may be waived depending on the student’s background. The master’s minor requires at least 6 graduate credits from the minor course lists, including one of the three required courses. The doctoral minor requires at least 9 graduate credits from the lists, including two of the three required courses (the third course may be from the required list or from the additional course list).

The required courses include Geo 4631—Earth System: Geosphere/Biosphere Interactions (3 cr); Geo 5426—Climatic Variations (3 cr); and Anth 4069—Environmental Archaeology (3 cr).

Recreation, Park, and Leisure Studies

Contact Information—Linda Estrem, Office of the Director of Graduate Studies, School of Kinesiology and Leisure Studies, University of Minnesota, 220 Cooke Hall, 1900 University Avenue S.E., Minneapolis, MN 55455 (612-624-5017; 612-625-5300; fax 612-626-7700; e-mail rpls@umn.edu; <www.kls.coled.umn.edu/>)

Professor
Dorothy H. Anderson, Forest Resources, AM
William C. Gartner, Applied Economics, AM
Mary Jo Kane, AM
Leo H. McAvoy, Jr., AM
John E. Rynders, Educational Psychology, AM
Michael Wade, AM

Associate Professor
Bruce D. Anderson, AM
Carla E. S. Tabourne, AM
Diane M. Wiese-Bjornstal, AM

Assistant Professor
W. Corliss Outley, AM

Instructor
JoAnn Buyse, AM
Stephan P. Carlson, Applied Economics, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.
Curriculum—Emphasis areas in the master’s program are leisure services management, outdoor recreation/education, sport management, and therapeutic recreation.

Prerequisites for Admission—Although prospective students generally have an undergraduate degree in recreation, park, and leisure studies, others with a baccalaureate degree including related preparation and a significant background and interest in the scientific study of recreation, park and leisure studies may be admitted. Admitted students may be required to complete background preparation in undergraduate and graduate recreation, park, and leisure studies and related coursework.

Special Application Requirements—Applicants must submit a completed application form including a clearly written statement of academic interests, goals, and objectives, scores from the General Test of the GRE (verbal and quantitative) or the Miller Analogies Test that are less than five years old, three letters of recommendation from persons familiar with their scholarship and research potential, a scholarly paper, and copies of official transcripts. Students may apply at any time; however, submission of all application materials by January 15 is strongly encouraged to ensure priority consideration as well as teaching and research assistantships awarded for the next academic year. Students can be admitted any term.

Research Facilities—Research facilities include the Institute on Community Integration and the Tucker Center for Research on Girls and Women in Sport.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Recreation, Park, and Leisure Studies (Rec) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements Students select an emphasis in leisure services management, outdoor education/recreation, sport management, or therapeutic recreation. The M.A. is offered under Plan A and Plan B. Plan A requires 30 credits, including at least 14 credits in recreation, park, and leisure studies, 6 credits in a minor or related field, and 10 thesis credits (Rec 8777). Plan B also requires 30 credits, including at least 14 credits in recreation, park, and leisure studies, 6 credits in a minor or related field, 4 credits of a research project (Rec 8995), and 6 additional credits in any of these areas. A 3.00 minimum GPA is required to maintain good standing and to graduate.

Language Requirements—None.

Final Exam—The final exam is oral.

Rehabilitation Science

Contact Information—LaDora Thompson, Ph.D., PT, Director of Graduate Studies, University of Minnesota; Mayo Mail Code 388, 420 Delaware St. S.E., Minneapolis, MN 55455; (612-626-5271; fax 612-625-7192; e-mail thomp067@umn.edu; <www.med.umn.edu/rehabsci/>.

Professor
Richard DiFabio, FM
Robert Patterson, FM

Associate Professor
James Carey, FM
Dennis Dykstra, AM
Virgil Mathiowetz, FM
Judith Reisman, AM
Glenn Scudder, E
Erica Stern, AM
LaDora Thompson, FM

Assistant Professor
Lisa Dorsey, E
Paula Ludewig, FM
Kristen Ness, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Physical rehabilitation optimizes recovery from disease or injury. The program prepares individuals to have a critical mind and research skills that will advance this clinical science. Emphasis areas in neurological rehabilitation and musculoskeletal rehabilitation are offered.

Prerequisites for Admission—Applicants must hold a bachelor’s degree or graduate degree in a discipline related to rehabilitation such as biomedical engineering, medicine, occupational therapy, physical therapy, or speech/audiology. International students must hold a comparable foreign degree from an accredited program. Depending on the educational background of the applicant, admission may be contingent upon completion of selected prerequisite coursework (i.e., physics, etc.).

Special Application Requirements—Applicants must submit the following materials: Graduate Record Examination (GRE) general test scores; three letters of reference; Test of Spoken English (TSE) score and TOEFL score for international students. All applicants must have a minimum undergraduate GPA of 3.0 and an agreement from a Rehabilitation Science faculty member to serve as an adviser. Compatibility of research interests is a major determinant in the selection of a student/advisor relationship.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms requires adviser and director of graduate studies approval. The use of 4xxx courses on degree program forms is highly discouraged.

Courses—Please refer to Rehabilitation Science (RSc) and Physical Medicine and Rehabilitation (PMed) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements Plan A (thesis) requires a minimum of 33 credits: a minimum of 14 credits in the major, including 6 credits of rehabilitation science seminars (PMed 5100, 8101, and 8102) and a research (design course in core rehabilitation science; a minimum of 6 credits in a minor or related fields; a statistics course (EPsy 5261 or equivalent); and a minimum of 10 thesis credits (RSc 8777). In place of the 10 thesis credits for Plan A, Plan B (nonthesis) requires courses chosen in consultation with an adviser and a Plan B project. Students must maintain a 3.00 minimum GPA for all coursework taken in the program.

Language Requirements—None.

Final Exam—For Plan A, the final exam is oral, for Plan B, it may be written, oral, or both.

Ph.D. Degree Requirements

The Ph.D. requires a minimum of 36 course credits: 16 credits in core courses (including 6 credits of rehabilitation science seminars), 12 credits in a minor or supporting program, 8 credits in statistics (credits earned in core courses and statistics cannot be applied to the minor or supporting program); and 24 thesis credits. Students must maintain a 3.00 minimum GPA for all coursework taken in the program.

Language Requirements—None.

Religions in Antiquity

See Classical and Near Eastern Studies.

Religious Studies

Contact Information—Director of Graduate Studies, Department of Classical and Near Eastern Studies, University of Minnesota, 305 Folwell Hall, 9 Pleasant Street S.E., Minneapolis, MN 55455 (612-625-5353).

Professor
Josef L. Altholz, History, E
Frederick M. Asher, Art History, E
Bernard S. Bachrach, History, E
Cesar E. Farah, Afro-American and African Studies, E
Jasper S. Hopkins, Philosophy, E
Riv-Ellen Prell, American Studies, E
Theofanis G. Stavrou, History, E
James D. Tracy, History, E
Gayle Graham Yates, American Studies, E

Associate Professor
William W. Malandra, E
Jonathan S. Paradise, E
Philip H. Sellew, E

Lecturer
David A. Shupe, E
Curriculum—The minor in religious studies is available to master’s (M.A. and M.S.) and doctoral students in relevant fields, such as history, classics, English, anthropology, philosophy, and American studies and is under the general direction of members of the graduate faculty, who represent a broad spectrum of disciplines.

Prerequisites for Admission—Admission is contingent on prior admission to a master’s or doctoral degree-granting program within the Graduate School.

Special Application Requirements—Students should consult with the director of graduate studies for the program as early as possible, and in any case no later than their third semester of study. The director of graduate studies must approve the applicant’s proposed course of study and sign the student’s degree program form.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to approval by the director of graduate studies.

Freestanding Minor Requirements

The minor requires 9 credits for an M.A. and 12 semester credits for the Ph.D. All minors will have at least one of the religious studies graduate faculty as members of their examination committees. All students enrolled in the minor take RelA 5700—Theory and Method in Religious Studies, and choose two (M.A.) or three (Ph.D.) of the following courses to complete the program: Afro 5036, AmSt 5101, ANE 5501/2, 5503/4, Anth 5059, Arab 5542, Arth 5795, Clas 5088/9, 5252, Jwst 5013, 5960, 5111, Phil 8081, 8550, RelA 5071, 5072, 5073, 5080, 8310, Salc 5412/3.

Language Requirements—There are no special language requirements beyond those of the student’s major program.

Rhetoric and Scientific and Technical Communication

Contact Information—Department of Rhetoric, University of Minnesota, 64 Classroom Office Building, 1994 Buford Avenue, St. Paul, MN 55108 (612-624-4761; fax 612-624-3617; e-mail rhetoric@umn.edu; <www.rhetoric.umn.edu>.

Rhetoric and Scientific and Technical Communication Graduate Faculty

Professor

John H. Beatty, Ecology, Evolution, and Behavior, FM
Lilian S. Bridwell-Bowles, English, FM
Karyln K. Campbell, Speech-Communication, FM
Terence G. Collins, General College, AM
Shirley N. Garner, English, FM
Michael P. Graves, Curriculum and Instruction, FM
Alan G. Gross, Rhetoric, FM
Mary M. Lay, Rhetoric, FM
Helen E. Longino, Women’s Studies, AM
Earl E. McDowell, Rhetoric, FM
Victoria M. Mikolonis, Rhetoric, AM
Donald J. Ross, Jr., English, AM
Edward A. Schiappa, Speech-Communication, FM
Robert L. Scott (emeritus) Speech-Communication, FM
Richard A. Swanson, Work, Community, and Family Education, FM
Billie J. Wahlstrom, Rhetoric, FM

Associate Professor

Lisa Albrecht, General College, AM
William A. Babcock, Journalism and Mass Communication, AM
Robert L. Brown, Jr., Cultural Studies and Comparative Literature, FM
Simon Hooper, Curriculum and Instruction, AM
Laura J. Gurak, Rhetoric, FM
Thomas M. Scanlan, Rhetoric, AM
Arthur E. Walzer, Rhetoric, FM

Assistant Professor

Lee-Ann Kastman Breuch, AM
Richard J. Geaff, AM
John Logie, AM
Daniel J. Philippon, AM

Scientific and Technical Communication Graduate Faculty

Professor

Alan G. Gross, Rhetoric, AM
Mary M. Lay, Rhetoric, AM
Earl E. McDowell, Rhetoric, AM
Victoria M. Mikolonis, Rhetoric, AM
Billie J. Wahlstrom, Rhetoric, AM

Associate Professor

Laura J. Gurak, Rhetoric, AM
Thomas M. Scanlan, Rhetoric, AM
Arthur E. Walzer, Rhetoric, FM

Assistant Professor

Lee-An Kastman Breuch, AM
Richard J. Geaff, AM
John Logie, AM
Daniel J. Philippon, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The M.S. focuses on applying basic theory and research to the practice of scientific and technical communication in the workplace. It is designed for students who plan to be technical communicators or information developers in business and industry. Required courses cover audience analysis, new media, message design, human factors and usability research, strategic planning, and technical training.

The M.A. and Ph.D. in rhetoric and scientific and technical communication prepare students to address complex issues in language, science, and technology. The programs are flexible enough to allow students to approach their studies from a variety of perspectives and research methods. This option prepares students for teaching at a university and conducting research in rhetoric and scientific and technical communication. The programs can also prepare students for specialist positions in industry and government that require the analysis and design of human communication systems. Required courses include theory, research, and practice in rhetoric and scientific and technical communication and in a minor or related field.

Prerequisites for Admission—All M.S. applicants are required to have a bachelor’s degree from an accredited college or university; 15 credits in science, technology, mathematics, and/or engineering; 9 credits in advanced communication courses such as writing/editing, oral communication, visual communication, organizational communication, and communication theory; and 3 credits in computer science or management information systems, or demonstrated equivalent experience. All M.A. and Ph.D. applicants must meet the admission requirements of the Graduate School and will be expected to have completed coursework or have equivalent experience in advanced communication (e.g., writing/editing, oral communication, visual communication, organizational communication, or communication theory) and one of the following areas: computer science, management information systems, science, technology, mathematics, engineering, or other related fields.

Special Application Requirements—Scores from the General Test of the GRE that are less than five years old are required of students with baccalaureate degrees from U.S. institutions. Nonnative speakers of English are required to take the TOEFL with satisfactory scores. All applicants must submit three letters of recommendation, two writing samples, and a professional objective statement. M.S. deadlines are June 15 for fall semester admission and October 15 for spring semester admission. All M.A. and Ph.D. applicants begin in the fall semester and have a January 15 deadline.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Rhetoric (Rhet) in the course section of this catalog for courses pertaining to the program.

M.S. and M.A. Degree Requirements

The M.S. in scientific and technical communication requirements for Plan A and Plan B are the same except that Plan A requires a thesis (10 credits) and Plan B requires a project (5 credits). Students take six courses in theory, research, and practice in technical communication. An internship is required for any student who has not yet worked as a technical communicator in industry. Students take additional electives in rhetoric to complete 34 credits for Plan A or 30 credits for Plan B. The M.A. requirements for Plan A and Plan B are the same except that Plan A requires a thesis (10 credits) and Plan B requires a project (5 credits). Students take six courses (18 credits) in theory, research, and practice in rhetoric and scientific and technical communication and in a minor or related field. An internship (3 credits) is required for those intending to pursue research or specialist positions in industry. Minor or related fields (6 credits) may focus on areas
such as speech-communication, English, curriculum and instruction, women’s studies, cognitive psychology, and history of science. Students take additional electives in rhetoric to complete 30 credits.

