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://cbs.umn.edu/academics/departments/bmbb/graduate-program/about-graduate-program](http://cbs.umn.edu/academics/departments/bmbb/graduate-program/about-graduate-program)

- Program Type: Master's
- Requirements for this program are current for Fall 2016
- 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&G) graduate programs. After the first year, students select either BMBB or MCDB&G to complete their degree.

Note: One cannot apply for admission to the master's degree in BMBB. Students are only admitted to the BMBB PhD program. Alternative, related master's degree programs that admit students are the Master of Biological Sciences (MBS) ([http://cce.umn.edu/master-of-biological-sciences](http://cce.umn.edu/master-of-biological-sciences)) and the Master in Microbial Engineering ([http://bti.umn.edu/MicE/](http://bti.umn.edu/MicE/)).

**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: One cannot apply for admission to the master's degree in BMBB. Students are only admitted to the BMBB PhD program. Alternative, related master's degree programs that admit students are the Master of Biological Sciences (MBS) (http://cce.umn.edu/master-of-biological-sciences) and the Master in Microbial Engineering (http://bti.umn.edu/MicE/).

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 20 major credits, 0 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 Master's 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 Core
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)
BIOC 8777 - Thesis Credits: Master's (1.0 - 18.0 cr)

Laboratory and Field Course
In August of the first year, 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 12 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. Courses from disciplines other than BMBB may be used to build an emphasis in consultation with the student's advisor.

Take 12 or more credit(s) from the following:

- BIOC 5352 - Biotechnology and Bioengineering for Biochemists (3.0 cr)
- BIOC 5361 - Microbial Genomics and Bioinformatics (3.0 cr)
- MICA 8002 - Structure, Function, and Genetics of Bacteria and Viruses (4.0 cr)
- GCD 8151 - Cell Structure and Function (3.0 cr)
- MICA 8003 - Immunity and Immunopathology (4.0 cr)
- MICA 8004 - Cellular and Cancer Biology (4.0 cr)
- GCD 8131 - Advanced Molecular Genetics and Genomics (3.0 cr)
- GCD 8008 - Mammalian Gene Transfer and Expression (2.0 cr)
- PUBH 6450 - Biostatistics I (4.0 cr)
- SCB 8181 - Stem Cell Biology (3.0 cr)
- STAT 5021 - Statistical Analysis (4.0 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 8111 - 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)
- GRAD 8200 - Teaching and Learning Topics in Higher Education (1.0 cr)
- BIOC 5309 - Biocatalysis and Biodegradation (3.0 cr)
- BIOC 5351 - Protein Engineering (3.0 cr)
- CSCI 5461 - Functional Genomics, Systems Biology, and Bioinformatics (3.0 cr)
- GRAD 5102 - Preparation for University Teaching for Nonnative English Speakers (2.0 cr)
Twin Cities Campus
Biochemistry, Molecular Biology and Biophysics Minor
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://cbs.umn.edu/academics/departments/bmbb/graduate-program/about-graduate-program

- Program Type: Graduate minor related to major
- Requirements for this program are current for Fall 2016
- 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 5xxx-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.
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.

**Doctoral**

**Required Courses**
- BIOC 8001 - Biochemistry: Structure, Catalysis, and Metabolism (3.0 cr)
- BIOC 8002 - Molecular Biology and Regulation of Biological Processes (3.0 cr)

**Biochemistry Elective Courses**
In addition to the 6 required credits, a doctoral minor requires 6 credits of graduate-level BMBB coursework, chosen in consultation with the BMBB director of graduate studies.
- BIOC 5xxx
- BIOC 6xxx
- BIOC 7xxx
- BIOC 8xxx

**Masters**

**Required Courses**
A master's minor requires 6 credits of graduate-level BMBB coursework, chosen in consultation with the BMBB director of graduate studies.
- BIOC 5xxx
- BIOC 8xxx
Biochemistry, Molecular Biology and Biophysics Ph.D.
Biochemistry, Molecular Biology, & Biophysics TCBS
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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://cbs.umn.edu/academics/departments/bmbb/graduate-program/about-graduate-program

• Program Type: Doctorate
• Requirements for this program are current for Fall 2016
• 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: One cannot apply for admission to the master's degree in BMBB. Students are only admitted to the BMBB PhD program. Alternative, related master's degree programs that admit students are the Master of Biological Sciences (MBS) (http://cce.umn.edu/master-of-biological-sciences) and the Master in Microbial Engineering (http://bti.umn.edu/MicE/).

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 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).

Note: One cannot apply for admission to the master's degree in BMBB. Students are only admitted to the BMBB PhD program. Alternative, related master's degree programs that admit students are the Master of Biological Sciences (MBS) (http://cce.umn.edu/master-of-biological-sciences) and the Master in Microbial Engineering (http://bti.umn.edu/MicE/).

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
24 credits are required in the major.
0 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 PhD 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 PhD, 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 to 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)
BIOC 8888 - Thesis Credit: Doctoral (1.0 - 24.0 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. Courses from disciplines other than BMBB may be used to build an emphasis in consultation with the student's advisor. Take 15 or more credit(s) from the following:

- BIOC 5552 - Biotechnology and Bioengineering for Biochemists (3.0 cr)
- BIOC 5361 - Microbial Genomics and Bioinformatics (3.0 cr)
- MICA 8002 - Structure, Function, and Genetics of Bacteria and Viruses (4.0 cr)
- GCD 8151 - Cell Structure and Function (3.0 cr)
- MICA 8003 - Immunity and Immunopathology (4.0 cr)
- MICA 8004 - Cellular and Cancer Biology (4.0 cr)
- GCD 8131 - Advanced Molecular Genetics and Genomics (3.0 cr)
- GCD 8008 - Mammalian Gene Transfer and Expression (2.0 cr)
- PUBH 6450 - Biostatistics I (4.0 cr)
- SCB 8181 - Stem Cell Biology (3.0 cr)
- STAT 5021 - Statistical Analysis (4.0 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 8013 - Translational Cancer Research (2.0 cr)
- GRAD 8101 - Teaching in Higher Education (3.0 cr)
- GRAD 8200 - Teaching and Learning Topics in Higher Education (1.0 cr)
- BIOC 5309 - Biocatalysis and Biodegradation (3.0 cr)
- BIOC 5351 - Protein Engineering (3.0 cr)
- CSCI 5461 - Functional Genomics, Systems Biology, and Bioinformatics (3.0 cr)
- GRAD 5102 - Preparation for University Teaching for Nonnative English Speakers (2.0 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 SE, Minneapolis, MN 55455 (612-624-9440; fax: 612-624-9108)
Email: bthxed@umn.edu
Website: http://www.bioethics.umn.edu/education/master-arts-bioethics

- Program Type: Master's
- Requirements for this program are current for Fall 2016
- 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 two kinds of MA degrees: Plan A and Plan B with a major in bioethics. The curriculum for both Plan A and Plan B degrees includes a set of required core courses, bioethics electives, and a requirement for coursework in fields related to bioethics. The Plan A culminates in a substantial, 10-credit master's thesis. In lieu of a thesis, the Plan B culminates in a 4-credit practicum, a 3-credit capstone project and final exam. Electives comprise the additional 3 credits in the Plan B degree.

Graduates of the MA in bioethics greatly enhance their professional opportunities in the field when they combine their bioethics degree with a terminal graduate or professional degree in another field. Examples of degree combinations can include an MA degree in bioethics with a JD, PhD, MD, nursing, or others. This model of pairing the MA in bioethics with another degree prompts students to acquire a firm disciplinary grounding as well as interdisciplinary bioethics expertise, a practice which best prepares students for the interdisciplinary career options related to bioethics. Some examples of careers include work in the fields of genetics, social work, public health, veterinary science, religious studies, psychology, biology and philosophy.

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. Applications are accepted as early as the first day of fall semester prior to the proposed start of the student's M.A. program. Our primary deadline is March 1 with an extended deadline of May 1 if space in our program remains available.

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.

Because our program recommends pairing the Bioethics degree with another graduate or professional degree, we recognize applicants may need to answer to another program prior to our deadline. If this is the case, please email bthxed@umn.edu with your concern.
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.

**Plan B:** Plan B requires 21 major credits and 9 credits outside the major. The final exam is written and oral. A capstone project is required.

**Capstone Project:** Students will design and undertake a project and its corollary product relevant to their interests, experience, and intended use of the MA in bioethics. The experiential component is designed to be flexible, allowing the student to undertake an internship, shadow physicians or other health care personnel, or use their own work experience when relevant to cater a project to their intended goals. Rigor is maintained through committee oversight, nature of the experience, and number of hours undertaken.

Products are also designed to be flexible while retaining rigor, innovation, and written analysis. Original research is not required (as with a thesis), but a thorough literature review and accompanying overview or synthesis of the arena of which the project is a part is necessary, as is a thorough explanation of the final product. Full committee approval of the final product before the project is undertaken is required.

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.

**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/education/graduate-minor-bioethics

- Program Type: Graduate minor related to major
- Requirements for this program are current for Fall 2016
- 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 minor is administered by the Center for Bioethics and is designed for University of Minnesota students interested in deepening their knowledge of the ethical issues surrounding health and the life sciences. Explore your interests in bioethics while also earning a degree in your home discipline.

The minor is open to students in many of the University’s masters or doctoral degree programs. Some professional degree-seeking students also may elect a minor, including MEd, MPH, MHA, MN, DNP, MOT, MPSE, MDH, MDT, and MPS students. 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 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.

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.
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: bibbgrad@umn.edu
Website: http://www.r.umn.edu/academics-research/bicb

- Program Type: Master's
- Requirements for this program are current for Fall 2016
- 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
Biomedical Informatics and Computational Biology Minor

Graduate School

Twin Cities Campus

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 2016
- 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 2016
- 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
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.
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 2016
- 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 2016
- 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 2016
- 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
Clinical Ethics Postbaccalaureate Certificate
Bioethics, Center for
Graduate School

Link to a list of faculty for this program.

Contact Information:
Center for Bioethics
N504 Boynton
410 Church St SE
Minneapolis, MN 55455
Email: bthxed@umn.edu
Website: http://www.bioethics.umn.edu/education/clinical-ethics-certificate-program

- Program Type: Post-baccalaureate credit certificate/licensure/endorsement
- Requirements for this program are current for Fall 2016
- Length of program in credits: 13
- This program does not require summer semesters for timely completion.
- Degree: Clinical Ethics 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 Clinical Ethics post-baccalaureate certificate will offer a graduate level educational opportunity for practicing professionals including physicians, nurses, social workers, chaplains, and others. Students will engage in classwork and practical experience geared toward mastery of the knowledge and skills needed for work in clinical ethics, including participation on ethics committees, clinical ethics consultation services, institutional and regional clinical ethics policy bodies such as organ allocation committees or brain death committees, support for institutional staff development programs in their professional fields, or simply being better prepared to meet the ethical challenges that arise in their work. The curriculum will fulfill the health care ethics core competencies promulgated by the American Society for Bioethics and Humanities.

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

Prerequisites for Admission
A graduate or professional degree in a field related to clinical ethics is required for admission.

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 (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 3.0 is required for students to remain in good standing.

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

Required Courses
NB: BTHX 8500 will be taken twice, 2 cr each time, once fall once spring.
BTHX 5100 - Introduction to Clinical Ethics (3.0 cr)
BTHX 5110 Ethical Issues in Pediatrics (2.0 cr)
BTHX 5120 Dying in Contemporary Medical Culture (2.0 cr)
BTHX 8100 Advanced Theory and Practice of Clinical Ethics (2.0 cr)
BTHX 8500 - Practicum in Bioethics (1.0 - 4.0 cr)
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 St SE, 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 2016
- 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.
Required Courses
  CSPH 5711 - Optimal Healing Environments (3.0 cr)
  NURS 7610 - System Leadership and Innovation (3.0 cr)
  HUMF 5874 - Service Design: Designing complex systems to improve service delivery (4.0 cr)
  NURS 6707 - Health Care Design and Innovation Practicum (2.0 cr)
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://healthinformatics.umn.edu

- Program Type: Master's
- Requirements for this program are current for Fall 2016
- Length of program in credits: 31
- 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 or an international equivalent.

