College of Science

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About Purdue University

Serving people was Purdue University's founding principle as the Indiana link in the nationwide chain of land-grant colleges and universities. Purdue, which opened its doors on September 16, 1874, with a student body of 39 and a staff of six, has grown into a world-class educational system of 69,600 students and about 18,400 faculty and staff members across Indiana. The West Lafayette campus comprises 39,200 students and nearly 15,000 faculty and staff members.

Purdue graduates have been to the moon, to the highest levels of business and government, and to Sweden to receive the Nobel Prize. The roster of about 384,000 living alumni includes noted CEOs, agriculturalists, scientists, teachers, engineers, pharmacists, journalists, veterinarians, and athletes who have made notable contributions to our society.

Purdue has been a vital resource to the people of Indiana, the nation, and the world — from its land-grant foundation to its status today as a prominent land-, sea-, and space-grant university that champions its missions of learning, discovery, and engagement.

Making higher education available to the people was the plan in 1862 when President Lincoln signed the Morrill Act. That act gave public lands to any state that would use proceeds from the sale of the land to support a college that would teach agriculture and the mechanic arts.

Three years after passage of the land-grant act, the Indiana General Assembly voted to take advantage of the provisions. Competition among various areas of the state culminated in 1869 when the assembly accepted $150,000 from Lafayette civic leader John Purdue, $50,000 from Tippecanoe County, and 100 acres of land from local citizens. In appreciation, the institution was named Purdue University and was established in West Lafayette. The University officially opened for classes September 16, 1874.

Purdue quickly established prominence in agriculture and engineering, answering the immediate needs of the people. And it has since built solid reputations in veterinary medicine, technology, a range of sciences, pharmacy, nursing, management, liberal arts, health sciences, education, and consumer and family sciences.

The physical growth of campus also has been dramatic. Originally the campus consisted of three buildings rising out of Indiana farmland. Today the main campus encompasses 160 major buildings. Nearly $600 million worth of new construction and renovation is under way or scheduled to occur at Purdue in West Lafayette during the first seven years of the new millennium.

The Purdue system has expanded to include Purdue campuses at Fort Wayne, Hammond, and Westville, and degree programs at Indiana University-Purdue University Indianapolis and Indiana University-Purdue University Columbus. Purdue's College of Technology exists in 10 Indiana communities in addition to the West Lafayette campus.

The mission of answering the people's needs goes beyond educating productive graduate and undergraduate students. Purdue is a highly respected research institution, with research and sponsored program expenditures of over $395.9 million in the 2004–05 fiscal year on the West Lafayette campus. In addition, the University offers its expertise to the state of Indiana in numerous ways, as well as to business and industry, retailers, and teachers.

Purdue's impact in Indiana is evident daily through its spectrum of learning, discovery, and engagement. The University has an annual impact of more than $2.5 billion on Indiana's economy. Purdue's march toward preeminence has solid footing in the development of Discovery Park, where the University's talent and ideas are pacesetters in interdisciplinary, world-leading nanotechnology and biosciences research and discovery.

Outreach programs include the Purdue University Cooperative Extension Service, with sites in each of Indiana's 92 counties serving as a gateway to lifelong learning. The Office for Continuing Education and Conferences serves tens of thousands of adult learners annually through Purdue courses for personal and professional development offered on campus, off campus, and by distance education.

Purdue is also a cultural and recreational hub for people in northwestern Indiana. The Edward C. Elliott Hall of Music, one of the largest proscenium theaters in the world, houses 6,025 spectators for music, dance, theatre, and pop entertainment. Boilermaker fans crowd Ross-Ade Stadium, Mackey Arena, and the Intercollegiate Athletic Facility for Big Ten Conference football, basketball, and volleyball.

Purdue University ranks among the 25 largest universities in the United States. Its position of leadership and influence in teaching and research stems in large part from its worldwide acclaim in engineering, science, and technology, but its preeminence is bolstered by an exciting array of academic disciplines. On the West Lafayette campus, there are 370 majors/specializations to choose from within the following colleges and schools:

College of Agriculture

Among the nation's highest ranked and most prestigious institutions, the college offers excellent teaching, research, extension, and international programs. More than 40 programs of study prepare scientists, engineers, business representatives, producers, information specialists, and resource managers for professional careers in the world's food and natural resource systems. See www.agriculture.purdue.edu/oap.

College of Consumer and Family Sciences

The college, one of the largest and highest ranked of its kind in the nation, prepares men and women for careers related to the needs of families and consumers. Students can choose a bachelor of science degree program from 13 majors in the areas of family studies and child development, consumer sciences and consumer business, hospitality, nutrition, health and fitness, tourism, and education. The Department of Hospitality and Tourism Management also offers an associate degree program. See www.cfs.purdue.edu.

College of Education

The state accredited and nationally ranked and accredited College of Education prepares outstanding teachers, instructional leaders, administrators, school counselors, counseling psychologists, curriculum specialists, teacher educators, and educational researchers for the essential roles they play in guiding the education of our youth. Through interdisciplinary instructional programs in teacher education, research in the educational process, and engagement with Indiana schools, College of Education graduates are well prepared for a rewarding career in education. The dedicated and experienced faculty members, some of whom are known internationally as experts in their fields, are respected leaders in a wide range of curriculum areas and are actively engaged in research. Together the students and faculty share a passion for learning, teaching, and changing the world. The college offers undergraduate and graduate degrees in a variety of disciplines. In addition to the teacher education programs offered by the College of Education, teacher preparation programs are also offered through other colleges and schools across campus. See www.education.purdue.edu.

College of Engineering

The College of Engineering is internationally known for the quality and scope of its programs. Students launch their careers with a common first-year program in the Department of Engineering Education. Once they have completed that program, they choose from undergraduate curricula in aeronautics and astronautics, agricultural and biological, biomedical, chemical, civil, computer, construction engineering and management, electrical, food process, industrial, interdisciplinary, land surveying and geomatics, materials, mechanical, or nuclear engineering. Every school and department offers graduate degree programs. See www.engineering.purdue.edu.

School of Health Sciences

The school offers a variety of health-related study areas, including medical technology, medical physics, health physics, industrial hygiene, and related environmental and general health science programs. It also administers the prepharmacy, premedical, predental, and pre-allied health programs, including occupational and physical therapy and dental hygiene. Students completing the programs and gaining experience in the field may qualify for professional certification. See www.healthsciences.purdue.edu.

College of Liberal Arts

The college offers essentially all of the traditional disciplines of the humanities, social and behavioral sciences, and creative arts. Majors and minors are available in 11 departments: audiology and speech sciences; communication; English; foreign languages and literatures; health and kinesiology; history; philosophy; political science; psychological sciences; sociology and anthropology; and visual and performing arts. Students can prepare themselves in more than 50 majors, including 11 undergraduate interdisciplinary programs. See www.cla.purdue.edu.

Krannert School of Management

Degree programs include accounting, management, industrial management, and econom-

ics. Accounting and management programs focus on finance, marketing, operations, human resources, and strategic planning. The industrial management program combines management and technical education with a manufacturing management, engineering, or science minor. The accounting program combines a management background with extensive education in accounting principles and practices. All programs include coursework in the arts, humanities, and international and cross-cultural aspects of modern business. See www.krannert.purdue.edu.

School of Nursing

The School of Nursing prepares students from diverse backgrounds for careers as professional nurses. The nationally accredited undergraduate program prepares a student for licensure as a registered nurse (R.N.) and for entry into graduate studies. A diverse mix of liberal arts, science, and nursing courses gives students a scientific, multidisciplinary education. Small clinical classes give students practical experience in health assessment, maternal child care, mental health, acute care, and community health nursing. This program admits nursing majors at the freshman year and offers early, hands-on clinical courses. The R.N.-to-B.S.N. program allows registered nurses to complete their baccalaureate requirements. The Second Degree Baccalaureate Program allows students who hold a degree in another field to pursue a B.S. in Nursing. The master's degree program prepares advanced practice nurses. The Doctor of Nursing Practice (D.N.P.) delivers a curriculum from post-baccalaureate to the practice doctorate degree, with an emphasis on care of rural, underserved populations. See www.nursing.purdue.edu.

School of Pharmacy and Pharmaceutical Sciences

The school offers an accredited professional program leading to the Doctor of Pharmacy degree. This program combines a basic and applied science background as well as clinical experience allowing students to function as licensed pharmacists to provide pharmaceutical care. The two prepharmacy years can be taken either at Purdue's School of Pharmacy or at another institution. The school also has a four-year, non-licensure-eligible B.S. in Pharmaceutical Sciences degree designed for entry-level pharmaceutical industry positions or as a foundation for advanced education. See www.pharmacy.purdue.edu.

College of Science

Actuarial science, biological sciences, chemistry, computer science, earth and atmospheric sciences, mathematics, physics, statistics, math and science secondary school teaching, and interdisciplinary science programs prepare students for immediate careers or advanced study. Premedical, predental, and preveterinary options; a cooperative education program; study abroad; and honors programs are available. Students may pursue official minors in other areas outside their major. Enrollment in sciences while deciding on a major in any field is encouraged. A highly qualified faculty, state-of-the-art facilities, and ongoing research keep teaching up to date. See www.science.purdue.edu.

College of Technology

The eight departments and 22 specializations in the College of Technology prepare students to meet the technological needs of business, industry, and government. Technology students begin taking courses in their major as early as the freshman year. Courses and other opportunities allow students to experience a variety of hands-on, real-world applications. The college awards associate, bachelor's, and graduate degrees. See www.purdue.edu/technology.

School of Veterinary Medicine

This professional school, which graduated its first class in 1963, has assumed a leading position nationally and internationally in veterinary education. The school is one of only 28 in the United States that grant the Doctor of Veterinary Medicine degree. The Veterinary Technology Program is accredited by the American Veterinary Medical Association (AVMA) and awards Associate of Science and Bachelor of Science degrees. The Associate of Science degree is also offered via distance learning. The Veterinary Technology Program at Purdue is the only such program in the state of Indiana and one of only two AVMA programs administered by a school of veterinary medicine. See www.vet.purdue.edu/admissions.

The Graduate School

All programs of graduate study and research leading to advanced degrees are under the Graduate School's jurisdiction. Programs of study lead to the degrees of Doctor of Philosophy, Doctor of Audiology, Doctor of Nursing Practice, Educational Specialist, Master of Arts, Master of

Arts in Teaching, Master of Fine Arts, Master of Business Administration, Master of Science, and Master of Science in various professional fields. More than 70 robust programs with research- and practice-oriented curricula are available in options that include the sciences, arts, engineering, agriculture, management, and humanities as well as exciting interdisciplinary programs. The Graduate School also offers several graduate-level, academic credit certificate programs. See www.gradschool.purdue.edu.

College of Science

Organization and Purpose

Science — the effort to observe, understand, and utilize the laws of nature — is an ancient discipline. Today, science is more exciting than ever because of the speed with which new insights are obtained and often applied to vital human problems, such as population growth, disease, pollution, energy shortages, and food production.

The College of Science at Purdue University offers many undergraduate and graduate programs that will prepare you for a variety of careers. Scientists are encouraged by society to pursue new avenues of research, either as individuals or as part of great research teams employing many scientists. They are needed to design computers and computer programs, locate and analyze natural resources, help find ways to protect our environment, and apply research findings to industrial and human problems. Scientists are needed as teachers at all levels of education. They are sought as administrators for governmental organizations using other scientists or engineers and as salespeople and managers by companies with science-based products.

Undergraduate education in the sciences is considered excellent background for graduate study in medicine (including veterinary medicine), dentistry, business administration, law, and areas of the social sciences where quantitative methods are important. The College of Science also is very interested in helping students whose goal is not a career in science but a general education with emphasis on the scientific aspects of our society.

The College of Science at Purdue is an excellent place to acquire an education in science. Its seven instructional departments give you the chance to increase your knowledge of science by interacting with first-rate scientists who also are gifted teachers and by working with modern equipment in well-designed laboratory experiments. The departments also have honors programs if you are qualified and fine libraries that allow you to pursue, in depth, subjects in which you have an interest. You also may choose to pursue a minor in an area of the College of Science or in other areas of the university.

Choosing a Major

Science today is a collection of specializations — and that can be confusing to students who know they want to study science but who aren't ready to commit themselves to a particular subdivision of the field. The undergraduate plans of study in the College of Science reflect the many specializations within science, but there also are opportunities for students to get a broad education in one or more of the sciences.

An important concern will be deciding between the main divisions of science study at Purdue — the life and physical sciences or the mathematical and computational sciences. If you are not sure what specific science to choose as a major, start in the subject you like best and sample other sciences as a first-year student. The first-year programs in the seven departments of the school are similar enough that switching from one science major to another is usually simple, if you decide your initial choice is not best for you.

Decisions about options offered within each department need not be made until at least your sophomore year, and often not until your junior year. Many students obtain a broad science education as undergraduates and delay specialization until graduate school.

If you have a specific interdisciplinary career objective in mind, you might consider one of the options suggested under the Interdisciplinary Science Program or plan to supplement your major courses with those offered by other schools or colleges of the University.

Choosing a major is not always easy, but help is available. Science Counseling advisors and faculty members will be happy to provide information and guidance.

Scholarships

The College of Science grants scholarships based on academic merit to highly qualified applicants each year. During recent years, more than $400,000 in scholarship money has been distributed annually by the College of Science to outstanding students. Top students will receive invitations to apply for scholarships; however scholarship applications are open to all students pursuing a science major.

For beginning students, successful applicants typically will be among the top 10 percent of their high school class, have strong grades in high school math and science courses, and have outstanding standardized test scores (greater than 1350 on the combined SAT exams, or 32 on the ACT exams) as well as outstanding participation in math and science competitions, high school activities, and honors. Continuing students who compete successfully for scholarships usually have at least a 3.5/4.0 overall GPA in addition to a strong record in leadership, community service, and research.

For further information, contact the Scholarship Coordinator, College of Science, Mathematical Sciences Building or visit the college scholarship Web site at www.science.purdue.edu/prospective_students/scholarships. For information about other types of financial assistance, see page 20.

Cooperative Education Program

The College of Science Cooperative Education Program gives science students the opportunity to alternate periods of supervised professional employment with periods of University coursework while studying for their bachelor's degrees.

If you choose to participate in cooperative education, it may take longer to earn your degree, but you will receive several important benefits. Based on past experience of students in co-op programs, you can expect that (1) your earnings from your employment will be enough to pay a substantial portion of your remaining years of employment/studies, and (2) you will gain valuable professional experience in your scientific field — giving you a feeling for the career you select, making your coursework more relevant, and increasing your value as a future employee.

As a co-op student, you will attend Purdue for about two academic years before your first work experience. After that, you will alternate periods of academic study with periods of work experience. The actual study-work schedule depends on your major and cooperative education employer.

Your cooperative education employer will have been approved by the University and will have agreed to give you a meaningful work experience related to your scientific interests. Normally, you will work for the same employer throughout your baccalaureate program and be given increasing responsibility with each work period.

Each department in the College of Science determines its own eligibility requirements for co-op participation and has a departmental coordinator of cooperative education. (Departmental requirements are given in the departmental sections of this catalog.) The departmental coordinator counsels co-op students and has information about available jobs.

You must apply to the coordinator in your department to be accepted into the co-op program. If you are an interdisciplinary science student, apply to the coordinator in the department of your major science concentration or to the College of Science cooperative education coordinator. If you are interested in co-op, you should contact the departmental coordinator as early as possible to facilitate job placement and to assure your eligibility.

The University, through a cooperative education coordinator, supervises you and your employer during work periods. After each work period, you must write a comprehensive report about your work experience. When they graduate, students who complete at least four work periods receive a certificate indicating that they have completed the cooperative education program.

While employed as a co-op student, you must register for noncredit departmental courses numbered 091, 092, 093, 094, or 095 and pay the special University fee for co-op registration.

Teacher Education Program

Purdue University offers programs that prepare students for teaching in early childhood, middle childhood (elementary education), early adolescence (junior high/middle school), adolescence/young adulthood (secondary) and exceptional needs (special education). Program standards, curricula, and licensure are in accord with regulations promulgated by the Indiana Department of Education Division of Professional Standards and authorized by the National Council for

Accreditation of Teacher Education (NCATE). Descriptions of performance-based programs may vary by content areas. Official performance-based program guidelines are available via the College of Education Office of Professional Preparation and Licensure (OPPL) Web site at www.education.purdue.edu/licensure. Students seeking additional clarification and guidance should consult with an academic counselor or faculty advisor.

A person who already holds a bachelor's degree may wish to complete a teacher education program as an "undergraduate for licensing only" student. If this option is chosen and a second baccalaureate degree is not desired, please contact the Office of Professional Preparation and Licensure for a transcript evaluation. Eligibility requirements do apply.

Title II Reporting Requirements. Purdue University is in compliance with Title II reporting requirements. Please visit www.education.purdue.edu/title2 to obtain complete details. If you are unable to access this Web site, please contact the Office of Professional Preparation and Licensure at Beering Hall of Liberal Arts and Education, Room 3229; 100 N. University Street; West Lafayette, IN 47907-2098 for a copy of the report.

2006–07 Teacher Education Requirements

The following information outlines the assessment of students completing a teacher education program at Purdue University. For the most current information, visit www.education.purdue.edu/oppl/program.html. The candidate must:

- Attend the Office of Professional Preparation and Licensure Teacher Education Orientation during Block I or CDFS 100;
- Submit the Application/Signature Form to the licensure office;
- Complete Gates A, B, and C (an application is not required for Gate B or C);
- Complete Gate D licensure requirements;
- Submit the State of Indiana license application through the Office of Professional Preparation and Licensure upon successful completion of the program.

Required Criteria and Suggested Time Line

Remain flexible. The length of time to complete the Teacher Education Program is determined by academic progress and career planning. Additional time may be necessary if you are: **a)** changing your degree objective (CODO) or transferring, **b)** overcoming a GPA below the required teacher education program standard, **c)** pursuing an additional major or licensure area, or **d)** encountering other unknown needs or circumstances.

Before the First Semester:

1. Admission to Purdue University.
2. Admission to the respective academic college, i.e., Agriculture, Consumer and Family Sciences, Education, Liberal Arts, Science, or Technology.
3. Assignment to and guidance by an academic advisor.

Consult with your academic advisor regularly to ensure that the required criteria are met and coursework is successfully completed in the sequence authorized by the Purdue University Teacher Education Council.

Requirements for Passing through Gate A

(A Teacher Education Program Application/Signature Form is required. See #7.)

1. Complete required courses for Gate A, with no grade lower than a "C":
   - Most program areas—Block I (EDCI 205, EDCI 285)
   - Early Childhood Education—CDFS 210
   - Special Education—Block I (EDCI 205, EDCI 285) and EDPS 260
2. Maintain a minimum overall GPA as established by the program area.
3. Maintain a professional education GPA of 3.0/4.0 with no grade lower than a "C" and no Incomplete ("I") for any professional education course. Courses include EDCI, EDFA, EDPS, and EDST courses, in addition to courses designated by a program area as professional education courses.
4. Maintain a minimum content/major GPA as established by the program area.
5. Meet satisfactory assessment of the initial portfolio as defined by faculty. Early Childhood Education (ECE) majors, see Unit Assessment Component Chart for ECE.
6. Meet Praxis I: Pre-Professional Skills Tests (PPST) or Computerized PPST with the following scores:
   - Reading: 176 or above
   - Writing: 172 or above
   - Mathematics: 175 or above

All scores must be officially submitted by the

Educational Testing Service to Purdue University; code RA #1631 or WLAF as a score recipient. For more details, please refer to the Teacher Education Program Testing Information sheets available in the Office of Professional Preparation and Licensure; Beering Hall, Room 3229; 101 N. University St.; West Lafayette, IN 47907-2098.