Language Requirements—None for M.S. students. M.A. students must demonstrate proficiency in a foreign language of their choice either by taking 3 credits of a beginning level language course or having their adviser and the director of graduate studies certify that they have reading comprehension in a particular language. A student could fulfill this requirement by taking a beginning 3 credit course or by completing a non-credit course such as Fren 0001—Reading French in the Arts and Sciences or Ger 1001—Beginning German. These courses are non-credit and are offered through the College of Continuing Education.

Final Exam—For both Plans A and B, students must pass an oral examination in which they defend their master’s work and demonstrate competence in their chosen field of study.

Ph.D. Degree Requirements
Ph.D. students in rhetoric and scientific and technical communication are required to earn a minimum of 42 credits beyond the master’s. This plan requires a minimum of 21 credits in rhetoric seminars—two of those seminars must be in rhetorical theory and criticism within rhetoric course offerings. Students take two courses (6 credits) in rhetorical theory and criticism beyond the M.A. requirements; two courses in technical communication research and theory (6 credits) including Rhet 8011 and 8012; two courses (6 credits) in a particular area of study such as science and rhetoric; feminist theory in science, technology, and communication; scientific and technical communication pedagogy; or technology and culture; 6 credits in research methods courses; and 12 credits in a minor or related field. Minor or supporting programs may focus on areas such as speech-communication, English, curriculum and instruction, women’s studies, cognitive psychology, or history of science. In addition, 6 elective credits are needed to fulfill the minimum credit requirement. Students may fulfill 18 credits of Ph.D. work in completing M.A. requirements (usually two courses in rhetorical theory and three courses in other core areas). Twenty-four thesis credits are also required. The final exam is oral.

Language Requirements—Ph.D. students must demonstrate proficiency in a foreign language of their choice either by taking 3 credits of a beginning level language course or having their adviser and the director of graduate studies certify that they have reading comprehension in a particular language. A student could fulfill this requirement by taking a beginning 3 credit course or by completing a non-credit course such as Fren 0001—Reading French in the Arts and Sciences or Ger 222—Reading German. These courses are non-credit and are offered through the College of Continuing Education.

Minor Requirements for Students Majoring in Other Fields—For M.A. and M.S. students, the minor requires 6 credits in 5xxx and 8xxx rhetorical courses. The minor for Ph.D. students requires 12 credits of 5xxx and 8xxx courses (6 of which can be taken for the M.A. or M.S. degree) with one course being in rhetorical theory and criticism. Students may choose the remaining courses from any of Rhetoric’s graduate courses.

Russian Area Studies

Contact Information—Russian Area Studies, Area Studies Programs, University of Minnesota, 214 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-8543; fax 612-626-2242).

Professor
John S. Adams, Public Affairs, AM
Iraj Bashiri, Linguistics and Asian and Slavic Languages and Literatures, AM
Gary R. Jahn, Linguistics and Asian and Slavic Languages and Literatures, AM
Anatoly Liberman, German, Scandinavian, and Dutch, AM
Thomas S. Noonan, History, AM
Herbert L. Pick, Jr., Child Development, AM
Miranda Beaver Remnek, AM
Theofanis G. Statireas, History, AM
Carol L. Urness, AM
Rudolph J. Vecoli, History, AM

Associate Professor
Irina H. Corten, Linguistics and Asian and Slavic Languages and Literatures, AM
Leonard A. Polakiewicz, Linguistics and Asian and Slavic Languages and Literatures, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This program provides students with the knowledge to better understand the Russian world, its history, culture, and restructuring in the post-Soviet era. As Russia redefines its place in the world, and as trade and cultural links between Russian and the United States grow, Russian area specialists are increasingly needed. Areas of concentration include Russian history, Russian literature, and twentieth-century Russia.

Prerequisites for Admission—A bachelor’s degree from an accredited university or college is required.

Special Application Requirements—The following must be forwarded directly to the department: three letters of recommendation, a copy of one or more papers representative of current level of scholarly development, and a statement of the student’s purpose. Scores from the General Test of the GRE are required. Prospective students should contact the department for further information. Students are admitted each semester.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please refer to Russian Area Studies (RAS), Russian (Russ), Global Studies (GloS), Central Asian Studies (CAS), Polish (Psh), and Slavic (Slav) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
The M.A. program uses an interdisciplinary approach involving both the humanities and the social sciences. Students must complete required coursework, master appropriate theoretical frameworks, and acquire a concise understanding of topic(s) developed in the Plan A thesis or in three Plan B papers. The thesis/papers must show a broad knowledge of the Russian area, methodological sophistication, and clear evidence of research in Russian language sources. Students must also demonstrate advanced Russian language proficiency.

All students complete six distribution courses (18 credits), including two courses on Russian literature (Russ 5421—Literature: Middle Ages to Dostoevsky in Translation and Russ 5422—Literature: Tolstoy to the Present in Translation), one course in social science (Geog 5181—Russia and Environments), two graduate level courses in Russian history, and a scope and methods course (Area 8061). Plan A students must complete three additional courses (9 credits) in their declared area of concentration and 10 thesis credits. Plan B students must complete four additional courses (12 credits) in their declared area of concentration.

Language Requirements—Students must demonstrate advanced Russian language proficiency by passing a special exam or by earning a B or higher average in Russ 3101-02 or the equivalent.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—The master’s minor requires intermediate proficiency in the Russian language (as demonstrated by passing a special exam or by earning a B or higher average in Russ 3001-02 or the equivalent) and completion of three courses (9 credits) in the field, including at least two semesters of seminars/proseminars.

Scandinavian Studies

See Germanic Studies.

School Psychology

See Educational Psychology.
Science, Technology, and Environmental Policy

Contact Information—Director of Admission, Hubert Humphrey Institute of Public Affairs, University of Minnesota, 301 19th Avenue South, Minneapolis, MN 55455 (612-624-3800; fax 612-625-3513; e-mail admissions@hhh.umn.edu; <www.hhh.umn.edu>).

Regents’ Professor
G. Edward Schuh, AM

Professor
Dean E. Abrahamson, AM
John S. Adams, AM
Sandra O. Archibald, AM
John E. Brandl, AM
John M. Bryson, AM
Nancy E. Eustis, AM
Katherine Fennelly, AM
Stephen A. Hoenack, AM
Ethan B. Kapstein, AM
Kenneth H. Keller, AM
Sally J. Kenney, AM
Morris M. Kleiner, AM
Robert T. Kudrle, AM
Ann R. Markusen, AM
Samuel L. Myers, AM
Carlisle F. Runge, Applied Economics AM
Esther Wattenberg, Social Work, AM

Associate Professor
Ragui A. Assaad, AM
Edward G. Goetz, AM
Maria J. Hanratty, AM
Deborah Levison, AM
Melissa M. Stone, AM

Assistant Professor
Karen Chapple, AM
Kenneth A. Kriz, AM

Other
Zbigniew M. Bochniarz, AM
Harry C. Boyte, AM
Barbara C. Crosby, AM
William A. Diaz, AM
Marsha A. Freeman, AM
Thomas F. Luce, AM
Barbara L. Lukermann, AM
Lee W. Munnich, AM
Joseph H. Nathan, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The M.S. program provides students with an understanding of the role of science and technology in food and health, the economy, energy and the environment, security, and education; the impact of science and technology on the political and economic relationships among nations; and the analysis and design of policies for appropriate promotion and regulation of science and technology regionally, nationally, and internationally. The program educates students with natural and social science backgrounds to assume roles in public policy development.

Prerequisites for Admission—Students typically have undergraduate degrees or advanced coursework in one of the natural or engineering sciences. They are also expected to have completed the equivalent of an introductory course in microeconomics.

Special Application Requirements—In addition to the materials submitted to the Graduate School, applicants must submit to the Humphrey Institute a photocopy of the Graduate School application, the Humphrey Institute Applicant Data Form, copies of all academic transcripts, a statement of purpose, at least three letters of recommendation, and a GRE official score report. Students who wish to be considered for financial aid should apply no later than January 15 of the preceding academic year. Entry is for fall semester.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted with instructor’s and adviser’s permission.

Courses—Please refer to Public Affairs (PA) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements
The M.S., which is offered under both Plan A (thesis) and Plan B (non-thesis), requires 40 credits including 21 credits in five core areas—12 credits in the area of science, technology, and environmental policy and 9 credits of the politics of public affairs, economic reasoning, and empirical analysis. Students should take an additional 6 credits to complement their previous training: appropriate courses in natural or engineering science or its history or philosophy for those with social science backgrounds; appropriate courses in the social sciences for those with natural or engineering science backgrounds.

Plan A also requires 10 thesis credits. Plan B requires completion of a Plan B paper (3 credits). The remaining elective credits (3 for Plan A; 10 for Plan B) are chosen in consultation with the student’s adviser.

Language Requirements—None.
Final Exam—The final exam is oral.

Scientific Computation

Contact Information—Director of Graduate Studies, 151 Amundson Hall, 421 Washington Ave. S.E., Minneapolis, MN 55455 (612-625-8881; fax 612-626-7246; e-mail sci@cem.gs.umn.edu; <http://scicomp.cs.umn.edu>}

Regents’ Professor
Avner Friedman, Mathematics, FM
L. E. Scriven, Chemical Engineering and Materials Science, FM

Professor
Ronald E. Anderson, Sociology, FM
Daniel L. Boley, Computer and Information Sciences, FM
Graham V. Candler, Aerospace Engineering and Mechanics, FM
James R. Chelikowsky, Chemical Engineering and Materials Science, FM
J. Bernardo Cockburn, Mathematics, FM
Jeffrey J. Derby, Chemical Engineering and Materials Science, FM
Timothy J. Elber, Neuroscience, FM
Jialu Gao, Chemistry, FM
Efi Foufoula-Georgiou, Civil Engineering, FM
Alexander Y. Grosberg, Physics and Astronomy, FM
Daniel J. Kersten, Psychology, FM
Vijay Kumar, Computer Science, FM
John S. Lowengrub, Mathematics, FM
Mitchell B. Luskin, Mathematics, FM
John L. Nieber, Biosystems and Agricultural Engineering, FM
Hans George Othmer, Mathematics, FM
N.P. Papankopulos, Computer and Information Sciences, FM
Haesun Park, Computer and Information Sciences, FM
Yousef Saad, Computer Science, FM
George R. Sell, Mathematics, FM
Charles C. S. Song, Civil Engineering (emeritus), FM
Harlan W. Stech, Mathematics and Statistics, Duluth, FM
Ahmed H. Tewfik, Electrical Engineering, FM
David D. Thomas, Biochemistry, FM
Luke Jon Tierney, Statistics, FM
Donald G. Truhlar, Chemistry, FM
Vaughan R. Voller, Civil Engineering, FM
George L. Wilcox, Neuroscience, FM
Paul R. Woodward, Astronomy, FM
David A. Yuen, Geology and Geophysics, FM

Associate Professor
John V. Carlis, Computer and Information Sciences, FM
Christopher J. Cramer, Chemistry, FM
David M. Ferguson, Medicinal Chemistry and Pharmacognosy, FM
David J. Lilja, Electrical and Computer Engineering, FM
J. Ilja Siepmann, Chemistry, FM
Jaddeep Srivastava, Computer and Information Sciences, FM
Michael R. Taaffe, Operations and Management Science, FM

Assistant Professor
Norman J. Troullier, Computer and Information Sciences, AM

Other
Phillip Barry, Computer Science, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Scientific and Technical Communication

See Rhetoric and Scientific and Technical Communication.
Curriculum—This program encompasses coursework and research on the fundamental principles for using intensive computation to support research in the physical, biological, and social sciences and engineering. Emphasis is on research issues, state-of-the-art methods, and applying these methods to outstanding problems in science, engineering, and other fields that use scientific computation, numerical analysis and algorithm development, symbolic and logic analysis, high-performance computing tools, supercomputing and heterogeneous networks, and visualization. A handbook that describes the program and degree requirements in detail is available from the program.

Prerequisites for Admission—Applicants fill out a form provided by the program as well as applicable Graduate School forms. A bachelor’s degree in a field that uses scientific computation is required for admission. Applicants without such a degree who expect to obtain one before the date on which admission in the graduate program is sought may also apply.

Special Application Requirements—Applicants must submit scores from the General Test of the GRE, three letters of recommendation from persons familiar with their scholarship and research potential, a complete set of official transcripts, and a clearly written statement of career interests, goals, and objectives. Students may apply at any time; however, submission of all application materials by January 1 is strongly encouraged to ensure priority consideration for fellowships and assistantships; late applications are considered if space is available.

M.S. Plan A Degree Requirements
The program is offered under Plan A (thesis), which includes a minimum of 20 course credits and 10 thesis credits. The course credits must include at least 14 credits from the scientific computation core or supplementary courses (with at least 6 credits from the core courses) and at least 6 credits in a minor. A core or supplementary course that is also in the minor area may be counted toward either requirement but not toward both; however, a maximum of 3 credits in such courses may be counted toward the core/supplementary requirement.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program’s approval.

Courses—Please refer to the Scientific Computation (SciC) in the course section of this catalog for courses pertaining to the program.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—The master’s minor requires approval of the director of graduate studies and a minimum of 6 credits from the core curriculum; the credits may not be from courses in the student’s major field.

Ph.D. Degree Requirements
A minimum of 32 course credits is required with a minimum of 16 credits in core courses; 24 thesis credits are also required. Students have two options:
1) Ph.D. with supporting program. In addition to the core credits, this option requires 10 credits in subjects that support computational science—these can include core credits beyond the required 16—and 6 credits of interdisciplinary coursework.
2) Ph.D. with minor. In addition to the core credits, this option requires 12 credits for the minor and an additional 4 course credits. Many minor programs have greater requirements; in such cases, the greater requirements will be in effect. The minor field must be declared before the student takes the preliminary oral exam.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires approval of the director of graduate studies and a minimum of 12 credits (a minimum of 8 of these in core courses with remaining credits from supplementary courses). If a minor course is also in the student’s major field, a student may use that course for the minor provided no more than one such course is used for the minor, there is no rule prohibiting this in the student’s major field, and other courses are used to satisfy the major requirement.

