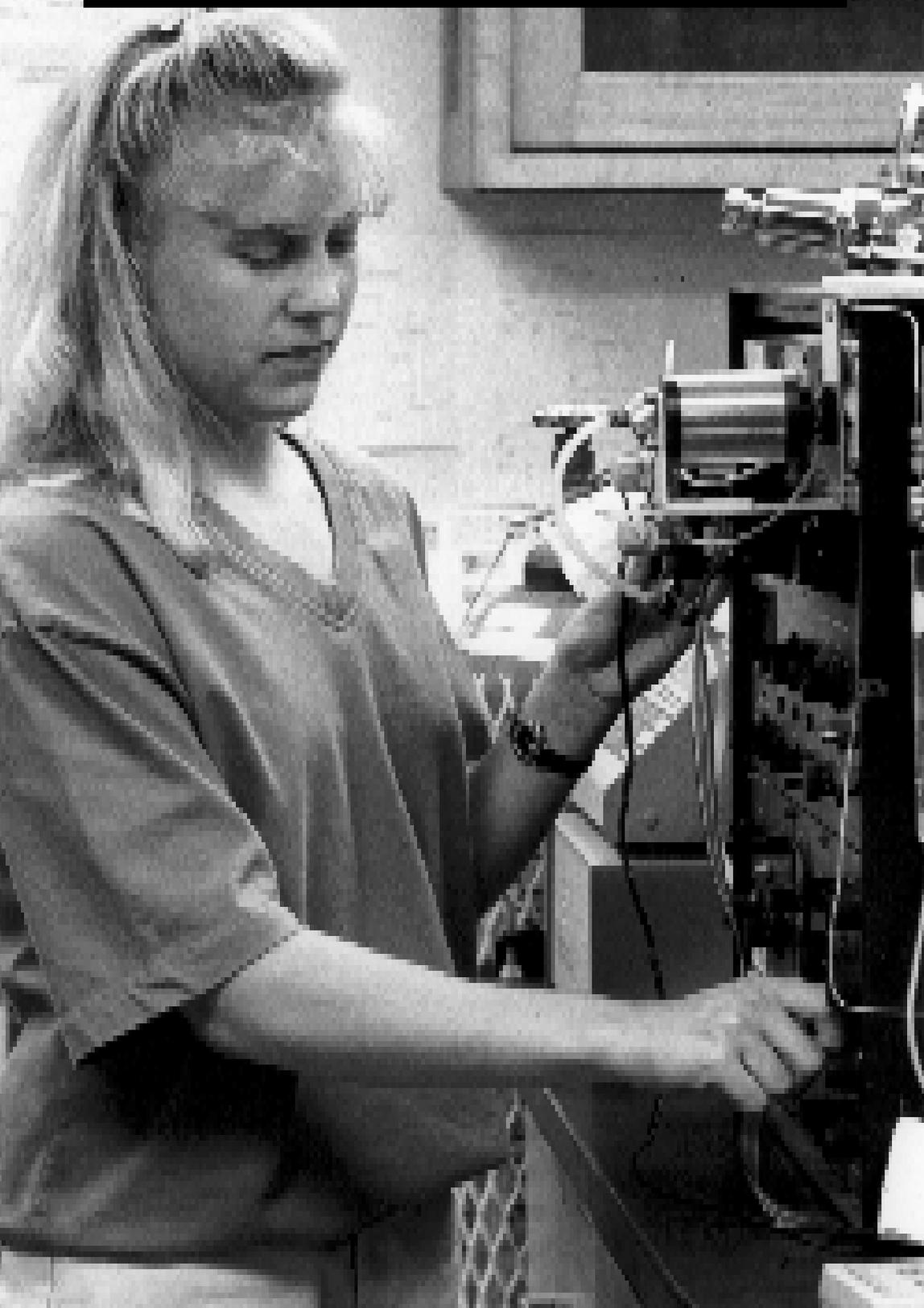


Graduate School



This is the Graduate School section of the 1997-1999 University of Minnesota, Duluth Catalog

## Graduate School

The UMD Graduate School offers programs for the *master of arts* degree in art (emphases in art studies and studio art), communication disorders, educational psychology (emphasis in counseling), and English.

The Graduate School offers programs leading to the *master of science* degree in applied and computational mathematics, biology, chemistry, computer science, geology, and physics. In addition, the master of business administration degree, master of music, master of social work degree, and master of liberal studies degree are offered.

All-University M.S./Ph.D. programs in 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 the graduate programs of their related departments on the Twin Cities campus. Cooperative programs offered at both the master's and doctoral levels include biochemistry, interdisciplinary archaeological studies, microbiology, pharmacology, and physiology. Cooperative arrangements offered solely at the doctoral level include chemistry and geology.

### 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 dean of the Graduate School 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 dean of the Graduate School. 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.

University of Minnesota undergraduates who have no more than 9 quarter credits or two courses to complete for the bachelor's degree (including both distribution and total credit requirements), if they are admitted, may

register in the Graduate School to begin a graduate program while simultaneously completing their baccalaureate work. Before registering in the Graduate School, students must have the minimum number of credits required for their undergraduate degree.

The Graduate School faculty and staff encourage applications from persons of color or other groups that have been underrepresented in the student body. The Graduate School is committed to providing equal opportunity to all who seek access to its programs, facilities, and services; establishing fair educational standards and applying them equitably in making decisions about admission and academic standing; and helping to compensate for inequities in society.

### Application Fee

For *each* program, the Graduate School application fee is \$40 for U.S. applicants and \$50 for foreign applicants. This fee is subject to change. The most detailed and up-to-date information about the fee is included in the instructions that accompany the Graduate School Application for Admission.