Required prerequisites
Health or Biological Sciences
6-semester credits or 9 quarter-credits of health or biological coursework at the undergraduate or graduate level.

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: 153
  - General Test - Analytical Writing: 4

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

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Information current as of December 20, 2016
- Internet Based - Writing Score: 21
- Internet Based - Reading Score: 19
- Paper Based - Total Score: 550

**IELTS**
- Total Score: 6.5
- Reading Score: 6.5
- Writing 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 7 to 13 credits outside the major. There 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 advisors 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 advisor will 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 semester must be completed before filing a Degree Program Form.

**HINF Courses**

Students must take HINF 5436 AHC Informatics Grand Rounds twice for a total of 2 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 7108** - Population Health Informatics (2.0 cr)
- **PUBH 6450** - Biostatistics I (4.0 cr)

**Electives**

Graduate-level electives of your choice to complete the total 31 credits; see student handbook for a list of recommended electives.

**Final Project**

MHI students should take HINF 5499.

MD/MHI students should take LAMP 7195 for 3 credits.

- **HINF 5499** - Capstone Project for the Masters of Health Informatics (3.0 cr)
- **or LAMP 7195** - Medical Informatics (3.0 - 6.0 cr)

**Joint- or Dual-degree Coursework:** MD/MHI program Student may take a total of 3 credits in common among the academic programs.
Twin Cities Campus
Health Informatics M.S.
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://healthinformatics.umn.edu

- Program Type: Master's
- Requirements for this program are current for Fall 2016
- 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.

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
  - Reading Score: 6.5
  - Writing Score: 6.5

- **MELAB**
  - Final score: 80

The preferred English language test is Test of English as Foreign Language (TOEFL). 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 15 to 19 major credits, 7 to 11 credits outside the major, and 10 thesis credits. The final exam is written and oral.

**Plan B:** Plan B requires 19 to 31 major credits and 7 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 semester 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 7108** - Population Health Informatics (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://healthinformatics.umn.edu

- Program Type: Graduate minor related to major
- Requirements for this program are current for Fall 2016
- 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.

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.

Masters
Master's minor
HINF 5430 - Health Informatics I (3.0 cr)
HINF 5431 - Health Informatics II (3.0 cr)

Doctoral

Doctoral minor
HINF 5430 - Health Informatics I (3.0 cr)
HINF 5431 - Health Informatics II (3.0 cr)
6 HINF elective credits
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://healthinformatics.umn.edu

- Program Type: Doctorate
- Requirements for this program are current for Fall 2016
- 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.
  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
    - Reading Score: 6.5
    - Writing 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
- Students must take HINF 5436 AHC Informatics Grand Rounds twice for a total of 2 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)
  - HINF 8525 - Health Informatics Teaching (2.0 cr)
  - HINF 8535 - Advanced Health Informatics Research Methods (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 7108 - Population Health Informatics (2.0 cr)
- PUBH 6450 - Biostatistics I (4.0 cr)
- PUBH 6451 - Biostatistics II (4.0 cr)

Electives
- Graduate-level electives of your choice to equal 70 credits; see student handbook for a list of recommended electives.
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 2016
• 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
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](http://sjmc.umn.edu/grad/hjComm.html#degree)

- Program Type: Graduate minor related to major
- Requirements for this program are current for Fall 2016
- 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, 154 Shepherd Labs, 100 Union Street S.E., Minneapolis, MN 55455 (612-624-7069; fax: 612-301-1442)
Email: hstm@umn.edu
Website: http://www.hstm.umn.edu

• Program Type: Master's
• Requirements for this program are current for Fall 2016
• Length of program in credits: 30 to 31
• 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 must 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.

Although it is not strictly required for admission, it's strongly recommended that applicants submit a GRE score.

Special Application Requirements:
All application materials are submitted online to the University. Check the HSTM website (www.hstm.umn.edu) for more information. Applications are accepted for fall admission only. The application deadline is December 1.

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 15 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 written.

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. All of the courses selected for the requirements must be passed with a grade of B or better.

Plan A requires 31 credits consisting of 6 credits in the required courses HSCI/HMED 8112 and 8113, 9 additional credits in HSCI or HMED, 6 credits in an outside field or in a minor, and 10 thesis credits.

Plan B requires 30 credits consisting of 6 credits in the required courses HSCI/HMED 8112 and 8113, 15 additional credits in HSCI or HMED, 3 credits in a directed study course, and 6 credits in an outside field or in a minor.

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
Plan A
Required Courses
Take the two-semester sequence of historiography and research preparation, plus an additional 9 credits in HMED chosen in consultation with adviser.
HMED 8112 - Historiography of Science, Technology, and Medicine (3.0 cr)
HMED 8113 - Research Methods in the History of Science, Technology, and Medicine (3.0 cr)

Outside Field Coursework
In consultation with adviser and the DGS, take 6 credits in courses from either the track alternative to the one in which you are enrolled, in outside fields, or in a minor.

Thesis Credits
Take 10 thesis credits
HMED 8777 - Thesis Credits: Master's (1.0 - 18.0 cr)

Plan B
Required Courses
Take the two-semester sequence of historiography and research preparation, plus an additional 15 credits in HMED chosen in consultation with adviser.
HMED 8112 - Historiography of Science, Technology, and Medicine (3.0 cr)
HMED 8113 - Research Methods in the History of Science, Technology, and Medicine (3.0 cr)

Outside Field Coursework
In consultation with adviser and the DGS, take 6 credits in courses from either the track alternative to the one in which you are enrolled, in outside fields, or in a minor.

Directed Study
Take 3 credits in a directed study course.
HMED 8631 - Directed Study (1.0 - 6.0 cr)
HMED 8632 - Directed Study (1.0 - 6.0 cr)

History of Science and Technology
Plan A
Required Courses
Take the two-semester sequence of historiography and research preparation, plus an additional 9 credits in HSCI chosen in
consultation with adviser.

HSCI 8112 - Historiography of Science, Technology, and Medicine (3.0 cr)
HSCI 8113 - Research Methods in the History of Science, Technology, and Medicine (3.0 cr)

**Outside Field Coursework**
- In consultation with adviser and the DGS, take 6 credits in courses from either the track alternative to the one in which you are enrolled, in outside fields, or in a minor.

**Thesis Credits**
- Take 10 thesis credits
  HSCI 8777 - Thesis Credits: Master's (1.0 - 18.0 cr)

**Plan B**

**Required Courses**
- Take the two-semester sequence of historiography and research preparation, plus an additional 15 credits in HSCI chosen in consultation with adviser.
  HSCI 8112 - Historiography of Science, Technology, and Medicine (3.0 cr)
  HSCI 8113 - Research Methods in the History of Science, Technology, and Medicine (3.0 cr)

**Outside Field Coursework**
- In consultation with adviser and the DGS, take 6 credits in courses from either the track alternative to the one in which you are enrolled, in outside fields, or in a minor.

**Directed Study**
- Take 3 credits in a directed study course.
  HSCI 8993 - Directed Studies (1.0 - 5.0 cr)
  HSCI 8994 - Directed Research (1.0 - 5.0 cr)
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, 154 Shepherd Labs, 100 Union Street SE, Minneapolis, MN 55455 (612-624-7069; fax: 612-301-1442)
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 2016
- 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 must 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.

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.

Masters
The master's minor requires two 3-credit courses in HSTM or HMED at the 5xxx level or above.

Recommended Courses
- HSCI 8112 - Historiography of Science, Technology, and Medicine (3.0 cr)
- or HMED 8112 - Historiography of Science, Technology, and Medicine (3.0 cr)
Doctoral
The doctoral minor requires four 3-credit courses in HSTM or HMED at the 5xxx level or above.

Recommended Courses
HSCI 8112 - Historiography of Science, Technology, and Medicine (3.0 cr)
or HMED 8112 - Historiography of Science, Technology, and Medicine (3.0 cr)
Twin Cities Campus

History of Science, Technology, and Medicine Ph.D.

Contact Information:
Program in the History of Science, Technology, and Medicine, University of Minnesota, 154 Shepherd Labs, 100 Union Street S.E., Minneapolis, MN 55455 (612-624-7069; fax: 612-301-1442)
Email: hstm@umn.edu
Website: http://www.hstm.umn.edu

- Program Type: Doctorate
- Requirements for this program are current for Fall 2016
- Length of program in credits: 54
- 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 must 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.

Although it is not strictly required for admission, it's strongly recommended that applicants submit a GRE score.

Special Application Requirements:
All application materials are submitted online to the University. Check the HSTM website (www.hstm.umn.edu) for more information. Applications are accepted for fall semester only. The application deadline is December 1.

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
24 credits are required in the major.
6 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 of area and period. All of the courses selected for the requirements must be passed with a grade of B or better.

The PhD requires 54 credits consisting of the following: 6 credits in the required courses HSCI/HMED 8112 and 8113, 15 additional credits in HSCI or HMED courses, 3 credits in a directed study course, 6 credits in outside fields, and 24 thesis credits.

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
Required Courses
Take the two-semester sequence of historiography and research preparation, plus an additional 15 credits in HMED chosen in consultation with adviser.
HMED 8112 - Historiography of Science, Technology, and Medicine (3.0 cr)
HMED 8113 - Research Methods in the History of Science, Technology, and Medicine (3.0 cr)

Directed Study
Take 3 credits in a directed study course.
HMED 8631 - Directed Study (1.0 - 6.0 cr)
HMED 8632 - Directed Study (1.0 - 6.0 cr)

Outside Field Coursework
In consultation with adviser and the DGS, take 6 credits in courses from either the track alternative to the one in which you are enrolled, in outside fields, or towards a doctoral minor.

Thesis Credits
Take 24 credits after passing preliminary oral exam.
HMED 8888 - Thesis Credit: Doctoral (1.0 - 24.0 cr)

History of Science and Technology
Required Courses
Take the two-semester sequence of historiography and research preparation, plus an additional 15 credits in HSCI chosen in consultation with adviser.
HSCI 8112 - Historiography of Science, Technology, and Medicine (3.0 cr)
HSCI 8113 - Research Methods in the History of Science, Technology, and Medicine (3.0 cr)

Directed Study
Take 3 credits in a directed study course.
HSCI 8993 - Directed Studies (1.0 - 5.0 cr)
HSCI 8994 - Directed Research (1.0 - 5.0 cr)

Outside Field Coursework
In consultation with adviser and the DGS, take 6 credits in courses from either the track alternative to the one in which you are enrolled, in outside fields, or towards a doctoral minor.

Thesis Credits
Take 24 credits after passing preliminary oral exam.
HSCI 8888 - Thesis Credit: Doctoral (1.0 - 24.0 cr)
Twin Cities Campus
Human Rights M.H.R.
Global Studies Department
Graduate School

Link to a list of faculty for this program.

- Program Type: Master's
- Requirements for this program are current for Fall 2016
- Length of program in credits: 45
- This program does not require summer semesters for timely completion.
- Degree: Master of Human Rights

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 Master of Human Rights will be a two-year interdisciplinary professional master's degree to prepare students to work in the field of human rights or to advance their knowledge and skills in the field. This degree will equip graduate students with core professional and conceptual knowledge and analytical tools necessary to operate on the professional level in the field of human rights, along with the in-depth academic and professional training needed for the specific human rights area in which they practice or intend to practice. Students will follow a core curriculum that includes the study of human rights norms and law, methodology, critical views of human rights, and human rights policy that will equip them with the skills needed to address the problems.

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:
Complete application will include a University of Minnesota application, personal statement, resume or C.V., transcripts, GRE scores, TOEFL scores (if applicable), at least three letters of recommendation, and an optional diversity statement.

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: 100
  - Paper Based - Total Score: 600

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
Plan C: Plan C requires 45 major credits and up to null credits outside the major. The is no final exam. A capstone project is required.
Capstone Project: Students will participate in a three-credit capstone seminar rather than a thesis. The capstone seminar is one of the required core courses.

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 semesters must be completed before filing a Degree Program Form.
Students will be required to complete 45 credits, including 21 credits of core human rights courses, 12 credits in an approved concentration, 2 credits in a first-year cohort seminar, and 3 credits in either a professional paper or capstone project in their second year, and a professional internship of 400 hours, completed before graduation and preferably during the summer after the first year. The internship would be supervised by the Human Rights Program, and would be a non-credit program.