7. Submit a completed teacher education Application/Signature Form to the Office of Professional Preparation and Licensure if all of the above requirements have been met or will be met by the end of the semester (or summer session if enrolled in summer classes). The application may be marked to hold for current semester grades or test score reports. See application for due dates. A student must be enrolled in the college that houses the teacher education major in order to apply for Gate A.

The student's signature on the Signature Form acknowledges that s/he will read the teacher education information on this Web site, referring to it regularly in order to remain informed of standards and responsibilities to the Teacher Education Program process. The signature also confirms understanding of the following:

- Limited Criminal History Reports may be required throughout the Teacher Education Program for field experiences, and a report will be required for licensing.
- Purdue University will check Zachary's Law Registry periodically.
- The Indiana Department of Education Division of Professional Standards will review misdemeanor/felony convictions at the time of licensing.
- Consent to release personal information and Social Security number to the State of Indiana and other state/federal departments of education and the Educational Testing Service (ETS).

8. Receive written notification of status through Gate A from the Office of Professional Preparation and Licensure.
9. If denied admission, reapplication is required.

Requirements for Passing through Gate B

Requirements for Passing through Gate B must be met in order to continue in the program, including eligibility for study abroad block courses.

(No Teacher Education Program application is required for Gate B, although a Student Teacher Application must be submitted. See "Note" below.)

1. Complete required courses for Gate B, with no grade lower than a "C":
   - Most program areas—Block II (EDPS 235, EDPS 265)
   - Early Childhood Education—CDFS 212B (grade of "B"), CDFS 310, CDFS 318, and EDPS 260
   - Special Education—Block II (EDPS 235, EDPS 265), EDPS 270, and EDPS 460
2. Maintain a minimum overall GPA as established by the program area.
3. Maintain a professional education GPA of 3.0/4.0 with no grade lower than a "C" and no Incomplete ("I") for any professional education course. Courses include EDCI, EDFA, EDPS, and EDST courses, in addition to courses designated by a program area as professional education courses.
4. Maintain a minimum content/major GPA as determined by the program area.
5. Meet satisfactory assessment of the beginning portfolio as defined by faculty. Early Childhood Education (ECE) majors, see Unit Assessment Component Chart for ECE.
6. Request a Limited Criminal History Report if required for field experiences throughout the Teacher Education Program. The Zachary's Law Registry also will be checked periodically.
7. Failure to meet or comply with the above requirements will result in removal from methods courses.
8. Receive written notification of status through Gate B from the Office of Professional Preparation and Licensure.
9. Contact the Office of Field Experiences (OFE) by mid-September of the academic year preceding the student teaching semester (i.e., junior year) to receive a pass code in order to complete the online Student Teaching Application on the Internet by November 1.

Note: For student teaching information, see the Office of Field Experiences (OFE) Web site at www.education.purdue.edu/fieldexp or e-mail fieldexp@purdue.edu. A student must pass through Gates A and B before submitting the Student Teaching Application form to OFE. This application serves as a "letter of intent" and does not imply automatic placement.

Requirements for Passing through Gate C

(No Teacher Education Program application is required.)

1. Complete required courses for Gate C, with no grade lower than a "C":
   - Most program areas—Specific methods courses
   - Early Childhood Education—CDFS 405, CDFS 406, and CDFS 408 with grades of "B"
   - Elementary Education—Block III (EDCI 361 and EDCI 362), IV (EDCI 363 and EDCI 370), and V (EDCI 364, EDCI 365, and EDPS 430)
2. Pass Praxis II: Subject Assessments/Specialty Area Tests required by the Indiana Department of Education Division of Professional Standards for licensing. For information on required tests and passing scores, please consult the Teacher Education Program Testing Information sheets and the Educational Testing Service Web site at www.ets.org/praxis.

Note: Praxis II must be passed before being allowed to student teach. Praxis II tests are only offered seven times a year and must be registered for in advance.

3. Maintain a minimum overall GPA as established by each program area.
4. Maintain a professional education GPA of 3.0/4.0 with no grade lower than a "C" and no Incomplete ("I") for any professional education course. Courses include EDCI, EDFA, EDPS, and EDST courses in addition to courses designated by a program area as professional education courses. All professional education coursework should be completed prior to student teaching.
5. Maintain a minimum content/major GPA as established by each program area. Most, if not all, content courses should be completed before student teaching.
6. Meet satisfactory assessment of the developing portfolio as defined by faculty.
7. Receive written notification of status through Gate C from the Office of Professional Preparation and Licensure.
8. Successful completion of requirements through Gate C of the Teacher Education Program allows the Office of Professional Preparation and Licensure to authorize the student to enter the student teaching semester. For information regarding student teaching placement, please see the Office of Field Experiences (OFE) Web site at www.education.purdue.edu/fieldexp or e-mail OFE at fieldexp@purdue.edu.
9. Request a Limited Criminal History Report if required for field experiences. The Zachary's Law Registry also will be checked periodically.
10. Begin job search through the Center for Career Opportunities at www.cco.purdue.edu/student.

Requirements for Passing through Gate D

(License application is required. See #9.)

1. Student teach.
   - Professional education courses, including methods courses, must be successfully completed before student teaching.
   - You may student teach only after passing through Gate C.
   - A grade of "C" or above must be earned in EDCI/EDPS 496, 498, 499, or CDFS 450 Supervised Teaching.

For more information regarding student teaching, please see the Office of Field Experiences (OFE) Web site at www.education.purdue.edu/fieldexp or e-mail fieldexp@purdue.edu.

2. Maintain a minimum overall GPA as established by each program area.
3. Maintain a professional education GPA of 3.0/4.0 with no grade lower than a "C" and no Incomplete ("I") for any professional education course. Courses include EDCI, EDFA, EDPS, and EDST courses, in addition to courses designated by a program area as professional education courses.
4. Maintain a minimum content/major GPA as established by each program area.
5. Meet satisfactory assessment of the proficient portfolio as defined by faculty.
6. Continue to meet all criteria for passing through Gates A, B, and C.
7. Request a Limited Criminal History Report for licensure. The Zachary's Law Registry also will be checked periodically.
8. Receive degree. Recommendation for licensure is contingent upon the posting of the degree on the transcript. All encumbrances must be paid.
9. Apply through the Office of Professional Preparation and Licensure for an Indiana Teaching License, even if leaving the State of Indiana. For more details, consult the Indiana Licensure instruction packet provided by the Office of Professional Preparation and Licensure at the Student Teacher Orientation.

The license application may be submitted to the Office of Professional Preparation and Licensure two months prior to the last day of required courses. Do NOT send the license application to the Indiana Department of Education Division of Professional Standards since a recommendation from Purdue University is required.

Note: The following questions will be asked by the Indiana Department of Education Division of Professional Standards on the license application:

- Have you ever had a credential, certificate, or license to teach denied, revoked, or suspended in Indiana or in any other state?
- Have you ever been convicted of a felony?
- Have you been convicted of a misdemeanor other than minor traffic violations since January 15, 1994?

If a conviction of a misdemeanor or felony (including a suspended sentence) is documented, the applicant will be required to submit a written explanation and copies of court records with the license application. The Indiana Department of Education Division of Professional Standards is solely responsible for the review and response of misdemeanor or felony convictions.

10. Apply for licensure in other states, if desired. Contact the licensing office in the particular state and request application materials. Consult the National Association of State Directors of Teacher Education and Certification at www.nasdtec.org/jurisdictions.tpl for Web sites, addresses, and telephone numbers.

Note: For additional licensing, apply for renewal or submit a request for an evaluation through the Office of Professional Preparation and Licensure if coursework is to be completed through Purdue University.

Admissions

Admissions Inquiries and Procedures

All inquiries about admissions (whether you are entering from high school, transferring from another institution, or re-entering after being out of school) should be addressed to: Office of Admissions; Purdue University; Schleman Hall; 475 Stadium Mall Drive; West Lafayette, IN 47907-2050; admissions@purdue.edu; (765) 494-1776.

Your first inquiry concerning admission should include (1) the amount of education you have completed; (2) your plans for further education, indicating your area of interest; and (3) the approximate date of your entrance to Purdue.

When you are entering directly from high school, the Office of Admissions suggests that you file your application for admission early in your senior year. Transfer students should apply as early as possible.

Campus Visits

A visit to the campus and an interview with an admissions counselor will help you determine which educational programs at Purdue are in keeping with your educational background and your future career interests. Such a campus visit is especially appropriate during your junior year in high school.

The Office of Admissions is open each weekday from 8 a.m. to 5 p.m. No appointment is necessary; however, if you would like a tour of the campus, contact the Office of Admissions before your visit.

Students interested in Purdue have a variety of opportunities to visit the campus. Some programs, such as Fall Preview Days and Introducing Purdue, offer more formal agendas that include admissions presentations, school and program sessions, and campus tours. Prospective students and their families also can make individual visits; the Office of Admissions offers multiple visit sessions on a daily basis, Monday through Friday, including walking tours of campus. Students planning a visit to campus should first contact the Office of Admissions or visit the Admissions Web site — www.purdue.edu/Admissions/undergrad — for further information.

Core 40 — Indiana Students

Purdue University applauds the state's efforts to strengthen Indiana's high school students' academic preparation and encourages all students to complete the Core 40 requirements. In addition to considering high school courses, Purdue will continue to use other factors such as grade point average, class rank, trends in achievement, honors courses, and test scores when reviewing

applications for admissions. We will evaluate applicants on an individual basis and in relation to their requested majors. Program limitations also will continue to be a factor in admission to certain majors.

Admissions Criteria

Your admission as a new student into the College of Science at Purdue is determined by a holistic review that evaluates rank in class, test scores, ability to be successful, grade average in college preparatory subjects, grades in courses related to the degree objective, trends in achievement, completion of minimum high school subject matter expectations (see table), the strength of the college preparatory program, personal attributes, and information provided by your high school counselor. All applicants who have not completed a full year of college work are required to provide SAT or ACT scores (including the writing sections of these tests). Students are encouraged to take either the SAT or ACT in the spring of their junior year. All applicants must graduate high school or have a GED.

Subjects	Minimum Semester Expectations
English	8
Academic math*	6
Laboratory science†	4
Foreign language	4

** Includes algebra, geometry, trigonometry, calculus, etc.*

† Includes biology, chemistry, physics, earth/space sciences, physiology/anatomy, etc.

In satisfying the entrance requirements in laboratory science, it is advisable for at least one semester to be in chemistry. If it is possible for you to exceed the above requirements, biology and physics are recommended in addition to chemistry.

In planning your other electives while in high school, you should review the starting points of the curricula in the College of Science (pages 27-30).

Because this catalog is used for two to three years, you should refer to www.purdue.edu/Admissions/undergrad for the most current and accurate information about admission to the College of Science.

Advance Deposit on Fees

If you are a new student admitted for the fall semester, you must make a nonrefundable advance deposit of $100. This deposit is to reserve a place for you on the new student roster. Students admitted on or before April 10 must submit the deposit by May 1. Those admitted after April 10 must submit the deposit within three weeks (21 days) after the date of the offer of admission.

If you receive an offer of admission but fail to make the required deposit of $100 within the time allotted, you automatically forfeit your right to a place on the new student roster.

The $100 advance deposit will be applied to your first semester fees and is not associated with your University housing application or contract.

Early Enrollment for Superior Students

If you are a high school student with a highly superior scholastic record during the first three years of high school, you may qualify for admission to Purdue without high school graduation.

The regular entrance requirements are supplemented by certain objective measurements of your qualification to advance to the university level. In this way, the University tries to recognize and provide for individual rates of learning and achievement.

As a nongraduate of high school, you will be considered for admission if you (1) have earned 12 or more credits toward graduation; (2) have a highly superior school record; (3) are strongly recommended by your principal; (4) have the approval of your parents for college entrance without high school graduation; (5) qualify by your performance on prescribed admissions tests; and (6) are approved by the University Admissions Committee.

Purdue cannot guarantee high school diplomas under this arrangement, but it cooperates with whatever arrangement the state or local school system may have for awarding a high school diploma to a successful participant in this plan.

Admission with Advanced Standing

On the basis of your CEEB Advanced Placement Examination, Purdue advanced credit examina-

tion, or high school record, you, as a first-year student, may receive advanced credit and/or advanced placement.

Transfer Students

If you are transferring from another college or university, you must comply with the following procedures:

1. Submit an official undergraduate application for admission.
2. Forward official transcripts of work done at institutions previously attended (both high school and college). A separate transcript must be provided by each institution, regardless of whether credit is requested.

To be considered for admission, transfer students should apply as soon as possible for the term they wish to enter. To be admitted, students must have the necessary grade point average at the time they apply (and any required college coursework) and meet high school subject matter requirements.

Because this catalog is used for two to three years, you should refer to www.purdue.edu/Admissions/Undergrad for the most current and accurate information about admission to the College of Science.

Transfer (or Advanced) Credit

Credit for courses at Purdue University will be given for work of equivalent character and amount successfully completed at another accredited college. Advanced standing will be determined on the basis of these credits. Advanced credit will be regarded as provisional and may be withdrawn by the director of admissions upon recommendation of the head of the department concerned if dependent work is not satisfactorily completed.

Purdue University is a supporter of and a participant in the Indiana Core Transfer Library (CTL), a growing list of courses that will transfer from one public Indiana institution to another. As the Core Transfer Library is developed, information will be available at www.che.state.in.us.

When credit earned at another college or university is transferred to Purdue and accepted toward advanced standing, the credit is converted into terms of Purdue courses and applied to the program of study. It remains for you, the student, to complete the program, and your schedule of courses each term will be adjusted accordingly. It does not follow that your classification at Purdue or the time necessary for completion of the required work for a degree will be in line with what was expected at the previous institution. Grades are not transferred; only credits in courses are recorded.

Students participating in college-credit courses taught concurrently for high school and college credit during the regular school day by local high school teachers must validate the credit by submitting satisfactory results on the College Board Advanced Placement Examination or the Purdue advanced credit examination, as determined by the subject department. The determination of use of transfer credit in part or in full to satisfy graduation requirements is the responsibility of the school head or his or her designated representative, in accordance with the regulations of the University faculty.

All credentials are submitted with the understanding that they become the property of Purdue University.

Early Registration — Day on Campus

The Student Access, Transition and Success Programs (SATS) and the Office of Admissions invite you to campus for one day of early registration during the summer before your first semester as a new student. This day is set aside for you to meet with your academic counselor and to select your first-semester classes. The University then will proceed with the registration process and mail you a fee statement and your class schedule.

Student Orientation and Support Programs

Student Access, Transition and Success Programs (SATS) is responsible for the coordination of initiatives that help students prepare for, transition into, and succeed in Purdue University's academically rigorous environment.

SATS, a division of the Office of Enrollment Management, offers several programs to help beginning and transfer students adjust to Purdue. Boiler Gold Rush is for new, beginning students and includes a variety of activities designed to help them make a smooth transition into Purdue. Students who begin their studies at other times of the year also have the opportunity to participate in orientation. Invitations to those different programs are mailed to the students at the appropriate times.

SATS programs include Day on Campus, Learning Communities, Orientation Programs (such as Boiler Gold Rush and Welcome Programs), Parent and Family Programs, the Purdue Opportunity Awards program, the Purdue HelpDesk, and the West Central Indiana Regional Twenty-first Century Scholars site. For more information on any of these programs, please visit www.purdue.edu/sats, e-mail sats@purdue.edu, or phone (765) 494-9328. The SATS address is Stewart Center, Room G77; 128 Memorial Mall Drive; West Lafayette, IN 47907.

Nondegree Students

If you are an adult living near one of Purdue's campuses and you want to take a course at the University without seeking a degree or following a regular plan of study, you can apply for admission as a nondegree student. You must show that you have the background and course prerequisites necessary for the course or courses in which you are interested. The Office of Admissions will advise you on admissions procedures.

International Students

If you are an applicant from another country, your application and supporting documents will be evaluated by the staff in the Office of International Students and Scholars. You will be admitted on the basis of credentials certifying the completion of preparatory studies comparable to requirements for United States citizens applying at the same entry level. Guidelines for determining admissibility are specified in the "Admissions Criteria" section of this publication. English translations must accompany transcripts and other credentials. You also must submit satisfactory evidence of your ability to comprehend English as shown by a TOEFL (Test of English as a Foreign Language) score of at least 550 (213 computer-based score, 79 Internet-based score). The minimum score for First-Year Engineering applicants is 567 (233 computer-based score, 88 Internet-based score).

You must furnish sufficient evidence of adequate financial support for your studies at Purdue.

The Office of International Students and Scholars will assist you in entering the United States and the University. The office also will provide other services such as orientation programs, immigration advising, and personal and cross-cultural counseling. See the Web site at www.iss.purdue.edu.

Military Training

Reserve Officers' Training Corps (ROTC) is available for all men and women who are full-time students. You can pursue military courses in conjunction with the academic curriculum and receive academic credits. If you complete the program, you will receive a commission as an officer in the Army, Navy, Marine Corps, or Air Force. You do not incur a commitment until you are accepted into the program and enroll in the third-year course or accept an ROTC scholarship. Scholarships that assist with tuition, incidental fees, and textbooks are available through all four services. A monthly allowance is available for students who sign a contract. Additional information is available in the College of Liberal Arts catalog, or you can contact any of the military departments directly. All ROTC offices are located in the Armory.

Time of Entrance

Purdue University offers instruction during two semesters and summer session. You can begin most programs of study with any semester or during the summer. The semesters start in August and January, and the summer modules begin in May, June, and July. Students may begin the following programs only at the times stated: flight, nursing, and the Undergraduate Studies Program, fall; the specific veterinary technology program you are interested in will determine when you may begin your studies.

Proof of Immunization

Indiana state law requires proof of immunization for the following vaccine preventable diseases as condition of enrollment on residential campuses of state universities: measles, mumps, rubella, diphtheria, and tetanus. In addition, international students must provide documentation that they have been tested for tuberculosis after arriving in the United States. Information regarding compliance will be forwarded to all admitted students.

The Purdue Statewide Academic System

Admission to Another Purdue Campus

Purdue's educational system provides students access to a full complement of the University's faculty, resources, and academic programs. Whether you're enrolled at Calumet, Fort Wayne, North Central, or West Lafayette, you can pursue a degree from Purdue University and fulfill your career aspirations.

As one of the nation's top research institutions, Purdue is recognized around the world for the quality of its programs and its graduates. When you pursue your goals at a Purdue campus, you'll earn your share of that reputation. You'll enjoy all the challenges as well as the benefits and rewards associated with a preeminent university. Purdue University's quality is available across the state, and the primary goal of each campus is to help each student excel through discovery, learning, and engagement.

