Key to Abbreviations

Faculty
Graduate faculty are listed at the beginning of each degree program. After the faculty name, the home department will be listed (unless the department is the same as the program name), followed by the graduate faculty status in the program. Professors emeriti are identified by "(emeritus)."

Membership Categories
Senior Member (SM)—Authorization to advise students at all levels, including the doctorate; to serve as a thesis reviewer and as an examiner on student examining committees, including service as chair of doctoral committees; to teach courses for graduate credit; and to participate in governance. In fields that also offer a professional doctorate, some senior member appointments may be restricted to the supervision of students seeking the professional degree.

Affiliate Senior Member (ASM)—Authorization to assume the same responsibilities as senior member, but not to participate in governance. In fields that also offer a professional doctorate, some affiliate senior member appointments may be restricted to the supervision of students seeking the professional degree.

Member/Advising (M2)—Authorization to advise students at the master’s level; to serve as a thesis reviewer at the master’s and as an examiner on student examining committees at the master’s and postbaccalaureate certificate levels; to teach courses for graduate credit; and to participate in governance. At the discretion of the appointing program, may also include authorization to serve as a thesis reviewer and examining committee member for doctoral students, but not as chair.

Affiliate Member/Advising (AM2)—Authorization to assume the same responsibilities as member/advising, but not to participate in governance.

Member (M)—Authorization to serve as a thesis reviewer at the master’s level and as an examiner on student examining committees at the master’s and postbaccalaureate certificate levels; to teach courses for graduate credit; and to participate in governance.

Examining Status (E)—Authorization to serve as a thesis reviewer and as an examiner on student examining committees at all levels, but not as chair, and to teach courses for graduate credit. Examining status does not include membership on the graduate faculty and does not confer governance privileges.

Affiliate Member (AM)—Authorization to assume the same responsibilities as member, but not to participate in governance.

Affiliate Member/Advising (AM2)—Authorization to assume the same responsibilities as member/advising, but not to participate in governance.

Addictions Studies
Postbaccalaureate Certificate
Contact Information—Addictions Studies Certificate, College of Continuing Education, Student Support Services, 150 Wesbrook Hall, 77 Pleasant Street S.E., Minneapolis, MN 55455 (612-624-4000; adv@cce.umn.edu; <www.cce.umn.edu/certificates>).
For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor
David C. Hollister, Social Work, M2

Associate Professor
Martha A. Rueet, Family Social Science, M
Ken C. Winters, Psychiatry, M

Assistant Professor
Traci Louise Toomey, Epidemiology, M

Teaching Specialist
Peter Dinock, Social Work, M

Curriculum—The postbaccalaureate addictions studies certificate gives students expertise in the prevention and treatment of addictive disorders relevant to a wide variety of human service, health care, and public health settings. Two tracks are available: public health and service provider. The public health track focuses on specialization in the epidemiology of addictive disorders and promising prevention approaches. The service provider track allows students to study advanced counseling and therapy skills, models, and intervention techniques related to the treatment of addictive disorders. Students can use the curriculum in this track to qualify for the Alcohol and Drug Counselor license from the Minnesota Department of Health.

Admission Requirements—Applicants for either track must have a bachelor’s degree from an accredited postsecondary U.S. institution or its foreign equivalent. A GPA of 3.00 is required. There are additional admissions requirements for the service provider track. Admissions information is available at <www.cce.umn.edu/certificates>.

Certificate Requirements—The public health track consists of 17 core credits and 2 elective credits. To earn a service provider track certificate, students must take 9 core credits and 10 elective credits. However, to sit for the licensure exam, students must also complete additional coursework (15 credits).

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; dept@aem.umn.edu; <www.aem.umn.edu>).
For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Regents Professor
Daniel D. Joseph, SM

Professor
Roger E. A. Arndt, Civil Engineering, SM
Gary J. Balas, SM
Gordon S. Beavers, SM
Graham V. Candler, SM
Roger Fosdick, SM
William L. Garrard, SM
Richard D. James, SM
Perry H. Lee, SM
Ellen K. Longmire, SM
John S. Lovengrub, Mechanics, SM
Mitchell B. Lusk, Mechanics, SM
Thomas Lundgren (emeritus), ASM
Theodore A. Wilson, SM
Akerman Professor of Design
Andrew Vano, AM

Associate Professor
Ivan Marusic, SM
Thomas W. Shield, SM
Lev Truskinovsky, SM
Yiyuan Zhao, SM

Adjunct Associate Professor
Dale F. Enns, SM

Assistant Professor
Demoz Gebre-Egziabher, SM
Ashley Janes, SM
Yohannes Koteema, AM
Krishnan Mahesh, SM

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.

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

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

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 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 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 subfield of mechanics.

Language Requirements—None.

Final Exam—The final exam is oral.

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 (612-625-3777; dgs@apec.umn.edu; <www.apec.umn.edu>).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Regents Professor
Vernon W. Ruttan (emeritus), ASM
G. Edward Schuh, SM

Professor
Jeffrey D. Apland, SM
Sandra O. Archibald, Public Affairs, SM
K. William Easter, SM
Vernon R. Eidman, SM
William C. Gartner, SM
Robert P. King, SM
Jean D. Kinsey, SM
Richard A. Levin, SM
George W. Morse, SM
Kent D. Olson, SM
Philip G. Parley, SM
Claudia A. Parliment, SM
Glenn D. Pederson, SM
Stephen Polasky, SM
Terry L. Roe, SM
C. Ford R unge, SM
Benjamin H. Senauer, SM
Delane E. Welsch (emeritus), ASM

Associate Professor
Brian L. Buhr, SM
Jay S. Coggin s, SM
Jeremiah E. F. Fraun, SM
Paul W. Glewwe, SM
Frances R. Homans, SM
Terrance M. Hurley, SM
William F. Lazarus, SM
Donald J. Liu, SM
Gerard McCullough, SM
Pamela J. Smith, SM
Rodney R. Smith, SM
Thomas F. Stinson, SM
Steven J. Taff, SM
David Trechter, AM

Assistant Professor
Elizabeth E. Davis, SM
Laura T J Kalamlbokids, SM
Margaretta V. Rudstrom, SM

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 consumer behavior and household economics; development, trade, and policy; natural resource and environmental economics; production and marketing economics; and community development.

Prerequisites for Admission—A GPA 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, domestic and foreign. A TOEFL score of 550 (paper) or 213 (computer) is also required for all international applicants whose native language is not English. This includes applicants with other academic study in the United States. TOEFL scores will be waived for applicants who have completed a degree from a United States institution within the last two years. 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.

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

Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is not permitted, with the exception of Stat 4101-02 for the M.S. degree only.

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 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. are a 1-credit seminar, 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 an approved minor in another graduate program. A typical program involves at least ten semester courses totaling at least 35 credits. Courses in economics may be counted 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 higher.

Agricultural Engineering
See Biosystems and Agricultural Engineering.

American Studies

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

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor
Patricia C. Albers, American Indian Studies, SM
Ronald R. Aminzade, Sociology, SM
Hyman Berman, History, SM
David O. Born, Preventive Sciences, SM
Hazel Dicken-Garcia, Journalism and Mass Communication, SM
Mary G. Dietz, Political Science, SM
Sara M. Evans, History, SM
James Farr, Political Science, SM
Philip J. Gersmehl, Geography, SM
Edward A. Griffin, English, SM
Karen N. Hoyle, Library Collection Development/Management (Children’s Literature Research Collection), AM
Mary Jo Kane, Kinesiology, SM
**Degree Programs and Faculty**

**Senior Fellow**
Harry C. Boyte, Public Affairs, AM

**Other**
Coleen 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 department office: a special application form available from the department office; a special application form available from the department office, a personal statement, three letters of recommendation, an academic writing sample, scores from the General (Aptitude) Test of the GRE that are less than five years old, and transcripts of all college work. Applications must be submitted by December 15. Entry is only in fall semester.

**Courses**—Please refer to American Studies (AmSt) in the course section of this catalog for courses pertaining to the program.

**Use of 4xxx Courses**—One 4xxx course in American studies, English, history, American Indian studies, comparative studies in American studies, English, history, American studies, or other preparation acceptable to the department office, a personal statement, three letters of recommendation, an academic writing sample, scores from the General (Aptitude) Test of the GRE that are less than five years old, and transcripts of all college work. Applications must be submitted by December 15. Entry is only in fall semester.

**Plan B** requires three additional adviser-approved courses in the field of concentration, (9 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 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.

**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 specialization seminars or from other units approved by the director of graduate studies, one of which must be original research (9 credits); one comparative culture course covering international or non-U.S. topics (3 credits); and seven adviser-approved field of concentration courses, including cultural pluralism courses (21 credits). Twenty-four thesis credits are also required. Ph.D. students may register for 0999 no more than two semesters total without approval from their adviser and the director of graduate studies.

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

**Minor Requirements for Students Majoring in Other Fields**—For a doctoral minor, students must complete at least 12 credits of courses consistent with or complementary to their major, including four 5xxx or 8xxx courses in American studies, one of which must be AmSt 8201 or AmSt 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; renox001@umn.edu; <www.anosci.umn.edu>).
**Degree Programs and Faculty**

**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; anth@umn.edu; [http://cla.umn.edu/anthropology/](http://cla.umn.edu/anthropology/)).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

**Professor**

Patricia Albers, American Indian Studies, ASM
Luther P. Gerlach (emeritus), ASM
Guy E. Gibbon, SM
Stephen F. Gudeman, SM
John M. Ingham, SM
Frank C. Miller (emeritus), ASM
Riv-Ellen Proll, American Studies, ASM
Gloria G. Raheja, SM
Peter S. Wells, SM
Joseph J. Westermeyer, Psychiatry, AM2

**Associate Professor**

Daphne Berdahl, SM
Timothy Dinunzio, SM
David M. Lipsit, SM
Mische Penn, SM
Janet D. Spector (emeritus), ASM

**Assistant Professor**

Kathleen Barlow, SM
Karen Ho, SM
Pradeep Jeganathan, SM
Gregory Laden, SM
Jean Langford, SM
Martha Tappen, SM
Karen S. Taussig, SM
Gilbert B. Tostevin, SM
Thomas Wolfe, History, ASM

**Fellow**

Sonia E. Patten, Family Practice and Community 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**—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.

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

**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.

**M.S. Degree Requirements**

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.

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.

**Minor 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 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.

**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.
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**—A B.A. degree or equivalent is required for admission.

**Special Application Requirements**—Three letters of recommendation on a form furnished by the department and scores from the General Test of the GRE should be sent to the director of graduate studies. Admission is for fall semester; the deadline for all materials is January 5.

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

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

**M.A. Degree Requirements**
For Plan A and Plan B, 20 semester credits; 14 in anthropology and 6 in minor or related field. Students should consult the department Web site at [www.cla.umn.edu/anthropology](http://www.cla.umn.edu/anthropology) for special requirements for sociocultural anthropology and for archaeology and biological anthropology.

**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**
Requirements include 36 credits of coursework; 24 in anthropology and 12 in a minor or supporting program. Students should consult the department Web site at [www.cla.umn.edu/anthropology](http://www.cla.umn.edu/anthropology) for special requirements for sociocultural anthropology and for archaeology and biological anthropology.

**Language Requirements**—Requirements depend upon student’s special area of research.

**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**

**Postbaccalaureate Certificate**

**Contact Information**—Applied Developmental Psychology Certification Program, Institute of Child Development, 51 East River Road, Minneapolis, MN 55455 (612-624-2576; fax 612-624-6373).

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

**Professor**
Ann D. Pick, M (emeritus)
Herbert L. Pick, Jr., M
Richard Weinberg, M

The certificate in applied developmental psychology allows graduate students who major or minor in child psychology to study and experience applications of developmental science issues, policies, and problems concerning children and child development at the local, state, and national level. Through the combination of theory and field experience, students learn how to help solve pressing real-life problems and to improve the lives of children. The 21-credit program explores such topics as ethical issues in applied developmental psychology, media and children’s programming, nutrition and hunger, accidents and safety issues, children in the judicial system, the design and role of children’s museums, and the development of children’s toys, games, and recreational activities. Professionals in this field need to develop an in-depth understanding of how public policy affects children’s lives, how to make pure research comprehensible and practical without losing its complexity, and how to work in interdisciplinary teams.

**Admission**—Admission is open to graduate students enrolled in a doctoral program at the University. Students in child psychology must consult with the training director(s) and complete a department application form before officially registering for the first seminar. Students not in child psychology must have successfully completed a four-year undergraduate degree with a minimum 3.00 GPA and equivalent of 12 quarter or 9 semester course credits in psychology, and one statistics course. Admission is based primarily on the applicant’s academic record, GRE scores, and research experience.

**Curriculum**—CPsy 8360 (2 cr, section 7) gives an overview of applied developmental science problems and provides a framework for the second two components of the program. CPsy 8301 (4 cr) and 8302 (4 cr) are the core courses in developmental psychology covering biological, cognitive, and social aspects of development. They are fundamental to understanding the developmental perspective. CPsy 8996 (5 cr) integrates and applies information learned in coursework. The course is individually designed based on each student’s prior experience and interests. Students focus on practical and/or public policy applications of developmental research in settings such as the Search Institute, the Minnesota Children’s Museum, the guardian ad litem program in the local courts, the Center for 4-H Youth Development, and the National Institute on Media and the Family. The field experience may be taken in one to three semesters or a summer session, but must be at least 5 credits and total 188 hours. A major paper describing the field experience and integrating relevant basic research literature with practical availability taking place in the field setting is expected. Electives (6 cr) may include 5xxx or 8xxx courses approved by the training directors and chosen to complement the student’s area of interest.

**Applied Plant Sciences**

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

For up-to-date graduate faculty listings, see [www.grad.umn.edu/faculty_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp).

