Graduate School

Graduate School

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For up-to-date graduate faculty listings see www.grad.umn.edu/faculty_rosters.

Overview

At the University of Minnesota Duluth, the Graduate School awards the doctor of education (Ed.D.), its highest professional degree, in teaching and learning. The Ed.D. recognizes satisfactory academic preparation and demonstrated competence for professional activity in that field. Standards and procedures for admission, and expectations for scholastic performance, are comparable to those for the doctor of philosophy degree (Ph.D.) offered at the Twin Cities campus. Rules and procedures governing examinations, candidacy, time limits, appointment of committees, and the thesis for the Ph.D. apply in general to the Ed.D.

For specific information about requirements and procedures for the Ed.D. in teaching and learning at UMD, please see www.d.umn.edu/grad/edd or contact the Graduate School's UMD office, 431 Darland Administration Building, 1049 University Drive, Duluth, MN 55812 (218-726-7523; grad@d.umn.edu).

The Graduate School also awards the master of fine arts in art (emphasis in graphic design); master of arts in communication sciences and disorders, criminology and English (emphases in literary studies, English studies, and publishing and print culture); master of science in applied and computational mathematics, chemistry, computer science, geological sciences, and physics; master of business administration; master of science electrical and computer engineering; master of science engineering management; master of liberal studies; master of music; and master of social work.

All-University master of science and doctor of philosophy programs in integrated biosciences, toxicology and water resources science are offered jointly with the Twin Cities campus. In addition, several graduate programs operate at UMD under the aegis of graduate programs on the Twin Cities campus. Cooperative programs offered at both the master's and doctoral levels include biochemistry, molecular biology, and biophysics; microbiology, immunology, and cancer biology; pharmacology; and cellular and integrative physiology.

Admission

Any student with a U.S. bachelor's degree or a comparable foreign degree from a recognized college or university may apply to the graduate school dean for admission. Applicants with the necessary background for their chosen major field, an excellent scholastic record from an approved college or university, and appropriate professional qualifications may be admitted for graduate work on recommendation of the graduate faculty in the proposed major field and approval of the graduate school dean. The Graduate School operational standard for admission is an undergraduate grade point average (GPA) of 3.00. Individual programs may require a higher GPA. Applicants should consult the program to which they are applying for more specific information about admission standards.

Before registering in the Graduate School, students must have received an undergraduate degree. However, University of Minnesota students who have no more than seven semester credits or two courses to complete for their bachelor's degree (including both distribution and total credit requirements), may be admitted and once admitted, may register in the Graduate School to begin a graduate program while simultaneously completing their baccalaureate work. In such cases, a final bachelor's transcript must be submitted before the second term of registration.

Graduate School faculty and staff encourage applications from persons of color or other groups that have been underrepresented in the student body.

Application Fee

For each program, the Graduate School application fee is $55 for U.S. applicants and $75 for international applicants. This fee is subject to change. The most detailed and up-to-date information about the fee is included in the online application instructions at www.d.umn.edu/grad/applyonline.html.

Transcripts

Students must submit official transcripts of all previous academic study. During the program of study, students often need a complete set of official credentials covering previous college and university training. Applicants therefore are urged to request two sets of official credentials when preparing their application for admission: one to be submitted with the application and the other for personal use.

International Applicants

International applicants must submit complete credentials. Details on the types of transcripts required are given in the online application instructions at **www.d.umn.edu/grad/applyonline.html**.

Tests

GMAT

Business administration applicants must take the Graduate Management Admission Test (GMAT) and request that an official report of the results be sent to the Graduate School from the Educational Testing Service as part of the admission application. Because this test is given at limited times and places during the year, applicants should register early for the examination. For more information, contact the Educational Testing Service, Box 6000, Princeton, NJ 08541-6000 or online at **www.ets.org**. Under certain circumstances, alternatives to the GMAT can be used; contact the director of the business administration program for more information at 218-726-6817 or **lsbe@d.umn.edu**.

GRE

Students who submit undergraduate narrative transcripts or transcripts containing pass/no credit (S-N), credit, or other ungraded notations for a substantial number of courses taken during the junior and senior years, or whose transcripts do not show a substantial number of letter grades during these years, must submit the results of the Graduate Record Examination (GRE) General Test and, if available, a Subject Test appropriate to the proposed major in the Graduate School.

The GRE General Test is required of all applicants for programs in applied and computational mathematics, computer science, education, English, geological sciences, and integrated biosciences. International applicants who are applying for assistantships from any science program not listed here are also strongly urged to submit GRE general test scores in support of their applications. Arrangements to take these tests can be made through the Educational Testing Service, Box 6000, Princeton, NJ 08541-6000 USA or online at **www.ets.org**.

TOEFL

This examination is required of all international applicants whose native language is not English and who have not lived in the United States for at least one year while completing at least 16 graded semester credits within the past 24 months. This requirement will not be waived. Test scores must be less than two years old. For more information, write to TOEFL, Box 899, Princeton, NJ 08541-6151 USA. If desired, the Michigan English Language Assessment Battery (MELAB) is an alternative to the TOEFL; a minimum score of 80 is required. Information about the MELAB is available by writing to the English Language Institute, Testing and Certification, 3020 North University Building, University of Michigan, Ann Arbor, MI 48109-1057 USA.

Another alternative to the TOEFL is the International English Language Testing System (IELTS). The minimum acceptable score is 6.5. Further information about this test can be obtained at **www.ceii.org**.

Additional Information

The Graduate School and individual programs within it reserve the right to request additional information when they believe it is necessary.

Application Procedure

Applicants are required to apply online at **www.d.umn.edu/grad/applyonline.html**. Applicants are encouraged to apply for admission well in advance of the term in which they wish to enter the Graduate School (but no more than one year in advance of the proposed entry date). The *Graduate School Application*, complete with all required materials, must be submitted by the following deadlines:

Fall semester	July 15 (June 15 for All-University and Cooperative Programs)
Spring semester	November 1 (October 15 for All-University and Cooperative Programs)
Summer session	May 1 (March 15 for All-University and Cooperative Programs)

Deadlines that occur on a holiday or weekend will be extended through the next regular business day. Many major fields have established deadlines earlier than those listed above and also require additional application and supporting materials. It is the applicant's responsibility to obtain information on those deadlines and requirements from the specific program descriptions in this catalog and from the director of graduate studies in the proposed major field.

Professional Development

Applicants who wish to enroll in a field in the Graduate School but are not interested in a graduate degree may apply for admission for professional development courses. These applicants must complete the usual application materials and meet existing deadlines and admission standards. Because some major fields restrict admission to those planning on pursuing an advanced degree, applicants are advised to consult with the director of graduate studies in their proposed major field before completing application materials.

Visiting Graduate Students

Students who have registered within the previous two years in a graduate degree program at another recognized U.S. graduate school and who wish to enroll for a summer session or a single semester in the University of Minnesota Graduate School in order to earn credits to apply toward their degree program may be admitted as visiting graduate students. Visiting graduate status may not be granted for more than one semester or one summer term. Students seeking

visiting graduate status should request and complete the *Visiting Application* available from the UMD Graduate School Office, 431 Darland Administration Building, University of Minnesota Duluth, Duluth, MN 55812. This form must be approved by the Graduate School before registering for classes.

Academic Staff

University of Minnesota staff members who hold academic appointments above the rank of instructor or research fellow are normally not permitted to complete a graduate degree at the University. Those who wish to register for courses and transfer them elsewhere may apply for admission for professional development courses.

Registration

New graduate students will receive instructions for registration with their admission letter. Graduate tuition and fees are listed on the Graduate School Web site at **www.d.umn.edu/grad**.

Registration Requirements

The University requires that graduate students holding appointments as teaching or research assistants or administrative fellows must register for at least 6 A–F or S-N credits in the Graduate School each term that an appointment is held. This does not apply to summer terms. Students may submit a petition to the program's director of graduate studies for exceptions to this requirement. To be exempt from FICA withholding, a graduate assistant must register for 3 or more credits. Audit registration by itself is not acceptable for maintaining an assistantship. Medical fellows must also register each term an appointment is held, including summer terms.

Students receiving other types of financial aid from the University or other agencies, international students with certain types of visas, and students wishing to use various University services and facilities may have to meet specific registration requirements of other agencies or University units. These students are responsible for securing information about such requirements from the appropriate offices.

Master's degree candidates are not required to register for any specific number of semesters.

Types of Registration

The two types of registration used by graduate students at UMD are:

For Coursework—The maximum number of credits for which a graduate student may register in a single semester during the academic year is 18; in a single summer session, 11. Exceptions are granted by the UMD Graduate School office (431 Darland Administration Building) however only under unusual circumstances.

Thesis Credit—Regardless of their initial dates of entry to the Graduate School, all students enrolled in a Plan A master's program must register for at least 10 master's thesis credits (8777), and all students enrolled in a doctoral program must register for at least 24 doctoral thesis credits (8888). Doctoral thesis credits can only be taken after the semester in which the preliminary examination is passed.

Doctoral Pre-Thesis Credits (8666)

These credits are available for doctoral students who have not yet passed their preliminary oral examination but who need to be registered in the Graduate School to meet requirements of agencies or departments outside the Graduate School (e.g., loan agencies). Doctoral pre-thesis credits are not graded.

Note: Registration for doctoral pre-thesis credits cannot be used to meet any Graduate School degree requirements.

Registration Holds

Registration holds may be placed on students' records when students fail to file official degree programs and/or thesis proposals or when they accumulate an excessive number of incompletes. Students who fail to meet Graduate School or major field standards for scholarly achievement may also have a hold placed on their registration.

International Students

International students are normally required to maintain registration in the Graduate School to satisfy the rules of the Immigration and Naturalization Service (INS). Students should, therefore, plan their programs carefully to meet this requirement. The Graduate School is required to notify the INS office when an international student fails to maintain registration.

Official Transcripts

Official transcripts of Graduate School students are available online at **www.d.umn.edu/registrar/transcripts.html** except for students who registered in the Graduate School summer session II, 1972 or earlier. Official records for these students are maintained in the Office of the Registrar, University of Minnesota, 200 Fraser Hall, 106 Pleasant Street S.E., Minneapolis, MN 55455.

Students may obtain unofficial copies of their transcripts online or by submitting a request in writing to UMD Transcripts, 184 Darland Administration Building, 1049 University Drive, Duluth, MN 55812. Unofficial transcripts can also be requested from the on-the-spot transcript service at the Student Assistance Center, 23 Solon Campus Center. There is no charge for these copies, but students are limited to one copy per visit.

A student can print or view an online copy of their transcript and grades by going to **www.d.umn.edu/registrar/transcripts.html**.

Changes in Registration

All registration changes require an adviser's signature. During fall and spring semesters, the end of the second week of the semester is the last day to add a course or change sections of a course, change the grading option (including to or from auditor status), or cancel a course without a W (indicating withdrawal) appearing on the transcript. During the summer term, the deadline for such changes is the fifth day of instruction.

Students may cancel courses through the end of the eighth week of the semester; canceling courses after the eighth week requires the approval of the adviser, instructor, and UMD Graduate School office. During the summer term, students may cancel a course through the last day of instruction with the adviser's signature.

If withdrawal from a course occurs within the first two weeks of the semester, no record of this course is shown on the transcript. If withdrawal occurs after the second week of the semester, the transcript will show the course with a W.

Students cannot change their registration after the last day of instruction of a semester or register for previous semesters.

Rate Structure

Students registering for 1 to 5 credits (part time) do so on a per-credit basis. Students registering for 6 to 14 credits do so on a flat-rate basis. Registration for credits beyond 14 credits is on a per-credit basis.

Students from North Dakota, South Dakota, Wisconsin, and Manitoba may wish to take advantage of tuition reciprocity. Because tuition procedures differ, students should contact the UMD Office of Admissions, 23 Solon Campus Center (218-726-7171), for specific information.

Readmission and Other Changes

Readmission, Change of Major or Degree

Admitted students who have not registered in the Graduate School each semester (excluding summer) must request readmission before registering for classes, submitting petitions, filing for graduation, scheduling examinations, or submitting a degree program/thesis. If readmitted, the student must also register in the Graduate School. Students who have completed a degree or certification program and who wish to complete additional work in the Graduate School must apply for readmission.

Currently enrolled students who wish to change their major field or degree objective from that which was originally approved by the Graduate School must complete and submit a *Change of Status* form and pay a change of status fee. *Readmission* or *Change of Status* forms may be obtained from the UMD Graduate School office (431 Darland Administration Building). A minimum of six weeks before the desired date of enrollment is typically required to process these requests.

Change of Campus

Students who are enrolled in the Graduate School on one campus of the University of Minnesota and who wish to complete their studies on another University campus should complete and submit a *Change of Status* form.

Transfer of Credits

Master's degree students are required by the Graduate School to complete at least 60 percent of the course credits (excluding thesis credits if any) for their official degree programs as registered Graduate School students. With the approval of the adviser, director of graduate studies in the major field (and the director of graduate studies in the minor field if the courses are to be applied to a designated minor), and the Graduate School, students are permitted to transfer up to 40 percent of the degree coursework from other recognized graduate schools or from the University's College of Continuing Education, in any desired combination. Individual graduate programs may, at their discretion, specify a lower percentage of coursework for transfer.

Any work to be transferred must be postbaccalaureate graduate level that was taken for graduate credit and taught by faculty authorized to teach graduate courses. Continuing Education courses must bear transcript entry verifying that they were completed for graduate credit. Credits transferred from other institutions must appear on official transcripts of the institutions. Credit for courses taken before the awarding of the baccalaureate degree cannot be transferred.

Any transfer course that will be used to satisfy degree requirements must be included on the proposed degree program. If the course has been completed by the time the degree program is approved, the transfer process is automatic. If the transfer course has not been completed by the time the degree program is approved, the course is not automatically transferred. To complete this transfer an appropriate petition must be submitted and approved. More information regarding this process can be obtained from the UMD Graduate School office (431 Darland Administration Building).

