This is the General Information; Programs and Services; and Admissions Procedures and Degree Requirements sections of the 1997-1999 University of Minnesota College of Biological Sciences Bulletin.
CBS Mission Statement
The mission of the College of Biological Sciences is to provide outstanding educational opportunities to undergraduate and advanced students and to carry out world-class research in areas of modern biology from the molecular to the ecosystem level. To accomplish this mission it is necessary to integrate a strong basic research program with both traditional and innovative classroom teaching and with intensive mentoring of students at all levels.

As part of its mission, the college is dedicated to providing basic biological science education and to sharing expertise with students and colleagues in other disciplines at the University of Minnesota, such as agriculture, natural resources, engineering, health sciences, and liberal arts.

The college is committed to outreach to the general community and cooperation with other educational institutions. Members of the college actively participate in the scientific community and in the leadership of professional organizations, and they contribute to the administration and governance of the University.

University of Minnesota Mission Statement
The University of Minnesota, founded in the belief that all people are enriched by understanding, is dedicated to the advancement of learning and the search for truth; to the sharing of this knowledge through education for a diverse community; and to the application of this knowledge to benefit the people of the state, the nation, and the world.

The University’s mission, carried out on multiple campuses and throughout the state, is threefold:

• **Research and Discovery**—Generate and preserve knowledge, understanding, and creativity by conducting high-quality research, scholarship, and artistic activity that benefit students, scholars, and communities across the state, the nation, and the world.

• **Teaching and Learning**—Share that knowledge, understanding, and creativity by providing a broad range of educational programs in a strong and diverse community of learners and teachers, and prepare graduate, professional, and undergraduate students, as well as non-degree-seeking students interested in continuing education and lifelong learning, for active roles in a multiracial and multicultural world.

• **Outreach and Public Service**—Extend, apply, and exchange knowledge between the University and society by applying scholarly expertise to community problems, by helping organizations and individuals respond to their changing environments, and by making the knowledge and resources created and preserved at the University accessible to the citizens of the state, the nation, and the world.

In all of its activities, the University strives to sustain an open exchange of ideas in an environment that embodies the values of academic freedom, responsibility, integrity, and cooperation; that provides an atmosphere of mutual respect, free from racism, sexism, and other forms of prejudice and intolerance; that assists individuals, institutions, and communities in responding to a continuously changing world; that is conscious of and responsive to the needs of the many communities it is committed to serving; that creates and supports partnerships within the University, with other educational systems and institutions, and with communities to achieve common goals; and that inspires, sets high expectations for, and empowers the individuals within its community.
Welcome to CBS!

The College of Biological Sciences (CBS) grew out of the University of Minnesota’s recognition that biology is a scholarly endeavor of great importance to society and the state of Minnesota. The University is one of the few institutions in the world that have colleges and schools devoted to each of the applied disciplines of biology. CBS is committed to instruction, research, and service to the community in biology and its fundamental disciplines. These disciplines include ecology, evolution, behavior, neuroscience, plant biology, microbiology, genetics, cell biology, developmental biology, biochemistry, molecular biology, and biophysics. CBS recognizes the social responsibility imposed by its mission and is dedicated to excellence in all of its endeavors.

Today, our knowledge of biology is in a period of expansion that has few precedents. Only 50 years ago, the chemical nature of DNA began to be understood; today, the exact code of the entire genome of a number of “simple” organisms has been determined; within the first few years of the twenty-first century, the code for the entire human genome and other complex organisms will be known. We now appreciate more than ever the genetic legacy and the molecular machines that are shared by all living organisms. At the same time, we stand in awe of the manner in which life forms have adapted to extreme conditions. Some microbes thrive in the boiling, sulfurous waters of Yellowstone National Park; others thrive in the acidic environment of our stomach—and cause ulcers.

Research has firmly established that the diversity of organisms within an ecosystem is critical for its health. Therefore, research in CBS is extremely broad. It includes studies of the molecular basis of phenomena as disparate as bacterial growth and mammalian behavior. It extends, sometimes in a single department, from the analysis of gene expression to the interaction of forest populations over the past several thousand years. CBS faculty study diverse organisms, from bacteria in toxic compounds to lions in East Africa.

Undergraduate and graduate teaching lies at the heart of CBS’s mission. We try to ensure that every undergraduate major will have an independent laboratory or field research experience because this is the best way to discover what biological sciences are all about. We believe strongly that all educated people should have a significant acquaintance with biology, and to address this need we present several courses for nonmajors. CBS has become a national leader in multimedia-assisted instruction, and we share with students the excitement of learning in new ways. Recognizing the enormous pool of untapped talent that lies in groups not well-represented today in academic sciences, we are working hard to recruit women and minorities into our discipline.

Almost every problem that society will face in the next 50 years has a significant biological component, and few can be solved if we neglect this critical area. Our faculty and staff are committed to providing the education needed by every citizen to understand and help solve these problems. We welcome students who share with us interest in and excitement about the rapidly developing field of biology.

Robert Elde, Dean
### College of Biological Sciences Directory

**Office of the Dean**, 123 Snyder Hall (St. Paul) ................................................................................. 624-2244  
Dean, Robert P. Elde; Assistant Dean, Kathryn Hanna

**Student Services**

**Advising and Registration**, 223 Snyder Hall (St. Paul) ........................................................................... 624-9717  
Kathleen Peterson, Leah Clark, Becky Raiche

**Biology Colloquium**, 305 Bell Museum of Natural History (Mpls.) ................................................. 626-1674  
Kathryn Hanna, Dr. Velta Sparnins, Dr. James Waddell, Dr. Kendall Corbin

**Career Information Center**, 217 Snyder Hall (St. Paul) ........................................................................ 624-9270  
Kathleen Peterson

**Community Outreach**, 217 Snyder Hall (St. Paul) ................................................................................. 624-9717  
Paul Germscheid, Melissa Weber

**Honors Program**, 223 Snyder Hall (St. Paul) ....................................................................................... 625-5296  
Dr. Franklin Barnwell

**International Education**, 610 Biological Sciences Center (St. Paul) ....................................................... 625-1958  
Dr. Willard Koukkari

**Minority Affairs**, 123 Snyder Hall (St. Paul) ......................................................................................... 625-8752  
Dr. Verna Holoman

**Professional Learning Experience Program**, 217 Snyder Hall (St. Paul) ............................................ 624-9270  
Amy Winkel

**Recruitment and Retention in the Life Sciences**, 124 Snyder Hall (St. Paul) ....................................... 625-8752  
Dr. Verna Holoman

**Departments, Institutes, and Programs**

**Advanced Biosciences Computing Center**, 247 Gortner Laboratory (St. Paul) .................................. 625-9284

**Biochemistry**, 140 Gortner Laboratory (St. Paul) .................................................................................. 624-7755

**Biological Process Technology Institute**, 240 Gortner Laboratory (St. Paul) ..................................... 624-6774

**Cedar Creek and Long-Term Ecological Research Programs**, 511 Ecology Building (St. Paul) .......... 625-5740

**Developmental Biology Center**, 4-122 Malcolm Moos Health Sciences Tower (Mpls.) .................... 624-3110

**Ecology, Evolution, and Behavior**, 100 Ecology Building (St. Paul) ..................................................... 625-5700

**General Biology**, P180 Kolthoff Hall (Mpls.) ...................................................................................... 625-6636

**Genetics and Cell Biology**, 250 Biological Sciences Center (St. Paul) .................................................... 624-3003

**Institute of Human Genetics**, 4-122 Malcolm Moos Health Sciences Tower (Mpls.) ............................. 624-3110

**Instructional Computing Center**, 406 Biological Sciences Center (St. Paul) ....................................... 625-2273

**Itasca Biology Program**, 303 Ecology Building (St. Paul) ................................................................. 624-6743

**Master of Biological Sciences**, 123 Snyder Hall (St. Paul) ................................................................. 625-3133

**Microbiology**, 1460 Mayo Memorial Building (Mpls.) ........................................................................ 624-6190

**Plant Biology**, 220 Biological Sciences Center (St. Paul) ................................................................. 625-1234

**Plant Molecular Genetics Institute**, 220 Biological Sciences Center (St. Paul) ................................ 625-3129

**Teaching Laboratory Support Staff**, 121 Biological Sciences Center (St. Paul) ................................. 624-2789

**Directors of Undergraduate Study**

**Biochemistry**, Dr. Clare Woodward, 244 Gortner Laboratory (St. Paul) .................................................. 624-4714

**Biology**, Kathryn Hanna, 123 Snyder Hall (St. Paul) ............................................................................ 624-2244


**Genetics and Cell Biology**, Dr. William Herman, 250 Biological Sciences Center (St. Paul) .......... 625-2243

**Microbiology**, Dr. Palmer Rogers, 925 Mayo Memorial Building (Mpls.) ............................................ 624-7140

**Neuroscience**, Dr. Richard Poppele, 6-255 Millard Hall (Mpls.) ....................................................... 625-7623

**Plant Biology**, Dr. Thomas Soulen, 768 Biological Sciences Center (St. Paul) ...................................... 625-2761
Beginning College in Biology

If you’re about to begin college and think biology may be your area of interest, there are some important questions you need to consider (if you’ve already completed one or two years of college work and are thinking of transferring to the University of Minnesota, you may want to go directly to page 18, where we discuss the transfer process).