Social, Administrative, and Clinical Pharmacy

Contact Information—College of Pharmacy, University of Minnesota, 7-155 Weaver-Densford Hall, 308 Harvard Street S.E., Minneapolis, MN 55455 (612-624-2973; fax 612-625-9931; e-mail tseda001@umn.edu).

Professor
Robert J. Cipolle, Pharmaceutical Care and Health Systems, FM
James C. Cloyd, Experimental and Clinical Pharmacology, FM
Courtney V. Fletcher, Experimental and Clinical Pharmacology, FM
Judith M. Garrard, Public Health, FM
Lail C. Gateswood, Laboratory Medicine and Pathology, FM
Cynthia R. Gross, Experimental and Clinical Pharmacology, FM
David R. Guasy, Experimental and Clinical Pharmacology, AM
Joseph T. Hanlon, Experimental and Clinical Pharmacology, FM
Thomas E. Lackner, Experimental and Clinical Pharmacology, E
Henry J. Mann, Experimental and Clinical Pharmacology, AM
Peter C. Morley, Pharmaceutical Care and Health Systems, FM

Degree Programs and Faculty

John C. Rotschafer, Experimental and Clinical Pharmacology, AM
Rory P. Remmel, Medicinal Chemistry, FM
Stephen W. Schondelmeyer, Pharmaceutical Care and Health Systems, FM
Stuart M. Speedoede, Health Informatics, Medical School, FM
Linda M. Strand, Pharmaceutical Care and Health Systems, FM
Vernon E. Weckworth, Health Services Administration, FM
Darwin E. Zaske, Experimental and Clinical Pharmacology, AM

Adjunct Professor
Paul C. Langley, Pharmaceutical Care and Health Systems, E

Associate Professor
Sidney B. Benson, Pharmaceutical Care and Health Systems, FM
Ronald S. Hadsall, Pharmaceutical Care and Health Systems, FM
Brian J. Isotts, Pharmaceutical Care and Health Systems, AM
Tom Alan Larson, Pharmaceutical Care and Health Systems, AM
MaryBeth E. O’Connell, Experimental and Clinical Pharmacology, AM
Jon C. Schommer, Pharmaceutical Care and Health Systems, FM
Robert J. Straka, Experimental and Clinical Pharmacology, AM
Donald L. Uden, Pharmaceutical Care and Health Systems, AM
Cheryl L. Zimmerman, Pharmaceutics, FM

Assistant Professor
Margaret Arz, Experimental and Clinical Pharmacology, AM
Angela K. Birnbaum, Experimental and Clinical Pharmacology, AM
Richard C. Brundage, Experimental and Clinical Pharmacology, AM
Charles E. Daniels, Pharmacy, AM
Pamala A. Jacobson, Experimental and Clinical Pharmacology, AM
Kristin K. Janke, Pharmaceutical Care and Health Systems, AM
Michael Kotlyar, Experimental and Clinical Pharmacology, AM
Raquel Rodriguez, Pharmaceutical Care and Health Systems, AM
Debra J. Skaar, Experimental and Clinical Pharmacology, E

Adjunct Assistant Professor
Samuel Wagner, Pharmaceutical Care and Health Systems, E

Clinical Professor
Daniel E. Keyler, Experimental and Clinical Pharmacology, E

Clinical Associate Professor
John V. St. Peter, Experimental and Clinical Pharmacology, AM

Clinical Assistant Professor
Angeline M. Carlson, Pharmaceutical Care and Health Systems, AM
Patrick P. Gleason, Pharmaceutical Care and Health Systems, AM
Ricci M. Giese, Pharmacy, E
Alan H. Heaton, Pharmacy, E
Bruce E. Scott, Pharmacy, E
Leo J. Sioris, Experimental and Clinical Pharmacology, E

Professional and Academic
Nancy Ann Hardie, Experimental and Clinical Pharmacology, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

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Curriculum—Students are prepared for research and related activities investigating relationships between biological and physical factors in social settings that involve the drug use process. This flexible interdisciplinary program uses the resources of the University’s many health and social science departments. Programs include courses and offerings from public health, geriatrics, management, sociology, psychology, and public affairs.

The program focuses on the discovery and dissemination of new knowledge to foster appropriate use of drugs in order to improve patient outcomes at the individual and societal level. Students are educated and mentored to become professional scientists. Those who complete the program will understand the process of conducting high quality research and problem solving through the application of disciplinary and interdisciplinary knowledge, theory, and research methodology.

Two program tracks are available. The emphasis of the social and administrative pharmacy (SAPh) track is the application of behavior-oriented interdisciplinary theories to pharmacy problem solving and pharmacy system development. This includes the study of the social, psychosocial, political, legal, public policy, historic, and economic factors that impinge upon the use, non-use, and abuse of drugs.

The emphasis of the experimental and clinical pharmacology (ECP) track is to advance the science of human pharmacology and therapeutics to improve the safe, effective, and economical use of drugs by patients. This includes the translation of both laboratory and clinical research to the medical use process.

Prerequisites for Admission—Although the majority of students in the program are pharmacists, a pharmacy education is not required. A bachelor’s degree or its foreign equivalent from a recognized college of pharmacy and a strong scholastic record are desirable. Individuals from other fields such as economics, engineering, computer science, medicine, psychology, sociology or public health may be admitted if their undergraduate coursework satisfies the prerequisites for graduate coursework.

Special Application Requirements—Applicants must complete a department supplementary application form in addition to the Graduate School forms. The supplementary form along with three letters of recommendation should be sent directly to the department. GRE scores are required and a minimum score of 580 is required on the TOEFL for all international applicants whose native tongue is not English.

Use of 4xxx Courses—Use of 4xxx courses towards degree requirements is permitted with director of graduate studies approval.

Courses—Please refer to Social, Administrative and Clinical Pharmacy (SACP), Social and Administrative Pharmacy (SAPh), and Experimental and Clinical Pharmacology (ECP) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

The M.S. program is offered under Plan A and Plan B.

Plan A requires at least 31 credits, including 15 credits in the major field, at least 6 credits in a minor or related field, and 10 thesis credits.

Plan B requires at least 30 credits, including 15 credits in the major field and at least 6 credits in a minor or related field; the balance of coursework is determined by agreement between the student and adviser. Plan B also requires two papers of publishable quality; one paper must include a research component with an analysis of data.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master’s minor requires 6 credits in program courses, which is determined in consultation with the director of graduate studies.

Ph.D. Degree Requirements

The Ph.D. requires 34 credits in the major, 12 credits in a minor or supporting program, and 24 thesis credits. Two preliminary written exams are required: one concentrates on research design, methodological issues, and statistical analysis, the other on material specific to the student’s chosen track. Students must also pass a preliminary oral exam.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires a minimum of 12 credits in program courses determined in consultation with the director of graduate studies.

Social and Philosophic Studies of Education

Contact Information—Department of Educational Policy and Administration, University of Minnesota, 330 Wulling Hall, 86 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-1006; fax 612-624-3377).

Professor

Ayers Bagley, Educational Policy and Administration, E
John J. Cogan, Curriculum and Instruction, E
Darrell R. Lewis, Educational Policy and Administration, E
Karen S. Louis, Educational Policy and Administration, E
Josef A. Mestenhauser, Educational Policy and Administration, E
Patrick J. Starr, Mechanical Engineering, E
Caroline S. V. Turner, Educational Policy and Administration, E

Associate Professor

Arthur M. Harkins, Educational Policy and Administration, E
Jean A. King, Educational Policy and Administration, E
R. Michael Paige, Educational Policy and Administration, E

Lecturer

Richard Nunneley, Educational Policy and Administration, E

Senior Fellow

Dean Hontschlag, Educational Policy and Administration, E

Other

Carol M. Boyer, E
Timothy J. Delmont, E
Richard B. Heydinger, E

Curriculum—The graduate minor provides a multidisciplinary foundation for the study of education from the perspectives of history, philosophy, and the social sciences. The minor program is shaped to suit the particular needs and interests of the student at the master’s or doctoral level. In consultation with a faculty member in social and philosophic studies of education in the Department of Educational Policy and Administration (EdPA), 5xxx and 8xxx courses are selected both in EdPA and in related fields.

Prerequisites for Admission—Admission is contingent upon prior admission to a master’s or doctoral degree-granting program within the Graduate School. Interested students should consult with a faculty member in social and philosophic studies of education in the Department of Educational Policy and Administration.

Special Application Requirements—Prospective students should contact the director of graduate studies in the Department of Educational Policy and Administration, which provides the administrative home for this graduate minor. The director of graduate studies in this department must approve the applicant’s proposed course of study by signing the student’s degree program form.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Courses—Please contact the minor program office for information on relevant coursework.

Freestanding Minor Requirements

M.A. students must complete at least 9 graduate credits (at least one course each) in the two areas of study below. Doctoral students must complete at least 12 graduate credits (at least two courses each) in the two areas of study.

Area I—history and philosophy of education: EdPA 5021, 5023, 5024, 5028, 5032, Phil 4324, WoSt 5103.

Area II—social sciences and education: EdPA 5041, 5044, 5103, 5128, 5302, 5352, 8104.
Social Work

Contact Information—School of Social Work, University of Minnesota, 105 Peters Hall, 1404 Gortner Avenue, St. Paul, MN 55108 (612-625-1220; fax 612-624-3744; e-mail retnard@che.umn.edu; <http://ssw.che.umn.edu>).

Professor
Michael Baizerman, FM
Jerome Baker, FM
Neil F. Bracht, FM
Clarke A. Chambers (emeritus), History, FM
Jeffrey L. Edelson, FM
Jane F. Gilgum, FM
Clifton D. Hollister, FM
Rosalie A. Kane, Public Health, FM
Helen Q. Kivnick, FM
David J. Klaassen, AM
Dario Menanteau-Horta, FM
Susan S. Meyers, AM
Jean K. Quam, FM
Ronald H. Roosevelt, FM
Mark S. Unbreit, FM
Esther Wattenberg (emeritus), FM
Oliver J. Williams, FM

Associate Professor
Sandra Beeman, FM
William J. Reeder, AM
Irl E. Carter (emeritus), FM
Linda E. Jones, FM
James R. Reinardy, FM

Assistant Professor
Laura Abrams, AM
Mark G. Freazel, AM
Yai-Sang (Terry) Lum, AM
Ronald L. Pitzer, AM

Instructor
Mary K. Burnison, AM

Lecturer
Nancy M. Abramson, AM

Other
Ann S. Alhquist, AM
Kevin John Burke, AM
Sonia Davila-Williams, AM
Trude D. Hendrickson, AM
Nancy J. Johnston, AM
Nan L. Kalke, AM
Glorta M. McGee, AM
Megan H. Merson, AM
Maura Sullivan, AM
Gail M. Walters, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The M.S.W. prepares students for advanced social work practice. A 50-credit program and a 34-credit advanced standing program are available. Concentrations in the master’s program include practice in two areas: direct practice, and community practice. Two dual programs are also available: M.S.W./master of public health and M.S.W./master of public policy. The Ph.D. program prepares students to provide intellectual leadership for the social work profession through advanced levels of scholarship, research, theory development, and policy analysis. Students are expected to acquire skill in research design and statistics and to develop a comprehensive knowledge of social work and social welfare history, theory, and policy.

The Ph.D. program does not focus on the development of advanced skills for clinical practice, although students gain knowledge of practice theory and research related to social work practice is encouraged. Many graduates assume positions as university faculty. Consequently, the program offers opportunities for students to acquire skills in teaching and curriculum development.

Prerequisites for Admission—Applicants must present 26 semester credits or 39 quarter credits in the social sciences, e.g., sociology, political science, economics, psychology, history, and anthropology. Applicants must also have completed a college-level course in statistics and one in biology that has content on human anatomical and physiological development. One year of paid or volunteer social work experience is required of all applicants who do not have a bachelor’s degree in social work. Doctoral applicants must meet requirements and standards set by the Graduate School and the School of Social Work. It is preferred that applicants have earned the master's degree in social work from a school of social work accredited by the Council on Social Work Education. However, applicants with a master’s degree in a related discipline will be considered for admission. Preference is also given to candidates with at least two years of post-M.S.W. practice experience.

Special Application Requirements—Three letters of recommendation, a complete set of transcripts (in addition to that required by the Graduate School), an example of written work, a personal statement, and a department application form are required of all applicants. GRE scores are not required for admission to the master’s program, but are required from applicants who wish to be considered for a Graduate School Fellowship and from applicants who do not have an official grade point average from their undergraduate degree. GRE scores are required for admission to the doctoral program. Application deadlines for both degrees are January 8. The Ph.D. program has a March 5 deadline for the second review. Beginning students in either program are admitted fall semester only.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted with director of graduate studies approval.

Courses—Please refer to Social Work (SW) in the course section of this catalog for courses pertaining to the program.

M.S.W. Coursework Only Degree Requirements
The M.S.W. requires 50 credits; a 34-credit advanced standing program is available to graduates of undergraduate social work programs accredited by the Council on Social Work Education. All credits must be completed within five years of the date of the earliest coursework students want to apply to their degree.

The 50-credit program includes a set of required foundation courses (25 credits), courses from a selected concentration, two field internships, and social work electives. A maximum of 24 credits may be transferred from the following sources with School of Social Work approval: up to 8 credits as a non-degree seeking student registered through the PRD process at the University of Minnesota; up to 24 credits from another regionally and professionally accredited school of social work, if the student was registered as a graduate student in the program.

