Twin Cities Campus
Biochemistry, Molecular Biology and Biophysics M.S.
Biochemistry, Molecular Biology, & Biophysics TCBS
Graduate School

Link to a list of faculty for this program.

Contact Information:
Department of Biochemistry, Molecular Biology and Biophysics
6-155 Jackson Hall
321 Church St. SE
Minneapolis, MN 55455
612-625-6100
Email: bmbbgp@umn.edu
Website: http://www.cbs.umn.edu/BMBB/graduate

- Program Type: Master’s
- Requirements for this program are current for Fall 2014
- Length of program in credits: 30
- This program requires summer semesters for timely completion.
- Degree: Master of Science

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

The Biochemistry, Molecular Biology and Biophysics (BMBB) graduate program is an interdisciplinary program that is supported by the College of Biological Sciences (CBS) and the Medical School of the University of Minnesota. The program provides a broad research-based education involving faculty from BMBB, as well as many faculty members from several other departments in CBS, the Medical School, the College of Science and Engineering (CSE), the College of Food, Agricultural and Natural Resources Sciences (CFANS), and the College of Veterinary Medicine.

BMBB focuses on determining the molecular mechanisms that underlie basic biological functions using an integrated approach that encompasses biochemistry, chemistry, biophysics, genomics, molecular biology, proteomics, and structural biology. Special emphasis is placed on revealing how biological processes go awry in diseases including cancer, diabetes, heart disease, and AIDS. The program has four areas of emphasis: synthetic biology and biotechnology, molecular biology, metabolic and systems biology, and chemical and structural biology. All students are expected to demonstrate a minimum level of competence in these areas but will emphasize the area most related to their thesis project.

While graduate training in a BMBB laboratory involves first-year coursework and associated preliminary examinations, the focal point for graduate education is thesis research. Laboratory-based exploration coupled with journal clubs, seminars, scientific meetings and retreats, career counseling and scientific ethics constitutes the major components of the program. Support for graduate education comes from a variety of sources but is augmented by several NIH and NSF-based training grants. Most graduate students from the University of Minnesota obtain full-time employment immediately after graduation or pursue advanced training in academic or corporate positions.

Students pursuing a degree in BMBB are only admitted to the PhD program (see note below) under the auspices of Molecular, Cellular and Structural Biology (MCSB), a first year program administered by BMBB and the Molecular, Cellular, Developmental Biology and Genetics (MCDB&BG) graduate programs. After the first year, students select either BMBB or MCDB&BG to complete their degree.

***Note: Pursuit of a Master's degree in BMBB is not an option at the point of admission. Students are only admitted to the BMBB PhD program. If you are interested in a Master's-only program, however, the Master of Biological Science (MBS) program is available for working professionals, including scientific staff working at the University of Minnesota. This program is offered through the College of Continuing Education (CCE) and is flexible with respect to time and focus of study. Please visit the program website for more information (http://www.cce.umn.edu/Master-of-Biological-Sciences/index.html).

Program Delivery
This program is available:
* via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
The program can accommodate for a variety of educational backgrounds. However, applications from students with an undergraduate degree in the biological, chemical, or physical sciences are encouraged.
The program can accommodate for a variety of educational backgrounds. However, applications from students with an advanced degree in the biological, chemical, or physical sciences are encouraged.

Other requirements to be completed before admission:
Recommended academic preparation includes one year each of calculus, organic chemistry, and basic biology, including biochemistry and genetics. For students of demonstrated ability, background deficiencies can be made up during the first year of graduate study.

Successful applicants must have previous research experience in an academic or industrial setting in addition to any course-related laboratory experiences. It is important to demonstrate familiarity with an aptitude for basic science research prior to embarking on a graduate career in this program.

***Note: Students are admitted only to the PhD program for BMBB (see additional note below).

Special Application Requirements:
Additionally, applicants must submit three letters of recommendation from persons familiar with their academic and research capabilities. A statement of interests and goals, a complete set of transcripts, and official scores from the General Test of the GRE are required. The GRE Subject Test in biochemistry, cell and molecular biology, biology, or chemistry is strongly recommended, but not required.

The deadline to submit a completed application is December 1. Completed files are reviewed between January and February. Graduate studies begin fall semester only.

***Note: Pursuit of a Master's degree in BMBB is not an option at the point of admission. Students are only admitted to the BMBB PhD program. If you are interested in a Master's-only program, however, the Master of Biological Science (MBS) program is available for working professionals, including scientific staff working at the University of Minnesota. This program is offered through the College of Continuing Education (CCE) and is flexible with respect to time and focus of study. Please visit the program website for more information (http://www.cce.umn.edu/Master-of-Biological-Sciences/index.html).

Applicants must submit their test score(s) from the following:

• GRE

Key to test abbreviations (GRE).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements
Plan A: Plan A requires 14 major credits, 6 credits outside the major, and 10 thesis credits. The final exam is oral.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 2.8 is required for students to remain in good standing.

Requirements for the Masters degree include core coursework, thesis credits, and laboratory experiences taken by all students as well as coursework in one of the four BMBB emphases: synthetic biology and biotechnology, molecular biology, metabolic and systems biology, or chemical and structural biology. Additionally, all students are expected to participate in the seminars involving student reports on current literature and research. A thesis based on original laboratory research is required.
Biochemistry, Molecular Biology and Biophysics Minor

Graduate School

Link to a list of faculty for this program.

Contact Information:
Department of Biochemistry, Molecular Biology and Biophysics
6-155 Jackson Hall
321 Church St. SE
Minneapolis, MN 55455
612-625-6100
Email: bmbbgp@umn.edu
Website: http://www.cbs.umn.edu/bmbb/graduate

- Program Type: Graduate minor related to major
- Requirements for this program are current for Fall 2014
- Length of program in credits (Masters): 6
- Length of program in credits (Doctorate): 12
- This program does not require summer semesters for timely completion.

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

The Biochemistry, Molecular Biology and Biophysics (BMBB) program is an interdisciplinary program that is supported by the College of Biological Sciences (CBS) and the Medical School of the University of Minnesota. The program provides a broad research-based education involving faculty from BMBB as well as many faculty members from several other departments in CBS, the Medical School, the College of Science and Engineering (CSE), the College of Food, Agricultural and Natural Resources Sciences (CFANS), and the College of Veterinary Medicine.

BMBB focuses on determining the molecular mechanisms that underlie basic biological functions using an integrated approach that encompasses biochemistry, chemistry, biophysics, genomics, molecular biology, proteomics, and structural biology. Special emphasis is placed on revealing how biological processes go awry in diseases including cancer, diabetes, heart disease, and AIDS. The program has four areas of emphasis: synthetic biology and biotechnology, molecular biology, metabolic and systems biology, and chemical and structural biology. All students are expected to demonstrate a minimum level of competence in these areas but will emphasize the area most related to their thesis project.

Program Delivery
This program is available:
- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements
Use of 4xxx courses towards program requirements is not permitted.

A master's minor requires 6 credits of general graduate level coursework which may be selected (with approval by the director of graduate studies) from the 5xxx and 8xxx courses offered by the program.

A doctoral minor requires BioC 8001 (3 cr) and BIOC 8002 (3 cr) plus additional BioC 5000 level and above courses (6 cr), approved by the director of graduate studies, to meet the minimum requirement of 12 credits total.

In extenuating cases, students may petition the director of graduate studies for substitution of a required course.
Twin Cities Campus
Biochemistry, Molecular Biology and Biophysics Ph.D.
Biochemistry, Molecular Biology, & Biophysics TCBS
Graduate School

Link to a list of faculty for this program.

Contact Information:
Department of Biochemistry, Molecular Biology and Biophysics
6-155 Jackson Hall
321 Church St. SE
Minneapolis, MN 55455
612-625-6100
Email: bmbbgp@umn.edu
Website: http://www.cbs.umn.edu/bmbb/graduate

- Program Type: Doctorate
- Requirements for this program are current for Fall 2014
- Length of program in credits: 48
- This program requires summer semesters for timely completion.
- Degree: Doctor of Philosophy

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

The Biochemistry, Molecular Biology and Biophysics (BMBB) graduate program is an interdisciplinary program that is supported by the College of Biological Sciences (CBS) and the Medical School of the University of Minnesota. The program provides a broad research-based education involving faculty from BMBB as well as many faculty members from several other departments in CBS, the Medical School, the College of Science and Engineering (CSE), the College of Food, Agricultural and Natural Resources Sciences (CFANS), and the College of Veterinary Medicine.

BMBB focuses on determining the molecular mechanisms that underlie basic biological functions using an integrated approach that encompasses biochemistry, chemistry, biophysics, genomics, molecular biology, proteomics, and structural biology. Special emphasis is placed on revealing how biological processes go awry in diseases including cancer, diabetes, heart disease, and AIDS. The program has four areas of emphasis: synthetic biology and biotechnology, molecular biology, metabolic and systems biology, and chemical and structural biology. All students are expected to demonstrate a minimum level of competence in these areas but will emphasize the area most related to their thesis project.

While graduate training in a BMBB laboratory involves first-year coursework and associated preliminary examinations, the focal point for graduate education is thesis research. Laboratory-based exploration coupled with journal clubs, seminars, scientific meetings and retreats, career counseling and scientific ethics constitutes the major components of the program. Support for graduate education comes from a variety of sources but is augmented by several NIH and NSF-based training grants. PhD graduates from the University of Minnesota obtain full-time employment immediately after graduation or pursue advanced training in academic or corporate postdoctoral positions.

Students pursuing the PhD are admitted to BMBB under the auspices of Molecular, Cellular and Structural Biology (MCSB), a first year program administered by BMBB and the Molecular, Cellular, Developmental Biology and Genetics (MCDB&G) graduate programs. After the first year, students select either BMBB or MCDB&G to complete their degree.

Related Ph.D. and M.S. Programs in BMBB:

As a part of the BMBB program, graduate studies leading to a PhD degree may be pursued on the Duluth Campus. A PhD in BMBB may also be obtained through the Combined MD-PhD Program. Please visit the program website for more information (http://www.med.umn.edu/mdphd/index.htm).

Note: Pursuit of a master's degree in BMBB is not an option at the point of admission. Students are only admitted to the BMBB PhD program. However, the Master of Biological Science (MBS) program is available for working professionals, including scientific staff working at the University of Minnesota. This program is offered through the College of Continuing Education (CCE) and is flexible with respect to time and focus of study. Please visit the program website for more information (http://www.cce.umn.edu/Master-of-Biological-Sciences/index.html).

Program Delivery
This program is available:
• via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
The program can accommodate for a variety of educational backgrounds. However, applications from students with an undergraduate degree in the biological, chemical, or physical sciences are encouraged.

The program can accommodate for a variety of educational backgrounds. However, applications from students with an advanced degree in the biological, chemical, or physical sciences are encouraged.

Other requirements to be completed before admission:
Recommended academic preparation includes one year each of calculus, organic chemistry, and basic biology, including biochemistry and genetics. For students of demonstrated ability, background deficiencies can be made up during the first year of graduate study.

Successful applicants must have previous research experience in an academic or industrial setting in addition to any course-related laboratory experiences. It is important to demonstrate familiarity with an aptitude for basic science research prior to embarking on a graduate career in this program.

Special Application Requirements:
Additionally, applicants must submit three letters of recommendation from persons familiar with their academic and research capabilities. A statement of interests and goals, a complete set of transcripts, and official scores from the General Test of the GRE are required. The GRE Subject Test in biochemistry, cell and molecular biology, biology, or chemistry is strongly recommended, but not required.

The deadline to submit a completed application is December 1. Completed files are reviewed between January and February. Graduate studies begin fall semester only.

Related Ph.D. and M.S. Programs in BMBB:
As a part of the BMBB program, graduate studies leading to a PhD degree may be pursued on the Duluth Campus. A PhD in BMBB may also be obtained through the Combined MD-PhD Program. Please visit the program website for more information (http://www.med.umn.edu/mdphd/index.htm).

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Applicants must submit their test score(s) from the following:
• GRE

Key to test abbreviations (GRE).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements
9 credits are required in the major.
15 credits are required outside the major.
24 thesis credits are required.

This program may not be completed with a minor.

Use of 4xxx courses towards program requirements is not permitted.

A minimum GPA of 3.00 is required for students to remain in good standing.

Requirements for the doctoral degree include core coursework, thesis credits, and laboratory experiences taken by all students as well as coursework in one of the four BMBB emphases listed below. To obtain a Ph.D degree, students must register for a minimum of 24 thesis credits (BioC 8888). Upon completion of the 24 thesis-credit requirement, students are required to register every fall and spring, up through the term they are awarded the Ph.D., for 1 credit of advanced doctoral credits (BioC 8444) in order to maintain full-time,
active student status.

Additional requirements for the PhD degree include seminar presentations, examinations, and teaching assignments. BioC 8084 is a weekly student seminar on current literature and research, and students must register for 1 credit of BioC 8084 each term until they have reached Advanced Doctoral Status. Students must attend at least 50% of weekly meetings for BioC 8084 and BioC 8184 which is a Departmental seminar involving prominent national and international scientists. Three examinations for the PhD degree include a written preliminary proposal (4th semester), preliminary oral exam (4th semester), and a final oral exam with thesis defense (typically year 5). Examinations will be conducted by the student's preliminary and graduate committees. Students are also required to complete two semesters of teaching, typically between years 2-4.