In the case of a transfer from a non-U.S. institution, credits must have been earned in a program comparable to a graduate degree program at a regionally accredited U.S. institution.

Financial Aid

Fellowships and scholarships are available through the Graduate School. For more information, contact the director of graduate studies in the particular program or the UMD Graduate School office (431 Darland Administration Building; 218-726-7523).

Assistantships (teaching and research) are normally granted through individual departments. Students can obtain information by writing to the director of graduate studies for their particular program. Graduate assistants on a 25 percent or greater appointment are entitled to health, medical, and dental insurance coverage at reduced premiums.

Some residence counseling positions may be available. For information, write to the Housing Office, 149 Lake Superior Hall, University of Minnesota Duluth, MN 55812.

Inquiries regarding loan funds, living accommodations, employment, and placement should be addressed to the vice chancellor for academic support and student life, 297 Darland Administration Building, University of Minnesota Duluth, MN 55812.

Sexual Harassment

See the Policies and Procedures section of this catalog for information on sexual harassment.

Master's Degree Requirements

The master's degree is offered under two plans: Plan A (involving a thesis) and Plan B (involving additional coursework and/or special projects in place of a thesis). Plan B is the only plan available at Duluth for majors in art, business administration, communication sciences and disorders, English, liberal studies, music, and social work. Majors in applied and computational mathematics, chemistry, computer science, criminology, electrical and computing engineering, engineering management, geological sciences, integrated biosciences, and physics may select either Plan A or Plan B. Integrated biosciences is offered only under Plan A.

Time Requirement

The maximum time allowed by the Graduate School for completion of the master's degree is seven years. The seven-year period begins with the oldest work included on the official degree program, including any transfer work applied. The graduate faculty in a specific program may set more stringent time requirements.

Grading System

The Graduate School uses two grading systems, A-B-C-D-F (with pluses and minuses) and S-N. Except for courses in which grading has been restricted to one system or the other, students have the option of choosing the system under which they will be graded. Students must declare a grading system choice as part of their initial registration. Changes in grading options must be made by the end of the second week of class (end of the first week during summer sessions). For information about courses in which grading is restricted, students should consult the department offering the course. Instructors must explain to students the achievement level necessary to earn an S grade for a course.

Course instructors may, at their discretion, set a time limit for removal of incomplete grades. In general, it is recommended that incomplete grades be removed within one calendar year. A student with an excessive number of incompletes may be denied further registration until some of them have been removed.

The Graduate School discourages retaking courses to improve grades. Permission of the course instructor and the major adviser is required to take a course again. If a course is retaken, all registrations for it remain on the student's transcript.

Minimum Grade Requirements

The minimum GPA required by the Graduate School for courses included on the official program for any master's degree is 2.80 (on a 4.00 scale). Students may apply 5xxx and 8xxx courses with grades of A, B, C (including C-), and S to a Graduate School degree program. Under some circumstances and with approval of the student's major field, 4xxx, 6xxx, and 7xxx courses may also be applied to a Graduate School degree. Grades of A, B, C, and S are acceptable, but grades of S are not calculated in the GPA. At least two thirds of the course credits taken in the Graduate School (excluding thesis credits) and included in any degree program must be taken A-F.

Individual major fields may set higher grade requirements, and students should be familiar with special requirements in their major field.

Transfer of Plan

A student transfers from one plan for the master's degree to the other by submitting to the Graduate School a revised Universal Degree Program Form signed by the adviser, director of graduate studies for the major, and director of graduate studies for the minor if a minor is declared.

Plan A: Master's Degree With Thesis

Major and Related Field(s) or Minor—Students must complete an approved program of coursework consisting of at least 14 semester credits in the major field, at least 6 semester credits in one or more fields outside the major, and at least 10 thesis credits (8777).

Students who wish to complete a designated minor (certified on the transcript; related fields option is not) must complete at least 6 semester credits in a single field. A designated minor must be approved by the director of graduate studies in the minor field.

In cases where the student takes coursework beyond the minimum requirements, both the adviser and the Graduate School may demand comparable standards of performance for all work taken.

Admission to the Graduate School requires the specification of a major field. Any proposal for a subsequent change in major necessitates a formal request to the Graduate School.

Official Degree Program—After completing 10 credits and ordinarily not later than the second semester of registration (the second year for longer programs), students must file an official degree program with the Graduate School. This requirement may vary with the program. The Universal Degree Program Form is available in the UMD Graduate School office (431 Darland Administration Building). Students list all coursework, completed and proposed, that will be offered to fulfill degree requirements, including transfer work. If a foreign language is required, it is specified The members of a student's final examining committee (who are the thesis reviewers for Plan A) are appointed by the graduate school dean on recommendation of the faculty in the major field at the time the student's official degree program is approved. A degree program approved by the Graduate School must be on file before the reviewers' report, examination report, or graduation forms can be released to the student.

Program Changes—Once approved, the program must be followed to meet graduation requirements. Alterations in the program, including committee changes, must be requested in advance by means of a Graduate School petition form.

Language Requirement—See the appropriate major field under Program Statements in the following stages to determine the language requirement, if any, for that field. The Graduate School monitors the fulfillment of the language requirement when a major field specifies one. Information about how the student must demonstrate proficiency and the conditions under which proficiency will be recorded on the official transcript is available from the UMD Graduate School office.

Master's Thesis—The thesis must be on a topic related to the major, be written in acceptable English, demonstrate the student's ability to work independently, and display the student's power of independent thought both in perceiving problems and in making satisfactory progress toward their solution. Familiarity with the bibliography of the special field and correct citation of authorities are expected.

Three unbound copies of the thesis must be provided and a $10 fee paid. The student's adviser(s) must sign unbound copies of the thesis to confirm that they are complete and satisfactory in all respects and that all revisions required by the final examining committee have been made.

One of the copies must be on 20-pound linen stock of 75 percent rag content. Both must contain all illustrative material; if photographs are included, copies must contain original photographs (i.e., no photocopies). Ample margins should be left for binding purposes. The body of the thesis should be double spaced, but footnotes may be single spaced. Photocopy methods of reproduction will be accepted (except photographs), provided that 20-pound rag content bond is used and adequate contrast and clarity is provided.

The thesis is examined by a committee of not less than three members, appointed by the graduate school dean upon recommendation of the adviser and the director of graduate studies. The examining committee will include at least two representatives of the major field and one representative of the related or minor field. This committee must be unanimous in certifying that the thesis is ready for defense, and a record of this action must be filed in the UMD Graduate School office on the appropriate form before the candidate may be admitted to the final written or oral examination.

The thesis may include materials that students have published while at University of Minnesota as graduate students, provided the research was carried out under the direction of the graduate faculty and approved by the adviser for incorporation into the thesis. The adviser should notify the Graduate School in writing of the intent to publish part of the thesis materials, but Graduate School approval is not required.

If the thesis is accepted, the candidate should immediately begin to have it prepared in its final form and should submit the *Application for Degree* before the first working day of the month she or he plans to graduate. *Application for Degree* forms must be obtained from the UMD Graduate School office (431 Darland Administration Building). Both unbound copies of the thesis, and the $10 fee must be submitted to the Graduate School office by the last working day of the month of proposed graduation.

Final Examinations—Candidates for the Plan A master's degree, must pass a final oral examination; a final written examination may also be required at the discretion of the graduate faculty in the major field. If both a written and an oral examination are specified, the written examination must precede the oral examination.

The final examination covers the major and minor or related fields and may include other related work, and is coordinated by the chair of the student's examining committee. A majority vote of the committee, all members present and voting, is required for a pass. Results are reported to the Graduate School on a *Final Examination Report*, which is issued to the chair when the oral exam is scheduled. In case of failure, unanimous consent of the examining committee is required to retake the examination, providing the reexamination is conducted by the original committee.

Reports—Forms are provided for signed reports concerning the thesis and the final written or oral examinations. All reports must be filed in the UMD Graduate School office by the published deadline.

Plan B: Master's Degree Without Thesis

The requirements for this plan follow Plan A in matters of admission and language requirements. Unless otherwise specified by the program, a Plan B student must pass either a final written examination or a final oral examination, or both, at the discretion of the graduate faculty in the major field.

Plan B differs from Plan A in substituting for the thesis a heavier course requirement and/or special projects. For professional purposes, the master's degree program under Plan B is less focused on research interests and more adapted to individuals who will profit from a broader range of knowledge in their fields. Whether taken for professional or personal purposes, the requirements for Plan B are meant to test interests and intellectual abilities at the same level as that of Plan A, but for a different purpose.

Under Plan B, students must complete an approved program of coursework consisting of at least 30 semester credits. At least 14 of these credits must be in the major field, a minimum of 6 credits must be in one or more fields outside the major, and the remaining credits may be in either the major or in fields outside the major. Normally a majority of the program credits are in the major field. These are minimum credit requirements; some major fields require additional work.

After completing 10 credits and ordinarily not later than the second semester of registration (the second year for longer programs), students must file an official degree program with the Graduate School. This requirement may vary with the program. The *Program Form* is available in the UMD Graduate School office (431 Darland Administration Building). Students list all coursework, completed and proposed, that will be offered to fulfill degree requirements, including transfer work. If a foreign language is required, it is specified. The members of a student's final examining committee are appointed by the graduate school dean on recommendation of the faculty in the major field at the time the student's official degree program is approved. A degree program approved by the Graduate School must be on file before reviewers' report, examination report, or graduation forms can be released to the student.

Students who wish to complete a designated minor (certified on the transcript; related fields option is not) must complete at least 6 semester credits in a single field. A designated minor must be approved by the director of graduate studies in the minor field.

If Plan B projects are required, these should take a combined minimum of 120 hours of effort on the part of the student. This requirement may be satisfied through papers written in conjunction with regular courses, papers written in specially designed courses, presentation of a studio show (art), or other appropriate methods. Students should consult individual programs concerning the project's requirement. If one Plan B project is required, it must be in the major; additional projects may be in related field(s).

In cases where the student takes coursework beyond the minimum requirements, both the adviser and the Graduate School may demand comparable standards of performance for all work taken, and in evaluating and approving the minimum program submitted, will reject the minimum degree program if the GPA for the total number of courses taken falls below 2.80, and may terminate candidacy.

Under this plan, the candidate is examined by a committee of not less than three members: two from the major field and one from a related field or minor, appointed by the graduate school dean upon recommendation of the adviser and the director of graduate studies. Before the student's final examination for the degree, the adviser is expected to insure that an *Examination Report Form* for use by the student's committee is obtained from the UMD Graduate School Office in advance of the examination. In addition, the student must make available to the examining committee all projects prepared to fulfill the required 120 hours of effort, within an adequate period of time to allow for the committee to review and evaluate before the examination(s). A majority vote of the committee, with all members present and voting, is required for the student to pass. The vote is reported to the Graduate School on the *Examination Report Form*. In case of failure, unanimous consent of the examining committee is required for the student to retake the master's final examination, providing the original committee conducts the reexamination.

Two Degrees

Students may have a maximum of eight semester credits in common between two Plan A master's degrees, two Plan B master's degrees, or a Plan A and a Plan B master's degree.

Termination of Graduate Student Status

When performance is unsatisfactory in terms of grades or normal progress standards as established and promulgated by the graduate faculty in the major field, graduate student status may be terminated. All guidelines stated in this catalog represent minimal requirements, and each program is free to set more specific terms by which progress is measured for purposes of continuation. Notice of termination is made in writing.

Attendance at Commencement

Subject to satisfying participation requirements, attendance at commencement is voluntary. However, all candidates are individually recognized at the ceremony and must inform the Graduate School whether or not they will attend. The policy governing commencement ceremony participation is attached to the Application for Degree available in the UMD Graduate Office (431 Darland Administration Building).

Degree Program Statements

A synopsis of information concerning each major and minor field follows. Further details are available from the director of graduate studies in each school or department. Courses in each area are listed in Course Descriptions section under the appropriate department headings.

General information concerning graduate work on the Duluth campus may be obtained from the UMD Graduate School Office, 431 Darland Administration Building, University of Minnesota Duluth, Duluth, MN 55812; or online at **www.d.umn.edu/grad**. The Graduate School section of the UMD catalog is available online at **www.d.umn.edu/catalogs/**. The full University of Minnesota Graduate School Catalog is available online at **www.catalogs.umn.edu/grad**.

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 if different from the program name, followed by the faculty member's 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 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. At the discretion of the appointing program, may also include authorization to co-advise doctoral students with a senior member or affiliate senior member of

the graduate faculty, and 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. 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 (AM)—Authorization to assume the same responsibilities as member, but not 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.

Tests

The following test abbreviations appear throughout graduate program listings.

ECFMG—Educational Commission Foreign Medical Graduates

GMAT—Graduate Management Admission Test

GRE—Graduate Record Examination

IELTS—International English Language Testing System

MELAB—Michigan English Language Assessment Battery

SPEAK—Speaking Proficiency English Assessment Kit

TOEFL—Test of English as a Foreign Language

TSE—Test of Spoken English

USMLE—United States Medical Licensing Examination

Degree Programs

For general information about Graduate School admissions, see the Graduate School Admissions section of this catalog, or visit the UMD Graduate School Web site, www.d.umn.edu/grad.

Education—Teaching and Learning Ed.D.

Director of Graduate Studies: Associate Professor Joyce Strand

Contact Information—Department of Education, University of Minnesota Duluth, Montague Hall 120, 1211 Ordean Court, Duluth, MN 55812-3012 (218-726-6525; fax 218-726-7008; kmehle@d.umn.edu; www.d.umn.edu/educ/programs/edd).