The 34-credit advanced standing program includes courses from a selected concentration, one field internship, and social work electives. A maximum of 16 credits may be transferred from the following sources with School of Social Work approval: 16 credits completed as a graduate student in another accredited M.S.W. program; up to 6 credits as a non-degree seeking student registered through the PRD process at the University of Minnesota.

Language Requirements—None.

Final Exam—None.

Ph.D. Degree Requirements
The Ph.D. program emphasizes mastery of student-determined and program-determined objectives rather than an accumulation of course credits. Degree requirements vary according to background and educational goals. Typically 40 credits plus 24 required thesis credits beyond the M.S.W. are required. Required courses include core seminars in social work research, social welfare history, social welfare policy, and theory and model development; a social work teaching course; a supervised research practicum and practicum seminar; supporting program courses; statistics courses. Students must also have teaching experience in the School of Social Work while in the program and fulfill the computer skills requirement.

Language Requirements—None.

Sociology

Contact Information—Graduate Secretary, Department of Sociology, University of Minnesota, 909 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-2093; fax 612-624-7020; e-mail socdept@atlas.socsci.umn.edu).

Regents’ Professor
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Professor
Ronald R. Aminzade, FM
Ronald E. Anderson, FM
John Arthur, Sociology-Anthropology, Duluth, AM
George A. Donohue (emeritus), FM
Barry C. Feld, Law School, AM
Robert L. Fulton (emeritus), FM
Joseph Galaskiewicz, FM
Degree Programs and Faculty

David Knobe, FM
Candace M. Knutsch, FM
Barbara Laslett, FM
Theodore J. Litman, Health Care Management, AM
Karen S. Louis, Educational Policy and Administration, AM
Ian H. Maitland, Strategic Management and Organization, AM
Carl P. Malmquist, FM
Margaret M. Mantla, FM
Darío Menanteau-Horta, Social Work, AM
Jeylan T. Mortimer, FM
Joel I. Nelson, FM
Steven Ruggles, History, AM
Joel B. Sanath, AM
Mark Snyder, Psychology, AM
Robin S. Stryker, FM

Associate Professor
Yanjie Bian, FM
Rose M. Brewer, African and Afro-American Studies, AM
Jeffrey P.Broadbent, FM
Kathleen T. Call, Public Health, AM
Scott R. Eliason, FM
March L. Krotee, Kinesiology and Leisure Studies, AM
Jennifer L. Pierce, FM
Joachim L. Savelberg, FM
Christopher Uggens, AM

Assistant Professor
Elizabeth H. Boyle, AM
Joseph Gerteis, AM
Douglas Hartmann, AM
Ann M. Hirokawa, AM
Erin L. Kelly, AM
Karen E. Luftey, AM
Ian R. Macmillan, AM
Evan A. Schofer, AM

Lecturer
Michael D. Finch, Healthcare Management, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Sociology is concerned with the study of human societies, groups, and social life. The program offers substantive training in five areas of specialization: family and life course; law, criminology, and deviance; organizations and work; political sociology and social movements; and stratification: race, class, and gender. Methodological training is available in historical and comparative research, survey research, network analysis, advanced statistical analysis, and qualitative research. Training for students interested in both academic and applied employment is generally available.

Prerequisites for Admission—A background in basic sociology, usually consisting of the equivalent of 18 credits in undergraduate work, including 9 credits of social science statistical methods, or an M.A. degree in sociology or a closely related field is required. Individuals who have completed fewer than 18 credits may be admitted but are generally required to complete background coursework in theory and statistics during their first year of residence.

Special Application Requirements—Applicants are evaluated on their general academic potential, commitment to the field, creativity, and potential for contribution to the field. In addition to the Graduate School application, applicants must submit the following: GRE scores; a complete set of transcripts in addition to that required by the Graduate School; an application for department support (if desired); a sample of written work, usually a term paper, written in English; three letters of recommendation; and a statement of professional objectives. The department accepts new students for fall admission only. The final application deadline for admittance is March 1. For maximum fellowship support, the final application deadline is January 1.

Use of 4xxx Courses—Use of 4xxx courses is not permitted toward degree requirements.

Courses—Please refer to Sociology (Soc) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements
Students are admitted only for the Ph.D.; the M.A. is an optional degree for students in the doctoral program.

Students take four required courses or their equivalent (13 credits) and two additional substantive courses in sociology (6 credits). Substantive courses are chosen in consultation with the adviser and program committee to meet the student’s educational and professional goals. Students must also complete a minimum of 6 credits in a minor or related field. Plan B students submit two papers, at least one of which is empirical. Plan A requires 10 thesis credits.

Language Requirements—None

Final Exam—The final exam is oral.

Ph.D. Degree Requirements
The doctoral program is for students planning to do research or teach. Students take four required courses or their equivalent (13 credits), including a course on professional skills development. Beyond that, each student’s program is individually planned in consultation with the adviser and program committee to meet both the student’s goals and broad program requirements. Those requirements include four substantive courses in sociology (12-credit minimum) and at least one semester of training in advanced methods (3-credit minimum). Students must also complete a minimum of 12 credits in a minor or supporting program and 24 thesis credits. Students who enter the program with an M.A. in sociology must earn a minimum of 18 credits in the department regardless of the number of courses for which they have petitioned equivalents from other institutions.

Language Requirements—Coursework in a foreign language may be used as outside coursework for those students who plan research in comparative sociology.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires four courses in sociology, at least one of which is 8xxx. Course choices are subject to the approval of the director of graduate studies.

Software Engineering

Contact Information—Software Engineering Graduate Program, Center for the Development of Technological Leadership, University of Minnesota, 510 West Bank Office Building, 1300 S. Second Street, Minneapolis, MN 55454-1082 (612-624-5747; fax 612-624-7510; e-mail degrees@cdtl.umn.edu; http://www.cdtl.umn.edu).

Professor
Shashi Shokhar, AM
Jadeep Srivastava, AM

Associate Professor
John V. Carlis, AM
Mats P. E. Heimdahl, AM
Joseph A. Konstan, AM

Assistant Professor
Richard M. Voyles, AM

Instructor
Neil A. Bitzenhofer, AM
Michael Calvo, AM
John E. Collins, AM
Paul B. Dokas, AM
Jesse D. Freese, AM
Richard Hedger, AM
Stephen Kan, AM
John Kruse, AM
Elizabeth M. Sisley, AM
Michael W. Wold, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The master of science in software engineering (M.S.S.E.) provides a thorough understanding of the fundamental issues related to software development and the software development process. It fosters an awareness of the problems and opportunities associated with software-intensive systems, and explains the methods for quickly evaluating, adopting, and taking advantage of emerging technologies. This program introduces emerging technologies and their applications and lays the foundation for lifelong learning and professional development in a rapidly changing field. The M.S.S.E. is an interdisciplinary program administered jointly by the Institute of Technology’s Center for the Development of Technological Leadership and the Department of Computer Science and Engineering.

The program is offered in a format designed for full-time working professionals. Students take courses one day per week (mostly on alternating Fridays and Saturdays) and move through the curriculum as a cohort, taking all classes together for the first three semesters.

Prerequisites for Admission—Prospective students should have an undergraduate degree in computer science or a closely related field and a minimum of one year of professional experience working in the software industry. Students with degrees in other fields may be considered for admission based on extensive industrial experience.
Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is subject to adviser and/or director of graduate studies approval.

Courses—Please refer to Software Engineering (SEng) in the course section of this catalog for courses pertaining to the program.

M.S.S.E. Plan B Degree Requirements

The M.S.S.E. requires 30 credits, including 27 credits of regular coursework and 3 credits for the Plan B project. Students take seven core courses, two or three industrial seminar courses, two or three elective courses, and a capstone course (Plan B project) where students undertake a challenging project.

Language Requirements—None.

Final Exam—The final exam is oral.

Soil Science

Contact Information—Director of Graduate Studies, Department of Soil, Water, and Climate, University of Minnesota, 439 Borlaug Hall, 1991 Upper Buford Circle, St. Paul, MN 55108 (612-625-1244; fax 612-625-2208; e-mail dgs@soils.umn.edu; www.soils.umn.edu).

Professor
Deborah L. Allan, FM
James L. Anderson, FM
Paul R. Bloom, FM
H.H. Cheng, FM
Terrence H. Cooper, FM
Peter H. Graham, FM
Satish C. Gupta, FM
Thomas Halbach, AM
John A. Lamb, FM
Gary L. Malzer, FM
Jean-Alex E. Molina, FM
John P. Moncrief, FM
David J. Mulla, FM
Edward A. Nater, FM
Gyles W. Randall, FM
George W. Rehm, FM
Pierre C. Robert, FM
Carl J. Rosen, FM
Michael J. Sadowsky, FM
Michael A. Schmitt, FM
Mark W. Seeley, FM

Adjunct Professor
John M. Baker, FM
Charles E. Clapp, FM
Robert H. Dowdy, FM
William C. Koskinen, FM
Donald C. Reicosky, AM
Michael P. Russelie, FM

Associate Professor
James C. Bell, FM
Albert L. Sims, AM

Adjunct Associate Professor
Dennis R. Linden, FM
Brenton S. Sharratt, AM

Assistant Professor
Neal S. Eash, AM
Neil Hansen, FM
Jeffrey S. Struck, AM
Dong Wang, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The program offers two concentrations: soil science and climatology. This multidisciplinary program encompasses aspects of chemistry, physics, biology, atmospheric sciences, and geology. The discipline is divided into five subdisciplines: climatology, soil chemistry/fertility, soil classification/genesis, soil microbiology/biochemistry, and soil physics. The soil science concentration focuses on the study of soil as it applies to environmental and agricultural issues. The climatology concentration focuses on the interdisciplinary study of earth-atmosphere interactions as well as climate variability as it applies to environmental and agricultural issues. This concentration requires competence in both atmospheric sciences and related areas of soil science. The minor, supporting, or related fields area is usually selected from some allied field such as agronomy, botany, chemistry, microbiology, biochemistry, physics, geology, economics, forestry, agricultural engineering, or atmospheric science.

Prerequisites for Admission—The academic background normally required includes standard courses in college physics, chemistry, geology, microbiology, and mathematics, including one course in calculus, and an introductory course in soil science. For agricultural climatology, additional courses in mathematics, physics, meteorology, and engineering may be substituted. Candidates for the Ph.D. degree are normally required to have completed an acceptable master’s degree thesis.

Special Application Requirements—A statement of career goals and three letters of recommendation evaluating the applicant’s potential for graduate study should accompany applications to both the M.S. and Ph.D. programs. Submission of GRE scores is required of all native English speakers and is strongly recommended for nonnative speakers (in addition to the TOEFL requirement); students whose native language is not English are expected to have ranked in the top 20 percent of their class. Students may be admitted in any semester.

Program-specific requirements and procedures for electronic application for admittance to the soil science graduate program are listed and updated on the department’s Web site at www.soils.umn.edu.

Use of 4xxx Courses—Use of 4xxx courses is permitted toward degree requirements per adviser and/or director of graduate studies approval.

Courses—Please refer to Soil Science (Soil) in the course section of this catalog for courses pertaining to the program or at the departmental Web site for an updated list of courses.

M.S. Degree Requirements

All M.S. students must complete a minimum of 30 credits: 14 credits in the major area, one seminar (1 credit) teaching experience, and a minimum of 6 credits in a minor or related field. Plan A students must take a minimum of 10 thesis credits; Plan B students must complete a Plan B paper and fulfill the 30 credit minimum by taking 10 credits of coursework or a special project to replace the 10 thesis credits.

Plan A students in the soil science concentration must take three out of the four core courses in soil science. Plan B students in the climatology concentration must take two or more courses in climatology or atmospheric sciences (approved by the student’s advisory committee) and two of the four core courses in soil science.

M.S. Plan B Degree Requirements

For the Plan B degree, students undertake a challenging project.

The M.S. degree requires 30 credits, including 27 credits of regular coursework and 3 credits for the Plan B project. Students take seven core courses, two or three industrial seminar courses, two or three elective courses, and a capstone course (Plan B project) where students undertake a challenging project.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students

Majoring in Other Fields—Students may minor in soil science with the approval of the director of graduate studies and under the direction of a soil science graduate faculty member serving as the minor adviser. The master’s minor requires completion of a minimum of two of the four core area courses in soil science and a seminar.

Ph.D. Degree Requirements

Students must take two seminars (1 credit each), 2 credits of teaching experience, a minimum of 12 credits in a minor or supporting program, and 24 thesis credits. Students in the soil science concentration must take all four core area courses in soil science.

Students in the climatology concentration must take a minimum of two courses in climatology or atmospheric sciences (approved by the student’s advisory committee) and two of the four core area courses in soil science.

Language Requirements—None.

Minor Requirements for Students

Majoring in Other Fields—Students may minor in soil science with the approval of the director of graduate studies and under the direction of a soil science graduate faculty member serving as the minor adviser. The doctoral minor requires a minimum of 12 credits in soil science, including a minimum of three of the four core area courses in soil science, a seminar, and teaching experience.
South Asian Languages
See Asian Languages and Literatures.

Spanish
See Hispanic and Luso-Brazilian Literatures and Linguistics.

Special Education
See Educational Psychology.

Speech-Communication

Contact Information—Department of Speech-Communication, University of Minnesota, 225 Ford Hall, 224 Church Street S.E., Minneapolis, MN 55455 (612-624-5800; www.comm.umn.edu).