### Transcripts

Two copies of official transcripts of all previous academic study must be submitted. Also, 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 three sets of official credentials when preparing their application for admission: one to be submitted with the application, one for permanent filing in the Graduate School office, and the other for personal use.

### International Applicants

All international applicants are required to submit complete credentials. Details on the types of transcripts required are given in the Graduate School Application for Admission instructions.

### GMAT

All applicants in business administration must take the Graduate Management Admission Test (GMAT) and must request that an official report

of the results be sent to the Graduate School from the Educational Testing Service as part of the application for admission to graduate work in that field. Since this test is given at limited times and places during the year, applicants are advised to register early for the examination. For more information, contact the Educational Testing Service, Box 6000, Princeton, NJ 08541-6000.

## 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, biology, computer science, educational psychology, English, geology, and music. International applicants who are applying for assistantships from any science program not listed here are also strongly urged to submit general test scores in support of their application. Arrangements to take these tests can be made through the Educational Testing Service, Box 6000, Princeton, NJ 08541-6000 USA.

## TOEFL

The operational standard for admission to the Graduate School is a score of 550 on the Test of English as a Foreign Language (TOEFL); individual programs may require a higher TOEFL score. This test is required of all international applicants whose native language is not English, except those who will have completed 24 quarter credits (16 semester credits) in residence as a full-time student at a recognized institution of higher learning in the United States before entering the University of Minnesota. This requirement will not be waived. Information can be obtained by writing TOEFL, Box 899, Princeton, NJ 08541-6155. If the TOEFL is not available in your country, you may substitute only the Michigan English Language Assessment Battery (MELAB). 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.

## Additional Information

The Graduate School and individual programs within it reserve the right to request additional information in any case in which it is believed necessary.

## Application Procedure

Requests for application materials must be sent to the Graduate School, 431 Darland Administration Building, University of Minnesota, Duluth, MN 55812. Requests should specify the applicant's proposed major field, degree objective, and desired date of entry. Requests can also be entered at <http://www.d.umn.edu/grad/> on the World Wide Web.

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 quarter .....	July 15
Winter quarter .....	October 1
Spring quarter .....	January 15
Summer session, first term .....	May 1
Summer session, second term .....	June 1

Deadlines that occur on a holiday or weekend will be extended through the next regular workday. 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 bulletin 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 wish to enroll for a summer session or a single quarter in the Graduate School of the University of Minnesota 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 quarter or two consecutive summer terms. Students seeking visiting graduate status should request and complete the Visiting Application form available from the UMD Graduate School office, 431 Darland Administration Building. This form must be approved by the Graduate School before registering for classes.

### Academic Staff

University of Minnesota staff holding 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.

### Readmission, Change of Major or Degree Objective

Admitted students who have not registered in the Graduate School at least once a year 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 for at least one credit in the Graduate School. Students admitted to the Graduate School who fail to register for classes within one year of their admission date are also required to reapply for admission. Students who have completed a degree or certification program and who wish to take additional work in the Graduate School must apply for readmission. Students currently enrolled

who wish to change their major field or degree objective from that originally approved by the Graduate School must complete and submit a Change of Status form. 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 enrolled in the Graduate School on one campus who wish to complete their studies on another campus should complete and submit a Change of Status form.

### Registration

New graduate students must obtain directions for registration at the UMD Graduate School office. Graduate fees are listed in the General Information section of this bulletin.

### Registration Requirements

The University requires that graduate students holding appointments as teaching or research assistants or administrative fellows must register for at least six A-F or S-N credits in the Graduate School each term that an appointment is held. This does not apply to summer terms. Exceptions to this can be done via petition to the program's director of graduate studies. To be exempt from FICA withholding, a graduate assistant must also register for six 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. Active graduate students need not register for the sole purpose of taking final written or oral examinations for the master's degree or specialist certificate or for taking the preliminary written or oral examinations for the doctorate.

Candidates for master's degrees are not required to register for any specific number of quarters.

## Types of Registration

The two kinds 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 quarter during the academic year is 18; in a single term during the summer session, 11. Exceptions are granted by the Graduate School office 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 a minimum of 16 master's thesis credits (8777), and all students enrolled in a doctoral program must register for a minimum of 36 doctoral thesis credits (8888). Doctoral thesis credits can only be taken after the quarter 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 student 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 records of Graduate School students are available in UMD Registrar's Office, except for students who registered in the Graduate School summer session II, 1972 or earlier. The official records of these students are maintained in the Office of the Registrar, 150 Williamson Hall, University of Minnesota, 231 Pillsbury Drive S.E., Minneapolis, MN 55455.

## Changes in Registration

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

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

Students are not permitted to change their registration after the last day of instruction of a quarter and are not permitted to register for previous quarters.

## Rate Structure

Students registering for 1 through 6 credits (part time) do so on a per-credit basis. Students registering for 7 through 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, contact the UMD Office of Admissions for specific information.

## 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 and director of graduate studies of 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, the transfer of up to 40 percent of the degree coursework from other recognized graduate schools, or from adult special and University College status at the University of Minnesota, in any desired combination, is permitted. Individual graduate programs may, at their option, specify a lower percentage of coursework for transfer.

The work to be transferred must be postbaccalaureate graduate level that was taken for graduate credit and taught by faculty authorized to teach graduate courses. University College courses must bear the special UC transcript entry verifying that they were completed for graduate credit. Credits transferred from other institutions must appear on official graduate school transcripts of the institutions. Credit for courses completed through independent (correspondence) study, completed through extension or special categories at other institutions, or taken before the awarding of the baccalaureate, cannot be transferred.

Any transfer course which 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.