How do I know if biology is a good choice for me?

Some students have known for many years that they want to major in biology when they get to college. They’re the ones who have had a lifelong interest in some part of biology—maybe it’s understanding diseases or animals in their habitats, or perhaps genetics has always fascinated them. Other students don’t really become interested in biology until high school, when some “great teacher” or exciting course helps them determine that this might really be an interest. Still others really aren’t sure at all. They aren’t ready yet to decide on a college major, but biology seems to be a possibility. Or perhaps biology seems to be a good choice because of what they’d like to do after college—maybe medical school, or preserving our natural environment, or agricultural or food technology, medical research, or possibly biotechnology.

If you fit in any of these areas and have a good high school background in science and math, then you should consider a major in biological sciences!

Is biology a good choice right now? Do biology careers look promising for the future?

Yes! Biology continues to play a critical role in our society and will be important in helping us address many of our most serious concerns and problems in this country. Our placement reports of recent graduates tell us that nearly 50 percent choose to go directly on to school for advanced degrees (both graduate and professional degree programs) and that 45 percent secure full-time employment, almost all of them in jobs related to biology. The future remains very promising!

The University of Minnesota is classified as a research university. What does this mean for undergraduates?

It’s good news, especially for students in the sciences. That our faculty are so actively involved in research means our students have extraordinary opportunities for personal involvement in research and exposure to the latest scientific findings.

Is involvement in research really available for all students, or is it an opportunity reserved only for honors students?

Most of our students participate in research. And they’re involved all over the University—in medicine, dentistry, pharmacy, veterinary medicine, agriculture, and natural resources. Modern biology requires hands-on training in addition to classroom and laboratory instruction. Without some research experience, students find it difficult to get admitted to some of the more competitive graduate biology programs. Some employers prefer to hire only those biology graduates who have research or internship experience.

The University has a College of Biological Sciences rather than just a department. What does this mean for students?

A lot, actually. Because we’re a college, we provide you with all the specialized services you’d expect from a college. The only difference is that all our specialized services relate specifically to your interests in biology. We have an advising staff of biologists who can help you prepare for college, explore your career interests in biology, plan your program of study, and help you become involved in our programs. We also have our own honors program, internship program, and committed faculty of more than 90 (actually there are more than 1,000 life sciences faculty on campus). We even have our own highly specialized Career Center to help you prepare for the biology career you choose.

Can I begin as a freshman in CBS at the University?

Yes! CBS admitted its first freshman class fall 1997. We’re excited to have these students now more directly involved with us, right from the beginning of their college careers. We’ve
designed a number of new specialized programs specifically for freshmen. And our faculty and staff are delighted about the opportunity to work with freshmen in our program.

**What if I’m not sure about my major? I’m interested in biology, but also in French and geography. Can I end up in the “wrong” college?**

No. You will be taking the *same* University courses (including biology courses) no matter what college you start in. There are no disadvantages to being in CLA as opposed to CBS. There is no such thing as “the wrong college.” If you are really unsure of your major, you will find CLA to be a good place from which to explore all your academic interests.

**But what will happen if I want to transfer to CBS after my freshman or sophomore year and can’t get in?**

That’s not going to happen if you’re making satisfactory progress in your courses. There’s no enrollment limit in CBS; we admit all qualified students (those who complete our required courses [your biology adviser will help you choose these!] with C’s or better).

**What should I do to learn more about biology at the University to help me decide if CBS is the right place for me?**

You should attend one of our Visit Days. Visit Days are offered once each month during the academic year. A full-day Visit Day provides you with an opportunity to explore careers in the life sciences, meet CBS faculty and students, and tour research laboratories and the St. Paul campus. Each month a different career is explored, such as molecular biology, genetics, ecology and the environment, and medicine/veterinary medicine. To request a CBS Visit Day brochure, call (612) 624-9717.
PROGRAMS AND SERVICES

Our Affirmative Action Commitment

The College of Biological Sciences, in accordance with policies established by the Board of Regents, affirms its support of affirmative action in admissions to the college. Racial minorities continue to be severely underrepresented in the professional biological sciences and in allied professions, such as the health sciences, which depend upon undergraduate education in biology. They are also underrepresented in the college’s undergraduate enrollment. The purpose of the CBS affirmative action policy is to attract, admit, and graduate increased numbers of individuals from underrepresented racial minority groups, both to enhance the educational benefits all students derive from a diverse student body and to increase the representation of minorities in biological science and allied professions.

Successful affirmative action, however, involves more than just sensitive evaluation at the point of admission. Through its Office of Minority Student Affairs, which reports directly to the college dean, the college provides academic and counseling/advising services to racial minority and other underrepresented University students before application to CBS (see Student Services, in the first section of this bulletin). The intent of such services is to help prospective students increase their awareness of the opportunities for study and careers in biology and related professions and to enhance their prospects of being accepted for admission to CBS. Such services continue to be available to students subsequent to enrollment in CBS, to help them successfully complete their undergraduate degree programs.

Undergraduate Programs

“CBS has all the advantages of a small college—personalized instruction and help, small classes—combined with the advantages of a major university—world-renowned instructors, excellent facilities, and, most importantly, encouragement to expand classroom learning with research experience. Quite simply, it’s the best of all possible worlds.” —CBS graduate

“CBS makes the large University a very small, family-like experience. Advising is terrific! The opportunities to become involved in campus activities, clubs, and research are abundant.” —CBS graduate

Our students choose CBS because we have a program of exceptionally high quality, offered by professors who are well-recognized in their fields. As students begin to plan for a specific career, they are urged to supplement their coursework with research experiences and internships to further develop their skills and prepare for successful entry into their chosen professions. Students are assisted in exploring their career interests in biology through the Biology Colloquium, a broad selection of course offerings, and special programs offered through the CBS Career Information Center, including an annual course, Biol 1961—Careers in Biology.

Careers in Biology

Biology encompasses many fields of study and appeals to students with diverse interests. Career opportunities are equally broad. While students might be drawn to some majors because of their direct application to vocations in the marketplace, most students will select a biology major because it is the subject they most enjoy learning about. Happily, they will discover that their career choices are limited only by their imagination, individual interests, and acquired skills.

Many students study biology to prepare for professional training in the health sciences. Since the entry requirements for the health sciences generally include similar courses to those required in CBS (math, chemistry, physics, and biology), students will find that a biology major provides the right foundation to explore and prepare for these fields of study. In fact, nearly a third of our graduates each year choose to continue their education in health fields, including medicine, dentistry, veterinary medicine, osteopathy, podiatry, and optometry.

CBS students beginning full-time employment immediately following graduation frequently take research scientist and laboratory technician positions. Others pursue a wide array of occupations requiring a liberal education and
a bachelor’s degree, from business fields (e.g., sales, quality control, communications) to public service (e.g., environmental control, public education). While national statistics have often depicted a limited and competitive market for biology majors, CBS graduates have proven to be unusually successful in gaining employment in their chosen professional fields. Some students are combining biology with other fields, such as engineering, graphic arts, or law. Those graduates who choose to continue their study are regularly admitted to top-notch graduate schools and professional programs.

About half of CBS graduates elect to pursue advanced study immediately after earning the B.S. degree (about 25 to 30 percent are admitted to professional schools, and 15 to 20 percent enter graduate programs); the percentage of each graduating class that pursues advanced training increases over time. Details about follow-up studies of graduates, both bachelor of science and advanced, are available upon request in 223 Snyder Hall.