**Regents Professor**
Ronald L. Phillips, SM

**Professor**
Roger L. Becker, SM
Deborah L. Brown, M2
Vernon B. Cardwell, SM
Iris Charvat, SM
Jerry D. Cohen, SM
Beverly R. Dungan, SM
Nancy J. Ehlke, SM
Vincent A. Fritz, SM
Gary M. Gartner; SM
Burle G. Gengenbach, SM
Jeffrey L. Gunsonius, SM
Leland L. Hardiman, SM
Dale R. Hicks, SM
Emily E. Hoover, SM
Robert J. Jones, SM
Nicholas R. Jordan, SM
Pen Hsiang Li, SM
James J. Luby, SM
Alburt H. Markhart III, SM
Peter J. Olin, M2
James H. Orf, SM
David G. Pitt, Landscape Architecture, M2
Carl J. Rosen, Soil, Water, and Climate, SM
Ruth G. Shaw, SM
Craig C. Sheaffner, SM
Steve R. Simmons, SM
David A. Somers, SM
Joseph R. Sowokinos, SM
Donn D. Stuthman, SM
Donald B. White, SM
David K. Wildung, SM
Donald L. Wyse, SM
Nevia D. Young, Plant Pathology, SM

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

**Associate Professor**
James A. Anderson, SM
Rex N. Bernardo, SM
Gregory J. Cuomo, SM
John E. Erwin, SM
Susan M. Glatowisch, SM
Gregg A. Johnson, SM
Mary H. Meyer, SM
Gary J. Mushliauer, SM
Bradley W. Pederson, M2
Paul M. Porter, SM
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 Departments 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—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—Students conduct research related to fruits, vegetables, potatoes, flowers, ornamental trees and shrubs or turf; and on the physiology, production, environmental impact of cropping systems, and use of horticultural crops. Research areas include the effect of horticultural commodities on human health, hormonal, and stress physiology; flower development and flowering physiology; integrated pest management; postharvest physiology; and cropping system strategies. Students get a broad range of experiences in the field, greenhouse, and/or laboratory using genetic, molecular, biochemical, and ecological tools to answer research questions.

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 genetics projects doing biotechnology, genetic engineering, and genomic research 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—Applicants must submit scores from the General (Aptitude) 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 teaching and research assistantships awarded for the next academic year. Students can be admitted any term.

Courses—Please refer to Agronomy and Plant Genetics (Agro), Applied Plant Sciences (APSc), Horticultural Science (Hort) and Sustainable Agricultural Systems (SAgr) in the course section of this catalog for courses pertaining to the program.

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

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.

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 currently being accepted to this program. Contact the Graduate School for information on the status of the program.

Contact Information—Arabic Program, Department of African American and African Studies, University of Minnesota, 808 Social Sciences Building, 267 19th Avenue S., Minneapolis, MN 55455 (612-624-9847). For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor
Cesar E. Farah, M2

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 Arab-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 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 5102 (Advanced Arabic) or an 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.

No written exam is required for the minor.

**Architecture**

**Contact Information—**Department of Architecture, University of Minnesota, 145 Rapson Hall, 89 Church Street S.E., Minneapolis, MN 55455 (612-624-7866; fax 612-624-5743; calainfo@umn.edu).

For up-to-date graduate faculty listings, see [this link](http://www.grad.umn.edu/faculty_rosters/step1.asp).

**Professor**
Thomas Fisher, M2
Lance A. LaVine, M2
Julia Robinson, M2
Garth C. Rockcastle, M2
Leon G. Satkowski, M2
Duane Thorbeck, AM2

**Adjunct Professor**
Dale M. Mulflinger, AM2

**Associate Professor**
Lee B. Anderson, M2
Arthur H. Chen, M2
Rene Cheng, M2
William F. Conway, M2
Gunter Dittmar, M2
Bruno Franck, M2
Mary M. Guzowski, M2
Cynthia Jara, M2
Andrzej Piotrowski, M2
Katherine M. Solomonson, M2
J. Stephen Weeks, M2

**Adjunct Associate Professor**
Thomas Andrew Meyer, AM2
Todd J. Rhoades, AM2
Lee E. Tollefson, AM2
Craig L. Wilkins, AM2

**Assistant Professor**
John Charles Carmody, M2

**Adjunct Assistant Professor**
Mary del’Lattre, AM
Nina Ebbighausen, AM
Timothy Fuller, AM
Ali Heshmati, AM
Douglas Lew, AM
Robert Mack, AM
Nancy Miller, M2
Tim Quigley, AM
Marcy Schulte, AM
Mark Searles, AM
Mark Wentzell, AM

**Lecturer**
Robert Adams, AM2
Robert Ferguson, AM2
Dawn Gipin, AM2
Sharon Roe, AM2

**Adjunct Teaching Instructor**
Lucas Alm, AM
Doug Bergert, AM
Jonee K. Brigham, M
Steve Buettow, AM
Mike Christenson, AM
Dan Clark, AM
Dave Dimond, AM
Jim Dozer, AM
Martha McQuade, AM
Mary Springer, AM
Suzi Stromhan, AM
Mark Tamborrino, AM
Marcel Valdes, AM
Josh Weinstein, AM
Tom Westbrook, AM

**Research Fellows**
John C. Carmody, M2
Virajita Singh, M
Billy Weber, M

**Other**
Janet Abrams, M
William A. Blanski, AM
Todd P. Hansen, AM
Thomas G. Whitcomb, AM
Jennifer A. Yoo, 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—**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.

In the United States, most state registration boards require a degree from an accredited professional degree program as a prerequisite for licensure. The National Architectural Accrediting Board (NAAB), which is the sole agency authorized to accredit U.S. professional degree programs in architecture, recognizes two types of degrees: the bachelor of architecture and the master of architecture. A program may be granted a five-year, three-year, or two-year term of accreditation, depending on its degree of conformance with established educational standards.

Master’s degree programs may consist of a pre-professional undergraduate degree and a professional graduate degree, which, when earned sequentially, comprises an accredited professional education. However, the pre-professional degree is not, by itself, recognized as an accredited degree.

**Prerequisites for Admission—**Track A 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. Track A candidates can expect to complete the M.Arch. program in six semesters (three years), including the thesis.

Students are expected to have basic computer skills before beginning the program, including familiarity either with 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. Typically, students who complete their B.A. or B.S. in architecture, as well as students who have undergraduate degrees in other disciplines, apply to the master’s program as Track A candidates.

Track B applicants who have completed at least two years of architectural design studios plus structures and materials courses that would be the equivalent of the first year of this graduate program, and who have a nonprofessional bachelor’s degree in architecture, would receive advanced placement in the program sequence. Depending on academic record, previous coursework, and portfolio review, Track B students can complete the M.Arch. degree in as little as two years. Upon acceptance, Track
B applicants will have coursework reviewed by the director of graduate studies to determine their specific course requirements.

Track C applicants, those who hold a bachelor of architecture professional degree (B.Arch.) or a first professional master of architecture (M.Arch.) degree, are admitted to pursue the master of architecture. These students, in conjunction with the director of graduate studies, plan a curriculum around their special interests. Students with a prior professional degree take a minimum of 30 credits in an individually developed program requiring a minimum of three semesters and culminating in a thesis project that reflects their course of study in their chosen specialty.

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 8.5” x 11” (other portfolio formats will be rejected). International students must submit scores from the TOEFL or the MELAB.

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

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

M.Arch. Plan A Degree Requirements

The professional M.Arch. curriculum accredited by the National Architectural Accreditation 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.

Language Requirements—None.

Final Exam—Oral and visual presentation of the thesis is required.

Art

Contact Information—Department of Art, University of Minnesota, 205 Art Building, 405 21st Avenue S., Minneapolis, MN 55455 (612-625-8066; fax 612-625-7881; artdept@umn.edu; <http://artdept.umn.edu>).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor

Karl E. Bethke, M2
Curis C. Hord, M2
M. Diane Katsiaficas, M2
Clarence E. Morgan, M2
Mark Pharis, M2
Wayne E. Portratz, M2
Thomas A. Rose, M2

Associate Professor

Guy A. Baldwin, M2
Thomas R. Cowette, M2
David Feinberg, M2
Lynn A. Gray, M2
Gary L. Hallman, M2
James V. Henkel, M2
Jerald A. Krepps, M2
Thomas J. Lane, M2
Susan M. Lacey, M2
Lynn T. Lukkas, M2
Joyce Lyon, M2

Assistant Professor

Christine A. Baenmier, M2
Margaret Bohls, M2
Jan Estep, M2
Marjorie Franklin, M2
Erik Geshke, M2
Alexi Kuhr, M2

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 fine arts program places major emphasis on creative studio work of high quality. It promotes not only the conceptual and technical education of the professional artist in the context of the studio environment, encouraging critical inquiry, excellence, and an understanding of the history of art, but also an experimental approach toward each media. The following areas of concentration are available: ceramics, drawing and painting, photography, printmaking, sculpture, and time and interactivity. The M.F.A. is considered the terminal degree in the field of fine arts and is typically the degree required to teach at the college or university level.

Prerequisites for Admission—An undergraduate degree is required.

Special Application Requirements—Admission is in fall semester only. Ceramics, painting, and sculpture applicants must submit from 10 to 20 color slides of work in a slide carousel completed in their chosen medium. Printmaking applicants must submit a minimum of four original prints in addition to slides. Time and interactivity applicants must submit a portfolio in the medium appropriate to the work being submitted for review. Photography applicants may submit 10 to 20 slides or a minimum of ten finished prints. Three letters of recommendation must be sent directly to the director of graduate studies, as well as a brief statement of purpose that describes the applicant’s reasons for pursuing an advanced degree. Completed Graduate School applications (including official transcripts) must reach the Graduate School by January 5. Slides or visual portfolio, letters of recommendation, and the statement of purpose must reach the director of graduate studies in the Department of Art also by January 5. Incomplete files will not be reviewed.

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

Use of 4xxx Courses—Inclusion of 4xxx courses in the related field (other than art history) on the degree program form is subject to the adviser and director of graduate studies approval.

M.F.A. Degree Requirements

The M.F.A. program requires a total of 60 credits. It is typically a three-year program and studio space is provided for a maximum of three consecutive years for the pursuit of appropriate research. The program requires that coursework be completed prior to the final year of thesis registration. Candidates must plan programs with their advisers to include the graduate seminars ArtS 8400 (taken in the first term) and ArtS 8410 (taken in the second year) and 27 credits of visual art coursework. The related field requirement of 9 credits includes three courses in the history of art (or two courses in the history of art and one course from another academic department pertinent to the student’s program). Candidates must be reviewed annually for progress through the program. At the end of the thesis year, candidates demonstrate their visual research accomplishments through a solo thesis exhibition on campus, a supporting paper, and a final oral exam.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—A minor in art may be obtained by candidates in a master’s program by completing 9 credits of graduate level coursework chosen in consultation with the director of graduate studies in art.

Candidates in a Ph.D. program must complete 12 credits. The minor must include ArtS 8400—Theoretical Constructions in Contemporary Art.

Art Education

See Education, Curriculum, and Instruction.

Art History

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

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor

Frederick M. Asher, SM
Frederick A. Cooper, SM
Karal Ann R. Marling, SM
Evan M. Maurer, AM
Sheila J. McNally, SM
Robert J. Poor, SM
Leon G. Satkowski, ASM
Gabriel P. Weisberg, SM
Degree Programs and Faculty

Associate Professor
W. John Archer, ASM
Catherine B. Asher, SM
Jane M. Blocker, SM
Lyndel I. King, AM
Robert B. Silverman, SM
Katherine M. Solomonsen, ASM
John W. Steyeart, SM

Assistant Professor
Jane M. Blocker, SM
Michael Gaudio, SM

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; early modern art; East Asian art and Bronze Age archaeology; Greek and Roman art and archaeology; art and architecture; Late Gothic and northern Renaissance art; modern art and theory 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, at least one substantial research paper in art history, and three letters of recommendation from persons well acquainted with the applicant’s research and writing skills are 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, an 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 are 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.

Art History Visual Resources Center—The Art History Visual Resources Center (VRC) is located at 460 Heller Hall. The center has holdings of approximately 250,000 slides, and 100,000 photo archives, with content ranging from the prehistoric to the contemporary, in architecture, sculpture, painting, and other media, from all areas of the world. In addition, there is a collection of over 250 films.

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

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.

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, early modern, East Asian, Islamic, medieval, modern and contemporary, South Asian. Of these, three courses must be in an area of secondary concentration, two courses in an area of primary 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.

Minor Requirements for Students Majoring in Other Fields—For an M.A. degree, a minimum of 11 graduate credits in art history is required for a minor.

Ph.D. Degree Requirements
A minimum of 54 course credits (about 18 courses) is required. At least 18 credits (about six courses) must be in an area of primary concentration within art history, while a minimum of 9 credits (about three courses) must be in an area of secondary concentration in art history. In addition, at least 6 credits (about two courses) must be outside the field of art history in the minor or supporting program beyond work done at the M.A. level; a minimum of 12 credits in a minor or supporting field is required.

Language Requirements—Students must attain reading proficiency in at least two foreign languages. Contact the director of graduate studies for details.

Minor Requirements for Students Majoring in Other Fields—A doctoral minor requires a minimum of 12 credits in art history.

Asian Languages and Literatures
New graduate degree programs in Asian Languages, Cultures, and Media (ALCM) in the department of Asian Languages and Literatures (ALL) are under development. Contact the program for more information.

Note: No new students are being admitted to the Chinese, Japanese, and South Asian Languages graduate programs.

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.