Biochemistry Core
To obtain a PhD in BMBB, all students must complete the biochemistry core coursework.
- **BioC 8001** - Biochemistry: Structure, Catalysis, and Metabolism (3.0 cr)
- **BioC 8002** - Molecular Biology and Regulation of Biological Processes (3.0 cr)
- **BioC 8401** - Ethics, Public Policy, and Careers in Molecular and Cellular Biology (1.0 cr)

Laboratory and Field Course
In August of the first year, all PhD BMBB students must register for this hands-on, intensive lab course which takes place at the Itasca Biological Station and Laboratories. This course will provide first-year students with exposure to a range of modern methods and model systems.
- **MCDG 8920** - Special Topics (1.0 - 4.0 cr)

Electives for Emphases
All students must complete 15 credits of coursework in one of the four BMBB emphases: synthetic biology and biotechnology, molecular biology, metabolic and systems biology, or chemical and structural biology. Students may choose from disciplines other than BMBB may be used to build a thesis in consultation with the student's advisor.
- **BioC 5352** - Biotechnology and Bioengineering for Biochemists (3.0 cr)
- **BioC 5361** - Microbial Genomics and Bioinformatics (3.0 cr)
- **BioC 8002** - Structure, Function, and Genetics of Bacteria and Viruses (4.0 cr)
- **GCD 8151** - Cell Structure and Function (3.0 cr)
- **BioC 8003** - Immunity and Immunopathology (4.0 cr)
- **BioC 8004** - Cellular and Cancer Biology (4.0 cr)
- **GCD 8131** - Advanced Genetics and Genomics (3.0 cr)
- **GCD 8008** - Mammalian Gene Transfer and Expression (2.0 cr)
- **PUBH 6450** - Biostatistics I (4.0 cr)
- **SB 8181** - Stem Cell Biology (3.0 cr)
- **STAT 5021** - Statistical Analysis (4.0 cr)
- **BioC 5528** - Spectroscopy and Kinetics (4.0 cr)
- **BioC 8411** - Introduction to Modern Structural Biology (4.0 cr)
- **BioC 5213** - Selected Topics in Molecular Biology (3.0 cr)
- **BioC 5444** - Muscle (3.0 cr)
- **BioC 5531** - Macromolecular Crystallography I: Fundamentals and Techniques (1.0 cr)
- **BioC 5532** - Macromolecular Crystallography II: Techniques and Applications (1.0 cr)
- **CHEM 8011** - Mechanisms of Chemical Reactions (4.0 cr)
- **CHEM 8021** - Computational Chemistry (4.0 cr)
- **CHEM 8411** - Introduction to Chemical Biology (4.0 cr)
- **CHEM 8412** - Chemical Biology of Enzymes (4.0 cr)
- **CHEM 8735** - Bioinorganic Chemistry (4.0 cr)
- **PHCL 5111** - Pharmacogenomics (3.0 cr)
- **PUBH 7445** - Statistics for Human Genetics and Molecular Biology (3.0 cr)
- **MICA 8010** - Microbial Pathogenesis (3.0 cr)
- **BioC 5216** - Current Topics in Signal Transduction (3.0 cr)
- **BioC 5527** - Introduction to Modern Structural Biology (4.0 cr)
- **BioC 5528** - Spectroscopy and Kinetics (4.0 cr)
- **CHEN 8754** - Systems Analysis of Biological Processes (3.0 cr)
- **BioC 5213** - Selected Topics in Molecular Biology (3.0 cr)
- **BioC 5444** - Muscle (3.0 cr)
- **BioC 5531** - Macromolecular Crystallography I: Fundamentals and Techniques (1.0 cr)
- **BioC 5532** - Macromolecular Crystallography II: Techniques and Applications (1.0 cr)
- **CHEM 8011** - Mechanisms of Chemical Reactions (4.0 cr)
- **CHEM 8021** - Computational Chemistry (4.0 cr)
- **CHEM 8411** - Introduction to Chemical Biology (4.0 cr)
- **CHEM 8412** - Chemical Biology of Enzymes (4.0 cr)
- **CHEM 8735** - Bioinorganic Chemistry (4.0 cr)
- **PHCL 5111** - Pharmacogenomics (3.0 cr)
- **PUBH 7445** - Statistics for Human Genetics and Molecular Biology (3.0 cr)
- **MICA 8010** - Microbial Pathogenesis (3.0 cr)
- **BioC 5528** - Spectroscopy and Kinetics (4.0 cr)
- **BioC 8411** - Introduction to Chemical Biology (4.0 cr)
- **BioC 8412** - Chemical Biology of Enzymes (4.0 cr)
- **BioC 8735** - Bioinorganic Chemistry (4.0 cr)
- **PHCL 5111** - Pharmacogenomics (3.0 cr)
- **PUBH 7445** - Statistics for Human Genetics and Molecular Biology (3.0 cr)
- **MICA 8013** - Translational Cancer Research (2.0 cr)
- **GRAD 8101** - Teaching in Higher Education (3.0 cr)
Twin Cities Campus
Bioethics M.A.
Bioethics, Center for
Graduate School

Link to a list of faculty for this program.

Contact Information:
Center for Bioethics, University of Minnesota, Suite N504 Boynton, 410 Church Street S.E., Minneapolis, MN 55455 (612-624-9440; fax: 612-624-9108)
Email: bthxed@umn.edu
Website: http://www.bioethics.umn.edu

- Program Type: Master's
- Requirements for this program are current for Fall 2014
- Length of program in credits: 30
- This program does not require summer semesters for timely completion.
- Degree: Master of Arts

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

The Center for Bioethics offers a Master of Arts (M.A., Plan A) degree with a major in Bioethics. The curriculum for this program includes a set of required core courses, the opportunity for study of electives in bioethics, as well as a requirement for coursework in other fields that are related to bioethics. Students will be required to write a master's thesis. Given the fundamentally interdisciplinary nature of bioethics, professional opportunities in the field are greatly enhanced for trainees with a graduate degree in bioethics as well as a terminal graduate or professional degree in another field - for example, degree combinations of an MA degree in Bioethics with another degree such as a JD, PhD, MD or others. This model prompts students to acquire a firm disciplinary grounding as well as interdisciplinary bioethics expertise, a practice which best prepares students for bioethics related career placement.

Program Delivery
This program is available:
- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
The preferred undergraduate GPA for admittance to the program is 3.00.

A bachelor's degree is required for admission.

Special Application Requirements:
Transcripts of all postsecondary academic work, a personal statement, a writing sample (preferably on a topic in bioethics), a description of research or relevant work experience, a C.V. or résumé, and at least three letters of reference are required. Applicants may also submit a statement on "Extenuating Circumstances" and "Diversity." See program website for more details.

Students are admitted to the Bioethics M.A. program for fall semester only. While the application deadline is April 30, applications are accepted as early as the fall semester prior to the proposed start of the student's M.A. program. Admissions decisions are made on a rolling basis, and preference is given to early applicants.

Students are encouraged to link their degree in bioethics to a degree in a related field (either before entering the bioethics M.A. program or at the same time). Given the fundamentally interdisciplinary nature of bioethics, prospective students are advised against viewing the bioethics M.A. as a stand-alone degree that prepares them for career placement. This model prompts students to acquire a firm disciplinary grounding as well as interdisciplinary bioethics expertise—a practice that best prepares students for bioethics-related career placement. Thus, the admissions process will give preference to students who have already earned or are in the process of earning an advanced degree in a related field, although this will not strictly be required for admission.

Applicants must submit their test score(s) from the following:
- GRE
- MCAT
- LSAT

International applicants must submit score(s) from one of the following tests:
• TOEFL
  - Internet Based - Total Score: 100
  - Paper Based - Total Score: 600

Key to test abbreviations (GRE, MCAT, LSAT, TOEFL).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements

Plan A: Plan A requires 14 major credits, 6 credits outside the major, and 10 thesis credits. The final exam is oral.

This program may be completed with a minor.

Use of 4xxx courses towards program requirements is not permitted.

A minimum GPA of 3.00 is required for students to remain in good standing.

Students in this Plan A (thesis-based) master's degree program are required to take at least 20 credits of courses: 9 credits of required courses including one course fulfilling an area requirement, 5 credits of bioethics electives, and 6 credits of electives from a related field. Details about curriculum can be found at www.ahc.umn.edu/bioethics/education/gradprogram/degreq/home.html. Elective courses must be chosen in consultation with the DGS or student's adviser to ensure their appropriateness for the student's course of study. Students may elect a graduate minor to fulfill their elective credits in a related field. However, students may also elect to take courses from different programs, for example, a health policy course from the School of Public Health and a health law course from the Law School.

Of the 20 total course credits required, at least one BTHX course and at least two courses total are to be taken at the 8xxx level. Thesis credits do not count toward this requirement.

Course Group 0

Joint- or Dual-degree Coursework: Joint Degree Program in Law, Health, and the Life Sciences. Student may take a total of 11 credits in common among the academic programs.
**Twin Cities Campus**

**Bioethics Minor**

*Bioethics, Center for Graduate School*

Link to a list of faculty for this program.

**Contact Information:**
Center for Bioethics, University of Minnesota, Suite N504 Boyton, 410 Church Street S.E., Minneapolis, MN 55455 (612-624-9440; fax: 612-624-9108)
Email: bthxed@umn.edu
Website: [http://www.bioethics.umn.edu](http://www.bioethics.umn.edu)

- Program Type: Graduate minor related to major
- Requirements for this program are current for Fall 2014
- Length of program in credits (Masters): 8
- Length of program in credits (Doctorate): 14
- This program does not require summer semesters for timely completion.

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

The Graduate Minor in Bioethics is designed for University of Minnesota students interested in deepening their knowledge of the ethical issues surrounding health and the life sciences. Students can explore their interests in bioethics while also earning a degree in their home discipline. Created by the Center for Bioethics in cooperation with the Department of Philosophy, the Graduate Minor program is administered by the Center for Bioethics and is open to students in many of the University's Master's or Doctoral degree programs. Some professional degree-seeking students may elect a minor as well. The University's policy states that MEd, MPH, MBA, MHA, MN, DNP, MOT, MPSE, MDH, MDT, MPS students may be eligible to pursue a minor. To be eligible, the degree program must offer the option to pursue a minor; please consult with your Director of Graduate Studies in your major field to determine if this option is open for you. At this time, students in first-professional programs (JD, MD, PharmD, DVM, DDS, and LLM) are not eligible for minors.

Enrollment in the Graduate Minor in Bioethics is contingent upon approval by the Director of Graduate Studies in Bioethics. Students work with the Director of Graduate Studies to tailor their minor program to their individual needs and interests.

**Program Delivery**

This program is available:

- via classroom (the majority of instruction is face-to-face)

**Prerequisites for Admission**

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

**Program Requirements**

Use of 4xxx courses towards program requirements is not permitted.

A doctoral student must complete a minimum of 14 graduate credits in bioethics offered outside the major field: 8 credits of required courses and 6 credits of electives. A master's student must complete a minimum of 8 graduate credits in bioethics offered outside the major field: 6 credits of required courses and 2 credits of electives. All students must take BTHX 5010 - Bioethics Proseminar and one moral theory course, preferably BTHX 5300 - Foundations of Bioethics. Courses should be chosen in consultation with the bioethics director of graduate studies. Courses that satisfy requirements and serve as electives can be found at [http://www.ahc.umn.edu/bioethics/education/graduate/home.html](http://www.ahc.umn.edu/bioethics/education/graduate/home.html).
Twin Cities Campus
Biomedical Informatics and Computational Biology M.S.  
R Bioscience/Biotechnology
Graduate School

Link to a list of faculty for this program.

Contact Information:
Biomedical Informatics and Computational Biology, 300 University Square, 111 South Broadway, Rochester, MN 55904 (507-258-8006; fax: 507-258-8066)
Email: bicbgrad@umn.edu
Website: http://www.r.umn.edu/academics-research/bicb

• Program Type: Master's
• Requirements for this program are current for Fall 2014
• Length of program in credits: 30
• This program does not require summer semesters for timely completion.
• The Biomedical Informatics and Computational Biology Program is an all-University program delivered on the Rochester and Twin Cities campuses. The University of Minnesota Twin Cities is the degree-granting authority for delivery of the Biomedical Informatics and Computational Biology Program in Rochester.
• Degree: Master of Science

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

The graduate program in biomedical informatics and computational biology (BICB) offers course work in five core areas: 1) biochemistry, molecular and cell biology; 2) database, data mining, and computing; 3) informatics, analysis, and machine learning; 4) mathematics, biostatistics, and statistics; and 5) computational and systems biology. In addition, students select courses from a diverse set of fields, including chemistry, chemical engineering, physics, biophysics, structural biology, imaging, signal processing, and clinical and translational sciences. The curriculum is individualized to fit the student's interest and research direction. Prior coursework may be used to fill the requirements if appropriate. Students may pursue a minor in a different program.

All students receive training in ethics, leadership, and management, including legal and intellectual property issues and entrepreneurship. Those interested in academic careers have the opportunity to participate in development programs that focus on aspects of teaching and learning.

The M.S. is offered under two plans: Plan A (with thesis), and Plan B (with project). Plan A is considered suitable for students planning to pursue careers that require a limited research experience or those planning to continue their education in a Ph.D. program. It is also suitable for students with full-time employment whose thesis can be related to their work assignments. Plan B is suitable for students planning to work in settings where technical knowledge is more germane than research experience.

Program Delivery
This program is available:
• via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
Other requirements to be completed before admission:
The program expects incoming graduate students to have a strong background in the quantitative sciences and varied backgrounds in the life/health sciences. The expected competencies of incoming students may be demonstrated by coursework completed at the undergraduate level or by informal competency examinations.

In addition to completing the online application form, applicants must submit a personal statement, which describes past experiences and career aspirations, and reasons for pursuing graduate studies in biomedical informatics and computational biology. Applicants should also indicate the names of the BICB graduate faculty whose interests overlap their own. Although there is no page limit for the personal statement, 2-3 pages are recommended.

Special Application Requirements:
Applications for the M.S. program are accepted throughout the year for either fall or spring.

GRE scores may be waived for students with significant work or academic experience.
Applicants must submit their test score(s) from the following:

- GRE

International applicants must submit score(s) from one of the following tests:

- TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
  - Paper Based - Total Score: 550

- IELTS
  - Total Score: 6.5

- MELAB
  - Final score: 80

Key to test abbreviations (GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements

**Plan A:** Plan A requires 14 major credits, up to null credits outside the major, and 10 thesis credits. The final exam is oral.

**Plan B:** Plan B requires 24 major credits and up to null credits outside the major. The final exam is oral. A capstone project is required.

**Capstone Project:** Plan B students complete a project under the direction of a faculty member and present the work to their faculty committee in an oral exam.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 2.80 is required for students to remain in good standing.

At least 1 semesters must be completed before filing a Degree Program Form.

The M.S. is offered under two plans: Plan A (with thesis), and Plan B (with project).