A student interested in teaching biology at the secondary level should consult the College of Education and Human Development office for information about the specialized curriculum that is available.

**Special Learning Opportunities**

Students are encouraged to explore the full scope of learning experiences available, including those beyond the required curriculum. Many students plan projects they carry out under faculty supervision in research laboratories and in the field. Some students obtain off-campus internships in private industry, government agencies, and the nonprofit sector. Other students seek employment as undergraduate teaching and research assistants or museum tour guides. Most departments offer special seminars for undergraduates.

**Biology Colloquium**—This is a unique class, organized and run by students, recommended for those who wish to explore the various fields and career alternatives in the biological sciences. Offered each quarter, the class gives students the chance to interact with biology faculty and students with similar interests. The colloquium offers both large group seminars, featuring prominent scientists discussing their research programs, and small group tours to research facilities on and off campus, such as the Raptor Rehabilitation Center, the Wolf Center, or behind-the-scenes at the Minnesota Zoo. In addition, students are encouraged to begin exploring their own interests through participation in a research project. The colloquium student leaders will help you find the project that fits your interests and allows you to earn University credit.

Socially, colloquium students always find time for fun, too, whether on a field trip or studying together in the colloquium student room. Upper division biology majors gain important leadership and communication experience as colloquium leaders.

**Undergraduate Research**

“CBS provided me with a great opportunity to do research in medicine. Most colleges do not offer this type of research experience.”

—CBS graduate

“I think what is impressive about CBS is its successful combination of a wide range of course offerings, diverse research opportunities, and a faculty that is approachable and dedicated to students.”

—CBS graduate

Each spring an Undergraduate Research Symposium is held to recognize the accomplishments of students participating in undergraduate research projects. The objectives of directed research are to provide students with experience in research and to obtain new information about the biological system under investigation. Students work largely on their own initiative and at their own pace, under the guidance of a University faculty or staff member.

Students may choose to earn academic credit for their research experiences, or they may wish to apply for special grants that provide students with a research stipend. The CBS Career Information Center maintains a Research Opportunities Notebook to help students find interesting research projects in laboratories throughout the University.
Programs and Services

Professional Learning Experience Program (PLEP)

“[I] feel that interning is a very important part of anyone’s college education. It helped me gain experience that I couldn’t have gained anywhere else, and I am thankful for the opportunity.” — PLEP student

The Professional Learning Experience Program is part of CBS’s Career Information Center. PLEP provides experiential education information and opportunities to students year-round, specializing in biology-related internships, community service opportunities, and study-travel internships. Experiential learning programs promote academic and professional competence, skills development, career exploration, personal growth, and social responsibility through student involvement in structured work situations. CBS promotes excellence among University students by helping them integrate their classroom study with practical learning experience in the academic, public, and private sectors. Participating in PLEP allows students interested in biology to begin career planning and exploration early in their academic careers.

Previous PLEP students have studied hazardous waste disposal with Northern States Power, gained laboratory experience in private industry, studied animal behavior in northern Minnesota, and completed ecology studies in Costa Rica, to name a few projects. Organizations sponsoring PLEP opportunities include educational institutions, government agencies, businesses, and nonprofit organizations. Both paid and volunteer positions are available throughout the year, and some offer credit. Students with specific interests may design their own internship, and PLEP will help them find a sponsoring organization. The CBS Alumni Society provides stipends each year for students who participate in unpaid internships.

“As a biology major, I found that the majority of my classes revolved around scientific theory and lab work. While these things interested me, I always felt a gap in my education. How do the theories I learn in school affect the ‘real world’? How can I apply science to help the public make better decisions about what it is doing to the environment? It was through the Sierra Club that I finally felt this gap in my education closing. For the first time I was able to look at what I had learned in school with a critical eye.” — PLEP student

Honors—CBS offers a specialized Honors Program for the most capable and motivated students. The Honors Program emphasizes undergraduate research and specialized seminars to bring students together to discuss biological issues of critical importance to society. (See full program description later in this bulletin.)

Study Abroad

CBS students recognize the need to prepare themselves to be citizens of a multicultural society, a global economy, and an increasingly interdependent world. The college encourages them to enhance their education by taking advantage of international programs sponsored by the University.

The two types of study abroad that best lend themselves to study in the biological sciences are field study and integrated classroom study. Two of the University’s interdisciplinary field study programs abroad easily permit study in the biological sciences. Minnesota Studies in International Development (MSID) offers in-country classroom study followed by full-time grassroots internships in Ecuador, India, Jamaica, Kenya, Morocco, or Senegal, preceded by on-campus preparatory courses in the fall; a number of MSID’s grassroots internships have dealt with environmental issues. The Student Project for Amity among Nations (SPAN) consists of a summer independent study project on a topic of the student’s choosing, preceded by a year’s on-campus preparation and followed by a project write-up in the fall; the four destinations change from year to year. The University also cosponsors several specialized options for CBS students: a marine biology program in Denmark, an Arctic biology program in Iceland, a tropical biology/ecology program in Costa Rica, an environment/ecology/development program in Thailand, and a health/nutrition program in the Dominican Republic.
Integrated study programs permit students to take regular foreign university courses alongside host-country nationals. The University's student exchanges and consortium memberships provide access to biology courses at universities in many countries. Courses taught in English are available in Australia, Canada, China (Hong Kong), Fiji, Finland, Ireland, Kenya, Malta, the Netherlands, New Zealand, the Philippines, Sweden, and the United Kingdom. Students with sufficient language fluency may choose to study in universities using Chinese, Dutch, Estonian, Filipino, Finnish, French, German, Hungarian, Italian, Japanese, Korean, Portuguese, Russian, Spanish, Swedish, or Thai.

Study abroad options are not limited to University-based programs. For example, recent students have taken advantage of opportunities to study genetics in Russia, the biology of koala bears in Australia, marine biology in the West Indies, and chimpanzee behavior in West Africa.

The college also encourages study abroad for language acquisition or culture learning. The resulting credits can be used as general electives or, in some cases, to satisfy liberal education requirements. The University sponsors or cosponsors a broad range of intensive short-term language programs and area studies programs.

**Special Exams for Credit**—Students earn college-level credit for prior learning and independent preparation through a variety of programs:

**CLEP**—College Level Examination Program. By passing one or more of these standardized exams, students may earn credit toward University degrees.

**AP**—Advanced Placement. These exams provide college credit for accelerated or advanced courses completed in high school.

**University Special Exams**—Students who have acquired special knowledge of a subject, either through individual study or experience in a nonaccredited program, may arrange to earn credit by exam for most University courses. To be eligible to earn credits by exam, students must be currently enrolled.

**Audited Courses**—With instructor permission, students may enroll in courses as auditors or visitors. Students may then participate in classroom and other activities and take exams, but no credit is awarded and no grade assigned. Audited course credits are included in the quarterly tuition credit total, and the regular course fee is assessed. Audited courses may not be taken later for credit. They appear on students' records with the symbol V.

**Student Organizations**

**Biological Sciences Student Association (BSSA)**—Through BSSA, biology undergraduates can take on leadership roles in the college. BSSA plans educational and social activities throughout the year and invites all University biology students to attend its meetings and events. Involvement in the association is an excellent way to meet faculty and students. For more information, contact the Office of Student Services (612/624-9717).

**Biochemistry Club**—The Biochemistry Club strengthens ties between biochemistry students and faculty, provides a source of individualized professional advice on career goals to each biochemistry major, helps undergraduates identify biochemistry labs for directed research, and helps students keep abreast of new advances in biochemistry. For more information, contact the Office of Student Services (612/624-9717) or the biochemistry department office (612/624-7755).

**Genetics and Cell Biology Club**—Students formed the Genetics and Cell Biology Club to bring together students, faculty, and staff interested in these disciplines. Members enjoy speakers, educational experiences, and social activities. For more information, contact the Office of Student Services (612/624-9717) or the genetics and cell biology department office (612/624-3003).

**Ecology Club**—The Ecology Club was established in 1991 to bring together students interested in the ecological and environmental problems of the world. The purpose of the meetings is basically educational; however, each activity is planned to bring together students and faculty in an informal, social
atmosphere. For more information, contact the Office of Student Services (612/624-9717) or the ecology, evolution, and behavior department office (612/625-5700).