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Chinese
Professor
Joseph R. Allen, SM
Richard B. Mathur (emeritus), ASM
Ann B. Waitner, History, SM
Assistant Professor
William Schaefer, SM

Japanese
Professor
Joseph R. Allen, SM
Associate Professor
Michael S. Molasky, SM
Polly E. Sztawrowski, SM
Assistant Professor
Mark Anderson, ASM
Maki Morinaga, ASM

South Asian Languages
Professor
Frederick M. Asher, Art History, SM
Iraj Bashiri, SM
Indira Y. Junghare, SM
Associate Professor
William W. Malandry, Classical and Near Eastern Studies, SM
Librarian
Donald C. Johnson, Ames Library of South Asia, M2
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; grad-equ@astro.umn.edu <http://astro.umn.edu> ).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor
Cynthia A. Cattell, Physics, ASM
Kris D. Davidson, SM
John M. Dickey, SM
Robert D. Gehrz, SM
Robert M. Humphreys, SM
Terry J. Jones, SM
Thomas W. Jones, SM
Leonard V. Kuhl, SM
Robert L. Lyons, Physics, ASM
Keith A. Olive, Physics, ASM
Robert O. Pepin, Physics, ASM
Lawrence Rudnick, SM
Evan D. Skillman, SM
Paul R. Woodward, SM

Associate Professor
Shaul Hanany, Physics, ASM
Yong-zhong Qin, Physics, ASM
Charles E. Woodward, SM
John R. Wygant, Physics, ASM

Assistant Professor
Michael DuVernois, Physics, ASM
Kim A. Venn, Macalester College, ASM
Lihiya L. Williams, SM

Senior Research Associate
David H. Porter, SM

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 activities that cover X-ray, ultraviolet, optical, infrared, and radio wavelengths. 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 into fall semester only.

Facilities—The Department of Astronomy has purchased a 5 percent share in the Large Binocular Telescope (LBT) on Mt. Graham in southeastern Arizona. The LBT is currently under construction as a consortium of universities and research institutes led by the University of Arizona and has an expected completion date of 2004. This purchase will also 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—as well as other smaller telescopes in Arizona, 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. Excellent shop facilities support our instrument development for the telescopes at O’Brien and Mt. Lemmon and for major national observatories such as the NASA Infrared Telescope Facility (IRTF) in Hawaii and for the LBT.

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 catalog is freely available on the Web. 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 Digital Technology Center 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; and 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.

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

Use of 4xxx Courses—A 4xxx astrophysics course may be counted toward the M.S. or Ph.D. degree programs.

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 credits of coursework and 10 thesis credits. Plan B requires 30 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.

Biochemistry, Molecular Biology, and Biophysics

Contact Information—Department of Biochemistry, Molecular Biology, and Biophysics, University of Minnesota, 6-155 Jackson Hall, 321 Church Street S.E., Minneapolis, MN 55455 (612-625-5179; fax 612-625-2163), bmbbgp@umn.edu <http://cbs.umn.edu/gpbmbb/).

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, 1035 University Drive, Duluth, MN 55812 (218-726-7922).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

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**Deans, Directors, and Program Heads**

Robert J. Sheaff, SM
Gianluigi Veglia, Chemistry, SM
Kylie J. Walters, SM
Jennifer J. Westendorf, Cancer Center, SM
Carrie M. Wilmot, SM

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 this emphasis on these areas are 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 chemistry is strongly recommended, but not required. The recommended date for receipt of completed applications is December 1. Completed files are reviewed between December and February. Graduate studies typically begin fall semester. 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.

**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**—A master’s minor requires 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**—A doctoral minor requires BioC 8002 (4 credits) plus additional courses (8 credits), approved by the director of graduate studies, to meet the minimum requirement of 12 total credits. In extenuating cases, students may petition the director of graduate studies for substitution of a required course.

**Bioethics**

**Minor Only**

Contact Information—Graduate Minor in Bioethics, Center for Bioethics, University of Minnesota, N504 Boynton, 410 Church St. SE, Minneapolis MN 55455-0346 (612-624-9440; fax 612-624-9108; bioethx@umn.edu; <www.bioethics.umn.edu>).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

**Professor**

Muriel Bebeau, Preventive Sciences, M
Dan Burk, Law, M
Norman Dahl, Philosophy, M
John Eyler, History of Medicine, M
Jasper Hopkins, Philosophy, M
Bioinformatics

Minor Only

Contact Information—Graduate Minor Program in Bioinformatics, Department of Laboratory Medicine and Pathology, University of Minnesota, MMC 511, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-625-8440; fax 612-625-7166; bioinfo@umn.edu; <www.binf.umn.edu>).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor
Daniel Boley, Computer Science, M
Lynda B. M. Ellis, Laboratory Medicine and Pathology, M
Alexander Grosberg, Physics, M
Vivek Kapur, Microbiology, M
Claudia Neuhauer, Ecology, Evolution, and Behavior, M
Hans Othmer, Mathematics, M
Lawrence P. Wackett, Biochemistry, Molecular Biology, and Biophysics, M
Nevin Dale Young, Plant Pathology, M

Associate Professor
Colin Campbell, Pharmacology, M
John Carls, Computer Science, M
Scott Fahrenkrug, Animal Science, M
Georgiana May, Ecology, Evolution, and Behavior, M
Wei Pan, Bioinformatics, M

Assistant Professor
Yang Da, Animal Science, M
George Karypis, Computer Science, M
Yiannis Kaznessis, Chemical Engineering and Materials Science, M
Arkady Khodursky, Biochemistry, Molecular Biology, and Biophysics, M
Cavan Reilly, Biostatistics, M

Curriculum—The bioinformatics minor is available to master’s (M.A. and M.S.) and doctoral students. The minor includes core coursework in computer and biological sciences and opportunities to interact with others interested in bioinformatics. The curriculum encourages interdisciplinary interaction, communication, and synthesis. The minor is intended to provide graduate-level biological or computer science students with basic training in bioinformatics as a complement to their major science background and broaden their professional abilities. The program of study is tailored by advance consultation between the student and the director of graduate studies for the bioinformatics minor. All courses taken to fulfill minor requirements must be graded A-F.

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.

Minor Only Requirements

Students Majoring in Philosophy—

Master’s students (M.A. and M.S.) must complete a minimum of 14 graduate credits in bioethics consisting of 8 credits of required courses and 6 credits of electives outside the Department of Philosophy.

PhD students must complete a minimum of 14 graduate credits in bioethics consisting of 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 consisting of 8 credits of required courses and 6 credits of electives.

Prerequisites for Admission—Admission to a master’s or doctoral degree-granting program within the Graduate School and preparation of a minor program of coursework approved by the director of graduate studies in bioinformatics is required. Potential programs must be discussed with the director of graduate studies.

Courses—Courses are taken from a designated course list available online at <www.binf.umn.edu/courses.html>.

Use of 4xxx Courses—Biol 4003—Genetics is the only 4xxx course that may be included on degree program forms.

Minor Only Requirements

The master’s and doctoral minors are developed in consultation with, and must be approved in advance by, the director of graduate studies for bioinformatics. The master’s minor requires at least 9 credits, including CSci 5481—Computational Techniques for Genomics, one of several genomics or sequence analysis courses, and a third designated course. Other courses may be substituted upon the recommendation of the director of graduate studies.

The doctoral minor requires at least 15 credits, including the master’s courses, one of several courses in statistical genomics, and an elective. Other courses may be substituted upon the recommendation of the director of graduate studies.

Biological Science

Contact Information—Master of Biological Science, Professional Program, College of Biological Sciences, 123 Snyder Hall, 1475 Gortner Avenue, St. Paul, MN 55108 (612-625-3153; fax 612-624-2785; biolink@cb.umn.edu; <www.cbs.umn.edu/biolink/mbs2.html>.

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor
John S. Anderson, Biochemistry, Molecular Biology, and Biophysics, M2
Jay Bell, Soil, Water, and Climate, AM2
Judith G. Berman, Molecular, Cellular, Developmental Biology and Genetics, M2
David A. Bernlohr, Biochemistry, Molecular Biology, and Biophysics, M2
Linda J. Brady, Food Science and Nutrition, AM2
Robert M. Brambl, Plant Biology, M2
Paul P. Cleary, Microbiology, AM2
Gary M. Dunny, Microbiology, AM2
Leonard C. Ferrington, Entomology, AM2
James A. Fuchs, Biochemistry, Molecular Biology, and Biophysics, M2
Daniel D. Galas, Food Science and Nutrition, AM2
Ralph W. Holzenthal, Entomology, AM2
Ross G. Johnson, Molecular, Cellular, Developmental Biology and Genetics, AM2
John H. Kersey, Laboratory Medicine and Pathology, AM2
Youngki Kim, Pediatrics, AM2
Richard King, Pediatrics, AM2
Mindy S. Kurzer, Food Science and Nutrition, AM2
Paul T. Magee, Microbiology, M2
Sheldon M. Mauer, Pediatrics, M2
Gary L. Nebestuen, Biochemistry, Molecular Biology, and Biophysics, AM2

Degree Programs and Faculty

Jeffrey Kahn, Medicine, M
Rosalie Kane, Public Health, M
David Mayo, Philosophy, Duluth, M
Steven Miles, Medicine, M
Naomi Scheman, Philosophy, M
Susan M. Wolf, Law School, M

Associate Professor
John Dolan, Philosophy, M
Carl Elliott, Pediatrics, M
Joan Lisachenko, Nursing, M
Gregory Plouinoff, Medicine, M
Michael Root, Philosophy, M

Assistant Professor
Debra DeBrun, Medicine, M
Edward Ratner, Medicine, M
John Song, Medicine, M
Karen Sue Taussig, Medicine, M
Beth Vining, Health Services Research and Policy, M

Senior Research Fellow
Jonathan Kahn, Law, M

Other
Dianne Bartels, Center for Bioethics, M
Ronald Cranford, Neurology, M

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 biomedicine or both.

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.

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

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.

Minor Only Requirements

Students Majoring in Philosophy—

Master’s students (M.A. and M.S.) must complete a minimum of 8 graduate credits in bioethics consisting of 6 credits of required courses and 2 credits of electives outside the Department of Philosophy.
Degree Programs and Faculty

Harry T. Orr, Laboratory Medicine and Pathology, M2
Gary A. Buczynski, Food Science and Nutrition, AM2
Michael J. Sadowsky, Soil, Water, and Climate, AM2
Patrick M. Schlievert, Microbiology, AM2
Michael J. Simmons, Molecular, Cellular, Developmental Biology and Genetics, M2
Donald B. Smidt, Ecology, Evolution, and Behavior, M2
Joanne L. Slavin, Food Science and Nutrition, AM2
D. Peter Romstad, Plant Biology, M2
George R. Spangler, Fisheries, Wildlife, and Conservation Biology, AM2
Howard Towle, Biochemistry, Molecular Biology, and Biophysics, M2
Daniel A. Vella, Therapeutic Radiology, AM2
Brian G. Van Ness, Laboratory Medicine and Pathology, M2
Lawrence P. Wackett, BioTechnology Institute, M2
Clifford M. Wetmore, Plant Biology, M2
Chester B. Whitney, Pediatrics, AM2

Adjunct Professor
Bruce Vondracek, Fisheries, Wildlife, and Conservation Biology, AM2

Associate Professor
Gregory Jose Bettin, Surgery, AM2
Wei Chen, Pediatrics, AM2
Joellen Feirtag, Food Science and Nutrition, AM2
Susan M. Galatowsich, Horticultural Science, AM2
Craig A. Hassel, Food Science and Nutrition, AM2
Stephen Jameson, Laboratory Medicine and Pathology, AM2
Ronald R. Jennmerson, Microbiology, AM2
David A. Largaespada, Genetics, Cell Biology, and Development, AM2
Susan E. Marino, Pharmacy, AM2
Christopher A. Pennell, Laboratory Medicine and Pathology, AM2

Assistant Professor
Cheryl A. Gale, Pediatrics, AM2
David C. Fulton, Fisheries, Wildlife, and Conservation Biology, AM2
Anna Petryk, Pediatrics, AM2

Research Associate
Nicole Kirchhof, Surgery, AM2
Laura J. Suggs, Biomedical Engineering, AM2
Robert C. Venette, Entomology, AM2

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 multicollaborative 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.

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

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

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 is 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 BSE&E, 312 Church Street S.E., Minneapolis, MN 55455

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

For up-to-date graduate faculty listings, see <www.umn.edu/faculty_rosters/step1.asp>.

Professor
Robert J. Bache, Medicine, SM
David G. Benditt, Medicine, SM
John C. Bischof, Mechanical Engineering, SM
Frank B. Cerra, Surgery, SM
Wei Chen, Radiology, SM
Jay N. Cohn, Medicine, SM
Max Donath, Mechanical Engineering, SM
William K. Durham, Mechanical Engineering, SM
Timothy J. Ebner, Neuroscience, SM
Arthur G. Erdman, Mechanical Engineering, SM
Stanley M. Finkelstein, Laboratory Medicine and Pathology, SM
Martha Flanders, Neuroscience, SM
John E. Foker, Surgery, SM
Lorraine F. Francis, Chemical Engineering and Materials Science, SM
Leo T. Furcht, Laboratory Medicine and Pathology, SM
James R. Gage, Orthopaedic Surgery, M2
Michael G. Garwood, Radiology, M2
Robert P. Hebbel, Medicine, SM
Wen Shou Hu, Chemical Engineering and Materials Science, SM
Xiaoping Hu, Radiology, SM
Paul A. Iazzro, Anesthesiology, SM
Kenneth H. Keller, Public Affairs, SM
Tara O. Kvalseth, Mechanical Engineering, SM
Paul C. Letourneau, Cell Biology and Neuroanatomy, SM
David G. Levitt, Physiology, SM
Jack L. Lewis, Orthopaedic Surgery, SM
Rex E. Lowrten, Biochemistry, SM
James B. McCarthy, Laboratory Medicine and Pathology, SM
Robert P. Patterson, Physical Medicine and Rehabilitation, SM
Dennis L. Polla, SM
Richard E. Poppele, Neuroscience, SM
Gundu H. R. Rao, Laboratory Medicine and Pathology, SM
William P. Robbins, Electrical and Computer Engineering, M2
Ronald A. Siegel, Pharmaceuticals, SM
Ephraim M. Sparrow, Mechanical Engineering, SM
Stephen C. Strother, Radiology, SM
Ahmed H. Tewfik, Electrical Engineering, SM
Robert T. Tranquillo, Biomedical Engineering, SM
Charles L. Truwit, Neurology, SM
Neal F. Viemeister, Psychology, SM
Robert E. Wilson, Medicine, M2

Associate Professor
Jerome H. Abrams, Surgery, SM
Alan J. Bank, Medicine, M2
Gladwin S. Das, Medicine, SM
Email S. Ebbini, Electrical and Computer Engineering, SM
William B. Gleason, Laboratory Medicine and Pathology, SM
Bruce E. Hammer, Radiology, SM
Ramesh Harjani, Electrical and Computer Engineering, M2
James E. Holte, Electrical and Computer Engineering, SM
Allison Hubel, Laboratory Medicine and Pathology, SM
Keith G. Lurie, Medicine, M2
Ronald C. McGlemen, Laboratory Medicine and Pathology, M2
David J. Odde, SM
Clark M. Smith II, Pediatrics, SM
Joseph J. Tahilghader, Electrical and Computer Engineering, M2
J. Thomas Vaughan, Radiology, SM
Timothy S. Wiedmann, Pharmaceutics, SM
Jay Zhang, Medicine, SM

Assistant Professor
Eagar A. Arriaga, Chemistry, SM
Victor H. Barocas, Biomedical Engineering, SM
Joan E. Bechtold, Orthopaedic Surgery, M2
Linda K. Hansen, Laboratory Medicine and Pathology, SM
Huiying Liu, Radiology, M2
Mark A. Nicosia, Biomedical Engineering, M2
A. David Redish, Neuroscience, M2
Kenneth P. Roberts, Urologic Surgery, SM
Michael H. Schwartz, Orthopaedic Surgery, SM
Carl S. Smith, Urologic Surgery, M2
Peter N. Steinmetz, Biomedical Engineering, M2
Babak Ziae, Electrical and Computer Engineering, M2

Research Associate
Laura J. Suggs, Biomedical Engineering, M2

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.
Degree Programs and Faculty

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 areas of science and engineering that are relevant for the degree objectives.