Professor

Randy E. Hyman, SM
Linda Miller-Cleary, M2
Bruce Munson, M2
Tom Peacock, SM

Associate Professor

Lynn M. Brice, M2
Frank Guldbrandsen, SM
Nedra Hazareesingh, M2
Mary Hermes, SM
Richard Kiefer-O'Deonnell, M2
Mary Ann Marchel, M2
Molly H. Minkkinen, M2
Helen Mongan-Rallis, M2
Terrie M. Shannon, M2
Jean Myers Stevensno, M2
Joyce Strand, SM
Jiyoon Yoon, M2

Assistant Professor

Sue Damme, M2
Priscilla A. Fairbanks, M2
Dan Glisczinski, M2
Trudie Hughes, M2
Joan Kwako, M2
Molly Minkkinen, M2
Chang'aa Mweti, M2
Gerry Nierengarten, M2
Jacqueline Onchwari, M2
Jean Stevenson, M2
Julia M. Williams, M2

The doctor of education degree (Ed.D.) with a major in teaching and learning is an applied degree for the professional development of P–12, community college and university faculty and administrators, professionals in other human service professions such as coaching, athletic training, criminal justice, social work, extension, community agency administration, university student personnel, as well as business professionals involved in education and training activities. The mission of the program is to produce scholarly practitioners. The goals of doctoral study in this program are to help students: 1) acquire greater content knowledge in teaching and learning; 2) develop abilities for research

in the field of teaching and learning; 3) evolve a broadened professional background in areas related to teaching and learning, such as systems and system interactions, and methods for program improvement; and 4) increase levels of cultural competence. Students will be immersed in research on best practices in teaching and learning, and will acquire the skills needed to apply best practices in their own schools and organizations.

Prerequisites for Admission

Admission standards include 1) a master's degree or a comparable foreign degree from a recognized college or university in education or a related field (e.g., special education, curriculum and instruction, human development, psychology, social work, management science, criminology); and 2) preferred minimum graduate GPA of 3.00.

Special Application Requirements

Submission of GRE scores (preferred minimum score of 500 on verbal and quantitative portions) is required. Students whose native language is not English must submit their TOEFL scores. The application must also include three letters of recommendation, a minimum of three work samples (e.g., written reports, articles, presentations, curricula, or other professional artifacts), and a personal statement of career objectives. The statement of career objectives will be used to 1) evaluate how well this program will meet the needs of the applicant, 2) determine if appropriate concentration courses are available, and 3) conduct an initial evaluation of writing skills. GRE scores will be considered as part of a holistic evaluation of the application. Students will also be required to complete an assessment designed to determine an individual's fit with the hybrid online delivery model. Results of the survey will also be used as part of a holistic evaluation of the application.

Ed.D. Degree Requirements

Required Core courses (37 cr)

EDUC 8015—Research Design (3 cr)
EDUC 8016—Theory and Practice in Qualitative Research Methods (3 cr)
EDUC 8017—Theory and Practice in Quantitative Research Methods (3 cr)
EDUC 8018—Statistical Analysis in Educational Research (3 cr)
EDUC 8020—Doctoral Seminar (1 credit each of 4 terms)
EDUC 8001—Historical and Philosophical Foundations of Education (3 cr)
EDUC 8003—Educational Policy (3 cr)
EDUC 8005—Curriculum Evaluation: Theory into Practice (3 cr)
EDUC 8007—Research on Knowledge and Learning (3 cr)
EDUC 7005—Teaching and Learning in a Systems Context (3 cr)
EDUC 8009—Distance Education in 21st Century: From Theory to Practice (3 cr)
EDUC 8021—Assessment (3 cr)

Related Field courses (minimum 15 credits)

EDUC 8888—Thesis (24 cr)

Language Requirement—None.

Preliminary Written and Oral Exam—Preliminary written and oral examinations are required and will be administered after completion of all research and major course work.

Project—A project designed to build a knowledge base relevant to problems in schools and organizations.

Final Exam—An oral defense of the project is required.

Applied and Computational Mathematics M.S.

Plan A and Plan B

Director of Graduate Studies: Professor Zhuangyi Liu

Contact Information—Department of Mathematics and Statistics, University of Minnesota Duluth, 140 Solon Campus Center, 1117 University Drive, Duluth, MN 55812 (218-726-8747; fax 218-726-8399; **math@d.umn.edu**; **www.d.umn.edu/math**).

For latest graduate faculty listings, see **www.grad.umn.edu/faculty_rosters/faculty.html**.

Professor

Richard A. Davis, Chemical Engineering, M2
Douglas J. Dunham, Computer Science, AM2
Dalibor Froncek, M2
Joseph A. Gallian, M2
Richard F. Green, M2
Barry R. James, M2
Kang Ling James, M2
Zhuangyi Liu, M2
John Pastor, Biology, M2
Ronald R. Regal, M2
Harlan W. Stech, M2

Associate Professor

Guihua Fei, M2
John R. Greene, M2
Carmen M. Latterell, M2
Kathryn E. Lenz, M2
Robert L. McFarland, M2
Bruce B. L. Peckham, M2
Yongcheng Qi, M2
Steven A. Trogdon, M2

Assistant Professor

Marshall E. Hampton, M2

This program is for those wishing to pursue careers that use applied mathematics and statistics in science, industry, business, and teaching, and for those wishing to go on for doctoral degrees in mathematics or statistics. It emphasizes the use of modern modeling techniques and computational methods with areas of concentration available in continuous modeling, probability/statistics, and discrete mathematics. The faculty is drawn largely from the Department of Mathematics and Statistics, but includes members from the Departments of Computer Science, Chemical Engineering, and Biology.

Prerequisites for Admission

Applicants should have completed an undergraduate degree in mathematics or statistics. However, a student with a degree in another major, and with a substantial background in mathematics or statistics (e.g., computer science or engineering), may also qualify. Students lacking certain prerequisites may make up deficiencies concurrently with graduate work.

Special Application Requirements

Applicants must submit scores from the General Test of the GRE, three letters of recommendation from individuals 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 applications materials by January 15 for fall semester is strongly encouraged to ensure priority consideration for university fellowships. The application deadline for assistantships awarded for the next academic year is March 1. Students can be admitted any term. Students whose native language is not English must submit TOEFL or IELTS or MELAB scores.

M.S. Degree Requirements

The master of science degree is offered under both Plan A (with thesis) and Plan B (without thesis). All students must complete at least 33 credits, of which at least 17 must be from approved mathematics or statistics courses or seminars (including a graduate seminar and three of the four core courses), and 6 must be from a minor or related field (statistics is a related field). Plan A also requires 10 thesis credits. Plan B requires a 2-credit project and an additional 8 credits from approved graduate-level mathematics, statistics, or related-field courses.

Language Requirements—None.

Final Exam—The final exams are written and oral.

Minor Requirements for Students Majoring in Other Fields—A minor for the master's degree requires 6 credits in approved MATH or STAT courses.

Art—Graphic Design M.F.A.

Plan B

Director of Graduate Studies: Associate Professor Janice Kmetz

Contact Information—Department of Art and Design, University of Minnesota Duluth, 317 Humanities Building, 1201 Ordean Court, Duluth, MN 55812 (218-726-8225; fax 218-726-6532; art@d.umn.edu; www.d.umn.edu/art/program/mfa.html).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Professor

Gloria Brush, M2
James C. Klueg, M2

Associate Professor

Alison J. Aune, M2
Janice D. Kmetz, M2
Sarah C. Nitschke, M2
Robert A. Repinski, M2
Robyn S. Roslak, Art History, M2
Eun-Kyung Sue, M

Assistant Professor

Steve Bardolph, M2
David W. Bowen, M
Jennifer L. Dietrich, AM2
Jennifer A. Gordon, M
Beth E. Koch, M2
Victoria D. Lehman, M2
Ryuta. Nakajima, M
Wanda J. Pearcy, M
Joellyn J. Rock, M
Eun-Kyung Suh, M
Mariana M. Waisman, M2
Jennifer Webb, M2

Instructor

Rob Wittig, M

Within a liberal arts setting, UMD's master of fine arts degree with an emphasis in graphic design is tailored to each individual's educational, artistic, and professional strengths. Expanding the boundaries of conventional design education, it includes the following areas of study: new media; motion graphics; communication design; interactive design; design in the public realm; experience design; graphic design history; and preparation for college teaching. Academic study and design studio practice are equally emphasized. The program draws on faculty with international and national experience as designers and artists, who are recognized for the quality of their teaching, research, and professional design activities.

Prerequisites for Admission

Applicants must have adequate undergraduate education and experience in the area of emphasis and a bachelor of arts, science, or fine arts in graphic design. Individuals with undergraduate degrees in other fine arts disciplines who have completed a substantial number of design courses or who have extensive professional graphic design portfolios also may be considered for admission.

Special Application Requirements

A portfolio of 20 design works (Mac format CD or DVD), a letter of intent, a writing sample (written in or translated into English), and three letters of recommendation are also required as part of the application. Applicants must have a minimum undergraduate GPA of 3.00. The GRE is not required. For more information about the M.F.A., visit the program's Web site, www.d.umn.edu/art/program/mfa.html.

M.F.A. Degree Requirements

The M.F.A. is offered under Plan B, and requires 60 credits. The degree may be earned on a full- or part-time basis; however, all requirements for the master's degree must be completed and the degree awarded within seven years. The department's financial aid does not extend beyond six semesters. The time frame for completion of the coursework and research required for the degree is usually three years for full-time students. For more complete information on degree requirements please see the *MFA Handbook* online at www.d.umn.edu/art/program/download/pdf/Grad_hnbk_03_03_07.pdf.

Language Requirements—None.

Final Exam—An oral exam based on the project and supporting paper is required.

Biochemistry

See Cooperative Programs.

Business Administration M.B.A.

Plan B, Coursework Only

Director of Graduate Studies:
Associate Professor Rajiv Vaidyanathan

Contact Information—M.B.A. Program, Labovitz School of Business and Economics, University of Minnesota Duluth, 111 LSBE Building, 1318 Kirby Drive, Duluth, MN 55812 (218-726-8986; fax 218-726-6789; lsbe@d.umn.edu; www.d.umn.edu/goto/MBA).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Professor

Praveen Aggarwal, Management Studies, M2
Curt L. Anderson, Economics, AM
Stephen B. Castleberry, Management Studies, M2
Rodrigo J. Lievano, Finance and Management Information Sciences, M2
Patricia A. Merrier, Finance and Management Information Sciences, M2
Jon L. Pierce, Management Studies, M2
Stephen A. Rubenfeld, Management Studies, M2
Rajiv Vaidyanathan, Management Studies, M2
Shee Q. Wong, Finance and Management Information Sciences, AM

Associate Professor

Geoffrey G. Bell, Management Studies, M2
Rodger L. Brannan, Accounting, AM
Anne Cummings, Management Studies, M2
Jannifer G. David, Management Studies, M2
Manjeet Dhatt, Finance and Management Information Sciences, M2
Sanjay Goel, Management Studies, M2
Nik R. Hassan, Finance and Management Information Sciences, AM
Kjell R. Knudsen, Management Studies, M2
Seung C. Lee, Finance and Management Information Sciences, M2
Dahui Li, Finance and Management Information Sciences, AM
Jerry W. Lin, Accounting, M2
A. Maureen O'Brien, Economics, M2
Linda Rochford, Management Studies, M2
Alan C. Roline, Accounting, M2
Jennifer Schultz, Economics, M2
Randall K. Skalberg, Accounting, AM

Assistant Professor

Patricia S. Borchert, M2
Saiying Deng, Finance and Management Information Sciences, M2
David Doorn, Economics, M2
Christopher R. McIntosh, Economics, M2
Jennifer Mencl, Management Studies, M2
Bedassa Tadesse, Economics, M2
Gregory P. Trudeau, Accounting, AM

Instructor

John L. Kratz, Management Studies, AM

The master of business administration program meets the needs of those who are currently employed full-time in professional managerial careers and would like to pursue a graduate management education primarily on a part-time basis. The program offers courses in both Duluth and Rochester. Most courses offered in Duluth meet one evening per week from 6 to 9 p.m. during the 15 weeks of the semester. Most courses offered in Rochester meet from 3 to 9:30 p.m. on Fridays, and 8 a.m. to 12:30 p.m., Saturdays, every other week over a period of seven weeks. It is possible to enroll in the program on a full-time basis by registering for 6 or more credits per semester.

Prerequisites for Admission

Applicants must have a bachelor's degree from an accredited college or university with prerequisite courses in calculus and statistics, and made satisfactory progress in completing the required foundation/prerequisite coursework in financial accounting, economics, finance, production/operations, marketing, organizational management, and human resource management. The bachelor's degree may be in any field; however, students who have had little or no undergraduate or other education in business administration must complete foundation courses in the areas identified above. Students with exceptional academic records may apply for early admission prior to completion of this coursework (see www.d.umn.edu/lsbe/mba/mba_earlyadmission.php for details).

Special Application Requirements

Applicants must have an acceptable score on the GMAT, passed the Certified Professional Accountant (CPA) examination, or completed a graduate degree from an accredited college or university. In addition, international students should have an acceptable score on the TOEFL (total of 79 plus a minimum score of 21 on the writing section and 19 on the reading section).

M.B.A. Degree Requirements

The M.B.A. requires 32 credits. All students must complete six core and three support area courses, which provide exposure to financial analysis and markets, the domestic and global environments of business and organizations, the creation and distribution of goods and services, and human behavior in organizations. Also required are a capstone strategic management course and at least 2 credits of cross-functional experiences selected from special topics, workshops, projects, or field study. Students then choose one of two options for completing an additional 6 credits of electives: through coursework only or with field research (Plan B). M.B.A. students may include selected 4xxx and/or 5xxx courses for electives in their degree programs subject to approval by the M.B.A. director.

Language Requirements—None.

Final Exam—For Plan B, students meet with their faculty committee for a final review of their completed project. For coursework only, no final exam is required.

Chemistry M.S.

