The Morris Biology Guide

A Handbook for Students Majoring in Biology and Related Fields

The University of Minnesota, Morris offers students a balance, yet distinctive liberal arts education—an academic experience that meets today's highest standards. Meaningful enrichment opportunities like undergraduate research, study abroad, and service learning are hallmarks of this intimate, residential campus. Unlike at large universities, professors—not teaching assistants—teach all Morris classes.

2008-2009 Version

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Biology

Introduction

This handbook introduces the program, facilities and people of the Biology Discipline, for students who are considering majoring in Biology and related pre-professional programs. While the basic requirements and personnel are listed in the UMM Bulletin, this handbook explains those requirements more thoroughly, includes recommendations for putting together the best program to fit *your* interests, and describes some of the opportunities available for students and how to best use those opportunities.

Biology is an unusually broad discipline, and people with many different interests major in biology: students who plan to go to medical school, work with wildlife, become veterinarians, work in genetic engineering, and other areas. Besides their unique specialties, these and other fields share a common basis of knowledge and common perspectives for understanding the world. This underlies the core program in biology.

Three main routes are open to pursue the areas within biology that interest you most.

First is to take advantage of the range of courses (mostly 4000-level) that deal with different specialties.

Second is to develop your own directed study in an area that interests you.

Third is to take advantage of different learning opportunities available at other locations, both in the U.S. and abroad, and integrate those experiences with what you do at UMM.

Increasingly, undergraduate education is seen not simply as what you learn from reading, lectures and discussions but also from what you learn from hands-on experience, and more emphasis is placed on students engaging in research projects.

The most important general point is that your education as a biologist does not begin and end in the classroom; that is only one portion of what you make as your education.

Requirements

Biology Coursework

This describes the offerings for 2008-2009. Every two years UMM issues a new Course Bulletin, which describes the program offerings and requirements. Changes from one Bulletin to another usually are slight, but may be significant when it comes down to the nitty-gritty of scheduling the courses you'll take. The requirements you will need to meet are those of the bulletin in effect when you start at UMM, though you have the option of choosing the requirements of any subsequent bulletins issued while you are a student.

Simple list of required courses:

One 1000 Level course: Bio 1111 Fundamentals of Genetics, Evolution, and Development

Two 2000-Level courses: Bio 2101 Evolution of Biodiversity, Bio 2111 Cell Biology

Two 3000-Level courses: Bio 3121 Molecular Biology, Bio 3131 Ecology

Four 4000-Level courses: Any 4XXX biology elective courses

Plus: Bio 3700 and 3701 (Biological Communications 1 and 2) and Bio 4901 (Senior Seminar)

Plus supporting courses in Chemistry, Math, and Statistics

One of our strongest recommendations is to complete the required courses soon, rather than put any off until your senior year (except the Senior Seminar, Bio 4901). The required courses are pre-requisites for elective courses (some electives require only 2101 or 2111, others also require 3121 or 3131). The core of required courses also helps you meet faculty so you can develop a plan of study that fits your interests, and prepare you for individualized work such as directed studies or research projects.

You can *petition* for anything. Every year, students have very reasonable requests for exceptions to the required program, such as taking courses at the Itasca station or other schools (such as study abroad). This flexibility isn't to avoid the program, but to allow various ways to meet it.

Below is the current schedule of courses. Courses numbered 10XX (e.g. Bio 1052, Conservation Biology) are intended for non-majors, and do not fulfill biology elective credit requirements.

Courses offered annually

Fall	Spring
	Bio 1002 Human Nutrition
Bio 1111 Fundamentals of Genetics, Evolution, & Development	Bio 1111 Fundamentals of Genetics, Evolution, & Development
Bio 2111 Cell Biology	Bio 2101 Evolution of Biodiversity
Bio 2102 Human Anatomy	Bio 2103 Introduction to Human Physiology
Bio 3131 Ecology	Bio 3121 Molecular Biology
Bio 4211 Biochemistry	Bio 4111 Microbiology
	Bio 4312 Genetics (not in Spring 2010)
Bio 3700 Bio. Comm. I	Bio 3700 Bio Comm. I
Bio 3701 Bio Comm. II	Bio 3701 Bio Comm. II
Bio 4901 Senior Seminar	Bio 4901 Senior Seminar

Summer Session I: Bio 1071 Plants of Minnesota

Courses offered biennially

Fall (odd years)	Spring (even years)
Bio 1052 Introduction to Conservation Biology	Bio 1001 Biological Rhythms (not S'10)
Bio 4003 Neurobiology (not F '09)	Bio 1052 Introduction to Conservation Biology
Bio 4131 Vertebrate Natural History	Bio 4161 Evolution

Bio 4191 Freshwater Biology	Bio 4172 Plant Systematics
Bio 4301 Plant Biology (not F'09)	
Bio 4311 Conservation Genetics (not F'09)	Bio 4351 Conservation Biology (Spring 2010)

Fall (even years)	**Spring (odd years)**
Bio 1051 Wildlife Biology	Bio 4121 Herpetology
Bio 4151 Entomology	Bio 4321 Animal Physiology (may not occur in 2009)
Bio 4181 Developmental Biology	Bio 4331 Global Change Biology
Bio 4351 Conservation Biology	

Below we summarize first the required Biology courses, and then the requirements from other disciplines.