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 (including linear algebra and differential equations) 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.

Courses—Please refer to Biomedical Engineering (BMEn) in the course section of this catalog for courses pertaining to the program.

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.

M.S. Degree Requirements

The M.S. is offered under two plans: Plan A (with thesis) and Plan B (with project). Each program requires courses in mathematics, biology, biomedical engineering, and relevant areas of science and engineering, 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 at least 6 course credits, including one BMEn core course (5001, 5101, 5201, 5311, or 5351) and one other BMEn course at 5xxx or higher.

Ph.D. Degree Requirements

The Ph.D. program requires coursework in mathematics, biology, biomedical engineering, and relevant areas of science and engineering (typically 40 credits, including those satisfying a minor field or supporting program), 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 at least 12 credits, including two BMEn core courses (5001, 5101, 5201, 5311, or 5351), one course with a biological sciences emphasis (may be BMEn 5501), and one course with an engineering emphasis. All courses must be at 5xxx or higher.

Biomedical Science

Contact Information—Assistant Director, Combined M.D./Ph.D. Training Program, University of Minnesota, MMC 293, 420 Delaware St. S.E., B690 Mayo, Minneapolis, MN 55455 (612-625-3680, 612-625-7402; <http://mdphd.med.umn.edu/>).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Regents Professor

Ashley T. Haase, Microbiology, SM
James G. White, Laboratory Medicine and Pathology, SM

Professor

Robert J. Bache, Medicine, SM
Leonard J. Banaszak, Biochemistry, SM
Timothy Behrens, Medicine, SM
Judith Berman, Genetics, Cell Biology, and Development, SM
David Bernzlauer, Biochemistry, Molecular Biology, and Biophysics, SM
Susan Berry, Pediatrics, SM
John Bischof, Mechanical Engineering, SM
Peter Bitterman, Medicine, SM
Bruce R. Blazar, Pediatrics, SM
David Brown, Pathobiology, SM
Paul P. Cleary, Microbiology, SM
Denis Clohety, Orthopaedic Surgery, SM
Bianca M. Conti-Fine, Biochemistry, SM
David N. Cornfield, Pediatrics, SM
Gary Dunny, Microbiology, SM
Timothy J. Eber, Neuroscience, SM
Robert P. Elde, Biological Sciences, SM
David P. Fan, Genetics, Cell Biology, and Development, SM
Stanley M. Finkelstein, Laboratory Medicine and Pathology, SM
Martha Flanders, Neuroscience, SM
Aaron Folsom, Epidemiology, SM
James Fuchs, Biochemistry, Molecular Biology, and Biophysics, SM
Apostolos P. Georgopoulos, Neuroscience, SM
Glenn J. Giesler, Jr., Neuroscience, SM
Christopher M. Gomez, Neurology, SM
Dale Gregerson, Ophthalmology, SM
Robert Hebbel, Medicine, SM
Stephen S. Hecht, Cancer Center, SM
Jordan L. Holtzman, Medicine, SM
Karen Hsiao-Ashe, Neurology, SM
Wei-Shou Hu, Chemical Engineering and Materials Science, SM
David Ingber, Medicine, SM
Marc Jenkins, Microbiology, SM
Jeffrey Kahn, Medicine, SM
Richard King, Medicine, SM
Ryoko Kurijana, Genetics, Cell Biology, and Development, SM
Alice A. Larson, Veterinary Pathobiology, SM
Ping-Yee Law, Pharmacology, SM
Tucker W. LeBien, Laboratory Medicine and Pathology, SM
Horace H. Loh, Pharmacology, SM
Walter C. Low, Neurosurgery, SM
Kevin Mayo, Biochemistry, Molecular Biology, and Biophysics, SM
James B. McCarthy, Laboratory Medicine and Pathology, SM
R. Scott McIvor, Genetics, Cell Biology, and Development, SM
Steven C. McLoon, Neuroscience, SM
Matthew F. Mescher, Laboratory Medicine and Pathology, SM
Jeffrey S. Miller, Medicine, SM
Robert Miller, Neuroscience, SM
Daniel Mueller, Medicine, SM
Charles Nelson, Child Health and Human Development, SM
Eric Newman, Neuroscience, SM
Douglas Ohlundorff, Biochemistry, Molecular Biology, and Biophysics, SM
Harry T. Orr, Laboratory Medicine and Pathology, SM
Richard Poppelle, Neuroscience, SM
Sundaram Ramakrishnan, Pharmacology, SM
Laura Ranum, Genetics, Cell Biology, and Development, SM
Michel M. Sanders, Biochemistry, SM
Patrick Schlievert, Microbiology, SM
Virginia S. Seybold, Neuroscience, SM
Eyal Shahar, Epidemiology, SM
Yoji Shimizu, Laboratory Medicine and Pathology, SM
John F. Soechting, Neuroscience, SM
Chang W. Song, Therapeutic Radiology, SM
Sheldon B. Sparber, Pharmacology, SM
Stanley A. Thayer, Pharmacology, SM
David D. Thomas, Biochemistry, SM
Howard C. Towle, Biochemistry, SM
Robert Tranquillo, Biomedical Engineering, SM
Kamil Ugurbil, Radiology, SM
Daniel A. Valleria, Therapeutic Radiology, SM
Brian G. Van Ness, Genetics, Cell Biology, and Development, SM
Catherine Verfaillie, Medicine, SM
Li-Na Wei, Pharmacology, SM
Carol L. Wells, Laboratory Medicine and Pathology, SM
George Wilcox, Neuroscience, SM
Douglas Yee, Medicine, SM

Associate Professor

James Ashe, Neuroscience, SM
Vivian J. Bardwell, Genetics, Cell Biology, and Development, SM
John C. Bischof, Mechanical Engineering, SM
Kathleen F. Conklin, Microbiology, SM
Stephen Ekker, Genetics, Cell Biology, and Development, SM
Kristin A. Högquist, Laboratory Medicine and Pathology, SM
Christopher Honda, Neuroscience, SM
Allison Hubel, Mechanical Engineering, SM
Victoria Iwanji, Genetics, Cell Biology, and Development, SM
Stephen C. Jameson, Laboratory Medicine and Pathology, SM
David A. Largaespada, Genetics, Cell Biology, and Development, SM
Linda McLoon, Ophthalmology, SM
Jose V. Parido, Psychology, SM
Christopher Pennell, Laboratory Medicine and Pathology, SM
Lisa A. Peterson, Environmental and Occupational Health, SM
Mary E. Porter, Genetics, Cell Biology, and Development, SM
Leslie Schiff, Microbiology, SM
Paul G. Siliciano, Biochemistry, Molecular Biology, and Biophysics, SM
Donald Simone, Oral Sciences, SM
Amy P. N. Skubitz, Laboratory Medicine and Pathology, SM
Peter J. Southern, Microbiology, SM
R. Carston Wagner, Pharmacy, SM
Assistant Professor
Edgar Arriaga, Chemistry, SM
Victor Barocas, Biomedical Engineering, SM
Joan Bechtold, Orthopaedic Surgery, SM
Paul Bohjanen, Microbiology, SM
Linda M. Boland, Neuroscience, SM
Michael Bowser, Chemistry, SM
Michael Farrar, Laboratory Medicine and Pathology, SM
Dan Kaufman, Medicine, SM
Carol A. Lange, Medicine, SM
Paul Mermelstein, Neuroscience, SM
Lincoln Potter, Biochemistry, Molecular Biology, and Biophysics, SM
Kathryn Schmitz, Epidemiology, SM
Peter Steinmetz, Biomedical Engineering, SM
Gianlugi Veglia, Chemistry, SM
Jennifer Westendorf, Orthopaedic Surgery, SM
Kevin Wickman, Pharmacology, SM

Senior Research Associate
William Engeland, Surgery, SM

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 consultation with their faculty advisers and the Committee on Graduate Studies, students custom design interdisciplinary programs at the interfaces of biology, medicine, engineering, and physical sciences.

Prerequisites for Admission—Admission is limited to students who have been accepted by the Medical School’s combined M.D./Ph.D. training program.

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

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.

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; hansen032@umn.edu).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor
Dwight L. Anderson, Oral Sciences, SM
Victor A. Bloomfield, Biochemistry, SM
Bianca M. Conti-Fine, Biochemistry, SM
Ralph DeLong, Oral Sciences, M2

William H. Douglas, Oral Sciences, SM
Stanley M. Finkelstein, Laboratory Medicine and Pathology, SM
John E. Foker, Surgery, SM
Michael G. Garwood, Radiology, SM
Rolf Gruetter, Radiology, SM
Russell K. Hobbie (emeritus), Physics and Astronomy, ASM
Xiaoping Hu, Radiology, ASM
Faz M. Khan (emeritus), Therapeutic Radiology, ASM
Merle K. Loken (emeritus), Radiology, ASM
Rex E. Lovrien, Biochemistry, SM
Robert H. Margolis, Otolaryngology, SM
Scott M. O’Grady, Animal Science, SM
Robert P. Patterson, Physical Medicine and Rehabilitation, SM
Richard E. Poppele, Physiology, SM
E. Russell Ritenour, Radiology, SM
Chang W. Song, Therapeutic Radiology, SM
Stephen C. Strother, Radiology, M2
David D. Thomas, Biochemistry, SM
Kamil Ugrubil, Radiology, SM
Warren J. Warwick, Pediatrics, SM

Associate Professor
Alan J. Bank, Medicine, M2
Richard A. Geise, Radiology, ASM
Bruce J. Gerbi, Therapeutic Radiology, SM
Bruce E. Hammer, Radiology, SM
Patrick Higgins, Therapeutic Radiology, M2
James E. Holte, Electrical Engineering, SM
Michael Jerosch-Herold, Radiology, M2

Assistant Professor
Vincent A. Barnett, Physiology, M2
Mark J. Conroy, Radiology, M2
Bruce E. Haseleuquist, Radiology, AM2
Haoying Liu, Radiology, M2
Kelly Relin, Radiology, AM2

Senior Research Associate
Chang-Chang Ko, Oral Science, M2
David H. Live, Biochemistry, Molecular Biology, and Biophysics, M2

Other
Firmin C. Deibel, M2
Christopher C. Kuni, M2
Kevin G. Waddick, M2

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.

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

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

M.S. Degree Requirements
The M.S. is offered under two plans: Plan A, (with thesis), and Plan B, (with 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, MMC 819, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-3500 or 1-800-774-8636; fax 612-626-6931; sph-ssc@umn.edu; <www.sph.umn.edu> or <www.biostat.umn.edu>).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor
Mark P. Becker, SM
Bradley P. Carlin, SM
John E. Connett, SM
Anne I. Goldman, SM
Chap T. Le, SM
James D. Neaton, SM

Associate Professor
Patrick M. Grambsch, SM
Birgit Grund, ASM
Wei Pan, M2
William Thomas, M2

Assistant Professor
Sadipito Banerjee, M2
Susan Duvall, AM2
Lynn E. Eberly, M2
Chuang-Yu Huang, M2
Cavan S. Reilly, M2
Melanie M. Wall, SM

Senior Research Associate
James S. Hodges, SM

Research Associate
Judith Bebchuk, M2
Li Chen, M2
Katherine Huppler Hullsiek, M2

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 participating 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, Fortran, or other high-level programming language 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 an overall GPA of at least 3.10. 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. Applicants to either program who are not native speakers of English should have a TOEFL score of at least 600 (paper version) or 250 (computer version) or a score of at least 7.0 on IELTS.

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

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

Use of 4xxx Courses— No 4xxx courses may be used to satisfy any graduate degree program requirements in biostatistics.

M.S. Degree Requirements
For the M.S. Plan B degree, students must complete 12 courses with a GPA of 3.00, pass a written exam, complete the Plan B project, and pass 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) eight required courses in statistical theory and biostatistics methods; 2) one elective course in health science; 3) three elective courses in biostatistics. Details of the program are in the Student Handbook at <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), pass a written exam, complete the Plan A thesis, and a final oral exam.

Language Requirements— None.

Final Exam— The final exam is oral.