Society for Microbiology—The society provides a forum in which students and faculty can meet informally to share common interests in microbiology. All meetings and activities reflect members’ interests. Members are officially part of the Student Chapter of the American Society for Microbiology (ASM), which provides information on microbiology lectures, meetings, seminars, and local job listings. Activities include discussions of microbiological issues, social events, and visits to local employers. For more information, contact the Office of Student Services (612/624-9717) or the microbiology department office (612/624-6190).

Plant Biology Club—Through the Plant Biology Club, students have the chance to interact with other students and with faculty interested in plants. Participants enjoy speakers and other educational experiences, usually in an informal, social atmosphere. For more information, contact the Office of Student Services (612/624-9717) or the plant biology department office (612/625-1234).

AEIMS (Achieving Excellence in Mathematics and Science)—All life science majors are encouraged to participate in AEIMS. The club was established to ensure full participation of students from groups currently underrepresented in science and to foster contact among biology students and faculty. It meets for monthly dinners and discussion and provides both academic and social experiences for its members. For more information, contact Cady Paulaha (612/625-2275).

Biological Sciences Alumni Society (BSAS)—The society provides a professional association for biological sciences graduates and encourages relationships among current students, faculty, alumni, and the community. The society has made a special commitment to enhance opportunities for current students and encourages them to participate in all of its programs, often at discounted ticket prices. The president of the Biological Sciences Student Association serves on the board of directors of the alumni society. Alumni volunteers have cooperated with the CBS Career Information Center to develop the Career Information Network, an innovative program to help current students and graduates explore career options. The society sponsors undergraduate scholarships, undergraduate research and internship grants, and a mentor program for students. The society supports continuing education programs in the biological sciences. Student and alumni volunteers from the society have also assisted the college with student recruitment, especially of women and minorities. For more information, contact Kathryn Hanna, assistant dean, 123 Snyder Hall (612/624-2244), or the Minnesota Alumni Association, 501 Coffman Memorial Union, 300 Washington Avenue S.E., Minneapolis, MN 55455 (612/624-2323).

Student Services

“CBS gave me the feeling of being in a small college—personal attention and recognition—and the benefits of being at a University with research exposure and class variety.”—CBS graduate

The size and diversity of the University offers unlimited opportunities for students to explore and develop their academic, professional, and personal interests.

Both current and prospective students are well-served by the advising services, resources, and programs provided by CBS’s faculty and Office of Student Services. CBS students are assigned to a faculty adviser in their particular area of interest. In addition, Office of Student Services staff are available by appointment for students to discuss a wide array of student concerns. Summarized below are the types of advising services available through a combination of faculty and professional advising.

The Office of Student Services performs a variety of other essential functions in the college, including admission, student orientation and registration, academic progress review, and degree certification.
Prospective Student Activities
Admissions counseling
Career transitions
Prospective student information
High school and community college visits
College tours
Summer science program
Visit Days

New Student Advising
Orientation
New student reception
Course planning
Freshman seminar and special events
Exploration of life science majors
Campus resource information

Developmental Advising
Intellectual and personal growth
Career directions
Goal setting
Clarifying values
Decision making
Refining skills
Developing leadership

Peer Advising/Networking
Honors
Biology Colloquium
Biological Sciences Student Association
CBS club activities
Alumni Society
Mentor programs
Biology House

Major and Faculty Advising
Program planning
Career exploration/planning
Professional Learning Experience Program (PLEP)
Undergraduate research
Seminars
Preparation for graduate and professional school programs

Program Planning—This annual, shared planning activity should form the basis of an ongoing relationship between the faculty adviser and student. The importance of the relationship between faculty adviser and student cannot be overemphasized. Students will find it useful to consult their advisers to discuss progress in specific courses, obtain information about graduate study, design a research project, plan internships, or arrange to work with faculty members in laboratory and field settings.

Career Information Center—The CBS Career Information Center (CIC) helps students explore the varied career options available to biology graduates. Undergraduates are encouraged to consult with CIC early to investigate careers, learn about career preparation, and begin to make decisions. CIC provides extensive career and employer information, as well as connections to professionals in many fields of interest. Contacts made through the Professional Learning Experience Program, the biannual Career Information Fair, and the Alumni Career Network program ensure that students make well-informed career decisions. CIC staff also offer an annual course, Biol 1961—Careers in Biology.

As graduation approaches, CIC assists students in applying to graduate schools and professional health sciences programs. For those choosing to enter the job market directly, CIC provides assistance in building job search skills (including résumé writing and interviewing), as well as job books and a specialized résumé distribution service.

Minority Affairs—CBS seeks to increase the number of students of color who enroll in and successfully complete its courses and majors. The college provides students of color with mathematics and science tutors, faculty mentors, and research experiences. The coordinator for recruitment and retention is available to work with individuals or groups of students to explore potential interests in biology, provide academic assistance, identify employment opportunities and alternative sources of financial aid, assist in leadership development, and help overcome barriers to educational success. For more information, contact Dr. Verna L. Holoman, 123 Snyder Hall (612/624-3060).

International Education—The University’s study abroad catalog describes a broad range of study abroad opportunities. Students can learn more about their options through an advising appointment at the Global Campus, 102 Nicholson Hall (612/625-3379), and by consulting with the PLEP coordinator in 217 Snyder Hall (612/624-9270). Special information is also posted outside 123 Snyder.
Hall. After identifying one or more programs of interest, students should see a Global Campus adviser in 102 Nicholson Hall (612/625-3379) for more detailed program information and application instructions, and to discuss credit and financial aid. CBS students must also review their plans with an adviser in 223 Snyder Hall (612/624-9717) and are also encouraged to meet with Dr. Willard Koukkari, CBS international education officer, 610 Biological Sciences Center (612/625-1958).

Student Facilities

**Student/Staff Lounge**—Biology undergraduates are invited to use the student/faculty lounge in 128 Snyder Hall on the St. Paul campus. The lounge is an excellent place to study, relax between classes, or meet with other students. The lounge is furnished with a small reference collection and current journals covering many fields of interest in biology.

**Computer Access**—All students have access to microcomputer facilities throughout the Twin Cities campus. These computing labs have both Macintosh and Windows-based systems. A listing of the locations and hours of these facilities is available at the computing labs and on Gopher.

In addition, biology students have access to well-equipped microcomputing facilities in the college: a Macintosh lab in 406 Biological Sciences Center and a Windows-based lab in 170 Ecology. Because the labs are primarily for instructional needs, priority is given to courses. The 170 Ecology lab is heavily booked for courses, but the 406 Biological Sciences Center lab is mostly an open lab. In both labs, students can use programs for word processing, graphing, drawing, or spreadsheets. Students can also access many electronic databases and file servers around the world, as well as their own electronic mail service. The 406 Biological Sciences Center lab provides specialized software such as programs to help prepare for the Graduate Record Examination (GRE).

**Libraries**—The University of Minnesota library system ranks among the largest American university libraries, with more than four million catalogued volumes. In addition to science and technology collections in Walter Library and the St. Paul Central Library, biological sciences students also benefit from specialized collections in the Bio-Medical Library, the CBS Reading Room (406 Biological Sciences Center), and the Entomology, Fisheries, and Wildlife Library.

Financial Assistance

The University of Minnesota Office of Scholarships and Financial Aid is located in 210 Fraser Hall on the Minneapolis campus and 197 Coffey Hall on the St. Paul campus (612/624-1665). Prospective or newly admitted students may also wish to consult with high school counselors. The office provides assistance by phone from 8:00 a.m. to 4:00 p.m., Monday through Friday. Walk-in assistance is available in the Minneapolis office from 9:00 a.m. to 3:00 p.m. on Mondays, Tuesdays, Wednesdays, and Fridays and from noon to 3:00 p.m. on Thursdays. The office in Coffey Hall is open on a more limited basis.

**Bioscience Scholarships and Grants**

Prospective students are encouraged to apply for both need-based and merit scholarships to help pay college tuition. CBS students may qualify for one of the following scholarships or grant awards.

*Ernst C. and Lucy B. Abbe Award*—to plant biology seniors who have exhibited academic excellence and who intend to pursue graduate studies.

*Biological Sciences Alumni Society Merit Undergraduate Scholarships*—awards given by the Biological Sciences Alumni Society to recognize and reward students who show initiative, enthusiasm, and commitment to their program in the biological sciences.