The Masters in Human Rights will require all students to take courses in the following framework, as outlined below:

Human rights core (9 credits), professional/social science/humanities core (minimum 12 credits), concentration (minimum 12 credits), a capstone or professional paper (3 credits), cohort seminar (1 credit per semester x 2 semesters=2 credits) and electives (remaining credits) and the aforementioned 400 hours in a non-credit professional internship.
Twin Cities Campus
Integrated Biosciences M.S.
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 2016
- 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 2016
- 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.
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 2016
- Length of program in credits: 38
- This program requires 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.

Health Coaching is an emerging method of partnering with clients to achieve their overall goals. It is practiced from a holistic perspective that views each person as intrinsically whole and the ultimate expert in his or her healing journey. Health coaching is being offered in a wide range of venues including hospitals, clinics, community health and fitness facilities, corporations, educational institutions, and private practices. The Center for Spirituality & Healing is a pioneer in the field of health coaching, working to advance education, research and care model innovation.

The Master of Arts degree is designed for individuals with a bachelor's degree in either a healthcare or non-healthcare field. Students without healthcare backgrounds are eligible for admission with the prior completion of required prerequisites. The 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 and is understood to be a terminal degree. The degree consists of 38 credits of coursework, including 6 credits of electives, and a minimum 2-credit project that is presented in both verbal and written format prior to graduation. Elective credits may be chosen from CSPH courses or students may complete a minor from other departments, if approved by their academic adviser. In all cases, the student's faculty advisor will work with the student in designing a program plan that accommodates the student's unique learning objectives.

The program 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. Students must be able to demonstrate the following competencies 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 may arrange with the program director to do additional outside coursework during the first year of the program.

University of Minnesota Health Coaching programs have transitional program approval from the National Consortium for Credentialing Health and Wellness Coaches (www.ncchwc.org), and will be permanently accredited when that status is available in 2017. Graduates from the MA program will be eligible to sit for National Board Certification when that exam becomes available in 2017.

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**

**Required Prerequisite Coursework**

Previous coursework in basic psychology, human physiology, and statistics must have been completed. Statistics must be completed within 7 years prior to application. All prerequisites must be completed at an accredited institution for a grade equal to B (3.0) or better.

Other requirements to be completed before admission:

In addition to the University's online application, applicants submit a personal statement describing their goals for the program and their professional qualifications. This three to five page 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. Three letters of recommendation, transcripts and a current C.V. or resume are also required. All items are uploaded into the University's online application. Selected applicants will be invited for admissions interviews.

**Special Application Requirements:**

The M.A. is designed for individuals with a bachelor's degree in a health-related field, or for professionals without healthcare backgrounds who have extensive interest in working with individuals and groups to optimize wellbeing, assuming completion of required prerequisites. All applicants must have completed the prerequisite courses in Physiology, Statistics (within past 7 years) and Psychology before beginning core health coaching coursework the Fall semester of entrance. All prerequisite courses must be completed at an accredited institution with a grade equal to B (3.0) or better.

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**

**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:** Culminating course for the Master of Arts in Integrative Health and Wellbeing Coaching Program. Students use coaching data collected during the Advanced Health Coaching Practicum, Health Coaching Professional Internship, or Group Health Coaching Course to write and orally present a research-informed concept analysis and retrospective narrative case report.

Prerequisites: Integrative Health and Wellbeing Coaching MA student, CSPH 5701, 5702, 5703, 5704, 5706, 5707, 5709* (*may be taken concurrently).

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.

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

Up to 3 credits of CSPH courses at the 4xxx-level may be used for elective credits.
### 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 5123** - 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)
- **CSPH 5706** - Lifestyle Medicine (2.0 cr)
- **CSPH 5707** - Coaching People with Clinical Conditions (2.0 cr)
- **CSPH 5708** - Mind-Body Science and the Art of Transformation (1.0 cr)
- **CSPH 5709** - Health and Wellbeing Group Coaching (2.0 cr)
- **CSPH 8701** - Integrative Health and Wellbeing Coaching MA Capstone Project (2.0 cr)

### Electives

Students complete 6 credits selected from CSPH courses. Up to 3 credits may be selected from CSPH courses at the 4xxx-level. Students may elect to use their elective credits to pursue a Minor in another department (more than 6 credits may be required depending on individual program requirements).

Take 6 or more credits from the following:

- **CSPH 4311** - Foundations of Hatha Yoga: Alignment & Movement Principles (3.0 cr)
- **CSPH 4312** - Hatha Yoga Philosophy, Lifestyle, & Ethics (3.0 cr)
- **CSPH 4313** - Hatha Yoga Teaching Principles & Methodology (2.0 cr)
- **CSPH 5000** - Explorations in Integrative Therapies and Healing Practices (1.0 - 4.0 cr)
- **CSPH 5102** - Art of Healing: Self as Healer (1.0 cr)
- **CSPH 5111** - Ways of Thinking about Health (2.0 cr)
- **CSPH 5115** - Cultural Awareness, Knowledge and Health (3.0 cr)
- **CSPH 5121** - Whole Systems Healing: Health and the Environment (2.0 cr)
- **CSPH 5201** - Spirituality and Resilience (2.0 cr)
- **CSPH 5211** - Peacemaking and Spirituality: A Journey Toward Healing and Strength (2.0 - 3.0 cr)
- **CSPH 5212** - Peacebuilding Through Mindfulness: Transformative Dialogue in the Global Community (3.0 cr)
- **CSPH 5215** - Forgiveness and Healing: A Journey Toward Wholeness (3.0 cr)
- **CSPH 5225** - Meditation: Integrating Body and Mind (2.0 cr)
- **CSPH 5226** - Advanced Meditation: Body, Brain, Mind, and Universe (1.0 cr)
- **CSPH 5311** - Introduction to Traditional Chinese Medicine (2.0 cr)
- **CSPH 5313** - Acupressure (1.0 cr)
- **CSPH 5315** - Traditional Tibetan Medicine: Ethics, Spirituality, and Healing (2.0 cr)
- **CSPH 5317** - Yoga: Ethics, Spirituality, and Healing (2.0 cr)
- **CSPH 5318** - Tibetan Medicine, Ayurveda, and Yoga in India (4.0 cr)
- **CSPH 5319** - Yoga and Ayurveda in India (4.0 cr)
- **CSPH 5331** - Foundations of Shamanism and Shamanic Healing (2.0 cr)
- **CSPH 5332** - Global Healing Traditions: Amazonia Plant Spirit Medicine (2.0 cr)
- **CSPH 5341** - Overview of Indigenous Hawaiian Healing (2.0 cr)
- **CSPH 5343** - Ayurveda Medicine: The Science of Self-healing (2.0 cr)
- **CSPH 5401** - People, Plants, and Drugs: Introduction to Ethnopharmacology (3.0 cr)
- **CSPH 5421** - Botanical Medicines in Integrative Healthcare (3.0 cr)
- **CSPH 5423** - Botanical Medicines: Foundations and Practical Applications (1.0 cr)
- **CSPH 5431** - Functional Nutrition: An Expanded View of Nutrition, Chronic Disease, and Optimal Health (2.0 cr)
- **CSPH 5503** - Aromatherapy Fundamentals (1.0 cr)
- **CSPH 5511** - Interdisciplinary Palliative Care: An Experiential Course in a Community Setting (2.0 cr)
- **CSPH 5512** - Spiritual Aspects of Palliative Care (2.0 cr)
- **CSPH 5521** - Therapeutic Landscapes (3.0 cr)
- **CSPH 5522** - Therapeutic Horticulture (3.0 cr)
- **CSPH 5523** - Applications in Therapeutic Horticulture (2.0 cr)
- **CSPH 5533** - Introduction to Energy Healing (2.0 cr)
- **CSPH 5535** - Reiki Healing (1.0 cr)
- **CSPH 5536** - Advanced Reiki Healing: Level II (1.0 cr)
- **CSPH 5541** - Emotional Healing and Happiness: Eastern and Western Approaches to Transforming the Mind (2.0 cr)
- **CSPH 5545** - Mind-Body Healing Therapies (2.0 cr)
- **CSPH 5555** - Introduction to Body and Movement-based Therapies (2.0 cr)
- **CSPH 5561** - Overview of the Creative Arts in Health and Healing (2.0 cr)
- **CSPH 5601** - Music, Health and Healing (2.0 cr)
- **CSPH 5605** - Movement and Music for Well-being and Healing (2.0 cr)
- **CSPH 5631** - Healing Imagery I (2.0 cr)
- **CSPH 5641** - Animals in Health Care: The Healing Dimensions of Human/Animal Relationships (3.0 cr)
• CSPH 5642 - Nature Heals: An Introduction to Nature-Based Therapeutics (3.0 cr)
• CSPH 5643 - Horse as Teacher: Intro to Nature-Based Therapeutics Equine-Assisted Activities & Therapies (EAAT) (3.0 cr)
• CSPH 5711 - Optimal Healing Environments (3.0 cr)
• CSPH 5805 - Wellbeing in the Workplace (3.0 cr)
• CSPH 5806 - Wellbeing and Resiliency for Health Professionals (1.0 cr)
• CSPH 6000 - Integrative Therapies and Healing Practices Topics (1.0 - 4.0 cr)
• CSPH 8101 - Critiquing and Synthesizing Complementary and Alternative Healing Practices (CAHP) Research (2.0 cr)
• CSPH 8191 - Independent Study in Integrative Therapies and Healing Practices (1.0 - 6.0 cr)
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 SE, 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 2016
- 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 integrative therapies and healing practices minor is an interdisciplinary program designed to expose students to a global range of integrative, complementary, cross-cultural and spiritual healing practices. Courses enhance 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 curriculum includes a core introductory course that provides the theoretical foundation for the program. Students choose additional courses offered by the Center for Spirituality & Healing in clinical applications, spirituality, or cross-cultural health and healing. The program draws upon the rich expertise of University and community-based faculty who encourage and challenge students to discover new ways of caregiving, and to cultivate diverse skills that will transform their life's work, experiences and relationships with others.

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 minor is designed for graduate students pursuing health or other careers, and who are seeking to deepen their understanding of integrative therapeutic topics.

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.

Note that students may not use course credits to satisfy requirements for both a major and the minor.

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.
Masters
Required Course
All students complete the Introduction to Integrative Therapies and Healing Practices course.
CSPH 5101 - Introduction to Integrative Healing Practices (3.0 cr)