Professor
Donald R. Browne, FM
Karlyn K. Campbell, FM
Alan G. Gross, FM
Dean E. Hewes, FM
Mary M. Lay, FM
Edward Schiappa, FM
Robert L. Scott (emeritus), FM
Amy L. Sheldon, FM
Michael Summefrank, Communication, Duluth, AM

Associate Professor
Rosita D. Albert, FM
Laura J. Gurak, FM
David L. Rarick, FM
Anthur E. Walzer, FM

Assistant Professor
Terry A. Kinney, AM
Ascan F. Keenner, AM
Mary D. Vavrus, AM
Kari H. Wilson, AM

Lecturer
Patricia Kovel-Jarboe, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Speech-communication involves the study of communicative dimensions of human experience using humanistic and social scientific methods. This program prepares students to become researchers and teachers, offering two concentrations: communication theory and rhetorical studies.

Coursework in communication theory has a social scientific orientation. Most students focus on a subarea such as small group, organizational, intercultural, electronic media, interpersonal communication, or problems (e.g., decision making, conflict resolution, information diffusion). Coursework outside the department is usually concentrated in one or more of the behavioral sciences. Students are expected to develop a command of research techniques and a thorough knowledge of statistics. Interdisciplinary programs are encouraged. Coursework in rhetoric and public address emphasizes humanistic methods and includes argumentation and persuasion, media studies, ethics, rhetorical theory and criticism, and American public address. Students may also pursue special interests in rhetorical philosophies, movements and campaigns, popular culture, or historical and contemporary political speaking. The program should be supplemented by coursework outside the department. An understanding of history, political science, sociology, or other social sciences is recommended.

Prerequisites for Admission—All applicants must have completed at least 15 undergraduate credits in speech or communication courses related to their proposed area of emphasis in the department. A brochure detailing prerequisite requirements is available from the department. All prerequisites must be completed before admission.

Special Application Requirements—Applicants must submit scores from the GRE General Test, transcripts of all post-secondary academic work, and a written statement of academic and occupational objectives. Three letters of recommendation are required of all applicants for assistantships or fellowships. A deadline of January 15 is recommended for students applying for teaching assistantships or University fellowships for the following academic year.

Use of 4xxx Courses—Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval. Such courses must be taught by graduate faculty and usually no more than two 4xxx courses are allowed on a degree program form.

Courses—Please refer to the Speech-Communication (Spch) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The degree is offered under Plan A (thesis) and Plan B (nonthesis). Both plans require a minimum of 15 course credits in speech-communication, including Spch 5421 and 5615, and a minimum of 6 course credits in a minor or related fields. Plan A also requires 10 thesis credits, and Plan B requires a Plan B paper and 6 additional course credits in speech-communication.

Language Requirements—None.

Ph.D. Degree Requirements

The program requires no set number of course credits, but students are urged to submit programs consisting of at least 60 course credits (which may include 30 credits from the M.A. and an additional 30 credits of doctoral coursework); 24 thesis credits are required.

The program should include about 12 credits in research tools relevant for completing the degree and continuing a scholarly career. Under certain circumstances, foreign language courses may be used to satisfy this requirement. Twelve credits is a guide indicating extent, rather than a specific count.

Language Requirements—None.

Statistics

Contact Information—School of Statistics, University of Minnesota, 313 Ford Hall, 224 Church Street S.E., Minneapolis, MN 55455 (612-625-8046; fax 612-624-8868; e-mail info@stat.umn.edu).

Professor
Christopher Bingham, FM
Kathryn M. Chaloner, FM
R. Dennis Cook, FM
James M. Dickey, FM
Morris L. Eaton, FM
Seymour Geisser, FM
Charles J. Geyer, FM
Douglas M. Hawkins, FM
Glen D. Meeden, FM
Christopher J. Nachtsheim, Operations and Management Science, AM
Gary W. Oehlert, FM
Ronald R. Regal, Mathematics and Statistics, Duluth, FM
William D. Sudderth, FM
Luke Jon Tierney, FM
Richard L. Tweedie, Biostatistics, FM
Sanford Weisberg, FM

Associate Professor
Briit Grund, FM
Frank B. Martin, FM
Ronald C. Pruit, FM

Assistant Professor
Subhashis Ghosal, AM
Tiefeng Jiang, AM
Pehua Qu, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The School of Statistics is the primary venue at the University for research teaching and dissemination of the theory, methodology, and applications of statistical procedures. Students may specialize in any area of statistics or probability. The core program for all students has strong components of both theoretical and applied statistics.

Prerequisites for Admission—For admission to the master’s program, familiarity with basic statistical concepts and methods, and mathematics through multivariable calculus and linear algebra, are required. For admission to the doctoral program, in addition to the above, knowledge of the elements of real analysis is required.

Special Application Requirements—Two letters of recommendation are required. Applicants are strongly encouraged to submit scores from the General (Aptitude) Test (and from the mathematics Subject Test for mathematics majors) of the GRE.

A
Studies in Africa and the African Diaspora

Contact Information—Department of Afro-American and African Studies, University of Minnesota, 808 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-9847; fax 612-624-9383).

Regents' Professor
Joanne B. Eicher, Design, Housing, and Apparel, E
Allen F. Eshelman, History, E

Professor
Ronald C. McCurdy, Music, E
August H. Nimtz, Jr., Political Science, E
Earl P. Scott, Geography, E

Associate Professor
Keleto E. Atkins, Afro-American and African Studies, E
Louis R. Bellamy, Theatre Arts, E
Rose M. Brewer, Afro-American and African Studies, E
Angelita D. Reyes, Afro-American and African Studies, E
Abdi I. Samatar, Geography, E
John S. Wright, English, E

Assistant Professor
Victoria B. Coifman, Afro-American and African Studies, E
Charles Ben Pike, Afro-American and African Studies, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This interdisciplinary graduate minor is administered through the Department of Afro-American and African Studies. The minor program gives students from a variety of disciplines a structured graduate curriculum that offers a systematic understanding of the contemporary and historical experiences of peoples of Africa and of African descent. It is organized around a group of core seminars and focuses on two broad areas; the humanities and the arts, and the social and behavioral sciences.

Prerequisites for Admission—Admission is contingent upon prior admission to a master's or doctoral degree-granting program within the Graduate School.

Special Application Requirements—Students must complete an application form by the end of fall semester to be considered for acceptance for the following academic year. It is expected that no more than 15 students will be admitted to this minor each year. An undergraduate major or minor in Afro-American and/or African studies is not required for admission to the program, but students are expected to have had sufficient background to begin graduate level study.

Use of 4xxx Courses—Use of 4xxx courses towards degree requirements is subject to adviser and/or director of graduate studies approval.

Courses—Please refer to Afro-American Studies (Afro) in the course section of this catalog for courses pertaining to the program.

Freestanding Minor Requirements
Students develop their program in consultation with the director of graduate studies in Studies in Africa and the African Diaspora and in their major. All courses must be outside the student’s major field of study. The master’s minor requires a minimum of 9 graduate credits, including the seminar Afro 8101—Studies in Africa and the African Diaspora. Remaining courses are selected from one of the following two areas: 1) humanities and the arts or 2) behavioral and social sciences.

The doctoral minor requires a minimum of 15 graduate credits, including the seminar Afro 8101—Studies in Africa and the African Diaspora. Students take one additional seminar that focuses on the study of Africa and peoples of African descent. Remaining courses are selected from one of the two areas listed above.

Studies of Science and Technology

Contact Information—Director of Graduate Studies, Studies of Science and Technology, University of Minnesota, 746 Heller Hall, 271 19th Ave. S., Minneapolis, MN 55455; (612-625-6635; fax 612-626-8380; e-mail mcps@umn.edu; <www.sst.umn.edu/>.

Professor
John H. Beatty, Ecology, Evolution, and Behavior, E
John M. Eyler, History of Medicine, E
Ronald N. Giere, Philosophy, E
Keith Gunderson, Philosophy, E
William H. Hanson, Philosophy, E
Geoffrey Hellman, Philosophy, E
Sally G. Kohlstedt, Geology and Geophysics, E
Helen E. Longino, Women’s Studies and Philosophy, E
Arthur L. Norberg, Computer Science, E
C. Wade Savage, Philosophy, E
Robert W. Seidel, Charles Babbage Institute, Institute, E
Alan E. Shapiro, Physics, E

Associate Professor
C. Kenneth Waters, Philosophy, E

Assistant Professor
Jennifer K. Alexander, Mechanical Engineering, E
Michael H. Janssen, History of Science and Technology, E

Curriculum—Studies of science and technology (SST) deals with a rapidly expanding field that seeks to understand the conceptual foundations, historical development, and social context of science and technology. SST faculty are drawn from five research or teaching units dedicated in whole or in part to the history and philosophy of science and technology: the Departments of Philosophy, History of Science and Technology, History of Medicine; the Center for Philosophy of Science; and the Charles Babbage Institute for the History of Information Processing. The SST minor is
Degree Programs and Faculty

for students from any major who want to gain a deeper understanding of the nature and development of science and technology. The SST minor provides introductory core courses in historiography and philosophy of science, followed by research seminars and other elective courses in four main research areas: models, theories, and reality; physical science; biological and biomedical sciences; and science, technology, and society. Seminar topics vary yearly depending on faculty and student interest.

Prerequisites for Admission—Admission is contingent upon prior admission to a master’s or doctoral degree-granting program within the Graduate School and is by permission of the director of graduate studies in SST.

Special Application Requirements—Prospective students should contact director of graduate studies.

Use of 4xxx Courses—Use of 4xxx courses is not permitted toward minor requirements.

Courses—Please refer to Studies of Science and Technology (SST) in the course section of this catalog for courses pertaining to the program.

Freestanding Minor Requirements

A master’s minor requires 7 graduate credits and a doctoral minor requires 12 graduate credits. Both minors must include HSci 8111; one of either Phil 8601, 8602, or 8605; and SST 8000 Colloquium (one semester for master’s, two for doctoral students). Doctoral students must also take one of the SST seminars (SST 8100, 8200, 8300, 8400, or 8420) in an area primarily outside the student’s major.

Language Requirements—None specific to the minor.

Studio Arts

See Art.

Surgery

Contact Information—Department of Surgery, University of Minnesota, 420 Delaware Street S.E., MMC 195, Minneapolis, MN 55455 (612-626-2590; e-mail surgwww@umn.edu).

Professor
Rodderick A. Barke, FM
R. Morton Bolman, FM
Henry Buchwald, FM
Michael D. Caldwell, FM
Frank B. Cerra, FM
Bruce L. Cunningham, AM
John P. Delaney, FM
David L. Dunn, FM
William C. Engeland, FM
John E. Foker, FM
Robert L. Goodale, FM
Rainer W. G. Gruessner, AM
James T. Lee, Jr., AM
Arthur J. Matas, FM
David G. Reynolds, FM
David A. Rothenberger, AM
Sara J. Shumway, AM
David E. R. Sutherland, FM
Herbert B. Ward, AM
John A. Weigelt, AM

Clinical Professor
Arnold S. Leonard, FM
John S. Najarian, FM

Associate Professor
Jerome H. Abrams, AM
Gregory J. Beilman, AM
Michael A. Maddaus, AM
Steven M. Santilli, AM

Assistant Professor
Timothy D. Sielaff, AM

Clinical Associate Professor
Julio E. Garcia-Aguilar, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The general surgery program trains medical doctors for the practice of surgery and for academic positions. See the Medical School for professional degree requirements; see below for academic degree requirements. Trainees spend two to three years in laboratory research, either in a basic science or in surgery, after which they begin their senior residency and chief residency training. The Medical School’s laboratory departments offer many graduate courses closely related to surgery (see the graduate programs in anatomy; biochemistry, molecular biology and biophysics; cellular and integrative physiology; microbiology, immunology, and molecular pathobiology; and pharmacology). These fields also offer opportunities for research work. The Department of Surgery offers supervised work in its experimental research laboratories, as well as in its hospital and outpatient departments, in the areas of surgical diagnosis and operative surgery and in some surgical specialties (such as colon and rectal surgery, transplantation, thoracic and cardiovascular surgery, and pediatric surgery).

Prerequisites for Admission—Prospective students must be in the general surgery training program and have 2-3 clinical years of training completed.

Use of 4xxx Courses—Use of 4xxx courses is not permitted toward degree requirements.

Courses—Please refer to Surgery (Surg) in the course section of this catalog for courses pertaining to the program.

M.S. Surg. Plan A Degree Requirements

The M.S. Surg. is offered Plan A only. Students spend two to three years in the Medical School’s general surgery program. A minimum of 53 course credits (47 in the major plus 6 in the minor or related fields) plus 10 thesis credits are required for a total of 63 credits.

Final Exam—The final exam is oral.

Language Requirements—None.

Ph.D. Surg. Degree Requirements

Students spend two to three years in the Medical School’s general surgery program. A minimum of 79 course credits (67 in the major plus 12 to 16 in the minor or supporting program) is required; 24 thesis credits are also required.

Language Requirements—None.

Sustainable Agriculture Systems

Contact Information—Director of Graduate Studies, Sustainable Agriculture Systems Minor, Minnesota Institute for Sustainable Agriculture, University of Minnesota, 411 Borlaug Hall, 1991 Upper Buford Circle, St. Paul, MN 55108 (612-625-8235; fax 612-625-1268; e-mail jordanna020@umn.edu).