1000-level Courses:

Bio 1111 (Fundamentals of Genetics, Evolution, and Development) is the first course that students will take. It can be taken EITHER during the Fall or Spring term, preferably during the first year.

2000-level Courses:

Bio 2101 (Evolution of Biodiversity) and Bio 2111 (Cell Biology) come after Biological Principles, and are prerequisites for 3000 and 4000 level courses. Evolution of Biodiversity is scheduled in the Spring, and can be taken during the first year if you have already finished Bio 1111, or can be taken during the second year. You should take Cell Biology (Bio 2111) during the Fall of your second year; it requires you to have finished Chem 1101 (General Chemistry I).

3000-level Courses:

All of the 3000-level courses are required: Bio 3101 (Molecular Biology) should be taken Spring of your second or third year; Bio 3131 (Ecology) should be taken Fall of your third year. It will be possible to put each of these courses off by a year, though in general the faculty recommend

completing the required courses as early as possible, since that allows more flexibility in scheduling elective courses. Bio 3700 and 3701(Biological Communications), a pair of one-credit courses in which you work individually with a faculty member to develop a paper reviewing some area of biology, should be completed during your third year; Bio 3701 is a pre-requisite for the Senior Seminar (Bio 4901).

4000-level Courses:

The 4000-level courses are elective courses, except for Senior Seminar (Bio 4901), which is a required, 1-credit course described more below. Biology majors are required to have at least 16 elective credits; these can be from Biology courses numbered 4000-4500, or Psych 3201 (Comparative Psychology), Psych 3211 (Biological Psychology), or Geol 3111 (Introduction to Invertebrate Paleontology).

Courses listed as "Topics in Advanced Biology" (Bio 400X) are usually new courses that have not yet been listed in the Bulletin, though they often show up in the Class Schedule, since that is prepared each year.

Senior Seminar (Bio 4901):

Seniors give seminars on Tuesday (12:00) and Thursday (5:00), in which they present the results of projects they have worked on at UMM or elsewhere, or a review of literature on some topic in biology. For the major, you are required to give one seminar and to attend at least 9 others. *Students register for Bio 4901 (1 credit) in the fall of their senior year but attend seminars all year long*. You are encouraged to attend these seminars even if you are not registered for the course-- you certainly don't have to wait until you are a senior to attend. These seminars are another way to informally broaden your biological education.

This course fulfills the general education requirement (GER) for a course in which students have public speaking experience. Early in the fall semester of their senior year, all bio majors attend an organizational meeting that includes scheduling the date for their presentation. Although you may be tempted to "put off the pain" of giving your seminar until the last possible day, it will be to your advantage (and relief) to give your seminar early in the year. This is also important because it gives faculty members more information that they can use in writing recommendations for you for medical school, graduate school, employment, etc.

Supporting Disciplines:

More than other sciences, Biology relies on information and understanding from other disciplines, and coursework in other disciplines is required for bio majors.

Chemistry Requirements:

Because of the role of chemistry in metabolic processes within living organisms, a fundamental understanding of chemistry is essential. While organisms themselves are familiar to all of us, the chemistry involved in living is not. Indeed, for those who have never had chemistry, even the symbolic language of chemistry, such as the diagrams of chemical structures, can be intimidating.

During your first year, you should take Chem 1101-1102 (General Chemistry I-II). During your second year you should take at least one semester of Organic Chemistry (Chem 2301), as well as one term of O-chem lab (Chem 2311).

Mathematics Requirements:

Bio majors are required to study calculus and statistics. Because of its utility in abstracting biological processes, an understanding of calculus is fundamental. The calculus requirement for a biology major may be fulfilled by taking Math 1021 (Survey of Calculus) or Math 1101 (Calculus I). Statistics is required both because of its utility in interpreting the results of experiments and, more fundamentally, because it introduces a structured analysis of variation found in nature. The statistics requirement may be fulfilled by taking either Math 1601 (Introduction to Statistics) or Math 2611 (Mathematical Statistics).

Study Abroad

Recommendations

What should you plan?

Obviously this depends on your interests and background, and your advisor (as well as other students) should be consulted about this. You can reasonably schedule two biology lab courses in the same semester; a semester with 4 lab science courses can be a challenge but suits some people well.

You should schedule Fundamentals of Genetics, Evolution, and Development (Bio 1111), Evolution of Biodiversity (Bio 2101) and Cell Biology (Bio 2111) as early as practicable. This gives you more flexibility later on, in your junior and senior year, for taking upper level biology courses, for directed studies, for being a T.A. for courses, for research projects, or foreign travel.

Also, you should start the chemistry sequence as soon as possible, since it will take 1 year for intro chem (either Chem 1101-1102 or 1111-1112), another year for organic (Chem 2301, 2311, and maybe 2302 and 2312); these courses are pre-requisites for some required upper-level biology courses.