Assistantships (teaching and research) are normally granted through the individual departments and information can be obtained by writing to the director of graduate studies for the particular program. Graduate assistants on a 25 percent or greater appointment will receive free health and medical insurance coverage.

Some residence counseling positions may be available. For information, write directly 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.

## Two Degrees

Students may have a maximum of 9 credits in common between two Plan A master's degrees or a maximum of 12 credits between two Plan B master's degrees or between a Plan A and Plan B master's degree.

## Requirements for the Master's Degree

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 disorders, educational psychology, English, liberal studies, music, and social work. Applied and computational mathematics, biology, chemistry, computer science, geology, and physics majors may select either Plan A or Plan B.

## 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 and S-N. Except in 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 do so. If a course is retaken, all registrations for it will remain on the student's record.

## 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). Only 5xxx and 8xxx courses with grades of A, B, C, and S may be applied to a Graduate School degree program. Grades of A, B, C, 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 under the A-F system.

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 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 a minimum of 20 or more quarter credits in the major field, a minimum of 8 quarter credits in one or more related fields outside the major, and a minimum of 16 thesis credits (8777).

Students who wish to complete a designated minor (which will be certified on the transcript unlike the related fields option, which will not be) must complete 9 or more quarter 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 Program for the Degree*—After completing 15 credits, and ordinarily not later than the third quarter 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. Students list all coursework, completed and proposed, that will be offered to fulfill degree requirements, including transfer work. If a foreign language is required, the one to be offered is specified. If the degree is being completed under Plan A, students should also include the proposed thesis title. The members of a student's final examining committee (who are the thesis reviewers for Plan A) are appointed by the dean of the Graduate School 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, or graduation forms can be released to the student.

*Changes in the Program*—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 below 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 title is submitted for approval as part of the information provided on the student's official degree program form available from the UMD Graduate School office. The thesis title must be approved by the adviser. 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. Two copies are for the University library in Minneapolis, and one is for the Duluth campus library. The student's adviser(s) must sign all three 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.

The copies must be on 20-pound linen stock of 75 percent rag content. The original and two copies must contain all illustrative material. If photographs are included, all three 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.

*Registration of the Thesis*—Students are required to file the title of their thesis with the Graduate School before taking their oral examinations. They may obtain forms for this purpose in the UMD Graduate School office.

The thesis will be examined by a committee of not less than three members, appointed by the dean of the Graduate School 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 University of Minnesota 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 typed in its final form and should submit the Application for Degree form before the first working day of the month the candidate plans to graduate. Application for Degree forms must be obtained from the UMD Graduate School office. Three unbound copies of the thesis, including the original, must be submitted to the UMD Graduate School office by the last working day of the month of proposed graduation.

*Final Examinations*—Candidates for the master's degree, Plan A, 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. This examination 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 that is issued to the student when the form certifying the thesis is ready for defense is submitted. 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 a test of research interest and more adapted to individuals who will profit by 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 for a different purpose, but not on a different level, from that of Plan A.

Under Plan B, candidates for the master's degree must complete an approved program of coursework consisting of at least 44 quarter credits in graduate courses. At least 20 of the 44 credits must be in the major field, and at least 8 credits must be in one or more related field(s) outside the major. The remaining credits may be in either the major or related field(s). Normally it is expected that a majority of the credits in the program will be in the major field. These are minimum credit requirements, and some major fields require additional work.

After completing 15 credits, and ordinarily not later than the third quarter 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. Students list all coursework, completed and proposed, that will be offered to fulfill degree requirements, including transfer work. If a foreign language is required, the one to be offered is specified. The members of a student's final examining committee are appointed by the dean of the Graduate School 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, 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 9 or more quarter 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 will be 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 dean of the Graduate School upon recommendation of

the adviser and the director of graduate studies. The adviser is expected to contact the UMD Graduate School office before the student's final examination for the degree to obtain an Examination Report Form for use by the student's committee. The student will make available to the examining committee for its review, the projects prepared to fulfill the required 120 hours of effort, within an adequate period of time to allow for evaluation before the examination(s). A majority vote of the committee, all members present and voting, is required to pass. The vote is reported to the Graduate School on a form the student must obtain from the UMD Graduate School office before taking the examination. In case of failure, unanimous consent of the examining committee is required to retake the master's final examination, providing the reexamination is conducted by the original committee.

## 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 bulletin represent minimal requirements, and each program is free to set more specific terms by which progress will be measured for purposes of continuation. Notice of termination will be 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 form.

## Sexual Harassment

Please see Policies and Procedures for information on sexual harassment.

## Program Statements

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

General information concerning graduate work on the Duluth campus may be obtained from the Graduate School office. The University of Minnesota *Graduate School Bulletin* may be requested by writing to the Graduate School, 316 Johnston Hall, University of Minnesota, 101 Pleasant Street S.E., Minneapolis, MN 55455. The zip code of the recipient is required for mailing all bulletins.

## Applied and Computational Mathematics

M.S. (Plan A or B)

Associate Professor John R. Greene  
Director of Graduate Studies

This program is for those wishing to pursue careers using applied mathematics and statistics in science, industry, business, and teaching, and for those wishing to go on for a Ph.D. degree in mathematics or statistics. It emphasizes the use of modern modeling techniques and computational methods, with areas of concentration available in continuous modeling, discrete mathematics, and probability/statistics.

*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 3xxx-level prerequisites may make up deficiencies concurrently with graduate work.

Scores from the GRE General Test are required from all applicants. Students whose native language is not English must submit their TOEFL scores.

*Language Requirements*—None.