Elective Options
Take 2 or more course(s) totaling 5 or more credit(s) from the following:
• CSPH 5000 - Explorations in Integrative Therapies and Healing Practices (1.0 - 4.0 cr)
• CSPH 5102 - Art of Healing: Self as Healer (1.0 cr)
• CSPH 5111 - Ways of Thinking about Health (2.0 cr)
• CSPH 5115 - Cultural Awareness, Knowledge and Health (3.0 cr)
• CSPH 5121 - Whole Systems Healing: Health and the Environment (2.0 cr)
• CSPH 5201 - Spirituality and Resilience (2.0 cr)
• CSPH 5211 - Peacemaking and Spirituality: A Journey Toward Healing and Strength (2.0 - 3.0 cr)
• CSPH 5212 - Peacebuilding Through Mindfulness: Transformative Dialogue in the Global Community (3.0 cr)
• CSPH 5215 - Forgiveness and Healing: A Journey Toward Wholeness (3.0 cr)
• CSPH 5225 - Meditation: Integrating Body and Mind (2.0 cr)
• CSPH 5226 - Advanced Meditation: Body, Brain, Mind, and Universe (1.0 cr)
• CSPH 5313 - Acupressure (1.0 cr)
• CSPH 5311 - Introduction to Traditional Chinese Medicine (2.0 cr)
• CSPH 5315 - Traditional Tibetan Medicine: Ethics, Spirituality, and Healing (2.0 cr)
• CSPH 5317 - Yoga: Ethics, Spirituality, and Healing (2.0 cr)
• CSPH 5318 - Tibetan Medicine, Ayurveda, and Yoga in India (4.0 cr)
• CSPH 5319 - Yoga and Ayurveda in India (4.0 cr)
• CSPH 5331 - Foundations of Shamanism and Shamanic Healing (2.0 cr)
• CSPH 5332 - Global Healing Traditions: Amazonia Plant Spirit Medicine (2.0 cr)
• CSPH 5341 - Overview of Indigenous Hawaiian Healing (2.0 cr)
• CSPH 5343 - Ayurveda Medicine: The Science of Self-healing (2.0 cr)
• CSPH 5401 - People, Plants, and Drugs: Introduction to Ethnopharmacology (3.0 cr)
• CSPH 5421 - Botanical Medicines in Integrative Healthcare (3.0 cr)
• CSPH 5423 - Botanical Medicines: Foundations and Practical Applications (1.0 cr)
• CSPH 5431 - Functional Nutrition: An Expanded View of Nutrition, Chronic Disease, and Optimal Health (2.0 cr)
• CSPH 5503 - Aromatherapy Fundamentals (1.0 cr)
• CSPH 5511 - Interdisciplinary Palliative Care: An Experiential Course in a Community Setting (2.0 cr)
• CSPH 5512 - Spiritual Aspects of Palliative Care (2.0 cr)
• CSPH 5521 - Therapeutic Landscapes (3.0 cr)
• CSPH 5522 - Therapeutic Horticulture (3.0 cr)
• CSPH 5523 - Applications in Therapeutic Horticulture (2.0 cr)
• CSPH 5533 - Introduction to Energy Healing (2.0 cr)
• CSPH 5535 - Reiki Healing (1.0 cr)
• CSPH 5536 - Advanced Reiki Healing: Level II (1.0 cr)
• CSPH 5541 - Emotional Healing and Happiness: Eastern and Western Approaches to Transforming the Mind (2.0 cr)
• CSPH 5545 - Mind-Body Healing Therapies (2.0 cr)
• CSPH 5555 - Introduction to Body and Movement-based Therapies (2.0 cr)
• CSPH 5561 - Overview of the Creative Arts in Health and Healing (2.0 cr)
• CSPH 5601 - Music, Health and Healing (2.0 cr)
• CSPH 5605 - Movement and Music for Well-being and Healing (2.0 cr)
• CSPH 5631 - Healing Imagery I (2.0 cr)
• CSPH 5641 - Animals in Health Care: The Healing Dimensions of Human/Animal Relationships (3.0 cr)
• CSPH 5642 - Nature Heals: An Introduction to Nature-Based Therapeutics (3.0 cr)
• CSPH 5643 - Horse as Teacher: Intro to Nature-Based Therapeutics Equine-Assisted Activities & Therapies (EAAT) (3.0 cr)
• CSPH 5701 - Fundamentals of Health Coaching I (4.0 cr)
• CSPH 5706 - Lifestyle Medicine (2.0 cr)
• CSPH 5708 - Mind-Body Science and the Art of Transformation (1.0 cr)
• CSPH 5711 - Optimal Healing Environments (3.0 cr)
• CSPH 5805 - Wellbeing in the Workplace (3.0 cr)
• CSPH 5806 - Wellbeing and Resiliency for Health Professionals (1.0 cr)
• CSPH 6000 - Integrative Therapies and Healing Practices Topics (1.0 - 4.0 cr)
• CSPH 8101 - Critiquing and Synthesizing Complementary and Alternative Healing Practices (CAHP) Research (2.0 cr)
• CSPH 8191 - Independent Study in Integrative Therapies and Healing Practices (1.0 - 6.0 cr)

Doctoral
Required Course
All students take the Introduction to Integrative Therapies and Healing Practices course.
CSPH 5101 - Introduction to Integrative Healing Practices (3.0 cr)
Elective Options

Take 2 or more course(s) totaling 9 or more credit(s) from the following:

- CSPH 5000 - Explorations in Integrative Therapies and Healing Practices (1.0 - 4.0 cr)
- CSPH 5102 - Art of Healing: Self as Healer (1.0 cr)
- CSPH 5111 - Ways of Thinking about Health (2.0 cr)
- CSPH 5115 - Cultural Awareness, Knowledge and Health (3.0 cr)
- CSPH 5121 - Whole Systems Healing: Health and the Environment (2.0 cr)
- CSPH 5201 - Spirituality and Resilience (2.0 cr)
- CSPH 5211 - Peacemaking and Spirituality: A Journey Toward Healing and Strength (2.0 - 3.0 cr)
- CSPH 5212 - Peacebuilding Through Mindfulness: Transformative Dialogue in the Global Community (3.0 cr)
- CSPH 5215 - Forgiveness and Healing: A Journey Toward Wholeness (3.0 cr)
- CSPH 5225 - Meditation: Integrating Body and Mind (2.0 cr)
- CSPH 5226 - Advanced Meditation: Body, Brain, Mind, and Universe (1.0 cr)
- CSPH 5313 - Acupressure (1.0 cr)
- CSPH 5311 - Introduction to Traditional Chinese Medicine (2.0 cr)
- CSPH 5314 - Emotional Tibetan Medicine: Ethics, Spirituality, and Healing (2.0 cr)
- CSPH 5317 - Yoga: Ethics, Spirituality, and Healing (2.0 cr)
- CSPH 5318 - Tibetan Medicine, Ayurveda, and Yoga in India (4.0 cr)
- CSPH 5319 - Yoga and Ayurveda in India (4.0 cr)
- CSPH 5331 - Foundations of Shamanism and Shamanic Healing (2.0 cr)
- CSPH 5332 - Global Healing Traditions: Amazonia Plant Spirit Medicine (2.0 cr)
- CSPH 5341 - Overview of Indigenous Hawaiian Healing (2.0 cr)
- CSPH 5343 - Ayurveda Medicine: The Science of Self-healing (2.0 cr)
- CSPH 5401 - People, Plants, and Drugs: Introduction to Ethnopharmacology (3.0 cr)
- CSPH 5421 - Biological Medicines in Integrative Healthcare (3.0 cr)
- CSPH 5423 - Botanical Medicines: Foundations and Practical Applications (1.0 cr)
- CSPH 5443 - Traditional Tibetan Medicine: Ethics, Spirituality, and Healing (2.0 cr)
- CSPH 5503 - Aromatherapy Fundamentals (1.0 cr)
- CSPH 5511 - Interdisciplinary Palliative Care: An Experiential Course in a Community Setting (2.0 cr)
- CSPH 5512 - Spiritual Aspects of Palliative Care (2.0 cr)
- CSPH 5521 - Therapeutic Landscapes (3.0 cr)
- CSPH 5522 - Therapeutic Horticulture (3.0 cr)
- CSPH 5523 - Applications in Therapeutic Horticulture (2.0 cr)
- CSPH 5533 - Introduction to Energy Healing (2.0 cr)
- CSPH 5535 - Reiki Healing (1.0 cr)
- CSPH 5536 - Advanced Reiki Healing: Level II (1.0 cr)
- CSPH 5544 - Mind-Body Healing and Happiness: Eastern and Western Approaches to Transforming the Mind (2.0 cr)
- CSPH 5545 - Mind-Body Healing Therapies (2.0 cr)
- CSPH 5555 - Introduction to Body and Movement-based Therapies (2.0 cr)
- CSPH 5561 - Overview of the Creative Arts in Health and Healing (2.0 cr)
- CSPH 5601 - Music, Health and Healing (2.0 cr)
- CSPH 5605 - Movement and Music for Well-being and Healing (2.0 cr)
- CSPH 5631 - Healing Imagery I (2.0 cr)
- CSPH 5641 - Animals in Health Care: The Healing Dimensions of Human/Animal Relationships (3.0 cr)
- CSPH 5642 - Nature Heals: An Introduction to Nature-Based Therapeutics (3.0 cr)
- CSPH 5643 - Horse as Teacher: Intro to Nature-Based Therapeutics Equine-Assisted Activities & Therapies (EAAT) (3.0 cr)
- CSPH 5701 - Fundamentals of Health Coaching I (4.0 cr)
- CSPH 5706 - Lifestyle Medicine (2.0 cr)
- CSPH 5708 - Mind-Body Science and the Art of Transformation (1.0 cr)
- CSPH 5711 - Optimal Healing Environments (3.0 cr)
- CSPH 5805 - Wellbeing in the Workplace (3.0 cr)
- CSPH 5806 - Wellbeing and Resiliency for Health Professionals (1.0 cr)
- CSPH 6000 - Integrative Therapies and Healing Practices Topics (1.0 - 4.0 cr)
- CSPH 8101 - Critiquing and Synthesizing Complementary and Alternative Healing Practices (CAHP) Research (2.0 cr)
- CSPH 8191 - Independent Study in Integrative Therapies and Healing Practices (1.0 - 6.0 cr)
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 SE, 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 2016
- Length of program in credits: 12 to 20
- This program does not require summer semesters for timely completion.
- Degree: Integrative Therapies & 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 integrative therapies and healing practices certificate is an interdisciplinary program designed to expose students to a global range of integrative, complementary, cross-cultural and spiritual healing practices. Courses enhance the preparation of students in health sciences and other disciplines 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 curriculum for the 12-credit certificate includes a core introductory course that provides the theoretical foundation for the program, as well as a course in self care. Students choose additional courses offered by the Center for Spirituality & Healing in clinical applications, spirituality, or cross-cultural health and healing. The program draws upon the rich expertise of University and community-based faculty who encourage and challenge students to discover new ways of caregiving, and to cultivate diverse skills that will transform their life’s work, experiences and relationships with others.

The certificate is also available with a health coaching track. Students who pursue the certificate with the health coaching track complete a total of 20 credits, including the core introductory course.

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.

The certificate requires applicants to have a bachelors or higher degree in a healthcare or healthcare-related field.

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 direct work experience in health related areas. Such fields include nursing, social work, psychology, medicine, nutrition, pharmacy, chiropractic, naturopathy, and licensed acupuncture.

The certificate’s Health Coaching track requires an applicant interview prior to admission.

Special Application Requirements:
In addition to the University's online application, applicants submit a personal statement describing their goals for obtaining the certificate and their professional qualifications. The statement should address your interest in integrative therapies and short- and long-term professional goals after completing the program. Two letters of recommendation are required, preferably one from an academic source and one from an employer/supervisor. A current C.V. or resume is also required. All items are uploaded directly into the University's online application.
Applicants to the Health Coaching track are required to provide three letters of recommendation 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. A current C.V. or resume is also required. All items are uploaded directly into the University's online application. Selected Health Coaching track applicants will be chosen for admissions interviews. The application deadline is March 15 for entrance into program the following fall semester.

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

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.

### Required Course

Students pursuing either the general certificate or the certificate with health coaching track must complete this course.

**CSPH 5101** - Introduction to Integrative Healing Practices (3.0 cr)

### Certificate Options

#### General Certificate

**Self Care Course Requirement**

General certificate students complete one of the two following courses for at least one credit:

**CSPH 5102** - Art of Healing: Self as Healer (1.0 cr)

or **CSPH 5806** - Wellbeing and Resiliency for Health Professionals (1.0 cr)

**Electives**

Students are encouraged to choose electives, in consultation with their faculty advisor, from CSPH courses consistent with their academic training and professional goals. Up to 3 credits of CSPH courses at the 4xxx-level may be applied to the certificate.