You should plan your schedule so that you complete the basic required courses except for the Senior Seminar course (Bio1111, 2101, 2111, 3121, 3131, 3700, and 3701) by the end of your junior year.

Graduate Schools:

What works best to make you an attractive candidate for graduate work?

1. Undergraduate research experience (not just course work)
2. Strong GPA
3. High score on the Graduate Record Examination (GRE)

-- see also the figure below, "What are grad schools looking for?"

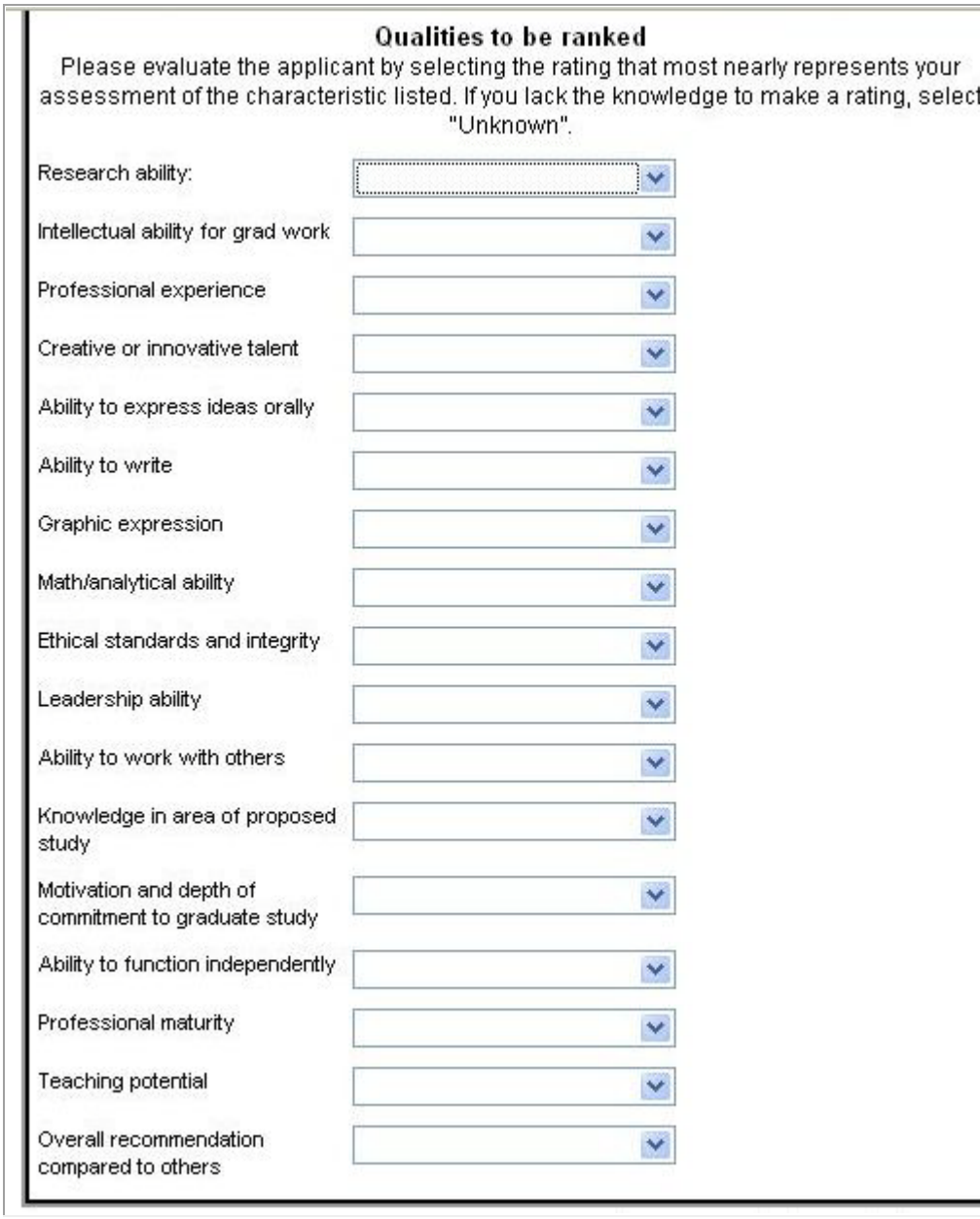
Going to graduate school is very different than going to college. First, the process of choosing a graduate program is entirely different. At the undergraduate level, one chooses a school for a broad range of courses and related experiences. At the graduate level, however, you do *not* choose a university, but target a specific individual with whom you want to work, or perhaps a specific department that has a program that is strong in the particular area you are interested in. You then make contact with that individual (or department); application to their university generally comes as the last step. Graduate work is far more focused (and intense) than undergraduate work; it is unlikely that you would go to graduate school without having visited the department, faculty, and other graduate students with whom you would be working. You are selecting them, and they are selecting you, on a much more individual level than occurs for undergraduate study.

Students planning to go to graduate school should plan to take the Graduate Record (GRE) exams in the fall of your senior year. Before this, you should have completed the basic required courses and a course in physiology (either Bio 4102 or Bio 4321). For calculus, you should take the full year sequence (Math 1101-1102) and for statistics you should take Math 2601. Students interested in graduate work in molecular or cell biology should take a minor in chemistry.