*Degree Requirements*—Students must complete 25 credits of approved mathematics or statistics courses or seminars. For Plan A, a thesis is required. For Plan B, a project is required, along with 16 additional credits from approved graduate

level mathematics or statistics or related courses. All master's students must demonstrate competence in the basic material through a written examination. Plan A students must also take a final oral examination on the thesis.

*Related Field or Minor Requirement*—Students must complete 8 additional credits in a related field(s) outside mathematics. (Statistics is considered a related field.) Plan A students may obtain a minor by completing 9 credits from an area outside mathematics or statistics.

## Art

*This program is not admitting new students. For current information, contact the Department of Art, 317 Humanities Building (218/726-8225 or art@d.umn.edu).*

M.A. (Plan B) (emphasis art studies)

M.A. (Plan B) (emphasis studio art)

Associate Professor James C. Klueg  
Director of Graduate Studies

*Prerequisites for Admission*—The normal prerequisites for admission to the degree program are an interest in the art-making process and an interest in art's cultural and historical importance. The candidate must have a B.A., B.S., or B.F.A. degree in art. Individuals with undergraduate degrees in other disciplines who have completed a substantial number of art courses may be considered for admission to the program. Deficiencies in undergraduate preparation may be made up concurrently with graduate work.

A portfolio of slides (15-20) of original work, or tapes and films of art activities, three letters of reference, and a letter of intent are required as part of the application. These should be sent or hand delivered to the director of graduate studies of the Department of Art when submitting the application form to the Graduate School office. The art department graduate applicant review committee recommends an on-campus interview with applicants when feasible.

*Emphasis Art Studies*—Candidates may focus on one studio area or pursue work in several related studio areas. Art history is part of the related field requirement, and other approved courses may be elected from such areas as the humanities or education or in internships in museum practice or

arts administration. Candidates will complete an approved 6-9 credit project and supporting paper, will participate in the graduate review studio sessions, and complete the oral examination. Full-time attendance for three quarters plus summer work is necessary in most cases to complete the M.A. emphasis in art studies. A minimum of 44 quarter credits is required in the following areas:

Major—Art Studies (20-29 cr)

Related Field(s)—Art History (9 cr) and 6-15 credits in approved courses in other related areas, including the final project and supporting paper.

*Emphasis Studio Art*—Candidates work under the direction of a faculty member in the appropriate studio area and with faculty having related expertise. Participation in the periodic graduate reviews, a satisfactory exhibition of the student's work in the Tweed Museum of Art, and completion of an approved supporting paper are major requirements for this emphasis. An oral examination covering coursework and the area of the supporting paper is the final step in completion of the degree. Full-time attendance for three quarters plus summer work is necessary in most cases to complete the M.A. emphasis in studio art.

A minimum of 44 quarter credits is required in the following areas:

Major—Studio Art (32 cr)

Related Field—Art History (12 cr)

Applicants seeking graduate teaching assistantships should complete an Assistantship Application Form and include this with the necessary supporting credentials sent to the director of art graduate studies.

## Biochemistry

See Cooperative Programs.

## Biology

M.S. (Plan A) in biology with areas of concentration in botany, zoology, environmental biology, cellular and physiological biology

M.S. (Plan B) in biology

Associate Professor David J. Schimpf  
Director of Graduate Studies

*Prerequisites for Admission*—Introductory biology plus at least 24 additional quarter credits of approved coursework in biology; a

sequence in inorganic chemistry; a sequence in organic chemistry; introductory calculus; and a sequence in general or introductory physics (or approved alternative courses in physical or analytical sciences).

Students with deficiencies may be admitted with the provision that equivalent coursework or approved substitutions be completed during the first year of graduate study.

As part of their application materials, applicants must also submit recent scores from the GRE General Test.

Prior coursework and/or GRE scores will be used to ascertain proficiency in the areas of general biology, genetics, cell biology, and ecology. Such proficiency will be considered in the admission deliberations.

*Language Requirement*—None.

*Degree Requirements*—In the major field for both Plan A and Plan B, 20 credits are required. Under Plan A, at least 15 of these credits must be from courses appropriate to the selected area of concentration. Final selection of courses for both plans will be made by the student in consultation with the advisement committee.

*Related Field or Minor Requirements*—An additional 8 credits must be completed in a related field(s), or a minimum of 9 additional credits in a single field that constitutes a minor.

*Other Requirements*—For Plan A, a thesis is required. For Plan B, additional credits to total 44 and the completion of one to three Plan B projects are required. For both plans, candidates must present a departmental seminar near the end of their studies and must successfully pass a final oral examination.

## Business Administration

M.B.A. (Plan B)

Professor Thomas B. Duff  
Director of Graduate Studies

*Prerequisites for Admission*—To be considered for admission to the M.B.A. program, applicants must have completed: a bachelor's degree from a recognized college or university; the Graduate Management Admission Test (GMAT); and education in financial reporting, analysis and markets, domestic and global

economic environments of organizations, creation and distribution of goods and services, and human behavior in organizations.

The bachelor's degree may be in any subject field, including the arts, business, education, engineering, or the social sciences. However, students who have had little or no undergraduate or other education in business administration are required to complete prerequisite or foundation courses in the areas of accounting, economics, finance, human resource management, information systems, marketing, operations, and organizational behavior and management. Completion of prerequisite courses to satisfy foundation area requirements must be completed before admission to the M.B.A. program. No graduate credit and no credit toward M.B.A. program requirements can be received for prerequisite courses.

*Language Requirement*—None.