Plan A is considered suitable for students planning to pursue careers that require a limited research experience or those planning to continue their education in a Ph.D. program. Plan A students defend their thesis in public and must pass an oral examination. Plan A is suitable for students with full-time employment whose thesis can be related to their work assignments.

Plan B is suitable for students planning to work in settings where technical knowledge is more germane than research experience.

The requirements include 20 course credits for Plan A and 30 course credits for Plan B.

Up to 6 credits outside the major may be taken but are not required.

Program Sub-plans

A sub-plan is not required for this program.

Students may not complete the program with more than one sub-plan.

Rochester
Twin Cities Campus

Biomedical Informatics and Computational Biology Minor
R Bioscience/Biotechnology

Graduate School

Link to a list of faculty for this program.

Contact Information:
Biomedical Informatics and Computational Biology, 300 University Square, 111 South Broadway, Rochester, MN 55904 (507-258-8006; fax: 507-258-8066)
Email: bicbgrad@umn.edu
Website: http://www.r.umn.edu/academics-research/bicb

- Program Type: Graduate minor related to major
- Requirements for this program are current for Fall 2014
- Length of program in credits (Masters): 9
- Length of program in credits (Doctorate): 12
- This program does not require summer semesters for timely completion.
- The Biomedical Informatics and Computational Biology Program is an all-University program delivered on the Rochester and Twin Cities campuses. The University of Minnesota Twin Cities is the degree-granting authority for delivery of the Biomedical Informatics and Computational Biology Program in Rochester.

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

The graduate program in biomedical informatics and computational biology (BICB) offers course work in five core areas: 1) biochemistry, molecular and cell biology; 2) database, data mining, and computing; 3) informatics, analysis, and machine learning; 4) mathematics, biostatistics, and statistics; and 5) computational and systems biology. In addition, students select courses from a diverse set of fields, including chemistry, chemical engineering, physics, biophysics, structural biology, imaging, signal processing, and clinical and translational sciences. The curriculum is individualized to fit the student's interest and research direction. Prior coursework may be used to fill the requirements if appropriate. Students may pursue a minor in a different program.

All students receive training in ethics, leadership, and management, including legal and intellectual property issues and entrepreneurship. Students interested in academic careers have the opportunity to participate in development programs that focus on aspects of teaching and learning.

Program Delivery
This program is available:
• via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
Special Application Requirements:
Minor programs are arranged on an individual basis.

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements
Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

Master's Minor: A minimum of 9 credits must be completed in Core Area 1 and one of Core Areas 2-5.

Doctoral Minor: A minimum of 12 credits must be completed in Core Area 1 and two of Core Areas 2-5.

Graduate students choose from a list of courses that satisfy requirements in core areas and electives.

There are five core areas:
1. Biochemistry, molecular and cell biology
2. Database, data mining, and computing
3. Informatics, analysis, and machine learning
4. Mathematics, biostatistics, and statistics
5. Computational and systems biology

Students choose elective courses from the following eight areas:
1. Biochemistry, molecular and cell biology
2. Informatics, database, data mining, and computing
3. Mathematics, biostatistics, and statistics
4. Chemistry, chemical engineering, and physics
5. Biophysics and structural biology
6. Imaging, information theory, and signal processing
7. Computational chemistry, medicinal chemistry, and drug design
8. Clinical and translational sciences

Core/elective courses are listed on the courses page of the BICB Student Handbook (http://r.umn.edu/academics-research/bicb/graduate-program/student-handbook/courses). The adviser(s), together with the DGS, will ensure that the student selects appropriate courses.
Twin Cities Campus
Biomedical Informatics and Computational Biology Ph.D.
R Bioscience/Biotechnology
Graduate School

Link to a list of faculty for this program.

Contact Information:
Biomedical Informatics and Computational Biology, 300 University Square, 111 South Broadway, Rochester, MN 55904 (507-258-8006; fax: 507-258-8066)
Email: bicbgrad@umn.edu
Website: http://www.r.umn.edu/academics-research/bicb

- Program Type: Doctorate
- Requirements for this program are current for Fall 2014
- Length of program in credits: 60
- This program requires summer semesters for timely completion.
- The Biomedical Informatics and Computational Biology Program is an all-University program delivered on the Rochester and Twin Cities campuses. The University of Minnesota Twin Cities is the degree-granting authority for delivery of the Biomedical Informatics and Computational Biology Program in Rochester.
- Degree: Doctor of Philosophy

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

The graduate program in biomedical informatics and computational biology (BICB) offers course work in five core areas: 1) biochemistry, molecular and cell biology; 2) database, data mining, and computing; 3) informatics, analysis, and machine learning; 4) mathematics, biostatistics, and statistics; and 5) computational and systems biology. In addition, students select courses from a diverse set of fields, including chemistry, chemical engineering, physics, biophysics, structural biology, imaging, signal processing, and clinical and translational sciences. The curriculum is individualized to fit the student's interest and research direction. Prior coursework may be used to fill the requirements if appropriate. Students may pursue a minor in a different program.

All students receive training in ethics, leadership, and management, including legal and intellectual property issues and entrepreneurship. The Ph.D. program includes an industrial or clinical internship. Students interested in academic careers have the opportunity to participate in development programs that focus on aspects of teaching and learning.

Program Delivery
This program is available:
• via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
Other requirements to be completed before admission:
The program expects incoming graduate students to have a strong background in the quantitative sciences and varied backgrounds in the life/health sciences. The expected competencies of incoming students may be demonstrated by coursework completed at the undergraduate level or by informal competency examinations.

In addition to completing the online application form, applicants must submit a personal statement, which describes past experiences and career aspirations, and reasons for pursuing graduate studies in biomedical informatics and computational biology. Prospective students should also indicate the names of the BICB graduate faculty whose interests overlap with their own. The department strongly encourages applicants to contact these faculty members before applying. Although there is no page limit for the personal statement, 2-3 pages are recommended.

Special Application Requirements:
Three letters of recommendation and scores from the General Test of the GRE are required. Applicants are admitted only for the fall semester.

GRE scores may be waived for students with significant work or academic experience.

Applicants must submit their test score(s) from the following:
• GRE

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The University of Minnesota is an equal opportunity educator and employer.
Information current as of September 19, 2014
International applicants must submit score(s) from one of the following tests:

- TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
  - Paper Based - Total Score: 550

- IELTS
  - Total Score: 6.5

- MELAB
  - Final score: 80

Key to test abbreviations (GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements

30 credits are required in the major.
24 thesis credits are required.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 2.80 is required for students to remain in good standing.

Ph.D. students take preliminary written exams at the end of the second year of study, which focuses on the development of a research proposal. An oral preliminary exam focuses on the plan for thesis research and the student's coursework and is taken by the fall of the third year of full-time registration or its equivalent. At least 24 course credits are required to gain competency in both biology and quantitative areas related to biomedical informatics and computational biology. An internship is required, which may be waived for students with equivalent experience. Additionally, 24 thesis credits are required. Ph.D. students defend their thesis in public and must pass an oral examination.

An internship is required, which may be waived for students with equivalent experience.

Up to 9 credits outside the major may be taken but are not required.

Program Sub-plans

A sub-plan is not required for this program.

Students may not complete the program with more than one sub-plan.

Rochester
Twin Cities Campus
Biophysical Sciences and Medical Physics M.S.
Radiology
Graduate School

Link to a list of faculty for this program.

Contact Information:
University of Minnesota School of Medicine, Department of Radiology, Box 292 UMHC, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-0131; fax: 612-626-1951)
Email: riten001@tc.umn.edu
Website: http://www.med.umn.edu/radiology/research/physics/home.html

- Program Type: Master's
- Requirements for this program are current for Fall 2014
- Length of program in credits: 30
- This program does not require summer semesters for timely completion.
- Degree: Master of Science

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

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

Program Delivery
This program is available:
- via classroom (the majority of instruction is face-to-face)

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

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

Applicants must submit their test score(s) from the following:
- GRE

Key to test abbreviations (GRE).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements
Plan A: Plan A requires 14 major credits, 6 credits outside the major, and 10 thesis credits. The final exam is oral.

Plan B: Plan B requires 14 major credits and 6 credits outside the major. The final exam is oral.

This program may be completed with a minor.
Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 2.80 is required for students to remain in good standing.

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

Link to a list of faculty for this program.

Contact Information:
University of Minnesota School of Medicine, Department of Radiology, Box 292 UMHC, 420 Delaware Street S.E., Minneapolis, Minnesota 55455 (612-626-0131; fax: 612-626-1951)
Email: riten001@tc.umn.edu
Website: http://www.med.umn.edu/radiology/research/physics/home.html

- Program Type: Graduate minor related to major
- Requirements for this program are current for Fall 2014
- Length of program in credits (Masters): 6
- Length of program in credits (Doctorate): 12
- This program does not require summer semesters for timely completion.

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

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

Program Delivery
This program is available:
- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements
Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

Programs are arranged on an individual basis and must consist of courses that represent a subfield of the discipline, e.g., radiobiology or medical physics.
Twin Cities Campus
Biophysical Sciences and Medical Physics Ph.D.
Radiology
Graduate School

Link to a list of faculty for this program.

Contact Information:
University of Minnesota School of Medicine, Department of Radiology, Box 292 UMHC, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-626-0131; fax: 612-626-1951)
Email: riten001@tc.umn.edu
Website: http://www.med.umn.edu/radiology/research/physics/home.html

- Program Type: Doctorate
- Requirements for this program are current for Fall 2014
- Length of program in credits: 36
- This program does not require summer semesters for timely completion.
- Degree: Doctor of Philosophy

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

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

Program Delivery
This program is available:
- via classroom (the majority of instruction is face-to-face)

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

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

Applicants must submit their test score(s) from the following:
- GRE

Key to test abbreviations (GRE).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements
12 credits are required outside the major.
24 thesis credits are required.

This program may not be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.
Ph.D. students take preliminary written exams at the end of the first year of study or as soon as possible after completing the core course sequence in topics in physics for medicine and biology. An oral preliminary exam focuses on the plan for thesis research and the student's grasp of related information and is taken by the fall of the third year of full-time registration or its equivalent. At least 12 credits are required in a minor or supporting program. Additionally, 24 thesis credits are required.
Twin Cities Campus
Health Care Design and Innovation Postbaccalaureate Certificate
School of Nursing
Graduate School

Link to a list of faculty for this program.

Contact Information:
Densford International Center for Nursing Leadership, University of Minnesota School of Nursing, 4-185 Weaver-Densford Hall, 308
Harvard Street S.E., Minneapolis, MN 55455 (612-625-1187; fax: 612-624-0908)
Email: nursecerts@umn.edu
Website: http://www.hcdi.umn.edu

- Program Type: Post-baccalaureate credit certificate/licensure/endorsement
- Requirements for this program are current for Fall 2014
- Length of program in credits: 12
- This program does not require summer semesters for timely completion.
- Degree: Health Care Design & Innovation PBacc Certificate

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

The postbaccalaureate certificate in health care design and innovation prepares health care and design practitioners to create optimal
healing environments. Students learn how to apply design thinking in creating new processes, systems, and care environments. The
certificate emphasizes principles that promote healing and safe patient care while maximizing clinical and financial outcomes.

Program Delivery
This program is available:
- partially online (between 50% to 80% of instruction is online)

Prerequisites for Admission
The preferred undergraduate GPA for admittance to the program is 3.00.

Admittance to the certificate program requires a baccalaureate degree from an accredited institution in a health-related field, interior
design, architecture, or other design-related area.

Other requirements to be completed before admission:
Applicants are required to submit transcripts from all institutions where postsecondary credit was earned, reference materials containing
an Admission Reference Form and personal letter of reference from two separate individuals, one essay, a current curriculum
vitae/resume, and English language proficiency scores (if applicable). This certificate has two application deadlines: November 1 for
spring admission and July 1 for fall admission.

International applicants must submit score(s) from one of the following tests:
- TOEFL
  - Internet Based - Total Score: 79
  - Paper Based - Total Score: 550

The preferred English language test is Test of English as Foreign Language

Key to test abbreviations (TOEFL).

For an online application or for more information about graduate education admissions, see the General Information section of the
catalog website.

Program Requirements
Use of 4xxx courses towards program requirements is not permitted.

A minimum GPA of 2.8 is required for students to remain in good standing.
The certificate has four required courses, taken from the School of Nursing, the College of Design, and the Center for Spirituality and Healing:

1. Health Innovation and Leadership, which integrates whole systems thinking, relevant theories and generative leadership to enhance the student's ability to advance innovation and achieve sustainable change in contemporary health care settings.

2. Optimal Healing Environments, which focuses on the development and implementation of Optimal Healing Environments (OHE) and examines the evidence base supporting design of human and care processes, and begins to explore how OHEs are created.

3. The Design of Health Care Processes, which provides a foundation for the thinking required to design processes in health care to reduce/eliminate medical errors and examines the use of design principles and the role of human factors in reducing human error.

4. Evidence-based Design in Health Care, which emphasizes the evidence-based processes used in the design of health care environments by interdisciplinary teams of designers, health care practitioners, administrators, and other users.
Twin Cities Campus
Health Informatics M.H.I.
Health Informatics, AHC Inst
Graduate School

Link to a list of faculty for this program.

Contact Information:
Physical Address: 505 Essex St. SE, 330 Diehl Hall, Minneapolis, MN 55455
Mailing Address: MMC 912, 420 Delaware St. SE, Minneapolis, MN 55455
Email: ihi@umn.edu
Website: http://www.bmhi.umn.edu

- Program Type: Master's
- Requirements for this program are current for Fall 2014
- Length of program in credits: 30
- This program does not require summer semesters for timely completion.
- Degree: Master of Health Informatics

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

Health informatics is an interdisciplinary field of scholarship that applies computer, information, and cognitive sciences to promote the effective and efficient use and analysis of information, ultimately improving the health, well-being, and economic functioning of society. Students take a sequence of core courses in health informatics and biostatistics, and electives in technical and health science areas. Possible areas of emphasis include health information systems, telehealth, bioinformatics, user interface design, system impact evaluation, database construction and analysis, clinical decision-making, evaluation of health programs, and physiological monitoring and control.