What are grad schools looking for?

The figure at the right is taken from an online recommendation for graduate study in biology. Reviewers are asked to rank a candidate for each line, as "top 1%", "top 5%", "top 10%", etc.

When they write letters of recommendation, reviewers address similar qualities.



Qualities to be ranked

Please evaluate the applicant by selecting the rating that most nearly represents your assessment of the characteristic listed. If you lack the knowledge to make a rating, select "Unknown".

Research ability:

Intellectual ability for grad work

Professional experience

Creative or innovative talent

Ability to express ideas orally

Ability to write

Graphic expression

Math/analytical ability

Ethical standards and integrity

Leadership ability

Ability to work with others

Knowledge in area of proposed study

Motivation and depth of commitment to graduate study

Ability to function independently

Professional maturity

Teaching potential

Overall recommendation compared to others

For the **Graduate Record Exam**: You can get a Bulletin for information and registration from the Counseling center in Behmler Hall, from the GRE website, or by writing to: Graduate Record Examinations, Educational Testing Service, P.O. Box 6000, Princeton, NJ 08541-6000. Besides the general test, you would take one or both of the "subject tests" related to biology. The "Biology" subject test covers Cellular and Molecular Biology, Organismal Biology, Ecology and Evolutionary Ecology, and Evolution. The "Biochemistry, Cell and Molecular Biology" subject test covers Biochemistry, Cell Biology, and Molecular Biology. You should consult the GRE Bulletin for further details about what the tests cover.

Be sure you read the sections below labeled *Everybody* and *Finally*, as well as the section on *Student Research*

Pre-Med Students:

Medical schools do not require students to get B.A. degrees in biology, though most do require majoring in some subject (i.e you don't major in pre-med studies). You will sometimes hear that medical schools are looking for students who are not science majors, and instead want people who have majored in humanities or social sciences. While there is truth in the notion that medical schools want people who are broadly educated (meaning a liberal arts education), it is misleading to suggest that, say, any English major can get into medical school. Unless they also have this strong science background, they'll bomb the Medical College Admissions Test (MCAT). Admission to medical school requires getting a fairly good score on the MCAT, which tests knowledge of Biology, Chemistry, Physics, Mathematics, and Writing. Consequently, most pre-med students major in biology or chemistry; some students take a second major in one of the social sciences or humanities.

The MCAT test is given online several times each year, but you must go to a special testing center to take the test. You should plan on taking the MCAT test by the **spring or early summer of your junior year**. This test is the primary criterion medical schools use for selecting applicants. You can have your grades sent directly to the schools you apply to (it is not cheap). It is also possible to take the test as late as the fall of your senior year, whether or not you took it in your junior year, *BUT the scores do not come back in time for you to get a decent place in the med school applicant pools*! It takes several weeks for the tests to be graded, and the fall scores come rather late for the admissions process.

Regardless of which time(s) you take the test, by then *you should have completed Genetics and Biochemistry, and either completed or be taking Molecular Biology.* You should also have taken a course in Human Anatomy (Bio 2102) and in Physiology, either Bio 4102 (Human Physiology) or Bio 4321 (Animal Physiology). You should start your chemistry sequence (1101 or 1111) during your freshman year, and should take at least Bio 1111 that year. It would also help your scheduling to take 2101 your freshman year. You will also need to complete introductory chemistry (1102 or 1112) and organic chemistry (2301, 2302, 2311) as well as physics and math before taking the test.

Prior to taking the MCAT test in the spring of your junior year, you should schedule extra time for preparation during the winter. Note that this might be more difficult if you put off Genetics until that year, because you would be taking two Biology lab courses that quarter (Bio 3101 and 3121).

Physics: For medical schools and for the MCAT test, you can take either the General Physics sequence (calculus-based) or the Principles of Physics sequence (algebra-based). The General Physics sequence starts in Spring and then finishes in Fall; the Principles of Physics starts in the

Fall and finishes in the Spring. Students taking the Principles sequence during their junior year find that it covers all of the topics used in the April MCAT test except optics, so you will need to plan some extra study time to make sure you understand that material before the MCAT test.

Some of the **most important advice**, however, is not about your academic preparation but the other kinds of preparation you must make. Many medical schools (and this includes especially the Twin Cities and Duluth schools) are looking for students who have extensive experience actually helping people. This kind of contact and responsibility for others' welfare-- such as might be gained by working at a nursing home, for instance-- demonstrates personal qualities that are not reflected in someone's GPA or MCAT scores. Another valuable form of preparation is to take the Emergency Medical Technician course offered each fall (and some winters) at the local hospital. This can be arranged for course credit, and prepares you for working on the ambulance crew here or elsewhere-- another example of the kind of experience medical schools are looking for.