Take 3 or more course(s) totaling 8 or more credit(s) from the following:

- **CSPH 4311** - Foundations of Hatha Yoga: Alignment & Movement Principles (3.0 cr)
- **CSPH 4312** - Hatha Yoga Philosophy, Lifestyle, & Ethics (3.0 cr)
- **CSPH 4313** - Hatha Yoga Teaching Principles & Methodology (2.0 cr)
- **CSPH 5000** - Explorations in Integrative Therapies and Healing Practices (1.0 - 4.0 cr)
- **CSPH 5102** - Art of Healing: Self as Healer (1.0 cr)
- **CSPH 5111** - Ways of Thinking about Health (2.0 cr)
- **CSPH 5115** - Cultural Awareness, Knowledge and Health (3.0 cr)
- **CSPH 5121** - Whole Systems Healing: Health and the Environment (2.0 cr)
- **CSPH 5201** - Spirituality and Resilience (2.0 cr)
- **CSPH 5211** - Peacemaking and Spirituality: A Journey Toward Healing and Strength (2.0 - 3.0 cr)
- **CSPH 5212** - Peacebuilding Through Mindfulness: Transformative Dialogue in the Global Community (3.0 cr)
- **CSPH 5215** - Forgiveness and Healing: A Journey Toward Wholeness (3.0 cr)
- **CSPH 5225** - Meditation: Integrating Body and Mind (2.0 cr)
- **CSPH 5226** - Advanced Meditation: Body, Brain, Mind, and Universe (1.0 cr)
- **CSPH 5311** - Introduction to Traditional Chinese Medicine (2.0 cr)
• CSPH 5313 - Acupressure (1.0 cr)
• CSPH 5315 - Traditional Tibetan Medicine: Ethics, Spirituality, and Healing (2.0 cr)
• CSPH 5317 - Yoga: Ethics, Spirituality, and Healing (2.0 cr)
• CSPH 5318 - Tibetan Medicine, Ayurveda, and Yoga in India (4.0 cr)
• CSPH 5319 - Yoga and Ayurveda in India (4.0 cr)
• CSPH 5331 - Foundations of Shamanism and Shamanic Healing (2.0 cr)
• CSPH 5332 - Global Healing Traditions: Amazonia Plant Spirit Medicine (2.0 cr)
• CSPH 5341 - Overview of Indigenous Hawaiian Healing (2.0 cr)
• CSPH 5343 - Ayurveda Medicine: The Science of Self-healing (2.0 cr)
• CSPH 5401 - People, Plants, and Drugs: Introduction to Ethnopharmacology (3.0 cr)
• CSPH 5421 - Botanical Medicines in Integrative Healthcare (3.0 cr)
• CSPH 5423 - Botanical Medicines: Foundations and Practical Applications (1.0 cr)
• CSPH 5431 - Functional Nutrition: An Expanded View of Nutrition, Chronic Disease, and Optimal Health (2.0 cr)
• CSPH 5503 - Aromatherapy Fundamentals (1.0 cr)
• CSPH 5511 - Interdisciplinary Palliative Care: An Experiential Course in a Community Setting (2.0 cr)
• CSPH 5512 - Spiritual Aspects of Palliative Care (2.0 cr)
• CSPH 5521 - Therapeutic Landscapes (3.0 cr)
• CSPH 5522 - Therapeutic Horticulture (3.0 cr)
• CSPH 5523 - Applications in Therapeutic Horticulture (2.0 cr)
• CSPH 5533 - Introduction to Energy Healing (2.0 cr)
• CSPH 5535 - Reiki Healing (1.0 cr)
• CSPH 5536 - Advanced Reiki Healing: Level II (1.0 cr)
• CSPH 5541 - Emotional Healing and Happiness: Eastern and Western Approaches to Transforming the Mind (2.0 cr)
• CSPH 5545 - Mind-Body Healing Therapies (2.0 cr)
• CSPH 5555 - Introduction to Body and Movement-based Therapies (2.0 cr)
• CSPH 5561 - Overview of the Creative Arts in Health and Healing (2.0 cr)
• CSPH 5601 - Music, Health and Healing (2.0 cr)
• CSPH 5605 - Movement and Music for Well-being and Healing (2.0 cr)
• CSPH 5631 - Healing Imagery I (2.0 cr)
• CSPH 5641 - Animals in Health Care: The Healing Dimensions of Human/Animal Relationships (3.0 cr)
• CSPH 5642 - Nature Heals: An Introduction to Nature-Based Therapeutics (3.0 cr)
• CSPH 5643 - Horse as Teacher: Intro to Nature-Based Therapeutics Equine-Assisted Activities & Therapies (EAAT) (3.0 cr)
• CSPH 5701 - Fundamentals of Health Coaching I (4.0 cr)
• CSPH 5706 - Lifestyle Medicine (2.0 cr)
• CSPH 5708 - Mind-Body Science and the Art of Transformation (1.0 cr)
• CSPH 5711 - Optimal Healing Environments (3.0 cr)
• CSPH 5805 - Wellbeing in the Workplace (3.0 cr)
• CSPH 5806 - Wellbeing and Resiliency for Health Professionals (1.0 cr)
• CSPH 6000 - Integrative Therapies and Healing Practices Topics (1.0 - 4.0 cr)
• CSPH 8101 - Critiquing and Synthesizing Complementary and Alternative Healing Practices (CAHP) Research (2.0 cr)
• CSPH 8191 - Independent Study in Integrative Therapies and Healing Practices (1.0 - 6.0 cr)

-OR-

Health Coaching track
Coursework for the certificate with the health coaching track is detailed in sub-plan 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.

Health Coaching
Health coaching is an emerging method of partnering with clients to achieve their overall goals. It is practiced from a holistic perspective that views each person as intrinsically whole and the ultimate expert in his or her healing journey. Health coaching is being offered in a wide range of venues including hospitals, clinics, community health and fitness facilities, corporations, educational institutions, and private practices. The Center for Spirituality & Healing is a pioneer in the field of health coaching, working to advance education, research and care model innovation.

University of Minnesota health coaching programs have transitional program approval from the National Consortium for Credentialing Health and Wellness Coaches (www.ncchwc.org), and will be permanently accredited when that status is available in 2017.

In addition to the required CSPH 5101 introduction course, students complete the health coaching track course requirements for a minimum of 20 credits. Students are strongly encouraged to confer with their faculty advisor concerning the specific sequence in which the track coursework must be taken. A minimum GPA of 3.0 must be maintained for all required track coursework.

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Information current as of December 20, 2016
Coursework may be completed in a minimum of four semesters or may be spread over a variable amount of time up to a maximum of four years.

Health Coaching track requirements
- 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)
- CSPH 5706 - Lifestyle Medicine (2.0 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 2016
- 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, genetics, biology, and biochemistry.

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:**
MCDG Graduate Program, 6-160 Jackson Hall, 321 Church Street SE, University of Minnesota, Minneapolis, MN 55455 (612-624-7470, fax: 612-626-6140).
Email: mcdbg@umn.edu
Website: [http://mcdbg.umn.edu](http://mcdbg.umn.edu)

- Program Type: Graduate minor related to major
- Requirements for this program are current for Fall 2016
- Length of program in credits (Masters): 12
- 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 towards program requirements is not permitted.

**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.

**Masters**

A master's minor requires 12 credits from the MCDBG curriculum, graded A-F and with a minimum 3.0 GPA. Courses should be approved by the MCDBG director of graduate studies.

**Required courses**

- GCD 8151 - Cell Structure and Function (3.0 cr)
- GCD 8131 - Advanced Molecular Genetics and Genomics (3.0 cr)
- GCD 8161 - Advanced Developmental Biology (3.0 cr)

**Electives**

Choose at least one of the following courses for at least 3 credits:
GCD 8920 Special Topics: Computational Genomics  
or GCD 5005 - Computer Programming for Cell Biology (3.0 cr)

**Doctoral**
A doctoral minor requires 12 credits from the MCDB&G curriculum, graded A-F and with a minimum 3.0 GPA. Substitutions for the required courses must be approved by the MCDB&G director of graduate studies.

**Required courses**
- GCD 8151 - Cell Structure and Function (3.0 cr)
- GCD 8131 - Advanced Molecular Genetics and Genomics (3.0 cr)
- GCD 8161 - Advanced Developmental Biology (3.0 cr)

**Electives**
Choose at least one of the following courses for at least 3 credits:
- GCD 8920 Special Topics: Computational Genomics  
  or GCD 5005 - Computer Programming for Cell Biology (3.0 cr)
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 SE, 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 2016
- Length of program in credits: 30 to 50
- 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.

PhD 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 MCDB&G PhD is also part of two joint degree programs: The Joint Degree Program in Law, Health, and Life Sciences; and the MD/PhD program.

The Joint Degree Program in Law, Health, and Life Sciences 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.

The MD/PhD 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**
24 credits are required in the major.
0 credits are required outside the major.
24 thesis credits are required.

**Plan A:** Plan A requires 20 major credits, up to null credits outside the major, and 10 thesis credits. The final exam is written and oral.

**Plan B:** Plan B requires 30 major credits and up to null credits outside the major. The final exam is written and oral. A capstone project is required.

**Capstone Project:** 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 advisor 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.

**Required courses**
Take all of the following courses:
- GCD 8151 - Cell Structure and Function (3.0 cr)
- GCD 8131 - Advanced Molecular Genetics and Genomics (3.0 cr)
- GCD 8161 - Advanced Developmental Biology (3.0 cr)
- GCD 8171 - Literature Analysis (2.0 cr)
- BIOC 8401 - Ethics, Public Policy, and Careers in Molecular and Cellular Biology (1.0 cr)
- MCDG 8920 - Special Topics (1.0 - 4.0 cr)
- MCDG 8900 - Student Research Seminar (1.0 cr)
GCD 8900 - Seminar (1.0 - 2.0 cr)
MCDG 8950 - Teaching Practicum (1.0 cr)
MCDG 8888 - Thesis Credit: Doctoral (1.0 - 24.0 cr)

Course options
Choose at least one of these courses
- GCD 8920 Special Topics: Computational Genomics
- or GCD 5005 - Computer Programming for Cell Biology (3.0 cr)

Elective Courses
Take 0 or more credit(s) from the following:
- BIOC 8001 - Biochemistry: Structure, Catalysis, and Metabolism (3.0 cr)
- BIOC 8002 - Molecular Biology and Regulation of Biological Processes (3.0 cr)
- BIOC 5309 - Biocatalysis and Biodegradation (3.0 cr)
- BIOC 5352 - Biotechnology and Bioengineering for Biochemists (3.0 cr)
- BIOC 5361 - Microbial Genomics and Bioinformatics (3.0 cr)
- BIOC 5444 - Muscle (3.0 cr)
- BIOC 5527 - Introduction to Modern Structural Biology (4.0 cr)
- BIOC 5528 - Spectroscopy and Kinetics (4.0 cr)
- CSCI 5461 - Functional Genomics, Systems Biology, and Bioinformatics (3.0 cr)
- CSCI 5980 - Special Topics in Computer Science (1.0 - 3.0 cr)
- CSCI 8980 - Special Advanced Topics in Computer Science (1.0 - 3.0 cr)
- GCD 8008 - Mammalian Gene Transfer and Expression (2.0 cr)
- GCD 8073 - Advanced Human Genetics (3.0 cr)
- GRAD 8101 - Teaching in Higher Education (3.0 cr)
- GRAD 8200 - Teaching and Learning Topics in Higher Education (1.0 cr)
- MICA 8002 - Structure, Function, and Genetics of Bacteria and Viruses (4.0 cr)
- MICA 8003 - Immunity and Immunopathology (4.0 cr)
- MICA 8004 - Cellular and Cancer Biology (4.0 cr)
- MATH 8540 - Topics in Mathematical Biology (1.0 - 3.0 cr)
- NSC 8211 - Developmental Neurobiology (3.0 cr)
- OBIO 8012 - Basic Concepts in Skeletal Biology (2.0 cr)
- PHCL 5111 - Pharmacogenomics (3.0 cr)
- PUBH 6450 - Biostatistics I (4.0 cr)
- SCB 8181 - Stem Cell Biology (3.0 cr)
- STAT 5021 - Statistical Analysis (4.0 cr)
- GRAD 5102 - Preparation for University Teaching for Nonnative English Speakers (2.0 cr)

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
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 2016
- Length of program in credits: 30 to 38
- 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. A Limnology and Oceanography track is also offered. 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 advisor 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 instructions can be found on the program website: wrs.umn.edu/admissions/admissions-info.

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 22 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 advisor. 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.

In addition to the required core coursework, students must complete at least 6 credits outside the major and at least 6 credits in their chosen emphasis or in the limnology and oceanology track.

Plan A students have the option to use their water quality elective twice, once to complete their water quality elective and once to partially complete their area of emphasis coursework, if the class overlaps in both areas and is approved by their advisor.

Students with WRS-equivalent core courses taken as undergraduates may substitute other classes to meet credit requirements.