*Degree Requirements*—A minimum of 45 quarter credits at the graduate level beyond the bachelor's degree and foundation coursework is required. All students complete an integrated core of 10 required courses totaling 30 quarter credits. In addition, students choose one of two options—course only or field research. The course-only option requires completion of a minimum of 15 quarter credits of electives at the graduate level beyond the integrated core. The field research option includes completion of a minimum of 9 credits of electives at the graduate level beyond the integrated core and completion of a 6-credit field research project. The research project is developed and carried out with the help of a three-person faculty committee and requires preparation and submission of a formal written description of the project and a final meeting with the faculty committee to discuss the project design, activities, findings, and conclusions.

## Chemistry

M.S. (Plan A or B)

Professor Donald P. Poe  
Director of Graduate Studies

*Prerequisites for Admission*—Applicants must have completed an undergraduate chemistry major, including a junior-senior level course in inorganic chemistry, one year of 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.

*Language Requirement*—None.

*Thesis Emphases*—For Plan A, emphases include analytical chemistry, biochemistry, inorganic chemistry, organic chemistry, and physical chemistry.

*Degree Requirements*—The specific program is designed to best serve the interests of the student. All students complete at least three of the five core courses: Chem 5710, 5720, 5730, 5740, and 5750.

*Other Requirements*—The final examination for both Plan A and Plan B is oral. For both plans, proficiency examinations must be taken before initial registration, and attendance and presentation at the chemistry seminar are required. For Plan B, preparation of three papers in the major and related fields is required.

## Communication Disorders

(Department of Communication Sciences and Disorders)

M.A. (Plan B)

Associate Professor Faith C. Loven  
Director of Graduate Studies

*Prerequisites for Admission*—Applicants must have completed a bachelor's degree in communication disorders or 50 quarter credits in speech/language pathology, audiology, speech/language/hearing science, or related areas. Three letters of recommendation evaluating the applicant's scholarship and clinical skill 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.

*Language Requirement*—None.

*Degree Requirements*—At least 53 credits in communication disorders are required. Those credits must include the following: CSD 5060, 5076, 5276, 5365, 5371, 5472 or 5476, 5500, 5505, 5575, 5600, 5956 (6 cr), 8100, 8176, 8205, 8305, and 3 credits of 8900.

*Related Field Requirements*—At least 8 credits of approved courses from related areas are required.

*Other Requirements*—Final written and oral examinations are required. Plan B projects are completed in conjunction with CSD 8900. All such projects must be pre-approved by the student's examination committee. Final approval of the Plan B project by the student's examination committee is also required.

Students wishing to obtain Minnesota licensure as a speech-language pathologist for school settings (prekindergarten to grade 12) must complete a preparation program approved by the Minnesota Board of Teaching. These students should consult the communication disorders program for further information. In addition, students wishing to be eligible for the American Speech, Language, and Hearing Association (ASHA) certificate of clinical competence must meet all ASHA course and clinical requirements.

Earning the degree involves completion of all required coursework with a GPA of at least 3.00, demonstration of satisfactory clinical skills in clinical practicum, satisfactory work on the Plan B research project, and acceptable performance on written and oral examinations. Students who do not meet these requirements may be prohibited from further registration.

## Computer Science

M.S. (Plan A or B)

Professor Carolyn J. Crouch  
Director of Graduate Studies

*Prerequisites for Admission*—It is desirable for applicants to have completed an undergraduate major in computer science; such students should be able to enroll immediately in the 8xxx computer science courses. Students with other backgrounds will be considered if they have completed the equivalents of the first-year sequence in computer science (CS 1621-1622-1623), machine language and organization (CS 3610), systems software (CS 3620), differential and integral calculus (Math 1296-1297), and either discrete mathematics (Math 3555) or a course in the mathematical underpinnings of computer science (CS 3710). Students who do not meet these requirements may be admitted provisionally and will be required to take specified courses before proceeding with their degree work. The GRE General Test is required of all applicants. The TOEFL is required of all international students.

*Language Requirement*—None.

*Degree Requirements*—At least 49 graduate credits are required, including 24 credits from 8xxx courses in computer science, 1 credit of CS 8900 seminar, and at least 8 credits from one or more related fields outside computer science.

*Additional Requirements*—Each student must present his or her Plan A thesis or Plan B project at a department colloquium. An oral examination by the student's committee follows this presentation. Plan A students are required to take 16 credits of CS 8777 (thesis). Plan B students are required to take a minimum of 16 credits in graduate-level computer science courses. All course selections are made by the student in consultation with his or her adviser, subject to approval by the director of graduate studies.

### Master of Education (M.Ed.)

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, or write to the director of the program, 221 Bohannon Hall.

## Educational Psychology

### M.A. (Plan B) (emphasis counseling)

Associate Professor Janine Watts  
Director of Graduate Studies

The graduate program in counseling is a two-year, full-time program leading to a master of arts degree in educational psychology. Students may prepare for a career in community counseling or school counseling. The program is accredited by the Council for Accreditation of Counseling and Related Educational Programs (CACREP). Therefore, graduates of both emphases qualify to take the National Certified Counselor (NCC) Examination.

*Prerequisites for Admission*—A minimum undergraduate GPA of 3.00 on a 4.00 point scale and a minimum of 9 quarter credits in psychology or education including an undergraduate inferential statistics course are required. Applicants must submit scores from the GRE General Test with minimum scores of 350 on the verbal and quantitative sections; scores of 500 on both sections

are preferred. A written statement providing evidence of social service or teaching experience and three recommendation forms are required. Applications should be submitted by March 15 for consideration for admission in the following fall quarter. Applications submitted after March 15 will be considered only if space is available.

*Language Requirement*—None.

*Degree Requirements*—The program requires 72 graduate credits, including 53-59 credits in core courses, a Plan B paper, a final oral examination, and three quarters of practicum.