Health Pre-Professional Programs:

Students interested in pre-med, pre-dental, physicians' assistant, pre-vet, pre-nursing, occupational therapy, or other health professional programs: you should consult with your advisor for information regarding the required and recommended courses for admission to these programs. Each year the Student Counseling office sends all faculty advisors a guide to these requirements and what courses at UMM fill those needs, and your advisor can work with you to outline your program to fill these needs. This will include term-by-term scheduling of what courses to take. You should also make sure you include some hands-on experience.

Ecology and Wildlife:

Students interested in graduate work in ecology should also take courses such as Bio 4351 (Conservation Biology), Bio 4331(Global Change Ecology), Bio 4311 (Conservation Genetics), Biostatistics (Stats 4601), Math 2111 (Linear Algebra) and perhaps Geology 1111 (Physical Geology).

The University of Minnesota runs an excellent field station in Itasca State Park (biosci.umn.edu/itasca/info-s.html). A wide variety of field courses are offered there each summer, most of which fulfill requirements for electives for the UMM Biology. Consider these comments, from a recent UMM grad: "Just to let you know, I have been accepted into graduate school … [woohooo) …. One of the main reasons I got this position is because I went to the Itasca Research Station for a summer and did the research project on turtles that I used for my senior seminar. I guess research outside of school really is beneficial!!"

Some scholarships are available, and other universities maintain field stations as well. You might want to take classes at a marine or mountain field station, for instance. If you have any leaning towards the study of ecology, evolution, or behavior, we strongly urge you to look into these courses. Many of these courses are also excellent preparation for people going into secondary education. More information on the Itasca program is available from the bio faculty, or by calling 651-625-1234 to ask for information (that's the Department of Plant Biology in St. Paul).

The statistical analysis of field data is such a crucial part of ecological research that students interested in ecology should get a good background in statistics. Stats 2601 (Mathematical Statistics) and 4601 (Biostatistics) would be the best courses for meeting this need.

Environmental Biology:

Students interested in environmental studies should consider taking related courses in other disciplines, such as Environmental Geology (Geo 1001) or (better choice) Physical Geology

(Geo 1101 or 1111), Hydrology (Geo 3501), or Environmental Economics (Topics in Economics, Econ 300X) when it is offered.

Everybody:

You should also consider tutoring, both as tutor and tutee. The Academic Assistance Center provides free tutoring for several courses, mostly at the 1000 level (depending on demand). This service is not only for students having trouble with a course but also for students who are doing well in a course and would like to do better. The AAC pays the tutors, so if you have done well in a course and would like to be a tutor for that course, talk to the AAC and to the instructor of the course.

Most of the biology courses are lab courses, and students are hired as teaching assistants for such tasks as preparing lab materials, etc. Some of these positions are available only to students eligible for work-study financial aid, but employment opportunities exist for students who are not work-study eligible. If you are interested in this work, you should talk to Dr. Kuchenreuther (who coordinates these assignments) and to the professor of the course you are interested in. Biologically-related employment, both in the field and lab, is also sometimes available at the USDA lab or the Agricultural Experiment Station, and with private companies in the area.

Finally:

You will probably want **letters of recommendation**, for summer jobs, for scholarships or internships during your undergraduate work, or for jobs, graduate school, or professional education after you graduate. Most students do not realize how important these letters of recommendation are. What can you do so that these people can write the strongest letters for you?

1. Get involved in **research**. This will give a stronger basis for recommendations than anything else. Not only does this give a professor a very good way to learn your strengths, he or she will have more anecdotes to include in writing a letter, illustrating why you are just the best person to have around, how you are a self-starter, how reliable you are, and so on. Start with Biological Communications (Bio 1700-1701) and work up to directed studies, UROP projects, internships, etc.
2. In-class **participation** is important: how can faculty write for you if they don't get to know you? How can they get to know you if you don't speak up? They want to be able to comment on how hard-working and interested you are, how broad your education is, etc.
3. **Discuss** you career or vocational plans with them. If you do this early, they will get to know you better and may be able to pass on information about possible jobs, interships, and so on.
4. Let them know about your relevant **extra-curricular activities**. Maybe you worked in a medical or biological lab during a summer or winter break; maybe you are interested in medical school and have training as an emergency medical technician; maybe you are interested in wildlife biology and have worked as an aide at a nature center.

5. Give your **seminar** early in the year and do a good job. As one faculty member put it, "Students always scramble to sign up for the last possible day and don't realize they've ..... themselves by doing so". When writing a letter of recommendation, a faculty member will be in a better position if she or he can say something like "Anne gave an outstanding seminar to the other biology seniors: it was clear, well-organized, and lively. She was well-prepared to discuss peripheral issues that came up during questions, and demonstrated not only a familiarity with the relevant literature but original insights into the problems."

Your Advisor

One of the biggest advantages that UMM has to offer, compared to larger campuses, is the relationship you can develop with an advisor. At the outset you are assigned an advisor based on your expressed interests and what letter your surname starts with. Hopefully, this person can help you start to plan your coursework for the first few semesters, etc.

Somewhere along the line, though, you might find a professor who you get along with well and whose interests, advice and personality seem to be a closer fit to yours. In that case, you should ask that person to be your advisor; the actual change is easily made online-- you don't need permission from your previous advisor, just agreement of the new one.