**Water Resources Seminar**
Students must take WRS 8100 for 0.5 credits.

WRS 8100 - Interdisciplinary Seminar in Water Resources (0.5 - 3.0 cr)
Water Resources Ethics
WRS 8581 - Research and Professional Ethics in Water Resources and Environmental Science (0.5 cr)

Hydrology Core
Take at least 3 credits from the following:
BBE 8513 - Hydrologic Modeling of Small Watersheds (3.0 cr)
or CEGE 4501 - Hydrologic Design (4.0 cr)
or ESCI 4702 - General Hydrogeology (3.0 cr)
or FNRM 5114 - Hydrology and Watershed Management (3.0 cr)
or FNRM 5153 - Forest Hydrology & Watershed Biogeochemistry (3.0 cr)

Environmental/Water Chemistry Core
Take at least 3 credits from the following:
CEGE 5541 - Environmental Water Chemistry (3.0 cr)
or ESCI 4401 - Aqueous Environmental Geochemistry (3.0 cr)
or LAAS 5311 - Soil Chemistry and Mineralogy (3.0 cr)
or PUBH 6190 - Environmental Chemistry (3.0 cr)

Limnology Core
EEB 5601 - Limnology (3.0 cr)

Water Resources Policy Core
WRS 5101 - Water Policy (3.0 cr)

Water Quality Core Elective
Take 3 or more credit(s) from the following:
• BBE 4523 - Ecological Engineering Design (3.0 cr)
• BBE 5513 - Watershed Engineering (3.0 cr)
• BBE 5523 - Ecological Engineering Design (3.0 cr)
• BBE 5535 - Assessment and Diagnosis of Impaired Waters (3.0 cr)
• BIOL 4121 - Microbial Ecology and Applied Microbiology (3.0 cr)
• CEGE 4502 - Water and Wastewater Treatment (3.0 cr)
• CEGE 4562 - Environmental Remediation Technology (3.0 cr)
• CEGE 5551 - Environmental Microbiology (3.0 cr)
• CEGE 8504 - Theory of Unit Operations (4.0 cr)
• CEGE 8505 - Biological Processes (3.0 cr)
• CEGE 8511 - Mechanics of Sediment Transport (3.0 cr)
• CEGE 8542 - Chemistry of Organic Pollutants in Environmental Systems (3.0 cr)
• ENT 5081 - Insects, Aquatic Habitats, and Pollution (3.0 cr)
• ESCI 4401 - Aqueous Environmental Geochemistry (3.0 cr)
• ESCI 5713 - Tracers and Karst Hydrogeology (3.0 cr)
• ESCI 8511 - Mechanics of Sediment Transport (3.0 cr)
• ESPM 5111 - Hydrology and Water Quality Field Methods (3.0 cr)
• ESPM 5575 - Wetlands (3.0 cr)
• ESPM 5601 - Principles of Waste Management (3.0 cr)
• ESPM 5703 - Agroforestry in Watershed Management (3.0 cr)
• FW 8459 - Stream and River Ecology (3.0 cr)
• FW 8465 - Fish Habitats and Restoration (3.0 cr)

Outside Major Electives
Take at least 6 credits outside your major, in consultation with your advisor.

Plan A Option:
Take 10 or more credit(s) from the following:
• WRS 8777 - Thesis Credits: Master's (1.0 - 18.0 cr)

Plan B Option
Select additional courses in consultation with your advisor to complete the Plan B option.

Areas of Emphasis
Complete at least 6 credits from the one of the following emphases:

Aquatic Biology Emphasis
Take 6 or more credit(s) from the following:
• BIOL 4121 - Microbial Ecology and Applied Microbiology (3.0 cr)
• CEGE 5551 - Environmental Microbiology (3.0 cr)
• EEB 5601 - Limnology (3.0 cr)
• ENT 5081 - Insects, Aquatic Habitats, and Pollution (3.0 cr)
• ENT 5361 - Aquatic Insects (4.0 cr)
• ESPM 5575 - Wetlands (3.0 cr)
• FW 4136 - Ichthyology (4.0 cr)
• FW 5604W - Fisheries Ecology and Management [WI] (3.0 cr)
• FW 8459 - Stream and River Ecology (3.0 cr)
• FW 8465 - Fish Habitats and Restoration (3.0 cr)
• HORT 5071 - Ecological Restoration (4.0 cr)

-OR-

Environmental Chemistry Emphasis
Take 6 or more credit(s) from the following:
• CEGE 5541 - Environmental Water Chemistry (3.0 cr)
• CEGE 5542 - Experimental Methods in Environmental Engineering (3.0 cr)
• CEGE 8542 - Chemistry of Organic Pollutants in Environmental Systems (3.0 cr)
• ESCI 4401 - Aqueous Environmental Geochemistry (3.0 cr)
• ESCI 4402 - Biogeochemical Cycles in the Ocean (3.0 cr)
• ESPM 4216 - Contaminant Hydrology (3.0 cr)
• LAAS 5311 - Soil Chemistry and Mineralogy (3.0 cr)
• PUBH 6190 - Environmental Chemistry (3.0 cr)

-OR-

Hydrology (Climatology) Emphasis
Take 6 or more credit(s) from the following:
• ESPM 5402 - Biometeorology (3.0 cr)
• GEOG 5426 - Climatic Variations (3.0 cr)

-OR-

Hydrology (Groundwater) Emphasis
Take 6 or more credit(s) from the following:
• CEGE 4351 - Groundwater Mechanics (3.0 cr)
• CEGE 4352 - Groundwater Modeling (3.0 cr)
• ESCI 4702 - General Hydrogeology (3.0 cr)
• ESCI 5971 - Field Hydrogeology (2.0 cr)

-OR-

Hydrology (Surface Water) Emphasis
Take 6 or more credit(s) from the following:
• BBE 5513 - Watershed Engineering (3.0 cr)
• BBE 8513 - Hydrologic Modeling of Small Watersheds (3.0 cr)
• CEGE 4501 - Hydrologic Design (4.0 cr)
• CEGE 8506 - Stochastic Hydrology (4.0 cr)
• CEGE 8507 - Advanced Methods in Hydrology (4.0 cr)
• CEGE 8572 - Computational Environmental Fluid Dynamics (4.0 cr)
• ESCI 8601 - Introduction to Stream Restoration (3.0 cr)
• CEGE 8601 - Introduction to Stream Restoration (3.0 cr)
• EEB 8601 - Introduction to Stream Restoration (3.0 cr)
• ESCI 8602 - Stream Restoration Practice (2.0 cr)
• CEGE 8602 - Stream Restoration Practice (2.0 cr)
• EEB 8602 - Stream Restoration Practice (2.0 cr)
• ESPM 5111 - Hydrology and Water Quality Field Methods (3.0 cr)
• ESPM 5555 - Wetland Soils (3.0 cr)
• SOIL 5555 - Wetland Soils (3.0 cr)
• FNRM 5153 - Forest Hydrology & Watershed Biogeochemistry (3.0 cr)
• FNRM 5114 - Hydrology and Watershed Management (3.0 cr)
• SOIL 5232 - Vadose Zone Hydrology (3.0 cr)

-OR-

Limnology Emphasis
Take 6 or more credit(s) from the following:
• EEB 4611 - Biogeochemical Processes (3.0 cr)
• EEB 5601 - Limnology (3.0 cr)
• ESCI 4402 - Biogeochemical Cycles in the Ocean (3.0 cr)
• ESCI 5705 - Limnogeology and Paleoenvironment (3.0 cr)
• FW 5604W - Fisheries Ecology and Management [WI] (3.0 cr)
• FW 8459 - Stream and River Ecology (3.0 cr)
• FW 8465 - Fish Habitats and Restoration (3.0 cr)
• PUBH 6190 - Environmental Chemistry (3.0 cr)

-OR-

Water Management Technology Emphasis
Take 6 or more credit(s) from the following:
• BBE 4523 - Ecological Engineering Design (3.0 cr)
• CEGE 4502 - Water and Wastewater Treatment (3.0 cr)
• CEGE 4511 - Hydraulic Structures (3.0 cr)
• CEGE 4512 - Open Channel Hydraulics (4.0 cr)
• CEGE 4562 - Environmental Remediation Technology (3.0 cr)
• CEGE 8504 - Theory of Unit Operations (4.0 cr)
• CEGE 8505 - Biological Processes (3.0 cr)
• CEGE 8511 - Mechanics of Sediment Transport (3.0 cr)
• ESCI 8511 - Mechanics of Sediment Transport (3.0 cr)

-OR-

Water Policy Emphasis
Take 6 or more credit(s) from the following:
• APEC 5651 - Economics of Natural Resource and Environmental Policy (3.0 cr)
• CONS 8004 - Economic and Social Aspects of Conservation Biology (3.0 cr)
• ESPM 5256 - Natural Resource Law and the Management of Public Lands and Waters (3.0 cr)

-OR-

Water Quality Emphasis
Take 6 or more credit(s) from the following:
• BBE 5535 - Assessment and Diagnosis of Impaired Waters (3.0 cr)
• CEGE 4502 - Water and Wastewater Treatment (3.0 cr)
• CEGE 8542 - Chemistry of Organic Pollutants in Environmental Systems (3.0 cr)
• ENT 5081 - Insects, Aquatic Habitats, and Pollution (3.0 cr)
• ESPM 5061 - Water Quality and Natural Resources (3.0 cr)
• ESPM 5111 - Hydrology and Water Quality Field Methods (3.0 cr)
• ESPM 5575 - Wetlands (3.0 cr)

-OR-

Watershed Science and Management Emphasis
Take 6 or more credit(s) from the following:
• BBE 5513 - Watershed Engineering (3.0 cr)
• BBE 8513 - Hydrologic Modeling of Small Watersheds (3.0 cr)
• CEGE 4501 - Hydrologic Design (4.0 cr)
• ESCI 8601 - Introduction to Stream Restoration (3.0 cr)
• CEGE 8601 - Introduction to Stream Restoration (3.0 cr)
• EEB 8601 - Introduction to Stream Restoration (3.0 cr)
• ESCI 8602 - Stream Restoration Practice (2.0 cr)
• CEGE 8602 - Stream Restoration Practice (2.0 cr)
• EEB 8602 - Stream Restoration Practice (2.0 cr)
• ESPM 5111 - Hydrology and Water Quality Field Methods (3.0 cr)
• ESPM 5575 - Wetlands (3.0 cr)
• ESPM 5703 - Agroforestry in Watershed Management (3.0 cr)
• ESPM 5555 - Wetland Soils (3.0 cr)
• SOIL 5555 - Wetland Soils (3.0 cr)
• FNRM 5114 - Hydrology and Watershed Management (3.0 cr)
• FNRM 5153 - Forest Hydrology & Watershed Biogeochemistry (3.0 cr)
• HORT 5071 - Ecological Restoration (4.0 cr)
• WRS 5050 - Special Topics in Water Resources Science (1.0 - 3.0 cr)

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 the 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.

In addition to the required core coursework, students must complete at least 6 credits outside the major, and at least 6 credits in the limnology and oceanology track.

Students with WRS-equivalent coursework taken as undergraduates may substitute other classes to meet minimum credit requirements.

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

**Water Resources Seminar**

Students must take WRS 8100 for 0.5 credits.

WRS 8100 - Interdisciplinary Seminar in Water Resources (0.5 - 3.0 cr)

**Water Resources Ethics**

WRS 8581 - Research and Professional Ethics in Water Resources and Environmental Science (0.5 cr)

**Hydrology Core**

Take 3 or more credit(s) from the following:
- BBE 8513 - Hydrologic Modeling of Small Watersheds (3.0 cr)
- FNRM 5114 - Hydrology and Watershed Management (3.0 cr)

**Water Quality Core Elective**

Take 3 or more credit(s) from the following:
- BBE 5535 - Assessment and Diagnosis of Impaired Waters (3.0 cr)
- BIOL 4121 - Microbial Ecology and Applied Microbiology (3.0 cr)
- CEGE 8505 - Biological Processes (3.0 cr)
- CEGE 8511 - Mechanics of Sediment Transport (3.0 cr)
- EEB 5605 - Limnology Laboratory (2.0 cr)
- ENT 5081 - Insects, Aquatic Habitats, and Pollution (3.0 cr)
- ESCI 4401 - Aqueous Environmental Geochemistry (3.0 cr)
- ESCI 8511 - Mechanics of Sediment Transport (3.0 cr)
- ESPM 5575 - Wetlands (3.0 cr)
- ESPM 5601 - Principles of Waste Management (3.0 cr)
- FW 8459 - Stream and River Ecology (3.0 cr)
- FW 8465 - Fish Habitats and Restoration (3.0 cr)

**Limnology/Oceanology Emphasis**

Take 6 or more credit(s) from the following:
- EEB 4611 - Biogeochemical Processes (3.0 cr)
- EEB 5601 - Limnology (3.0 cr)
- EEB 5605 - Limnology Laboratory (2.0 cr)
- ESCI 4402 - Biogeochemical Cycles in the Ocean (3.0 cr)
- ESCI 5705 - Limnogeology and Paleoenvironment (3.0 cr)
- FW 5604W - Fisheries Ecology and Management [WI] (3.0 cr)
- FW 8459 - Stream and River Ecology (3.0 cr)
- FW 8465 - Fish Habitats and Restoration (3.0 cr)
- PUBH 6190 - Environmental Chemistry (3.0 cr)

**Outside Major Electives**

Take at least 6 credits outside your major, in consultation with your advisor.
**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](http://wrs.umn.edu)

- Program Type: Graduate minor related to major  
- Requirements for this program are current for Fall 2016  
- 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 PhD 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.