Program Delivery
This program is available:
- via classroom (the majority of instruction is face-to-face)
- completely online (all program coursework can be completed online)
- primarily online (at least 80% of the instruction for the program is online with short, intensive periods of face-to-face coursework)
- partially online (between 50% to 80% of instruction is online)

Prerequisites for Admission
The preferred undergraduate GPA for admittance to the program is 3.00.

Applicants are expected to have at least a bachelor of science or equivalent degree from a regionally accredited institution of higher education.

Required prerequisites
Health or Biological Sciences
6-semester credits or 9 quarter-credits of health or biological coursework at the undergraduate or graduate level. HINF 5501 may be used to help meet this requirement.

Programming Language
Documented work or educational experience working with a programming language such as C, C++, Java, Visual Basic, PASCAL, etc.
or HINF 5502 - Programming Essentials Python 3 (1.0 cr)
or Department Consent

Applicants must submit their test score(s) from the following:
- GRE
  - General Test - Verbal Reasoning: 153
  - General Test - Quantitative Reasoning: 152
  - General Test - Analytical Writing: 4

International applicants must submit score(s) from one of the following tests:
- TOEFL
  - Internet Based - Total Score: 79
- Internet Based - Writing Score: 21
- Internet Based - Reading Score: 19
- Paper Based - Total Score: 550

- IELTS
  - Total Score: 6.5
- MELAB
  - Final score: 80

The preferred English language test is Test of English as Foreign Language

Key to test abbreviations (GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements

Plan C: Plan C requires 18 to 24 major credits and 6 to 12 credits outside the major. The is no final exam. A capstone project is required.

Capstone Project: The capstone project is a 3-credit course in which students will have a final opportunity to apply their newly acquired knowledge and skills to a project involving a practical problem in health informatics. Students will learn how to design these projects properly, reviewing past exemplary projects as guides. Then, with the help of their advisers and the capstone course director, students will design and carry out their own projects which can take a variety of forms, including: developing design and evaluation specifications for software to address a specific healthcare need; working on, observing, analyzing, and reporting the actions of a team involved in implementing a new information system; or observing and measuring the impact of such a system in a healthcare setting. Students will submit a written project report in lieu of a final examination. The capstone project instructor and the student's adviser grade the report.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 2.80 is required for students to remain in good standing.

At least 1 semesters must be completed before filing a Degree Program Form.

HINF Courses

- HINF 5430 - Health Informatics I (3.0 cr)
- HINF 5431 - Health Informatics II (3.0 cr)
- HINF 5436 - AHC Informatics Grand Rounds (1.0 cr)
- HINF 5510 - Applied Health Care Databases: Database Principles and Data Evaluation (3.0 cr)
- HINF 5520 - Clinical Informatics and Patient Safety (2.0 cr)
- HINF 5531 - Health Data Analytics and Data Science (2.0 cr)
- HINF 5499 - Capstone Project for the Masters of Health Informatics (3.0 cr)

Other Required Courses

- NURS 5116 - Consumer Health Informatics (1.0 cr)
- NURS 7113 - Clinical Decision Support: Theory (2.0 cr)

Biostatistics

- PUBH 6414 - Biostatistical Literacy (3.0 cr)
  or PUBH 6450 - Biostatistics I (4.0 cr)

Electives

Graduate-level electives of your choice; see student handbook for a list of recommended electives.

Joint- or Dual-degree Coursework: MD/MHI program

Student may take a total of 3 credits in common among the academic programs.
Health Informatics M.S.
Graduate School

Link to a list of faculty for this program.

Contact Information:
Physical Address: 505 Essex St. SE, 330 Diehl Hall, Minneapolis, MN 55455
Mailing Address: MMC 912, 420 Delaware St. SE, Minneapolis, MN 55455
Email: ihi@umn.edu
Website: http://www.bmhi.umn.edu

- Program Type: Master's
- Requirements for this program are current for Fall 2014
- Length of program in credits: 36
- This program does not require summer semesters for timely completion.
- Degree: Master of Science

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

Health informatics is an interdisciplinary field of scholarship that applies computer, information, and cognitive sciences to promote the effective and efficient use and analysis of information, ultimately improving the health, well-being, and economic functioning of society. Students take a sequence of core courses in health informatics and biostatistics, and electives in technical and health science areas. Possible areas of emphasis include health information systems, telehealth, bioinformatics, user interface design, system impact evaluation, database construction and analysis, clinical decision-making, evaluation of health programs, and physiological monitoring and control.

The MS is a 36 credit degree that may be completed in as little as two years or up to five years. It is intended for students who are interested in research, but who do not have the background or are not ready to commit to the PhD program.

There are two kinds of MS degrees: MS Plan A and MS Plan B. The Plan A culminates in a substantial, 10-credit master's thesis. The Plan B culminates in a smaller, 4-credit, Plan B project. Electives comprise the additional six credits in the Plan B degree.

Program Delivery
This program is available:
• via classroom (the majority of instruction is face-to-face)
• partially online (between 50% to 80% of instruction is online)

Prerequisites for Admission
The preferred undergraduate GPA for admittance to the program is 3.30.

Applicants are expected to have at least a bachelor of science or equivalent degree from a regionally accredited institution of higher education.

Required prerequisites
Health or Biological Sciences
6-semester credits or 9 quarter-credits of health or biological coursework at the undergraduate or graduate level. HINF 5501 may be used to help meet this requirement.
or Department Consent

Programming Language
Documented work or educational experience working with a programming language such as C, C++, Java, Visual Basic, PASCAL, etc.
or HINF 5502 - Programming Essentials Python 3 (1.0 cr)
or Department Consent

Applicants must submit their test score(s) from the following:
• GRE
  - General Test - Verbal Reasoning: 152
  - General Test - Quantitative Reasoning: 159
General Test - Analytical Writing: 4

International applicants must submit score(s) from one of the following tests:

- **TOEFL**
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
- **IELTS**
  - Total Score: 6.5
- **MELAB**
  - Final score: 80

The preferred English language test is Test of English as Foreign Language

Key to test abbreviations (GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

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**Program Requirements**

**Plan A:** Plan A requires 15 to 17 major credits, 9 to 11 credits outside the major, and 10 thesis credits. The final exam is written and oral.

**Plan B:** Plan B requires 19 to 27 major credits and 9 to 17 credits outside the major. The final exam is written and oral.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

At least 1 semesters must be completed before filing a Degree Program Form.

**Required HINF Courses**

N.b. All students must take AHC Informatics Grand Rounds (HINF 5436) twice for a total of two credits.

- HINF 5430 - Health Informatics I (3.0 cr)
- HINF 5431 - Health Informatics II (3.0 cr)
- HINF 5436 - AHC Informatics Grand Rounds (1.0 cr)
- HINF 5510 - Applied Health Care Databases: Database Principles and Data Evaluation (3.0 cr)
- HINF 5520 - Clinical Informatics and Patient Safety (2.0 cr)
- HINF 5531 - Health Data Analytics and Data Science (2.0 cr)

**Other Required Courses**

- NURS 5116 - Consumer Health Informatics (1.0 cr)
- NURS 7113 - Clinical Decision Support: Theory (2.0 cr)
- PUBH 6450 - Biostatistics I (4.0 cr)

**Final Project/Thesis**

- Plan A students will take 10 credits of 8777 and Plan B students will take 4 credits of 8770.
- HINF 8770 - Plan B Project (4.0 cr)
  - or HINF 8777 - Thesis Credits: Master's (1.0 - 18.0 cr)

**Electives**

Graduate-level electives of your choice; see student handbook for a list of recommended electives. Plan A students will need 4 credits of electives, and Plan B students will need 10 credits of electives.
Twin Cities Campus

Health Informatics Minor
Health Informatics, AHC Inst
Graduate School

Link to a list of faculty for this program.

Contact Information:
Physical Address: 505 Essex St. SE, 330 Diehl Hall, Minneapolis, MN 55455
Mailing Address: MMC 912, 420 Delaware St. SE, Minneapolis, MN 55455
Email: ihi@umn.edu
Website: http://www.bmhi.umn.edu

- Program Type: Graduate minor related to major
- Requirements for this program are current for Fall 2014
- Length of program in credits (Masters): 6
- Length of program in credits (Doctorate): 12
- This program does not require summer semesters for timely completion.

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

Health informatics is an interdisciplinary field of scholarship that applies computer, information, and cognitive sciences to promote the effective and efficient use and analysis of information, ultimately improving the health, well-being, and economic functioning of society. The minor provides an opportunity for the student to supplement their primary training with additional knowledge and skills in health informatics.

Program Delivery
This program is available:
- via classroom (the majority of instruction is face-to-face)
- completely online (all program coursework can be completed online)
- primarily online (at least 80% of the instruction for the program is online with short, intensive periods of face-to-face coursework)
- partially online (between 50% to 80% of instruction is online)

Prerequisites for Admission
The preferred undergraduate GPA for admittance to the program is 3.00.

Other requirements to be completed before admission:
Applicants are required to have taken 6 semester credits or 9 quarter credits in medical, life, or biological sciences from a recognized institution of higher learning. This a broadly defined requirement and most courses with a health or biology emphasis will be accepted including biostatistics, health services research, and public health, as well as the more traditional biology or life science courses.

Special Application Requirements:
Applicants must be earning a graduate-level degree from the University of Minnesota.

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements
Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

Master’s students must take the introductory sequence in health informatics (HINF 5430 and HINF 5431). Ph.D. students must take a total of 12 credits in health informatics including the introductory sequence and at least 6 additional credits including one 8xxx course.
Twin Cities Campus

Health Informatics Ph.D.
Health Informatics, AHC Inst
Graduate School

Link to a list of faculty for this program.

Contact Information:
Physical Address: 505 Essex St. SE, 330 Diehl Hall, Minneapolis, MN 55455
Mailing Address: MMC 912, 420 Delaware St. SE, Minneapolis, MN 55455
Email: ihi@umn.edu
Website: http://www.bmhi.umn.edu

- Program Type: Doctorate
- Requirements for this program are current for Fall 2014
- Length of program in credits: 70
- This program does not require summer semesters for timely completion.
- Degree: Doctor of Philosophy

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

Health informatics is an interdisciplinary field of scholarship that applies computer, information, and cognitive sciences to promote the effective and efficient use and analysis of information, ultimately improving the health, well-being, and economic functioning of society. Students take a sequence of core courses in health informatics and biostatistics, and electives in technical and health science areas. Possible areas of emphasis include health information systems, telehealth, bioinformatics, user interface design, system impact evaluation, database construction and analysis, clinical decision-making, evaluation of health programs, and physiological monitoring and control.

Program Delivery
This program is available:
- via classroom (the majority of instruction is face-to-face)
- partially online (between 50% to 80% of instruction is online)

Prerequisites for Admission
The preferred undergraduate GPA for admittance to the program is 3.50.

Applicants must have at least a master's degree or equivalent in a science, technology, engineering, or math field (or another field related to informatics) from a regionally accredited university.

Required prerequisites
Health or Biological Sciences
6-semester credits or 9 quarter-credits of health or biological coursework at the undergraduate or graduate level. HINF 5501 may be used to help meet this requirement.
or Department Consent

Programming Language
Documented work or educational experience working with a programming language such as C, C++, Java, Visual Basic, PASCAL, etc.
or HINF 5502 - Programming Essentials Python 3 (1.0 cr)
or Department Consent

Applicants must submit their test score(s) from the following:
- GRE
  - General Test - Verbal Reasoning: 152
  - General Test - Quantitative Reasoning: 159
  - General Test - Analytical Writing: 4

International applicants must submit score(s) from one of the following tests:
- TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
- Internet Based - Reading Score: 19
- Paper Based - Total Score: 550
- IELTS
  - Total Score: 6.5
- MELAB
  - Final score: 80

The preferred English language test is Test of English as Foreign Language

Key to test abbreviations (GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements
20 to 35 credits are required in the major.
11 to 26 credits are required outside the major.
24 thesis credits are required.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

At least 2 semesters must be completed before filing a Degree Program Form.

Required HINF Courses
- HINF 5430 - Health Informatics I (3.0 cr)
- HINF 5431 - Health Informatics II (3.0 cr)
- HINF 5436 - AHC Informatics Grand Rounds (1.0 cr)
- HINF 5510 - Applied Health Care Databases: Database Principles and Data Evaluation (3.0 cr)
- HINF 5520 - Clinical Informatics and Patient Safety (2.0 cr)
- HINF 5531 - Health Data Analytics and Data Science (2.0 cr)
- HINF 8525 - Health Informatics Teaching (2.0 cr)
- HINF 8535 - Advanced Health Informatics Research Methods (1.0 - 3.0 cr)
- HINF 8888 - Thesis Credit: Doctoral (1.0 - 24.0 cr)

Other Required Courses
- NURS 5116 - Consumer Health Informatics (1.0 cr)
- NURS 7113 - Clinical Decision Support: Theory (2.0 cr)
- PUBH 6450 - Biostatistics I (4.0 cr)
- PUBH 6451 - Biostatistics II (4.0 cr)

Electives
Graduate-level electives of your choice; see student handbook for a list of recommended electives.
Twin Cities Campus
Health Journalism and Communication M.A.
School of Journalism & Mass Communication
Graduate School

Link to a list of faculty for this program.

Contact Information:
Health Journalism and Communication M.A. Program, School of Journalism and Mass Communication, 111 Murphy Hall, 206 Church Street S.E., Minneapolis MN 55455 (612-626-1851; fax 612-625-9525)
Email: dans@umn.edu
Website: http://sjmc.umn.edu/grad/hjComm.html#degree

- Program Type: Master's
- Requirements for this program are current for Fall 2014
- Length of program in credits: 33
- This program does not require summer semesters for timely completion.
- Degree: Master of Arts

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

Note: This program has been temporarily suspended. Applications are not being accepted at this time. Please contact Graduate Student Services at sjmcgrad@umn.edu with questions.