What kind of an education are you going to make here? The relationship you develop with your advisor will be important for several reasons. Planning your education is not a matter of simply making choices off of some menu; nor are all the possible alternatives described within the Bulletin. Your advisor can help you develop your program to best suit your interests, talents, and opportunities-- and these change!

Student Research

Research experience is almost an absolute requirement for admission to graduate school in biology. It is also one of the strongest steps you can take toward securing admission to professional school or employment in any field related to biology. This is true even if the research you work on as an undergraduate is not directly related to the job or graduate work you are applying for. Working closely with a professor gives him or her an opportunity to learn your strengths, which they can comment on when writing recommendations for you.

Imagine you are an employer, and you get two letters. Which of these students would you hire?

"Tony is attentive during class and wrote clear answers on his exams. He is a friendly person who gets along well with his peers."

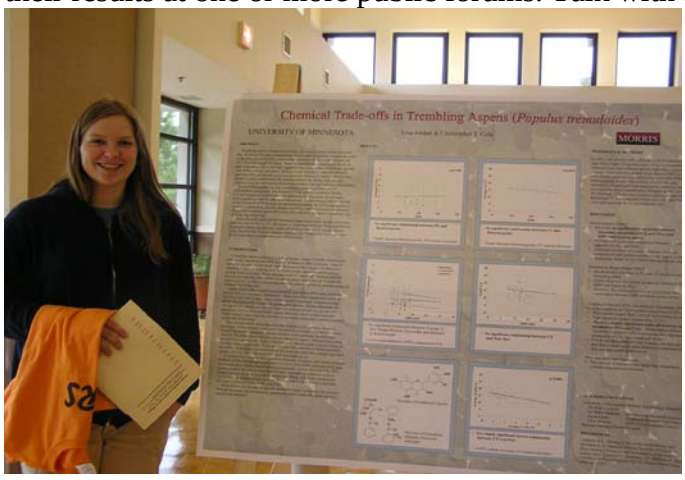
The second says,

"Toni proposed a directed study research project that I supervised. She is a real self-starter who I could rely on to get things done without needing constant supervison; when the inevitable difficulties arose, she was often able to solve them on her own."

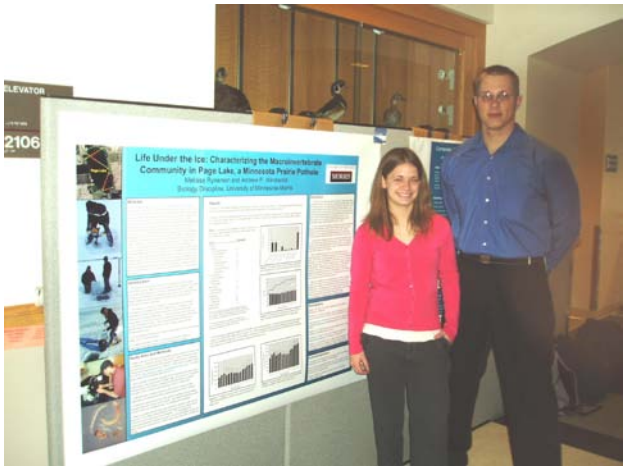
There are several avenues for working on research projects:

Directed Study - Students enroll for this by signing up for Bio 4993. The first step is to discuss the project you have in mind with a faculty member. Often this is a project in which you pursue some topic you encountered in another course, and can be hands-on research, literature reviews, or both. Your proposal for directed study is then discussed by the biology faculty and student representatives, who may have recommendations for changes in design. Students can sign up for directed studies at any time during a quarter; the number of credits is flexible.

Undergraduate Research Opportunities Program (UROP)- This is a university-wide program that provides funds for undergraduates to work on research projects with the supervision of a faculty member. Students write proposals and submit them in two rounds of competition, one in the spring and one in the fall. Awards are made of up to $300 for expenses and $1400 for stipends. Winning one of these grants is a substantial honor and students often get to present their results at one or more public forums. Talk with a professor if you are interested.



Morris Academic Partners - This program provides a stipend of $1200 for each of two semesters (or $2000 for a summer), primarily for juniors, who work with a faculty member on a variety of projects. If you are interested in this program, ask the faculty member(s) with whom you would like to work.



Internships - Students are able to arrange internships in fields related to their study, especially during the summer. Some internships are with private companies, some with government agencies, some with other branches of the U. of M., and some with other universities. Some internships are paid, some are not. There is no regular route for gaining one of these positions; the best strategy is to let faculty know of your interests and to check the bulletin boards, particularly the board outside the Division office and the board next to the lounge area.

Research Assistants - Faculty sometimes have funds to hire undergraduate assistants as part of a research grant. They will solicit applicants, usually in the appropriate advanced courses. (This is another advantage to getting the required courses completed early in your career).

Faculty

Tracey Anderson studies life history and taxonomy of freshwater invertebrate organisms. Her current research focuses on the interactions of parasitic water mites and their aquatic insect hosts, especially dragonflies and damselflies. She is also interested in the use of aquatic organisms as indicators of water quality in a variety of freshwater habitats, including streams, lakes and wetlands.