For information about what is offered at each Purdue University campus, use the following contact list:

Calumet	www.calumet.purdue.edu adms@calumet.purdue.edu
Fort Wayne	www.ipfw.edu ASK@ipfw.edu
North Central	www.pnc.edu admissions@pnc.edu
West Lafayette	www.purdue.edu admissions@purdue.edu

There also are Purdue programs at Indiana University-Purdue University Indianapolis. Go to www.iupui.edu for more information.

Admission to the College of Technology — Statewide

The College of Technology resides in 10 Indiana communities in addition to the West Lafayette campus. A unique partnership of education, business, industry, and government, these community-based locations feature quality curriculum requirements, faculty who are as highly qualified as their West Lafayette campus peers, low student-to-faculty ratios, and the opportunity to earn a degree from Purdue University.

Technology programs at all locations emphasize hands-on, real-world applications to engineering principles. Students learn marketable skills to meet the defined needs of Indiana business and industry. Purdue Technology graduates are well prepared for immediate employment and enjoy one of the University's highest job-placement rates and some of the highest starting salaries for undergraduate majors.

In addition to academics, these College of Technology locations offer opportunities to get involved in on-campus and community activities. They also provide a full range of student services to ensure a rewarding college experience and future success.

The College of Technology Web site is www.purdue.edu/technology. For information about what is offered at each location, contact the Office of Admissions on the West Lafayette campus at admissions@purdue.edu or the location that interests you. The following list provides contact information for each location.

West Lafayette
Niaz Latif
(765) 494-1101
latif@purdue.edu

Anderson
319 Cottage Avenue
Anderson, IN 46012-3404
Phone: (765) 641-4551
E-mail: techanderson@purdue.edu

Columbus
4555 Central Avenue, Suite 1200
Columbus, IN 47203-1892
Phone: (812) 314-8526
E-mail: techcolumbus@purdue.edu

Greensburg
422 East Central Avenue, Suite 2
Greensburg, IN 47240-1834
Phone: (812) 622-8686

Indianapolis
2175 South Hoffman Road
Indianapolis, IN 46241-3650
Phone: (317) 484-1824
E-mail: techindianapolis@purdue.edu

Kokomo
2300 South Washington Street
Kokomo, IN 46904-9003
Phone: (765) 455-9339
E-mail: techkokomo@purdue.edu

Lafayette
5500 State Road 38 East, AD 2900
Lafayette, IN 47903-9405
Phone: (765) 496-6886
E-mail: techlafayette@purdue.edu

Muncie
Ball State University AT 223
Muncie, IN 47306-0256
Phone: (765) 285-5554

New Albany
4201 Grant Line Road
New Albany, IN 47150-2158
Phone: (812) 941-2353
E-mail: technewalbany@purdue.edu

Richmond
Indiana University
2325 Chester Boulevard
Richmond, IN 47374-1220
Phone: (765) 973-8228
E-mail: techrichmond@purdue.edu

South Bend
1733 Northside Boulevard
South Bend, IN 46634-7111
Phone: (574) 520-4180
E-mail: techsouthbend@purdue.edu

Readmission

Students who are dropped from Purdue University for academic deficiency must be out of the University for at least one semester (not including summer session) and must apply for readmission through the Office of the Dean of Students. There are deadlines for submitting an application with a $100 fee, and for removing all encumbrances. A student may strengthen his or her application by submitting evidence of successful coursework from another institution. Information about the readmission process is available from the Office of the Dean of Students; Schleman Hall; 475 Stadium Mall Drive; West Lafayette, IN 47907-2050; (765) 494-1747.

Nondiscrimination Policy Statement

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life.

Purdue University views, evaluates, and treats all persons in any University related activity or circumstance in which they may be involved, solely as individuals on the basis of their own personal abilities, qualifications, and other relevant characteristics.

Purdue University prohibits discrimination against any member of the University community on the basis of race, religion, color, sex, age, national origin or ancestry, marital status, parental status, sexual orientation, disability, or status as a disabled or Vietnam era veteran. The University will conduct its programs, services and activities consistent with applicable federal, state and local laws, regulations and orders and in conformance with the procedures and limitations as set forth in Executive Memorandum No. D-1 which provides specific contractual rights and remedies. Additionally, the University promotes the full realization of equal employment opportunity for women, minorities, persons with disabilities and Vietnam era veterans through its affirmative action program.

Expenses

The cost of attending Purdue University varies, depending on a variety of factors, including where a student chooses to live; travel expenses; food costs; enrollment in a special program; date of entry; the college or school in which you are enrolled; etc. Basic minimum costs for the two-semester 2006–07 school year on the West Lafayette campus are shown in the following table. Some academic programs may have additional fees. Contact the department if you have questions.

2006–07 Estimated Costs West Lafayette Campus (Fall and Spring Semesters)

Items		Indiana Resident	Nonresident
Tuition/Fees		$6,846* †	$21,016* †
Room/Board		7,140	7,140
Books/Supplies		990	990
Travel		270	420
Miscellaneous		1,650	1,650
	Total	**$16,896**	**$31,216**

** First-time students enrolled at the West Lafayette campus beginning in the Fall 2002 Semester and thereafter pay these fees. Undergraduate, graduate, and professional students who were enrolled as degree-seeking students in the Spring 2002 Semester on the West Lafayette campus may be eligible for a lower fee. To maintain eligibility for a lower fee, students must be continuously enrolled (Fall and Spring semesters); eligible students will pay a lower fee until the date of attainment of one degree or until the Fall 2007 Semester, whichever comes first. Beginning in the Fall 2006 Semester, students who enroll for a new degree-seeking program will be assessed a campus repair and rehabilitation fee. That fee, as approved by the Board of Trustees, is also retroactive for students who enrolled as new degree-seeking students in Summer 2006.*

† Your budget can vary, depending on your state of residence and the type of housing and academic program you select. Some programs have additional fees: Engineering, $600; Management, $936; Flight, individual courses in the program have additional fees that can be reviewed at www.purdue.edu/bursar or by contacting the Department of Aviation Technology. International students pay an additional $50 per semester.

Rates and refund schedules are subject to change without published notice.

Full-time students are charged a general service fee, a technology fee, and a repair and rehabilitation fee. The general service fee provides students with access to a variety of services and privileges such as access to the Recreational Sports Center and the Boilermaker Aquatic Center for recreational sports activities. It also allows deep-discount ticket prices for most Convocations-sponsored events and for Intercollegiate Athletics contests with presentation of a student ID card.

With payment of full fees, students have access to the Purdue Student Health Center that covers medical clinical office visits, nutrition consultations, health education services, and a limited number of sessions for psychological counseling. Additional fees are charged for lab, x-ray, urgent care, physical therapy, and other services.

The technology fee is used to enhance student access to the campus networks, computer laboratories, and electronic access to information and databases. Technology fee funds are used to equip classrooms with computer and video projection equipment.

Beginning in the Fall 2006 Semester, students who enroll for a new degree-seeking program will be assessed a repair and rehabilitation fee. (The fee is retroactive for students who were enrolled as new degree-seeking students in Summer 2006.) This fee is assessed to address maintenance funding for buildings and infrastructure on campus, and funds received from the fee will be dedicated to building and infrastructural needs. The establishment of the fee is a result of growing unfunded needs to address critical building and infrastructural upkeep.

Miscellaneous personal expenses include such items as clothing, transportation, telephone, newspapers and magazines, dry cleaning and laundry, entertainment, etc.

Refunding of Fees and Tuition

Registered students who find it necessary to cancel their registration before the beginning of classes, upon the recommendation of the registrar, will receive a 100 percent refund of all fees and tuition.

Non-Title IV Aid

Students who withdraw during the first six weeks of a semester, with the recommendation of the registrar, will receive a partial refund of the general service fee and tuition. More specifically, the percentage of refund is determined as follows:

Fall or Spring Semester

1. Withdrawal during the first or second week, 80 percent refund
2. Withdrawal during the third or fourth week, 60 percent refund
3. Withdrawal during the fifth or sixth week, 40 percent refund

No portion of the technology fees, repair and rehabilitation fees, or academic building facilities fee will be refunded once classes begin.

Title IV Aid

Once classes begin, refunds are prorated based on the date of withdrawal from class(es). Refunds are based on a diminishing scale through 60 percent of the semester. Refunds are calculated on all fees and tuition.

Summer Modules

Refunds for summer modules are proportionate on the same basis as semester refunds.

Financial Aid

Purdue University recognizes that not all students and their parents can afford to finance a college education entirely from their income and assets. To ensure that all students have an opportunity to obtain a college education regardless of their financial circumstances, the University, through the Division of Financial Aid, administers a four-fold program of scholarships, grants, employment opportunities, and loans.

The Purdue University Division of Financial Aid administers federal, state, and University financial assistance programs. These programs require students to have a high school diploma or GED. Information regarding the GED is available through any public high school or any state department of education/public instruction.

Most types of aid are based upon financial need and satisfactory academic progress. To be considered for all types of financial aid, you must submit a Free Application for Federal Student Aid (FAFSA). This form should be submitted online at www.fafsa.ed.gov or can be obtained from the Division of Financial Aid; Schleman Hall of Student Services, Room 305; 475 Stadium Mall Drive; West Lafayette, IN 47907-2050.

You should apply early for Purdue University financial aid. Eligible FAFSAs postmarked by March 1 will receive preference in the awarding of aid.

You are welcome to visit the campus to discuss not only family budgeting in order to meet college expenses, but also the types of available aid and the application procedure.

Walk-in counselors are available from 9 a.m. to 5 p.m. on Monday, Tuesday, Wednesday, and Friday, and from 1 to 5 p.m. on Thursday. Phone counselors are available from 8 a.m. to 5 p.m. Monday through Friday at (765) 494-0998. Computer access to your aid status is available at www.ssinfo.purdue.edu.

Resident Assistants

University Residences has a plan whereby graduate and undergraduate students who are at least 21 years of age by the end of their first semester of employment with University Residences can be hired as a resident assistant (RA). An RA devotes approximately 20 hours each week to his or her duties in this capacity, with most of the time scheduled during evenings and weekends. Compensation for an RA position includes reduced tuition, room and board, and a small stipend. Applications and additional information for those interested in becoming a resident assistant can be found at www.housing.purdue.edu.

Living Accommodations

University housing facilities and programs are available to all students based on Purdue's policy of equal opportunity regardless of national origin, race, or religion. It is the University's desire and expectation that all others providing housing or services to Purdue students will do so in a manner consistent with this policy. However, the University does not approve or disapprove specific housing accommodations since it believes that the choice of housing rests with you, the student.

As a Purdue student, you have a variety of choices when it comes to choosing your new home while attending school. You can live in one of 14 University Residences, a fraternity or sorority house, cooperative housing, or in a privately operated facility within the local community.

Apply for housing as soon as possible — whether or not you've made a final decision about enrolling at Purdue. University Residences begins accepting applications from admitted stu-

dents in September for the following academic year.

Housing assignments generally are made in the order in which applications and $75 housing deposits are received, after housing assignments are made for certain groups such as Learning Communities and National Merit finalists. Therefore, you should apply for housing as soon as possible to improve your chance of assignment to a residence of your higher preference. You will have the opportunity to indicate your housing preferences and a specific roommate request at the time you receive your housing contract mailing.

Apply online at www.housing.purdue.edu to expedite your application. If you don't have Internet access, use the paper application included with the housing brochure in your initial admission packet. With your application, you will be required to submit a $75 deposit. If you do decide to live on campus, this deposit will be credited to your first housing bill; if you do not, the deposit is refundable per the schedule below.

March 1 is the preferential housing application deadline. Because the University does not guarantee on-campus housing, it is important that students meet this deadline, although applying earlier is recommended. Students who apply for housing after the March 1 deadline will be assigned to a residence if space is available. First-year students are not required to live on campus.

Students who apply for housing by March 1 receive a housing contract mailing by April 1, which will be due to be returned by mid-April. When you receive your housing contract mailing, you will be prompted to fill out an online preference form, which will be used to assign your residence and match you with a compatible roommate. If you want to live with a friend, each of you must rank your residence preferences the same and request each other as a roommate.

New students who notify University Residences in writing of their choice to cancel their housing application will receive a refund of the housing deposit as follows:

Fall semester or summer session, cancellation received:

- Before May 1, $75 refund
- Between May 1 and May 31, $25 refund
- On or after June 1, no refund

Spring semester, cancellation received:

- Before December 1, $25 refund
- On or after December 1, no refund

The Office of the Dean of Students offers assistance to students seeking off-campus housing. After being admitted, students should contact the Office of the Dean of Students as early as possible to begin their search for off-campus housing: visit www.purdue.edu/odos, e-mail offcampushousing@purdue.edu, or call (765) 494-7663.

University Residences for Undergraduate Men and Women

University Residences provides accommodations for approximately 11,100 single undergraduate men and women.

The all-male residences include Cary Quadrangle, providing accommodations for 1,166 students, and Tarkington and Wiley Halls, each providing space for about 700 students.

Six University Residences — Owen, McCutcheon, Harrison, Shreve, Earhart, and Hillenbrand halls — house approximately 800 students each, and Meredith Hall accommodates 620 students. These are coeducational units with male and female students assigned to separate areas of each building.

Duhme, Shealy, Wood, Warren, and Vawter halls comprise the all-women's residences and are referred to as Windsor Halls. Windsor Halls provide accommodations for 595 students.

All residences contain generous lounge space, recreation areas, kitchenettes, study spaces, and post office facilities.

As a student, you may choose from three plans consisting of 10, 15, or 20 meal swipes a week, as suits your lifestyle. University Residences offers students who are sophomore 3 and above the Black Meal Plan, consisting of a block of 210 meals, and the Gold Meal Plan, consisting of 300 meals. With these plans, you may use your meal swipes as often as you wish. All meal plans include Dining Dollars, which may be used to buy additional food items at University Residences' Dining Services retail operations, such as grills and mini-marts. You may eat at any University Residences' Dining Services facility by using your University ID card.

Computer labs are available in each University Residences hall. If you bring a personal computer, you may use the Residences' optional Ethernet connections or data-over-voice service

to access the University computing network directly from your room.

Room and board rates in 2006–07 vary from $5,528 to $8,624, depending on your chosen meal plan option, residence, and room size.

Approximately 700 spaces in Hawkins Hall are reserved for assignment to older undergraduate students. Hawkins Hall residents are not required to purchase a meal plan. Accommodations in Hawkins Hall are on a room-only basis. The cost for a room in 2006–07 ranges from $320 to $585 a month depending on the type of room selected; that includes local telephone service with voicemail and call waiting.

More than 1,000 spaces for single undergraduate students are available in Hilltop Apartments. The apartments house two, three, or four students and are available for both single male and female students. All normal policies and regulations of University Residences apply to the apartments. Students living in the apartments may choose a meal plan that allows access to any University Residences Dining Services facility, or they may choose a non-board option. The room and board rate for 2006–07 in the apartments ranges from $6,172 to $9,466 a year.

(Rates quoted are subject to change as approved by the Board of Trustees and undoubtedly will be somewhat higher during the 2007–08 period of this publication.)

Visit www.housing.purdue.edu for additional information.

Accommodations for Married Students/Families

At Purdue Village, there are 1,000 University Residences-operated apartments located within a one-mile walking distance of the main campus. The apartments are unfurnished and equipped with a stove and refrigerator. There are one-bedroom and two-bedroom apartments, with the two-bedroom apartments having washers and dryers.

One-bedroom apartment costs range from $520 to $535 a month. Two-bedroom units range from $640 to $655 a month. Your rent payment covers all utilities, including local telephone service and Boiler TV (cable). These rates are effective during the 2006–07 academic year and are subject to change as approved by the Board of Trustees.

Each apartment is equipped with a connection for the campus cable TV system as well as for the campus computing network. The apartments are not air-conditioned, but tenants may bring or purchase their own air-conditioning unit as long as it meets specified criteria, has compatible voltage ratings, and the apartment's maintenance staff does the installation.

For more information on Purdue Village, visit www.housing.purdue.edu, call (800) 440-2140, or fax (800) 440-2141.

Cooperatives

Cooperative houses also provide housing for students. These houses are large residences that are owned and operated by 20 to 50 students. Seven women's houses and five men's houses have been recognized officially by the Office of the Dean of Students, and each house has a live-out faculty or staff advisor.

Students in cooperative houses significantly decrease their housing costs by contributing three to four hours of house duties a week. Residents of cooperatives pay an average of $3,000 per academic year for room and board. New members are selected by current members through a rush process each January.

To obtain information about becoming a cooperative member, contact the Office of the Dean of Students; Schleman Hall, Room 250; 475 Stadium Mall Drive; West Lafayette, IN 47907-2050; or call (765) 494-1231. Students are expected to complete and return application information by February 1 or earlier for membership the following fall semester.

Additional information is available at www.purduecooperatives.org.

Fraternities and Sororities

Purdue has 46 fraternities and 24 sororities. Most members live in chapter houses, and membership is by invitation.

Sororities provide an opportunity in the fall for interested women students to join a chapter. Yearly costs for sororities range from $3,300 to $4,380. The average number of women living in a sorority is 88.

In the fall, the Interfraternity Council provides recruitment information through which interested men can become acquainted with the fraternity system. Open recruitment is conducted throughout the academic year. The average number of men belonging to a fraternity is 72, and costs range from $2,000 to $3,500 a semester.

For additional information, contact the Office of the Dean of Students; Purdue University; Schleman Hall, Room 250; 475 Stadium Mall Drive; West Lafayette, IN 47907-2050; or call (765) 494-1232. Online information is available at www.purdue.edu/greek.

Student Services

Accelerated Programs

The departments of the College of Science give a variety of honors and offer advanced placement courses. Through the awarding of additional credit hours, you are permitted to complete your programs at an accelerated rate as well as enroll in scientific courses of greater depth.

You also can establish credit by examination on specific Purdue courses. Eligibility is based on advanced work done in high school or on independent study.

For specific information, contact the Academic Advising Office of the College of Science.

Academic Advising

The Academic Advising Office of the College of Science will be a valuable resource for you as an undergraduate. Generally, you will work with the same advisor throughout your freshman and sophomore years. During your junior and senior years, you may be assigned a faculty advisor in addition to a professional advisor. Your academic advisor will aid you in developing your total educational plan. In addition to coursework, your education may include the pursuit of experiences such as internships, research opportunities, volunteer work, or study abroad. You will meet with your advisor for curriculum planning assistance each semester. During advising appointments, you will discuss course requirements for your major, placement criteria for courses, elective choices, concentrations and minors of interest, special opportunities, co-curricular opportunities, and your academic progress. Your advisor also will be available to discuss your career goals, refer you to appropriate resources, and address other issues of concern to you.

In the course of your studies, you will encounter situations governed by state laws and University regulations. Although you will be responsible for the fulfillment of degree requirements, your advisor will help keep you informed about such requirements and advise you concerning ways to satisfy various regulations. A thorough study of this *College of Science* bulletin as well as other official University publications is recommended, although they do not include all of the University rules and regulations. From time to time, you will be given notice of required actions (other than those listed in this bulletin) by e-mail, at your campus address, or in the campus press.