A joint program of the School of Journalism and Mass Communication and the School of Public Health, the professional master's in health journalism and communication promotes improved public communication about health matters by combining knowledge, skills, and experience from both disciplines. The program is designed for journalists and health professionals, who earn a master's degree in health journalism. Journalists and communications professionals learn the fundamentals of medical research and public health. Health professionals learn basic journalistic principles and ethics, and how to develop meaningful health stories. Those pursuing other master's degrees, (e.g., master's in public health), earn the M.A. in health journalism and communication in addition to the other degree.

The Health Journalism and Communication program has two distinct, but overlapping, programs of study. Students in the health journalism emphasis will gain advanced knowledge about public health and the evaluation of claims from health, medical, and scientific sources, as well as advanced training on reporting health stories for different media. Students in the health communication emphasis will learn the fundamentals of writing about health topics for different audiences in different formats, as well as health campaign development and evaluation.

Program Delivery
This program is available:
• via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
Special Application Requirements:
Applications to this master's program are not currently being accepted. Please contact sjmcgrad@umn.edu with questions.

Applicants must submit their test score(s) from the following:
• GRE

International applicants must submit score(s) from one of the following tests:
• TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
  - Paper Based - Total Score: 550
• IELTS
  - Total Score: 6.5

Key to test abbreviations (GRE, TOEFL, IELTS).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.
Program Requirements

Plan B: Plan B requires 25 major credits and 6 credits outside the major. The final exam is oral. A capstone project is required.

Capstone Project: Contact the program for capstone project information.

This program may not be completed with a minor.

Use of 4xxx courses towards program requirements is not permitted.

The M.A. in health journalism and communication requires a minimum of 33 semester credits, to be completed over a two-year schedule. The program has two distinct areas of emphasis: health journalism and health communication. Students in the health journalism emphasis area learn to evaluate claims from health, medical, and scientific sources and to tell health-oriented stories in broadcast or magazine journalism. Students in the health communication emphasis learn the fundamentals of writing about health topics for different audiences, as well as health campaign development and evaluation.
Twin Cities Campus

Health Journalism and Communication Minor

School of Journalism & Mass Communication

Graduate School

Link to a list of faculty for this program.

Contact Information:
Health Journalism and Communication M.A. Program, School of Journalism and Mass Communication, 111 Murphy Hall, 206 Church Street S.E., Minneapolis MN 55455 (612-626-1851; fax 612-625-9525)
Email: dans@umn.edu
Website: http://sjmc.umn.edu/grad/hjComm.html#degree

- Program Type: Graduate minor related to major
- Requirements for this program are current for Fall 2014
- Length of program in credits (Masters): 6
- Length of program in credits (Doctorate): 12
- This program does not require summer semesters for timely completion.

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

Note: This program has been temporarily suspended. Applications are not being accepted at this time. Please contact the School of Journalism's Graduate Student Services office at sjmcgrad@umn.edu with questions.

A joint program of the School of Journalism and Mass Communication and the School of Public Health, the professional master's in health journalism and communication promotes improved public communication about health matters by combining knowledge, skills, and experience from both disciplines. The program is designed for journalists and health professionals, who earn a master's degree in health journalism. Journalists and communications professionals learn the fundamentals of medical research and public health. Health professionals learn basic journalistic principles and ethics, and how to develop meaningful health stories. Those pursuing other master's degrees, (e.g., master's in public health), earn the M.A. in health journalism and communication in addition to the other degree.

Program Delivery
This program is available:
- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements
Use of 4xxx courses towards program requirements is not permitted.

The master's minor requires 6 credits. The doctoral minor requires 12 credits.
Twin Cities Campus
History of Science, Technology, and Medicine M.A.

History of Science & Technology
Graduate School

Link to a list of faculty for this program.

Contact Information:
Program in the History of Science, Technology, and Medicine, University of Minnesota, 108 Pillsbury Hall, 310 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-7069; fax: 612-625-3819)
Email: hstm@umn.edu
Website: http://www.hstm.umn.edu

- Program Type: Master's
- Requirements for this program are current for Fall 2014
- Length of program in credits: 30
- This program does not require summer semesters for timely completion.
- Degree: Master of Arts

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

The program offers opportunities for advanced research and study in the history of science and technology (with particular expertise in the history of the physical sciences, history of the biological sciences, history of technology, and history of American science and technology) and in the history of medicine.

Program Delivery
This program is available:
- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
The preferred undergraduate GPA for admittance to the program is 3.00.

Other requirements to be completed before admission:
Students must have a bachelor's degree with a preferred grade average of B or better and should be capable of interdisciplinary study. Depending on background and career objectives, additional preparatory studies may be necessary in either the science-technology area or in the humanities and social sciences.

Special Application Requirements:
All application materials are submitted online to the University. Check the HSTM website (www.hstm.umn.edu) for more information. Although it is not required for admission, it's strongly recommended that applicants submit a GRE score.

International applicants must submit score(s) from one of the following tests:
- TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
  - Paper Based - Total Score: 550
- IELTS
  - Total Score: 6.5
- MELAB
  - Final score: 80

Key to test abbreviations (TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.
Program Requirements

**Plan A:** Plan A requires 14 major credits, 6 credits outside the major, and 10 thesis credits. The final exam is oral.

**Plan B:** Plan B requires 24 major credits and 6 credits outside the major. The final exam is oral.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

Language Requirement: Reading proficiency in one foreign language.

A minimum GPA of 3.30 is required for students to remain in good standing.

The M.A. is offered under Plan A and Plan B. Following the guidelines in the Graduate Student Handbook for the program (www.hstm.umn.edu), M.A. students select one of two tracks, the history of science and technology or the history of medicine, and, within the chosen track, select courses subject to distribution requirements in terms of area and period. In addition, each student must take one of the two courses in the two-semester sequence of historiography and research methods (HSCI/HMED 8112 and HSCI/HMED 8113). All of the courses selected for the requirements must be passed with a grade of B or better.

Program Sub-plans

Students are required to complete one of the following sub-plans. Students may not complete the program with more than one sub-plan.

**History of Medicine**

**History of Science and Technology**
Twin Cities Campus

History of Science, Technology, and Medicine Minor

History of Science & Technology

Graduate School

Link to a list of faculty for this program.

Contact Information:
Program in the History of Science, Technology, and Medicine, University of Minnesota, 108 Pillsbury Hall, 310 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-7069; fax: 612-625-3819)
Email: hstm@umn.edu
Website: http://www.hstm.umn.edu

- Program Type: Graduate minor related to major
- Requirements for this program are current for Fall 2014
- Length of program in credits (Masters): 6
- Length of program in credits (Doctorate): 12
- This program does not require summer semesters for timely completion.

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

The program offers opportunities for advanced research and study in the history of science and technology (with particular expertise in the history of the physical sciences, history of the biological sciences, history of technology, and history of American science and technology) and in the history of medicine.

Program Delivery
This program is available:
  • via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
Other requirements to be completed before admission:
Students must have a bachelor's degree with a preferred grade average of B or better and should be capable of interdisciplinary study. Depending on background and career objectives, additional preparatory studies may be necessary in either the science-technology area or in the humanities and social sciences.

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements
Use of 4xxx courses towards program requirements is not permitted.

Students who wish to take the graduate minor in the history of science, technology, and medicine are required to take 6 credits for the master's minor and 12 credits for a doctoral minor. The Historiography course (HSCI or HMED 8112) is strongly recommended, along with other courses that are selected to define a course of study that should have some identifiable focus but also a certain breadth. Students should not plan to take all courses in the minor from the same faculty member.
Twin Cities Campus
History of Science, Technology, and Medicine Ph.D.
History of Science & Technology
Graduate School

Link to a list of faculty for this program.

Contact Information:
Program in the History of Science, Technology, and Medicine, University of Minnesota, 108 Pillsbury Hall, 310 Pillsbury Drive S.E., Minneapolis, MN 55455 (612-624-7069; fax: 612-625-3819)
Email: hstm@umn.edu
Website: http://www.hstm.umn.edu

- Program Type: Doctorate
- Requirements for this program are current for Fall 2014
- Length of program in credits: 57
- This program does not require summer semesters for timely completion.
- Degree: Doctor of Philosophy

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

The program offers opportunities for advanced research and study in the history of science and technology (with particular expertise in the history of the physical sciences, history of the biological sciences, history of technology, and history of American science and technology) and in the history of medicine.

Program Delivery
This program is available:
• via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
The preferred undergraduate GPA for admittance to the program is 3.00.

Other requirements to be completed before admission:
Students must have a bachelor's degree with a preferred grade average of B or better and should be capable of interdisciplinary study.
Depending on background and career objectives, additional preparatory studies may be necessary in either the science-technology area or in the humanities and social sciences.

Special Application Requirements:
All application materials are submitted online to the University. Check the HSTM website (www.hstm.umn.edu) for more information. Although it is not required for admission, it's strongly recommended that applicants submit a GRE score.

International applicants must submit score(s) from one of the following tests:
• TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
  - Paper Based - Total Score: 550
• IELTS
  - Total Score: 6.5
• MELAB
  - Final score: 80

Key to test abbreviations (TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.
Program Requirements
21 credits are required in the major.
12 credits are required outside the major.
24 thesis credits are required.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

Language Requirement: Reading proficiency in two foreign languages.

A minimum GPA of 3.30 is required for students to remain in good standing.

Following the guidelines in the Graduate Student Handbook for the program (www.hstm.umn.edu), Ph.D. students select one of two tracks, the history of science and technology or the history of medicine, and, within the chosen track, select courses subject to distribution requirements in terms area and period. In addition, each student must take the two-semester sequence of historiography and research preparation (HSCI/HMED 8112 and HSCI/HMED 8113). All of the courses selected for the requirements must be passed with a grade of B or better.

Program Sub-plans
Students are required to complete one of the following sub-plans.
Students may not complete the program with more than one sub-plan.

History of Medicine

History of Science and Technology
Twin Cities Campus

Integrated Biosciences M.S.

Medical School - Adm
Graduate School

Link to a list of faculty for this program.

Contact Information:
University of Minnesota, 251 Swenson Science Building, 1035 Kirby Drive, Duluth, MN 55812 (218-726-6898; fax: 218-726-8152)
Email: ibs@d.umn.edu
Website: http://www.d.umn.edu/ibs

- Program Type: Master's
- Requirements for this program are current for Fall 2014
- Length of program in credits: 30
- This program requires summer semesters for timely completion.
- Degree: Master of Science

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

The all-University integrated biosciences graduate program offers study toward the 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.

Program Delivery
This program is available:
- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
The preferred undergraduate GPA for admittance to the program is 3.00.

A bachelor's degree or equivalent from an accredited college/university in the biological or physical sciences or a related field. Background in a variety of subdisciplines is appropriate preparation.

Other requirements to be completed before admission:
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.

Applicants must submit their test score(s) from the following:
- GRE

International applicants must submit score(s) from one of the following tests:
- TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
  - Paper Based - Total Score: 550
- IELTS
  - Total Score: 6.5
- MELAB
  - Final score: 80

The preferred English language test is Test of English as Foreign Language

Key to test abbreviations (GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.
Program Requirements

Plan A: Plan A requires 14 major credits, 6 credits outside the major, and 10 thesis credits. The final exam is oral.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

At least 2 semesters must be completed before filing a Degree Program Form.

Required Coursework
Twin Cities Campus
Integrated Biosciences Ph.D.
Medical School - Adm
Graduate School

Link to a list of faculty for this program.

Contact Information:
Integrated Biosciences Graduate Program, University of Minnesota, 251 Swenson Science Building, 1035 Kirby Drive, Duluth, MN 55812 (218-726-6898; fax: 218-726-8152)
Email: ibs@d.umn.edu
Website: http://www.d.umn.edu/ibs

• Program Type: Doctorate
• Requirements for this program are current for Fall 2014
• Length of program in credits: 56
• This program does not require summer semesters for timely completion.
• The Integrated Biosciences Ph.D. is an All-University program delivered on the Twin Cities and Duluth Campuses. The University of Minnesota Twin Cities is the degree granting authority for the Integrated Biosciences Ph.D. program in Duluth.
• Degree: Doctor of Philosophy

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

The all-University integrated biosciences graduate program offers study toward the doctor of philosophy (Ph.D.) degree. The program has two areas of emphasis: cell, molecular, and physiological (CMP) biology; and ecology, organismal, and population (EOP) biology.

Program Delivery
This program is available:
• via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
The preferred undergraduate GPA for admittance to the program is 3.00.

A bachelor's degree or equivalent from an accredited college or university in the biological or physical sciences or a related field.

Other requirements to be completed before admission:
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 ecology, organismal, and population (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.

Applicants must submit their test score(s) from the following:
• GRE

International applicants must submit score(s) from one of the following tests:
• TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
  - Paper Based - Total Score: 550
• IELTS
  - Total Score: 6.5
• MELAB
  - Final score: 80

The preferred English language test is Test of English as Foreign Language
Key to test abbreviations (GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements

20 credits are required in the major.
12 credits are required outside the major.
24 thesis credits are required.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

At least 2 semesters must be completed before filing a Degree Program Form.

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 University regulations and all students will be required to pass the oral examination to continue in the Ph.D. program.

Most students will complete the requirements for the Ph.D. degree within five years. The final oral defense will be conducted by the graduate faculty according to University regulations. It will consist of a public seminar presented by the student.
Twin Cities Campus

Integrative Health & Wellbeing Coaching M.A.

Health Sciences-Adm
Graduate School

Link to a list of faculty for this program.

Contact Information:
Center for Spirituality & Healing
C592 Mayo Memorial Building
420 Delaware St SE
Minneapolis, MN 55455
Email: fider002@umn.edu
Website: http://www.csh.umn.edu

- Program Type: Master's
- Requirements for this program are current for Fall 2014
- Length of program in credits: 38
- This program requires summer semesters for timely completion.
- No
- Degree: Master of Arts

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

The proposed Master of Arts degree is designed for individuals with a bachelor's degree in a health-related field, or in a health field. Professionals without healthcare backgrounds, but with extensive interest in working with individuals and groups to optimize wellbeing, and who have a desire for a full graduate degree, would also be excellent candidates assuming completion of required prerequisites. This Master's degree is designed for students who wish to further their education so that they may hold positions of responsibility coaching individuals and groups, initiating and leading new coaching service lines, and developing outcomes assessments for coaching initiatives.