Professor
David D. Biesboer, Plant Biology, E
Vernon B. Cardwell, Agronomy and Plant Genetics, E
Iris D. Charvat, Plant Biology, E
Sharon M. Danes, Family Social Science, E
Peter H. Graham, Soil, Water, and Climate, E
Emily E. Hoover, Horticultural Science, E
Robert Philip King, Applied Economics, E
Richard A. Levins, Applied Economics, E
Albert H. Markhart III, Horticultural Science, E
Pamela J. Molina, Soil, Water, and Climate, E
Roger D. Moon, Entomology, E
David J. Mulla, Soil, Water and Climate, E
James H. Orf, Agronomy and Plant Genetics, E
Edward B. Radcliffe, Entomology, E
Paul C. Rosenblatt, Family Social Science, E
Craig C. Sheaffer, Agronomy and Plant Genetics, E
Steve R. Simmons, Agronomy and Plant Genetics, E

Associate Professor
Deborah L. Allan, Soil, Water, and Climate, E
David A. Andow, Entomology, E
Jeffrey Lynn Gunsulos, Agronomy and Plant Genetics, E
Craig A. Hassel, Food Science and Nutrition, E
Nicholas R. Jordan, Agronomy and Plant Genetics, E
Kent D. Olson, Applied Economics, E
John M. Shutts, Biosystems and Agricultural Engineering, E
William F. Wilcke, Biosystems and Agricultural Engineering, E

Assistant Professor
Susan M. Galatowitsch, Horticultural Science, E
Jeffrey H. Gillman, Horticultural Science, E
Cheryl Smith, Food Science and Nutrition, E
Marla Spivak, Entomology, E

Adjunct Assistant Professor
Helene Murray, Agronomy and Plant Genetics, E

Curriculum—The minor in sustainable agriculture systems offers master’s (M.A. and M.S.) and doctoral students an interdisciplinary curriculum that considers the biological, sociological, and economic aspects of agriculture. The minor emphasizes a holistic perspective to designing farming and food systems and solving problems in agriculture. The importance of yield and profitability are balanced by considerations of the environment and the health and social well-being of producers, consumers, and communities. The minor complements major programs in ecology, conservation biology, forestry, sociology, geography, political
Curriculum—Theatre arts programs provide practical and theoretical education for the performer, artist, educator, scholar, and audience member. Training the historian, theorist, artist, and crafts person is linked to and centered in the laboratory experience of live performance as well as in the academic classroom. The programs serve the dual roles of examining the various historical and contextual relationships of past and present theatre while educating audiences and theatre artisans/educators of tomorrow. The programs prepare students for careers in professional or academic theatre and related artistic fields.

Prerequisites for Admission—Students are admitted for fall semester only. The M.A./Ph.D. program and the M.F.A. design/technology program admit every year. The M.F.A. directing program admits every three years (next class will be admitted for fall 2003). Prerequisites for the initial screening phase of admission include a U.S. bachelor’s degree or comparable foreign degree from a recognized college or university, a minimum of 18 undergraduate credits or the equivalent in theatre arts, and a 3.00 grade point average. Applicants for all degree programs must submit scores from the GRE by February 1. International students’ TOEFL scores must be submitted by January 15 (a paper score of 550 is considered the minimum for acceptance or 213 on the computer test).

The master’s degree is a prerequisite for admission to the Ph.D. program. Students without a master’s degree will be admitted to the Ph.D. with the intention that the M.A. will be attained in route to the Ph.D. For admission to the M.A./Ph.D. or Ph.D. program, students must have a working knowledge/read ing proficiency of at least one foreign language (or a sign language). [A computer language will not satisfy this requirement.]

Special Application Requirements—The application deadline for all degree programs is January 15. Applications received after that date will be considered only if there is an opening in the particular program. M.A./Ph.D. students wishing to have materials reviewed for the Graduate School Fellowship (for support of first-year students) must have materials submitted by January 5. All programs require a current résumé, statement of purpose/intent, and three letters of recommendation to accompany the departmental application. The M.F.A. directing program requires an audition by invitation in Minneapolis in early March after an initial screening of application files. The directing program does NOT interview with URTA. The M.F.A. design and technology program requires a portfolio review either through the Chicago URTA or by submitting materials to be received by February 1. The program also interviews by pre-arrangement during USITT.

The M.A./Ph.D. program requires a submitted sample of research writing.

Use of 4xxx Courses—Inclusion of 4xxx theatre and dance courses on degree program forms is subject to approval by the director of graduate study. Students from other programs may include these courses with their own program’s approval.

Courses—Please refer to Theatre Arts (Th) and Dance (Dnce) in the course section of this catalog for courses pertaining to the program.

M.A. Degree Requirements

The M.A. degree emphasizes academic pursuits and is considered a prerequisite for the Ph.D. The formal areas of study for the M.A./Ph.D. are theatre history and dramatic literature, dramatic theory, design and technical production, and directing (including management). Any of these four may serve as a concentration of study, although the Ph.D. ordinarily focuses on the first two. Candidates must complete coursework in both academic and performance areas. For both Plan A and B: three of the six sequence courses (8111-8116) plus 8102, totaling 12 credits; 8 credits from acting, design, directing, playwriting, and/or practicum; 6 credits from outside the department; and 4 elective credits (30 credits total). For Plan A, 10 additional thesis credits and an oral defense of the thesis are required. For Plan B, three papers are required. There is an 8-credit limit on the number of credits in practicum and performance courses that may be used to satisfy M.A. degree requirements.

Language Requirements—The M.A. leads to the Ph.D.; therefore, language requirements for the Ph.D. apply.

Final Exam—For Plan A, the final exam is written and oral. For Plan B, the final exam is written; an oral exam typically is not required, but one may be requested by the M.A. committee.

Minor Requirements for Students Majoring in Other Fields—A master’s minor requires a minimum of 9 credits as approved by the director of graduate studies.

M.F.A. Degree Requirements

The three-year, performance-oriented M.F.A. degree offers two areas of specialization: directing, and design and technical production. The M.F.A. in directing focuses on developing intellectual and artistic skills and leadership talent through an intensive course of study with an emphasis on performance. For the M.F.A. in design and technology, all areas of design are studied in order to increase understanding in specialization areas, and technology is studied as an essential part of design. Students are expected to achieve proficiency in at least two areas of any combination of design and technology (scenery/properties, costuming, lighting, sound) and a level of expertise in at least one of these areas.
Program faculty will work with students to identify the final areas for the degree. The M.F.A. degree is considered a terminal degree in these areas of theatre arts. The M.F.A. requires 60 graduate credits, although a particular program’s requirements may exceed this minimum. The degree requires 6 credits of dramatic literature or theatre history, which may be fulfilled by TH 4177 and 4178; and a minimum of 6 credits from outside the department (at least 3 credits of which must be a University course that contributes substantially to the degree program). Each program requires a final performing and communicating that knowledge. For specific program requirements, contact the director of graduate studies.

Language Requirements—None.

Final Exam—Students must take a final oral exam related to the final creative project and must submit a written record of the project and the research related to it.

Ph.D. Degree Requirements
The Ph.D. certifies the mastery of a body of knowledge in the history, theory, and literature of theatre arts and the facility for applying and communicating that knowledge. The formal areas of study for the M.A./Ph.D. are theatre history and dramatic literature, dramatic theory, design and technical production, and directing (including management). Any of these four may serve as a concentration of study, although the Ph.D. ordinarily focuses on the first two. Candidates must complete coursework in both academic and performance areas. Students must take seven core courses: six consecutive courses in history, theory, and literature of theatre and one course in theatre historiography (21 credits); coursework in a supporting program or a minor (12 credits); and 24 thesis credits, for a minimum total of 57 credits beyond the B.A. Various seminars support the core courses. Students must also demonstrate a research technique appropriate to the thesis. This could take the form of the foreign language or a discipline research methodology.

There is a 16-credit limit on the number of credits in practicum and performance courses that may be used to satisfy Ph.D. requirements.

Language Requirements—Ph.D. students are expected to demonstrate proficiency in at least one foreign language as certified by the adviser or program faculty in the language. The language may serve as the research technique for the dissertation, if appropriate. In some cases a disciplinary research methodology is more appropriate than a language. Options may include statistics, psychology, women’s studies, economics, political history, or anthropology. Note: research technique credits are not the same as supporting program or minor credits.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires a minimum of 12 credits as approved by the director of graduate studies.

Theriogenology
See Veterinary Medicine.

Toxicology
Contact Information—Director of Graduate Studies, Toxicology Graduate Program, Veterinary Diagnostic Laboratory, 1333 Gortner Avenue, St. Paul, MN 55108 (612-625-8236; fax 612-624-8707; e-mail murphb005@umn.edu).

Professor
Yusuf J. Abul-Hajj, Medicinal Chemistry, Pharmacognosy, FM
David R. Brown, Veterinary Pathobiology, FM
Robert M. Carlson, Chemistry, Duluth, FM
Joseph DiSalvo, Physiology, FM
Lester R. Drewes, School of Medicine, Duluth, FM
Vincent F. Garry, Laboratory Medicine and Pathology, FM
Patrick E. Hanna, Medicinal Chemistry, Pharmacognosy, FM
Gerald J. Niemi, Biology, Duluth, FM
Joseph R. Prohaska, School of Medicine, Duluth, FM
Jean F. L. Regal, School of Medicine, Duluth, FM
W. Thomas Shier, Medicinal Chemistry, Pharmacognosy, FM
Sheldon B. Sparber, Pharmacology, FM
Kendall B. Wallace, School of Medicine, Duluth, FM

Adjunct Professor
Gerald T. Anklew, Duluth, AM
Herbert T. Nagasawa, Medicinal Chemistry, Pharmacognosy, FM
John W. Nichols, Duluth, AM
Robert R. Roy, Veterinary Diagnostic Medicine, AM
Andrew M. Seacat, Veterinary Diagnostic Medicine, AM
Robert S. Skoglund, Veterinary Diagnostic Medicine, AM

Associate Professor
Cecilia Gualini, Chemistry, Duluth, FM
Randall E. Hicks, Biology, Duluth, AM
Richard G. Hofman, School of Medicine, Duluth, FM
Michael J. Murphy, Veterinary Diagnostic Medicine, FM
Mark S. Rutherford, Veterinary Pathobiology, FM
Ashok K. Singh, Veterinary Diagnostic Medicine, FM

Assistant Professor
Subhash C. Basak, School of Medicine, Duluth, AM
Lisa A. Peterson, School of Public Health, FM
Elizabeth V. Wattenberg, School of Public Health, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This University-wide program provides comprehensive training in the broad scope of toxicology. Toxicology, the science of poisons, is devoted to identifying and quantifying potential noxious agents in our environment. Although most chemical agents at sufficiently large doses may be toxic, not all present a significant risk to human health, environmental organisms, or ecosystems. Accordingly, the essence of the science of toxicology is defining the line that distinguishes a risk from a residue. This requires scientific expertise in analytical and environmental chemistry, biology, and mathematics. Advanced courses and research are also available in subdisciplines such as human health risk assessment; epidemiology; environmental chemistry and engineering; ecotoxicology; food additives and nutritional toxicology; biochemical and physiological mechanisms; histopathology; diagnostic and analytical toxicology; drug metabolism; chemical carcinogenesis; behavioral toxicology; veterinary toxicology; and the toxicity of noxious agents to various organ systems (e.g., nervous, heart, liver, kidneys).

Prerequisites for Admission—A B.S. in basic science is required. All applicants should have completed a full year of biology, chemistry, and physics, and have completed mathematics through calculus. The M.S. is not a terminal degree and students are not admitted to it. Applicants are evaluated for admission only to the Ph.D. program.

Special Application Requirements—Applicants must submit scores from the General (Aptitude) Test of the GRE, three letters of recommendation from college-level faculty or equivalent persons who are familiar with the applicant’s scholarship and research potential, a complete set of official transcripts, and a clearly written statement of career interests, goals, and objectives.

Graduate study in the program begins in fall semester. The application deadline is January 1. All applications are evaluated once each year in early February.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted with director of graduate studies approval.

Courses—Please refer to Toxicology (Txcl) in the course section of this catalog for courses pertaining to the program.

M.S. Degree requirements
The M.S. is offered under plan A and Plan B. Plan A requires 22 course credits and 10 thesis credits. Plan B requires 30 course credits. A core curriculum of 8 credits in toxicology (Txcl 8012, 8013 and 8100) is required for both plans. Additional courses are arranged on an individual basis.

Language Requirements—None.

Final Exam—The final exam is written and oral.

Ph.D. Degree Requirements
The Ph.D. requires core courses in physiology, biochemistry, statistics, and toxicology. Students must also complete 12 credits in a minor or supporting program and 24 thesis credits. Because the program spans the Duluth and Twin Cities campuses, the required course numbers differ on each campus.

Additional advanced courses in toxicology or related fields may be specified by the adviser. Students must complete and defend an original research project.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A minor is available at the doctoral level and requires 12 credits: 8 credits of core course and 4 credits of advanced toxicology courses.
Transportation Studies

Contact Information—Center for Transportation Studies, University of Minnesota, 511 Washington Ave. S.E., Minneapolis, MN 55455 (612-626-1077; fax 612-625-6381; e-mail cts@umn.edu; <www.cts.umn.edu>.

Professor
John Adams, Geography, E

Assistant Professor
David Levinson, Civil Engineering, E

Instructor
Karen Chapple, Humphrey Institute of Public Affairs, E

Curriculum—The transportation studies program allows students to gain advanced interdisciplinary knowledge of transportation by taking a set of core courses along with a series of focused electives. Students must complete two courses in transportation policy and planning and a one-credit intelligent transportation technology seminar. In addition to this foundation, students acquire further expertise in a specific area related to transportation by taking at least 9 graduate credits in a field chosen by the student and approved by the director of graduate studies. These credits may consist of any combination of courses that will further the student’s knowledge of a specific transportation-related subject area or areas. A broad array of topical areas and course offerings are available including advanced traffic engineering and related mathematical disciplines; transportation pavements or structures; management, logistics, regional planning, or human factors; historical, political, or economic analysis.