Core courses include counseling theory, counseling skills, group procedures, ethics, developmental guidance, cross-cultural counseling, family counseling, learning, consultation, tests and measurements, statistics, and research methods. Licensure requirements differ so school counselors will be advised to take different electives than community counselors.

*Related Field Requirements*—At least 8 credits must be taken outside the psychology department.

*Other Requirements*—Students pursuing a career in community counseling who wish to obtain Minnesota licensure as a psychological practitioner should take psychology electives to prepare for the Minnesota Psychological Practitioner exam. Licensure requirements are subject to change; students should consult with the program director or their adviser for current provisions, including legal provisions. Obtaining licensure as a psychological practitioner is ultimately the student's responsibility.

Students pursuing a career in school counseling who wish to obtain Minnesota licensure at the elementary, middle, and/or secondary levels must either have a valid Minnesota teaching license and completed one year of teaching experience, both for the level of licensure desired, or substitute a one-year supervised school counseling internship for the teaching license and teaching experience. Licensure requirements also include legal provisions and are subject to change; consult with the program director for current requirements. After completing the coursework and internship or teaching experience, students are endorsed for school counselor licensure.

## English

M.A. (Plan B) with emphasis on literary studies

M.A. (Plan B) with emphasis on English studies

Professor William A. Gibson  
Director of Graduate Studies

The UMD English graduate program offers courses in British and American literature, creative writing, linguistics, composition and rhetorical theory, and English education. Students work closely with faculty in developing their own program of study through coursework, independent readings, and related research projects. The program has two master's tracks: a literary studies track, for concentrated study of literature and preparation for the Ph.D. in English, and an interdisciplinary English studies track for those who wish to teach English at the community college level.

*Prerequisites for Admission*—Students applying for admission to either of these programs must submit scores from the GRE General Test, two writing samples such as course papers, and three letters of recommendation. International applicants must submit TOEFL scores of at least 600. Entering students should have completed 44 quarter credits in English (these may include credits in literature, language, and advanced composition), including 28 upper division credits.

M.A. (Plan B) With Emphasis on Literary Studies

*Course Prerequisites*—Students must have completed or complete as graduate students upper division courses in Chaucer, Shakespeare, Milton, and the English language or English linguistics. Certain course prerequisites may be taken concurrently with graduate work and may be applied toward degree requirements.

*Language Requirement*—A reading knowledge of Latin, Greek, French, German, Italian, Spanish, Russian, or another approved language is required.

*Degree and Major Requirements*—A minimum of 44 credits is required. The major must have at least 36 credits, including 4 credits of English 8906 and 12 credits in English proseminars.

*Related Field Requirements*—Students must complete at least 8 credits in one or more related fields outside the major. Linguistics may be chosen as a related field or designated minor.

*Other Requirements*—Students must complete a two-day, six-hour written examination containing the following sections: analysis of text selected before the examination; discussion of questions on a reading list prepared by the candidate and approved by the examining committee; and discussion of questions dealing with a related field. A one-hour oral examination is also required.

Before taking the examination, students must submit Plan B papers (normally three) or projects totaling 120 hours of effort. These projects will normally be completed in connection with graduate courses in English or in a related field. A completed project must be approved by a graduate faculty member.

M.A. (Plan B)  
With Emphasis on English Studies

*Language Requirement*—Candidates may choose certification in a foreign language or complete 8 credits of graduate coursework in addition to the 44 required credits. Certification is gained by demonstrating reading knowledge of a foreign language appropriate for the candidate's area of study and approved by the English Graduate Committee. Candidates whose professional objectives are best served by completing the additional 8 credits will select graduate courses from literature and literary analysis, linguistics, rhetoric and composition, or graduate courses closely related to the degree field of concentration.

*Degree and Major Requirements*—A minimum of 44 credits is required. The major has 36 credits, consisting of 4 credits in Engl 8906; 8 credits in literature and literary analysis, including one proseminar; 8 credits in linguistics, including Ling 5842; 8 credits in rhetoric and composition; and 8 credits of English or composition electives at the 5xxx or 8xxx level. Students in residence during the regular academic year must take 12 credits in 8xxx courses.

*Related Field Requirements*—Students must complete at least 8 credits in one or more related fields outside the major. Linguistics may be chosen as a related field or designated minor.

*Other Requirements*—Students must complete a two-day, six-hour written examination containing the following sections: analysis of text selected before the examination; discussion of questions on a reading list prepared by the candidate and approved by the examining committee; and discussion of questions dealing with a related field. A one-hour oral examination is also required. The examination will test student knowledge in literature and literary analysis, linguistics, rhetoric and composition, and related field(s). The Plan B project's requirement is the same as that for the M.A. (Plan B) with emphasis on literary studies.

## Geology

M.S. (Plan A or B)

Associate Professor Penelope Morton  
Director of Graduate Studies

*Prerequisites for Admission*—Applicants must have completed an undergraduate major in geology, geophysics, or related earth science with one year each of college mathematics, including calculus, college chemistry, and college physics. A full-time geological field course of at least five weeks is also required. Scores from the GRE General Test are required.

*Language Requirement*—None.

*Requirements*—For Plan A, a thesis is required. For Plan B, acceptable papers are required. For both plans, a written candidacy examination during the second or third quarter of residency and final oral examinations are required.

## Master of Industrial Safety (M.I.S.)

For information about the master of industrial safety (M.I.S.) degree program, see College of Science and Engineering in the Colleges and Schools section, or write to the director of the program, 105 Voss-Kovach Hall.

## Interdisciplinary Archaeological Studies

See Cooperative Programs.

## Liberal Studies

M.L.S. (Plan B)

Professor James Fetzer  
Director of Graduate Studies

*Prerequisites for Admission*—M.L.S. program applicants must hold a baccalaureate degree from a recognized college or university.