*Richard S. Caldecott Award*—in honor of CBS’s first dean. Competitive scholarship awarded to a CBS senior who demonstrates outstanding scholarship, citizenship, and athletic participation.

*Stanley Dagley Scholarship*—annual award to a deserving undergraduate in memory of Regents’ Professor Stanley Dagley, biochemistry.

*Franklin Enfield Memorial Scholarship*—awarded to a student who has a minimum GPA of 3.00 and work experience in a biology-related institution outside of the University. In memory of Professor Enfield, genetics and cell biology.
LaVell M. Henderson Scholarship—award presented to an outstanding junior or senior biochemistry student who has demonstrated research capabilities.

Richard and Judi Huempfner Research Award—to support an EEB student who is researching ruffed grouse or woodcock.

INCSTAR Award—recognizes outstanding academic achievements by minority students and others in biochemistry, genetics and cell biology, and microbiology.

Itasca Directors Fund Scholarship—award presented to students attending the Itasca summer session to help defray the cost of tuition and living expenses. The awards are made possible by many former students and staff who retain fond feelings for the field station.

Norman Kerr Memorial Scholarship—awarded to a junior or senior who intends to pursue a teaching career at any level. In memory of Norman Kerr, professor of genetics and cell biology.

Donald and Elizabeth Lawrence Scholarship—awarded to students to support research work on plant ecology or botany at Cedar Creek Natural History Area.

Michael C. Loveless Scholarship—in memory of Mike Loveless (class of 1986), an outstanding former CBS student; annual award to a deserving senior in CBS with demonstrated leadership abilities.

Henrietta N. Miller Award—presented to an outstanding junior or senior biochemistry student who has demonstrated research capabilities.

Richard C. Nelson Biochemistry Scholarship—awarded to a deserving biochemistry student.

Eloise Newcomb Pittman Scholarship—given when appropriate to an outstanding female student in plant sciences.

Leon A. Snyder Award—in memory of Professor Snyder of the Genetics and Cell Biology Department. Given to a deserving undergraduate in biology.

Applications for all scholarships and awards listed above are due April 1. Applications must be accompanied by the CBS Scholarship Application Cover Sheet.

Zumbro/IPF Freshman Scholarship—to encourage budding biologists in rural Minnesota to pursue their interest and then consider jobs in biology-related businesses in small towns around the state.

Murray Rosenberg Fund—in memory of Professor Rosenberg of GCB. Provides travel grants for CBS students who wish to perform service in a health-related field to help people in need in non-English-speaking countries or economically depressed areas of the United States. Applications are due November 15 and April 15.

PLEP Grants for Unpaid Internships—The Biological Sciences Alumni Society provides stipends for students who participate in unpaid or fee-requiring biology-related PLEP internships that do not earn University credit. For application materials, check in 217 Snyder Hall.

Harold P. Morris Memorial Scholarship—in memory of University alumnus H.P. Morris. Multiyear grant to support outstanding students from rural Minnesota studying genetics or biochemistry. Application: open, depending on availability of funds.

Philip C. Hamm Memorial Scholarship—encourages and rewards undergraduate students who show promise as research scientists in the plant sciences. Two scholarships of $500 each. Campus contact: Dr. Philip Larson, 612/625-8200. Application deadline: winter.

Carol E. Macpherson Scholarship—awarded to females 28 years or older who have been out of college for at least 5 years. Application deadline: early January.

Sigma Xi Awards

Nominations for Sigma Xi awards are made by Sigma Xi members with a letter of recommendation and appropriate supporting documentation. The executive committee of Sigma Xi chooses the winner of the following three awards:

Thomas F. Andrews Prize—for students in any school or college of the University who have demonstrated proficiency in independent research in science and who have not yet obtained a baccalaureate degree. Papers and other evidence of research work offered in
application may be used by the student for thesis purposes or otherwise. Cash prize, plus initiation fee and admission to membership in Sigma Xi.

George T. Walker Prizes—to be used in the senior year by students in chemistry, selected on the basis of aptitude in science and promise in research. Two undergraduate cash prizes, plus initiation fee and admission to membership in Sigma Xi.

Olson-Wallace Award in Zoology—for an undergraduate or graduate student, for original research in the zoological sciences in the broadest sense. The research is to be in the form of a thesis, a paper published in a reviewed scientific journal, or a paper presented at a national meeting. This award was established in 1978 in honor of Magnus Olson and Franklin G. Wallace, emeriti CBS zoology faculty.

UROP
The University of Minnesota’s Undergraduate Research Opportunities Program (UROP) offers financial awards to undergraduates for research, scholarly, or creative projects undertaken in partnership with a faculty member. UROP affords undergraduates the unique educational experience of collaborating with a faculty member on the design and implementation of a project. At the same time, faculty have the opportunity to work closely with students and receive valuable assistance with their own research or professional activity. UROP adds a new dimension to the undergraduate experience. It encourages students to conduct research and pursue academic interests outside of their regular courses by employing them to work on special projects.

UROP applications are judged on the basis of the quality of the proposed project and the educational benefit to the student. Since funding is limited, awards are granted to the strongest proposals. There are two opportunities to apply for research funds each year: October and April.

National Scholarships
Harry S Truman Scholarship—For undergraduate study leading to graduate study and a career in public service. Applicants must be U.S. citizens or nationals, currently-enrolled juniors with a minimum 3.00 GPA at time of application. Award covers college fees up to $3,000 for the senior year and up to $27,000 for graduate studies (80 scholarships available nationwide, at least one award given to a Minnesota resident). Campus contact: Sally Lieberman, CLA Honors Division. Application deadline: early November.

Barry M. Goldwater Scholarship—For undergraduate study leading to graduate study and a career in mathematics or the natural sciences (normally does not include engineering or the health sciences). Applicants must be U.S. citizens and currently enrolled sophomores or juniors with a 3.00 GPA at time of application. Award covers all college fees to a maximum of $7,000 for up to two years (300 scholarships nationwide, at least two given to Minnesota residents). Campus contact: Sally Lieberman, CLA Honors Division. Application deadline: mid-November.

National Science Foundation Graduate Fellowships—For three years of graduate study. Approximately 750 given nationally. Campus contact: Alison Skoberg, Graduate Fellowship office. Application deadline: early November.

Study Abroad
A number of University and national scholarships exist for study abroad. Deadlines are often far in advance of the study. Information is available in the Global Campus office, 102 Nicholson Hall (612/625-3379).

Leadership Awards
Donald R. Zander—for outstanding leadership, service, and academic achievements. Nomination deadline: late winter quarter.


President’s Leadership and Service Award—presented to the top one-half of one percent of the student body for exceptional leadership and service to the University or surrounding community. Nomination deadline: late winter quarter.
Admission Procedures and Degree Requirements
Admission to CBS

Students may enter CBS at the beginning of their freshman, sophomore, junior, or senior year. CBS began admitting freshmen fall 1997, and we are excited about having students directly enrolled in our college for their entire academic program. For those students who choose to begin at another institution or even in a different college here at the University, transfers into CBS are welcome at any point in their undergraduate program. The first years may be completed in another unit within the University, at a community college, or at any four-year college or university. CBS faculty and staff are happy to help students select appropriate coursework for transferring to the college. During the freshman and sophomore years, students should plan to complete, as a minimum, the beginning English composition course, mathematics, general chemistry, and general biology. Most students take organic chemistry during their sophomore year, thereby allowing ample time for major coursework and research experience.

Applications are given individualized attention. Factors such as racial and cultural background and economic or educational disadvantage are considered carefully to prevent excluding students whose academic potential for success might be misjudged based on traditional predictors alone.

Acceptance to CBS

To be admitted as a freshman, students must meet the following requirements: AAR of 120 or above, completion of four years of high school math, and three years of high school science, including both chemistry and physics.

Successful completion of 40 quarter credits (with a GPA of at least 2.00), including Biol 1009 or 1201-1202, Chem 1051-1052, and Math 1251-1252 with grades of at least a C, is required for admission at the sophomore, junior, or senior level. Equivalent courses are transferable.

Admitted students will receive a letter of acceptance and welcome from both the Office of Admissions and CBS with information about orientation dates and registration.

All new students, freshmen as well as transfers, are also expected to meet the high school preparation requirements for admission to the University: four years of English, three years of math, three years of science, two years of a single second language, and two years of social sciences. In some cases, students may be admitted with course deficiencies with the expectation that these will be addressed in the first year in residence.