Whether you are a prospective student or are already enrolled at the University, you are welcome to write or visit the Office of Undergraduate Education in Room 231, Mathematical Sciences Building. The office is open weekdays from 8 a.m. to 5 p.m.

Center for Career Opportunities – Science Division

The Center for Career Opportunities office in Science — CCO-Science — can help you figure out where you want to go and how to get there. A career counselor can help you find a particular career path, make sure you are in the right major to suit your interests, and help you technically improve your resume and find experiences to enhance it in your job search or other post-graduate plans.

You may make an appointment with a career counselor in the Office of Undergraduate Education, Room 231, Mathematical Sciences Building, or phone 494-1771 to make an appointment.

Science Diversity Office

The Science Diversity Office is an umbrella organization that encompasses both the Multicultural Science Programs and the Women in Science Programs. The College of Science believes that all students have a better educational experience within a diverse environment. Therefore, programming is available to increase the recruitment and retention of students who are underrepresented in the College of Science. All programs are open to all students regardless of race or gender.

Multicultural Science Programs

The College of Science offers programming to increase the number of underrepresented groups graduating in the sciences. Programs include precollege activities for middle and senior high school students, summer transitional programs for matriculating first-year students, classes to cultivate leadership and academic success, mathematics enrichment instruction, and personal counseling.

The Association of Multicultural Science Students, founded in 1972, offers opportunities for multicultural students to grow academically and professionally by featuring workshops, incentive programs, community outreach programs, and coalition building.

Women in Science Programs

The College of Science is committed to making careers in all areas of science accessible to female students. The goals of the Women in Science Programs are to provide personal support, enhance self-esteem, and share effective strategies to assist women in achieving their academic goals. Components of the Women in Science Programs include a residential program for first-year students, tutoring, an undergraduate mentoring program, and a graduate mentoring program.

The residential program puts a group of first-year students together on several floors of a residence hall. Tutoring and other special programs, including the undergraduate mentoring program, are available directly in the residence hall. In the undergraduate mentoring program, each first-year student in the residence is matched with a more advanced student in the same major to provide a unique mentoring relationship.

Both the undergraduate and graduate mentoring programs provide monthly dinner programs in which the students can network with each other and listen to speakers with the goal of increasing the number of females in the College of Science through providing role models and strategies for success.

Directors and Special Program Coordinators

Kerry P. Daley, Director of Undergraduate Education, kdaley@purdue.edu
Alan H. Welch, Director of Academic Advising, welch@purdue.edu
Laurie Swift, Coordinator of New Student Recruiting, recruiting@science.purdue.edu
Cher W. Yazvac, Coordinator, Center for Career Opportunities – Science Division; yazvac@science.purdue.edu
Barbara S. Clark, Director of Science Diversity Office; BarbClark@purdue.edu
Zenephia E. Evans, Director of Multicultural Science Programs; zevans@purdue.edu

Counseling

Each college or school has a general counseling office and academic advisors who can answer questions about degree requirements, registration, dropping and adding courses, and withdrawal from school.

Mature and qualified faculty and staff, graduate students, and older undergraduate students are employed on the University Residences counseling staffs and live in the halls to assist students with personal and scholastic problems.

The Office of the Dean of Students is staffed by professionally trained counselors who provide personal, educational, and career counseling. They can, for example, offer assistance or refer you to specialized help in such areas as vocational choice, campus activities, scholastic concerns, multicultural programs, assistance for students with disabilities, home and community relationships, and coping strategies.

Other campus services for students include the Counseling and Guidance Center, Counseling and Psychological Services, Financial Advising Service, International Students and Scholars, Learning Center, Marriage and Family Therapy Center, Steer Audiology and Speech-Language Center, Student Health Center, and Writing Lab.

Services for Students with Disabilities

Services for students with disabilities (physical, mental, and learning disabilities) are provided through the Adaptive Programs division of the Office of the Dean of Students. Services vary according to the needs of students. They include interpreters, readers, note-taking assistance, accessible class scheduling, parking permits, and help working with professors. For further information, contact the Office of the Dean of Students. The Web site is www.purdue.edu/odos/adpro. The general office number is (765) 494-1747, and the TDD number for people with hearing or speech impairments is (765) 494-1247.

College of Education Academic Services

The College of Education's Academic Services Unit offers several types of assistance important to students enrolled in teacher education programs. At Purdue, students in teacher education programs are academic majors in the colleges of Agriculture, Education, Consumer and Family Sciences, Liberal Arts, Science, and Technology. The College of Education offers majors in the fields of elementary education, social studies education, and special education. The Academic Services Unit within the College of Education assists all students in teacher education, regardless of the college in which their major is housed, by providing the following specialized services: admission and retention, field experiences, and licensure.

The Office of Professional Preparation and Licensure processes students' applications for all teacher education programs, provides information about programs available at Purdue, and monitors students' progress for retention within programs. As a student, you should be aware that admission to the Purdue University Teacher Education Programs is a separate and distinct step beyond admission to the University and that the standards for admission to, and retention in, teacher preparation programs are higher than those required to remain in good standing within the University. This office also provides explanation and interpretation of teacher licensing requirements. Students who have completed teacher education programs are evaluated and recommended for licenses. This office maintains licensing records and provides accreditation support.

See www.education.purdue.edu/oppl for more information.

The Office of Field Experiences coordinates all placements in area schools in order to provide students with the early field experiences and student teaching experiences required in all teacher education programs.

See www.education.purdue.edu/fieldexp for more information.

Center for Career Opportunities

The staff of the campus-wide Center for Career Opportunities will assist you with your career-related employment search. Counseling, guidance, and a wide variety of job search services related to internships and full-time employment are available.

The center maintains contacts with many industrial and business organizations as well as with governmental and non-profit agencies. You can arrange interviews with employer representatives or explore current openings for internships or full-time positions. For more information, refer to the center's home page at www.cco.purdue.edu.

The Technology Resources Center

The Technology Resources Center (TRC) provides curricular materials, instructional resources, and technology support and service for educators. It assists students, pre-service teachers, faculty, and staff to ensure that they possess the necessary skills to use technology in support of their professional goals. This includes a 24-workstation computing facility, software and equipment checkout, and an e-Portfolio development site. The TRC also serves as a textbook review site for annual state textbook adoption services. See www.education.purdue.edu/trc.

For Further Information

General Information. The *General Information* bulletin will give you further details about admission, fees, expenses, financial aid, registration, living accommodations, student activities, student services, requirements for graduation, transfer students, ROTC, and other areas of student interest.

University Regulations. The *University Regulations* bulletin will provide details about academic, conduct, and student organization policies and procedures. You can request copies from Purdue Marketing Communications, South Campus Courts, Building D, 507 Harrison Street, West Lafayette, IN 47907-2025; (765) 494-2034; or access the Web site at www.purdue.edu/oop/univregs.

Graduation Rates. Graduation rates for the West Lafayette campus are available by contacting the Office of Management Enrollment, Schleman Hall, 475 Stadium Mall Drive, West Lafayette, IN 47907-2050; (765) 494-0292, enrollmentmanagement@purdue.edu. These rates are calculated and made available as required by the Student Right-to-Know and Campus Security Act.

Alcohol Policy. Purdue students are subject to Indiana law, which prohibits consumption or possession of alcoholic beverages by anyone under 21 years of age. The University does not permit alcohol to be brought onto Purdue property, with certain exceptions, by any person regardless of age. Fraternity and sorority houses and student cooperative housing units are considered off-campus housing and are permitted to have alcoholic beverages, but they must observe specific University guidelines and state law.

The University does not have the responsibility or the authority to control off-campus student drinking, but it does attempt to give students the opportunity to make informed and mature decisions about alcohol use. A variety of educational and counseling programs are offered to help students deal with all aspects of alcohol and drug use, from peer pressure to dependency.

Safety. The University strives to provide a safe and secure environment for students, staff, and visitors. The University distributes an annual security report containing campus crime statistics and information relating to campus safety and security policies and programs. The report is available on the Web at www.adpc.purdue.edu/PhysFac/police. A paper copy may be requested by calling (765) 494-8221 or contacting the Purdue University Police Department, Terry House, 205 S. Intramural Drive, Purdue University, West Lafayette, IN 47907-1971.

Intellectual Property. All students are subject to the University policy on intellectual property, Executive Memorandum B-10, which can be found at www.purdue.edu/oop/policies/ pages/teach_res_outreach/b_10.html.

Information Technology

The Office of the Vice President for Information Technology is in charge of the integrated computing and telecommunications services on the West Lafayette campus. The information technology (IT) program, formally known by the acronym ITaP, serves Purdue faculty, staff, and students.

Computing services range from the very visible computing laboratories that are located throughout campus to the unseen but essential enterprise applications that facilitate the business of the University. Computing staff install, maintain, operate, and repair computer equipment, and provide services including career accounts, e-mail, calendering, directories, and database administration.

In addition to laboratory facilities, instructional services include:

1. The WebCT course management system.
2. Technology in the Classroom (TIC) sites.
3. Help in preparing multimedia materials to enhance instruction.
4. Grants for innovative instructional projects using information technology.
5. The Digital Learning Collaboratory, a joint project with the Purdue University Libraries.
6. The Adaptive Programs lab for those with special needs.
7. Web-based access to many software applications (DACS).

Distributed computing and grid computing are basic elements in the computing program. An IBM SP, a Regatta, and Linux clusters provide supercomputing power for intensive computational needs ranging from simulations and modeling to computational chemistry.

The optical fiber network known as I-Light links Purdue's West Lafayette campus to Indiana University and Indiana University-Purdue University Indianapolis (IUPUI) and joins computers at Indiana University and Purdue into a virtual machine room with teraflop capabilities. Parallel programming services and archival storage systems are available to researchers.

The Envision Center for Data Perceptualization provides visualization computing and multimedia production services as well as animation and rendering capabilities, computer-aided design, large-scale data handling, haptic interaction capabilities, and virtual environment creation. Within the center there is an access grid node linking the University to several hundred research sites around the globe, plus portable versions of the node to facilitate videostreaming. Separate video production and audio-visual duplication facilities are available as are satellite uplink and downlink capabilities and broadcast and network services.

Policies and best practices provide the foundation for a security system that also includes:

1. Firewall protection.
2. Free anti-virus applications.
3. Spam filtering.
4. Authentication and authorization procedures.

5. Vulnerability scanning.
6. Forensics.

Telecommunications services provided by ITaP range from basic phone services for campus offices and residences to wireless connectivity in areas throughout the campus. ItaP supports the infrastructure that links campus buildings by optical fiber and provides commodity Internet to residences and offices as well as connectivity to Internet 2 for researchers.

ITaP negotiates contracts for mass purchases of informational technology equipment and licenses for software used by University personnel. As an additional service, ITaP has negotiated significant discounts for faculty, staff, and students on personal purchases of hardware available through the Web, and for software media sold on campus. The hardware discounts also are available to Purdue alumni.

To help University personnel stay up to date on the rapidly changing information technology field, courses and one-on-one consulting are available on every aspect of computing and telecommunications, including selecting phone systems, basic use of Microsoft office applications, programming, visualization, instructional media, e-learning, and research techniques.

For additional information, please consult www.itap.purdue.edu, call (765) 494-4000, or visit the ITaP Customer Service Center in Stewart Center, Room G068, 128 Memorial Mall, West Lafayette, IN 47907-2034.

Libraries

The collections and services of the Purdue University Libraries are an important resource for your educational experience.

The University Libraries system on the West Lafayette campus includes 13 subject-oriented libraries and the Hicks Undergraduate Library. The Libraries provide a print collection of nearly 2,500,000 volumes and more than 3,100,000 microforms of older scholarly materials in addition to many current scientific and technical reports. Approximately 21,000 serial titles are received, including periodicals and serial publications of societies, institutions, and the federal and state governments. Federal government publications and patents are received on a depository basis. The Libraries also offer more than 7,000 electronic information sources. The Libraries Web site at www.lib.purdue.edu is the gateway to information and services.

Local library resources are supplemented by the four million items of research materials held by the Center for Research Libraries in Chicago, including 7,000 rarely held serial titles. Through Purdue's membership in the center, faculty and graduate students are assured of fast access to this material through the Interlibrary Loan Office in the Humanities, Social Science, and Education (HSSE) Library in Stewart Center.

The library collections and services of the Big Ten libraries, the University of Chicago, Ball State University, and Indiana State University also are available to Purdue students and faculty under cooperative agreements. Individuals who wish to use these facilities are encouraged to contact Circulation Services in the HSSE Library.

The Digital Learning Collaboratory (DLC) is located in the Undergraduate Library. It is a joint initiative of the Purdue Libraries and Information Technology at Purdue. The DLC supports student learning through access to state-of-the-art hardware and software for creating multimedia projects in individual, group work, and instructional settings. It facilitates the integration of information and technology literacy into the undergraduate curriculum.

Librarians and a knowledgeable reference staff are readily available to assist students with their information retrieval needs.

Students in the sciences will find most of the materials needed for study and research in one or more of the libraries specializing in the physical and life sciences. Reference and instruction services are available in each of these libraries.

The Life Sciences Library, located in Lilly Hall of Life Sciences, has the collections most closely related to the programs of the College of Agriculture and the Department of Biological Sciences. The library has about 84,000 bound volumes and more than 970 current subscriptions, specifically on the topics of agriculture, biology, agricultural and biological engineering, agronomy, animal sciences, biochemistry and molecular biology, botany and plant pathology, entomology, food science and technology, forestry and natural resources, horticulture, genetics, and environment. Older volumes are held in the University Libraries' on-campus repository.

The M. G. Mellon Library of Chemistry maintains a strong collection of materials and information on services related to the field of chemistry. The 56,000-volume collection includes over 300 journals in all areas of chemistry. Extensive reference services include access to the major indexes to chemical information, spectral data sources, and hazardous substance information in both print and electronic formats.

The Earth and Atmospheric Sciences Library contains more than 30,000 volumes, including a comprehensive collection of U.S. Geological Survey and state survey publications. The library subscribes to about 250 journals. Additional resources include a consolidated map collection of nearly 200,000 topographic and geologic maps, a large collection of navigation maps, gazetteers, aerial photos, and a Geographic Information Systems station that includes a map scanner.

The Mathematical Sciences Library, the principal library resource for the departments of Computer Science, Mathematics, and Statistics, provides an excellent collection especially strong in journals, conference proceedings, and professional society publications. The library contains more than 59,000 volumes.

The Physics Library is the principal library resource for research and instruction in physics. The 59,000-volume collection includes about 260 journals with emphasis on condensed matter and solid state physics, semiconductor physics, astrophysics, high energy physics, and materials science.

Numerous electronic resources also support study and research in these fields. Librarians and reference staff in each library assist users in retrieving information in all formats.

Study Abroad

Through Programs for Study Abroad, you gain international experience, develop maturity and independence, and increase your knowledge of other cultures. These traits help prepare you for a successful career after graduation from Purdue.

With over 200 programs in more than 45 countries, you — like all Purdue students — have the opportunity to participate in study, work, or internships abroad. You can take courses in your major or minor, or earn general elective credits. Some programs are designed for students in specific areas of study, while others are open to all Purdue students regardless of major. Academic credit transfers back to Purdue, allowing you to fit study abroad into your four-year plan. You remain enrolled as a regular Purdue student while on study abroad programs, and you therefore are eligible for Purdue University scholarships and financial aid, which may be applied to program fees.

Programs for Study Abroad awards a limited number of scholarships to students who have been approved for study abroad based on need and merit. In addition, a variety of other scholarships also are available. Information about all scholarships can be found on the Study Abroad Web site.

Study Abroad programs vary by discipline, foreign language ability, and length of stay — from one week to one year — making study abroad accessible for all students. You can apply online at www.studyabroad.purdue.edu.

Graduation Requirements

The College of Science is in the process of reviewing its undergraduate curriculum. Students should check the College of Science Web site (www.science.purdue.edu/academic_programs/majors.asp) and speak with an academic advisor for the most up-to-date information and requirements.

The College of Science offers two bachelor's degrees, the Bachelor of Science (B.S.) and the Bachelor of Science in Chemistry (B.S. in Chemistry).

The two bachelor's degrees are traditional four-year degrees. All programs leading to the two degrees have certain requirements in common:

1. Satisfaction of various University-wide requirements, i.e., academic scholarship, residence, fee payments, etc., as described in the Purdue University *General Information* bulletin.
2. Completion of either the general requirements of the College of Science and of

your departmental major (see "Actuarial Sciences," "Biological Sciences," "Chemistry," "Computer Sciences," "Earth and Atmospheric Sciences," "Mathematics," "Physics," "Statistics," or "Interdisciplinary Science".

If you successfully complete the requirements of one of the departmental honors programs (see listings within the applicable sections), your transcript will be appropriately annotated.

It is the responsibility of each student to become familiar with degree requirements, graduation requirements, and all other aspects regarding academic progress. Each student is assigned an advisor who will assist the student in planning curricula and will give advice that assists the student toward timely graduation. However, the ultimate responsibility for understanding and completing degree and graduation requirements lies with the student, not the advisor.

General Requirements — B.S. Degree

Students earn a B.S. degree by completing a major in one of the seven departments of the College of Science or by completing an interdisciplinary science major. (The B.S. in Chemistry is awarded to those who complete the program approved by the American Chemical Society; information can be found on page 50.)

In addition to meeting these general requirements, students with departmental majors must complete the requirements established by their departments.

B.S. Degree Requirements: College of Science

Total 124 (or more) semester credits
English composition: 6–7 credits
Modern foreign language: 6–16 credits
General education: 18 or more credits
Mathematics requirements: 11 or more credits
Science requirements: 12 or more credits

Total of 124 (or more) Semester Credits

An average of 15.5 credits per semester is sufficient to accumulate 124 credits in eight semesters. Students with a graduation index of less than 3.0 are advised not to take more than 17 credits in any one semester. At least 32 of these credits must be taken in residence at Purdue, in accordance with University regulations.

English Composition

Students must complete Freshman Composition — ENGL 106 (First-Year Composition) (4 cr.) or ENGL 108 (Accelerated First-Year Composition) (3 cr.) — and an advanced composition course. The faculty that teaches freshman composition determines whether a student is placed in ENGL 106 or 108. The advanced composition course must be at or above the 200-level and must be approved by the dean of the College of Science or the dean's designee.

Courses currently approved include: ENGL 205 (Introduction to Creative Writing), ENGL 304 (Advanced Composition), ENGL 306 (Introduction to Professional Writing), ENGL 309 (Computer-Aided Publishing), ENGL 406 (Review Writing), ENGL 419 (Multimedia Writing), ENGL 420 (Business Writing), ENGL 421 (Technical Writing), and ENGL 424 (Writing for the Computer Industry). Each course counts for three credit hours.
Note: Enrollment in advanced composition courses might be limited.

Modern Foreign Language

All College of Science majors are expected to have proficiency in another language besides their native language. "Native language" refers to the language of instruction in the school that awarded the high school diploma. Competency in the second language must be demonstrated at the fourth-semester college level by completing, with a regular passing grade, a fourth-semester, college-level course in a modern foreign language or by passing an equivalent proficiency examination.