Christopher Cole works on population and molecular genetics. His research emphasis is on the conservation and ecology of native and endangered plants, and interactions between genetics and changing climate and atmosphere affecting forest trees.

Van Gooch studies biological rhythms, particularly in fungi (*Neurospora*) and in luminescent dinoflagellates (*Gonyaulux*). His work is in the physiology of cells and in genetic engineering.

Rich Hardy teaches Human Anatomy (lecture and lab) as well as Human Nutrition. He is also a Certified Athletic Trainer in the Wellness and Sports Science Department.	
	Angela Hodgson's work analyzes the influence of herbivory on forest ecosystems. Her studies of the role of moose in boreal forests focus on nitrogen cycling and spatial patterns of trees.
	David Hoppe (Professor Emeritus) works on amphibians and reptiles, especially frogs and snakes. This includes work in ecological genetics and development as well as in vertebrate natural history. ("Emeritus" is Latin for "Gone fishing").

Margaret Kuchenreuther is an ecologist and conservation biologist who specializes in plant population biology. Her work includes demographic and genetic analyses of rare plant populations and, most recently, studies examining the effects of fire and grazing on prairie plant populations.	
	Karen Mumford
Paul Myers studies developmental biology and neuroscience. His particular interests are in the formation of early neuronal circuits and the development of behavior in the zebrafish, and in genetic variation in motor behavior in different lines of fish. He is also studying the cellular mechanisms of responses by embryos to agents that cause birth defects, such as alcohol.	

	Heather Waye works on physiology, behavior, and ecology of reptiles and amphibians-- especially orientation and chemically-mediated behavior in snakes. Her work includes native reptiles of North America as well as invasive species on Pacific islands.
Peter Wyckoff works on forest community ecology, especially on the factors that lead to changes in forest composition. His research interests include tree ring analysis of tree growth patterns, the impact of invasive species on forest community composition, and the use of field data to improve forest simulation models.	
	Timna Wyckoff works on biochemistry and microbiology, and specializes in the formation of protective structures in pathogenic bacteria.

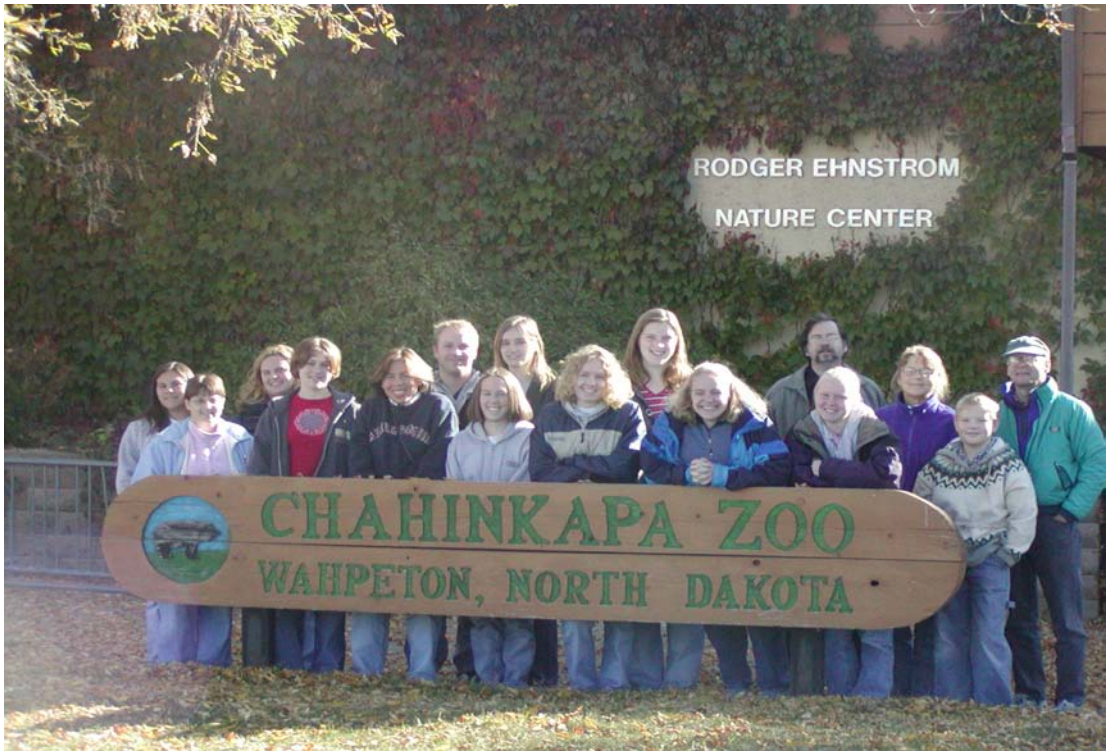
Visiting faculty often supplement the biology faculty when regular members are on leave or sabbatical, and bring special insights and expertise into the discipline. Getting to know these faculty gives you a chance to broaden your education in biology.