Minor Requirements for Students Majoring in Other Fields— The master’s minor in biostatistics requires two courses from the following list: PubH 5462, 5470, 5482, 5483, 8420.

Ph.D. Degree Requirements
The Ph.D. program requires five core courses (including mathematical statistics, linear models, probability models, and Bayesian methodology) and three elective courses in biostatistical theory and methods, a preliminary written examination on the material from some of the required courses, a preliminary oral examination, a written dissertation, and dissertation defense in a final oral examination. This usually requires three years of full-time study after the M.S. degree.

Language Requirements— None.
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. As an alternative, 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.

Final Exam—Students must pass preliminary written and oral exams, write a dissertation, 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 12 credits of BAE courses numbered 4xxx or higher.

Business Administration

Contact Information—Ph.D. Program in Business Administration, Carlson School of Management, Room 4-201, 321 19th Avenue S., University of Minnesota, Minneapolis, MN 55455 (612-624-0875 or 612-624-5065; fax 612-624-8221; ebronson@csom.umn.edu; <www.carlsonschool.umn.edu/Page798.aspx>.

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, Minnesota, MN 55455 (612-625-5555; fax 612-626-7785). For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor

Carl R. Adams, Information and Decision Sciences, SM
Dennis A. Ahlburg, Human Resources and Industrial Relations, AM2
Gordon J. Alexander, Finance, SM
Amin H. Amershi, Accounting, SM
John C. Anderson, Operations and Management Science, SM
Richard D. Arvey, Human Resources and Industrial Relations, ASM
Frederick J. Bener, Marketing and Logistics Management, SM
Lawrence M. Benveniste, Finance, SM
Mark E. Bergen, Marketing and Logistics Management, SM
Robert G. Berryman (emeritus), Accounting, ASM
Norman E. Bowie, Strategic Management and Organization, SM
John H. Boyd, Finance, SM
Philip Bronasley, Strategic Management and Organization, SM
John M. Bryson, Public Affairs, Strategic Management and Organization, AM2
Norman L. Chernev, Information and Decision Sciences, SM
Terry L. Childers (emeritus), Marketing and Logistics Management, ASM
Shawn F. Curley, Information and Decision Sciences, SM
Gordon B. Davis, Information and Decision Sciences, SM
John W. Dickhaut, Accounting, SM
W. Bruce Erickson, Strategic Management and Organization, SM
Arthur V. Hill, Operations and Management Science, SM
Thomas R. Hoffman (emeritus), Information and Decision Sciences, SM
Michael J. Houston, Marketing and Logistics Management, SM
Deborah R. John, Marketing and Logistics Management, SM
George John, Marketing and Logistics Management, SM
Paul E. Johnson, Information and Decision Sciences, SM
Edward J. Joyce, Accounting, SM
Chandra S. Kanodia, Accounting, SM
John H. Kareken (emeritus), Finance, ASM
Robert J. Kauffman, Information and Decision Sciences, SM
Stefanie A. Lenway, Strategic Management and Organization, SM
Ross Levine, Finance, SM
Barbara J. Loken, Marketing and Logistics Management, SM
Ian H. Maitland, Strategic Management and Organization, SM
Alfred A. Marcus, Strategic Management and Organization, SM

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Courses—Please refer to Accounting (Acct); Business Administration (BA); 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.

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.

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—This area of concentration 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 macroeconomics 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 8653 is recommended as one of the two). An additional eight courses can be taken as electives and supporting program courses, with at least two of these being methodology courses.

Marketing and Logistics Management—The department requires students to take its five seminars (20 credits total) 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...
Degree Programs and Faculty

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 (strategy, 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) and 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; mbt@tc.umn.edu; <www.mbt.carlsonschool.umn.edu>). For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor
R. Glen Berryman (emeritus), Accounting, Business Law, M2
W. Bruce Erickson, Strategic Management and Organization, M2

Lecturer
Charles Caliendo, M2
Gary W. Carter, M2
Paul G. Guterman, M2
Frederick R. Jacobs, M2

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.

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

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

M.B.T. Plan B Degree Requirements
The M.B.T. requires 30 credits, including 6 credits in specified courses dealing with accounting and 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 must make them up before being awarded the degree and may do so while enrolled in program courses.

Final Exam—None.

Language Requirements—None.

Cell and Developmental Biology
See Molecular, Cellular, Developmental Biology and Genetics.

Cellular and Integrative Physiology
Contact Information—Cellular and Integrative Physiology Program, 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; physio@umn.edu; <http://physiology.med.umn.edu/grad/grad_index.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, 1035 University Drive, Duluth, MN 55812 (218-726-7934; phsl@d.umn.edu).<www.umn.edu/medweb/phsl/physiology/>

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor
Peter B. Bitterman, Medicine, ASM
Frank B. Cerra, Surgery, ASM
Joseph DiSalvo, Physiology, SM
William C. Engeland, Surgery, ASM
John E. Foker, Surgery, ASM
Robert P. Hebel, Medicine, ASM
Lois J. Heller, School of Medicine, Duluth, SM
Paul A. Iaizzo, Surgery, SM
David H. Ingbir, Medicine, SM
Hoon Cheung Lee, Pharmacy, ASM
Arthur S. Leon, Kinesiology, ASM
David G. Levitt, Physiology, SM
Walter C. Low, Neurosurgery, SM
Scott M. O’Grady, Animal Science, SM
John W. Osborn, Physiology, SM
O. Douglas Wangensteen, Physiology, SM

Associate Professor
Mustafa N. Al’Absi, School of Medicine, Duluth, AM2
W. Dale Branton, Neuroscience, ASM
Janet L. Fitzakerley, School of Medicine, Duluth, M2
Jurgen F. Fohlmeister, Physiology, SM
Edwin W. Haller (emeritus), School of Medicine, Duluth, AM2
Stephen A. Katz, Physiology, SM
David E. Mohrman, School of Medicine, Duluth, M2
Edward K. Stauffer, School of Medicine, Duluth, M2
LaDora V. Thompson, Physical Medicine and Rehabilitation, SM
Lorenz E. Wittmers, Jr., School of Medicine, Duluth, SM

Assistant Professor
Vincent A. Barnett, Physiology, M2

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—Physiology may be defined as the application of mathematics, physics, and chemistry to the study of structure and function in living systems. As such, physiology is a “hybrid” field in which expertise from many other disciplines is ordinarily required and combined.

The program emphasizes a quantitative approach to understanding the functions of cells, organs, and systems in living animals. Ph.D. students take a core concentration that provides a broad background in the physiology of membranes, cells, transport, and organ systems. Individualized programs are structured to build on the student’s strengths and to fill in gaps that would otherwise be an impediment to specific problem solving. Teaching experience is also available to all students.

Areas of specialization include cardiovascular, respiratory, membrane and transport processes, cell physiology, and to a limited extent, exercise and gastrointestinal physiology, and endocrinology.

Students enter the M.S. program from one of the 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 eurlar areas of neuroscience.
In addition, the Twin Cities campus has a special masters program that focuses on training people in local private industries who are engaged in relevant physiological projects. People working in various biotechnology, biomedical, and bioengineering companies in the Twin Cities area and doing work in physiology may benefit from formal training. The curriculum can be blended into a part-time graduate program, allowing continued employment while working for the M.S. degree.

Students enter the Ph.D. program only from the Twin Cities campus, although a Ph.D. may be pursued on the Duluth campus in some circumstances. The Twin Cities Ph.D. program focuses on educating people with previous medical training who are already at the University of Minnesota or are considering the University of Minnesota Medical School for residency or fellowship training. A surgical resident, a renal or cardiology fellow, or other comparable students may be interested in bundling their required or optional research into a Ph.D. program. Also, people already affiliated with University graduate faculty such as appropriate undergraduate students, lab techs, or others already working in a graduate faculty laboratory are encouraged to apply for admission. An additional route of admission is application with the aid of a graduate faculty sponsor.

Entering Ph.D. students are expected to take a series of laboratory rotations to familiarize themselves with areas of research active within the degree program. The program offers faculty and corresponding research laboratories from the Department of Physiology and from other departments (or divisions), including medicine, psychology, surgery, neuroscience, neurosurgery, veterinary biology, neurology, anesthesiology, kinesiology, and animal science.

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 is required. For the minor, a background in mathematics, physics, chemistry, and biology acceptable to the graduate faculty, is required.

Special Application Requirements—For the M.S. and Ph.D., applicants must take either the General Test of the GRE or the Medical College Admission Test. In addition, all applicants need three letters of recommendation. Admission can be in either fall or spring semester.

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

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.

M.S. Degree Requirements

Duluth campus: 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 encouraged 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 faculty from both campuses.

Twin Cities campus: 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 or a written project and an oral presentation of the work for the final exam. The M.S. degree is Plan A, unless there are special circumstances requiring a Plan B. 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 basis. 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; cemsgrad@umn.edu; <www.cems.umn.edu/>).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Regents Professor

H. Ted Davis, SM
Lanny D. Schmidt, SM
L. E. Scriven, SM

Professor

Frank S. Bates, SM
Raul Caredda, SM
Robert W. Carr, Jr., SM
C. Barry Carter, SM
James R. Cheilikow, SM
Philip I. Cohen, Electrical and Computer Engineering, ASM
Robert F. Cook, SM
Edward L. Cassder, SM
Prodromos Daoutidis, SM
Jeffrey J. Derhy, SM
Michael C. Flickinger, BioTechnology Institute, ASM
Lorraine F. Francis, SM
Christie J. Gennakoplis, SM
William W. Gerberich, SM
Steven L. Girshlick, Mechanical Engineering, ASM
Wayne L. Gladfelter, Chemistry, ASM
J. Woods Halley, Physics and Astronomy, ASM
Wei-Shou Hu, SM
Kenneth H. Keller, SM
David L. Kohlstedt, Geology and Geophysics, ASM
Timothy P. Lodge, SM
John S. Lowengrub, Mathematics, ASM
Christopher W. Macosko, SM
Alon V. McCormick, SM
Hans G. Othmer, Mathematics, ASM
Christopher J. Palmstrom, SM
David A. Shores, SM
Ronald A. Siegel, Pharmacy, ASM
J. Ilja Sieppmann, Chemistry ASM
William H. Smyrl, SM
Friedrich Srocinc, SM
Robert F. Tranquillo, SM
Michael Tsapatsis, SM
Michael D. Ward, SM
Kewen Yin, Wood and Paper Science, ASM
Michael R. Zachariah, Mechanical Engineering, ASM

Associate Professor

Alfonso Franciosi, Chemical Engineering, ASM
C. Barry Carter, SM
Marc A. Hillmyer, Chemistry, ASM
David C. Morse, SM
David J. Norris, SM
David J. Odde, Biomedical Engineering, ASM
Beth Stadler, Electrical and Computer Engineering, ASM
Renata M. Wentzcovitch, SM

Assistant Professor

Victor H. Barocas, Biomedical Engineering, ASM
Yiannis Kaznessis, SM
Efrosou Kokoli, SM
Satis Kumar, SM
Christopher Leighton, SM
Jennifer Maynard, SM
Richard B. McClurg, SM

Research Associate

Daniel M. Kroll, Pharmacy, AM
Greg D. Haugstad, Characterization Facility, AM

Degree Programs and Faculty
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 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 nonlinear 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, 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 BioTechnology 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.

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

Use of 4xxx Courses—Chemical engineering allows MatS 4214 to be taken for graduate credit. Materials science allows MatS 4212, 4214, 4221, 4301, and 4511 to be taken for graduate credit. All other ChEn or MatS 4xxx courses must have adviser and director of graduate studies approval.

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; inquiry@chem.umn.edu; <www.chem.umn.edu/chemphys>.

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Regents Professor—

H. Ted Davis, Chemical Engineering and Materials Science, SM
Lanny D. Schmidt, Chemical Engineering and Materials Science, SM

Professor—

Charles E. Campbell, Physics, SM
Barry C. Carter, Chemical Engineering and Materials Science, SM
James R. Chelikowsky, Chemical Engineering and Materials Science, SM
Christopher J. Cramer, Chemistry, SM
Jiali Gao, Chemistry, SM
William R. Gentry, Chemistry, SM
Allen M. Goldman, Physics, SM
J. Woods Halley, Physics, SM
Cheng-Cher Huang, Physics, SM
Kenneth R. Leopold, Chemistry, SM
Sanford Lipsky, Chemistry, SM
Wilmer G. Miller, Chemistry, SM
Karim Musier-Forsyth, Chemistry, SM
Jeffrey T. Roberts, Chemistry, SM
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; inquiry@chem.umn.edu; <www.chem.umn.edu>).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Regents Professor
H. Ted Davis, SM

Professor
George Barany, SM
Bridgette A. Barry, Biochemistry, ASM
Frank S. Bates, Chemical Engineering and Materials Science, ASM
Victor A. Bloomfield, Biochemistry, ASM
Peter W. Catt, SM
Christopher J. Cramer, SM
John E. Ellis, SM
Jialin Gao, SM
W. Roland Gentry, SM
Wayne L. Gladfelter, SM
Gary Roland Gray, SM
Thomas R. Hoye, SM
Steven R. Kass, SM
Kenneth R. Leopold, SM
John D. Lipscomb, Biochemistry, ASM
Sanford Lipsky, SM
Timothy P. Lodge, SM
Kent R. Mann, SM
Karin Musser-Forsyth, SM
Wayland E. Noland, SM
Louis H. Pignolet, SM
Lawrence Que, Jr., SM
Jeffrey T. Roberts, SM
J. Ilja Siepmann, SM
Kristopher McNeill, SM
George A. O’Doherty, SM
R. Lee Penn, SM
T. Andrew Taton, SM
Gianluigi Veglia, SM
Darrin M. York, SM

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, chemical biology, 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 University of 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 Examinations—Student in the Ph.D. program are expected to pass four of five proficiency examinations during their first year in residence. The exams, which are at the level of an advanced undergraduate course, are in analytical chemistry, biochemistry, inorganic chemistry, organic chemistry, and physical chemistry. The exams are given during the chemistry first-year orientation program in August. In the event that a student does not pass the first exam, they are offered two more times during the academic year.