Prerequisites for Admission—Admission requires a B.S. or B.A. from an accredited U.S. institution or its foreign counterpart. The degree must be in a field related to transportation. Applicants who hold a degree in an unrelated field must demonstrate familiarity with the transportation-related issues through work experience, community involvement, political leadership, or other activity.

A 3.0 minimum GPA is required for admission. International students must score 550 on the TOEFL exam. Exceptions may be made in cases where applicants have slightly lower than the minimum requirements but have demonstrated their abilities through substantial professional experience. The GRE is not required.

Special Application Requirements—Prospective students who do not meet the minimum 3.00 GPA must submit a statement explaining how their work experience, community involvement, political leadership, or other activity has prepared them for the program. Prospective students may supplement this statement with letters of recommendation from employers, community leaders, etc., if appropriate.

Use of 4xxx Courses—Use of 4xxx courses toward requirements is subject to director of graduate studies approval.

Courses—The four core courses are PA 5202/Geog 5372, PA 8202, CE 5212, and CE 5214. CE 5212 covers the systems approach and its application to transportation engineering and planning. Topics include prediction of flows and level of service, production functions and cost optimization, utility theory and demand modeling, transportation network analysis and equilibrium assignment, decision analysis, and multidimensional evaluation of transportation projects. This is a new course currently in the proposal stage. It is expected to be in place for the 2001-2002 academic year.

Postbaccalaureate Certificate Requirements
Completion of two of the four core courses along with the Transportation Technology Seminar, three or more cognate elective courses chosen by the student in consultation with the director of graduate studies, and at least 16 graduate level credits. In addition to completing two of the above courses, students will be required to complete ME 8773/8774.

Urban and Regional Planning

Contact Information—Director of Admissions, Hubert H. Humphrey Institute of Public Affairs, University of Minnesota, 301 19th Avenue South, Minneapolis, MN 55455 (612-624-3800; fax 612-625-3513; e-mail admissions@hhh.umn.edu; <www.hhh.umn.edu>.

Regents’ Professor
G. Edward Schuh, AM

Professor
Dean E. Abrahamson, AM
John S. Adams, AM
Sandra Archibald, AM
John E. Brandl, AM
John M. Bryson, AM
Nancy N. Eustis, AM
Katherine Fennelly, AM
Stephen A. Hoenack, AM
Ethan B. Kapstein, AM
Anne R. D. Kapuscinski, Fisheries and Wildlife, AM
Kenneth H. Keller, AM
Sally J. Kenney, AM
Morris M. Kleiner, AM
Robert T. Kuddel, AM
Ann R. Markusen, AM
Judith A. Martin, Geography, AM
William R. Morrise, Architecture, AM
Samuel L. Myers, AM
Lance M. Neckar, Landscape Architecture, AM
David G. Pitt, Landscape Architecture, AM
Carlise F. Runge, Applied Economics, AM
Esther Wattenberg, Social Work, AM

Associate Professor
Raghu A. Assaad, AM
Edward G. Goetz, AM
Maria J. Hanratty, AM
Deborah Levison, AM

Assistant Professor
Karen Chapple, AM
Kenneth A. Kriz, AM

Other
Zbigniew M. Bochniarz, AM
Harry C. Boyte, AM
Barbara C. Crosby, AM
William A. Duz, AM
Marsha A. Freeman, AM
Thomas F. Luice, AM
Barbara L. Lukermann, AM
Lee W. Munnich, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The master of urban and regional planning (M.U.R.P.) degree is an interdisciplinary program that prepares students to analyze, forecast, design, and implement plans for regions, communities, and neighborhoods. Students develop a comprehensive understanding of the built environment (land use, transportation, housing, regional economies) and the ability to mediate among competing interests. They are prepared for jobs in public, nonprofit, and private sectors. Students can generally complete the M.U.R.P. degree in two years of full-time study.

Prerequisites for Admission—Students are expected to have completed the equivalent of an introductory course in microeconomics.

Special Application Requirements—In addition to the materials submitted to the Graduate School, applicants must submit to the Humphrey Institute a photocopy of their Graduate School application, the Humphrey Institute Applicant Data Form, copies of all academic transcripts, a statement of purpose, at least three letters of recommendation, and a GRE official score report. Students who wish to be considered for financial aid should apply no later than January 15 of the preceding academic year. Entry is for fall semester.

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted with instructor’s and adviser’s permission.

Courses—Please refer to Public Affairs (PA) in the course section of this catalog for courses pertaining to the program.

M.U.R.P. Plan B Degree Requirements
The M.U.R.P. requires 48 credits including Humphrey Institute core courses (12 to 13 credits), planning core courses (12.5 credits), specialization electives (9 credits), and 10.5 to 11.5 credits of free electives. Each student completes an internship in a public or private planning agency usually during the summer after the first year of the program. Students also take a capstone seminar or workshop (3 credits) that constitutes a final professional-level project and complete a professional paper. Specializations for the M.U.R.P. degree include housing and community development; regional, economic, and workforce development; transportation planning; land use/urban design planning; and environmental planning.
Degree Programs and Faculty

Language Requirements—None.

Final Exam—The final exam is oral.

Veterinary Medicine

Contact Information—Director of Graduate Studies, Veterinary Medicine, 385 Animal Science/Veterinary Medicine, 1985 Fitch Avenue, St. Paul, MN 55108 (612-624-0750; fax 612-624-3233; e-mail vmedgrad@umn.edu; <www.cvm.umn.edu/graduate>).

Professor
Trevor R. Ames, Clinical and Population Sciences, FM
P. Jane Armstrong, Small Animal Clinical Sciences, FM
Russell F. Bey, Veterinary Pathobiology, FM
Stephen Bistner, Small Animal Clinical Sciences, FM
Thomas G. Blaha, Clinical and Population Sciences, FM
David R. Brown, Veterinary Pathobiology, FM
Cathy S. Carlson, Veterinary Diagnostic Medicine, FM
James E. Collins, Veterinary Diagnostic Medicine, AM
Melvin L. Fahning, Clinical and Population Sciences, FM
John Farnsworth, Clinical and Population Sciences, FM
Daniel A. Freeney, Small Animal Clinical Sciences, FM
John Fetrow, Clinical and Population Sciences, FM
Sandra M. Godden, Clinical and Population Sciences, FM
Thomas H. Hostetter, Medicine, AM
Alan G. Hunter, Animal Science, FM
Carl R. Jessen, Small Animal Clinical Sciences, AM
Han S. Joo, Clinical and Population Sciences, FM
Mathur S. Kannan, Veterinary Pathobiology, FM
Jeffrey S. Klausner, Small Animal Clinical Sciences, FM
Harold J. Kurtz, Veterinary Diagnostic Medicine, E
Alan Lipowitz, Small Animal Clinical Sciences, FM
Samuel K. Maheswaran, Veterinary Pathobiology, FM
Thomas W. Molitor, Clinical and Population Sciences, FM
Roger D. Moon, Entomology, FM
Robert B. Morrison, Clinical and Population Sciences, FM
Michael P. Murtaugh, Veterinary Pathobiology, FM
Kakambi V. Nagaraja, Veterinary Pathobiology, FM
Moses K. Ngjega, Veterinary Pathobiology, AM
Timothy D. O'Brien, Veterinary Diagnostic Medicine, AM
Carl A. Osborne, Small Animal Clinical Sciences, FM
Phillip K. Peterson, Medicine, AM
Carlos Pijoan, Clinical and Population Sciences, FM
David J. Polzin, Small Animal Clinical Sciences, FM
Michael Pullen, Clinical and Population Sciences, AM
Patrick T. Redig, Small Animal Clinical Sciences, AM
Jeffrey K. Reneau, Animal Science, AM
Bradley E. Seguin II, Clinical and Population Sciences, FM
Michael, G. O’Sullivan, Veterinary Pathobiology, FM
William G. Olson, Clinical and Population Sciences, FM
Elaine P. Robinson, Small Animal Clinical Sciences, FM
Kurt D. Rossow, Veterinary Diagnostic Medicine, AM
Mark S. Rutherford, Veterinary Pathobiology, FM
Daniel P. Shaw, Veterinary Diagnostic Medicine, AM
Ashok K. Singh, Veterinary Diagnostic Medicine, FM
Ava M. Trent, Clinical and Population Sciences, AM
Mats H. T. Troedsson, Clinical and Population Sciences, FM
Stephenie J. Valberg, Clinical and Population Sciences, FM
Patricia A. Walter, Small Animal Clinical Sciences, AM
Associate Professor
Jeff B. Bender, Clinical and Population Sciences, AM
Sheila M. F. Torres, Small Animal Clinical Sciences, AM
Scott J. Wells, Clinical and Population Sciences, AM
Associate Clinical Specialist
Paula K. Hendrix, Small Animal Clinical Sciences, AM
Associate Clinical Specialist
Erin D. Malone, Clinical and Population Sciences, AM
Margaret V. Root Kustritz, Small Animal Clinical Sciences, AM
Abby M. Sage, Clinical and Population Sciences, AM
Research Associate
Connie J. Gebhardt, Veterinary Pathobiology, FM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—Emphases in the major are large, small, comparative, and food animal medicine. Emphasis can further be directed toward specific systems or population medicine.

The veterinary medicine graduate program encompasses all the clinical and applied graduate education of the College of Veterinary Medicine. The program is divided into five specialty tracks: internal medicine; population medicine; infectious disease; surgery, radiology, and anesthesia; and theriogenology. Program faculty are drawn from all the departments of the college as well as from other colleges within the University.

The program emphasizes quality clinical training with state-of-the-art research in areas of animal disease at the individual and population levels. All species of domestic animals are the subject of both teaching and research, the program being particularly strong in population-based medicine and epidemiology. Other areas of strength include feline and canine urology, radiology, pain, molecular epidemiology in food animals, microbiology, and immunology. The program also has quality research and teaching in the area of theriogenology.

Prerequisites for Admission—Applicants must meet the stated requirements of the Graduate School, including a minimum undergraduate GPA of 3.00 and a minimum TOEFL score of 550 or a minimum computer-based TOEFL score of 213.

The majority of applicants have a D.V.M. degree or its equivalent. Applicants lacking a D.V.M. degree, including those currently enrolled in a D.V.M. degree program, can be accepted upon approval by the director of graduate studies.

Applicants are requested but not required to take the GRE prior to consideration for admission.

Special Application Requirement—Applicants must submit a letter of intent stating career goals and defining the specialty of graduate study selected (e.g., subdiscipline or animal species). Also required are three letters of recommendation from individuals knowledgeable about the applicant’s academic performance. These letters must be sent directly to the director of graduate studies or the program coordinator.

Research Facilities—Research facilities available to the veterinary medicine graduate student include the Advanced Genetic Analysis Center, the Clinical Investigation Center, the Raptor Center, the Swine Center, the Swine Disease Eradication Center, and the Avian Disease Research Center.

Use of 4xx Courses—Use of 4xx courses to meet degree requirements is subject to director of graduate studies approval.

Courses—Please refer to Veterinary Medicine (VMed) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements
The M.S. is offered under Plan A and Plan B. Plan A requires 20 credits; a minimum of 14 credits in the major, 6 credits in a minor or related field, and in addition 10 thesis credits. Plan B requires 30 course credits, 14 of which must be in the major and 16 in a minor or related field, in consultation with the adviser. Three papers are also required (e.g., a case report, a research project, and a literature review).

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students

Majoring in Other Fields—A master’s minor requires 6 course credits taken from recommended courses in the veterinary medicine major.

Ph.D. Degree Requirements
There are no minimum requirements but students usually take 24 to 30 credits in the major field and 12 credits minimum for official minor or supporting program. In addition, 24 thesis credits are required.

Language Requirements—None.

Minor Requirements for Students

Majoring in Other Fields—A doctoral minor requires 12 course credits taken from recommended courses in the veterinary medicine major.
Vocational Education
See Work, Community, and Family Education.

Water Resources Science

Contact Information—Director of Graduate Studies-Twin Cities, Water Resources Science, University of Minnesota, 173 McNeal Hall, 1985 Buford Avenue, St. Paul, MN 55108 (612-624-9282; fax 612-625-1263; e-mail juer001@umn.edu); and Director of Graduate Studies-Duluth, Water Resources Science, 213 RLB, University of Minnesota, Duluth, MN 55812 (218-726-8891; fax 218-726-6979).