To demonstrate proficiency in your native language you may either a) present your high school transcript or equivalent, which states the language of instruction; b) successfully pass an approved exam in your native language; c) successfully complete a literature course or a course beyond the 202-level taught in your native language. If this course is a literature, history, or culture course, it may fulfill part of your general education requirement.

If your native language is not English, you may satisfy the foreign language requirements by demonstrating your competence in English by completing the English composition requirement of the College of Science and COM 114 (Fundamentals of Speech Communication) (3 cr.).

You may not earn credit toward graduation for courses below the 300-level in your native language. The Foreign Languages and Liter-

atures department may not allow any native speaker to take 301/302 or 401/402 language development courses in their native language but will allow students to take history, literature, and culture courses.

If you expect to pursue graduate studies, you should note that at some universities one requirement for a Ph.D. in science is a reading knowledge of one or two modern languages. For serious work in many areas of science, such knowledge is necessary.

If you successfully complete the professional semester in a high school teaching curriculum or the applied physics curriculum, you need only complete, with a regular passing grade, a second-semester, college-level course in a modern language or pass an equivalent proficiency examination.

General Education

You must complete 18 credits of study in the humanities, social sciences, and behavioral sciences. The College of Science identifies the following five broad areas:

1. Humanities: literature, philosophy, and aesthetics
2. Social Studies: history or political science
3. Behavioral Sciences: economics, psychology, sociology, and anthropology
4. Communication:

   Skills: COM 224 (Communicating in the Global Workplace), COM 314 (Advanced Presentational Speaking), or COM 320 (Small Group Communication);

   Aesthetics/General Education: COM 240 (Introduction to Oral Interpretation), COM 250 (Mass Communication and Society), COM 251 (Introduction to the Electronic Mass Media), COM 312 (Rhetoric in the Western World), COM 316 (Controversy in American Society), COM 318 (Principles of Persuasion), or COM 329 (History of the Mass Media).

5. Interdisciplinary Studies: Any African American, American, Jewish, Religious, or Women's Studies course; any culture or civilization course in Foreign Language, EDPS 235 (Learning and Motivation); SCI 460 (Science and Society); and University honors courses (HONR) (only 3 approved honors credits may be used to meet general education requirements)

General Education Course Distribution

A minimum of 18 credits is required and must be distributed as follows:

a. Two courses must be from areas 1, 2, or 3, in the same department.
b. Two more courses must be from one of the remaining two areas (1, 2, or 3 only) not chosen to meet requirement "a." These two courses do not have to be in the same department, but they must be in the same area.
c. Two more courses from any of the five areas (1, 2, 3, 4, and 5).

Courses at the 500-level may be taken pass/not pass to satisfy the general education requirement. Courses below the 500-level must be taken for a letter grade to meet this requirement.

Unacceptable General Education Courses

Independent research courses are not acceptable. Courses cross-listed with a course in the College of Science or any that have a laboratory or studio component are also not acceptable. In addition, the following specific courses are not acceptable to meet this requirement: PHIL 150 (Principles of Logic), PHIL 450 (Symbolic Logic), PHIL 550 (Advanced Symbolic Logic), PSY 204 (Use Of Computers in Psychology), PSY 500 (Statistical Methods Applied to Psychology, Education, and Sociology), PSY 501 (Mathematics Essential for Quantitative Psychology), and SOC 382 (Introduction to Methods of Social Research).

If you have any questions about the general education requirements, please ask your advisor to help you early in your course planning.

Mathematics

You must take at least 11 credits of mathematics courses selected to meet the requirements of your departmental major. All mathematics courses must be at the level of calculus or above.

Science

Students in the College of Science must complete four laboratory science courses outside of their major discipline. At least two of the courses must be foundational laboratory science coursework in biological sciences, chemistry, earth and atmospheric sciences, or physics offered at a level appropriate for science majors. A list of acceptable courses is available at www.science.purdue.edu/catalog/lab. In addition to other and more advanced courses in these areas, certain courses in computer science or engineering may also be approved to complete the requirement. Courses, including their laboratory component, must be at least three credits each.

Academic Policies

"Pass/Not-Pass" Option. In addition to the grades "A," "B," "C," etc., traditionally assigned to indicate the level of performance in class work, an alternate grading system, the pass/not-pass option, has been established. This option gives you the opportunity to broaden your education with minimal concern for grades earned. Only free electives and courses at the 500-level in the 18-credit general education block may be taken under the pass/not-pass option.

The option is open only to students who are classified as sophomores or upper-division students. This option is not available to students on probation.

A student who is enrolled in a course under this option has the same obligations as those who are enrolled in the course for credit with letter grade. When the instructor reports final grades in the course, he/she will report that any such student who would have earned a grade of A, B, or C has passed the course, and that any other such student has not passed.

You may elect to use the pass/not-pass option for no more than two courses per year and not more than 20 percent of the 124 credits required for graduation. These two restrictions do not apply to credits taken beyond the 124-credit requirement for graduation. For example, if you complete 130 credits, you may take the extra six credits pass/not-pass, if those six credits are not specific courses required by your major or by the college.

The pass/not-pass option cannot be elected for a course that already appears on your academic record. If you are enrolled in a course under this option, you have the same obligations as those who will receive a letter grade. Courses taken under the pass/not-pass option are not used in computing grade indexes. See *University Regulations* for more information.

Multiple Course Enrollments. Occasionally, College of Science students may find it necessary to repeat coursework in order to make appropriate progress toward their degree objectives. Science students may attempt a course twice with the permission of their advisor. A third enrollment in a course, or an equivalent course, requires the permission of the dean or designee. An "attempt" is considered to be any time a course is recorded on the academic record, including withdrawals.

Declaration of Major. It is expected that students will refine their academic goals during the course of taking classes. Students must have declared a major in the College of Science before registering for classes in the college as a junior. Occasionally students will decide to pursue a different major outside of the College of Science but will have not yet met the entrance requirements for the new program. Students in the College of Science may register as an "undesignated" student for no more than four semesters, and only while classified as a freshman or sophomore.

Academic Credit Load. In accordance with University policy, Science students may take up to 18 credits with the permission of their academic advisor. Enrollment in more than 18 credits requires permission of the dean or designee. Students with a graduation index of less than 3.0 are advised not to take more than 17 credits in any one semester. Students on academic probation may not attempt more than 15 credits without permission.

Equivalent, Preparatory, and Transfer Courses. Current and relevant academic coursework is essential to providing a quality academic experience for science students. Credit that was earned more than 10 years ago may not be acceptable to meet degree requirements of the College of Science. A determination by the dean or designee about the acceptability of old coursework will be made upon request.

The College of Science utilizes lists maintained by the Office of the Registrar at www.purdue.edu/Registrar/InteralOps/CourseLists/ to determine which courses might be used to meet degree requirements as alternatives to those listed in this document. In addition, certain courses have been determined by the faculty to be preparatory and will not be accepted toward graduation from the College of Science. That listing is available at the same Web location.

Transfer students are welcome, but students are expected to complete at least 50% of the credits in their major in residence, with the vast majority of upper-level courses taken at Purdue. Exceptions will be reviewed by the dean or designee.

Minors. Science students may pursue minors in areas outside of their major that have

been approved by the various faculties of the University. See www.science.purdue.edu/academic_programs/minor.asp for the list of currently approved minors for College of Science students.

Abbreviations

The following abbreviations of subject fields are used in the "Graduation Requirements" and the "Plans of Study" sections of this catalog. Alphabetization is according to abbreviation.

ABE—Agricultural and Biological Engineering
AGEC—Agricultural Economics
AGRY—Agronomy
ANSC—Animal Sciences
ANTH—Anthropology
ASTR—Astronomy
BCHM—Biochemistry
BIOL—Biological Sciences
BMS—Basic Medical Sciences
BTNY—Botany and Plant Pathology
C E—Civil Engineering
CHE—Chemical Engineering
CHM—Chemistry
COM—Communication
C S—Computer Science
EAS—Earth and Atmospheric Sciences
ECON—Economics
EDCI—Educational Curriculum and Instruction
EDST—Educational Foundations and Administration
EDPS—Educational Psycho-Educational Studies
ECE—Electrical and Computer Engineering
ENGL—English
ENGR—Engineering
ENTM—Entomology
FNR—Forestry and Natural Resources
HORT—Horticulture
HSCI—Health Sciences
IE—Industrial Engineering
MA—Mathematics
ME—Mechanical Engineering
MGMT—Management
MSE—Materials Engineering
PHIL—Philosophy
PHYS—Physics
POL—Political Science
PSY—Psychology
SCI—General Science
SOC—Sociology
STAT—Statistics

Plans of Study

The College of Science undergraduate program gives you the opportunity to acquire a broad science education and/or to concentrate your studies in one of more than 60 specialized scientific areas. This wide variety of study is provided by the seven academic departments — Biological Sciences, Chemistry, Computer Science, Earth and Atmospheric Sciences, Mathematics, Physics, and Statistics — and by the interdisciplinary science major as supplemented by courses offered in other colleges/schools of the University.

All of the options described in the following pages are based on major programs in the College of Science. The names of the options are frequently taken from the supplementary courses. Students who want more depth in one of these supplementary areas than is possible while pursuing a science major should consult the bulletin of the college/school offering the supplemental courses for a possible major in that field.

In the charts throughout the "Plans of Study" section, figures enclosed in parentheses signify the number of credit hours, e.g., (3) signifies three credit hours.

In addition to satisfying various University-wide degree requirements, each science student must complete either the requirements of the college/school and of a departmental major or complete the requirements of an interdisciplinary science major. Details about departmental and interdisciplinary science plans of study and requirements follow.

The seven departments offer the more or less traditional scientific majors; the interdisciplinary science major is for students whose interests and professional plans require broad training in several sciences, and in many cases, substantial work outside the College of Science. Examples of career objectives that might be met within interdisciplinary science include science and technical writing, food science, prelaw, biometry, and environmental science.

Actuarial Science

The interdisciplinary actuarial science major is administered jointly by the Department of Mathematics and the Department of Statistics. The purpose of the program is to provide the broad quantitative background in mathematics, statistics, and related areas that is necessary for success in the actuarial profession and to provide the academic background needed to pass the first four actuarial exams.

Actuaries use mathematics, statistics, and financial theory to study uncertain future events, especially those of concern to insurance and pension programs. Actuaries may work for insurance companies, consulting firms, government, employee benefits departments of large corporations, hospitals, banks and investment firms, or, more generally, in businesses that need to assess the financial consequences of risk. A career as an actuary is better described as a "business" career with a technical basis than as a "technical" career. Actuaries assess their work as challenging and interesting and generally enjoy a good working environment. Actuaries are well paid and, according to several studies, the profession is more open than others to women and members of underrepresented minority groups. As might be expected, entry into the profession is very competitive, and success in the field demands commitment and hard work during college and the few years after graduation when the actuarial exams continue to be taken.

To become an actuary, one must become an associate, and ultimately a fellow, of one of the professional societies — the Society of Actuaries (SOA) or the Casualty Actuarial Society (CAS) — by passing examinations administered by them, completing required coursework, and satisfying additional requirements. The Purdue actuarial science program provides preparation for the first four examinations as well as fulfilling the economics, finance, and applied statistical methods requirements of SOA/CAS. Students who wish to pursue actuarial careers should coordinate their actuarial exam schedules with their academic plans of study and may begin taking exams in the freshman year.

For current information on the academic program, as well as more career information, see our Web site at www.math.purdue.edu/actuary.

In meeting the following requirements, a student will also automatically fulfill the College of Science graduation requirements listed on pages 28–30.

In addition to courses required for graduation, students should carefully consider electives that will coordinate with an actuarial career. In particular, additional courses from Krannert School of Management or courses in writing and communication are very helpful. Most actuarial majors also obtain a statistics degree and a management minor.

The College of Science is in the process of reviewing its undergraduate curriculum. Students should check the College of Science Web site (www.science.purdue.edu/academic_programs/majors.asp) and speak with an academic advisor for the most up-to-date information and requirements.

Actuarial Science Requirements

Actuarial Science Core	***37 credits***
ECON 251 (Microeconomics) (3 cr.) and ECON 252 (Macroeconomics) (3 cr.)	*6 cr.*
MA 490A (Mathematical Theory of Interest) (4 cr.)	*4 cr.*
MGMT 200 (Introductory Accounting) (3 cr.); MGMT 201 (Management Accounting I) (3 cr.); MGMT 310 (Financial Management) (3 cr.)	*9 cr.*
STAT 472–473 (Actuarial Models I and II) (6 cr.); STAT 512 (Applied Regression Analysis) (3 cr.); MA/STAT 416 (Probability) (3 cr.); STAT 417 (Statistical Theory) (3 cr.); STAT 490T (Time Series Analysis) (3 cr.)	18 *cr.*
Science Requirements	***12–15 credits***
Four courses in laboratory sciences. (See page 30)	
Mathematics Requirements	***19–21 credits***
MA 161 (Plane Analytic Geometry and Calculus I) (5 cr.) or MA 165 (Analytic Geometry and Calculus I) (4 cr.)	*4–5 cr.*
One of: MA 162 (Plane Analytic Geometry and Calculus II) (5 cr.), MA 166 (Analytic Geometry and Calculus II) (4 cr.), MA 173 (Calculus and Analytic Geometry II) (5 cr.), MA 181 (Honors Calculus I) (5 cr.)	*4–5 cr.*
One of: MA 261 (Multivariate Calculus) (4 cr.), MA 174 (Multivariable Calculus) (4 cr.), MA 182 (Honors Calculus II) (5 cr.), MA 271 (Several Variable Calculus) (5 cr.)	*4–5 cr.*

MA 351 (Elementary Linear Algebra) (3 cr.) or MA 350 (Elementary Linear Algebra: Honors) (3 cr.) *3 cr.*

MA 366 (Ordinary Differential Equations) (4 cr.) *4 cr.*

Additional Requirements ***36–41 credits***

English Composition: See page 29 for English composition requirements. *6–7 cr.*

Modern Foreign Language: All College of Science majors are expected to have proficiency in another language in addition to their native language. Competency in the second language must be demonstrated at the fourth-semester college level. (See Modern Foreign Language requirements on page 29-30). *12–16 cr.*

General Education Requirements: You must complete 18 credit hours of study in the humanities, social sciences, and behavioral sciences. (See page 30 for requirements.) *18 cr.*

Free Electives ***21–31 credits***

Free electives can be selected from any department of the University. Students are encouraged to use free electives to broaden their knowledge. However, free elective credit is not allowed for courses that significantly overlap courses taken to fulfill departmental degree requirements. This excludes, in particular, introductory courses. Students must take at least as many free electives as is needed to bring the credit hour total to 124.

Grade Requirements

All actuarial science majors must have a graduation index of at least 2.5 in MA 351, MA 366, and all courses required for the actuarial science core.

Honors Program

Students who successfully complete the requirements for this program are certified at the time of graduation as having graduated "with honors in actuarial science." The honors class STAT 490C completes the material required for the fourth actuarial exam, Exam C. Students may enter the program any time. Entering the honors program indicates an intention to meet the more rigorous requirements of graduation "with honors" as outlined below. There is no penalty if a student later changes plans. In addition to the general degree requirements students must satisfy the following requirements: (a) obtain a GPA of at least 3.3 over all, (b) obtain at least a "B" in each of ECON 251 (or ECON 340), 252 (or ECON 352), MGMT 310,411, (c) take STAT 490C (Honors Loss Models), (d) obtain an average GPA of at least 3.5 in the following set of classes: STAT 417, 490C, 472, 473, (e) obtain grades of "A" or "B" in all of the mathematics and statistics classes required for the actuarial science degree, (f) provide documentation of having passed two of the Society of Actuaries (SOA) or Casualty Actuarial Society (CAS) actuarial exams prior to the end of classes in the semester of graduation.

Special Programs and Opportunities

The Actuary Club coordinates a very active summer internship program. The majority of internship opportunities are for juniors, although a number of sophomores and even freshmen participate in the program.

Biological Sciences

The biological sciences are undergoing an extraordinary revolution, and these plans of study are designed to help students successfully master this explosion of knowledge. The Department of Biological Sciences at Purdue University was one of the first in the country to recognize that it is not necessary to separate the life sciences by type of organism and that all living organisms depend upon the same cellular and molecular organization. We have emphasized structure and function throughout the living world and, thus, can prepare students for a wide range of curricula and careers.

It is important to recognize that the study of biological organisms also requires an understanding of the physical and chemical world. Thus, our curriculum requires courses in chemistry, physics, and mathematics/computer science/statistics. Biology builds upon this knowledge and tries to understand the complexity that gives rise to living organisms and, ultimately, to biological diversity. Our curriculum is designed so that this basic biological knowledge can readily be applied to critical problems in health and medicine, agriculture and the management of other renewable resources, and the nature of populations and their control.

The amount of biological information is exploding, and the rate at which it is discovered is incredible. It is essential that we provide opportunities for students to focus on an area of specialization built upon a common base. Thus, we begin our curriculum with the four-semester biology core. This set of courses, with both lecture and laboratory components each semester, provides a comprehensive foundation for all biology majors. The sequence begins with an overview of evolutionary and organism concepts and the way organisms interact with their environment and with each other. Next, we cover the principles of organism structure, function, and development, and explore the relationship among these topics. We then move deeper and deeper into the cell and study how cells are structured and how they function. Finally, the principles of genetics and molecular biology are provided to students who are now well versed in the chemical and quantitative sciences. Such students are now able to fully grasp the nature of molecular genetics as well as the quantitative components of classical genetics.

By the third year, students can build upon the courses in chemistry, physics, math, and the biology core, and branch out into one of a number of areas. Those interested in medicine or veterinary medicine can concentrate on preprofessional studies. Those who are still interested in sampling many areas of biology can take our general biology emphasis or consider biology teaching. Those who might want to specialize in a particular area can do so in majors such as biochemistry; cell, molecular, and developmental biology; ecology, evolution, and environmental biology; genetic biology; microbiology; and neurobiology and physiology.

These disciplinary emphases are differentiated by upper-level undergraduate and graduate courses that are nationally known for their excellence. However, the key to our curriculum is the way that advanced laboratory courses and experiences are built into the degree. Thus, we have a series of advanced modular laboratories that provide state-of-the-art experimentation for upper-class students in all disciplines. In addition, we emphasize undergraduate research so that all students can perform independent research in laboratories within the Department of Biological Sciences, in other laboratories on the Purdue campus, and in various industrial and government laboratories. Many students who participate in this program have written undergraduate honors theses and have been co-authors on papers in top scientific journals. This is the type of experience that can only be obtained at a research-intensive institution such as Purdue with the tremendous resources available from federal and industrial grants.

Finally, the Department of Biological Sciences has developed a student-centered environment to enable all students to succeed. There are three seminars for biology majors. In the first semester, students may take a resource and problem-solving seminar that is coordinated with the first-semester biology course, BIOL 121. The second seminar, titled Planning Your Future in Biology, is one in which successful alumni talk to students about their careers and their science and why the path between points A and B in career planning is almost never a straight line! This seminar also introduces students to the exciting world of research and the role that undergraduates play in the discovery process. The third seminar, Preparing for Your Future in Biology, equips upper-level

undergraduates with the tools needed to search for jobs or seek admission to graduate or professional schools. These and many other elements of our curriculum were designed in conjunction with resources provided by the Howard Hughes Medical Institute Undergraduate Initiative Program. The Department of Biological Sciences at Purdue is one of only a handful of major institutions that have received support from this organization over many years. We have utilized these resources to develop many new courses and approaches to teaching and learning, and we are confident that we will continue this excellence in undergraduate learning well into the twenty-first century.