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

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

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.
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 pass four out of five 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—Twelve course credits from graduate-level chemistry courses are required for a Ph.D. minor.

Child Psychology

Contact Information—Child Psychology Program, University of Minnesota, 204 Child Development Building, 51 East River Road, Minneapolis, MN 55455 (612-624-4127; fax 612-624-6373; <http://education.umn.edu/icd>.

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.

For up-to-date faculty listings, see <http://grad.umn.edu/faculty_rosters/step1.asp>.

Professor

Dale A. Blyth, 4H Youth Development Center, AM2
Patricia J. Bauer, SM
Sandra L. Christenson, Educational Psychology, AM2
W. Andrew Collins, SM
Nicki R. Crick, SM
Byron Egeland, SM
Michael K. Georgieff, Pediatrics, SM
Harold D. Grovetant, Family Social Science, AM2
Megan R. Gunnar, SM
Susan C. Hupp, Educational Psychology, AM2
William G. Iacono, Psychology, ASM
Glória R. Leon, Psychology, ASM
Michael P. Maratos, SM
Ann S. Masten, SM
Scott R. McConnell, Educational Psychology, AM2
Charles A. Nelson, SM
Anne D. Pick (emeritus), ASM
Herbert L. Pick, Jr., SM
Maria D. Sera, SM
Elsa G. Shapiro, Pediatrics, AM2
L. Alan Sroufe, SM
Paulus W. van den Broek, Educational Psychology, AM2
Richard A. Weinberg, SM
Albert Yonas, SM
Steven R. Yussen, SM

Associate Professor

Carrie M. Borchardt, Psychiatry, AM2
Martha Erickson, Children, Youth, and Family Consortium, AM2
Monica Luciana, Psychology, ASM

Assistant Professor

Canan Karatekin, SM
Kathleen Thomas, M2

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 collaborative program options for careers in applied areas of child psychology as well. 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 (DPCS) 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 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—The equivalent of three semester (or four quarter) courses 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 the departmental applications for graduate school work, 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, and a clearly written statement of career interests, goals, and objectives. The three letters of recommendation also must be received by the deadline. The TOEFL should be submitted when applicable.

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

Use of 4xxx Courses—Child psychology Ph.D. students may include 4xxx courses as part of their supporting program coursework 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.

M.A. Degree Requirements

The Institute of Child Development does not offer admission for a master’s degree. Students may choose to 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 is also required.

Language Requirements—None.

Final Exam—The final exam for Plan A is oral; typically, 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 cr), 8302 (4 cr), and 8996 (1-6 cr). 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; gradsec@ce.umn.edu; <www.ce.umn.edu>).

For up-to-date faculty listings, see <http://grad.umn.edu/faculty_rosters/step1.asp>.

Professor

Roger E. A. Arndt, SM
Patrick L. Brezovik, SM
Steven L. Crouch, SM
Emmanuel M. Detournay, SM
Andrew Drescher, SM
Efi Foufoula-Georgiou, SM

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Degree Programs and Faculty


**Adjunct Professor**

Peter A. Cundall, ASM

**Associate Professor**


**Associate Adjunct Professor**

Paul D. Capel, AM2  Karl A. Smith, SM

**Assistant Professor**

William A. Arnold, SM  Kevin J. Krizek, Urban and Regional Planning, AM2  Timothy M. Labara, SM  David M. Levinson, SM  Mihai O. Marasteau, SM  Fernando Porté-Agel, SM

**Assistant Adjunct Professor**

Eil Kwon, AM2

**Senior Research Associate**

Soﬁa G. Moglevskaya, ASM  Eugene L. Škoł, Jr., AM2

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, trafﬁc safety), 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 engineering is required.

**Special Application Requirements**—Applicants are required to submit results of the GRE in support of their applications. A minimum score of 550 on the paper-based or 213 on the computer-based TOEFL is required of foreign applicants from non-English-speaking countries. 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.

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

**Use of 4xxx Courses**—Inclusion of 4xxx department 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.

**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. 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.

**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 a 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

- **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 55455-0125 (612-624-5353; fax 612-624-4894; cnes@umn.edu; <http://cnes.cla.umn.edu/>).

For up-to-date faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

**Regents Professor**

- Thomas Clayton, English, ASM

**Professor**

- Elizabeth Belifiore, SM
- Frederick Cooper, SM
- Sheila McNally, SM
- S. Douglas Olson, SM
- Sandra Peterson, Philosophy, ASM
- Robert P. Sourkesky, SM
- Theofanis G. Stavrou, History, ASM
- Peter Wells, Anthropology, ASM

**Associate Professor**

- Andrea Berlin, SM
- Nita Kevans, SM
- Bernard Levinson, SM
- William Malandra, SM
- Oliver Nicholson, SM
- Jonathan Paradise, SM
- Philip Sellew, SM
- George Sheets, SM
- John Steyaert, Art History, ASM

**Assistant Professor**

- Christopher Nappa, M2
- Eva Von Dassow, M2
- Amanda Wilcox, M2

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**—Classical and Near Eastern Studies (CNES) is an interdisciplinary department that brings together faculty and graduate students who might in other settings be dispersed among a wide range of programs. CNES is dedicated to rigorous philological and literary training and to the conviction that the ancient Mediterranean world is best studied as a diverse but richly integrated cultural whole. The various M.A. and Ph.D. tracks allow students to concentrate in the area and period that most appeals to them, but students are strongly encouraged to take courses across the entire range of the department’s offerings and to develop a broad, multidisciplinary approach to research and teaching. Students entering the Ph.D. program with an M.A. can usually receive credit for some earlier coursework, subject to the approval of the graduate faculty and graduate school requirements. Related special facilities include the Center for Medieval Studies and the Center for Modern Greek Studies.

#### Prerequisites for Admission

- For the major track in ancient and medieval art and archaeology, a background in archaeology, art history, and history sufficient to begin graduate level studies in the discipline, and evidence of language-acquisition ability. For the major track in classics, sufficient knowledge to begin graduate reading courses in either Greek or Latin and at least intermediate ability in the other language. For the major tracks in Greek or Latin, sufficient knowledge to begin graduate reading courses in the language of the track. For the major in religions in antiquity, an undergraduate background in the field and sufficient knowledge to begin graduate reading courses in classical Hebrew, Greek, or Latin. Some course prerequisites can be made up on provisional admission.

Applications are welcome from students with undergraduate majors in fields such as ancient Near Eastern studies, art history, biblical studies, classical archaeology, classics, history, Jewish studies, linguistics, and religious studies.

#### Special Application Requirements

- Applicants must send the following directly to the Department of Classical and Near Eastern Studies: copy of all transcripts; copy of the GRE; three letters of recommendation from persons well acquainted with the student’s academic work and professional experience; and a statement describing the student’s intended course of study and professional goals. For non-native speakers of English, a copy of the TOEFL is required. Students may be admitted in any academic term, but financial assistance is normally available only to applicants admitted for fall semester (deadline: February 10).

**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.

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

### Ancient and Medieval Art and Archaeology Track

#### M.A. Degree Requirements

The degree allows concentrations ranging broadly over the ancient and medieval periods, with an emphasis on art historical and archaeological approaches. Work in an appropriate ancient language is encouraged. 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

- 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 degree allows concentrations ranging broadly over the ancient and medieval periods, with an emphasis on art historical and archaeological approaches. Graduate-level ability in an appropriate ancient language is required for graduation.

Students who continue from the M.A. program may apply those credits toward the Ph.D., with the exception of Plan A thesis credits or Plan B paper credits. A typical Ph.D. program is at least 71 credits, including at least 21 credits in the major, 12 in a 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 are 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 Track

#### M.A. Degree Requirements

This program provides a broad training in the literature of ancient Greece and Rome in its cultural context. Work in Greek and Latin is supplemented by courses in a related field or area of interest.

The program requires nearly equal emphasis on courses and seminars in Greek and in Latin, as well as supporting work in a related field or area of interest. 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 both Greek and Latin as certified by a department exam on previously unseen passages is required.

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

Minor Requirements for Students

Majoring in Other Fields—Students must complete Class 5794, as well as 9 graduate credits in graduate-level Latin courses (excluding Grk 8120) and 6 credits in graduate-level Greek courses (excluding Grk 8120).

Ph.D. Degree Requirements

This program requires extensive advanced work in both Latin and Greek, together with some study in a related field or area of interest.

The program requires nearly equal emphasis on courses and seminars in Greek and in Latin. Students must take at least three seminars in the major, a graduate level course in archaeology, and a two-semester sequence in ancient history, in addition to fulfilling all course requirements specified for the M.A. Students who continue from the M.A. program may apply those credits toward the degree, with the exception of Plan A thesis credits or Plan B paper credits. 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 and a second modern language, preferably French, and reading proficiency in ancient Greek as demonstrated by a department exam on previously unseen passages is required.

Minor Requirements for Students

Majoring in Other Fields—Students must complete Class 5794, as well as 15 graduate credits in Greek (excluding Grk 8120).

Latin Track

M.A. Degree Requirements

A core of advanced work in Latin is supplemented by a minor or supporting program in a related field or area of interest. 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 (Latin reading proficiency) and oral (general).

Minor Requirements for Students

Majoring in Other Fields—Students must complete Class 5794, as well as 15 graduate credits in Latin (excluding Lat 8120).

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; cls@umn.edu; <http://pathology.umn.edu/ClinicalLab/MS_CLS.html>).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor

Fred S. Apple, Laboratory Medicine and Pathology, M2
Henry H. Balfour, Jr., Laboratory Medicine and Pathology, M2
Paul P. Cleary, Microbiology, M2
Agustin P. Dalmasso, Laboratory Medicine and Pathology, M2
Gary M. Dunny, Microbiology, M2
John H. Eckfeldt, Laboratory Medicine and Pathology, M2
Stanley L. Erlandsen, Cell Biology and Neuroscience, M2
Patricia Ferretti, Laboratory Medicine and Pathology, M2
Robert P. Hebbel, Medicine, M2
Stephen S. Hecht, Laboratory Medicine and Pathology, M2
Marc K. Jenkins, Microbiology, M2
Russell C. Johnson, Microbiology, M2
Vivek Kagar, Veterinary Pathobiology, M2
John H. Kersey, Laboratory Medicine and Pathology, M2
Nigel Key, Medicine, M2
Tucker W. LeBien, Laboratory Medicine and Pathology, M2
J. Jeffrey McCullough, Laboratory Medicine and Pathology, M2
R. Scott McIvor, Laboratory Medicine and Pathology, M2

Minor Requirements for Students

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

Religions in Antiquity Track

M.A. Degree Requirements

The religions in antiquity track is comparative in both method and content. Although students may focus on a particular religious tradition, they will nonetheless study several ancient religions. The Plan A requires 22 credits in the major, 9 credits in a related field, plus 10 thesis credits. The Plan B requires 26 credits in the major plus 12 credits in a related field.

Minor Requirements for Students

Majoring in Other Fields—Students must complete Class 5794 and 15 graduate credits of Latin (excluding Lat 8120).
Degree Programs and Faculty

Gary L. Nelsen, Biochemistry, M2
Harry T. Orr, Laboratory Medicine and Pathology, M2
Gundu H. R. Rao, Laboratory Medicine and Pathology, M2
Michael Y. Tsai, Laboratory Medicine and Pathology, M2
Daniel A. Valleria, Therapeutic Radiology, M2
Catherine M. Verfaillie, Medicine, M2
Carol L. Wells, Laboratory Medicine and Pathology, M2
Michael J. Wilson, Laboratory Medicine and Pathology, M2

Associate Professor
Ronald R. W. Jemmerson, Microbiology, M2
Ronald C. McGlennen, Laboratory Medicine and Pathology, M2
Phuong T. Nguyen, Laboratory Medicine and Pathology, M2
Timothy W. Olsen, Ophthalmology, M2
Miriam Segall, Laboratory Medicine and Pathology, M2
Amy P. Skubitz, Laboratory Medicine and Pathology, M2
William R. Swaim, Laboratory Medicine and Pathology, M2

Assistant Professor
Elizabeth G. Ingulli, Pediatrics, M2
Angela Panoskaltsis-Mortari, Pediatrics, M2
Kim-Sue Tudor, Laboratory Medicine and Pathology, M2

Research Associate
Connie J. Gebhart, Research Animal Resources, M2

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, 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; sph-ssc@umn.edu; <www.epi.umn.edu/eppages/academic/ms_cr.html>).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor
Linda H. Bearinger, Nursing, M2
Carole J. Bland, Family Practice and Community Health, M2
David M. Brown, Laboratory Medicine and Pathology, M2
James C. Cloyd III, Pharmacy Practice, M2
Allan J. Collins, Medicine, M2
Kristine E. Ensrud, Medicine, M2
G. Scott Giebink, Pediatrics, M2
Stephen P. Glasser, Epidemiology, M2
Richard H. Grimm, Medicine, M2
Joseph T. Hanlon, Health Services Research and Policy, M2
Dorothy Hatsukami, Psychiatry, M2
Robert P. Hebbel, Medicine, M2
Jeffrey P. Kahn, Health Services Research and Policy, M2
Robert L. Kane, Health Services Research and Policy, M2
Bertram L. Kasinoske, Medicine, M2
Nigel S. Key, Medicine, M2
Russell V. Luepker, Epidemiology, M2
Jeffrey McCullough, Laboratory Medicine and Pathology, M2
Jim D. Neaton, Biostatistics, M2
Thomas E. Nevin, Pediatrics, M2
Mark S. Paller, Medicine, M2
Bruce A. Peterson, Medicine, M2
Bruce L. Philstrom, Preventive Sciences, M2
Norma K. Ramsay, Pediatrics, M2
Leslie L. Robison, Pediatrics, M2
Hanna B. Rubins, Medicine, M2
Elizabeth R. Seaward, Medicine, M2
Daniel J. Weisdorf, Medicine, M2
Douglas Yee, Medicine, M2

Associate Professor
Gregory J. Belinson, Surgery, M2
Donna Z. Bliss, Nursing, M2
Linda J. Burns, Medicine, M2
Patricia Fontaine, Family Practice and Community Health, M2
James G. Garney, Pediatrics, M2
Timothy D. Henry, Medicine, M2
Alan T. Hirsch, Medicine, M2
Ann C. Mertens, Pediatrics, M2
Antonette Moran, Pediatrics, M2
Pamela J. Schreiner, Epidemiology, M2
John William Thomas, Biostatistics, M2

Assistant Professor
Moise Desvarieux, Epidemiology, M2
Edward W. Greeno, Medicine, M2
Hassan N. Ibrahim, Medicine, M2
Karen L. Margolis, Medicine, M2
Timothy W. Schucker, Medicine, M2
M. Kathryn Schumitz, Epidemiology, M2
Mark W. Yeazel, Family Practice and Community Health, M2

Senior Research Associate
James S. Hodges, Biostatistics, M2
John O. Look, Diagnostic and Surgical Science, M2

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 and be affiliated with someone at the University of Minnesota who can provide advising and access to a clinical project. The admissions committee considers exceptions on an individual basis.