**Required Course**

WRS 5101 - Water Policy (3.0 cr)
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.

Master's
Core Courses
Take 6 or more credit(s) from the following:

Hydrology Core Courses
- BBE 8513 - Hydrologic Modeling of Small Watersheds (3.0 cr)
  or CEGE 4501 - Hydrologic Design (4.0 cr)
  or ESCI 4702 - General Hydrogeology (3.0 cr)
  or FNRM 5114 - Hydrology and Watershed Management (3.0 cr)
  or FNRM 5153 - Forest Hydrology & Watershed Biogeochemistry (3.0 cr)

Environmental/Water Chemistry Core Courses
- CEGE 5541 - Environmental Water Chemistry (3.0 cr)
  or ESCI 4401 - Aqueous Environmental Geochemistry (3.0 cr)
  or LAAS 5311 - Soil Chemistry and Mineralogy (3.0 cr)
  or PUBH 6190 - Environmental Chemistry (3.0 cr)

Limnology Core Courses
- EEB 5601 - Limnology (3.0 cr)
  or BBE 4523 - Ecological Engineering Design (3.0 cr)
  or BBE 5523 - Ecological Engineering Design (3.0 cr)
  or BBE 5513 - Watershed Engineering (3.0 cr)
  or BBE 5535 - Assessment and Diagnosis of Impaired Waters (3.0 cr)

Doctoral
Core Courses
Take 3 or more credit(s) from the following:

Hydrology Core Courses
- BBE 8513 - Hydrologic Modeling of Small Watersheds (3.0 cr)
  or CEGE 4501 - Hydrologic Design (4.0 cr)
  or ESCI 4702 - General Hydrogeology (3.0 cr)
  or FNRM 5114 - Hydrology and Watershed Management (3.0 cr)
  or FNRM 5153 - Forest Hydrology & Watershed Biogeochemistry (3.0 cr)

Environmental/Water Chemistry Core Courses
- CEGE 5541 - Environmental Water Chemistry (3.0 cr)
  or ESCI 4401 - Aqueous Environmental Geochemistry (3.0 cr)
  or LAAS 5311 - Soil Chemistry and Mineralogy (3.0 cr)
  or PUBH 6190 - Environmental Chemistry (3.0 cr)

Limnology Core Courses
- EEB 5601 - Limnology (3.0 cr)
  or BBE 4523 - Ecological Engineering Design (3.0 cr)
  or BBE 5523 - Ecological Engineering Design (3.0 cr)
  or BBE 5513 - Watershed Engineering (3.0 cr)
  or BBE 5535 - Assessment and Diagnosis of Impaired Waters (3.0 cr)

Emphasis Courses
Take 6 or more credit(s) from the following:

Aquatic Biology Emphasis
- BIOL 4121 - Microbial Ecology and Applied Microbiology (3.0 cr)
  or CEGE 5551 - Environmental Microbiology (3.0 cr)
  or EEB 5601 - Limnology (3.0 cr)
  or ENT 5081 - Insects, Aquatic Habitats, and Pollution (3.0 cr)
  or ENT 5361 - Aquatic Insects (4.0 cr)
  or ESPM 5575 - Wetlands (3.0 cr)
  or FW 4136 - Ichthyology (4.0 cr)
  or FW 5604W - Fisheries Ecology and Management [WI] (3.0 cr)
  or FW 8459 - Stream and River Ecology (3.0 cr)
  or FW 8465 - Fish Habitats and Restoration (3.0 cr)
  or HORT 5071 - Ecological Restoration (4.0 cr)

Environmental Emphasis
- CEGE 5541 - Environmental Water Chemistry (3.0 cr)
  or CEGE 5542 - Experimental Methods in Environmental Engineering (3.0 cr)
CEGE 8542 - Chemistry of Organic Pollutants in Environmental Systems (3.0 cr)
ESCI 4401 - Aqueous Environmental Geochemistry (3.0 cr)
ESCI 4402 - Biogeochemical Cycles in the Ocean (3.0 cr)
ESPM 4216 - Contaminant Hydrology (3.0 cr)
LAAS 5311 - Soil Chemistry and Mineralogy (3.0 cr)
PUBH 6190 - Environmental Chemistry (3.0 cr)

**Hydrology Emphasis (Climatology)**
- ESPM 5402 - Biometeorology (3.0 cr)
- GEOG 5426 - Climatic Variations (3.0 cr)

**Hydrology Emphasis (Groundwater)**
- CEGE 4351 - Groundwater Mechanics (3.0 cr)
- CEGE 4352 - Groundwater Modeling (3.0 cr)
- ESCI 4702 - General Hydrogeology (3.0 cr)
- ESCI 5971 - Field Hydrogeology (2.0 cr)

**Hydrology Emphasis (Surface Water)**
- BBE 5513 - Watershed Engineering (3.0 cr)
- CEGE 4501 - Hydrologic Design (4.0 cr)
- CEGE 8506 - Stochastic Hydrology (4.0 cr)
- CEGE 8507 - Advanced Methods in Hydrology (4.0 cr)
- CEGE 8572 - Computational Environmental Fluid Dynamics (4.0 cr)
- ESCI 8601 - Introduction to Stream Restoration (3.0 cr)
- CEGE 8601 - Introduction to Stream Restoration (3.0 cr)
- EEB 8601 - Introduction to Stream Restoration (3.0 cr)
- ESCI 8602 - Stream Restoration Practice (2.0 cr)
- CEGE 8602 - Stream Restoration Practice (2.0 cr)
- ESPM 5111 - Hydrology and Water Quality Field Methods (3.0 cr)
- ESPM 5555 - Wetland Soils (3.0 cr)
- SOIL 5555 - Wetland Soils (3.0 cr)
- FNRM 5153 - Forest Hydrology & Watershed Biogeochemistry (3.0 cr)
- FNRM 5114 - Hydrology and Watershed Management (3.0 cr)
- SOIL 5232 - Vadose Zone Hydrology (3.0 cr)

**Limnology Emphasis**
- BBE 4611 - Biogeochemical Processes (3.0 cr)
- EEB 5601 - Limnology (3.0 cr)
- ESCI 4402 - Biogeochemical Cycles in the Ocean (3.0 cr)
- ESCI 5705 - Limnogeology and Paleoenvironment (3.0 cr)
- FW 5604W - Fisheries Ecology and Management [WI] (3.0 cr)
- FW 8459 - Stream and River Ecology (3.0 cr)
- FW 8465 - Fish Habitats and Restoration (3.0 cr)
- PUBH 6190 - Environmental Chemistry (3.0 cr)

**Limnology/Oceanography Emphasis**
- EEB 4611 - Biogeochemical Processes (3.0 cr)
- EEB 5601 - Limnology (3.0 cr)
- ESCI 4402 - Biogeochemical Cycles in the Ocean (3.0 cr)
- ESCI 5705 - Limnogeology and Paleoenvironment (3.0 cr)
- FW 5604W - Fisheries Ecology and Management [WI] (3.0 cr)
- FW 8459 - Stream and River Ecology (3.0 cr)
- FW 8465 - Fish Habitats and Restoration (3.0 cr)
- PUBH 6190 - Environmental Chemistry (3.0 cr)

**Water Management Technology Emphasis**
- BBE 4523 - Ecological Engineering Design (3.0 cr)
- CEGE 4502 - Water and Wastewater Treatment (3.0 cr)
- CEGE 4511 - Hydraulic Structures (3.0 cr)
- CEGE 4512 - Open Channel Hydraulics (4.0 cr)
- CEGE 4562 - Environmental Remediation Technology (3.0 cr)
- CEGE 8504 - Theory of Unit Operations (4.0 cr)
- CEGE 8505 - Biological Processes (3.0 cr)
- CEGE 8511 - Mechanics of Sediment Transport (3.0 cr)
- ESCI 8511 - Mechanics of Sediment Transport (3.0 cr)

**Water Policy Emphasis**
- APEC 5651 - Economics of Natural Resource and Environmental Policy (3.0 cr)
- CONS 8004 - Economic and Social Aspects of Conservation Biology (3.0 cr)
or ESPM 5256 - Natural Resource Law and the Management of Public Lands and Waters (3.0 cr)

**Water Quality Emphasis**
- BBE 5535 - Assessment and Diagnosis of Impaired Waters (3.0 cr)
- CEGE 4502 - Water and Wastewater Treatment (3.0 cr)
- CEGE 8542 - Chemistry of Organic Pollutants in Environmental Systems (3.0 cr)
- ENT 5081 - Insects, Aquatic Habitats, and Pollution (3.0 cr)
- ESPM 5061 - Water Quality and Natural Resources (3.0 cr)
- ESPM 5111 - Hydrology and Water Quality Field Methods (3.0 cr)
- ESPM 5575 - Wetlands (3.0 cr)

**Watershed Science and Management Emphasis**
- BBE 5513 - Watershed Engineering (3.0 cr)
- BBE 8513 - Hydrologic Modeling of Small Watersheds (3.0 cr)
- CEGE 4501 - Hydrologic Design (4.0 cr)
- ESCI 8601 - Introduction to Stream Restoration (3.0 cr)
- CEGE 8601 - Introduction to Stream Restoration (3.0 cr)
- EEB 8601 - Introduction to Stream Restoration (3.0 cr)
- ESCI 8602 - Stream Restoration Practice (2.0 cr)
- CEGE 8602 - Stream Restoration Practice (2.0 cr)
- EEB 8602 - Stream Restoration Practice (2.0 cr)
- ESPM 5111 - Hydrology and Water Quality Field Methods (3.0 cr)
- ESPM 5575 - Wetlands (3.0 cr)
- ESPM 5703 - Agroforestry in Watershed Management (3.0 cr)
- ESPM 5555 - Wetland Soils (3.0 cr)
- SOIL 5555 - Wetland Soils (3.0 cr)
- FNRM 5114 - Hydrology and Watershed Management (3.0 cr)
- FNRM 5153 - Forest Hydrology & Watershed Biogeochemistry (3.0 cr)
- HORT 5071 - Ecological Restoration (4.0 cr)
- WRS 5050 - Special Topics in Water Resources Science (1.0 - 3.0 cr)
Twin Cities Campus
Water Resources Science PhD
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 2016
- Length of program in credits: 64
- This program does not require summer semesters for timely completion.
- The Water Resources Science PhD 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 PhD 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 PhD level: aquatic biology, environmental chemistry, hydrologic science, limnology, water management technology, water policy, water quality, and watershed science and management. A Limnology and Oceanography track is also available. 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
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/admissions/admissions-info.

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

22 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.

Water Resources Seminar

Students must take WRS 8100 for 0.5 credits.