Plan A and Plan B

Director of Graduate Studies: Professor Viktor V. Zhdankin

Contact Information—Department of Chemistry and Biochemistry, 246 Chemistry Building, 1039 University Drive, Duluth, MN 55812 (218-726-7212; fax 218-726-7394; chem@d.umn.edu; www.d.umn.edu/chem/grad/).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Professor

Ronald Caple, M2
Robert M. Carlson, M2
Lester R. Drewes, Biochemistry and Molecular Biology, M2
John F. Evans, M2
Vincent R. Magnuson, M2
Donald P. Poe, M2
Joseph R. Prohaska, Biochemistry and Molecular Biology, M2
James P. Riehl, M2
Bilin P. Tsai, M2
Kendall B. Wallace, Biochemistry and Molecular Biology, M2
Viktor Zhdankin, M2

Associate Professor

Benjamin L. Clarke, Medical Microbiology and Immunology, M2
Paul Kiprof, M2
Keith B. Lodge, Chemical Engineering, M2
Venkatram R. Mereddy, M2
Elizabeth C. Minor, M2
Viktor N. Nemykin, M2
Paul D. Siders, M2
Josef Werne, M2

Assistant Professor

Grant W. Anderson, Pharmacy, M2
Steven M. Berry, M2
Robert T. Cormier, Biochemistry and Molecular Biology, M2
Peter Grundt, M2
Anne Hinderliter, M2
Joseph L. Johnson, M2
Jon N. Rumbley, M2

Senior Research Associate

Subhash C. Basak, Natural Resources Research Institute (NRRI), M2

Research Fellow

Pavel A. Krasutsky, NRRI, M2

The master of science program offers a broad-based education in chemistry that is well suited for students going on to doctoral programs, careers in industry, or professional schools. Both Plan A (with thesis) and Plan B (without thesis) are available. For Plan A, emphases include analytical, biological, inorganic, organic, and physical chemistry. The faculty includes members from the Departments of Chemistry and Chemical Engineering in the Swenson College of Science and Engineering; the Departments of Biochemistry and Molecular Biology and Medical Microbiology and Immunology in the Medical School; as well as members from the Natural Resources Research Institute, and the College of Pharmacy.

Prerequisites for Admission

Applicants must have completed an undergraduate chemistry or biochemistry major, including a junior-senior level course in inorganic chemistry, physical chemistry, mathematics through calculus, and one year of college physics, preferably taught using calculus. Students lacking some of these prerequisites may make up deficiencies concurrently with graduate work.

M.S. Degree Requirements

All students must complete 31 credits, including a seminar and four core courses. All students must complete at least 14 credits in the major and at least 6 credits in a related field or minor. In addition, Plan A students must register for 10 thesis credits; Plan B students must complete an additional 10 course credits and write three papers. Attendance and presentation at the chemistry seminar are required. Individual programs are designed to best serve the interests of the student. 4xxx courses must be approved by the director of graduate studies.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires at least 6 credits in chemistry courses. Individual programs must be approved by the director of graduate studies in chemistry.

Communication Sciences and Disorders (CSD) M.A.

Plan B

Director of Graduate Studies: Associate Professor Faith Loven

Contact Information—Department of Communication Sciences and Disorders, University of Minnesota Duluth, 221 Bohannon Hall, 1207 Ordean Court, Duluth, MN 55812 (218-726-7974; fax 218-726-8693; cd@d.umn.edu; www.d.umn.edu/csd/masters/index.html).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Professor

Paul N. Deputy, M2
Mark I. Mizuko, M2

Associate Professor

Kent R. Brorson, M2
Faith C. Loven, M2
Cynthia S. Spillers, M2

Assistant Professor

Dana R. Collins, M2

Instructor

Lynette R. Carlson, M2
Jolene K. Hyppa Martin, M2

The graduate program in communication sciences and disorders effectively combines academic and clinical endeavors to prepare students to become speech-language pathologists. The program places a major emphasis on the development of clinical skills, although students have the opportunity to engage in a wide variety of academic and

research activities as well. The curriculum, which is based on five semesters of study, is accredited by the American Speech-Language Hearing Association (ASHA).

Prerequisites for Admission

Applicants must have a bachelor's degree in communication sciences and disorders.

Special Application Requirements

Three letters of recommendation evaluating the applicant's scholarship and clinical potential are required. At least two letters should be from academic faculty familiar with the applicant. A personal statement of the applicant's short- and long-term goals is also required.

M.A. Degree Requirements

The M.A. is offered only under Plan B. At least 43 credits are required, including 31 credits of required CSD courses, 2 credits for the Plan B project (CSD 8099), 4 internship credits, and at least 6 credits of approved courses (4xxx and higher) from related fields. All Plan B projects must be pre-approved by the student's examining committee, which also must give final approval.

Language Requirements—None.

Final Exam—The final exam is oral.

Computer Science M.S.

Plan A and Plan B

Director of Graduate Studies: Professor Carolyn J. Crouch

Contact Information—Department of Computer Science, University of Minnesota Duluth, 320 Heller Hall, 1114 Kirby Drive, Duluth, MN 55812 (218-726-7678; fax 218-726-8240; cs@d.umn.edu; www.d.umn.edu/cs/degr/grad).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Professor

Carolyn C. Crouch, M2
Donald B. Crouch, M2
Douglas, J. Dunham, M2
Richard F. Maclin, M2

Associate Professor

Theodore D. Pedersen, M2
Christopher G. Prince, M2
Gary M. Shute, M2
C. Hudson Turner, M2

Assistant Professor

Peter J. Willemsen, M2

Computer science is a discipline that involves understanding the design of computers and computational processes. Study in the field ranges from the theoretical examination of algorithms to the design and implementation of software at the systems and applications levels.

The master of science is a two-year program that provides the necessary foundational studies for graduates planning to pursue either a doctorate in computer science or a career as a computer scientist in business or industry.

Prerequisites for Admission

The program is designed for students with undergraduate degrees in computer science or computer engineering. These students should be able to enroll immediately in 8xxx computer science courses. Students with other backgrounds may be considered if they have completed the following courses or their equivalents: CS 1511–1521—Computer Science I–II; CS 2511—Software Analysis and Design; CS 2521—Computer Organization and Architecture; CS 3511—Computer Science Theory; CS 5621—Computer Architecture or CS 5651—Computer Networks; and CS 5631—Operating Systems. The appropriate math prerequisites, namely MATH 1296–1297—Calculus I–II and STAT 3611—Introduction to Probability and Statistics, are also required.

Special Application Requirements

The GRE General Test is required of all applicants; the TOEFL is also required of international students.

M.S. Degree Requirements

The master of science degree is offered under Plan A (thesis) and Plan B (non-thesis). At least 33 credits are required, including 16 credits from 8xxx courses in computer science, 1 credit of CS 8993—Seminar, and 6 credits from a specified set of courses outside of computer science (minor or related field). Plan A also requires 10 thesis credits; Plan B requires at least 10 credits in additional courses, 5xxx or above. Except in very rare instances, these must be computer science courses. All courses are chosen in consultation with the student's adviser, subject to approval by the director of graduate studies. Normally, 4xxx computer science courses may not be included in degree programs for the master of science in computer science.

Language Requirements—None.

Final Exam—Students present a departmental colloquium, followed by an oral exam.

Minor Requirements for Students Majoring in Other Fields—At least 6 credits in computer science are required for a master's minor.

Criminology M.A.

Plan A and Plan B

Director of Graduate Studies: Associate Professor Jeffrey R. Maahs

Contact Information—Department of Sociology-Anthropology, University of Minnesota Duluth, 228 Cina Hall, 1123 University Drive, Duluth, MN 55812 (218-726-7801; fax 218-726-7759; crimma@d.umn.edu; www.d.umn.edu/socanth/criminology/macrim_graduateprogram.php).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Professor

John A. Arthur, M2
William A. Fleischman (emeritus), M2
J. Clark Laundergan (emeritus), M2
Janelle L. Wilson, M2

Associate Professor
Sheryl J. Grana, M2
John E. Hamlin, M2
Jeffrey R. Maahs, M2
Robert R. Weidner, M2

Assistant Professor
Emily Gaarder, M2
Denise S. Hesselton, M2
Daniel D. Martin, M2
Melissa L. Walls, M2

The core courses for the master of arts (M.A.) in criminology feature relevant theoretical perspectives in understanding criminal behavior, methods of research and data analysis, and critical analysis of the criminal justice system. The curriculum is based on the premise that a liberal education in the social sciences includes the development of a student's ability to 1) define problems effectively by asking appropriate questions; 2) understand and respect people with diverse opinions, backgrounds, characteristics, and lifestyles; 3) respect the right of freedom of inquiry, willingly challenge conventional wisdom, and be intellectually flexible when challenged by factual information; and 4) understand the significance of inequality in the way that criminal justice is administered. The theme of inequality is incorporated into the graduate program through the examination of structural forms of oppression and an emphasis on issues of social justice, human rights, and treatment/rehabilitation.

The framework of the program provides students with opportunities to develop a knowledge base that enhances understanding of criminal behavior and the workings of the criminal justice system. Core requirements give students experience in using various methods of research, analyzing and interpreting data, understanding and critiquing the main theoretical traditions in the field, and examining the organization of the criminal justice system. Furthermore, course electives enable students to focus on more specific interests (e.g., policing, courts, youth justice, etc.).

The M.A. in criminology provides an opportunity for both intellectual and professional development. The program serves those students with undergraduate degrees in criminology (or a related social science) who are interested in pursuing the advanced study of crime and justice. The program also serves those who have been employed in organizations and agencies and who wish to expand their knowledge and understanding in ways that may enhance their professional careers.

Prerequisites for Admission

Applicants must have a baccalaureate degree from an accredited U.S. institution or a foreign equivalent for admission to the master's program. Preference is given to applicants with undergraduate degrees in criminology, criminal justice, corrections, or sociology. Applicants with an undergraduate minor in criminology, criminal justice, corrections, sociology, law enforcement, or a major in a related field may also be considered. Undergraduate degrees in criminology, criminal justice, corrections, sociology, or a related field from foreign universities may also be considered as long as those degrees are equivalent to a four-year American university baccalaureate degree. Admission to the program is competitive.

Applicants must have successfully completed an introduction to criminology or criminal justice course, the equivalent of one semester of research methods and/or statistics beyond the introductory level, and a course devoted primarily to social/behavioral theory. The minimum GPA for admissions is normally 3.00. Students with a GPA lower than 3.00 may occasionally be admitted where other credentials indicate a high likelihood of success in the program.

Special Application Requirements

Applicants must supply three letters of recommendation evaluating the his or her scholarship and potential for graduate study (at least two letters should be from academic faculty familiar with the applicant); an essay explaining why an advanced degree in criminology is of interest; why the applicant merits serious consideration; and a personal statement of the applicant's short and long-term professional goals and commitment to and preparation for graduate study in criminology. International students whose native language is not English also are required to submit scores from the TOEFL examination.

M.A. Degree Requirements

The M.A. is offered under both Plan A and Plan B; each requires 38 credits. The Plan A option involves thesis work; the Plan B option involves a special project based upon a student's practicum work. The Plan B project combines theories, concepts, principles, and/or best practices from at least one course in the student's program of study with work being done in a practicum. All students must take CRIM 8100 (3 credits), CRIM 8200 (3 credits), CRIM 8201 (3 credits), CRIM 8140 (1 credit), and CRIM 8300 (3 credits). Plan A students must enroll in CRIM 8777—Masters Thesis Credits (minimum of 10 credits required). Plan B students must enroll in CRIM 8600—Criminology Practicum (minimum of 10 credits required). In addition to the credits listed above, all students must choose at least 9 additional credits in criminology courses, 5xxx-level or above.

Students are expected to include additional elective courses (6 credits) outside the major (in a minor or related field) as part of their program of study. The related field courses must be chosen in consultation with, and approved by, the student's advising/examining committee. Upon the advice and approval of the director of graduate studies, students may use 4xxx courses in related fields as appropriate. Sociology 4xxx courses may be included in either the Plan A or Plan B programs for the M.A. in criminology.

Language Requirement—None.

Final Exam—Students present a department colloquium, followed by an oral examination

Minor Requirements for Students Majoring in other Fields—A master's minor requires 4 credits in methods/statistics, 3 credits in theory, and 3 credits of electives.

Electrical and Computer Engineering M.S.E.C.E.

Plan A and Plan B

Director of Graduate Studies: Associate Professor Imran M. Hayee

Contact Information—Department of Electrical and Computer Engineering, University of Minnesota Duluth, 271 Marshall W. Alworth Hall, 1023 University Drive, Duluth, MN 55812 (218-726-6147; fax 218-726-7267; ece@d.umn.edu; www.d.umn.edu/ece).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Professor

Stanley G. Burns, M2
Taek Mu Kwon, M2
Marian Stachowicz, M2
Jiann-Shiou Yang, M2

Associate Professor

Christopher R. Carroll, M2
Mohammed Hasan, M2
M. Imran Hayee, M2

Assistant Professor

Jing Bai, M2
Hua Tang, M2
Paul J. Weber, M2
George L. Zimmerman, AM2

The master of science in electrical and computer engineering (M.S.E.C.E.) combines scholarship and research in a program oriented towards students and engineering practitioners in the private and public sectors who are interested in advanced coursework and applied research. The program requires 31 credits of graduate coursework and research, and focuses on core departmental strengths of design and implementation of computer hardware and software embedded controllers, computer networks, distributed computing, analog and digital VLSI circuit design and application, signal processing, communication systems, computational intelligence, robotics, and control systems.

Prerequisites for Admission

Applicants should have completed an undergraduate degree in electrical, computer, electrical and computer engineering, or a related discipline, and must meet the general admission requirements of the Graduate School. A GPA of 3.00 to 4.00 from an accredited U.S. institution or foreign equivalent is preferred. Industrial experience and professional licensure may be considered. Previous graduate-level coursework completed after receiving a baccalaureate degree may qualify for transfer credit upon recommendation and approval by the director of graduate studies.

Special Application Requirements

Two letters of recommendation concerning the student's academic abilities and readiness for graduate education are required.