Although the instruction is based on research in the field, this Plan B degree is not intended to provide intensive research training. This Plan B Master's Degree Program is understood to be a terminal degree, and is thus not recommended for students who intend to pursue the PhD degree. The degree consists of a minimum of thirty-eight (38) credits of coursework, including 6 credits of electives, and a minimum 2-semester, 2-credit project that is presented in both verbal and written format prior to graduation.

This degree is structured to prepare a wide variety of students to be skilled and knowledgeable advocates and support agents for individuals on their path to greater health and healing. All students must be able to demonstrate the following competencies (through review of transcripts and course work completed) prior to being admitted into the Advanced Health Coaching Seminar:

- Demonstrate appropriate knowledge of major health problems.
- Demonstrate familiarity with the routine mechanics of the conventional healthcare system and its processes.
- Demonstrate basic knowledge of physical and psychological symptoms related to disease and treatment.
- Demonstrate basic knowledge of pharmacology, pathophysiology of disease, and assessment of symptoms across the life span.

Students whose previous coursework does not enable them to meet these competencies can arrange with the program director to do additional outside coursework during the first year of the program. If a significant gap in knowledge has been identified by the program director upon admission, supplemental coursework may be judiciously required during the first year of study. Six credits of electives are required to be chosen from one of four CSH areas of concentration, or students may design their own concentration or complete a minor from other departments, based on interests, if approved by their academic adviser. In all cases, the student's faculty adviser will work with the student in designing a program plan that accommodates the student's unique learning objectives. Upon successful completion of this Plan B program, the student will receive a Masters of Arts Degree in Integrative Health and Wellbeing Coaching.

Accreditation
This program is accredited by n/a

Program Delivery
This program is available:
• primarily online (at least 80% of the instruction for the program is online with short, intensive periods of face-to-face coursework)
Prerequisites for Admission
The preferred undergraduate GPA for admittance to the program is 3.00.

Bachelor's degree in a health-related field or a Bachelor's in a non-health-related field with specific coursework in psychology, physiology, and statistics from an accredited institution.

Required prerequisites
Course Group 0
Previous coursework in psychology, physiology, and statistics must have been completed.

Other requirements to be completed before admission:
In addition to the University's online application, applicants must submit a letter describing their goals for the program and their professional qualifications. This three to five page personal statement should focus on what led to the applicant's interest in health coaching as a professional activity, including a description of interest in and experience with holistic integrative health and healing. Be as specific as possible. Three letters of recommendation, transcripts and a current C.V. or resume are also required. All items can be uploaded to the University's online application. An applicant interview is required prior to admission.

Special Application Requirements:
This M.A. is designed for individuals with a bachelor's degree in a health-related field, or in a health field. Professionals without healthcare backgrounds, but with extensive interest in working with individuals and groups to optimize wellbeing, and who have a desire for a full graduate degree, would also be excellent candidates assuming completion of required prerequisites. Although the instruction is based on research in the field, the Plan B degree is not intended to provide intensive research training. It is understood to be a terminal degree, and is thus not recommended for students who intend to pursue the PhD degree. All students must be able to demonstrate certain competencies and knowledge in healthcare (through review of transcripts and course work completed) prior to being admitted into the Advanced Health Coaching Seminar. Students whose previous coursework does not enable them to meet these competencies can arrange with the program director to do additional outside coursework during the first year of the program.

International applicants must submit score(s) from one of the following tests:
- TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
  - Paper Based - Total Score: 550
- IELTS
  - Total Score: 6.5
- MELAB
  - Final score: 80

The preferred English language test is Test of English as Foreign Language

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements
Plan B: Plan B requires 32 to 38 major credits and 0 to 6 credits outside the major. The final exam is written and oral. A capstone project is required.

Capstone Project: 2 credits (120 hrs.) Optimally spread over 2 semesters, this service-learning opportunity builds upon the core tenets from all preceding course work, including the Health and Wellness Coaching for Groups course. Students will be matched with a community partner to design, develop, and deliver a program that contains some component of both individual coaching and group-coaching, with an identified population in need. Additionally, the project must be placed within, or utilized through an interdisciplinary team. The 2-semester coursework will culminate with students submitting a formal 20-page paper, as well as presenting their projects to faculty and their classmates.

This program may be completed with a minor.

Use of 4xxx courses towards program requirements is not permitted.

A minimum GPA of 2.8 is required for students to remain in good standing.
At least 1 semester must be completed before filing a Degree Program Form.

**Required Coursework**

- **CSPH 5101** - Introduction to Integrative Healing Practices (3.0 cr)
- **CSPH 5431** - Functional Nutrition: An Expanded View of Nutrition, Chronic Disease, and Optimal Health (2.0 cr)
- **KIN 5133** - Motivational Interventions in Physical Activity (3.0 cr)
- **CSPH 5701** - Fundamentals of Health Coaching I (4.0 cr)
- **CSPH 5702** - Fundamentals of Health Coaching II (4.0 cr)
- **CSPH 5703** - Advanced Health Coaching Practicum (3.0 cr)
- **CSPH 5704** - Business of Health Coaching (2.0 cr)
- **CSPH 5705** - Health Coaching Professional Internship (2.0 cr)

**Required Coursework**

- **CSPH 5000** - Introduction to Lifestyle Medicine (2 cr);
- **CSPH 5000** - Coaching People with Chronic Clinical Conditions (2 cr);
- **CSPH 5000** - Health and Wellness Coaching for Groups (2 cr);
- **CSPH 5000** - Mind-Body Science and the Art of Transformation (1 cr);
- **CSPH 8000** - Master's Capstone project (2 cr)

Take 5 or more course(s) from the following:

**Electives A. Cultural Healing Approaches**

- **CSPH 5111** - Ways of Thinking about Health (2 cr)
- **CSPH 5115** - Cultural Awareness, Knowledge, and Health (3 cr)
- **CSPH 5311** - Introduction to Traditional Chinese Medicine (2 cr)
- **CSPH 5331** - Foundations of Shamanism & Shamanic Healing (2 cr)
- **CSPH 5341** - Overview of Indigenous Hawaiian Healing (2 cr)
- **CSPH 5342** - Mind-Body Science and the Art of Transformation (2 cr)
- **CSPH 5315** - Traditional Tibetan Medicine: Ethics, Spirituality, & Healing (2 cr) **CSPH 5318** - Tibetan Medicine, Ayurveda, and Yoga in India (4 cr)

Take 0 - 6 credit(s) from the following:

**Electives B. Expanding Healing Practices**

- **CSPH 5503** - Aromatherapy Fundamentals (1 cr)
- **CSPH 5535** - Reiki Healing (1 cr)
- **CSPH 5536** - Advanced Reiki Healing: Level II (1 cr)
- **CSPH 5631** - Healing Imagery I (2 cr)
- **CSPH 5313** - Acupressure (1 cr)
- **CSPH 5545** - Mind-Body Healing Therapies (2 cr)
- **CSPH 5421** - Botanical Medicines in Complementary Healthcare (3 cr)
- **CSPH 5423** - Botanical Medicines: Foundations and Practical Applications (1 cr)

Take 0 - 6 credit(s) from the following:

**Electives C. Mind-Body Integration**

- **CSPH 5545** - Mind-Body Healing Therapies (2 cr)
- **CSPH 5225** - Meditation: Integrating Body and Mind (2 cr)
- **CSPH 5226** - Advanced Meditation: Body, Brain, Mind, and Universe (1 cr)
- **CSPH 5541** - Emotional Healing and Happiness: Eastern and Western Approaches to Transforming the Mind (2 cr)
- **CSPH 5201** - Spirituality and Resilience (2 cr)
- **CSPH 5212** - Peace-building Through Mindfulness: Transformative Dialogue in the Global Community (3 cr)

Take 0 - 6 credit(s) from the following:

**Electives D. Creative Expressions for Health**

- **CSPH 5555** - Introduction to Body and Movement-based Therapies (2 cr)
- **CSPH 5561** - Overview of the Creative Arts in Health and Healing (2 cr)
- **CSPH 5601** - Music, Health and Healing (2 cr)
- **CSPH 5605** - Movement and Music for Well-being and Healing (2 cr)
- **CSPH 5631** - Healing Imagery I (2 cr); **CSPH 5611** - Healthy Humor (1 cr)
- **CSPH 5641** - Animals in Health Care: The Healing Dimensions of Human/Animal Relationships (3 cr)

Take 0 - 6 credit(s) from the following:
Twin Cities Campus

Integrative Therapies and Healing Practices Minor

Health Sciences-Adm
Graduate School

Link to a list of faculty for this program.

Contact Information:
Center for Spirituality & Healing, Mayo Memorial Building, 5th floor, MMC 505, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-624-9459; fax: 612-626-5280)
Website: http://www.csh.umn.edu

- Program Type: Graduate free-standing minor
- Requirements for this program are current for Fall 2014
- Length of program in credits (Masters): 8
- Length of program in credits (Doctorate): 12
- This program does not require summer semesters for timely completion.

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

The Graduate Minor in Integrative Therapies and Healing Practices is an interdisciplinary program designed to expose students to the global range of integrative, complementary, cross-cultural, and spiritual healing practices. It enhances the preparation of graduate students in health sciences and other disciplines by developing knowledge and skills in the emerging field of integrative health care. Specifically, the Minor provides students with a theoretical basis for applying integrative therapies and healing practices; prepares students to research integrative therapies and healing practices; and prepares students to work collaboratively with other health professionals and patients in a multicultural, pluralistic healthcare system. The Minor includes a set of core courses that provide the theoretical foundation for the program. Students may elect to take additional courses offered by the Center for Spirituality & Healing in clinical applications, spirituality, or cross-cultural health and healing. A number of other University courses also satisfy the course requirements of the minor; contact the Minor program office for more information.

Program Delivery

This program is available:
- via classroom (the majority of instruction is face-to-face)
- completely online (all program coursework can be completed online)
- primarily online (at least 80% of the instruction for the program is online with short, intensive periods of face-to-face coursework)
- partially online (between 50% to 80% of instruction is online)

Prerequisites for Admission

Health professional students, practitioners and lifelong learners seeking to deepen their understanding of integrative therapeutic topics.

Full and part-time graduate students come from wide-ranging backgrounds and careers, including nursing, pharmacy, medicine, nutrition, psychology, physical therapy, liberal studies and public health.

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements

Use of 4xxx courses towards program requirements is not permitted.

Master's and doctoral students are required to take CSPH 5101 (3 cr). Master's students take an additional 5 credits for a total 8 credits; Doctoral students take an additional 9 credits for a total of 12 credits. Note that students cannot use course credits to satisfy requirements for both a major and the minor.
Twin Cities Campus

Integrative Therapies and Healing Practices Postbaccalaureate Certificate

Health Sciences-Adm

Graduate School

Link to a list of faculty for this program.

Contact Information:
Center for Spirituality & Healing, Mayo Memorial Building, 5th floor, MMC 505, 420 Delaware Street S.E., Minneapolis, MN 55455 (612-624-9459; fax: 612-626-5280).
Website: http://www.csh.umn.edu

- Program Type: Post-baccalaureate credit certificate/licensure/endorsement
- Requirements for this program are current for Fall 2014
- Length of program in credits: 12 to 19
- This program does not require summer semesters for timely completion.
- Degree: Integrative Thpys & Healing Practices PBacc Cert

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

The Certificate in Integrative Therapies and Healing Practices is an interdisciplinary program designed to expose students to the global range of integrative, complementary, cross-cultural, and spiritual healing practices. It enhances the preparation of health science practitioners by developing knowledge and skills in the emerging field of integrative health care. Specifically, the Certificate provides students with a theoretical basis for applying integrative therapies and healing practices; prepares students to research integrative therapies and healing practices; and prepares students to work collaboratively with other health professionals and patients in a multicultural, pluralistic healthcare system. The 12-credit Certificate includes a set of core courses that provide the theoretical foundation for the program. Students who choose the Certificate's Health Coaching track must complete a total of 19 credits. Students may elect to take additional courses offered by the Center for Spirituality and Healing in clinical applications, spirituality, and cross-cultural health and healing.

Program Delivery
This program is available:
- via classroom (the majority of instruction is face-to-face)
- primarily online (at least 80% of the instruction for the program is online with short, intensive periods of face-to-face coursework)
- partially online (between 50% to 80% of instruction is online)

Prerequisites for Admission
The preferred undergraduate GPA for admittance to the program is 3.00.

Other requirements to be completed before admission:
This field of study is designed for the healthcare professional, those currently enrolled in a graduate health professions program, board-certified chaplains with at least three years in a healthcare setting, and those with a non-healthcare bachelor's degree with life/work experience in health related areas. Such fields include nursing, social work, psychology, medicine, nutrition, pharmacy, chiropractic, naturopathy, and licensed acupuncturer.

The Health Coaching track of the Certificate requires an applicant interview prior to admission.

Special Application Requirements:
In addition to the University's online application, applicants must submit a letter describing their goals for obtaining the Certificate and their professional qualifications. The statement should address the question, "What are your short- and long-term professional goals after you complete the Postbaccalaureate Certificate program in Integrative Therapies and Healing Practices?" Be as specific as possible. Two letters of support are required if the individual is not currently enrolled in a graduate program at the University of Minnesota, one from an academic source and one from an employer/supervisor. A current C.V. is also requested. All items can be uploaded to the University's online application.

Applicants to the Health Coaching track will need three recommendations and a three to five page personal statement focusing on what led to the applicant's interest in Health Coaching as a professional activity, including a description of interest in and experience with holistic integrative health and healing. Students should also include a current C.V. or resume. All items can be uploaded to the University's online application.
International applicants must submit score(s) from one of the following tests:

- **TOEFL**
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
  - Paper Based - Total Score: 550

- **IELTS**
  - Total Score: 6.5

- **MELAB**
  - Final score: 80

The preferred English language test is Test of English as Foreign Language

Key to test abbreviations (TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

**Program Requirements**

Use of 4xxx courses towards program requirements is not permitted.

A minimum GPA of 2.80 is required for students to remain in good standing.

At least 1 semester must be completed before filing a Degree Program Form.