WRS 8100 - Interdisciplinary Seminar in Water Resources (0.5 - 3.0 cr)

Water Resources Ethics

WRS 8581 - Research and Professional Ethics in Water Resources and Environmental Science (0.5 cr)

Hydrology Core

Take at least 3 credits from the following:

BBE 8513 - Hydrologic Modeling of Small Watersheds (3.0 cr)
or CEGE 4501 - Hydrologic Design (4.0 cr)
or ESCI 4702 - General Hydrogeology (3.0 cr)
or FNRM 5114 - Hydrology and Watershed Management (3.0 cr)
or FNRM 5153 - Forest Hydrology & Watershed Biogeochemistry (3.0 cr)

Environmental/Water Chemistry Core

Take at least 3 credits from the following:

CEGE 5541 - Environmental Water Chemistry (3.0 cr)
or ESCI 4401 - Aqueous Environmental Geochemistry (3.0 cr)
or LAAS 5311 - Soil Chemistry and Mineralogy (3.0 cr)
or PUBH 6190 - Environmental Chemistry (3.0 cr)

Limnology Core
EEB 5601 - Limnology (3.0 cr)

Water Resources Policy Core
WRS 5101 - Water Policy (3.0 cr)

Water Quality Core Elective
Take 3 or more credit(s) from the following:
• BBE 4523 - Ecological Engineering Design (3.0 cr)
• BBE 5513 - Watershed Engineering (3.0 cr)
• BBE 5523 - Ecological Engineering Design (3.0 cr)
• BBE 5535 - Assessment and Diagnosis of Impaired Waters (3.0 cr)
• BIOL 4121 - Microbial Ecology and Applied Microbiology (3.0 cr)
• CEGE 4502 - Water and Wastewater Treatment (3.0 cr)
• CEGE 4562 - Environmental Remediation Technology (3.0 cr)
• CEGE 5551 - Environmental Microbiology (3.0 cr)
• CEGE 5504 - Theory of Unit Operations (4.0 cr)
• CEGE 5505 - Biological Processes (3.0 cr)
• CEGE 8511 - Mechanics of Sediment Transport (3.0 cr)
• CEGE 8542 - Chemistry of Organic Pollutants in Environmental Systems (3.0 cr)
• ENT 5081 - Insects, Aquatic Habitats, and Pollution (3.0 cr)
• ESCI 4401 - Aqueous Environmental Geochemistry (3.0 cr)
• ESCI 5713 - Tracers and Karst Hydrogeology (3.0 cr)
• ESCI 8511 - Mechanics of Sediment Transport (3.0 cr)
• ESPM 5111 - Hydrology and Water Quality Field Methods (3.0 cr)
• ESPM 5575 - Wetlands (3.0 cr)
• ESPM 5601 - Principles of Waste Management (3.0 cr)
• ESPM 5703 - Agroforestry in Watershed Management (3.0 cr)
• FW 8459 - Stream and River Ecology (3.0 cr)
• FW 8465 - Fish Habitats and Restoration (3.0 cr)

Outside Major Electives
Take at least 12 credits outside your major, in consultation with your advisor.

Thesis Requirement
All doctoral students must take 24 doctoral thesis credits.
WRS 8888 - Thesis Credit: Doctoral (1.0 - 24.0 cr)

Area of Emphasis
Complete a least 6 credits from the one of the following emphases:

Aquatic Biology Emphasis
Take at least 6 credits from the following:
BIOL 4121 - Microbial Ecology and Applied Microbiology (3.0 cr)
or CEGE 5551 - Environmental Microbiology (3.0 cr)
or EEB 5601 - Limnology (3.0 cr)
or ENT 5081 - Insects, Aquatic Habitats, and Pollution (3.0 cr)
or ENT 5361 - Aquatic Insects (4.0 cr)
or ESPM 5575 - Wetlands (3.0 cr)
or FW 4136 - Ichthyology (4.0 cr)
or FW 5604W - Fisheries Ecology and Management [WI] (3.0 cr)
or FW 8459 - Stream and River Ecology (3.0 cr)
or FW 8465 - Fish Habitats and Restoration (3.0 cr)
or HORT 5071 - Ecological Restoration (4.0 cr)

-OR-

Environmental Chemistry Emphasis
Take at least 6 credits from the following:
CEGE 5541 - Environmental Water Chemistry (3.0 cr)
or CEGE 5542 - Experimental Methods in Environmental Engineering (3.0 cr)
or CEGE 8542 - Chemistry of Organic Pollutants in Environmental Systems (3.0 cr)
or ESCI 4401 - Aqueous Environmental Geochemistry (3.0 cr)  
or ESCI 4402 - Biogeochemical Cycles in the Ocean (3.0 cr)  
or ESPM 4216 - Contaminant Hydrology (3.0 cr)  
or LAAS 5311 - Soil Chemistry and Mineralogy (3.0 cr)  
or PUBH 6190 - Environmental Chemistry (3.0 cr)

-OR-

Hydrology (Climatology) Emphasis  
Take at least 6 credits from the following:  
ESPM 5402 - Biometeorology (3.0 cr)  
or GEOG 5426 - Climatic Variations (3.0 cr)

-OR-

Hydrology (Groundwater) Emphasis  
Take at least 6 credits from the following:  
CEGE 4351 - Groundwater Mechanics (3.0 cr)  
or CEGE 4352 - Groundwater Modeling (3.0 cr)  
or ESCI 4702 - General Hydrogeology (3.0 cr)  
or ESCI 5971 - Field Hydrogeology (2.0 cr)

-OR-

Hydrology (Surface Water) Emphasis  
Take at least 6 credits from the following:  
BBE 5513 - Watershed Engineering (3.0 cr)  
or BBE 8513 - Hydrologic Modeling of Small Watersheds (3.0 cr)  
or CEGE 4501 - Hydrologic Design (4.0 cr)  
or CEGE 8506 - Stochastic Hydrology (4.0 cr)  
or CEGE 8507 - Advanced Methods in Hydrology (4.0 cr)  
or CEGE 8572 - Computational Environmental Fluid Dynamics (4.0 cr)  
or ESCI 8601 - Introduction to Stream Restoration (3.0 cr)  
or CEGE 8601 - Introduction to Stream Restoration (3.0 cr)  
or CEGE 8602 - Stream Restoration Practice (2.0 cr)  
or CEGE 8602 - Stream Restoration Practice (2.0 cr)  
or EEB 8601 - Introduction to Stream Restoration (3.0 cr)  
or EEB 8602 - Stream Restoration Practice (2.0 cr)  
or ESPM 5111 - Hydrology and Water Quality Field Methods (3.0 cr)  
or ESPM 5555 - Wetland Soils (3.0 cr)  
or SOIL 5555 - Wetland Soils (3.0 cr)  
or FNRM 5153 - Forest Hydrology & Watershed Biogeochemistry (3.0 cr)  
or FNRM 5114 - Hydrology and Watershed Management (3.0 cr)  
or SOIL 5232 - Vadose Zone Hydrology (3.0 cr)

-OR-

Limnology Emphasis  
Take at least 6 credits from the following:  
EEB 4611 - Biogeochemical Processes (3.0 cr)  
or EEB 5601 - Limnology (3.0 cr)  
or ESCI 4402 - Biogeochemical Cycles in the Ocean (3.0 cr)  
or ESCI 5705 - Limnogeology and Paleoenvironment (3.0 cr)  
or FW 5604W - Fisheries Ecology and Management [WI] (3.0 cr)  
or FW 8459 - Stream and River Ecology (3.0 cr)  
or FW 8465 - Fish Habitats and Restoration (3.0 cr)  
or PUBH 6190 - Environmental Chemistry (3.0 cr)

-OR-

Water Policy Emphasis  
Take at least 6 credits from the following:  
APEC 5651 - Economics of Natural Resource and Environmental Policy (3.0 cr)  
or CONS 8004 - Economic and Social Aspects of Conservation Biology (3.0 cr)  
or ESPM 5256 - Natural Resource Law and the Management of Public Lands and Waters (3.0 cr)

-OR-

Water Quality Emphasis  
Take at least 6 credits from the following:
BBE 5535 - Assessment and Diagnosis of Impaired Waters (3.0 cr)
or CEGE 4502 - Water and Wastewater Treatment (3.0 cr)
or CEGE 8542 - Chemistry of Organic Pollutants in Environmental Systems (3.0 cr)
or ENT 5081 - Insects, Aquatic Habitats, and Pollution (3.0 cr)
or ESPM 5061 - Water Quality and Natural Resources (3.0 cr)
or ESPM 5111 - Hydrology and Water Quality Field Methods (3.0 cr)
or ESPM 5575 - Wetlands (3.0 cr)

-OR-

Watershed Science and Management Emphasis
Take at least 6 credits from the following:
BBE 5513 - Watershed Engineering (3.0 cr)
or BBE 8513 - Hydrologic Modeling of Small Watersheds (3.0 cr)
or CEGE 4501 - Hydrologic Design (4.0 cr)
or ESCI 8601 - Introduction to Stream Restoration (3.0 cr)
or CEGE 8601 - Introduction to Stream Restoration (3.0 cr)
or EEB 8601 - Introduction to Stream Restoration (3.0 cr)
or EEB 8602 - Stream Restoration Practice (2.0 cr)
or CEGE 8602 - Stream Restoration Practice (2.0 cr)
or EEB 8602 - Stream Restoration Practice (2.0 cr)
or ESPM 5111 - Hydrology and Water Quality Field Methods (3.0 cr)
or ESPM 5575 - Wetlands (3.0 cr)
or ESPM 5703 - Agroforestry in Watershed Management (3.0 cr)
or ESPM 5555 - Wetland Soils (3.0 cr)
or SOIL 5555 - Wetland Soils (3.0 cr)
or FNRM 5114 - Hydrology and Watershed Management (3.0 cr)
or FNRM 5153 - Forest Hydrology & Watershed Biogeochemistry (3.0 cr)
or HORT 5071 - Ecological Restoration (4.0 cr)
or WRS 5050 - Special Topics in Water Resources Science (1.0 - 3.0 cr)

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.

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.

PhD students pursuing the Limnology and Oceanography track must have at least two members of the limnology and oceanography faculty on their committee, including the adviser.

Water Resources Seminar
Students must take WRS 8100 for 0.5 credits.
WRS 8100 - Interdisciplinary Seminar in Water Resources (0.5 - 3.0 cr)

Water Resources Ethics
WRS 8581 - Research and Professional Ethics in Water Resources and Environmental Science (0.5 cr)
Hydrology Core
Take 3 or more credit(s) from the following:
- BBE 8513 - Hydrologic Modeling of Small Watersheds (3.0 cr)
- FNRM 5114 - Hydrology and Watershed Management (3.0 cr)

Environmental/Water Chemistry Core
Take 3 or more credit(s) from the following:
- CEGE 5541 - Environmental Water Chemistry (3.0 cr)
- ESCI 4401 - Aqueous Environmental Geochemistry (3.0 cr)
- LAAS 5311 - Soil Chemistry and Mineralogy (3.0 cr)
- PUBH 6190 - Environmental Chemistry (3.0 cr)

Limnology Core
- EEB 5601 - Limnology (3.0 cr)

Water Resources Policy Core
- WRS 5101 - Water Policy (3.0 cr)

Water Quality Core Elective
Take 3 or more credit(s) from the following:
- BBE 5535 - Assessment and Diagnosis of Impaired Waters (3.0 cr)
- BIOL 4121 - Microbial Ecology and Applied Microbiology (3.0 cr)
- CEGE 8505 - Biological Processes (3.0 cr)
- CEGE 8511 - Mechanics of Sediment Transport (3.0 cr)
- EEB 5605 - Limnology Laboratory (2.0 cr)
- ENT 5081 - Insects, Aquatic Habitats, and Pollution (3.0 cr)
- ESCI 4401 - Aqueous Environmental Geochemistry (3.0 cr)
- ESCI 8511 - Mechanics of Sediment Transport (3.0 cr)
- ESPM 5575 - Wetlands (3.0 cr)
- ESPM 5601 - Principles of Waste Management (3.0 cr)
- FW 8459 - Stream and River Ecology (3.0 cr)
- FW 8465 - Fish Habitats and Restoration (3.0 cr)

Limnology/Oceanology Emphasis
Take 6 or more credit(s) from the following:
- EEB 4611 - Biogeochemical Processes (3.0 cr)
- EEB 5601 - Limnology (3.0 cr)
- EEB 5605 - Limnology Laboratory (2.0 cr)
- ESCI 4402 - Biogeochemical Cycles in the Ocean (3.0 cr)
- ESCI 5705 - Limnogeology and Paleoenvironment (3.0 cr)
- FW 5604W - Fisheries Ecology and Management [WI] (3.0 cr)
- FW 8459 - Stream and River Ecology (3.0 cr)
- FW 8465 - Fish Habitats and Restoration (3.0 cr)
- PUBH 6190 - Environmental Chemistry (3.0 cr)

Outside Major Electives
Take at least 12 credits outside your major, in consultation with your advisor.