The three broad areas of concentration in this department include:

1. Basic biology
2. Biology teaching
3. Preprofessional studies

Our graduates pursue a broad variety of career opportunities. Many go into professional schools (medicine, veterinary medicine, dentistry, etc.) or graduate schools in biology, biochemistry, management, education, and other health-related programs. Students who enter the workforce after the bachelor of science degree take positions such as research assistants, associate scientists, laboratory technicians, and technologists in industry, government, hospitals, and universities; teachers in junior highs and high schools; salespeople in scientific and health-related firms; and park/zoo staff. Because of the strong training in basic sciences and analytical thinking, biologists are well poised to meet the demands of a constantly changing workplace … and of their constantly evolving selves.

The Web site for the biology department can be found at www.biology.purdue.edu.

General Degree Requirements

The College of Science is in the process of reviewing its undergraduate curriculum. Students should check the College of Science Web site (www.science.purdue.edu/academic_programs/majors.asp) and speak with an academic advisor for the most up-to-date information and requirements.

The Biology Core consists of courses taken during a sequence of four semesters required of all undergraduate majors. The sequence begins with an overview of the evolutionary development of organismal diversity and ways organisms interact with their environment and each other; it is followed by a course that introduces the principles of plant and animal development and explores the relationship between their structure and function. The third course includes the study of how cells are structurally organized and how they function. Finally, students are introduced to the principles of genetics and the molecular mechanisms of gene expression, mutation, and replication.

In addition to the core and elective biology courses, students majoring in biology must take certain courses in chemistry, mathematics, and physics, as well as English, foreign language, humanities, and the social sciences. In meeting the various requirements (in the following summary), a student automatically fulfills the College of Science graduation requirements listed on pages 28–30.

A student wishing to graduate with a degree from the Department of Biological Sciences must have a 2.0 grade point average in all biology and biology elective courses required for his or her major. This may include courses outside the Department of Biological Sciences if such courses fulfill biology or biology elective requirements for that major.

Additionally, each student wishing to graduate with a degree from the Department of Biological Sciences must also complete a 500-level biology course other that 500 or 542. This course may be a required course, a biology elective, or a free elective.

Students have the choice of focusing or broadening their education by the selection of electives. These elective courses are offered in many aspects of biology. Usually, they take these specialized courses after the sophomore year. It is advantageous for a student to decide by the end of the sophomore year what aspect of the biological sciences he or she wants to emphasize in order to begin the correct sequence of courses required by each major. The majors described on the following pages build on the biology core courses.

Biological Sciences Requirements

Biology Core	***19 credits***
BIOL 121 (Diversity, Ecology,	

and Behavior) (2 cr.); BIOL 131 (Development, Structure, and Function of Organisms) (3 cr.); BIOL 136 (Quantitative and Problem Solving Skills) (1 cr.); BIOL 137 (Handling Cells and Tissues; Microscopy) (1 cr.); BIOL 138 (Information and Communication Skills) (1 cr.); BIOL 139 (Measurements and Basic Solution Chemistry) (1 cr.); BIOL 232 (Laboratory in Cell Structure and Function) (2 cr.); BIOL 242 (Laboratory in Genetics and Molecular Biology) (2 cr.); BIOL 270 (Molecular & Cellular Biology) (3 cr.); BIOL 271 (Genetics) (3 cr.); BIOL 272 (Ecology & Evolution) (2 cr.) *16 cr.*

One of:

1. BIOL 370 (Development) (3 cr.)
2. BIOL 371 (Physiology) (3 cr.)
3. BIOL 438 (General Microbiology) (3 cr.)

3 cr.

Upper-Level Biology *15–42 credits*

Each student majoring in biology is required to select additional credit hours of upper-division biology courses beyond the core. Courses that can be selected are determined by the individual major and areas in which the student is interested.

Science Requirements *27–31 credits*

One of the following sequences:

Either CHM 115 and 116 (General Chemistry) or CHM 125 and 126 (Introduction to Chemistry, I and II) *8–10 cr.*

One of the following three sequences:

a. CHM 255–255L, and 256–256L (Organic Chemistry and Organic Chemistry Laboratory)

b. CHM 257 and 257L (Organic Chemistry and Organic Chemistry Laboratory) (5 cr.) and either CHM 333 (Principles of Biochemistry) (3 cr.) or BCHM 307 (Biochemistry) (3 cr.)

c. CHM 261–262 (Organic Chemistry) and 263–264 (Organic Chemistry Laboratory) *8 cr.*

Plus one of the following:*

BCHM 221 (Analytical Biochemistry) (3 cr.); BCHM 561 (General Biochemistry) (3 cr.); CHM 224 (Quantitative Analysis) (4 cr.); CHM 321 (Analytical Chemistry) (4 cr.); CHM 372 (Physical Chemistry) (4 cr.); CHM 373 (Physical Chemistry) (3 cr.); CHM 533 (Biochemistry)(3 cr.) *3–4 cr.*

PHYS 220 and 221 (General Physics) (total 8 cr.); or PHYS 172 (Modern Mechanics), PHYS 241 (Electricity and Optics), PHYS 252 (Electricity and Optics Laboratory), and 290D (Heat and Thermal) (total 9 cr.) *8–9 cr.*

For specific chemistry sequences and additional requirements, see individual biology majors on the following pages.

For specific physics sequences and additional requirements, see individual biology majors on the following pages.

Mathematics Requirements *12–14 credits*

Select one of the following:

a. MA 223–224 (Introductory Analysis I and II) (6 cr.);

b. MA 161–162 (Plane Analytic Geometry and Calculus, I and II) (6 cr.);

c. MA 165–166 (Analytic Geometry and Calculus, I and II) (8 cr.);

d. MA 173 (Calculus and Analytic Geometry II) (5 cr.) *9–10 cr.*

One of the following (two if MA 223–224 are chosen from above):

a. Calculus: MA 174 (Multivariable Calculus; continuation of 173) (4 cr.); MA 271 (Several Variable Calculus) (5 cr.); or MA 261 (Multivariate Calculus; follows MA 162 or 165) (4 cr.) *4–5 cr.*

b. Probability: STAT 311 (Introductory Probability) (3 cr.) *3 cr.*

c. Statistics: STAT 503 (Statistical Methods for Biology) (3 cr.); or STAT 511 (Statistical Methods) (3 cr.) *3 cr.*

d. Computer Programming: C S 154 (Fortran Programming) (3 cr.) or C S 159 (Programming Applications for Engineers) (3 cr.) or C S 177 (Programming with Multimedia Objects) (4 cr.) *3–4 cr.*

For specific mathematics sequences and additional requirements, see individual majors on the following pages.

Additional Requirements *33–41 credits*

English Composition: See page 29 for English composition requirements. *6–7 cr.*

** Required for all biology majors except the biology teaching major.*

Modern Foreign Language: All College of Science majors are expected to have proficiency in another language in addition to their native language. Competency in the second language must be demonstrated at the fourth-semester college level. (See Modern Foreign Language requirements on pages 29-30). *12–16 cr.*

General Education Requirements: You must complete 18 credit hours of study in the humanities, social sciences, and behavioral sciences. (See page 30 for requirements.) *18 cr.*

Free Electives ***0–18 credits***

Free electives can be selected from any department of the University. Students are encouraged to use free electives to broaden their knowledge. However, free elective credit is not allowed for courses that significantly overlap courses taken to fulfill departmental degree requirements. Students must take at least as many free electives as is needed to bring the credit hour total to 124.

Biological Sciences Majors and Requirements

The majors in biology offered by the Department of Biological Sciences reflect several principal areas of faculty strength. Programs also are offered in preprofessional areas. Descriptions of the majors and their requirements follow.

Biology Major

This program is designed to allow for a broad foundation in the biological sciences while providing sufficient free electives for the student to explore and develop additional interests. The student is given maximum flexibility in designing a plan of study that may contain courses from a wide variety of biology disciplines.

Biology Major Requirements **15 credits**

In addition to the requirements listed under "General Degree Requirements" on pages 28-30, 15 credits in the upper-division courses listed in group A, group B, and laboratory courses are required to complete a biology major. These credits must include at least one laboratory course and at least one course from each group as a minimum distribution requirement.

Group A

Select from the following:

BIOL 415 (Introduction to Molecular Biology) (3 cr.), BIOL 416 (Molecular Virology) (3 cr.), BIOL 420 (Eukaryotic Cell Biology) (3 cr.), BIOL 438 (General Microbiology) (3 cr.), BIOL 439 (Laboratory in Microbiology) (2 cr.), BIOL 444 (Human Genetics) (3 cr.), BIOL 446 (Cellular Microbiology) (3 cr.), BIOL 478 (Introduction to Bioinformatics) (3 cr.), BIOL 481 (Eukaryotic Genetics) (3 cr.), BIOL 495N (Introduction to Neurobiology) (3 cr.), BIOL 511 (Introduction to X-Ray Crystallography) (3 cr.), BIOL 514 (Laboratory in Crystallography) (2 cr.), BIOL 515 (Molecular Genetics) (2 cr.), BIOL 516 (Molecular Biology of Cancer) (3 cr.), BIOL 517 (Molecular Biology: Proteins) (2 cr.), BIOL 519: (Molecular Biology: Nucleic Acids) (2 cr.), BIOL 529 (Bacterial Physiology) (3 cr.), BIOL 533 (Medical Microbiology) (3 cr.), BIOL 538 (Molecular, Cellular, and Developmental Neurobiology) (3 cr.), BIOL 541 (Genetic Biology) (3 cr.), BIOL 549 (Microbial Ecology) (2 cr.), BIOL 550 (Plant Molecular Biology) (3 cr.), BIOL 562 (Neural Systems) (3 cr.), BIOL 573 (The Molecular Biology of Animal Cells) (3 cr.), BIOL 595A (Protein Bioinformatics) (2 cr.), BIOL 595K (Methods and Measurements in Physical Biochemistry) (3 cr.)

BCHM 561 (General Biochemistry I)* (3 cr.), BCHM 562 (General Biochemistry II) (3 cr.), BCHM 572 (Advanced Biochemical Techniques) (2–4 cr.)

CHM 533 (Introductory Biochemistry)* (3 cr.)

Group B

Select from the following:

BIOL 301 (Human Design: Anatomy and Physiology 1)† (3 cr.), BIOL 302 (Human Design: Anatomy and Physiology 2)† (3 cr.), BIOL 455 (Animal Physiology) (3 cr.), BIOL 483 (Environmental and Conservation Biology) (3 cr.), BIOL 493 (Introduction to Ethology) (3 cr.), BIOL 495I (Reproductive Physiology) (3 cr.), BIOL 537 (Immunobiology) (3 cr.), BIOL 559 (Endocrinology) (3 cr.), BIOL 580 (Evolution) (3 cr.), BIOL 585 (Ecology) (3 cr.), BIOL 591 (Field Ecology) (4 cr.), BIOL 592 (The Evolution of Behavior) (3 cr.), BIOL 595D (Developmental Biology) (3 cr.), BIOL 595G (Animal Communication) (3 cr.), BIOL 597 (Sex and

** These courses may be used as biology electives or to meet the chemistry requirement, but not both.*

† If both BIOL 301 and 302 are completed, three of the six credits will count toward the 15-credit requirement. The other three credits will count as free electives. If only BIOL 301 or 302 is completed, the credits will count only as free-elective credits.

‡ Students who choose to meet the laboratory requirement for the biology major with modular upper-division laboratory courses must take BIOL 500I and one additional 500 or 542 module. Advisors will have the complete list of available modules for any given semester.

Evolution) (3 cr.)
HORT 301 (Plant Physiology) (4 cr.)

Laboratory Courses

Select from the following:
BIOL 439 (Laboratory in General Microbiology) (2 cr.)
BIOL 500 (Modular Upper-Division Laboratory Courses)* (2 cr.): BIOL 500A (Animal Physiology) or BIOL 500I (Introduction to Protein Expression)
BIOL 514 (Laboratory in Crystallography) (2 cr.)
BIOL 542 (Modular Upper-Division Laboratory Courses)* (1 cr.): BIOL 542B (Bacterial Genetics), BIOL 542C (Animal Cell Culture), BIOL 542D (Analysis of Disease States), BIOL 542F (Introduction to Labview), BIOL 542G (Introduction to Nucleic Acid Sequence Analysis), BIOL 542M (Microscopy and Cell Biology), BIOL 542N (Neurophysiology), BIOL 542R (Exploration of Protein Structure), BIOL 542S (Chromatin Structure), BIOL 542U (DNA Sequencing Lab), BIOL 542V (Molecular Virology), BIOL 542Z (Exploring the Living Cell)
BIOL 591 (Field Ecology) (4 cr.)
BIOL 394 or 494 (Biology Research) or BIOL 499 (Biology Honors Thesis Research), taken during the junior or senior years, and BIOL 495C (Ideas in Science and Law), can be used as partial fulfillment of the 15-elective-hour requirement. However, these credits cannot be used to fulfill the minimum distribution requirement or the laboratory requirement.

Students who anticipate working immediately after earning a B.S. in biology should consider supplementing departmental requirements with courses in applied areas. Advisors can make specific recommendations.

Biochemistry Major

Biochemistry investigates the chemical and molecular foundations of life processes. A student may study the transfer of genetic information into biological structures, the conversion of nutrients into cell constituents and their utilization as sources of energy, the storage of memory, and the chemical nature of neural processes. Relevant laboratory techniques include electrophoresis, chromatography, Western blotting, protein sequence analysis, and peptide mapping. Understanding the development and application of enzymatic assays is fundamental to the field of study. Students can also study biochemistry through majors in the Department of Chemistry in the College of Science (page 49) and the Department of Biochemistry in the College of Agriculture.

To complete the biochemistry major, the following courses must be selected when fulfilling the "General Degree Requirements" listed on page 37:

a. MA 161–162 (Plane Analytic Geometry and Calculus, I and II) (10 cr.), or MA 165–166 (Analytic Geometry and Calculus, I and II) (8 cr.), or MA 173 (Calculus and Analytic Geometry II) (5 cr.) *5–10 cr.*
b. C S 177 (Programming with Multimedia Objects) (4 cr.) or C S 159 (Programming Applications for Engineers) (3 cr.) or C S 154 (FORTRAN Programming) (3 cr.) *3–4 cr.*
c. CHM 261–262 (Organic Chemistry) (6 cr.) and CHM 263–264 (Organic Chemistry Laboratory) (2 cr.) *8 cr.*
d. BCHM 221 (Analytical Biochemistry) (3 cr.) or CHM 224 (Introductory Quantitative Analysis) (4 cr.) or CHM 321 (Analytical Chemistry I) (4 cr.) *3–4 cr.*

Biochemistry Major Requirements **30–34 credits**

STAT 503 (Statistical Methods for Biology) (3 cr.) *3 cr.*
One of the following:
a. CHM 372 (Physical Chemistry) (4 cr.)
b. CHM 373–374 (Physical Chemistry) (6 cr.) *4–6 cr.*
BCHM 561–562 (General Biochemistry I and II) (6 cr.); BIOL 415 (Molecular Biology)† (3 cr.); BIOL 420 (Eukaryotic Cell Biology)† (3 cr.); BIOL 515 (Molecular Genetics)† (2 cr.) or BIOL 519 (Molecular Biology: Nucleic Acids)† (2 cr.); BIOL 517 (Molecular Biology: Proteins)† (2 cr.); BIOL 529 (Bacterial Physiology)† (3 cr.) or BIOL 550 (Plant Molecular Biology)† (3 cr.) or BIOL 573 (Molecular Biology of Animal Cells)† (3 cr.); BIOL 500I (Introductory Module: Protein Expression) (2 cr.) *21 cr.*
One of the following:
a. Two additional 500 or 542 laboratory

** Students who choose to meet the laboratory requirement for the biology major with modular upper-division laboratory courses must take BIOL 500I and one additional 500 or 542 module. Advisors will have the complete list of available modules for any given semester.*

† One of these courses may be replaced by one of the following courses: BIOL 416 (Molecular Virology), BIOL 438 (General Microbiology), BIOL 511 (Introduction to X-Ray Crystallography), BIOL 537 (Immunology), or BIOL 595K (Methods and Measurement in Physical Biochemistry). Only one substitution is allowed.

modules (various course titles). (See page 38 for a list of BIOL 500 and 542 modules) (2–3 cr.)

b. BIOL 439 (Microbiology Laboratory) (2 cr.)

c. BIOL 514 (Laboratory in Crystallography) (2 cr.)

d. Four credits of undergraduate research – BIOL 394 or 494 (Biology Research) or BIOL 499 (Biology Honors Thesis Research). (Must be approved in advance by the Biophysics, Biochemistry, and Structural Biology Area Committee (4 cr.) *2–4 cr.*

Biochemistry Honors Curriculum

Additionally, students in the biochemistry honors curriculum must complete, as part of the "General Degree Requirements" listed on page 27, PHYS 172 (Modern Mechanics), PHYS 241 (Electricity and Optics), PHYS 252 (Electricity and Optics Laboratory), and PHYS 290D, (Heat and Thermal). Students must also complete one of the following:

a. CHM 321 (Analytical Chemistry I) (4 cr.) (from "General Degree Requirements")

b. CHM 373–374 (Physical Chemistry) (6 cr.) (from "Biochemistry Major Requirements")

Students in the Biochemistry Honors Curriculum may use MA 261 (Multivariate Calculus) to replace one of the following: STAT 503 (Statistical Methods for Biology), C S 154 (FORTRAN Programming), C S 159 (Programming Applications for Engineers), or C S 177 (Introduction to Computer Science).

Additionally, a 3.0 graduation index is required at the time of graduation.

Biology Teaching Major

The biology teaching program at Purdue University combines a strong emphasis on biology content knowledge with a thorough grounding in the theoretical and practical aspects of science teaching. A student completing the requirements in biology teaching is qualified to teach high school life science. Biology teaching majors are advised that it is wise to select an additional developmental area, such as middle school, and additional courses in physics, chemistry, or earth and atmospheric science.

Although each state has different requirements for teacher certification, an Indiana certificate will be reciprocal in many states. In addition, students can ascertain the requirements in other states by writing directly to the Certification Office, Department of Public Instruction, in the capital city of any state. Indiana now requires those seeking certification to pass the PRAXIS I and PRAXIS II exams.

Prospective teachers are exempt from the second year of the foreign-language requirement and from the last course of the chemistry requirement. During the professional semester, students take coursework on campus followed by student teaching.

Biology Teaching Major Requirements — 42 credits

Upper-Division Courses — *10 credits*

Ten additional credits in the upper-division courses listed in groups A and B (following) are required to complete a biology teaching major. These 10 credits must include at least one laboratory course and, as a minimum distribution requirement, each group must be represented by at least one course in a student's selections.