M.S.E.C.E. Degree Requirements

The M.S.E.C.E. degree provides both thesis (Plan A) and non-thesis (Plan B) options. Plan B is primarily for new engineering graduates and practicing engineers who want and need more technical education than would be provided by courses and an applied research-oriented project component. Plan A is primarily for those students wishing to prepare themselves for advanced doctoral studies and careers in research and academia.

Plan A students must complete a minimum of 31 semester credits in graduate courses. At least 15 credits must be electrical and computer engineering courses with at least 6 credits in courses numbered 4xxx or higher, 6 credits in courses numbered 5xxx or higher, and at least 3 credits in 8xxx courses . At most, 8 credits in ECE 4xxx courses will be counted toward a degree. An additional 6 graduate level course credits must be taken in a related field or minor. The student must register for a minimum of 10 semester credits for the master's thesis. The director of graduate studies must approve all programs.

Plan B students must complete a minimum of 31 credits in graduate courses. At least 9 credits must be ECE courses numbered 5xxx and higher with at least 3 of those credits numbered 8xxx, excluding colloquium and Plan B project credits. Of the remaining credits, 12 must be in ECE courses numbered 4xxx or higher. At most, 8 ECE 4xxx credits will be counted. Of the remaining 10 credits, at least 6 must be taken outside of electrical and computer engineering. No more than 4 credits can be earned from projects. The director of graduate studies must approve all programs.

Language Requirements—None.

Final Exam—A formal defense of the thesis is required for Plan A students. The final exam for Plan B is a formal report and oral presentation.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires 6 courses in electrical and computer engineering courses. Individual programs must be approved by the director of graduate studies in electrical and computer engineering.

Engineering Management M.S.E.M.

Plan A and Plan B

Director of Graduate Studies: Professor Richard R. Lindeke

Contact Information—Department of Mechanical and Industrial Engineering, University of Minnesota Duluth, 229 Voss-Kovach Hall, 1305 Ordean Court, Duluth, MN 55812 (218-726-8117; fax 218-726-8581; msem@d.umn.edu; www.d.umn.edu/mie/MSEM).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Professor

Mark A. Fugelso, M2
Abu Rashid Hasan, Chemical Engineering, M
Ewil Kwon, Civil Engineering, M2
Richard R. Lindeke, M2

Associate Professor
Emmanuel Enemuoh, M2
Daniel N. Pope, Mechanical Engineering, M2
Ryan G. Rosandich, M2

Assistant Professor
Seraphin C. Abou, M2
Hongyi Chen, M2
Robert G. Feyen, M2
Todd W. Loushine, M2
Bill Pedersen, M2
John Voss, AM
Xun Yu, M2

Instructor
David J. Keranan, M

The master of science in engineering management (M.S.E.M.) program provides engineers with tools to more effectively manage people, projects, technology, and information in their careers in order to promote economic growth, competitiveness, ethical decision-making, and environmental responsibility and sustainability. As people in engineering positions often manage technical projects of varying size and complexity, the M.S.E.M. provides an excellent foundation to perform these tasks. To meet the needs of practitioners, courses are offered in the evening and are available to remote sites by interactive television. Full-time enrollment is possible and the course structure allows for unique research opportunities.

Prerequisites for Admission

All applicants must meet the general admission requirements for the Graduate School. Applicants should have completed an undergraduate degree in an engineering discipline. However, an applicant with a degree in another technical major and a substantial background in engineering may qualify. Such students may be admitted on a case-by-case basis and are asked to submit documentation that substantiates their engineering experience and responsibilities.

A minimum 3.00 GPA from an accredited U.S. institution or foreign equivalent is preferred.

Special Application Requirements

Applicants must provide two letters of recommendation concerning their academic ability and readiness for graduate education.

M.S.E.M. Degree Requirements

Plan A students must complete at least 31 credits, including a minimum of 12 credits in the major core sequence, 6 credits from a related field, a minimum of 3 credits of electives, and 10 thesis credits. Individual programs are designed to best serve the interests of the student. The director of graduate studies must approve all programs.

Plan B students must complete at least 30 credits, including the 12-credit major core sequence, a minimum of 3 additional credits in the major, a 3-credit capstone project course—Project Methodology and Practice, and 6 credits in a related field or minor. Students must complete an additional 6 credits in engineering management or other electives. The capstone project requires a formal report and oral presentation. Individual programs are designed to best serve the interest of the student. The director of graduate studies must approve all programs.

Students, upon the advice and approval of the director of graduate studies, may use 4xxx courses in related fields as appropriate for both Plan A and Plan B.

Language Requirement—None.

Final Exam—A formal defense of the thesis is required for Plan A students. The final exam is a formal report and oral presentation in EMGT 8310 for Plan B students.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires 6 credits in engineering management courses. Individual programs must be approved by the director of graduate studies in engineering management.

English M.A.

Plan B

Director of Graduate Studies: Associate Professor Krista Sue-Lo Twu

Contact Information—Department of English, University of Minnesota Duluth, 410 Humanities Building, 1201 Ordean Court, Duluth, MN 55812 (218-726-8228; fax 218-726-6882; engl@d.umn.edu; www.d.umn.edu/engl/englishgrad/main/index.php).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Professor
Martin F. Bock, M2
Thomas J. Farrell, Writing Studies, M2
Michael D. Linn, Writing Studies, M2
Joseph C. Maiolo, M2
Linda Miller-Cleary, M2

Associate Professor
Katherine L. Basham, M2
Carol A. Bock, M2
Paul D. Cannan, M2
Jill D. Jenson, Writing Studies, M2
Kenneth C. Risdon, Writing Studies, M2
Carolyn Sigler, M2
Craig Stroupe, Writing Studies, M2
Krista Sue-Lo Twu, M2

Assistant Professor
David E. Beard, Writing Studies, M2
Evan Brier, M2
John Hatcher, Writing Studies, M2
Hilary C. Kowino, M2
Chongwon Park, Writing Studies, M2
Juli J. Parrish, Writing Studies, M2
John D. Schwetman, M2
Rochelle R. Zuck, M2

Instructor
Rob Wittig, Art and Design, AM

The master of arts program offers courses in English, Irish, and American literature; creative writing; linguistics; composition and rhetorical theory; book history; publishing; and English education. The program has three master's

emphases: a literary studies emphasis for concentrated study of literature, an interdisciplinary emphasis in English studies, and an emphasis in publishing and print culture.

Prerequisites for Admission

Entering students should have completed 30 credits in English (these may include credits in literature, language, and advanced composition), including 20 upper division English courses that offer broad coverage of English and American literature and at least one course in English language or English linguistics. Any deficiencies will be determined by the director of graduate studies in consultation with the graduate committee. Certain course prerequisites may be taken concurrently with graduate work and may be applied toward degree requirements. For more information, see the program's Web site, www.d.umn.edu/engl/englishgrad/main/index.php.

Special Application Requirements

Students applying to this program must submit GRE General Test scores, two writing samples (such as course papers), and three letters of recommendation.

M.A. Degree Requirements

Literary Studies Emphasis (Plan B)

Requires a minimum of 30 credits, including at least 24 credits in the major, 6 to 8 credits in a related field, and two Plan B projects.

English Studies Emphasis (Plan B)

Requires a minimum of 31 credits, including at least 25 credits in the major, distributed in literature, linguistics, and composition/rhetoric; 6 to 8 credits in a related field; and two Plan B projects.

Publishing and Print Culture Emphasis (Plan B)

Requires a minimum of 31 credits, including at least 25 credits within the major, distributed in literature, publishing, and print culture; 6 to 8 credits in a related field; and two Plan B projects. 4xxx courses in English, composition, and linguistics may not be included in degree programs in English, but some 4xxx courses are permitted in the related field.

Language Requirements—The emphases in literary studies and publishing and print culture require certification of a reading knowledge of Latin, Greek, French, Italian, Spanish, Russian, or another approved language.

The English studies emphasis requires certification of a reading knowledge of a foreign language appropriate to the candidate's area of study and approved by the English graduate committee, or completion of at least 6 course credits beyond the 31 required credits. Candidates whose professional objectives are best served by completing the additional 6 credits select courses from literature and literary analysis, linguistics, composition/rhetoric, print culture, publishing, or courses closely related to their field of concentration.

Final Exam—Final exams are written and oral.

Students must submit two Plan B projects totaling 120 hours of effort before taking the exam. The projects normally are completed in connection with courses in English or in a related field. A completed project must be approved by a graduate faculty member.

Minor Requirements for Students Majoring in Other Fields—At least 8 credits in English, composition, and/or linguistics is required for a master's minor.

Geological Sciences M.S.

Plan A and Plan B

Director of Graduate Studies: Associate Professor Penelope Morton

Contact Information—Department of Geological Sciences, University of Minnesota Duluth, 229 Heller Hall, 1114 Kirby Drive, Duluth, MN 55812 (218-726-7239; fax 218-726-8275; geol@d.umn.edu; www.d.umn.edu/geology/programs/grad.html).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Professor

Erik T. Brown, M2
Keith A. Brugger, Geology, Morris, AM2
Steve Colman, M2
John W. Goodge, M2
Vicki L. Hansen, M2
Timothy B. Holst, M2
Thomas C. Johnson, M2
Charles L. Matsch (emeritus), AM2
Howard D. Mooers, M2
Ronald L. Morton, M2
Richard W. Ojakangas (emeritus), AM2

Associate Professor

Christian D. Gallup, M2
James D. Miller, Jr., M2
Penelope Morton, M2
John B. Swenson, M2
Nigel J. Wattrus, M2
Josef P. Werne, Chemistry and Biochemistry, AM2

Assistant Professor

Karen B. Gran, M2
Jim Miller, M2

Adjunct Assistant Professor

George J. Hudak III, Geology, University of Wisconsin Oshkosh, AM2
Dean M. Peterson, (NRRI), AM2
Richard D. Ricketts, Large Lakes Observatory, AM2

Research Associate

Tamara R. Diedrich, NRRI, AM2

The master of science program in geological sciences includes areas of economic geology, geophysics, glacial geology and geomorphology, hydrogeology, igneous and metamorphic petrology, isotope and aqueous geochemistry, limnogeology, paleoclimatology, planetary geology, sedimentology and stratigraphy, surface processes, and structure-tectonics. Several of these areas are strengthened by collaboration with the Large Lakes Observatory and the Natural Resources Research Institute.

Prerequisites for Admission

Most candidates will have completed a bachelor's degree in geology, geophysics, or a related field. However, students with degrees in fields such as chemistry, physics, or biology are encouraged to apply. At least one year of study in calculus, chemistry, and physics is required. Field camp and/or undergraduate research experience is recommended.

Special Application Requirements

GRE General Test scores are required.

M.S. Degree Requirements

The master of science degree is offered under Plan A (thesis) and Plan B (non-thesis). Courses are selected with approval of the student's adviser and the director of graduate studies. All courses must be at the 4xxx, 5xxx, or 8xxx levels.

For Plan A, a candidacy exam that involves an oral defense of the written thesis research proposal during the second semester of residency is required. Plan A requires 31 credits, including 14 course credits in the major, 6 course credits in a minor or related field, a 1-credit course (GEOL 8200), and 10 thesis credits. For Plan B, a written candidacy exam during the second semester is required. Plan B requires 31 credits in approved courses, including three Plan B papers.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires at least 6 credits and is decided in consultation with the student's adviser and the director of graduate studies in geological sciences.

Integrated Biosciences

See All-University Programs.

Liberal Studies M.L.S.

Plan B

Director of Graduate Studies: Assistant Professor John Schwetman

Note: *Admissions to the Master of Liberal Studies program have been suspended indefinitely.*

Contact Information—College of Liberal Arts, M.L.S. Program, University of Minnesota Duluth, 104 Darland Administration Building, 1049 University Drive, Duluth, MN 55812 (218-726-8965; fax 218-726-6386; nolsen@d.umn.edu; www.d.umn.edu/ce/html/mls.html).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Professor

Stephen Adams, English, M2
John Arthur, Sociology-Anthropology, M2
Elizabeth Bartlett, Women's Studies, M2
William Fleischman, Sociology-Anthropology, M2
Tom K. Isbell, Theatre, M2
Lawrence Knopp, Geography, M2
Michael W. Pfau, Communication, M2
Richard A. Seybolt, Foreign Languages and Literatures, M2
Judith Ann Trolander, History, M2

Associate Professor

Mitra C. Emad, Sociology-Anthropology, M2
Scott Freundschuh, Geography, M2
Milan Kovacovic, Foreign Languages and Literatures, M2
Robyn S. Roslak, Art, M2
Rosemary Stanfield-Johnson, History, M2
Maureen Tobin Stanley, Foreign Languages and Literatures, M2
Robert R. Weidner, Sociology-Anthropology, M2
Janelle L. Wilson, Sociology-Anthropology, M2
Gesa Zinn, Foreign Languages and Literatures, M2

Assistant Professor

Scott M. Laderman, History, M2
John D. Schwetman, English, M2

The interdisciplinary master of liberal studies (M.L.S.) is a community outreach program that provides citizens with the opportunity to return to higher education to broaden their intellectual horizons without having to focus on specific professional goals. To complete the M.L.S. degree, one to three papers or creative projects with an in-depth exploration of an interdisciplinary topic are required.

M.L.S. Degree Requirements

The M.L.S. is offered only under Plan B. Students must complete 32 credits, including at least 4 credits of IS 8001—Introduction to Liberal Studies. One to three Plan B papers or creative projects are required in both emphases. Inclusion of 4xxx courses on degree program forms is subject to adviser and director of graduate studies approval.

Language Requirements—None.

Final Exam—The final exam is oral.