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
Degree Programs and Faculty

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) students who have taken and successfully passed the ECFMG or USMLE exams 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 are exempt from providing an official TOEFL score if they provide a transcript of these credits; 3) the MELAB has been taken as an alternative exam to the TOEFL. The GRE is not required. One of the three required recommendation letters and a 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: faculty members at the University of Minnesota above the rank of instructor have additional administrative procedures required by the Graduate School. Contact the Graduate School Admissions Office early in the process.

Courses—Please refer to the clinical research curriculum sheet available on the School of Public Health Web site at <http://www.epi.umn.edu/academic/ms_cr.shrm> for courses pertaining to the program.

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

M.S. Plan A Requirements
The M.S. requires 38 credits, including 3 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—The master’s minor requires at least 6 credits. Contact the major coordinator for more information at gradstudies@epi.umn.edu.

Cognitive Science

Minor Only

Contact Information—Center for Cognitive Sciences, University of Minnesota, 205 Elliott Hall, 75 East River Road, Minneapolis, MN 55455 (612-624-9367; fax 612-624-7253; ecs@cogsci.umn.edu; <http://cogsci.umn.edu>). For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor
Patricia J. Bauer, Child Development, M
Maria Gin, Computer Science, M
Jeanette K. Gundel, Linguistics, ESL, and Slavic Languages and Literatures, M
Keith Gunderson, Philosophy, M
Paul E. Johnson, Information and Decision Sciences, M
Michael B. Kac, Philosophy, M
Daniel J. Kersten, Psychology, M
Gordon E. Legge, Psychology, M
Charles A. Nelson, Child Development, M
J. Bruce Overmyer, Psychology, M
Herbert L. Pick, Jr., Child Development, M
C. Wade Savage, Philosophy, M
Maria D. Sera, Child Development, M
Paulus W. van den Broek, M
Albert Yonas, Child Development, M

Associate Professor
Charles R. Fletcher, Psychology, M
Chad J. Marsolek, Psychology, M

Clinical Associate Professor
Mary Jo Nissen, Psychology, M

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.

Special Application Requirements—Contact 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.

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

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

Minor Ony 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 program 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 (612-624-322; fax 612-624-756; dis@umn.edu; <www.cdis.umn.edu>). For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor
Arlene E. Carney, SM
Karlind T. Moller, SM
David A. Nelson, ASM
Joe E. Reichle, SM
Charles E. Speaks, SM
Jennifer A. Windsor, SM

Adjunct Professor
Dianne Van Tasell, ASM

Associate Professor
Robert S. Schlauch, SM

Adjunct Associate Professor
David A. Fabry, AM

Assistant Professor
Mary R. T. Kennedy, M2
Kathryn Kohntt, M2
Benjamin Munson, M2
Peggy B. Nelson, M2

Adjunct Assistant Professor
Timothy D. Trine, AM

Clinical Specialist
Leslie E. Glaze, M2

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 master’s program are speech-language pathology and audiology. Emphasizes in the doctoral program are speech-language pathology, speech science, language science, audiology, 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 term. Review of applicants to the doctoral program is continuous.

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

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

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, a comprehensive written examination, and an oral examination.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students

Majoring in Other Fields—A minimum of 12 credits, approved by the director of graduate studies, is required for a master’s minor.

Ph.D. Degree Requirements

Emphasizes 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 15 credits, approved by the director of graduate studies, is required for a doctoral minor.

Communication Studies

Contact Information—Department of Communication Studies, University of Minnesota, 225 Ford Hall, 224 Church Street S.E., Minneapolis, MN 55455 (612-624-5800; <www.comm.umn.edu>).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor

Donald R. Browne, SM
Karyn K. Campbell, SM
W. Andrew Collins, ASM
Alan G. Gross, ASM
Dean E. Hewes, SM
Mary M. Lay, ASM
Edward Schiappa, SM
Robert L. Scott (emeritus), ASM
Amy L. Sheldon, SM
Michael Sunamiwaki, Communication, Duluth, AM2
Arthur E. Walzer, ASM

Associate Professor

Rosita D. Albert, SM
Laura J. Gurak, ASM
David L. Rarick, SM
Mary D. Vavrus, M2
Kirt H. Wilson, M2

Assistant Professor

Ronald W. Greene, M2
Terry A. Kinney, M2
Ascan F. Koerner, M2

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—Communication studies focuses on 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 postsecondary 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.

Courses—Please refer to Communication Studies (Comm) in the course section of this catalog for courses pertaining to the program.

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.

M.A. Degree Requirements

The degree is offered under Plan A (thesis) and Plan B (without thesis). Both plans require a minimum of 15 course credits in communication studies, including Comm 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 paper and 6 additional course credits in communication studies.

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; Comm 5615 and 5421 or equivalents must be included); 24 thesis credits are required.

The program should include 12 credits in research methods relevant for completing the degree and continuing a scholarly career. Under certain circumstances, foreign language courses may be used to satisfy this requirement.

Language Requirements—None.
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; complit@umn.edu; <http://complit.umn.edu>).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor
Timothy A. Brennan, SM
John W. Mowitt, SM
Harvey B. Sarles, SM
Jochen Schulte-Sasse, German, Scandinavian, and Dutch, SM
Nicholas Spadaccini, Spanish and Portuguese Studies, AMZ
Arlene Teraoka, German, Scandinavian, and Dutch, ASM
Hernan Vidal, ASM
Jack D. Zipes, German, Scandinavian, and Dutch, ASM

Associate Professor
Maria M. Brewer, French and Italian, ASM
Robert Brown, SM
Cesare Casarino, SM
Keya Ganguly, SM
Catherine Liu, SM
Leslie Morris, German, Scandinavian, and Dutch, ASM
Thomas A. Pepper, SM

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

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 majors.

Curriculum—Comparative literature is the oldest field of literary criticism, dating back to the eighteenth century. Among the wide range of studies currently conducted in comparative literature nationally 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.

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.

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.

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 CLit credits, 6 credits in courses in related fields outside comparative literature or in a formal minor in another program, and 4 credits either in CLit courses or in the related minor field are required. One substantial Plan B paper is required.

Language Requirements—In addition to English, high competence in one language and reading knowledge of another language are required. The choice of languages is made with respect to the student’s area of specialization and in consultation with, and approval of, the adviser.

Final Exam—The final exams are written and oral.

Minor Requirements for Students

Majoring in Other Fields—A minimum of 12 credits are required for a master’s minor, which must include CLit 8001 and 8002.

Ph.D. Degree Requirements
The Ph.D. requires 51 seminar credits, as follows: 8 credits of basic seminar (CLit 8001-8002), 3 credits in Pedagogy of Cultural Studies and Comparative Literature (CLit 8901), 28 credits in CLit 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 in coursework that constitutes a supporting program. A supporting program may be a formal Graduate School minor, or it may be a program designed by students in consultation with their adviser. Overall, the degree should include 16 credits of 8xxx courses (exclusive of CLit 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—In addition to English, the following language competencies are required: high proficiency in one language, proficiency in a second language, and a good reading knowledge of a third language. The choice of languages is made with respect to the student’s area of specialization and in consultation with, and with the approval of, the adviser. For example, a student specializing in theory could have a high proficiency in French and proficiency in German (or vice versa) and reading knowledge of a classical language such as Latin. Language requirements must be completed before taking the preliminary examination.

Minor Requirements for Students

Majoring in Other Fields—A minimum of 16 credits is required for the doctoral minor and must include CLit 8001 and 8002.

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; cdds.umn.edu; <http://cdds.umn.edu>).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor
Timothy Brennan, Cultural Studies and Comparative Literature, SM
Richard D. Leppert, Cultural Studies and Comparative Literature, SM
Ellen Messer-Davidow, English, ASM
John W. Mowitt, Cultural Studies and Comparative Literature, SM
Paula Rabinowitz, English, ASM
Harvey Sarles, Cultural Studies and Comparative Literature, SM
Jochen Schulte-Sasse, German, Scandinavian, and Dutch, ASM
Hernan Vidal, Spanish and Portuguese Studies, ASM
Jack D. Zipes, German, Scandinavian, and Dutch, ASM

Associate Professor
W. John Archer, Cultural Studies and Comparative Literature, SM
Robert L. Brown, Jr., Cultural Studies and Comparative Literature, SM
Cesare Casarino, Cultural Studies and Comparative Literature, SM
Maria Damon, English, ASM
Keya Ganguly, Cultural Studies and Comparative Literature, SM
Catherine Liu, Cultural Studies and Comparative Literature, SM
Roger P. Miller, Geography, ASM
Leslie Morris, German, Scandinavian, and Dutch, ASM
Thomas Pepper, Cultural Studies and Comparative Literature, SM
Katherine M. Solomonson, Architecture, ASM
Gary C. Thomas, Cultural Studies and Comparative Literature, SM
Jacquelyn N. Zita, Women’s Studies, ASM

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

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.
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 nonrecurring 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 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.

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

**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.

**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 minor is not pursued in another program, the student must complete 15 credits in coursework outside of CSDS, CSCL, or CLit courses, in a coherent and complementary program to be approved by the adviser and the director of graduate studies. Overall, the degree should include 16 credits of 4xxx 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 student’s program is required. Language requirement must be completed 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**

**Minor Only**

**Contact Information**—Center for Spirituality and Healing, MMC 505, 420 Delaware St. S.E., Minneapolis, MN 55455 (612-624-5166; fax 612-626-5280; <[www.css.umn.edu](http://www.css.umn.edu)>).

For up-to-date graduate faculty listings, see <[www.grad.umn.edu/faculty_rosters/step1.asp](http://www.grad.umn.edu/faculty_rosters/step1.asp)>.

**Professor**

Linda J. Brady, M

Francis F. Busta (emeritus), AM

Barbara Leonard, M

Robert P. Patterson, M

Mariah Snyder (emeritus), AM

Marilyn Speedee, M

Mark S. Umbreit, M

**Associate Professor**

Laura Duckyt, M

V. Lois Erickson, M

Craig A. Hassel, M

Richard Kingston, M

Ruth A. Lindquist, M

Gregory Plotnikoff, M

Janice Post-White, M

Carla Tabourne, M

**Assistant Professor**

Linda L. Chlan, M

Linda Halcon, M

Kate M. Hathaway, AM

Donald R. Hougé (emeritus), AM

Mary Jo Kreitzer, M

Karen Lawson, M

**Lecturer**

Miriam Cameron, M

Pat Culliton, M

Dennis McKenna, M

Sue M. Towey, M

**Other**

Lynne Mason, M

**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 enhances 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 provides students with a theoretical basis for applying complementary therapies and healing practices; prepares students to research complementary therapies and healing practices; and prepares 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
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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; contact the minor program office for more information.

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.

Courses—Please refer to Center for Spirituality and Healing (CSpH) in the course section of this catalog. Contact the minor program office for the most current information on relevant coursework pertaining to the program.

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.

Minor Only Requirements
Master’s and doctoral students take CSph 5101 (3 cr) and 8101 (1 cr). Master’s students must take an additional 4 credits for a total of 8 credits; doctoral students must take an additional 1 credit 8xxx CSph elective course 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, Literacy, and Rhetorical Studies
See Literacy and Rhetorical Studies.

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; dgs@cs.umn.edu; <www.cs.umn.edu>). For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor
Daniel L. Boley, SM
Vladimir Cherkassky, ASM
David H. Du, SM
Ding-Zhu Du, SM
Maria Gini, SM
Ravi Janardan, SM
Paul E. Johnson, Information and Decision Sciences, AM2
Daniel J. Kersten, Psychology, ASM
Larry L. Kinney, AM2
Vipin Kumar, SM

E. Bruce Lee, ASM
David J. Lilja, ASM
Arthur L. Norberg, SM
Nikolaos P. Papanikolopoulos, SM
Haesun Park, SM
Yousef Saad, SM
Shashi Shekhar, SM
Eugene B. Shragowitz, SM
Jaideep Srivastava, SM
Anand R. Tropf, SM
Pen-Chung Yew, SM

Associate Professor
John V. Carlis, SM
Mats P. E. Heimdahl, SM
Wei-Chung Hsu, SM
Joseph A. Konstan, SM
Gary Meyer, SM
Gopalan Nadathur, SM
John T. Reidl, SM
Loren Terveen, SM
Jon Weissman, SM
Zhi-Li Zhang, SM

Assistant Professor
Baoquan Chen, SM
Vicentia Interante, SM
George Karypis, SM
Yongdae Kim, M2
Donglin Liang, M2
Stergios Roumeliotis, M2
Paul Schrater, M2
Erik Van Wyk, M2
Richard M. Voyles, SM

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 graduate program in computer and information sciences conducts research in a broad spectrum of theoretical and applied computer sciences. 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, data mining, graphics and visualization, human-computer interaction, artificial intelligence, vision and robotics, computer architecture and networks, computer-aided design, software engineering, distributed systems, information science, and computer security. 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 masters of science in computer engineering, and many faculty from computer science and engineering also participate in the graduate program in scientific computation.