A total of 12 credits are required to complete the Certificate. Required courses: CSPH 5101 - Introduction to Integrative Therapies and Healing Practices (3 cr) and CSPH 5102 - Art of Healing: Self as Healer (1 cr). Students are encouraged to choose the remaining 8 credits from courses consistent with their academic training and professional goals. The student’s faculty adviser works with the student in designing a program plan that accommodates the student’s unique learning objectives. Students pursuing the Health Coaching Track within the Certificate must complete 19 credits. In addition to the two courses required for the Certificate, Health Coaching students complete a required course sequence of CSPH 5701, CSPH 5702, CSPH 5703, CSPH 5704 and CSPH 5705. To earn a Certificate, the preferred GPA for all courses is 2.80.

**Program Sub-plans**

A sub-plan is not required for this program.

Students may not complete the program with more than one sub-plan.

**Health Coaching**

A total of 19 credits are required to complete this track within the Certificate. The track requires four semesters of coursework, which can be spread over a variable amount of time up to a maximum of four years. Certain courses must be taken sequentially, leading to skill sets and a knowledge base which grows and matures over time. In addition to the two required courses for the Certificate, Health Coaching students must take CSPH 5701 - Fundamentals of Health Coaching I (4 cr), CSPH 5702 - Fundamentals of Health Coaching II (4 cr), CSPH 5703 - Advanced Health Coaching Practicum (3 cr), CSPH 5704 - Business of Health Coaching (2 cr), and a professional internship in health coaching (2 cr). To earn a Certificate, the preferred GPA for all courses is 2.80.

- CSPH 5101 - Introduction to Integrative Healing Practices (3 cr)
- CSPH 5102 - Art of Healing: Self as Healer (1 cr)
- CSPH 5701 - Fundamentals of Health Coaching I, with Laboratory (4 cr)
- CSPH 5702 - Fundamentals of Health Coaching II, with Laboratory (4 cr)
- CSPH 5703 - Advanced Health Coaching Practicum (3 cr)
- CSPH 5704 - Business of Health Coaching (2 cr)
- CSPH 5705 - Professional Internship in Health Coaching (2 cr)
Twin Cities Campus

Molecular, Cellular, Developmental Biology and Genetics M.S.
Genetics, Cell Biology, and Development TCBS, Genetics, Cell Biology, and Development TMED

Graduate School

Link to a list of faculty for this program.

Contact Information:
MCDB&G Graduate Program, 6-160 Jackson Hall, 321 Church Street S.E., University of Minnesota, Minneapolis, MN 55455 (612-624-7470, fax: 612-626-6140)
Email: mcdbg@umn.edu
Website: http://mcdbg.umn.edu

- Program Type: Master's
- Requirements for this program are current for Fall 2014
- Length of program in credits: 30 to 50
- This program requires summer semesters for timely completion.
- The clinical component of the program program in genetic counseling involves work multiple clinical settings throughout the Twin Cities, the Mayo clinic in Rochester and clinics in St. Cloud and Duluth.
- Degree: Master of Science

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

Genetic Counseling Focus: The master of science in MCDB&G is offered with a focus of study in genetic counseling. It is offered for full-time study, and designed to provide students with the academic foundation and clinical expertise necessary to enter the profession of genetic counseling. The curriculum integrates selected coursework with firsthand experience in the diagnostic medical genetics laboratories and supervised work in multiple clinical genetics settings with patients and families. The program is accredited by the Accreditation Council for Genetic Counseling and all graduates are eligible to apply to the American Board of Genetic Counseling for active candidate status and sit for board certification.

Joint Degree Program: MCDB&G also offers a master of science that is part of the Joint Degree Program in Law, Science, and Technology. This program is unique in the nation and enables students to combine a JD degree with a PhD or MS degree. Students entering this program must be admitted to both the MCDB&G program and the Law School. Admission qualifications for MS and PhD students are identical; only the student's career objectives distinguish the degree that they pursue.

MS Research Degree: Eligible students who were admitted to the MCDB&G doctoral program, but who leave before they have completed their PhD, may be offered the option to complete the MS degree. Eligibility is determined by the student's adviser and the MCDB&G DGS.

Accreditation
This program is accredited by The Accreditation Council for Genetic Counseling

Program Delivery
This program is available:
- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
The preferred undergraduate GPA for admittance to the program is 3.00.

An undergraduate or master's degree in the biological, chemical, or physical sciences is preferred.

Other requirements to be completed before admission:
Applicants to the MCDB&G with the genetic counseling focus are required to have completed courses in organic chemistry, biochemistry, general genetics, statistics and probability, and psychology. In addition, all applicants to the genetic counseling focus must have some type of client advocacy experience such as volunteer or paid work with troubled teens, working in a shelter for battered women, or a suicide prevention hotline, etc. The best experiences afford the applicant the opportunity to work in a helping profession.

Successful applicants to the JD/MS must have previous research experience in an academic or industrial setting in addition to any course-related laboratory experiences. It is important to demonstrate familiarity with and aptitude for basic science research prior to embarking on a graduate career in this program. Recommended academic preparation includes coursework in molecular biology,
Special Application Requirements:
Applications to the genetic counseling focus of study are stronger if the applicant has spent some time with a practicing genetic counselor either in the clinical setting or in some capacity such as personal interviews that affords the applicant a real life understanding of the profession.

Applicants to the JD/MS program must submit three letters of recommendation from persons familiar with their academic and research capabilities. A statement of interests and goals, a complete set of transcripts, and scores from the General Test of the GRE are required. The GRE Subject Test in biochemistry, cell and molecular biology, biology, or chemistry is strongly recommended, but not required. The recommended date for receipt of completed applications is December 1. Graduate studies begin fall semester. Entry into the JD/MS program requires separate admittance to both the Law School and the MCDB&G Graduate Program.

Applicants must submit their test score(s) from the following:
• GRE
  - General Test - Verbal Reasoning: 550
  - General Test - Quantitative Reasoning: 600
  - General Test - Analytical Writing: 3.5

International applicants must submit score(s) from one of the following tests:
• TOEFL
  - Internet Based - Total Score: 107
  - Internet Based - Writing Score: 25
  - Internet Based - Reading Score: 25
  - Paper Based - Total Score: 625
• IELTS

Key to test abbreviations (GRE, TOEFL, IELTS).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements

Plan A: Plan A requires 14 major credits, 6 credits outside the major, and 10 thesis credits. The final exam is written and oral.

Plan B: Plan B requires 14 to 40 major credits and 6 to 10 credits outside the major. The final exam is written and oral. A capstone project is required.

Capstone Project: All Plan B students must complete a research or capstone project that is scholarly in quality, and present their results at their final oral examination. Projects that qualify for the genetic counseling focus include those that study a genetic counseling problem and add to the existing genetic counseling literature; produce materials that add to the profession such as teaching materials or ways of evaluating the service; or produce educational materials needed by patient populations or the general public. Other Plan B students are expected to produce a report approximately 15 pages in length that thoughtfully discusses an important scientific topic that the student and adviser agree upon. The report should include an introduction that explains the significance of the topic, a review of the literature or an analysis of a specific aspect of the area and a discussion regarding current or future endeavors.

This program may not be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.0 is required for students to remain in good standing.

At least 2 semesters must be completed before filing a Degree Program Form.

The genetic counseling focus of study is offered under Plan B and is designed to be completed in 4 semesters and the interim summer. Most of the coursework takes place in the first year, leaving more open time during the second year for clinical experience. Students must complete a minimum of 40 graduate credits with at least 30 credits in the major area of study, a plan B project paper, and a final oral exam. Students will be placed in laboratory and clinical observation experiences during the first year and five clinical genetic counseling internships during the second year. Students will complete a minimum of 800 hours of direct patient contact. Students must earn a passing grade in their five clinical internship rotations and present a completed log of at least 50 clinical cases before final oral exam. Only under exceptional circumstances will the course of study be varied to meet the needs of a student with many of the courses...
already completed or with extensive clinical laboratory experience.

Students in the JD/MS program or PhD to MS students may complete the MS under Plan A or Plan B. Plan A requires a minimum of 24 course credits and 10 thesis credits; Plan B requires a minimum of 24 course credits and the completion of a Plan B paper. Students take a core curriculum, which is multidisciplinary and contributes to both the major and minor or related field requirements. Students may choose a concentration or specialization within the program such as cell biology, developmental biology, genetics, or human genetics.

Degree Focuses

Genetic Counseling

Year 1
Students will take courses that focus on medical, human, and behavioral genetics and genetic counseling practice. Students will have the option to choose between several electives from law and ethics, public health, and counseling psychology. In addition, students will observe in a clinical setting one day per week and gain experience in the clinical laboratories one day per week.

Summer
During the summer between the first and second year of the program, students will begin their first clinical internship rotation where the student will have patient responsibilities. This rotation will be a full 10 weeks long with the expectation that students will spend between 2-3 days per week in the clinic. The minimum time in the clinic will be 20 hours per week but will ultimately be set by the clinical supervisor and may exceed the minimum.

Year 2
Students will complete course work in counseling skills, psychosocial issues in genetic counseling, and ethical issues in genetic counseling. In addition students will spend 2-3 days per week in the clinic seeing patients and families under the supervision of a board certified genetic counselor.

-OR-

Academic Focus

Joint- or Dual-degree Coursework: Joint Degree Program in Law, Science and Technology. Student may take a total of 12 credits in common among the academic programs.
Twin Cities Campus
Molecular, Cellular, Developmental Biology and Genetics Minor
Genetics, Cell Biology, and Development TCBS, Genetics, Cell Biology, and Development TMED
Graduate School

Link to a list of faculty for this program.

Contact Information:
MCDB&G Graduate Program, 6-160 Jackson Hall, 321 Church Street S.E., University of Minnesota, Minneapolis, MN 55455 (612-624-7470, fax: 612-626-6140).
Email: mcdbg@umn.edu
Website: http://mcdbg.umn.edu

• Program Type: Graduate minor related to major
• Requirements for this program are current for Fall 2014
• Length of program in credits (Masters): 6
• Length of program in credits (Doctorate): 12
• This program does not require summer semesters for timely completion.

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

This program provides scientific training in the basic life sciences, with emphasis on the molecular basis of genetics, development, and cell biology. Areas of specialization include membranes, receptors, membrane transport, cell interactions, macromolecular structure, extracellular matrix, cytoskeleton, cell motility, regulation of gene expression, neuroscience, developmental mechanisms, human genetics, plant cell and molecular biology, genetic mechanisms, and genomics.

The program is interdisciplinary and involves faculty from several departments in the College of Biological Sciences, the Medical School, and the College of Food, Agricultural and Natural Resource Sciences. Institutes for human genetics, plant molecular genetics, biological process technology, Genome Engineering, Stem Cell research and a center for developmental biology provide opportunities for graduate study.

Program Delivery
This program is available:
• via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements
Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A master's minor requires 6 credits. A doctoral minor typically includes the genetics core (GCD 8131 and BIOC 8002 or GCD 4034), cell biology (GCD 8151 or 5036), and developmental biology (GCD 8161, 4151, or 4161), as appropriate to the student's field of specialization.
Twin Cities Campus

Molecular, Cellular, Developmental Biology and Genetics Ph.D.
Genetics, Cell Biology, and Development TCBS, Genetics, Cell Biology, and Development TMED

Graduate School

Link to a list of faculty for this program.

Contact Information:
MCDB&G Graduate Program, 6-160 Jackson Hall, 321 Church Street S.E., University of Minnesota, Minneapolis, MN 55455 (612-624-7470, fax: 612-626-6140)
Email: mcdbg@umn.edu
Website: http://mcdbg.umn.edu

Program Type: Doctorate
Requirements for this program are current for Fall 2014
Length of program in credits: 48
This program does not require summer semesters for timely completion.
Degree: Doctor of Philosophy

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

This program provides scientific training in the basic life sciences, with emphasis on the molecular basis of genetics, development, and cell biology. Areas of specialization include membranes, receptors, membrane transport, cell interactions, macromolecular structure, extracellular matrix, cytoskeleton, cell motility, regulation of gene expression, neuroscience, developmental mechanisms, human genetics, plant cell and molecular biology, genetic mechanisms, and genomics.

The program is interdisciplinary and involves faculty from several departments in the College of Biological Sciences, the Medical School, and the College of Food, Agricultural and Natural Resource Sciences. Institutes for human genetics, plant molecular genetics, biological process technology, Genome Engineering, Stem Cell research and a center for developmental biology provide opportunities for graduate study.

Ph.D. students are admitted to MCDB&G under the auspices of Molecular, Cellular and Structural Biology (MCSB), a first year program administered by the MCDB&G and the Biochemistry, Molecular Biology and Biophysics (BMBB) Graduate Programs. After the first year, students select either MCDB&G or BMBB to complete their degree. MCDB&G does not have a freestanding master's program.

The MCBDB&G Ph.D. is also part of two joint degree programs: The Joint Degree Program in Law, Health and Life Sciences; and the M.D./Ph.D. program.

The Joint Degree Program in Law, Health and Life Sciences is unique in the nation and enables students to combine a J.D. degree with a Ph.D. or M.S. degree. Students entering this program must be admitted to both the MCDB&G program and the Law School. Admission qualifications for M.S. and Ph.D. students are identical; only the student's career objectives distinguish the degree that they pursue.

The M.D./Ph.D. program emphasizes integration of the two major components of training--medicine and research--to ensure excellence in both. The program features a special curriculum that facilitates the transition from Medical School to the first year of formal graduate training, and the transition from graduate training back to Medical School.

Program Delivery
This program is available:
• via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
The preferred undergraduate GPA for admittance to the program is 3.50.

Applications from students with an undergraduate or master's degree in the biological, chemical, or physical sciences are preferred.

Other requirements to be completed before admission:
Recommended academic preparation includes coursework in molecular biology, genetics, biology, and biochemistry.

Successful applicants must have previous research experience in an academic or industrial setting in addition to any course-related laboratory experiences. It is important to demonstrate familiarity with and aptitude for basic science research prior to embarking on a
graduate career in this program.