Linguistics (Minor Only)

Coordinator: Professor Michael D. Linn

Contact Information—Program in Linguistics, University of Minnesota Duluth, 435 Humanities Building, 1201 Ordean Court, Duluth, MN 55812 (218-726-8131; fax 218-726-6882; mlinn@d.umn.edu).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Professor

Michael D. Linn, Writing Studies, M

Associate Professor

Jonanthan B. Conant, Foreign Languages and Literatures, M
Milan Kovacovic, Foreign Languages and Literatures, M
Krista S. Twu, English, M

Assistant Professor

Chongowon Park, Writing Studies, AM

Graduate students may elect linguistics—which is offered interdepartmentally and through the Program in Linguistics—as a related field, or, with approval of the director of graduate studies of the major, as a designated minor.

Minor Requirements

The minor in linguistics requires a minimum of 6 credits selected from ANTH 4628—Language and Culture (3 cr), ENGL 5811—Introduction to Modern English (4 cr), ENGL 5821—History of the English Language (4 cr), LING 5195—Special Topics (3 cr), LING 5802—Applied

Linguistics (4 cr), LING 5852—Practicum in Teaching Linguistics (3 cr), LING 8500—Graduate Seminar (3 cr), and LING 8591—Independent Study in Linguistics (1–3 cr).

Microbiology

See Cooperative Programs.

Music M.M.

Plan B

Director of Graduate Studies: Professor Judith Kritzmire

Contact Information—Department of Music, University of Minnesota Duluth, 231 Humanities Building, 1201 Ordean Court, Duluth, MN 55812 (218-726-8207; fax 218-726-8210; mu@d.umn.edu; www.d.umn.edu/music/degree/index.html).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Professor

Ann C. Anderson, AM
Judith Ann Kritzmire, M2
Thomas J. Wegren, M
Mark E. Whitlock, M2
Stanley R. Wold, M2

Associate Professor

Jeanne A. Doty, M2
Ryan J. Frane, M
Rudy Perrault, M2
Justin H. Rubin, M2
Theodore A. Schoen, M

Assistant Professor

Jefferson T. Campbell, M2
Rachel L. Inselman, AM
Jean R. Perrault, AM
Tina L. Thielen-Gaffey, AM

The master of music program offers students an opportunity to acquire advanced understanding and skills in music education theory and practice or in musical performance. Through a comprehensive curriculum, students in both emphases undertake core courses in musicianship, theory, history, research, and education/pedagogy. Additional courses in the area of specialization are specified relative to the interests and objectives of the student.

Prerequisites for Admission

Applicants must have an undergraduate degree in music. A GPA of 3.00 or higher is strongly preferred.

Special Application Requirements

In addition, the following must be submitted for review by the music graduate committee: 1) a completed Department of Music Graduate Study Application; 2) a sample of professional writing (a three- to five-page paper addressing current issues in music education or music performance); 3) two letters of reference from professional colleagues and/or supervisors describing the candidate's potential for success in the graduate music program; and 4) an entrance performance audition on the major instrument. Music Education candidates may elect to substitute a DVD or videotape of classroom teaching or conducting. Candidates seeking admission as a vocal performer must demonstrate foreign language proficiency or enroll in remedial courses.

M.M. Degree Requirements

The M.M. Plan B in music education and performance emphases each require 30 credits. The music education emphasis requires 14 credits in music education/education, 8 credits in the related field of music, 6 credits for the Plan B paper, and 2 elective credits.

The performance emphasis requires 14 credits in performance/pedagogy (includes recital credit), 8 credits in music theory and literature, 6 credits in research/foundations courses, 2 elective credits, and a solo recital. The recital fulfills the Plan B project requirement.

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

Language Requirements—None.

Final Exam—A comprehensive final examination is required. An oral examination must also be completed in music education (Plan B Thesis) or performance (recital literature).

Pharmacology

See Cooperative Programs.

Physics M.S.

Plan A and Plan B

Director of Graduate Studies: Associate Professor Alec Habig

Contact Information—Department of Physics, University of Minnesota Duluth, 371 Marshall W. Alworth Hall, 1023 University Drive, Duluth, MN 55812 (218-726-7124; fax 218-726-6942; phys@d.umn.edu; www.d.umn.edu/~jmaps/gradpgm.html).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Professor

Bo Casserberg (emeritus), AM2
John R. Hiller, M2
Thomas F. Jordan (emeritus), AM2
Michael Sydor, M2

Associate Professor

Alec T. Habig, M2

Assistant Professor

Jay A. Austin, M2
Sergei Katsev, M2
Jonathan Maps, M2

The master of science program provides a grounding in the fundamentals of physics, combined with significant research involvement. The primary areas of research are computational physics, high-energy neutrino physics, experimental work in condensed-matter physics, and observational and theoretical work in physical limnology.

Prerequisites for Admission

An undergraduate degree in physics or the equivalent is required.

Special Application Requirements

Three letters of recommendation are required for assistantship support.

M.S. Degree Requirements

The master of science degree is offered under both Plan A and Plan B. All students take 11 credits in a common core of courses (including PHYS 5501, 5511, 5521; and 2 credits in 5090), 3 credits in a methods course (PHYS 5052 or 5053 or 5061), and 6 credits in a minor or related field. Plan A also requires 10 thesis credits. Plan B requires one or more projects for a total of 120 hours of work, preparation of a written report for each project, and 10 additional course credits in physics. These courses may include 4xxx courses if appropriate and if approved for graduate credit; for distinctly interdisciplinary programs, the courses may be outside physics. In all cases, the overall plan of study and selection of elective courses must form a coherent program and be approved by the director of graduate studies.

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 which no more than 1 credit can be from PHYS 5090.

Physiology

See Cooperative Programs.

Social Work M.S.W.

Plan B (coursework only)

Director of Graduate Studies: Professor Dennis R. Falk

Contact Information—Department of Social Work, University of Minnesota Duluth, 220 Bohannon Hall, 1207 Ordean Court, Duluth, MN 55812 (218-726-7245; fax 218-726-7185; sw@d.umn.edu; www.d.umn.edu/sw).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Professor

Priscilla A. Day, M2
Dennis R. Falk, M2
Melanie F. Shepard, M2

Associate Professor

Lynn Ellen H. Bye, M2
R. Michael Raschick, M2

Assistant Professor

Evie Campbell, M2
Johanna M. Garrison, M2
Janet M. Haynes, M2
Ann Tellett, M2

Instructor

Kathleen V. Heltzer, M2

The master of social work (M.S.W.) program offers a concentration in advanced generalist practice that prepares students to practice in a variety of human service settings. Graduates undertake a variety of professional social work roles ranging from counselor and case manager to community organizer and administrator. The curriculum has a special focus on services to American Indians and their communities. Coursework is also available in the area of child welfare practice. The M.S.W. program is accredited by the Council on Social Work Education.

Prerequisites for Admission

Applicants should have a bachelor's degree from a regionally accredited college or university. This degree should include a solid background in the liberal arts, as evidenced on the transcript by courses in the arts, cultural studies, and behavioral and social sciences. Applicants should be knowledgeable about diverse cultures, social problems, social conditions, and the social, psychological, and biological determinants of human behavior. Applicants with undergraduate degree majors in social work or a related field or discipline are given preference over applicants with other majors.

Special Application Requirements

Completion of at least 15 semester credits in two or more social science disciplines, such as sociology, psychology, economics, anthropology, or political science is required, as well as strong academic preparation as demonstrated by a preferred minimum undergraduate GPA of 3.00.

Applicants should show potential to contribute to the social work profession. Preference is given to applicants with professional experience in human service settings, particularly when this experience involves working with underrepresented and protected classes.

Enrollment Prerequisites—Admitted applicants must complete a college-level biology course with content on human anatomical and physiological development and a college-level statistics course. The biology course must be completed before registering for the first semester in the M.S.W. program, and the statistics course must be completed before registering for the first research course. Interested persons can apply and be admitted before completing the enrollment prerequisites.

Advanced Standing—Applicants with a bachelor of social work degree from a program accredited by the Council on Social Work Education may apply for admission to the advanced standing program. All other applicants are ineligible for this program.

Degree Requirements

The M.S.W. requires 51 credits (34 credits for students admitted with advanced standing), including a minimum of 41 credits in social work courses (28 credits for advanced standing students), a master's project and final examination. The program requires two field placements in human service agencies (one field placement for students with advanced standing). A minimum GPA of 3.00 for courses included in the degree program is required. A level of personal and professional competence, as indicated by social work course and field placement evaluations, is required. Inclusion of 4xxx courses on degree programs forms is subject to adviser and director of graduate studies approval.

Language Requirements—None.

Final Exam—None.

All-University Programs

Integrated Biosciences M.S. and Ph.D.

Director of Graduate Studies: Professor George Trachte

Contact Information—Integrated Biosciences Graduate Program, University of Minnesota, 162 Medical School Duluth, 1035 University Drive, Duluth, MN 55812 (218-726-6898; fax: 218-726-8152; ibs@d.umn.edu; www.d.umn.edu/ibs).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Professor

Mustafa N. al'Absi, Behavioral Sciences, SM
Matthew T. Andrews, Biology, M2
Gregory J. Beilman, Surgery, Twin Cities, SM
Yosef Cohen, Fisheries, Wildlife, and Conservation Biology, Twin Cities, M2
Timothy P. Craig, Biology, M2
Lester R. Drewes, Biochemistry and Molecular Biology, SM
Barbara A. Elliott, Family Medicine and Community Health, SM
Goran B. Hellekant, Physiology and Pharmacology, M2
Lois J. Heller, Physiology and Pharmacology, M2
Randall E. Hicks, SM
Alan B. Hooper, Biochemistry, Molecular Biology and Biophysics, Twin Cities, M2
John J. Pastor, Biology, SM
Joseph R. Prohaska, Biochemistry and Molecular Biology, SM
Jean F. Regal, Biochemistry and Molecular Biology, SM
George J. Trachte, Pharmacology, M2
Kendall B. Wallace, Biochemistry and Molecular Biology, M2

Adjunct Professor

Janet R. Keough, Biology, AM2
Carl Richards, Biology, M2

Associate Professor

Gerald T. Ankley, Fisheries, Wildlife, and Conservation Biology, Twin Cities, SM
Edgar Arriaga, Chemistry, Twin Cities, SM
Benjamin L. Clarke, Medical Microbiology and Immunology, M2
Haim Einat, Pharmacy, SM
Julie R. Etterson, Plant Biology, SM
Janet L. Fitzakerley, Pharmacology, M2
Jon M. Holy, Anatomy and Cell Biology, SM
Allen Mensinger, Biology, SM
Ayman M. Noreddin, Pharmacy, SM

Adjunct Associate Professor

M. K. Froberg, Pathology and Laboratory Medicine, M2

Assistant Professor

Grant W. Anderson, Pharmacy, SM
Lucia P. Barker, Medical Microbiology and Immunology, M2
Bjoern Bauer, Pharmacy, M2
Steven M. Berry, Chemistry and Biochemistry, SM
Clay J. Carter, Biology, SM
Stephanie J. Guildford, Biology, M2
Marshall E. Hampton, Biology, M2
Anne Hinderliter, Chemistry and Biochemistry, M2
Tim L. Kroft, Biology, SM
Venkatram R. Mereddy, Chemistry and Biochemistry, M2
Glenn R. Nordehn, Family Medicine, M2
Teresa Rose-Hellekant, Physiology and Pharmacology, M2
Jon N. Rumbley, Chemistry and Biochemistry, SM
Gregory Rutkowski, Chemical Engineering, M2
Patricia M. Scott, Biochemistry and Molecular Biology, M2

Adjunct Assistant Professor

Joseph L. Johnson, Chemistry and Biochemistry, SM

Senior Research Associate

Richard P. Axler, NRRI, SM
Subhash C. Basak, NRRI, M2
Donn K. Branstrator, NRRI, M2
Brian H. Hill, NRRI, ASM
George E. Host, NRRI, SM
Thomas R. Hrabik, NRRI, SM
Lucinda B. Johnson, NRRI, SM
John R. Kelly, NRRI, ASM
David R. Mount, NRRI, ASM
Gerald J. Niemi, NRRI, SM

Research Associate

Valerie J. Brady, NRRI, M2
Sigmund J. Degitz Jr., NRRI, AM2
Rodney D. Johnson, NRRI, AM2
Ron Moen, NRRI, M2
Euan D. Reavie, NRRI, M2
Patrick K. Schoff, NRRI, M2

The all-university integrated biosciences graduate program offers study toward the doctor of philosophy (Ph.D.) degree and master of science (M.S.) degree under Plan A (coursework and original thesis). The program has two areas of emphasis: cell, molecular, and physiological (CMP) biology and ecology, organismal, and population (EOP) biology.

M.S. and Ph.D. Prerequisites for Admission

Undergraduate admission standards for the M.S. and Ph.D. graduate program in Integrated Biosciences include a Bachelor's degree or equivalent from an accredited college or university in the biological or physical sciences or a related field. Background in a wide variety of subdisciplines is appropriate preparation for the Integrated Biosciences Graduate program. Examples include, but are not limited to: biochemistry, botany, cell biology, developmental biology, ecology, evolution, genetics, immunology, limnology, microbiology, molecular biology, neuroscience, physiology, and zoology.

Applicants with a GPA of 3.00 or better and 60th percentile placement in the GRE general test are preferred. Applicants for whom English is not a native language should submit TOEFL, MELAB, or IELTS scores whose standards are those of the U of M Graduate School (www.grad.umn.edu/prospective_students/application_information/TOEFL.html).

No single deficiency automatically disqualifies an application from being considered. Applicants deficient in some requirements may be admitted with the provision that specific courses are completed within the first year of the program. Coursework used to make up deficiencies may not be applied toward fulfillment of the graduate degree.

M.S. and Ph.D. Special Application Requirements

The GRE test is required. Applicants with a GPA of 3.00 or better and 60th percentile placement in the GRE general test are preferred. Applicants for whom English is not a native language should submit TOEFL, MELAB, or IELTS scores whose standards are those of the U of M Graduate School (www.grad.umn.edu/prospective_students/application_information/TOEFL.html).