Professor
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Marvin Bauer, Forest Resources, FM
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Paul R. Bloom, Soil, Water, and Climate, FM
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Robert M. Carlson, Chemistry, Duluth, FM
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Efthoufoula, Civil Engineering, FM
Philip J. Giersch, Geography, FM
Florence K. Gleason, Plant Biology, FM
Sagar M. Goyal, Veterinary Diagnostic Medicine, FM
John S. Gulliver, Civil Engineering, FM
Satish C. Gupta, Soil, Water, and Climate, FM
Richard S. Hanson, Microbiology, FM
Ralph W. Holzental, Entomology, FM
Thomas C. Johnson, Geological Sciences, Duluth, FM
Andrew R. Klerer, Biology, Duluth, FM
Richard W. Lichty, Fisheries and Wildlife, FM
Robert O. Megard, Ecology, Evolution, and Behavior, FM
John F. Moncier, Soil, Water, and Climate, FM
David J. Mulla, Soil, Water, and Climate, FM
Edward A. Nater, Soil, Water, and Climate, FM
John L. Nieber, Biosystems and Agricultural Engineering, FM
Christopher Paolino, Geology and Geophysics, FM
Gary Parker, Civil Engineering, FM
John Pastor, Biology, Duluth, FM
James A. Perry, Forest Resources, FM
Mark A. Person, Geology and Geophysics, FM
Hans-Olaf Pfannkuch, Geology and Geophysics, FM
Carl Richards, Minnesota Sea Grant, Duluth, FM
C. Ford Runge, Applied Economics, FM
Mark W. Seeley, Soil, Water, and Climate, FM
Michael J. Semmens, Civil Engineering, FM
Richard H. Skaggs, Geography, FM
Heinz G. Stefan, Civil Engineering, FM
Robert W. Sterner, Ecology, Evolution, and Behavior, FM
Otto D. L. Strack, Civil Engineering, FM
Deborah L. Swackhammer, Environmental and Occupational Health, FM
Michael Sydor, Physics, Duluth, FM
G. David Tilman, Ecology, Evolution, and Behavior, FM

Adjunct Professor
Dan Horbach, Fisheries and Wildlife, AM
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Randall J. Barnes, Civil Engineering, FM
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Katherine Klink, Geography, AM
Howard D. Mooers, Geological Sciences, Duluth, FM
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Steven J. Taff, Applied Economics, FM
Bruce N. Wilson, Biosystems and Agricultural Engineering, FM

Adjunct Associate Professor
Bruce C. Vondracek, Fisheries and Wildlife, FM

Assistant Professor
Paul D. Capel, Civil Engineering, AM
Raymond N. Hoalzalk, Civil Engineering, AM
Neil C. Hansen, Soil, Water, and Climate, AM
James McManus, Large Lakes Observatory, Duluth, AM
Kristen C. Nelson, Forest Resources/Fisheries and Wildlife, AM
Paege J. Novak, Civil Engineering, AM
Elise A. Ralph, Physics, Duluth, AM
Gary R. Sands, Biosystems and Agricultural Engineering, FM
Dong Wang, Soil, Water, and Climate, AM
Meng Zhou, Physics, Duluth, AM
Tongxin Zhu, Geography, Duluth, AM

Adjunct Assistant Professor
Mary Renwick, Applied Economics, AM

Research Associate
Richard P. Axel, Natural Resources Research Institute, Duluth, AM
Prasanna Gowda, Soil, Water, and Climate, AM
Lucinda B. Johnson, Natural Resources Research Institute, Duluth, AM
John C. Kingston, Natural Resources Research Institute, Duluth, FM

Other
Elon S. Verry, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—This University-wide program provides comprehensive training in water resources science, with integration across scientific disciplines. A structured interdisciplinary graduate curriculum is offered. The program includes a set of core courses plus electives in the following areas of specialization at the M.S. and Ph.D. levels: aquatic biology, aquatic chemistry, hydrologic science, limnology, water economics, water management technology, water policy, water quality, and watershed management. Approximately 80 courses offered within 15 other graduate programs are available to students majoring in water resources science.

This interdisciplinary program produces scientists with strong technical skills in disciplines relevant to water resources science and promotes a broad understanding of 1) the hydrologic cycle and associated ecosystems, 2) the interconnectedness of the sciences involved in managing aquatic resources, and 3) the interplay between the biophysical sciences and social sciences in developing and implementing public policies related to water.

The program involves the Twin Cities campus Departments of Applied Economics; Biosystems and Agricultural Engineering; Civil Engineering; Ecology, Evolution, and Behavior; Entomology; Environmental and Occupational Health; Fisheries and Wildlife; Forest Resources; Geography; Horticultural Science; Geology and Geophysics; Microbiology, Plant Biology; and Soil, Water, and Climate; and the Humphrey Institute of Public Affairs. It also involves the Duluth campus Departments of Biology, Chemical Engineering, Chemistry, Economics, Geography, Geological Sciences, Physics, and Political Science as well as the Large Lakes Observatory and the NRRI.

Prerequisites for Admission—The program is flexible enough to accommodate students from a variety of backgrounds. Normally students have a bachelor’s degree in physical or biological science or engineering. Recommended academic preparation includes one year (or two semesters) each of calculus, physics, and chemistry and one biology course. Further preparation may be expected from students wishing to specialize in certain areas of the program.

Special Application Requirements—Applicants must submit three letters of recommendation to the director of graduate studies. These letters should be from professors qualified to estimate applicants’ class rank and evaluate their ability to complete a program of graduate study, or from persons who can assess their professional potential. These letters also may be used in applying for financial aid. Applicants must also submit a résumé of their academic history and professional experience and a statement of purpose, including the proposed area of emphasis. Applicants are strongly encouraged to submit results of the GRE. Those who have not taken the GRE are at a disadvantage in competing for financial aid. Students may be admitted any semester but are strongly encouraged to begin fall semester and to submit their application by January 1 in the year they expect to begin their studies.

Use of 4xxx Courses—Use of 4xxx courses is permitted for degree requirements based on director of graduate studies approval.

Courses—Please refer to Water Resources Science (WRS) in the course section of this catalog for courses pertaining to the program.

M.S. Degree Requirements

Students may choose Plan A, which requires a thesis, or Plan B, which requires additional coursework and a major project. Both plans incorporate courses offered on the Twin Cities and Duluth campuses.
Students must complete courses in four core areas: 1) hydrology (surface and/or ground water); 2) environmental/water chemistry; 3) limnology; and 4) water resources policy, economics and management and at least three electives in emphasis areas such as aquatic biology, hydrologic science, watershed management, and water quality engineering. One elective must be from an approved list of technical courses dealing with water quality science/management; two electives must be in the student’s focus area within aquatic science. A minimum of two supporting courses (at least 6 credits) outside of aquatic science also are required. A minimum of 20 course credits (plus 10 thesis credits) are required for Plan A and a minimum of 30 credits are required for Plan B (up to 3 credits of independent study may be used for the Plan B project). Students who had classes equivalent to those in the WRS core as undergraduates may substitute other classes to meet the Graduate School minimum requirement of 20 credits.

**Language Requirements**—None.

**Final Exam**—The final exam is oral.

**Minor Requirements for Students Majoring in Other Fields**—A master’s minor requires 6 credits, including WRS 5101 (3 credits) and a core course from one of the program’s emphasis areas. In aquatic biology and limnology, on the Twin Cities campus, the core course is EEB 4601/Geo 4601; in hydrological science, watershed management, and water engineering, the core course is in hydrology.

**Ph.D. Degree Requirements**

Coursework is tailored to student interests, and many areas of specialization are possible. Core courses are offered on both the Twin Cities and Duluth.

Students complete coursework equivalent to that of an M.S. in water resources science, with additional coursework in an area of specialization. There are no specific credit requirements in the major, but Ph.D. programs normally include at least 40 course credits beyond the B.S. level, including relevant coursework taken for a master’s degree and a required minimum of 12 credits in a minor or supporting program.

**Language Requirements**—None.

**Minor Requirements for Students Majoring in Other Fields**—Doctoral students must complete 12 credits, including WRS 5101 (3 credits), a core course from one of the program’s emphasis areas, and two electives within one field of specialization. In aquatic biology and limnology, on the Twin Cities campus, the core course is EEB 4601/Geo 4601; in hydrological science, watershed management, and water engineering, the core course is in hydrology.

**Wildlife Conservation**

**Contact Information**—Kathleen Walter, College of Natural Resources, University of Minnesota, 135 Natural Resources Administration Building, 2003 Upper Buford Circle, St. Paul, MN 55108-6146 (612-624-2748; fax 612-624-6282; e-mail walter@forestry.umn.edu; <www.fw.fw.umn.edu>).

**Professor**

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Donald B. Smiff, Ecology, Evolution, and Behavior, FM
J. L. David Smith, FM
Anthony M. Starfield, Ecology, Evolution, and Behavior, FM

**Adjunct Professor**

David E. Andersen, FM
L. David Mech, FM

**Associate Professor**

James A. Cooper, FM
Peter A. Jordan, FM

**Adjunct Associate Professor**

Alfred H. Berner, E
Glenn D. DeGiudice, FM
David L. Garshelis, AM
Richard O. Kimmel, E

**Adjunct Assistant Professor**

David C. Fulton, AM
Edward B. Swain, AM

**Other**

Thomas D. Drummer, E

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

**Curriculum**—This program, administered within the Department of Fisheries, Wildlife, and Conservation Biology, is an applied program emphasizing resource-management applications. For the M.S. degree, emphasis is on wildlife biology and related areas in ecology, animal behavior, and physiology as these relate to resource management and conservation problem solving. For many students, the M.S. is a terminal degree leading to employment with government resource-management agencies. For the Ph.D. program, emphasis is on basic biology and ecology with concentrated work in independent, original research generally relating basic science to management/conservation challenges.

This program combines basic biology and ecology with other academic areas and with applied problem solving in natural resource management and conservation areas such as animal behavior, population modeling, habitat management, integrated resource management, and animal physiology.

**Prerequisites for Admission**—For the M.S., a bachelor’s degree with a biological sciences background is required, preferably with emphasis on terrestrial or wetland vertebrates, and with a natural-resource management orientation. A strong background in physical sciences and mathematics is expected; familiarity with statistics and computer use is desirable. For the Ph.D., a master’s degree in wildlife science or a closely related field is normally required.

**Special Application Requirements**—Three letters of recommendation are required from persons able to evaluate the applicant’s scholarship and professional experience. Also required are scores from the GRE General Test. Applicants taking the examination should list the wildlife management major field code (0115). Applications are accepted at any time; however, because the faculty reviews most applications in late January for admission the following fall, applications should be sent before January 1.

**Use of 4xxx Courses**—Use of 4xxx courses toward degree requirements is subject to adviser and director of graduate studies approval. Students from other majors may include such courses subject to their own program’s approval.

**Courses**—Please refer to Fisheries and Wildlife (FW) in the course section of this catalog for courses pertaining to the program.

**M.S. Degree Requirements**

Plan A is recommended; Plan B is available under special circumstances. Students must become familiar with factors underlying wildlife population and habitat ecology, management techniques, and how management agencies function. Academic work includes coursework in animal ecology, wildlife management, and statistics. The Plan A thesis should involve at least one field season, but generally two. Plan B students complete one to three projects involving field, laboratory, or planning work.

**Language Requirements**—None.

**Final Exam**—The final exam is oral.

**Minor Requirements for Students Majoring in Other Fields**—A master’s minor requires a minimum of 6 credits as approved by the director of graduate studies.

**Ph.D. Degree Requirements**

Degree programs include basic wildlife biology, development of analytical skills, and one or more areas of specialization.

**Language Requirements**—A foreign language is required only when the advisory committee determines that a language is needed to support the student’s research objectives. Symbolic language (computer programming) is recommended for all students.

**Minor Requirements for Students Majoring in Other Fields**—A doctoral minor requires a minimum of 12 credits as approved by the director of graduate studies.
Work, Community, and Family Education

Contact Information—Gary Leske, Director of Graduate Studies, Department of Work, Community, and Family Education, University of Minnesota, R-350 Vocational and Technical Education Building, 1954 Buford Avenue, St. Paul, MN 55108 (612-624-1221; fax 612-625-8041; e-mail wcfe@umn.edu; <www.wcfe.coled.umn.edu>).

Professor
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Richard A. Swanson, FM
Ruth G. Thomas, FM

Adjunct Professor
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Associate Professor
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Jerry H. McClelland, FM
Rosemarie J. Park, FM
Shari L. Peterson, FM

Assistant Professor
Kenneth R. Bartlett, AM
Richard M. Joerger, AM
Shelia K. Ruhland, AM

Lecturer
Robert D. Shumer, AM
John R. Vreyens, AM

Other
Jeanette R. Daines, AM
James C. Kielsmeier, AM
Marie J. Maher, AM
Tom Peacock, Education, Duluth, AM
Jerome Stein, AM
Joyce Walker, AM
Barbara A. Warren, AM

Along with the program-specific requirements listed below, please read the General Information section of this catalog for Graduate School requirements that apply to all major fields.

Curriculum—The Ed.D. offers specializations in adult education; agriculture, food, and environmental education; business and industry education; family education; human resource development; and comprehensive work, community, and family education. Students combine study and related experiences to develop, apply, analyze, synthesize, and evaluate knowledge of the purposes, practices, issues, and problems of work, community, and family education; social, economic, historical, political, cultural, educational, technological, and psychological contexts within which work, community, and family education exist; and types of research that contribute to or apply that knowledge to the specialization.

See also Education—Work, Community, and Family Education for information about the M.A. and Ph.D. degrees.

Prerequisites for Admission—Prospective master’s degree students generally have completed an undergraduate degree or extensive coursework in the specialization area. Prospective doctoral degree students should have academic background and experience in at least one specialization area.

Special Application Requirements—Scores from the GRE general test are required for applicants with a bachelor’s degree from a U.S. institution. Applicants should designate the specific specialization to which they seek admission in their goal statement. A current resume is required. Students are admitted each term.

Courses—Please refer to Adult Education (AdEd), Agricultural, Food, and Environmental Education (AFEE), Business and Industry Education (BIE), Family Education (FE), Human Resource Development (HRD), and Work, Community, and Family Education (WCFE) in the course section of this catalog for courses pertaining to the program.

Use of 4xxx Courses—A maximum of 15 credits from 4xxx courses may be used in the supporting program. Students are responsible for determining that the course was available for graduate credit and the offering department criteria for graduate credit were satisfied. Degree programs must include rationale for the use of 4xxx course credits.

Ed.D. Degree Requirements

The Ed.D. requires 60 course credits and 24 field study credits (thesis credits). Course credits include a minimum of 10 credits in general aspects, a minimum of 10 credits in research, and a minimum of 28 credits in the specialization, 4 of which must be internship credits. Course credits must also include 12 credits from outside the department, which may overlap with those in general aspects, research, and the specialization.

Language Requirements—None.

Final Exam—A written preliminary exam in each of the program areas (general aspects, research, and specialization) and a final oral exam are required.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires a minimum of 12 credits in one of the specializations, approved by the director of graduate studies.