**Special Application Requirements:**
Applicants must submit three letters of recommendation from persons familiar with their academic and research capabilities. A statement of interests and goals, a complete set of transcripts, and scores from the General Test of the GRE are required. We will accept copies of the transcripts and GRE scores. The GRE Subject Test in biochemistry, cell and molecular biology, biology, or chemistry is strongly recommended, but not required. The deadline for receipt of completed applications is December 1. Graduate studies begin fall semester only.

Entry into the J.D./Ph.D. program requires separate admittance to both the Law School and the MCDB&G Graduate Program. Entry into the M.D./Ph.D. program requires separate admittance to both the Medical School and the MCDB&G Graduate Program.

Applicants must submit their test score(s) from the following:

- **GRE**
  - General Test - Verbal Reasoning: 550
  - General Test - Quantitative Reasoning: 600
  - General Test - Analytical Writing: 3.5

International applicants must submit score(s) from one of the following tests:

- **TOEFL**
  - Internet Based - Total Score: 107
  - Internet Based - Writing Score: 25
  - Internet Based - Reading Score: 25
  - Paper Based - Total Score: 625

Key to test abbreviations (GRE, TOEFL).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

**Program Requirements**
12 credits are required in the major.
12 credits are required outside the major.
24 thesis credits are required.

This program may not be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.0 is required for students to remain in good standing.

The Ph.D. program is designed by the student and the adviser to meet individual interests and goals. Advanced courses in genetics, molecular biology, cell biology, developmental biology, and biochemistry are required, in addition to special courses, topical seminar courses, laboratory research rotations, thesis research, student research seminars, departmental seminars, and journal clubs. The student's core curriculum is multidisciplinary and contributes to both major and minor field requirements. Ph.D. students serve as TAs for two semesters during their graduate career. Students in one of the joint degree programs serve as a TA for one semester.

This program is part of Joint Degree Program in Law, Health and the Life Sciences offering a J.D./Ph.D. and a J.D./M.S. track. Selected courses must be approved by the DGS. Students pursuing the J.D./Ph.D. start by completing the first year of Law School, then enter the Ph.D. portion of the program and complete this degree before returning to finish Law School.

This program also offers a joint M.D./Ph.D. degree program: 12 credits of Medical School courses can be used to fulfill credit requirements for the Ph.D. program with approval of the DGS. Students pursuing the M.D./Ph.D. start the program by completing the first two years of Medical School during which time they do laboratory rotations. After selecting a laboratory, they then enter the Ph.D. portion of the program and complete this degree before returning to finish Medical School.

**First Year**
To obtain a PhD in MCDB&G, all students must complete the following courses.

- **BIOC 8001** - Biochemistry: Structure, Catalysis, and Metabolism (3.0 cr)
- **BIOC 8002** - Molecular Biology and Regulation of Biological Processes (3.0 cr)
- **MCDG 8920** - Special Topics (1.0 - 4.0 cr)
- **MCDG 8900** - Student Research Seminar (1.0 cr)
GCD 8151 - Cell Structure and Function (3.0 cr)
BIOC 8401 - Ethics, Public Policy, and Careers in Molecular and Cellular Biology (1.0 cr)
GCD 8131 - Advanced Genetics and Genomics (3.0 cr)
GCD 8171 - Literature Analysis (2.0 cr)

Joint- or Dual-degree Coursework: The Joint Degree Program in Law, Health and the Life Sciences; and the M.D./Ph.D. program. Student may take a total of 12 credits in common among the academic programs.
Twin Cities Campus
Water Resources Science M.S.
Water Resources Center
Graduate School

Link to a list of faculty for this program.

Contact Information:
Water Resources Science, University of Minnesota, 193 McNeal Hall, 1985 Buford Avenue, St. Paul MN 55108 (612-624-7456; fax: 612-625-1263)
Email: wrs@umn.edu
Website: http://wrs.umn.edu

- Program Type: Master's
- Requirements for this program are current for Fall 2014
- Length of program in credits: 30
- This program does not require summer semesters for timely completion.
- University of Minnesota, Duluth
- Degree: Master of Science

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

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. level: 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.

Students in the program develop the breadth of scientific knowledge appropriate to understand the complicated aquatic ecosystems and watersheds on which they will work, as well as social dimensions of the topic, including the public policy and legal frameworks in which water resources are protected and managed.

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

Program Delivery
This program is available:
- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission
The preferred undergraduate GPA for admittance to the program is 3.00.

The program is flexible enough to accommodate students from a variety of backgrounds. Normally students have a bachelor's degree in physical, biological, or environmental science or engineering.

Other requirements to be completed before admission:
Recommended academic preparation includes one year (or two semesters) each of calculus, physics, and chemistry, and one biology course.

Availability of funding and willingness of a member of the graduate faculty to serve as an adviser are important criteria for admission to the program.
Special Application Requirements:
Applicants must submit three letters of recommendation via the University of Minnesota's ApplyYourself website. 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.

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 General Test. Students may be admitted any semester but are strongly encouraged to submit their application by December 15 for fall semester admission. More specific application instruction can be found on the program website: wrs.umn.edu/prospectivestudents/apply/index.htm.

Applicants must submit their test score(s) from the following:
• GRE

International applicants must submit score(s) from one of the following tests:
• TOEFL
  - Internet Based - Total Score: 79
  - Paper Based - Total Score: 550
• IELTS
  - Total Score: 6.5
• MELAB
  - Final score: 80

The preferred English language test is Test of English as Foreign Language

Key to test abbreviations (GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements
Plan A: Plan A requires 14 major credits, 6 credits outside the major, and 10 thesis credits. The final exam is oral.

Plan B: Plan B requires 24 major credits and 6 credits outside the major. The final exam is oral. A capstone project is required.

Capstone Project: The Plan B project is defined by the faculty adviser. The Plan B option is well suited to students who have little undergraduate course work in water resources science and thus need more coursework to gain the combination of depth and breadth needed in this field. Plan B projects involve field, laboratory, or computer work and the analysis, synthesis, or interpretation of data.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

At least 1 semesters must be completed before filing a Degree Program Form.

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 and economics, and two electives in such areas of emphasis: aquatic biology, hydrologic science, watershed science and management, water quality, environmental chemistry, limnology, water policy and economics, or water management technology. One elective must be from an approved list of technical courses dealing with water quality science/management. A minimum of two related field courses (at least 6 credits) outside of aquatic science are required. Registration for the WRS Seminar during the first semester in residence and training in responsible conduct of research and ethics are also required.

Approved core and area of emphasis courses as well as a list of faculty are listed on the program website: wrs.umn.edu/degreesandcourses/index.htm.

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 minimum credit requirements.

Program Sub-plans
A sub-plan is not required for this program. Students may not complete the program with more than one sub-plan.

Limnology and Oceanography
The science of inland waters, or “limnology,” includes the study of streams, lakes, ponds, and wetlands. While Lake Superior falls into this category, the style of research, particularly the nature of sampling and the scale of the processes investigated, makes study of Lake Superior and other Great Lakes more akin to oceanography than to classical limnology. A program that focuses on the study of both limnology and oceanography strengthens understanding of both systems, through comparative studies and by fostering interaction between groups that focus more strongly on one or the other system. Limnology and oceanography are by necessity interdisciplinary fields, with major components contributed by biological, geological, physical and chemical sciences. Such interdisciplinary fields in the modern research university require mechanisms to insure cross-fertilization of ideas, approaches, methods, techniques, and knowledge. The limnology and oceanography track in WRS provides just such a much-needed mechanism.

The goal of the program is to produce scientists with strong technical skills in aquatic science and a broad understanding of limnology and oceanography.

Students may choose Plan A, which requires a thesis, or Plan B, which requires additional coursework and a major project. Specific curriculum for the limnology and oceanography track follows WRS course requirements. Both plans incorporate courses offered on the Twin Cities and Duluth campuses.

Students must complete courses in four limnology and oceanography track core areas: 1) hydrology (surface and/or hydrogeology); 2) environmental/water chemistry; 3) limnology; and 4) water resources policy, economics, and management; and one elective must be from an approved list of technical courses dealing with water quality science/management. An additional one or two electives in limnology and oceanography are also required. A minimum of two related field courses (at least 6 credits) outside of aquatic science are required. Registration for the WRS Seminar during the first semester in residence and training in responsible conduct of research and ethics are also required.

A minimum of 20 course credits (plus 10 thesis credits) are required for Plan A and a minimum of 30 credits are required for Plan B (up to 3 credits 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 minimum credit requirements.

The faculty adviser must be a member of the limnology and oceanography track faculty.

Approved limnology and oceanography track core and elective courses as well as a list of faculty are listed on the program website: wrs.umn.edu/degreesandcourses/landotrack/index.htm.
**Twin Cities Campus**

**Water Resources Science Minor**

**Water Resources Center**

**Graduate School**

Link to a list of faculty for this program.

**Contact Information:**
Water Resources Science, 193 McNeal Hall, 1985 Buford Avenue, St. Paul MN 55108 (612-624-7456; fax: 612-625-1263)
Email: wrs@umn.edu
Website: http://wrs.umn.edu

- Program Type: Graduate minor related to major
- Requirements for this program are current for Fall 2014
- Length of program in credits (Masters): 9
- Length of program in credits (Doctorate): 12
- This program does not require summer semesters for timely completion.
- University of Minnesota Duluth

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

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.

Students in the program develop the breadth of scientific knowledge appropriate to understand the complicated aquatic ecosystems and watersheds on which they will work, as well as social dimensions of the topic, including the public policy and legal frameworks in which water resources are protected and managed.

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

**Program Delivery**
This program is available:
- via classroom (the majority of instruction is face-to-face)

**Prerequisites for Admission**
The preferred undergraduate GPA for admittance to the program is 3.00.

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

**Program Requirements**
Use of 4xxx courses towards program requirements is not permitted.

A master's minor requires 9 credits, including WRS 5101 (3 credits) and two of the other core courses described under M.S. degree requirements. Doctoral students must complete 12 credits, including WRS 5101 (3 credits), a core course described under the M.S. degree requirements, and two electives from one of the areas of emphasis.
Twin Cities Campus

Water Resources Science Ph.D.

Water Resources Center

Graduate School

Link to a list of faculty for this program.

Contact Information:

Water Resources Science, 193 McNeal Hall, 1985 Buford Avenue, St. Paul MN 55108 (612-624-7456; fax: 612-625-1263)

Email: wrs@umn.edu

Website: http://wrs.umn.edu

- Program Type: Doctorate
- Requirements for this program are current for Fall 2014
- Length of program in credits: 64
- This program does not require summer semesters for timely completion.
- The Water Resources Science Ph.D. is an All-University program delivered on the Twin Cities and Duluth Campuses. The University of Minnesota Twin Cities is the degree granting authority for the Water Resources Science Ph.D. program in Duluth.
- Degree: Doctor of Philosophy

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

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 Ph.D. level: 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.

Students in the program develop the breadth of scientific knowledge appropriate to understand the complicated aquatic ecosystems and watersheds on which they will work, as well as social dimensions of the topic, including the public policy and legal frameworks in which water resources are protected and managed.

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

Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission

The preferred undergraduate GPA for admittance to the program is 3.00.

The program is flexible enough to accommodate students from a variety of backgrounds. Normally students have a master's degree in physical, biological, or environmental science or engineering.

Other requirements to be completed before admission:

Recommended academic preparation includes one year (or two semesters) each of calculus, physics, and chemistry, and one biology course at the undergraduate level.

Availability of funding and willingness of a member of the graduate faculty to serve as an adviser are important criteria for admission to the Ph.D. program.
Special Application Requirements:
Applicants must submit three letters of recommendation via the University of Minnesota's ApplyYourself website. 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.

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. Students may be admitted any semester but are strongly encouraged to submit their application by December 15 for fall semester admission. More specific application instruction can be found on the program website: wrs.umn.edu/prospectivestudents/apply/index.htm.

Applicants must submit their test score(s) from the following:
• GRE

International applicants must submit score(s) from one of the following tests:
• TOEFL
  - Internet Based - Total Score: 79
  - Paper Based - Total Score: 550
• IELTS
  - Total Score: 6.5
• MELAB
  - Final score: 80

The preferred English language test is Test of English as Foreign Language

Key to test abbreviations (GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements
28 credits are required in the major.
12 credits are required outside the major.
24 thesis credits are required.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

At least 2 semesters must be completed before filing a Degree Program Form.

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 supporting or minor program.

Approved core and area of emphasis courses as well as a list of faculty are listed on the program website: wrs.umn.edu/degreesandcourses/index.htm.

Program Sub-plans
A sub-plan is not required for this program.
Students may not complete the program with more than one sub-plan.

Limnology and Oceanography
The science of inland waters, or "limnology," includes the study of streams, lakes, ponds and wetlands. While Lake Superior falls into this category, the style of research, particularly the nature of sampling and the scale of the processes investigated, makes study of Lake
Superior and other Great Lakes more akin to oceanography than to classical limnology. A program that focuses on the study of both limnology and oceanography strengthens understanding of both systems, through comparative studies and by fostering interaction between groups that focus more strongly on one or the other system. Limnology and oceanography are by necessity interdisciplinary fields, with major components contributed by biological, geological, physical, and chemical sciences.

This track within the cross-campus interdisciplinary WRS program provides comprehensive training in limnology and oceanography. As is the case for the WRS graduate program as a whole, the L&O program includes a set of core courses plus electives in the subfield of limnology and oceanography.

The goal of the program is to produce scientists with strong technical skills in aquatic science and a broad understanding of limnology and oceanography. Faculty on both Twin Cities and Duluth campuses participate in the limnology and oceanography track. WRS limnology and oceanography faculty list: http://wrs.umn.edu/faculty/landotracklist/index.htm.

Specific curriculum for the limnology and oceanography track follows WRS course requirements. Core courses are offered on both the Twin Cities and Duluth campuses.

Students must complete coursework equivalent to that of an M.S. in the water resources science limnology and oceanography track, with additional coursework in an area of limnology and oceanography. 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 supporting or minor program.

Ph.D. students pursuing this track must have at least two members of the limnology and oceanography track faculty on their committee including the adviser.

Approved limnology and oceanography track core and elective courses as well as a list of faculty are listed on the program website: wrs.umn.edu/degreesandcourses/landotrack/index.htm.