M.S. and Ph.D. Degree Requirements:

The following comprises the core curriculum for all IBS students pursuing either a M.S. or Ph.D. degree: IBS 8011—Integrated Biological Systems, IBS 8012—Integrated Evolutionary Processes, IBS 8099—The Biological Practitioner, STAT 5411—Analysis of Variance, IBS 8020—IBS Colloquia (2 semesters), and IBS 8030—IBS Research Club (4 semesters).

M.S. and Ph.D. Language Requirements: None

M.S. and Ph.D. Minor Requirements for Students Majoring in Other Fields: No minor is available in the Integrated Biosciences graduate program.

M.S. Plan A

M.S. Admission Standards

Additional recommended undergraduate courses for applicants pursuing the M.S. degree include one year each of chemistry, biology, and physics. One semester of calculus is also recommended. Applicants are strongly encouraged to have taken other advanced courses in chemistry, biology, additional calculus, and introductory statistics.

M.S. Degree Requirements

Students must complete at least 14 course credits in the major; a minimum of 6 credits of electives in another graduate program or programs (for a minor or related field) or in the IBS emphasis other than that which comprises the major program; and at least 10 thesis credits. Students must designate one of the areas of emphasis in the second semester of their first year.

M.S. Final Exam: Students must present a department seminar and pass a final oral exam.

Ph.D.

Ph.D. Admission Standards

Additional recommended undergraduate courses for applicants pursuing the Ph.D. degree include one year each of chemistry, biology, physics, calculus, and advanced chemistry. One semester (minimum) of statistics is also recommended.

Additional recommended courses for students in the EOP emphasis include one year of calculus, one semester each of ecology and evolutionary biology along with one course in two of the following subjects: genetics, cell biology, biochemistry.

Additional recommended courses for students in the cell, molecular and physiological (CMP) emphasis include one year of organic chemistry plus one course in each of the following: genetics, cell biology and biochemistry.

Ph.D. Degree Requirements

Students must complete at least 14 course credits in the major; a minimum of 6 credits of electives in another graduate program or programs (for a minor or related field) or in the IBS emphasis other than that which comprises the major program; and at least 10 thesis credits. Students must designate one of the areas of emphasis in their second semester.

Ph.D. Written Preliminary Examination

In addition to completing the curriculum for the major and internal related fields, students will be required to pass both a written and oral preliminary examination prior to completing the Ph.D. program. The preliminary written examination will be administered once the student has completed the majority of the required coursework. This will typically occur in the summer of the second year. The written examination will consist of a completed NIH or NSF grant application for the student's proposed research project. The project will be evaluated by the Thesis Examining Committee, which will also serve as the student's Final Oral Examining Committee to provide continuity of advice during the length of the student's research program.

Ph.D. Oral Preliminary Examination

The oral preliminary examination will be administered within two months of the successful completion of the preliminary written examination. The examination will be administered by the graduate faculty according to Graduate School regulations and all students will be required to pass the oral examination to continue in the Ph.D. program. Within one semester of passing the preliminary oral examination, each Ph.D. student must file a Thesis Proposal Form with the Graduate School.

Ph.D. Final Oral Defense

Most students will complete the requirements for the Ph.D. degree within five years. Evaluation of the final oral defense will be conducted by the graduate faculty according to Graduate School regulations. It will consist of a public seminar presented by the student, followed by a closed examination with the student's examining committee.

Toxicology M.S. and Ph.D.

M.S. Plan A and Plan B

Associate Director of Graduate Studies: Professor Kendall Wallace

Contact Information—Toxicology Graduate Program, Medical School Duluth, 162 SMed, 1035 University Drive, Duluth, MN 55812 (218-726-6354; fax: 218-726-8014; toxgrad@d.umn.edu; www.d.umn.edu/medweb/toxicology).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Professor

Yusuf J. Abul-Hajj, Medicinal Chemistry, Pharmacognasy, Twin Cities, SM
David R. Brown, Veterinary and Biomedical Sciences, Twin Cities, SM
Robert M. Carlson, Chemistry and Biochemistry, SM
Lester R. Drewes, Biochemistry and Molecular Biology, SM
Vincent F. Garry, Jr., Laboratory Medicine/Pathology, Twin Cities, SM
Patrick E. Hannah, Medicinal Chemistry, Pharmacognasy, Twin Cities, SM
Michael J. Murphy, Veterinary Population Medicine, Twin Cities, SM
Joseph R. Prohaska, Biochemistry and Molecular Biology, SM
Jean F. Regal, Biochemistry and Molecular Biology, SM
W. Thomas Shier, Medicinal Chemistry, Pharmacognasy, Twin Cities, SM
Lawrence P. Wackett, Biotechnology Institute, Twin Cities, SM
Kendall B. Wallace, Biochemistry and Molecular Biology, SM

Adjunct Professor

Anthony Kiorpes, Veterinary Population Medicine, Twin Cities, ASM

Associate Professor

Gerald T. Ankley, Fisheries, Wildlife, and Conservation Biology, Twin Cities, AM2
Yinduo Ji, Veterinary and Biomedical Sciences, Twin Cities, SM
Ayman M. Noreddin, Pharmacy, SM
Mark S. Rutherford, Veterinary and Biomedical Sciences, Twin Cities, SM
Ashok K. Singh, Veterinary Population Medicine, Twin Cities, SM

Assistant Professor

Robert T. Cormier, Biochemistry and Molecular Biology, SM

Adjunct Assistant Professor

Hillary M. Carpenter, Environmental Health Sciences, Twin Cities, AM2
John W. Nichols, Pharmacology, AM2
Geary W. Olsen, Environmental Health Sciences, Twin Cities, AM2
Robert Roy, Environmental Health Sciences, Twin Cities, AM2

Senior Research Associate

Subhash C. Basak, NRRI, AM2
Gerald J. Niemi, NRRI, SM

This University-wide program provides comprehensive training in the broad scope of toxicology. Toxicology, the science of poisons, is devoted to identifying and quantifying potential noxious agents in our environment. Although most chemical agents at sufficiently large doses may be toxic, not all present a significant risk to human health or to environmental organisms or ecosystems. Accordingly, the essence of the science of toxicology is defining the fine line that distinguishes a risk from a residue. To accomplish this requires scientific expertise in such areas as analytical and environmental chemistry, biology, and mathematics. Advanced courses and research are also available in such subdisciplines as human health risk assessment, epidemiology, environmental chemistry and engineering, ecotoxicology, food additives and nutritional toxicology, biochemical and physiological mechanisms, histopathology, diagnostic and analytical toxicology, drug metabolism, chemical carcinogenesis, behavioral toxicology, and the toxicity of noxious agents to various organ systems (e.g., nervous, heart, liver, kidneys).

Prerequisites for Admission

Applicants must have a bachelor's degree or its foreign equivalent from a recognized college or university. At least a full year each of biology, organic chemistry, and physics, as well as mathematics through calculus are expected.

Special Application Requirements

GRE General Test scores are required; international students must also submit TOEFL scores.

M.S. Degree Requirements

The master of science degree is offered under Plan A and Plan B. Plan A requires 22 course credits and 10 thesis credits; Plan B requires 30 course credits. A core curriculum of 8 credits in toxicology (TXCL 8012, 8013, and 8100) is required for both plans. Additional courses are arranged on an individual basis.

Language Requirements—None.

Final Exam—The final exam is oral.

Ph.D. Degree Requirements

The doctor of philosophy degree requires core courses in physiology (4 credits), biochemistry (6 credits), statistics (2 credits), and toxicology (10 credits). Students must also complete 12 credits in a minor or supporting program and 24 thesis credits. Because the program spans the Duluth and Twin Cities campuses, the required courses differ on each campus.

Additional advanced courses in toxicology or related fields may be specified by the adviser. Students must complete and defend an original research project.

Minor Requirements for Students Majoring in Other Fields—A minor is available at the doctoral level and requires 12 credits—8 credits of core courses and 4 credits of advanced toxicology courses.

Water Resources Science M.S. and Ph.D.

M.S. Plan A and Plan B

Associate Director of Graduate Studies: Associate Professor Josef P. Werne

Contact Information—Water Resources Science Graduate Program, 205 RLB, 2205 E. 5th St., Duluth, MN 55812 (218-726-7435; fax: 218-726-6979; **wrs@umn.edu**; **www.wrs.umn.edu**).

For latest graduate faculty listings, see **www.grad.umn.edu/faculty_rosters/faculty.html**.

Professor

E. Calvin Alexander, Jr., Earth Science, Geology and Geophysics, Twin Cities, SM
Dorothy H. Anderson, Forest Resources, Twin Cities, SM
Roger E. Arndt, Civil Engineering, Twin Cities, SM
John M. Baker, Soil, Water, and Climate, Twin Cities, SM
Marvin E. Bauer, Forest Resources, Twin Cities, SM
Jay Bell, Soil, Water, and Climate, Twin Cities, SM

David D. Biesboer, Plant Biology, Twin Cities, SM
Stephen A. Bortone, Biology, SM
Patrick L. Brezonik, Civil Engineering, Twin Cities, SM
Kenneth N. Brooks, Forest Resources, Twin Cities, SM
Erik T. Brown, Geological Sciences, SM
H. H. Cheng, Soil, Water, and Climate, Twin Cities, ASM
Charles J. Clanton, Bioproducts and Biosystems Engineering, Twin Cities, SM
Steve M. Colman, Geological Sciences, SM
James B. Cotner, Ecology, Evolution, and Behavior, Twin Cities, SM
K. William Easter, Applied Economics, Twin Cities, SM
Leonard C. Ferrington, Entomology, Twin Cities, SM
Efi Foufoula, Civil Engineering, Twin Cities, SM
Susan M. Galatowitsch, Horticultural Science, Twin Cities, SM
Philip J. Gersmehl, Geography, Twin Cities, SM
Florence K. Gleason, Plant Biology, Twin Cities, SM
John S. Gulliver, Civil Engineering, Twin Cities, SM
Satish C. Gupta, Soil, Water, and Climate, Twin Cities, SM
Robert E. Hecky, Biology, SM
Randall E. Hicks, Biology, SM
Miki Hondzo, Civil Engineering, Twin Cities, SM
Emi Ito, Earth Science, Geology and Geophysics, Twin Cities, SM
Thomas C. Johnson, Geological Sciences, SM
Nicholas R. Jordan, Agronomy and Plant Genetics, Twin Cities, SM
Mary H. Meyer, Horticulture, Twin Cities, SM
John F. Moncrief, Soil, Water, and Climate, Twin Cities, SM
Howard D. Mooers, Geological Sciences, SM
D. J. Mulla, Soil, Water, and Climate, Twin Cities, SM
Ed Nater, Soil, Water, and Climate, Twin Cities, SM
Raymond M. Newman, Fisheries, Wildlife, and Conservation Biology, Twin Cities, SM
Chris Paola, Earth Science, Geology and Geophysics, Twin Cities, SM
John J. Pastor, Biology, SM
Jim A. Perry, Fisheries, Wildlife, and Conservation Biology, Twin Cities, SM
Hans-Olaf Pfannkuch, Earth Science, Geology and Geophysics, Twin Cities, SM
David G. Pitt, Landscape Architecture, Twin Cities, SM
Alan S. Polasky, Ecology, Evolution, and Behavior, Twin Cities, SM
Carl J. Rosen, Soil, Water, and Climate, Twin Cities, SM
Michael J. Sadowsky, Soil, Water, and Climate, Twin Cities, SM
Ingrid E. Schneider, Forest Resources, Twin Cities, SM
Mark W. Seeley, Soil, Water, and Climate, Twin Cities, SM
Peter W. Sorenson, Fisheries, Wildlife, and Conservation Biology, Twin Cities, SM
Fotis Sotiropoulos, Civil Engineering, Twin Cities, SM
Susan G. Stafford, Forest Resources, Twin Cities, SM
Heinz G. Stefan, Civil Engineering, Twin Cities, SM
Robert W. Sterner, Ecology, Evolution, and Behavior, Twin Cities, SM
Deborah L. Swackhamer, Environmental Health Sciences, Twin Cities, SM
Michael Sydor, Physics, SM
Harvey Thorleifson, Earth Science, Geology and Geophysics, Twin Cities, SM
Vaughan R. Voller, Civil Engineering, Twin Cities SM
Bruce N. Wilson, Bioproducts and Biosystems Engineering, Twin Cities, SM

Adjunct Professor

Janet R. Keough, Biology, AM2
Carl Richards, Biology, SM
Carlisle F. Runge, Forest Resources, Twin Cities, SM
Bruce Vondracek, Fisheries, Wildlife, and Conservation Biology, Twin Cities, SM

Associate Professor

Todd W. Arnold, Fisheries, Wildlife, and Conservation Biology, Twin Cities, SM
William Arnold, Civil Engineering, Twin Cities, SM
Randal J. Barnes, Civil Engineering, Twin Cities, SM
Christina Gallup, Geological Sciences, SM
Timothy J. Griffis, Soil, Water, and Climate, Twin Cities, SM
Sarah E. Hobbie, Ecology, Evolution, and Behavior, Twin Cities, SM
Frances R. Homans, Applied Economics, Twin Cities, SM
Raymond N. Hozalski, Civil Engineering, Twin Cities, SM
Katherine Klink, Geography, Twin Cities, SM
Timothy M. LaPara, Civil Engineering, Twin Cities, SM
Kristopher McNeill, Chemistry, Twin Cities, SM
Elizabeth C. Minor, Chemistry and Biochemistry, SM
Laura R. Musacchio, Landscape Architecture, Twin Cities, SM
Kristen C. Nelson, Forest Resources, Twin Cities, SM
John L. Nieber, Bioproducts and Biosystems Engineering, Twin Cities, SM
Paige J. Novak, Civil Engineering, Twin Cities, SM
Gary R. Sands, Bioproducts and Biosystems Engineering, Twin Cities, SM
Matt Simcik, Environmental Health Sciences, Twin Cities, SM
Steven P. Sternberg, Chemical Engineering, SM
Jeffrey S. Strock, Soil, Water, and Climate, Twin Cities, M2
John B. Swenson, Geological Sciences, SM
Steven J. Taff, Applied Economics, Twin Cities, SM
Josef P. Werne, Chemistry and Biochemistry, SM
Tongxin Zhu, Geography, M2