Procedure Check Lists

I. Application for Admission From Outside the University

New freshmen may apply directly to CBS. Students who do not meet freshman admission requirements, or who apply after our freshman class has been filled, may begin their program as a “pre-biology” student in the College of Liberal Arts and then transfer to CBS as a sophomore or junior.

Transfer students may apply directly to CBS. To be admitted as a sophomore or junior, certain requirements must be completed before admission. If these requirements have not been completed at the time of application, we recommend that you also apply to the College of Liberal Arts as a pre-biology student.

Acceptance into a pre-biology program requires that you meet the admission standards for the College of Liberal Arts. See the CLA bulletin for specific requirements. Acceptance into pre-biology ensures that you will have contact with a biology adviser early in your academic career.

Application deadlines are

- Fall quarter ......................... June 1
- Winter quarter ..................... October 15
- Spring quarter ..................... January 15

Note: Freshmen as well as transfer students who must first complete work as a pre-biology major in another University college before entering CBS should apply between October 1 and December 15 of the year before desired admission to ensure consideration before the priority deadline.

Applications to the University of Minnesota, Twin Cities may be requested from the Office of Admissions (612/625-2008 or, toll free in the United States, 1-800-752-1000).

Questions? Call the CBS Office of Student Services at (612) 624-9717.
International Students

Deadlines for applications from international students are

Fall quarter .................................. June 1
Winter quarter .......................... October 1
Spring quarter ........................... January 1

English Proficiency—If English is not your native language, you may be required to take the Test of English as a Foreign Language (TOEFL) or the Michigan English Language Assessment Battery (MELAB). To register for the TOEFL, contact the agency that handles TOEFL registration in your country or write to the Educational Testing Service (Box 899, Princeton, NJ 08540 USA) at least 10 weeks before any scheduled test date. If you are already in the Twin Cities area, you may register for the MELAB with the Minnesota English Center, 320 16th Avenue S.E., University of Minnesota, Minneapolis, MN 55455, or call (612) 624-1503. To register for the MELAB outside the Twin Cities area, contact the English Language Institute, Testing and Certification Division, University of Michigan, Ann Arbor, MI 48109 USA, or call (313) 764-2416.

Orientation Procedures

Before classes begin, both freshmen and transfer students will be invited to attend a New Student Program/Orientation session. It will acquaint you with the campus and provide information about the college and the University. Part of the time will be spent with an adviser who will help you plan your biology program. You are urged to participate. Failure to attend will result in a late registration date and difficulty obtaining needed courses.

Freshmen will be attending a series of programs and seminars throughout the first year to fully acquaint them with the faculty, staff, and students in CBS and to inform them about special opportunities for biology students.

Transfer students will also attend a CBS orientation/reception during the first week of the quarter. Information will be presented about research and internship opportunities as well as information critical to your success in preparing for a profession in biology.

II. Application for Transfer From Within the University

Students who wish to transfer to CBS from another college on the Twin Cities campus or from one of the coordinate campuses should submit a Change of College form to the Office of the Registrar. Deadlines are

Fall quarter .................................. June 1
Winter quarter .......................... October 15
Spring quarter ........................... January 15
Summer quarter ........................... May 1

Transfer applications may be requested from the Office of the Registrar, 150 Williamson Hall, or from the Office of the Registrar—St. Paul, 130 Coffey Hall. Forward the application to the Office of the Registrar, University of Minnesota, 150 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455 (612/625-5333).

Questions? Call the CBS Office of Student Services at (612) 624-9717.

Orientation Procedures

If you are transferring from a coordinate campus, you will be invited to a New Student Program/Orientation session (see above). All new students will attend a CBS orientation/reception during the first week of the quarter. Information will be presented about research and internship opportunities as well as information critical to your success in preparing for a profession in biology.

III. Application for Admission With Adult Special Status

Adult special status is for those who already have a degree and want to take courses for personal or professional interest or to meet admission requirements for advanced programs. A degree transcript must be submitted with the application. Adult special applications may be requested from the Office of Admissions, 240 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455 (612/625-2008 or, toll free in United States, 1-800-752-1000).

Deadlines for adult special applications are

Fall quarter ........................... September 1
Winter quarter ......................... December 1
Spring quarter ........................... March 1
Summer quarter ........................ May 1
Residency and Reciprocity

Residence—Because the University is a state institution, Minnesota residents pay lower tuition than nonresidents and, in many programs, receive priority consideration for admission. To qualify for resident status, students must reside in Minnesota for at least one calendar year before the first day of class attendance. For more information, contact the Resident Classification and Reciprocity Office, 240 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455 (612/625-6330), or the residency office on your campus.

Reciprocity—The University has reciprocity agreements with North Dakota, South Dakota, Wisconsin, and Manitoba. The University also participates in a reciprocity program with Kansas, Michigan, Missouri, and Nebraska for students in the following undergraduate colleges: Agricultural, Food, and Environmental Sciences; Architecture and Landscape Architecture; Biological Sciences; Education and Human Development; Human Ecology; Liberal Arts; Natural Resources; Carlson School of Management; Division of Dental Hygiene; School of Nursing; and Institute of Technology. If you are a resident of any of these states or this province, you may qualify for reciprocity tuition rates, which are lower than nonresident tuition rates and, in some cases, comparable to resident rates. For more information, contact the Resident Classification and Reciprocity Office, 240 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455 (612/625-6330), or the residency office on your campus.

Degree Requirements

The CBS bachelor of science degree program is composed of four essential elements. Each is important in preparing students to be leaders in their chosen professions in an increasingly complex and interdisciplinary world.

I. Liberal Education—A liberal education frees individuals from the limitations of their powers of judgment and choice that result from ignorance. It provides students with the skills to seek: control over the general intellectual instruments for acquiring and communicating knowledge, primarily the instruments of language and number; understanding of the ways scientists contribute to knowledge; historical and philosophical perspective on the nature of students’ own lives and the world in which they live; and appreciation of the creative insights into life and nature provided by literature and the arts. To help achieve these goals, the University requires all students to distribute a portion of their coursework in areas of study outside of those most directly linked to their specialized interests in science.

II. Physical Sciences and Math—Biology as a science relies heavily on the tools of mathematics and physical science. Organisms consist of molecules that obey the rules of physics and chemistry; these rules are often stated using mathematics.

Modern biologists in the field and in the laboratory must be able to use fundamental principles of mathematics, chemistry, and physics to appreciate living organisms at all levels from molecules to ecosystems.

Mathematics is a tool that underlies all of science. It permits the description of the kinetics of reactions occurring in organisms, is used to model population growth and distribution, and forms a basis for statistical analysis of data.

Chemistry is the study of molecules and their interactions. Phenomena such as nerve impulses, the exchange of gases in respiration, water balance, and the conversion of food energy to useful work by organisms require an understanding of chemistry. Organisms are composed of organic molecules. An understanding of these molecules and their reactive groups is essential to an understanding of biological phenomena such as metabolism, gene function, and nutrient cycling in ecosystems.

Physics includes the study of atoms and their interactions, mechanics, heat, sound, electricity and magnetism, and the properties of light. It is the basis for our understanding of photosynthesis, blood and air flow, mutations, and energy pyramids in ecosystems. It underlies most of the instruments and techniques used by biologists: pH meters, spectrophotometers, thermometers, microscopes, centrifuges, computers, the use of radiation to induce mutations, and the use of radioactive tracers.
Liberal Education Requirements

Effective for all freshmen with fewer than 39 credits enrolling from fall 1994 to summer session II 1996. Beginning fall 1996, the liberal education requirements apply to all students entering a baccalaureate degree program, regardless of prior credits.

A liberal education introduces you to the modes of inquiry and subject matter of the major branches of knowledge, including the factual information and theoretical or artistic constructs that form their foundations; the “ways of knowing”—the kinds of questions asked and how insight, knowledge, and data are acquired and used; the changes over time of their central ideas or expressive forms; and the interrelationships among them and with human society in general. To these ends, study by all undergraduate students on the Twin Cities campus is guided by a common framework.

The Diversified Core Curriculum

Physical and Biological Sciences. Comprehension of physical and biological principles; understanding of and ability to use the methods of scientific inquiry—the ways in which scientists investigate physical and biological phenomena; and appreciation of the importance of science and the value of a scientific perspective.