Student Organizations

One of the Biology Club Spring Break trips to Belize	

Tri-Beta, the Bio Club

The Tri Beta club is run entirely by students, and provides a good way to get to meet other students interested in biology, especially the upperclass students, who will have advice about scheduling courses (e.g. including preparing for graduate record exams (GRE) or Medical College Admission Test (MCAT). They also organize field trips (e.g. to Belize, Wahpeton, or the Twin Cities) and seminars, sometimes inviting faculty from other schools. Usually about once a year, the club organizes an informal meeting (usually at the Pizza Hut) for students to talk with faculty about pursuing graduate education and careers in biology and chemistry. Sometimes these get-togethers include former UMM students or others who are now in graduate school, or faculty from graduate programs visiting UMM-- and the faculty don't always agree, so you can get a good variety of opinions. The club has adopted a stretch of highway north along the State Wildflower Route north of Morris. They also conduct the annual Fall Plant sale, which brings in much of the money used for stocking the greenhouse and conservatory.



MPIRG

The Minnesota Public Interest Research Group (MPIRG) is a student organization chiefly involved with environmental issues, and has achieved a record as one of the strongest PIRG groups in the country. The group has conducted original research that has affected both environmental and student affairs, including energy policy, forest preservation, recycling, and consumer protection. More information is available by calling their office at 589-6099.

Equipment and Facilities

- Greenhouse (Room 168): maintenance of living material for course labs and facilities for student and faculty research projects. Two separate rooms can have temperature, humidity and supplemental lighting controlled independently.

- Conservatory: primarily for display of tropical and large plants
- Growth Chambers (in Sci 167, next to the Greenhouse): Temperature, light cycles and (in the new unit) humidity can be controlled.
- Cold Rooms: a low-temperature environment for physiological studies.
- Herpetarium: Includes provisions for "wet lab"

  cleaning and maintenance, pressurized air, and both aquaria and terraria for housing live amphibians and reptiles.

- Herbarium and Insectarium: systematic collections of representative plants (mainly vascular plants) and insects.

Students interested in field research should consult "Biology Field Trip Guide to Areas in West Central Minnesota" by Professor Emeritus Tom Straw for useful information about areas managed by the U.S. Fish and Wildlife Service, the Minnesota Department of Natural Resources, the University of Minnesota, City governments, The Nature Conservancy, and other private organizations.

A variety of miscellaneous equipment is listed below. This list is never complete and if you need something, ask the faculty.

- Anemometer, hot wire
- Aquarium-10 gal (4), also larger
- Autoclave
- Balances, top loading
- Balances, Analytical (4), Mettler
- Centrifuge, refrigerated, Beckman J2-21ME
- Centrifuges, clinical (5)
- Centrifuge, micro, Eppendorf
- Centrifuge, micro, Fisher
- DataLoggers, Vernier (8)
- Dessicators
- Dishwasher
- Electrofishing generator and electrodes
- Electrophoresis rigs: DNA sequencing, starch, polyacrylamide, agarose
- Electroporator, Bio Rad
- Environmental Chamber (2), Percivel
- Environmental Chamber (1), EGC
- Fluorometer, filter, Turner 110
- Fluorometer, micro, Hoefer DQ-200
- Fraction Collectors
- Freezers
- Freezer, -85 C, Harris
- Gel Dryer
- Homogenizer, Virtis

- Hoods, ventilated
- Hoods, Laminar Flow
- Hoods, Transfer (2), UV & white light equipped
- Hot plates, stirring
- Ice Machine
- Increment borers (various)
- Incubator, roller (Hybaid)
- Incubators (7), hot air
- Light Boxes (various)
- Limnology equipment: dredges, water samplers, stream current meters, nets, etc
- Liquid N2 tanks
- Luminometer, LKB
- Micropipettes (various fixed and adjustable)
- Microscopes (22), dissecting
- Microscope, Leitz, dissecting
- Microscope, Zeiss; phase, darkfield, and UV illumination
- Microscopes (40), oil immersion
- Microscopes (69), AO sixty
- Microscopes (28), Olympus CHT, binocular
- Microwave ovens
- Orbital Shaker, New Brunswick
- Orbital Shaker, Lab Line, temp. controlled
- Oxygen Meter, YSI model 54, portable
- Oxygen Electrode setups (9)
- Ph meters
- Power Supplies (for electrophoresis), various
- Pump, air, vacuum and pressure
- Pump, peristaltic
- Recorders (1), analog strip chart
- Refrigerators
- Sander, mounted belt, for increment cores
- Sonicator
- Spectrophotometer (2) Beckman DB
- Spectrophotometer (1) B&L spec 20
- Spectrophotometer (8) Sequoia-Turner 340
- Stimulators (4)
- Television - 24" color
- Temperature Blocks (4)
- Tree ring measuring system (mechanical stage & A/D converter, etc.)
- TV cameras - color, B&W
- Thermocyclers (2) for PCR
- Thermometers, recording (3)
- Transilluminator & Polaroid camera
- Traps, small mammal snap traps and live traps
- VCR - time lapse capable
- Water baths, assorted fixed and shaking (Precision)

- Water baths, cooling (GCA)
- Water supplies, U.S. Filter, 16 megaohm purity.