Group A

Select from the following:

BIOL 415 (Introduction to Molecular Biology) (3 cr.), BIOL 416 (Molecular Virology) (3 cr.), BIOL 420 (Eukaryotic Cell Biology) (3 cr.), BIOL 438 (General Microbiology) (3 cr.), BIOL 439 (Laboratory in Microbiology) (2 cr.), BIOL 444 (Human Genetics) (3 cr.), BIOL 446 (Cellular Microbiology) (3 cr.),BIOL 478 (Introduction to Bioinformatics) (3 cr.), BIOL 481 (Eukaryotic Genetics) (3 cr.), BIOL 495N (Introduction to Neurobiology) (3 cr.), BIOL 511 (Introduction to X-Ray Crystallography) (3 cr.), BIOL 514 (Laboratory in Crystallography) (2 cr.), BIOL 515 (Molecular Genetics) (2 cr.), BIOL 516 (Molecular Biology of Cancer) (3 cr.), BIOL 517 (Molecular Biology: Proteins) (2 cr.), BIOL 519 (Molecular Biology: Nucleic Acids) (2 cr.), BIOL 529 (Bacterial Physiology) (3 cr.), BIOL 533 (Medical Microbiology) (3 cr.), BIOL 538 (Molecular, Cellular, and Developmental Neurobiology) (3 cr.), BIOL 541 (Genetic Biology) (3 cr.), BIOL 549 (Microbial Ecology) (2 cr.), BIOL 550 (Plant Molecular Biology) (3 cr.), BIOL 562 (Neural Systems) (3 cr.), BIOL 573 (The Molecular Biology of Animal Cells) (3 cr.), BIOL 595A (Protein Bioinformatics) (2 cr.), or BIOL 595K (Methods and Measurements in Physical Biochemistry) (3 cr.)

BCHM 561 (General Biochemistry I) (3 cr.), BCHM

* *If both BIOL 301 and 302 are completed, three of the six credits will count toward the 10-credit requirement. The other three credits will count as free electives. If only BIOL 301 or 302 is completed, the credits will count only as free-elective credits.*

562 (General Biochemistry II) (3 cr.), or BCHM 572 (Advanced Biochemical Techniques) (2–4 cr.)
CHM 533 (Introductory Biochemistry) (3 cr.)

Group B

Select from the following:
BIOL 301 (Human Design: Anatomy and Physiology 1)* (3 cr.), BIOL 302 (Human Design: Anatomy and Physiology 2)* (3 cr.), BIOL 455 (Animal Physiology) (3 cr.), BIOL 483 (Environmental and Conservation Biology) (3 cr.), BIOL 493 (Introduction to Ethology) (3 cr.), BIOL 495I (Reproductive Physiology) (3 cr.), BIOL 537 (Immunobiology) (3 cr.), BIOL 559 (Endocrinology) (3 cr.), BIOL 580 (Evolution) (3 cr.), BIOL 585 (Ecology) (3 cr.), BIOL 591 (Field Ecology) (4 cr.), BIOL 592 (The Evolution of Behavior) (3 cr.), BIOL 595D (Developmental Biology) (3 cr.), BIOL 595G (Animal Communication) (3 cr.), BIOL 597 (Sex and Evolution) (3 cr.)
HORT 301 (Plant Physiology) (4 cr.)

Laboratory Courses

Select from the following:
BIOL 439 (Laboratory in General Microbiology) (2 cr.); BIOL 500 (Modular Upper-Division Laboratory Courses)* (2 cr.) (see page 38 for a complete list of BIOL 500 modules); BIOL 514 (Laboratory in Crystallography) (2 cr.); BIOL 542 (Modular Upper-Division Laboratory Courses)* (1 cr.) (see page 39 for a complete list of BIOL 542 modules); or BIOL 591 (Field Ecology) (4 cr.)

BIOL 394 or 494 (Biology Research) or BIOL 499 (Biology Honors Thesis Research) (maximum 2 cr.), taken during the junior or senior years, and BIOL 495C, (Ideas in Science and Law) can be used as partial fulfillment of the 10-credit requirement. However, these credits cannot be used to fulfill the minimum distribution requirement or the laboratory requirement.

Professional Education Courses 32 credits

The following education courses are required for certification to teach in Indiana schools. In addition, EDPS 235 can be used in partial fulfillment of the College of Science general education requirement.
EDCI 205 (Exploring Teaching as a Career) (3 cr.); EDCI 270 (Introduction to Educational Technology and Computing) (2 cr.); EDCI 285 (Multiculturalism and Education) (3 cr.); EDPS 235 (Learning and Motivation) (3 cr.); EDPS 265 (The Inclusive Classroom) (3 cr.); EDST 200 (History and Philosophy of Education) (3 cr.); EDCI 421 (The Teaching of Biology in Secondary Schools) (3 cr.); EDCI 428 (Teaching Science in the Middle and Junior High School) (2 cr.); and EDCI 498 (Supervised Teaching) (10 cr.)

Cell, Molecular, and Developmental Biology Major

Understanding how eukaryotic cells process information from their environment and initiate programs of gene expression leading to growth, development, and functional specification is the essence of a CMD major. Students enrolled in this curriculum will take courses providing a solid foundation in the molecular biology of cells and gain a full appreciation of how molecular complexes interact to make a cell function. This fundamental knowledge in cell and molecular biology will be applied through further coursework in genetics and developmental biology to examine how eukaryotic organisms function and how specific aspects of that function are perturbed by disease. Within the CMD major, students have the option of focusing their studies on animal systems, plant systems, or both. Graduates with a CMD major are well-prepared to pursue careers in academic or industrial research, biotechnology, genetic engineering, medicine, veterinary medicine, and other health related professions.

Cell, Molecular, and Developmental Biology Major Requirements 22–23 credits

Cell, Molecular, and Developmental Biology Courses 16–17 credits

Two courses from the following:
BIOL 415 (Introduction to Molecular Biology) (3 cr.); BIOL 420 (Eukaryotic Cell Biology) (3 cr.); BIOL 481 (Eukaryotic Genetics) (3 cr.) *6 cr.*
BIOL 500I (Introductory Module: Protein Expression)
Two other BIOL 500 or BIOL 542 lab courses. See page 39 for a complete list of courses titles *4–5 cr.*
BCHM 561 (General Biochemistry I) (3 cr.) or CHM 533 (Introductory Biochemistry) (3 cr.) *3 cr.*
Select one of the following:
BIOL 516 (Molecular Biology of Cancer) (3 cr.); BIOL 550 (Plant Molecular Biology) (3 cr); BIOL

* *Students who choose to meet the laboratory requirement for the biology teaching major with modular upper-division laboratory courses must take BIOL 500I and one additional 500 or 542 module. Advisors will have the complete list of available modules for any given semester.*

595D (Developmental Biology); BIOL 595Z (Cellular Biology of Plants) (3 cr.)

Electives ***6 credits***

Select six credits from:

1. Any advanced biology elective (400- or 500-level) with the exception of BIOL 497 (Biology Honors Seminar), BIOL 498 (Biology Teaching), or one-credit electives in biology. BIOL 495 or 595 (Special Assignments in Biology) requires the approval of the Cell, Molecular and Developmental Biology Area Committee.
2. BCHM 562 (General Biochemistry II) (3 cr.)

Ecology, Evolution, and Environmental Biology Major

This area investigates how organisms interact with their physical environment and other organisms, from an evolutionary perspective. Ecologists' work includes research and/or teaching involving population genetics and evolution, adaptive strategies for survival, the nature of populations, and community ecology. Ecologists also offer technical services in connection with environmental impact decisions and regional planning, and environmental education at various levels as teacher, naturalist, or journalist. Students with a particularly strong interest in the environment may choose to select the environmental science option. This option allows greater latitude in selecting electives to broaden one's environmental perspective. Students interested in this area may consider programs in interdisciplinary science (page 78) and the College of Agriculture.

Ecology, Evolution, and Environmental Biology Major Requirements 17–20 credits

Ecology, Evolution, and Environmental Biology Major Requirements ***10–13 credits***

BIOL 580 (Evolution) (3 cr.); BIOL 585 (Ecology) (3 cr.) *6 cr.*

BIOL 592 (Evolution of Behavior) (3 cr.) or BIOL 595G (Animal Communication) (3 cr.) or BIOL 597 (Evolution of Behavior) (3 cr.) *3 cr.*

One of the following:

a. BIOL 394 (Biology Research) (1–4 cr.)
b. BIOL 494 (Biology Research) (1–4 cr.)
c. BIOL 499 (Biology Honors Thesis Research)(1–4 cr.)
d. BIOL 591 (Field Ecology)* (4 cr.) *1-4 cr.*

Electives ***7 credits***

Select from the following:

BIOL 415 (Introduction to Molecular Biology) (3 cr.); BIOL 438 (General Microbiology) (3 cr.); BIOL 439 (Laboratory in Microbiology) (2 cr.); BIOL 444 BIOL 478 (Introduction to Bioinformatics) (3 cr.); (Human Genetics) (3 cr.); BIOL 481 (Eukaryotic Genetics) (3 cr.); BIOL 483 (Environmental and Conservation Biology) (3 cr.); BIOL 493 (Introduction to Ethology) (3 cr.); BIOL 515 (Molecular Genetics) (2 cr.); BIOL 541 (Genetic Biology) (3 cr.); BIOL 549 (Microbial Ecology) (2 cr.); BIOL 562 (Neural Systems) (3 cr.); BIOL 591 (Field Ecology)* (4 cr.); BIOL 592 (The Evolution of Behavior) (3 cr.); BIOL 595G (Animal Communication) (3 cr.); BIOL 597 (Sex and Evolution) (3 cr.); ANSC 511 (Population Genetics) (3 cr.); ANTH 535 (Foundations of Biological Anthropology) (3 cr.); ANTH 536 (Primate Ecology) (3 cr.); BCHM 561 (General Biochemistry I) (3 cr.); BCHM 562 (General Biochemistry II) (3 cr.); BTNY 555 (Aquatic Botany) (3 cr.); EAS 572 (Paleoecology) (3 cr.); ENTM 500 (Fundamentals of Entomology) (4 cr.); FNR 501 (Limnology) (3 cr.); FNR 581 (Ecological Impact Analysis) (3 cr.)

Genetic Biology Major

Genetics is the science of information transfer from one generation to another. We learn the laws of inheritance in all creatures big and small, how they evolve, and how they change. On the molecular level we learn about DNA and RNA; on the cellular level, we discover what makes a cell cancerous; and on an organismal level, we examine the reproductive habits of various organisms. Crucial principles include the structure, function, and transmission of genes. Laboratory techniques explore genetic engineering from the "inside." Genetics is crucial to all of biology; so, a genetics major has wide applicability. Students interested in applied genetics also should consider programs in the College of Agriculture.

Genetic Biology Major Requirements 18–21 credits

Genetic Biology Courses ***12–15 credits***

BCHM 561 (General Biochemistry I) (3 cr.) or CHM 533 (Introductory Biochemistry) (3 cr.); BIOL 441 (Senior Seminar in Genetics) (1 cr.); BIOL 438 (General Microbiology)

** BIOL 591 may be used as a required course or as four credits of biology elective, or as three credits of biology elective plus a required course.*

(3 cr.); and BIOL 481 (Eukaryotic Genetics), BIOL 515 (Molecular Genetics), or BIOL 541 (Genetic Biology) (2–3 cr.) *9–10 cr.*

One of the following:

a. BIOL 500I (Introductory Module: Protein Expression) (2 cr.) and two other BIOL 500 or BIOL 542 lab courses. See page 38 for a complete list of course titles. (2–3 cr.)

b. Three credits of BIOL 394 (Biology Research), or BIOL 494 (Biology Research), or BIOL 499 (Biology Honors Thesis Research). Must be approved in advance by Molecular Genetics and Microbiology Area Committee. (3 cr.) *3–5 credits*

Electives ***6 credits***

Select from the following: BIOL 416 (Molecular Virology) (3 cr.); BIOL 444 (Human Genetics) (3 cr.); BIOL 478 (Introduction to Bioinformatics) (3 cr.); BIOL 481 (Eukaryotic Genetics) (3 cr.); BIOL 515 (Molecular Genetics) (2 cr.); BIOL 516 (Molecular Biology of Cancer) (3 cr.); BIOL 519 (Molecular Biology: Nucleic Acids) (2 cr.); BIOL 541 (Genetic Biology) (3 cr.); BIOL 550 (Plant Molecular Biology) (3 cr.); BIOL 573 (The Molecular Biology of Animal Cells) (3 cr.); BIOL 580 (Evolution) (3 cr.); AGRY 530 (Plant Genetics) (3 cr.); ANSC 511 (Population Genetics) (3 cr.); BCHM 562 (General Biochemistry II) (3 cr.)

Microbiology Major

Microbiology includes the study of viruses, bacteria, and fungi. A student can expect to study topics such as microbial growth, nutrition, metabolism, pathogenesis, morphogenesis, and production of antibiotics.

The American Board of Microbiology, a committee of the American Academy of Microbiology, has established a National Registry of Microbiologists to recognize individuals at the bachelor's level who have an adequate understanding of basic and applied microbiology. Parts of the requirements for registration specify 30 credits in biological sciences, 20 credits of which must be in microbiology. It is likely that similar criteria will be used for classification as a microbiologist by the U.S. Civil Service Commission. Students should consider this when selecting elective courses.

Microbiology Major Requirements 17–18 credits

Microbiology Courses ***14–15 credits***

BIOL 438 (General Microbiology) (3 cr.); BIOL 439 (Laboratory in Microbiology) (2 cr.); BIOL 529 (Bacterial Physiology) (3 cr.); BCHM 561 (General Biochemistry I) (3 cr.); BIOL 441 (Senior Seminar in Genetics) (1 cr.) *12 cr.*

BIOL 481 (Eukaryotic Genetics) (3 cr.). or BIOL 515 (Molecular Genetics) (2 cr.), or BIOL 541 (Genetic Biology) (3 cr.) *2–3 cr.*

Electives ***3 credits***

Select from the following:

BIOL 416 (Molecular Virology) (3 cr.); BIOL 446 (Molecular Bacterial Pathogen) (3 cr.); BIOL 495S (Introduction to Bioinformatics) (3 cr.); BIOL 500 or 542 (Modular Laboratory Courses; see page 39 for a complete list of titles) (1-2 cr.); BIOL 515 (Molecular Genetics) (3 cr.); BIOL 533 (Medical Microbiology) (3 cr.); BIOL 541 (Genetic Biology) (3 cr.); BIOL 549 (Microbial Ecology) (2 cr.); BCHM 562 (General Biochemistry II)

Microbiology Honors Curriculum

Microbiology Honors Course Requirements ***14–23 credits****

To complete the microbiology honors curriculum, the following courses must be selected when fulfilling the "General Degree Requirements" listed on page 37:

MA 261 (Multivariate Calculus) (4 cr.), or MA 174 (Multivariable Calculus) (4 cr.), or MA 271 (Several Variable Calculus) (5 cr.)

CHM 261–262 (Organic Chemistry) (6 cr.) and CHM 263–264 (Organic Chemistry Laboratory) (2 cr.)

Additionally, students in the microbiology honors curriculum must complete one of these courses:

C S 177 (Programming with Multimedia Objects) (4 cr.), or C S 159 (Programming Applications for Engineers) (3 cr.),or C S 154 (FORTRAN Programming) (3 cr.) *3–4 cr.*

Students in the microbiology honors curriculum must

** PHYS courses may also be chosen as part of the General Degree Requirements listed on page 36.*

complete three of these courses/course sequences:

a. CHM 321 (Analytical Chemistry I) (4 cr.)
b. MA 262 (Linear Algebra and Differential Equations) (4 cr.)
c. PHYS 172 (Modern Mechanics) (4 cr.), PHYS 241 (Electricity and Optics) (3 cr.), PHYS 252 (Electricity and Optics Laboratory) (1 cr.), PHYS 290D (Heat and Thermal) (1 cr.)
d. CHM 372 (Physical Chemistry) (4 cr.) or both CHM 373 and 374 (Physical Chemistry) (3 cr.)
e. STAT 503 (Statistical Methods for Biology) (3 cr.) *11-19 cr.**

For the microbiology honors curriculum, a 3.0 graduation index is required at the time of graduation.

Neurobiology and Physiology Major

Physiology is the study of the functions of living organisms and the organ and tissue systems of which they are composed. The goal of physiology is to understand, in terms of physical and chemical principles, the mechanisms that operate in living organisms from the subcellular level to the level of the whole animal. The emphasis is on how these mechanisms are integrated to produce a viable organism. Neurobiology is the study of the structure, function, and development of the nervous system. It originated, in part, as a subdiscipline of physiology. In recent years, neurobiology is one of the most rapidly changing and exciting areas of biology.

Neurobiology and Physiology Major Course Requirements 18–21 credits

Neurobiology and Physiology Courses 12–15 credits

Biology: BIOL 455 (Animal Physiology) (3 cr.), or BIOL 538 (Molecular, Cellular, and Developmental Neurobiology) (3 cr.), or BIOL 562 (Neural Systems) (3 cr.) *3 cr.*

BIOL 495I (Reproductive Physiology) (3 cr.) or
BIOL 495N (Introduction to Neurobiology) (3 cr.) or
BIOL 559 (Endocrinology) (3 cr.) *3 cr.*

One of the following:

a. BIOL 500A (Animal Physiology Laboratory) (2 cr.) or BIOL 542N (Laboratory in Neurophysiology) (1 cr.); Two other BIOL 500 or BIOL 542 lab courses. (2-3 cr.)
b. Three credits of BIOL 394 (Biology Research), or BIOL 494 (Biology Research), or BIOL 499 (Biology Honors Thesis Research). Must be approved in advance by Neurobiology and Physiology Area Committee. (3 cr.) *3–5 cr.*

One of the following:

BCHM 561 (General Biochemistry I) (3 cr.), CHM 372 (Physical Chemistry) (4 cr.), CHM 373 (Physical Chemistry) (3 cr.), or CHM 533 (Introductory Biochemistry) (3 cr.) *3–4 cr.*

Electives 6 credits

Select 6 credits from the following four options:

a. BIOL 301 (Human Design: Anatomy and Physiology I) (3 cr.) and BIOL 302 (Human Design: Anatomy and Physiology II) (3 cr.). (Both courses must be completed, but only three of these credits may be used toward this requirement.).
b. Any advanced biology elective (400- or 500-level) with the exception of BIOL 497 (Biology Honors Seminar), BIOL 498 (Biology Teaching), or one-credit electives in biology. BIOL 495 or 595 (Special Assignments in Biology) requires the approval of the Neurobiology and Physiology Area Committee.
c. Three (but no fewer) credits of advanced research (BIOL 394, 494, or 499) can count toward the six-credit requirement, provided the research is not also used as a substitute for a modular laboratory course. Approval of the Neurobiology and Physiology Area Committee is required.
d. BCHM 562 (General Biochemistry II) (3 cr.)

Biological Sciences Honors Research Program

The Department of Biological Sciences sponsors an honors research program to supplement the formal course offerings in the department's degree programs, to increase the breadth and depth of the student's knowledge of modern biology, and to lead to an honors research program designation at graduation. The program offers guided study in biology through independent research. It is available to any qualified student in the University who plans to complete a major in the biological sciences.