Requirement: A minimum of three courses totaling at least 12 credits, including one course with a laboratory or field experience in the physical sciences and one course with a laboratory or field experience in the biological sciences. (A CBS major automatically satisfies requirements in this area.)

History and Social Sciences. Knowledge of how historians and social scientists describe and analyze human experiences and behavior; study of the interrelationships among individuals, institutions, structures, events, and ideas; understanding of the roles individuals play in their historical, cultural, social, economic, and political worlds.

Requirement: A minimum of three courses totaling at least 12 credits, including one course with historical perspective.

Arts and Humanities. Understanding of approaches to the human condition through works of art, literature, and philosophy; knowledge of how artists create and humanistic scholars think; ability to make aesthetic judgments.

Requirement: A minimum of three courses totaling at least 12 credits including courses in two of the following: literature, philosophical perspective, and visual or performing arts.

Mathematical Thinking. Acquisition of mathematical modes of thinking; ability to evaluate arguments, detect fallacious reasoning, and evaluate complex reasoning chains; appreciation of the breadth of applications of mathematics and its foundations.

Requirement: A minimum of one course totaling at least four credits. (The calculus requirement in CBS automatically satisfies this requirement.)

The Designated Themes of Liberal Education

The designated themes of liberal education offer a dimension to liberal learning that complements the diversified core curriculum. Each of the themes focuses on an issue of compelling importance to the nation and the world, the understanding of which is informed by many disciplines and interdisciplinary fields of knowledge.

Requirement: A minimum of six courses (or five courses if one includes an approved practicum), including one course in each of the following:

- Cultural Diversity. Understanding of the roles gender, ethnicity, and race play in structuring the human experience in and developing the social and cultural fabric of the United States.
- International Perspectives. Comprehension of the ways in which you are part of a rapidly changing global environment dominated by the internationalization of most human endeavors.
- Environment. Knowledge of the interaction and interdependence of the biophysical systems of the natural environment and human social and cultural systems.
- Citizenship and Public Ethics. Reflection on and determination of a clearer sense of your present and future civic relationships and your obligations to the community.

Writing Skills

The ability to communicate effectively is a hallmark of a liberally educated individual and a key to a successful and satisfying life. To encourage refining of writing skills, the liberal education curriculum includes both writing courses and writing across the curriculum.

Requirement: Writing skills requirements are being revised. Until the new requirements are in effect, all students will complete the writing requirement specified by the college awarding their baccalaureate degree.

You may satisfy the liberal education requirements with a number of courses and credits different from those of other students because some courses serve multiple goals in the curriculum; e.g., some courses will satisfy a diversified core requirement and a designated theme requirement, and other courses will satisfy the requirements for each of two themes. Thus, you may satisfy the designated theme requirements with a smaller number of courses than is stated in the requirement. Each quarter, the Class Schedule will publish the requirements and list all courses that satisfy them. In addition, the Class Schedule will list which of these courses are offered that quarter and which are tentatively scheduled for the subsequent quarters during the academic year.

Minnesota Transfer Curriculum

If you complete the Minnesota Transfer Curriculum at any participating Minnesota college or university, you fulfill the University’s Twin Cities campus liberal education requirements. However, you will still need to complete a portion of the writing skills requirements. Contact your college advising office concerning these requirements. For more information on using transfer credits for the liberal education requirements, contact the Office of Admissions (612/625-2008).
III. The Biology Core Curriculum—Specialists working in well-circumscribed areas will always be important in biology, but today there is a growing need for people whose understanding ranges across the disciplines of biology. Students are introduced to diverse aspects of biology by completing a set of core courses. Some courses introduce students to various kinds of organisms—animals, plants, and microorganisms. Biochemistry introduces students to organic compounds of importance to organisms, to enzyme-catalyzed reactions, and to the metabolic pathways by which energy is used. Cell biology examines the structure and function of cells in some depth. Genetics introduces students to mechanisms of heredity, including both molecular genetics and population genetics. Ecology, evolution, and behavior introduces students to populations, evolution, and the behavior of animals.

IV. Specialization in the Major—In addition to completing the required courses in biology, students take courses to expand on some aspects of biology. They may do so either by completing a biology major, which allows for more breadth in choosing electives, or by completing one of several department majors (biochemistry; ecology, evolution, and behavior; genetics and cell biology; microbiology; neuroscience; and plant biology). These more specialized majors each have required courses, as specified by the department. In addition to elective courses, most students will plan to complete a research project in their special area of interest; each department offers credit for Directed Study (5970) and Directed Research (5990).

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### CBS Science Requirements: Suggested Time Sequence

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### A. Prerequisites

- Calculus (3 quarters)
- General Chemistry (2 quarters)
- Organic Chemistry (2 quarters with lab)
- Physics (3 quarters; see note 2 below)
- General Biology 1009 or 1201-1202-1203

### B. Biology Core (see note 3 below); check individual majors for core requirements

- Biol 3011, Animal Biology
- Biol 3012 or 3812, Plant Biology
- Biol 5013, Microbiology
- Biol 3008 or 5841, Ecology
- BioC 3021 or 5331, Biochemistry
- Biol 5003, Genetics
- Biol 5004, Cell Biology

**Notes:**

1. The recommended time period for many sequences is longer than required to allow some flexibility as to when the sequence is started.
2. The physical chemistry courses required for biochemistry majors, as well as some of the elective physiology courses, must be preceded by the complete physics sequence.
3. The period indicated is recommended to leave the senior year open for advanced study and research.
Requirements for Graduation

To earn a B.S. from CBS, a student must complete a minimum of 180 credits with grades of A, B, C, or S. To be used for credit toward graduation, each credit of D must be balanced by a credit of A or B in a course at the same level; each credit of D earned in courses meeting specific science or math requirements must also be balanced by a credit of A or B in courses at the same level that meet those requirements. Grades of D are not accepted in courses specifically required for admission—Biol 1009 or 1201-1202, Chem 1051-1052, Math 1251-1252, and their equivalents.

CBS students may apply up to eight technical, non-liberal arts college credits toward their degrees (e.g., credits in physical education or military science). For details, check with an adviser in 223 Snyder Hall.

Residency Requirements

a. A minimum of 45 credits in courses taken on the Twin Cities campus. Candidates for the B.S. must have a minimum of 75 percent of their University of Minnesota residence credits (required for graduation) in courses in which grades of A, B, C, or D have been received.

b. A minimum of 36 credits as a student registered in CBS. These credits may also apply toward a) above.

c. A minimum of 30 credits on the Twin Cities campus in 3xxx and 5xxx courses that are specifically required for the student’s major. Ordinarily this will include any 3xxx and 5xxx course listed in this bulletin as well as appropriate advanced courses in mathematics, statistics, computer science, and the physical sciences.

Course Requirements

1. English Communication Skills—Writing practice (freshman composition; Comp 1011 or 1015 or Rhet 1101 or equivalent) and one advanced course in writing to be selected from the following: Comp 3015 or 3027 or 3033 or 3085; Rhet 3562.

2. Foreign Language—Either two high school years or one college year of study of a single foreign language or demonstration of equivalent proficiency satisfactory to the appropriate language department.

3. Liberal Education—The University's liberal education diversified core, designated themes, and writing skills curriculum is required for all students completing a degree program on the Twin Cities campus.

   Physical and biological sciences
   History and social sciences
   Arts and humanities
   Mathematical thinking
   Cultural diversity
   International perspectives
   Environment
   Citizenship and public ethics
   Writing skills

   The mathematics and science coursework required of CBS students will automatically satisfy the minimum University requirements for physical and biological sciences and for mathematical thinking.

   The liberal education requirements include three courses (at least 12 credits total) in history and social sciences, including one course with historical perspective; three courses (minimum 12 credits) in arts and humanities, including courses in two of the following: literature, philosophical perspective, and visual or performing arts; and a minimum of six courses, including one course in each of the following theme areas: cultural diversity, international perspectives, environment, and citizenship and public ethics (see page 21). A list of approved courses can be found in the introductory section of the quarterly Class Schedule.

4. Physical Sciences and Mathematics—CBS majors each require a minimum of one year of calculus, one year of physics, and chemistry through organic. See specific requirements included with the description of each major in the Major Requirements and Course Descriptions section.