The application should include a thoughtfully composed letter stating, in narrative form, reasons for wishing to pursue the M.L.S. and describing education and career experiences. This letter should be addressed to the Director of Graduate Studies, c/o the UMD Graduate School office.

*Language Requirement*—None.

*Degree Requirements*—Completion of 44 graduate credits, 20 of which fulfill core requirements and the remainder from approved electives. The individually designed plan of study can include graduate courses in the humanities, social sciences, and natural sciences meeting the personal and educational aims of the student.

*Core Requirements*—20 credits

IS 8001—Introduction to Liberal Studies (8)

IS 8500—Seminar: Ethics and the Human Condition (4)  
8 additional credits from any IS or HmCl 5xxx or 8xxx course

*Electives* (24 credits, minimum)—The balance of M.L.S. courses examine issues from the perspectives of various academic fields.

*Related Field Requirements*—Because the program is interdisciplinary and composed of courses from several departments, the related field requirement is waived.

*Other Requirements*—One to three research papers or projects in an approved area of interest must be submitted in addition to passing a final oral presentation/examination.

## Linguistics

Professor Michael D. Linn

Linguistics, offered interdepartmentally, may be elected by graduate students as a related field or, with approval of the director of graduate studies of the major, as a designated minor.

## Microbiology

See Cooperative Programs.

## Music

M.M. (Plan B) With Emphasis in Music Education

Professor Judith Kritzmire  
Director of Graduate Studies

This program offers the practicing music teacher an opportunity to acquire advanced understanding and skill in music education theory and practice. A course of study is designed to meet the interests and objectives of the student. While an undergraduate degree in music education is preferred, students with an undergraduate degree in music who wish to pursue teaching licensure are also considered for admission.

*Prerequisite for Admission*—Applicants must have completed an undergraduate degree in music. The GRE General Test is required and must be completed no later than the end of the first quarter of graduate study. Entrance examinations in music history, theory, and an entrance interview and performance audition are required; these may also be completed during the first quarter of study.

Students who wish to apply for the M.M. program should complete a Department of Music Graduate Study Application form (available from the Department of Music) in addition to the admission requirements of the Graduate School.

*Language Requirement*—None.

*Degree Requirements*—Completion of 45 graduate credits are required.

Music education/education (24)  
Plan B paper (Music Education) (9)  
Related Field Requirements (12)

## Pharmacology

See Cooperative Programs.

## Physics

M.S. (Plan A or B)

Assistant Professor Jonathan Maps  
Director of Graduate Studies

*Prerequisite for Admission*—An undergraduate degree in physics or the equivalent is required.

*Language Requirement*—None.

*Degree Requirements*—Students must complete at least 20 credits in six approved physics courses numbered above 5103, including at least 8 credits chosen from 5123 or 5124 or 5125 (no more than one of these three courses), and from 5109, 5166, 5174, 5176, 5177, and 5178. Students who propose a more interdisciplinary concentration (e.g., in geophysics or physical limnology) may plan different programs appropriate to their needs and interests with their faculty adviser; such programs require approval of the director of graduate studies.

*Related Field or Minor Requirements*—Students must complete 8 credits in a related field(s) outside of physics. They may include courses from more than one department; for example, courses in biology, chemistry, or geology may be used to provide an interdisciplinary approach to environmental problems. A student who wants to complete a traditional minor must earn a minimum of 9 credits in one department outside of physics.

*Other Requirements*—For Plan A, a thesis and final oral examination are required. For Plan B, 44 credits in graduate courses, a Plan B project consisting of the preparation of three papers in courses, and a final oral examination are required.

## Physiology

See Cooperative Programs.

## Social Work

M.S.W. (Plan B)

Professor Joyce M. Kramer  
Director of Graduate Studies

The master of social work program offers a concentration in advanced generalist practice. The curriculum provides students with an integrated professional knowledge base, which prepares them to practice in a variety of human service settings. The program prepares students for social work practice at the direct service, administrative, and community development levels; and involves such varied roles as counselor, advocate, broker,

teacher, mediator, and evaluator. The department has a strong commitment to recruiting students from underrepresented populations and has one of only a few M.S.W. programs in the nation that includes a special focus on American Indian social services. The M.S.W. program is accredited by the Council on Social Work Education.

#### *Prerequisites for Admission*

- 1) A bachelor's degree from a regionally accredited college or university. The bachelor's degree should include a solid background in the liberal arts, as evidenced on the transcript by courses in the arts, humanities, 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 will be given preference over applicants with other majors.
- 2) Completion of at least 18 semester credits (or 27 quarter credits) in two or more social science disciplines, such as sociology, psychology, economics, anthropology, or political science.
- 3) Strong academic preparation as demonstrated by undergraduate GPA.
- 4) Demonstrated interest in becoming a social worker is required. 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 quarter 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.

*Language Requirement*—None.

*Degree Requirements*—A total of 81 quarter credits of graduate-level work (51 quarter credits for students admitted with advanced standing) are required. A minimum of 69 credits must be completed in social work courses (45 for students with advanced standing).

*Related Field Requirements*—At least one graduate elective course from outside the Department of Social Work is required.

*Other Requirements*—Students in the 81-credit program are required to complete two field placements (480 hours each) in human service agencies. Advanced standing students are required to complete one field placement (480 hours). Student performance is reviewed annually. A minimum GPA of 3.00 is required for courses included on the student's official master's degree program. Plan B research projects are to be completed in conjunction with SW 8750. A final oral examination is required. A satisfactory level of personal and professional competence, as indicated by course and field placement evaluations, is required.

## Toxicology

M.S. (Plan A or B) only under special circumstances

Ph.D.