Adjunct Associate Professor

David Fulton, Fisheries, Wildlife, and Conservation Biology, Twin Cities, SM
Naomi Zeitouni, Applied Economics, Twin Cities, SM

Assistant Professor

Jay A. Austin, Large Lakes Observatory, M2
Dennis R. Becker, Forest Resources, Twin Cities, M2
Jacques Finlay, Ecology, Evolution, and Behavior, Twin Cities, M2
Jeffrey A. Gralnick, Biotechnology Institute, Twin Cities, SM
Karen B. Gran, Geological Sciences, M2
Stephanie J. Guildford, Biology, SM
Kimberly Hill, Civil Engineering, Twin Cities, SM
Qiuqiong Huang, Applied Economics, Twin Cities, M2
Sergei Katsev, Physics, M2
Joe Knight, Forest Resources, Twin Cities, M2
Katsumi Matsumoto, Earth Science, Geology and Geophysics, Twin Cities, M2
Lee Penn, Chemistry, Twin Cities, SM
Fernando Porte-Agel, Civil Engineering, Twin Cities, SM
Anthony C. Runkel, Earth Science, Geology and Geophysics, Twin Cities, AM2
Martin O. Saar, Earth Science, Geology and Geophysics, Twin Cities, M2
Sangwon Suh, Bioproducts and Biosystems Engineering, Twin Cities, SM
Brandy M. Toner, Soil, Water, and Climate, Twin Cities, M2

Adjunct Assistant Professor

James Almendinger, Fisheries, Wildlife, and Conservation Biology, Twin Cities, AM2
Paul D. Capel, Civil Engineering, Twin Cities, ASM
Karlyn Eckman, Forest Resources, Twin Cities, M2
Mark Edlund, Earth Science, Geology and Geophysics, Twin Cities, ASM
Mindy L. Erickson, Bioproducts and Biosystems Engineering, Twin Cities, AM2
Carrie E. Jennings, Geology and Geophysics, Twin Cities, AM2
Joe Magner, Fisheries, Wildlife, and Conservation Biology, Twin Cities, ASM
Tyson Ochsner, Soil, Water, and Climate, Twin Cities, ASM
Pamela Rice, Soil, Water, and Climate, Twin Cities, AM2
Edward B. Swain, Fisheries, Wildlife, and Conservation Biology, Twin Cities, AM2

Senior Research Associate

Richard P. Axler, NRRI, SM
Paul R. Bloom, Soil, Water, and Climate, Twin Cities, SM
Donn K. Branstrator, NRRI, SM
Brian H. Hill, NRRI, ASM
George E. Host, NRRI, SM
Thomas R. Hrabik, NRRI, SM
Lucinda B. Johnson, NRRI, SM

Research Associate

Valerie J. Brady, NRRI, M2
Daniel R. Engstrom, Earth Science, Geology and Geophysics, Twin Cities, ASM
Lorin K. Hatch, Fisheries, Wildlife, and Conservation Biology, Twin Cities, AM2
Euan D. Reavie, NRRI, M2

Senior Fellow

Larry Baker, Water Resources Center, SM

Along with the program-specific requirements listed on the following pages, please read the general information listed at the beginning of this section for Graduate School requirements that apply to all major fields.

Curriculum—This cross-campus interdisciplinary program provides comprehensive training in water resources science, with integration across scientific disciplines. A structured interdisciplinary graduate curriculum is offered. The program includes a set of core courses plus electives in the following areas of emphasis at the M.S. and Ph.D. levels: aquatic biology, environmental chemistry, hydrologic science, limnology, water management technology, water policy, water quality, and watershed science and management. Approximately 80 courses offered within 15 other graduate programs are available to students majoring in water resources science.

The goal of the program is to produce scientists with strong technical skills in disciplines relevant to water resources and a broad understanding of 1) the hydrologic cycle and associated ecosystems, 2) the interconnectedness of the sciences involved in managing aquatic resources, and 3) the interplay between the biophysical sciences and social sciences in developing and implementing public policies related to water.

The program involves faculty from the following departments on the Twin Cities campus: Applied Economics; Bioproducts and Biosystems Engineering; Civil Engineering; Ecology, Evolution, and Behavior; Entomology; Environmental and Occupational Health; Fisheries, Wildlife, and Conservation Biology; Forest Resources; Geography; Horticultural Science; Geology and Geophysics; Microbiology, Plant Biology; Soil, Water, and Climate; and the Humphrey Institute of Public Affairs. It also involves faculty from the following departments on the Duluth campus: Biology, Chemical Engineering, Chemistry, Geography, Geological Sciences, Physics, and Political Science, as well as the Large Lakes Observatory and the Natural Resources Research Institute in Duluth.

Prerequisites for Admission

The program is flexible enough to accommodate students from a variety of backgrounds. Normally students have a bachelor's degree in physical or biological science or engineering. Recommended academic preparation includes one year (or two semesters) each of calculus, physics, and chemistry; and one biology course. Further preparation may be expected from students wishing to specialize in certain areas of the program. Students who do not have a master's degree in a related subject are admitted to the M.S. program first, even if their long-term goal is a Ph.D. Availability of funding and willingness of a member of the graduate faculty to serve as an advisor are important criteria for admission to the Ph.D. program.

Special Application Requirements

Letters of recommendation are required. These letters should be from professors qualified to estimate applicant's class rank and evaluate their ability to complete a program of graduate study, or from persons who can assess their professional or research potential. These letters also may be used in applying for financial aid. Instructions for arranging the submission of letters are provided in the online application system.

Applicants must also submit a résumé of their academic history and professional experience and a statement of purpose, including the proposed area of emphasis. Applicants should submit results of the GRE; only rarely, under extenuating circumstances, will students be considered for admission without GRE scores. Students may be admitted any semester but are strongly encouraged to begin fall semester and to submit their application by January 1 in the year they expect to begin their studies.

Courses—Please refer to Water Resources Science (WRS) in the course section of this catalog for courses pertaining to the program. Check the program Web site at **www.wrs.umn.edu** for additional course information.

Use of 4xxx Courses—Use of 4xxx courses is permitted for degree requirements based on approval by the advisor and the director of graduate studies.

M.S. Degree Requirements

Students may choose Plan A, which requires a thesis, or Plan B, which requires additional coursework and a major project. Both plans incorporate courses offered on the Twin Cities and Duluth campuses.

Students must complete courses in four core areas: 1) hydrology (surface and/or hydrogeology); 2) environmental/water chemistry; 3) limnology; and 4) water resources policy, economics, and management, and two electives in such areas of emphasis as aquatic biology, hydrologic science, watershed science and management, and water management technology. One elective must be from an approved list of technical courses dealing with water quality science/management. A minimum of two supporting courses (at least 6 credits) outside of aquatic science also are required. Training in responsible conduct of research and ethics is also required. Approved core and area of emphasis courses are listed on the program Web site at www.wrs.umn.edu.

A minimum of 20 course credits (plus 10 thesis credits) are required for Plan A and a minimum of 30 credits are required for Plan B (up to 3 credits may be used for the Plan B project). Students who had classes equivalent to those in the WRS core as undergraduates may substitute other classes to meet the Graduate School minimum credit requirements.

Language Requirements—None.

Final Exam—The final exam is oral.

Minor Requirements for Students Majoring in Other Fields—A master's minor requires 9 credits, including WRS 5101 (3 credits) or in Duluth, POL 4201 (4 credits) and two of the other core courses described under M.S. degree requirements.

Ph.D. Degree Requirements

Coursework is tailored to student interests, and many areas of emphasis are possible. Core courses are offered on both the Twin Cities and Duluth campuses.

Students complete coursework equivalent to that of an M.S. in water resources science, with additional coursework in an area of emphasis. There are no specific credit requirements in the major, but Ph.D. programs normally include at least 40 course credits beyond the B.S. level, including relevant coursework taken for a master's degree and a required minimum of 12 credits in a minor or supporting program.

Language Requirements—None.

Minor Requirements for Students Majoring in Other Fields—Doctoral students must complete 12 credits, including WRS 5101 (3 credits) or in Duluth, POL 4201 (4 credits), a core courses described under the M.S. degree requirements, and two electives from one of the areas of emphasis.

Cooperative Programs

Biochemistry, Molecular Biology, and Biophysics M.S. and Ph.D.

M.S. Plan A

Associate Director of Graduate Studies: Professor Lester R. Drewes

Contact Information—Department of Biochemistry and Molecular Biology, University of Minnesota, 251 School of Medicine, 1035 University Drive, Duluth, MN 55812 (218-726-7922).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

The UMD Department of Biochemistry and Molecular Biology faculty participate fully in the University's biochemistry, molecular biology, and biophysics graduate program (www.med.umn.edu/duluth/about/BMB.html). Students are subject to the same entrance and degree requirements as all other University biochemistry graduate students. Up to two semesters of coursework on the Twin Cities campus may be required for doctoral students, depending on their needs and interests. Postdoctoral students are welcome and find favorable opportunities for continued research. Teaching and research assistantships are available to some students through the department as a form of financial aid.

Cellular and Integrative Physiology M.S. and Ph.D.

M.S. Plan A

Associate Director of Graduate Studies: Associate Professor Lorentz Wittmers

Contact Information—Director of Graduate Studies, Department of Physiology and Pharmacology, University of Minnesota, 308 & 345 School of Medicine, 1035 University Drive, Duluth, MN 55812 (218-726-7934; phsl@d.umn.edu; www.med.umn.edu/duluth/about/Phys_Pharm/home.html).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

Advanced degrees in physiology at the University of Minnesota can be earned through the cellular and integrative physiology graduate program. The Department of Physiology and Pharmacology on the Duluth campus, in cooperation with the Department of Physiology on the University's Minneapolis campus, offers a course of study leading to a master's degree in several areas of physiology. A doctoral degree can be pursued on the UMD campus as well.

On the UMD campus, opportunities exist to pursue studies in cardiovascular, muscle, neurophysiology, respiratory, and endocrine physiology; mammary physiology and disease; as well as in membrane transport, temperature regulation, and certain areas of neuroscience.

All course requirements for the master of science degree can be completed on the UMD campus. Students are expected to complete degree requirements over a period of two calendar years. The master's degree program requires at least 20 semester credits in physiology and 6 semester credits in a minor or related field of study. Fulfillment of master's degree requirements also includes the presentation and defense of a thesis and the completion of 10 thesis credits. Advanced physiology courses as well as research projects leading to the doctorate degree are available on the UMD campus. However, students are required to complete a portion of their doctoral course requirements (typically two semesters) from selections offered on the Twin Cities campus.

Microbiology, Immunology, and Cancer Biology M.S. and Ph.D.

M.S. Plan A

Contact Information—Microbiology, Immunology, and Cancer Biology Program, University of Minnesota, MMC 196, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-624-5947; fax 612-626-0623; micab@umn.edu).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

This program is associated with the graduate program in microbiology on the Twin Cities campus. Preparative coursework is offered primarily on the Twin Cities campus and can be completed in one year. Thesis research is conducted in molecular genetics, bacteriology, virology, mycology, or immunology.

Pharmacology M.S. and Ph.D.

M.S. Plan A

Associate Director of Graduate Studies:
Associate Professor Janet L. Fitzakerley

Contact Information—Department of Physiology and Pharmacology, University of Minnesota, 308 and 345 School of Medicine, 1035 University Drive, Duluth, MN 55812 (218-726-8512; phclgrad@umn.edu; www.pharmacology.med.umn.edu).

For latest graduate faculty listings, see www.grad.umn.edu/faculty_rosters/faculty.html.

This program is associated with the graduate program in pharmacology on the Twin Cities campus. All requirements for the master of science degree can be completed on the Duluth campus. Up to two semesters of coursework on the Twin Cities campus may be required for doctoral students. Courses and research provide opportunities for training in biochemical and physiological pharmacology, immunopharmacology, and toxicology. All students complete coursework in biochemistry, physiology, and statistics, as well as the major courses in pharmacology. In general, applicants should be well grounded in chemical and biological sciences and mathematics. Applicants must submit GRE General Test scores. Financial aid in the form of research assistantships is available through the department. When applying, students should specify whether they are applying for the master's or doctorate program at UMD. Applications and information may be obtained from the associate director of graduate studies, Department of Physiology and Pharmacology, University of Minnesota Medical School Duluth, Duluth, MN 55812.

Collegiate Graduate Programs

Master of Advocacy and Political Leadership M.A.P.L.

Director: Wy Spano
214 Cina Hall
Web site: www.d.umn.edu/~maplwww/

For information about the master of advocacy and political leadership (M.A.P.L.) degree program, see College of Liberal Arts in the Colleges and Schools section of this catalog or write to the program director, 112 Cina Hall.

Master of Education M.Ed.

Director: To be announced
120 Bohannon Hall
Web site: www.d.umn.edu/cehsp/GradProg

For information about the master of education (M.Ed.) degree program, see College of Education and Human Service Professions in the Colleges and Schools section of this catalog, or write to the program director, 125 Bohannon Hall.

Master of Environmental Health and Safety M.E.H.S.

Director: To be announced
229 Voss Kovach Hall
Web site: http://mehs.d.umn.edu

For information about the master of environmental health and safety (MEHS) degree program, see Swenson College of Science and Engineering in the Colleges and Schools section of the catalog, or write to the program director, 229 Voss-Kovach Hall.

Master of Special Education M.Sp.Ed.

Director: Joyce Strand
125 Bohannon Hall
Web site: www.d.umn.edu/cehsp/GradProg

For information about the master of special education (M.Sp.Ed.) degree program, see College of Education and Human Service Professions in the Colleges and Schools section of this catalog, or write to the program director, 125 Bohannon Hall.