5. Biological Sciences—Each major has a defined list of required courses in general and organismal biology, as well as components of the biology core curriculum. The requirements are listed with each major in the Major Requirements and Course Descriptions section.
Biology Core Course List for BioC, EEB, GCB, NSc, and PBio Majors

Biochemistry
BioC 3021—Biochemistry
BioC 5301—Ecological Biochemistry
BioC 5331-32-33—Biochemistry
BioC 5401—Metabolism and its Regulation
BioC 5525—Physical Biochemistry: Solution, Structure, and Interactions of Biological Macromolecules
BioC 5526—Physical Biochemistry: Spectroscopic Methods I
BioC 5527—Physical Biochemistry: Spectroscopic Methods II
BioC 5528—Physical Biochemistry: Enzyme Kinetics
PBio 5182—Plant Metabolism
PBio 5186—Topics in Plant Biochemistry

Genetics/Cell Biology/Development
Biol 5003—Genetics
Biol 5004—Cell Biology
Biol 5125—Recombinant DNA Laboratory
GCB 5034—Intermediate Molecular Genetics
GCB 5035—Intermediate Cell Biology
GCB 5015—Histology:
  Cell and Tissue Organization
GCB 5061—Developmental Biology
GCB 5114—General Physiology
GCB 5134—Endocrinology
PBio 5109—Molecular Genetics and Biochemistry of Yeasts
PBio 5111—Plant Cell, Tissue, and Organ Development
PBio 5141—Plant Cell Biology
PBio 5184—Plant Growth and Development

Integrative/Organismal Biology/Physiology
Biol 3011—Animal Biology (if not used for the general and organismal biology requirement)
Biol 3012/3812—Plant Biology (if not used for the general and organismal biology requirement)
Biol 3112—Biological Rhythms and Timing Mechanisms
Biol 5013/MicB 5105—Microbiology (if not used for the general and organismal biology requirement)
MicB 5218—Immunology
MicB 5232—Medical Microbiology
MicB 5234—Immunology and Medical Micro Lab
MicB 5321—Physiology of Bacteria
MicB 5322—Microbial Diversity and Physiology Lab
MicB 5352/BioC 5352—Applied Microbial Biochemistry
MicB 5424—Biology of Viruses
MicB 5425—Virology and Microbial Genetics Lab
EEB 5129—Mammology
EEB 5134—Introduction to Ornithology
EEB 5136—Ichthyology
EEB 5156—Comparative Animal Physiology
EEB 5834—Field Ornithology
EEB 5838—Field Studies in Mammology
Ent 3005—Introductory Entomology
PBio 3131/5131—Survey of Plant Physiology
PBio 5103—Algae, Fungi, and Bryophytes
PBio 5105—Morphology of Vascular Plants
PBio 5132—Plant Physiology Laboratory
PBio 5183—Water, Minerals, Translocation
PBio 5231—Introduction to Algae
Phsl 3052/53; 3055/56—Principles of Physiology

Ecology/Evolution/Systematics/Behavior
Biol 3008/5841—Ecology
EEB 3111/5811—Introduction to Animal Behavior
EEB 5008—Quaternary Ecology
EEB 5014—Ecology of Vegetation
EEB 5016—Ecological Plant Geography
EEB 5044—Evolution
EEB 5051—Analysis of Populations
EEB 5052—Theoretical Population Ecology
EEB 5063—Evolutionary Ecology of Insect Populations
EEB 5064—The Process of Evolution
EEB 5122—Plant/Animal Interactions
EEB 5321—Evolution of Social Behavior
EEB 5323—Mechanisms of Behavior
EBB 5324—Evolution of Primate Social Behavior
EEB 5325—Behavioral Ecology
EEB 5608—Ecosystems: Form and Function
EEB 5601—Limnology
EEB 5814—Plant Community Ecology
EEB 5817—Vertebrate Ecology
MicB 5611—Microbial Ecology
PBio 3201—Introductory Plant Systematics
PBio 5221—Plant Molecular Evolution
PBio 5801—Plains and Boreal Flora

Course requirements for the MicB major automatically satisfy the college core biology requirements.
Honors Program

“The CBS Honors Program is a big plus for students planning on a science career, whether academic, medical, commercial, or other. It can be a valuable tool for providing much needed experience and insight for your life.”
—Honors Program graduate

There are two components of the CBS Honors Program. Freshman and sophomore level students participate in the CLA Honors Program, which is for students in all areas of arts and sciences. The program provides specially designed courses as well as opportunities for involvement in a mix of academic, social, and preprofessional cocurricular activities.

As juniors and seniors, CBS students are involved in a program designed around their interests in biology. That program is described below.

The purpose of the CBS Honors Program is to recognize and promote outstanding academic achievement. The nucleus of the program is directed research in biology, the most significant and challenging experience the faculty can offer to qualified undergraduates. Another facet of the program is the CBS Honors Seminar, which provides exposure to the breadth of biological inquiry and allows honors students to get to know each other.

The honors experience culminates in the Undergraduate Research Symposium and honors dinner which celebrate students’ research accomplishments and academic achievements.

Directed Research—The objectives of directed research are to provide participants with experience in research and to obtain new information about the biological system under investigation. A goal of the Honors Program is to promote research of a quality that warrants publication in a professional journal. Honors Program participants should select a research adviser from the college faculty and start on a research project early in their junior year or as soon thereafter as possible. Participation in a minimum of two quarters (a total of eight credits) of research is required; students may register in BioC 5990, EEB 5990, GCB 5990, MicB 5990, NSc 5990, or PBio 5990. Students who participated in the Undergraduate Life Sciences Summer Research Program or who received UROP grants may petition to use this work to satisfy up to four of the eight credits of research. An honors thesis, summarizing the research and written in the style of a publishable manuscript, is required of all honors students. The thesis must be approved by the faculty member supervising the research and by two other members of the faculty (at least one of whom must be from the major department), chosen with approval of the college.

Honors Seminar—Two quarters of participation in the CBS Honors Seminar (Biol 3960H) are required of all Honors Program graduates. In the fall quarter, the seminar is a forum to discuss special topics focused on a theme of general relevance to all biologists. In the spring quarter, seniors nearing completion of their directed research projects are required to present summaries of their project results. Students are required to take a seminar in the fall and follow that with a seminar in the spring quarter preceding graduation. They are also encouraged to enroll in the spring quarter seminar before the senior year.

Honors Program Admission—Freshmen apply to the Honors Program at the time of their application to the University. Students may apply to the CBS component of the program in their junior year. A minimum of three quarters of honors registration must be completed to fulfill the requirements for graduation with honors. Applicants should have a minimum GPA of 3.40 and present reasonable evidence of potential to attain the GPA required for graduation with honors (see below). Applications are available in 223 Snyder Hall.

Graduation With Honors—Participation in the Honors Program is required for graduation with the traditional honors designations cum laude, magna cum laude, and summa cum laude. In addition to the requirements for graduation, candidates for graduation with honors must complete the following:

1. At least 60 credits in upper division courses (3xxx and 5xxx) at the University of Minnesota, Twin Cities campus
2. Two quarters (8 credits) of directed research, the results of which are to be reported in an acceptable honors thesis
3. Two CBS honors seminars (Biol 3960H), one of which must be completed during fall quarter and the other during the last spring quarter in residence.

4. One additional honors opportunity, which may be selected from the following:
   a. An additional quarter (2 credits) of participation in directed research
   b. An honors seminar offered by the Honors Division of the College of Liberal Arts
   c. An upper division honors course (3xxx or 5xxx course designated by H)
   d. An 8xxx course (seniors only; requires permission)

5. The last 90 credits of A-F registration with the minimum GPAs specified below:
   
   - *cum laude:* minimum 3.40 GPA
   - *magna cum laude:* minimum 3.60 GPA
   - *summa cum laude:* minimum 3.80 GPA

   Grades of F and N, which carry no grade points, are included in the computation of the CBS Honors GPA. If a portion of the last 90 credits completed has been transferred from another institution, the proportion of residence credits with grades of A must at least equal the proportion of transfer credits with grades of A.

   Students planning to graduate with honors in microbiology must include specific courses in their programs in addition to meeting the college requirements. A listing of these requirements may be obtained from the Office of Student Services.

**For More Information**—Once admitted, students should also consult the *CBS Student Handbook* and feel free to discuss individual questions with an adviser in the CBS Office of Student Services, 223 Snyder Hall.