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. Master’s and Ph.D. students are accepted for fall admission only. The application deadline is April 1. Students seeking financial aid must apply by December 15.

Research Facilities—Graduate students have access to today’s most powerful supercomputers through the Minnesota Supercomputer Institute 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.

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

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.

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, including the following: at least 18 credits from CSci classes; a breadth requirement of four courses in three different areas—theory, systems, and applications; at least 6 credits from outside the department; at least 6 credits from 8xxx courses; and 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.

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. Students must complete a breadth requirement of four
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courses in three different areas—theory, systems, and applications. For Plan A, at least 10 thesis credits are required; for Plan B, three Plan B project credits are required. Students must also complete 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—Contact the department.

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—Contact the department.

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; gradinfo@compengr.umn.edu; <www.compengr.umn.edu>.

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor

Vladimir Cherkassky, M2
David H. Du, M2
Larry L. Kinney, M2
Vipin Kumar, M2
David J. Lilja, M2
Nikolaos Papakonstantinou, M2
Sachin Sapatekar, M2
Guillermo Sapiro, M2
Shashi Shekhar, M2
Eugene B. Shragowitz, M2
Jadeep Srivastava, M2
Ahmed H. Tewfik, M2
Anand Tirpathi, M2
Pen-Chung Yew, M2

Associate Professor

Mats P. E. Heimdahl, M2
Wei-Chung Hsu, M2
John Riedl, M2
Jaijeet Roychowdhury, M2
Gerald E. Sobelman, M2
Zhi-Li Zhang, M2

Assistant Professor

Kiarash Bazargan, M2
George Karvysi, M2
Richard M. Voyles, M2

Other

Farnaz Mounes-Toussi, AM2
Matthew T. O’Keefe, AM2

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.

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

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

M.Comp.E. Coursework Only Degree Requirements

The M.Comp.E. degree requires 30 credits of graduate work, including at least 15 credits 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); at least 3 major field credits in 8xxx courses; at least 6 credits from a minor or related field; and 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). 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 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 for the program must be taken A-F.

Language Requirements—None.

Final Exam—The final exam is oral.

Conflict Management

Minor Only

Contact Information—Director of Graduate Studies, Graduate Minor in Conflict Management, Conflict and Change Center, University of Minnesota, Hubert H. Humphrey Center, 301 North 19th Avenue S., Minneapolis, MN 55455 (612-625-3046; fax 612-625-3513; fiutak001@umn.edu).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor

Mario F. Bognanno, Industrial Relations, M
Eugene Borgida, Psychology, M
Paul V. Ellefon, Forest Resources, M
Mark S. Umbreit, Social Work, M

Associate Professor

Melissa Stone, Humphrey Institute, M

Lecturer

Thomas R. Fiutak, Independent Study, M

Curriculum—The conflict management minor, 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.

Courses—Please contact the minor program office for information on relevant coursework.
Use of 4xxx Courses—Use of 4xxx courses toward degree requirements is permitted with the approval of the instructor, the adviser, and the conflict management minor director of graduate studies.

Minor Only 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, 180 McNeal Hall, University of Minnesota, 1885 Buford Avenue, St. Paul, MN 55108 (612-624-7751; cb-program@fw.umn.edu; <www.consbio.umn.edu>.
For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Professor
Ira R. Adelman, Fisheries, Wildlife, and Conservation Biology, SM
Deborah L. Allain, Soil, Water, and Climate, SM
Donald N. Altstad, Ecology, Evolution, and Behavior, SM
David E. Andersen, Fisheries, Wildlife, and Conservation Biology, SM
Dorothy H. Anderson, Forest Resources, SM
David A. Andow, Entomology, SM
Sandra O. Archibald, Public Affairs, SM
Franklin H. Barnwell, Ecology, Evolution, and Behavior, SM
Marvin E. Bauer, Forest Resources, SM
John H. Beauty, Ecology, Evolution, and Behavior, SM
Jay C. Bell, Soil, Water, and Climate, M2
Charles R. Blinn, Forest Resources, SM
James L. Bowyer, Wood and Paper Science, SM
Thomas E. Burk, Forest Resources, SM
Vernon B. Cardwell, Agronomy and Plant Genetics, SM
Yosef Cohen, Fisheries, Wildlife, and Conservation Biology, SM
Kendall W. Corbin, Ecology, Evolution, and Behavior, SM
James W. Curtinsger, Ecology, Evolution, and Behavior, SM
Edward J. Cushing, Ecology, Evolution, and Behavior, SM
Francesc C. Cuthbert, Fisheries, Wildlife, and Conservation Biology, SM
K. William Easter, Applied Economics, SM
Mohamed E. El Halawani, Animal Science, SM
Nicholas R. Jordan, Agronomy and Plant Genetics, SM
Anne R. D. Kapuscinski, Fisheries, Wildlife, and Conservation Biology, SM
Scott M. LANyon, Bell Museum of Natural History, SM
Patrice A. Morrow, Ecology, Evolution, and Behavior, SM
Claudia Neuhauser, Ecology, Evolution, and Behavior, SM
Raymond M. Newman, Fisheries, Wildlife, and Conservation Biology, M2
Gerald J. Niemi, Biology, Duluth, SM
Karen S. Oberhauser, Ecology, Evolution, and Behavior, SM
James A. Perry, Fisheries, Wildlife, and Conservation Biology, SM
A. Stephen Polasky, Applied Economics, SM
Anne E. Posey, Ecology, Evolution, and Behavior, SM
Patrick T. Redig, Small Animal Clinical Sciences, SM
Philip J. Regal, Ecology, Evolution, and Behavior, SM
Peter B. Reich, Forest Resources, SM
Carlisle F. Runge, Applied Economics, SM
Abdi I. Samatar, Geography, SM
Ruth G. Shaw, Ecology, Evolution, and Behavior, SM
Donald B. Sniff, Ecology, Evolution, and Behavior, SM
J. L. David Smith, Fisheries, Wildlife, and Conservation Biology, SM
Peter W. Sorensen, Fisheries, Wildlife, and Conservation Biology, SM
George R. Spangler, Fisheries, Wildlife, and Conservation Biology, SM
Anthony M. Starfield, Ecology, Evolution, and Behavior, SM
Robert W. Sterner, Ecology, Evolution, and Behavior, SM
Bruce C. Vondracek, Fisheries, Wildlife, and Conservation Biology, SM
Robert M. Zink, Ecology, Evolution, and Behavior, SM

Adjunct Professor
Robert G. Haught, Forest Resources, SM
Diane L. Larson, Ecology, Evolution, and Behavior, SM
Clarence L. Lehman, Ecology, Evolution, and Behavior, SM
L. David Mech, Fisheries, Wildlife, and Conservation Biology, SM
Roderick A. Squires, Geography, SM

Associate Professor
Paul V. Bolstad, Forest Resources, SM
Jay S. Coggins, Applied Economics, SM
Susan M. Galatowitsch, Horticultural Science, SM
Jay T. Hatch, General Science, SM
Frances R. Homans, Applied Economics, SM
Peter A. Jordan, Fisheries, Wildlife, and Conservation Biology, SM

Adjunct Associate Professor
Gerald T. Ankley, Fisheries, Wildlife, and Conservation Biology, SM
David L. Garshels, Fisheries, Wildlife, and Conservation Biology, SM
Frederick J. Jannett, Jr., Fisheries, Wildlife, and Conservation Biology, SM
Ronald L. Tilson, Fisheries, Wildlife, and Conservation Biology, SM
David Western, Fisheries, Wildlife, and Conservation Biology, SM

Assistant Professor
Robert B. Blair, Fisheries, Wildlife, and Conservation Biology, SM
Eileen V. Carey, Forest Resources, SM
David C. Fulton, Fisheries, Wildlife, and Conservation Biology, SM
Sharon A. Jansa, Ecology, Evolution, and Behavior, SM
John P. Loop anders, Agricultural Resources, Crookston, M2
Kristen C. Nelson, Forest Resources, SM
Daniel J. Philippin, Rhetoric, SM
Andrew M. Simons, Fisheries, Wildlife, and Conservation Biology, SM
Ellen E. Strong, Ecology, Evolution, and Behavior, SM

Adjunct Assistant Professor
Charles S. Anderson, Fisheries, Wildlife, and Conservation Biology, SM
David N. Bengston, Forest Resources, SM
Donald L. Pereira, Fisheries, Wildlife, and Conservation Biology, ASM

Lecturer
Thomas R. Fruita, Public Affairs, SM

Research Associate
Lee E. Frelich, Forest Resources, SM
Loren M. Miller, Fisheries, Wildlife, and Conservation Biology, M2
Carl Richards, Duluth, SM
Ingrid E. Schneider, Forest Resources, SM

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. Students may select a named track, fisheries and aquatic biology, which offers an aquatic specialization. Students may also pursue a joint degree in law and conservation biology through the joint law degree program. 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. Applicants to the joint law degree program must also apply to the Law School. Application deadline is January 1. Typically students only are admitted for fall semester.

Research Facilities—Faculty are involved in local, regional, national, and international programs of research and education. Local research facilities include Cedar Creek Natural History Area, Cloquet Forestry Center, Lake Itasca Forestry and Biological Station, the Bell Museum of Natural History, and Minnesota Zoo. Fisheries and aquatic biology research is conducted in the many lakes, rivers, and streams that Minnesota is famous for and in 13,000 feet of wet-tab space on the St Paul campus with dedicated wells and water conditioning equipment. The program is strongly linked with on-campus institutes such as the Institute for Social,
For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

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.

Counseling and Student Personnel
See Educational Psychology.

Creative Writing

Contact Information—See English. (612-625-6366; creatwrit@umn.edu; <creawrit.cla.umn.edu/creativewriting/program> ).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

Regents Professor
Patricia M. Hampil, M2

Professor
Charles Baxter, M2
Michael Dennis Browne, M2
Ray Gonzalez, M2
Valerie Minner, M2
Madelon M. Sprangnether, M2

Associate Professor
Maria J. Fitzgerald, M2
Julie Schumacher, M2
Charles J. Sugen, M2
David Treuer, M2

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 with 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.

Control Science and Dynamical Systems

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

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

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

**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 an M.F.A. defense. 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 (7 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. defense requires students to discuss their creative work as well as a literary essay that they write in response to a booklist of 20 books chosen in consultation with creative writing 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; wegnet009@umn.edu; <www.dentistry.umn.edu> ).

For up-to-date graduate faculty listings, see <www.grad.umn.edu/faculty_rosters/step1.asp>.

**Professor**
Dwight L. Anderson, Oral Sciences, M2
M. Bashur Bakdash, Preventive Sciences, M2
Soraya M. Beiraghi, Preventive Sciences, M2
David O. Born, Preventive Sciences, M2
Edward C. Combe, Oral Sciences, M2
Ralph DeLong, Oral Sciences, M2
Anthony J. DiAngelis, Preventive Sciences, AM2
William H. Douglas, Oral Sciences, M2
James R. Friction, Diagnostic/Surgical Sciences, M2
Mark C. Herzberg, Oral Sciences, M2
William F. Lijemarck, Oral Sciences, M2

Leslie V. Martens, Preventive Sciences, M2
Kartal T. Mollicone, Preventive Sciences, M2
Bruce L. Pihlstrom, Preventive Sciences, M2
Nelson L. Rhodus, Diagnostic/Surgical Sciences, M2
Charles F. Schachtele, Oral Sciences, M2
Burt L. Shapiro, Preventive Sciences, M2
Michael J. Till, Preventive Sciences, M2
Larry F. Wolff, Preventive Sciences, M2

**Associate Professor**
Gary C. Anderson, Restorative Sciences, M2
James L. Baker, Restorative Sciences, M2
Pamela R. Erickson, Preventive Sciences, AM2
James E. Hinrichs, Preventive Sciences, M2
James R. Holtan, Restorative Sciences, M2
Ramesh K. Kuba, Diagnostic/Surgical Sciences, M2
Thomas D. Larson, Restorative Sciences, M2
Bryan S. Michalowicz, Preventive Sciences, M2
Kathleen J. Newell, Preventive Sciences, M2
Paul Olin, Restorative Sciences, M2
Joy B. Osborn, Preventive Sciences, M2
Jorge M. Perdigao, Restorative Sciences, M2
Igor J. Pesun, Restorative Sciences, M2
Maria R. Pintado, Oral Sciences, M2
Eric L. Schieffman, Diagnostic/Surgical Sciences, M2
John K. Schulte, Diagnostic/Surgical Sciences, M2
Stephen K. Shuman, Preventive Sciences, M2
Jill L. Stoltenberg, Preventive Sciences, M2
James Q. Swift, Diagnostic/Surgical Sciences, M2
Omar A. Zidan, Restorative Sciences, M2

**Assistant Professor**
John P. Beyer, Diagnostic/Surgical Sciences, M2
Walter R. Bowles, Restorative Sciences, M2
Mary E. Brosky, Restorative Sciences, M2
Darryl T. Hamamoto, Diagnostic Sciences, M2
Kate M. Hathaway, Restorative Sciences, M2
Donald R. Nuxdorf, Diagnostic/Surgical Sciences, M2

**Research Associate**
John O. C. Look, Diagnostic/Surgical Sciences, M2

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, oral pathology, 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 that enroll students for the M.S. degree include endodontics, orthodontics, pediatric dentistry, periodontics, prosthodontics, dental hygiene (with baccalaureate degree), and residencies in general practice dentistry (AEGD and GPR). Other dental school clinical and postdoctoral programs that enroll students for the M.S. degree include those in geriatric dentistry and TMJ disorders/orofacial pain.

**Clinical Instruments**—The School of Dentistry dental 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.

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

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

**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 in teaching and evaluation in dentistry; basic research methodology; introductory biostatistics; and fundamentals of health-care administration. Courses from