Associate Professor Jean F. Regal  
Associate Director of Graduate Studies

The all-University program in toxicology is an intercampus, multidisciplinary program encompassing both environmental and biomedical toxicology. Entering students may enroll either in the Twin Cities or Duluth and complete all requirements for the Ph.D. without relocating between campuses. The adviser to the thesis research is selected before completing the first year of studies and may be any of the graduate faculty on either the Twin Cities or Duluth campuses of the University of Minnesota. Every effort is made to ensure that each student enrolled in the program receives some form of financial assistance.

*Prerequisites for Admission*—Students must have earned a bachelor’s degree or its foreign equivalent from a recognized institution of higher education. A minimum of a full year each of biology, organic chemistry, and physics as well as mathematics through calculus is expected. The GRE General Test is also required of all applicants, and international students must submit their TOEFL scores.

*Language Requirement*—None.

*Degree Requirements*—Ph.D. students are required to successfully complete two quarters each of biochemistry and physiology, one quarter of biostatistics, three quarters of both principles in toxicology and toxicology seminars, and a single quarter of advanced toxicology. Ph.D. students are also required to complete 36 thesis credits and at least 18 credits of advanced graduate-level courses in a minor or supporting field.

*Other Requirements*—Doctoral students must successfully complete both a written and oral preliminary examination before submitting a doctoral thesis proposal. These examinations are administered by the graduate faculty after students complete the majority of the required courses. The final oral examination for the Ph.D. degree consists of the defense of the candidate’s research thesis or project.

## Water Resources Science

M.S. (Plan A or B)

Ph.D.

Professor Anne E. Hershey  
Associate Director of Graduate Studies

The all-University program in water resources science is an intercampus, multidisciplinary program encompassing water research and/or management. Graduates will gain technical skills in disciplines relevant to water resources, a holistic understanding of the hydrologic cycle and the interconnectedness of the sciences required to understand it, and an appreciation for the social dimensions of water resources, including the public policy and legal frameworks in which they are managed and protected. Entering students may enroll either in the Twin Cities or Duluth and complete all requirements for the M.S. without relocating

between campuses. Normally, Ph.D. students in Duluth need to spend one or more quarters on the Twin Cities campus.

*Prerequisites for Admission*—Students must have earned a B.S. degree in a physical or biological science or in engineering, with a minimum GPA of 3.00, and normally will have taken at least two courses each in calculus, chemistry, and physics and one course in biological sciences. 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. degree. The GRE General Test is recommended for all applicants.

*Language Requirement*—None.

*Degree Requirements*—The curriculum consists of a core of six courses (22-24 quarter credits), elective courses in one of three areas of specialization, coursework in a related field (M.S.) or supporting program (Ph.D.), and thesis credits. The core courses are in surface and groundwater hydrology, limnology, aquatic chemistry, technical aspects of water quality management, and policy, legal, and institutional aspects of water management.

*Other Requirements*—For the M.S. degree a final oral examination is required. For the Ph.D. degree, two preliminary examinations, one written and one oral, and a final oral examination are required.

## Cooperative Programs

### Biochemistry

M.S. (Plan A)

Ph.D.

Professor Lester R. Drewes  
Associate Director of Graduate Studies

Faculty of the UMD Department of Biochemistry and Molecular Biology participate fully in the University of Minnesota biochemistry graduate program. Students are subject to the same entrance and degree requirements as all other biochemistry graduate students of the University of Minnesota. All requirements for the M.S. degree can be completed with coursework on the Duluth campus. Up to three academic quarters of coursework on the Twin Cities campus may be

required for Ph.D. students, depending on their needs and interests. Postdoctoral students are welcome and will find favorable opportunities for continued research. Teaching and research assistantships are available to some students through the department as a form of financial aid.

### Interdisciplinary Archaeological Studies

M.A. (Plan A or B)

M.S. (Plan A or B)

Regents Professor George R. Rapp  
Associate Director of Graduate Studies

This interdisciplinary program is offered cooperatively with the graduate program in Interdisciplinary Archaeological Studies on the Twin Cities campus. Students combine archaeology with a related field such as geology, ecology, geography, ethnobotany, or ancient history. Certain UMD faculty supervise interdisciplinary archaeology students and the Archaeometry Laboratory at UMD is affiliated with this program.

### Microbiology

M.S. (Plan A)

Ph.D.

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. (Plan A)

Ph.D.

Associate Professor Edward T. Knych  
Associate Director of Graduate Studies

This program is associated with the graduate program in pharmacology on the Twin Cities campus. All requirements for the M.S. degree can be completed on the Duluth campus. Up to three academic quarters of coursework on the Twin Cities campus may be required for Ph.D. 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 results from the GRE General Test. Financial aid in the form of research assistantships is available through the department. When applying, students should specify that they are applying for the M.S. or Ph.D. program at UMD. Applications and information may be obtained from the Associate Director of Graduate Studies, Department of Pharmacology, University of Minnesota, Duluth, MN 55812.

### Physiology

M.S. (Plan A)

Ph.D.

Associate Professor Edwin W. Haller  
Associate Director of Graduate Studies

This program is part of the Cellular and Integrative Physiology graduate program located on the Twin Cities campus. Students may complete their M.S. studies on the Duluth campus. Students may enter and complete their doctoral studies on the Duluth campus with graduate faculty in the Department of Medical and Molecular Physiology; however, completion of the requirements for the doctoral degree will require study for at least two quarters on the Twin Cities campus or at an internationally recognized institution that strengthens their training program. Students can pursue studies in muscle, cardiovascular, respiratory, cellular, and endocrine physiology as well as membrane transport, neuroscience, and temperature regulation.