The requirements for graduation with honors in research are:

1. A minimum 3.0 cumulative GPA (however, a student with a lower GPA may petition the Undergraduate Honors Committee)
2. Conducting research supervised by a research director selected by the student, with the research plan approved by the Undergraduate Honors Committee

** PHYS courses may also be chosen as part of the General Degree Requirements listed on page 36.*

3. Completion of an honors research thesis approved by the research director and the head of the Department of Biological Sciences
4. Enrollment and participation in BIOL 497 (Honors Seminar), which is required of juniors and seniors but is optional for other honors research students
5. Presentation and discussion of the research during class and at Undergraduate Research Day

Advantages of the Honors Research Program

1. Students have the opportunity to grasp a better understanding of the thought processes and methods for developing new scientific knowledge. The program provides a practical research experience and contributes to a better preparation for graduate and professional schools.
2. Biology honors students have close contact with a functioning research group. They have the opportunity to carry out basic research and, if significant results are obtained, to publish their data.
3. Students who complete the honors research program are recognized on their transcript for having done so and receive the bachelor's designation "with honors."
4. Students who complete the honors research program are considered for the annual Singleton Award that recognizes the honors student who best exemplifies research excellence and scholarship.

Honors Curriculum Programs

An honors curriculum program is available in biochemistry, microbiology, and biochemistry. Each major that offers an honors curriculum program has designated advanced courses/course sequences that are required to earn a degree in the honors curriculum. Additionally, a 3.0 graduation index is required at the time of graduation. For specific requirements, see the applicable individual major section.

Special Programs and Opportunities

Preprofessional Major

This is a program designed for students who plan to attend a school of medicine, dentistry, optometry, or veterinary medicine upon completion of their coursework at Purdue. The program allows students to complete approximately three-fourths of the credit hours and all of the courses required for graduation in six semesters. After successfully completing the first year at an accredited school of medicine, dentistry, optometry, or veterinary medicine, the student may transfer his or her professional school credits back to Purdue, and the Bachelor of Science degree is granted. This is called the three-plus-one program.

It is important for the student who chooses to enroll in the three-plus-one program to realize that enrollment in the program does not guarantee admission to a professional school. Medical schools no longer encourage students to apply after three years of study, but will review the applications of three-plus-one students. Strong students enrolled in the three-plus-one program often are admitted to schools of dentistry, veterinary medicine, and optometry.

Three-plus-one students who are not accepted to a professional school after the third year have the option of completing a fourth year of study in the biological sciences and earning the B.S. degree. Three-plus-one students should meet regularly with their academic advisors to ensure that they are meeting the professional school requirements and to develop an alternate plan of study should they need to add a fourth year of undergraduate coursework.

Undergraduate Research

Students interested in doing research but who will not participate in the Honors Research Program can do so for credit. Students must fill out the "Initial Enrollment for Undergraduate Research" form available in the Biology Counseling Office. Once the form is approved, students register for credit in BIOL 194, 294, 394 or 494, depending upon their semester classification. These courses can be repeated for credit.

Special Assignments

Students who would like to undertake special study in areas not available through formal coursework offered by the department are strongly encouraged to find a faculty member whose work is in the area of their interest and arrange to enroll in special assignment courses: BIOL 195, 295, 395, and 495. The special study can be directed readings; independent study; supervised library, laboratory, or field work; or discussions. Credit will be given for the work, and a title of the area investigated will appear

on the transcript. These courses can be repeated for credit.

Summer Internships

Students are encouraged to pursue summer internships both off and on campus. For the past several years, the Department of Biological Sciences has offered summer research fellowships for biology majors. Students selected for these internships do 10 weeks of research at Purdue and receive a generous stipend. The Biology Counseling Office also collects information about other available summer internships.

Cooperative Education

The Department of Biological Sciences participates in the Cooperative Education Program as described on page 9. Interested students should contact the Coordinator of Cooperative Education, Department of Biological Sciences, Room 1–123, Lilly Hall of Life Sciences. The department coordinator will have information about available programs and can offer advice.

To be eligible for the Cooperative Education Program, a student must have a cumulative index of 2.5 or better and have an index of 2.8 or better in biology courses at the end of three semesters.

If grade achievements do not meet these requirements but a student possesses other qualifications that should be considered, he or she can petition for special consideration.

While a co-op student employee, a student must register for the noncredit departmental courses in the sequence BIOL 091, 092, 093, 094, and 095 and pay the special University fee for co-op registration.

Under specified circumstances, students who want to participate in some form of independent study while off campus can register for Special Assignments: BIOL 395 or 495 (1–4 cr.) with the consent of the departmental coordinator of the program.

Minor in Biological Sciences

The minor in biological sciences is designed to allow a non-biology major to establish a strong background knowledge of the biological sciences. It requires courses that cover the spectrum of basic biology, from diversity and ecology to molecular biology and genetics. Students who complete the minor will have sufficient background to understand foundational concepts from any area of biology and their application in everyday settings.

Changes in the Biological Sciences minor are in progress. Students should check with the department for the most recent information.

Minor in Biological Sciences
Requirements **16–18 credits**

The minor in biological sciences requires the following courses:

One of these two sequences: *7–8 cr.*

a. BIOL 121 (Diversity, Ecology, and Behavior) (2 cr.), BIOL 131 (Development, Structure, and Function of Organisms) (3 cr.), BIOL 136 (Quantitative and Problem Solving Skills Laboratory) (1 cr.), BIOL 137 (Handling Cells and Tissues; Microscopy Laboratory) (1 cr.), BIOL 138 (Information and Communication Skills Laboratory) (1 cr.), and BIOL 139 (Measurements and Basic Solution Chemistry Laboratory) (1 cr.) *7 cr.*

b. BIOL 110 (Fundamentals of Biology I) (4 cr.), and BIOL 111 (Fundamentals of Biology II) (4 cr.) *8 cr.*

And the following courses:

BIOL 270 (Molecular and Cellular Biology) (3 cr.) or BIOL 295E (Biology of the Living Cell) (3 cr.); and BIOL 232 (Cell Structure and Function) (2 cr.) *5 cr.*

Plus one of the following sets of courses: *4–5 cr.*

a. BIOL 271 (Genetics) and BIOL 242 (Genetics and Molecular Biology) (5 cr.)

b. AGRY 320 (Genetics) and AGRY 321 (Genetics Laboratory) (4 cr.)

The following courses are prerequisite or corequisite for some of the above courses:

CHM 115 (General Chemistry) (4 cr.), and CHM 116 (General Chemistry) (4 cr.)

Chemistry

The Department of Chemistry offers five baccalaureate programs:

A. Bachelor of Science in Chemistry (American Chemical Society [ACS]-certified) *54–56 credits*

B. Bachelor of Science degree with chemistry major, including specializations in atmospheric chemistry, biochemistry, bioinformatics, computational chemistry, environmental chemistry, and materials science *40–79 credits*

C. Bachelor of Science degree with chemistry teaching major *71–73 credits*

D. Bachelor of Science in Chemistry/Bachelor of Science in Chemical Engineering *87–89 credits*

E. Bachelor of Science in Chemistry/Bachelor of Science in Materials Science and Engineering *93–95 credits*

The educational objectives for individual programs are given in the "Special Degree Requirements" section.

In the last 5 years, 40 percent of chemistry graduates attended graduate school, 40 percent started working in industry (primarily inchemical and pharmaceutical industries), 10 percent went to professional schools (medicine, law), and 10 percent became teachers.

The most recent Web information can be found at: www.chem.purdue.edu.

General Degree Requirements

The College of Science is in the process of reviewing its undergraduate curriculum. Students should check the College of Science Web site (www.science.purdue.edu/academic_programs/majors.asp) and speak with an academic advisor for the most up-to-date information and requirements.

The following courses are required for chemistry majors in all programs. In meeting these general degree requirements, you also will automatically fulfill the College of Science graduation requirements listed on 28-30.

Special requirements for individual degrees are given in the following section.

Chemistry Core ***39–41 credits***

CHM 125 (General Chemistry) (5 cr.), or CHM 115 (General Chemistry) (4 cr.), or CHM 123 (General Chemistry for Engineers I) (4 cr.) *4–5 cr.*

CHM 126 (General Chemistry II) (5 cr.), or CHM 116 (General Chemistry) (4 cr.), or CHM 124 (General Chemistry for Engineers II) (4 cr.), or CHM 136 (General Chemistry Honors) *4–5 cr.*

CHM 241 (Introductory Inorganic Chemistry) (4 cr.); CHM 342 (Inorganic Chemistry) (3 cr.); CHM 261 (Organic Chemistry) (3 cr.); CHM 265 (Organic Chemistry Laboratory) (2 cr.); CHM 294 (Sophomore Chemistry Seminar) (1 cr.); CHM 262 (Organic Chemistry) (3 cr.); CHM 266 (Organic Chemistry Laboratory) (2 cr.); CHM 321 (Analytical Chemistry) (4 cr.); CHM 373 (Physical Chemistry) (3 cr.); CHM 374 (Physical Chemistry) (3 cr.); CHM 376 (Physical Chemistry Laboratory) (2 cr.); CHM 494 (Junior–Senior Chemistry Seminar) (1 cr.) *31 cr.*

Science Requirements ***15–18 credits***

PHYS 172 (Modern Mechanics) (4 cr.); PHYS 241 (Electricity and Optics) (3 cr.) or PHYS 261 (Electricity and Optics) (4 cr.); PHYS 252 (Electricity and Optics Laboratory) (1 cr.); PHYS 290D (Heat and Thermal) (1 cr.) *9–10 cr.*

Two other science courses (3 credits or above) in biology, earth and atmospheric sciences, physics (300 or above level), astronomy, and computer science. All courses should be for science majors and not designed for elementary teachers. Check with your advisor for approval.* *6–8 cr.*

Mathematics Requirements ***12–14 credits***

MA 161 (Plane Analytic Geometry and Calculus I) (5 cr.) or MA 165 (Analytic Geometry and Calculus I) (4 cr.) *4–5 cr.*

One of: MA 162 (Plane Analytic Geometry and Calculus II) (5 cr.), MA 166 (Analytic Geometry and

* *Examples of approved courses for chemistry majors are: BIOL 110–111 (Fundamentals of Biology I and II) (4 cr.); BIOL 286–287 (Introduction to Ecology) (4 cr.); BIOL 231 (Cell Structure and Function) (3 cr.); EAS 111 (Physical Geology) (3 cr.); EAS 403 (Physical Oceanography) (3 cr.); ASTR 363–364 (Intermediate Astronomy I and II) (3 cr.); C S 159 (Programming Applications for Engineers) (3 cr.).*

Calculus II) (4 cr.), MA 173 (Calculus and Analytic Geometry II) (5 cr.), MA 181 (Honors Calculus I) (5 cr.) *4–5 cr.*

One of: MA 261 (Multivariate Calculus) (4 cr.), MA 174 (Multivariable Calculus) (4 cr.), MA 182 (Honors Calculus II) (5 cr.), MA 271 (Several Variable Calculus) (5 cr.) *4–5 cr.*

Additional Requirements 36–41 credits

English Composition: See page 29 for English composition requirements. *6–7 cr.*

Modern Foreign Language: All College of Science majors are expected to have proficiency in another language in addition to their native language. Competency in the second language must be demonstrated at the fourth-semester college level. (See Modern Foreign Language requirements on pages 29-30). *12–16 cr.*

General Education Requirements: You must complete 18 credit hours of study in the humanities, social sciences, and behavioral sciences. (See page 30 for requirements.) *18 cr.*

Free Electives 18 cr.

Free electives can be selected from any department of the University. Students are encouraged to use free electives to broaden their knowledge in chemistry or to gain experience in a non-chemistry area that is of special interest or that will help professionally. However, free elective credit is not allowed for courses that significantly overlap courses taken to fulfill departmental degree requirements. This excludes, in particular, introductory courses. Students must take at least as many free electives as is needed to bring the credit hour total to 124.

Grade Requirement

An undergraduate student is expected to have an average grade point index of at least 2.0 in general chemistry courses and in CHM 241 (Introductory Organic Chemistry), CHM 261 (Organic Chemistry), and CHM 265 (Organic Chemistry Laboratory) or CHM 267 (Organic Chemistry, Honors) to continue in a chemistry program. A student must have an average grade point index of at least 2.0 in required chemistry courses to graduate in any of the chemistry options, except for the teaching option, which requires an index of 2.5.

Chemistry Degrees/Majors

Bachelor of Science in Chemistry

This degree program is designed primarily for students planning professional careers as chemists in industry, universities, or research institutes. This degree program fulfills the recommendations of the Committee on Professional Training of the American Chemical Society (ACS); graduates who follow this program will be certified by the American Chemical Society as having fulfilled its recommended requirements.

By concentrating advanced elective credit hours in biochemistry and by taking biology courses for the laboratory science requirement, this degree provides an excellent preparation for medical, dental, or veterinary schools. This program would particularly benefit those planning careers in medical research.

B.S. in Chemistry (ACS)
Additional Requirements 16 credits

The following courses are required for this option in addition to those listed under "General Degree Requirements" on page 49:

CHM 342L (Inorganic Chemistry Laboratory) (1 cr.); CHM 424 (Analytical Chemistry II) (4 cr.); CHM 513 (Chemical Literature) (1 cr.); Advanced chemistry elective (3 cr.); and CHM 533 (Introductory Biochemistry) (3 cr.) *12 cr.*

MA 262 (Linear Algebra and Differential Equations) (4 cr.) *4 cr.*

Bachelor of Science Degree with Chemistry Major

This degree program is designed for those who want less specialized training in chemistry than is required for the B.S. in Chemistry degree. This program requires the basic courses listed under the "General Degree Requirements" section and permits 9 to 22 credit hours in free electives.

Free electives allow a student to build a program of study in another area to complement a chemistry background. It is possible, for example, to concentrate elective credit hours in one of the following areas: administration, biochemistry, chemical literature, chemical physics, computer applications in chemistry, cosmochemistry, geochemistry, patent law, and preprofessional.

More information about recommended courses for these programs as well as other programs of study are available from an advisor or faculty member.

Bachelor of Science with Chemistry Major — Options

ACS-Accredited Degree in Chemistry/ Biochemistry

Biochemists study the chemical basis of life. Some of the major problems include the transfer of genetic information to biological structures, the conversion of nutrients into cell constituents and their utilization as sources of energy, the storage of memory, and the chemical nature of neural processes. Furthermore, biochemists are interested in the chemical details of important processes such as photosynthesis, blood clotting, fertilization, and other functions that may be unique to certain organisms.

A major in biochemistry also is available through the Department of Biochemistry in the College of Agriculture, and students majoring in the Department of Biological Sciences can elect a biochemistry concentration as listed on page 39.

ACS-Accredited Degree in Chemistry/ Biochemistry Additional Requirements — 22 credits

The following courses are required for this option in addition to those listed under "General Degree Requirements" on page 47:

BIOL 231 (Biology III: Cell Structure and Function) and BIOL 232 (Laboratory in Biology III: Cell Structure and Function) (5 cr.); BIOL 241 (Biology IV: Genetics and Molecular Biology) and BIOL 242 (Laboratory in Biology IV: Genetics and Molecular Biology) (5 cr.) *10 cr.*

CHM 533 (Introductory Biochemistry) (3 cr.) and CHM 538 (Molecular Biotechnology) (3 cr.) or BCHM 561 and BCHM 562 (General Biochemistry I and II) *6 cr.*

CHM 499 (Undergraduate Research in Biochemistry) *6 cr.*

Atmospheric Chemistry

Measurements of atmospheric constituents conducted since the middle of the 19th century have shown that human activities have had a significant impact on the chemical composition of the atmosphere. These changes are manifested in local and global scale pollution problems, including stratospheric ozone depletion, increases in ground level ozone and photochemical smog, global climate change, and acid rain. Problems associated with global atmospheric change have resulted in an increased demand for scientists with a solid education in the fundamentals of atmospheric chemistry. To help meet this need and to provide a unique opportunity for our students in applied chemistry, the Department of Chemistry has created an atmospheric chemistry degree option. Students completing this option will then be well positioned to seek employment with government environmental agencies or with consulting and manufacturing firms in the private sector, or to go on to graduate school.

Atmospheric Chemistry Additional Requirements — 19 credits

The following courses are required for this option in addition to those listed under "General Degree Requirements" on page 47-48:

CHM 424 (Analytical Chemistry II) (4 cr.); CHM 581 (Atmospheric Chemistry) (3 cr.); CHM 582 (Chemistry of the Earth's Upper Atmosphere) (3 cr.) *10 cr.*

EAS 225 (Science of the Atmosphere) (3 cr.); EAS 421 (Atmospheric Thermodynamics) (3 cr.); EAS 525 (Atmospheric Observation on Measurements) (3 cr.) *9 cr.*

It is suggested that students who are pursuing this option take EAS 431 (Synoptic Laboratory) (1 cr.).

Bioinformatics

Bioinformatics is a branch of science that combines applied math, statistics, computer science and biochemistry to solve biological problems. Chemists with bioinformatics specialization can work in the pharmaceutical industry or in companies associated with genomics and proteomics.

Bioinformatics Requirements — 18 credits

The following courses are required for this option in addition to those listed under "General Degree Requirements" on page 47-48.

CHM 533 (Introductory Biochemistry) (3 cr.), CHM 499 (Undergraduate Research in Bioinformatics) (3 cr.)

C S 177 (Programming with Multimedia Objects) (4 cr.), C S 478 (Introduction to Bioinformatics) (3 cr.)

MA 262 (Linear Algebra and Differential Equations) (4 cr.),

STAT 511 (Statistical Methods) (3 cr.), STAT 598B (Bioinformatics) (1 cr.)

Recommended BIOL 231 (Biology III: Cell Structure and function) (3 cr.) or BIOL 295 E (Biology of the Living Cell) (3 cr.).

Computational Chemistry

Scientists today routinely use computer models to study complicated chemical systems. With the availability of high-speed computing from the desktop to the supercomputer, chemical problems can be studied extensively as computer models. This degree option will prepare individuals with computing skills and a technical understanding of the chemical sciences for careers in science where computers are one more tool used every day to solve complex chemical problems.

Computational Chemistry
Additional Requirements **25 credits**

The following courses are required for this option in addition to those listed under "General Degree Requirements" on page 47:

Chemistry: Undergraduate Research in Computational Chemistry or related field: CHM 499 (Special Assignments) (6 cr.)/ and CHM 579 (Computational Chemistry) (3 cr.) *9 cr.*

Computer Science: C S 180 (Programming I) (4 cr.); C S 240 (Programming in C) (3 cr.); C S 251 (Data Structures) (3 cr.); C S 314 (Numerical Methods) (3 cr.); and C S 334 (Fundamentals of Computer Graphics) (3 cr.) *16 cr.*

Environmental Chemistry

Society faces many challenges involving environmental issues. Important issues such as ground water pollution, hazardous chemical waste treatment, ozone depletion, radioactive waste treatment, industrial hygiene, and water treatment require a strong fundamental understanding of the chemistry involved. This degree option has been designed to provide students a means to tailor a field of study with an emphasis on chemistry and the environment.

Environmental Chemistry
Requirements **31–33 credits**

The following courses are required for this option in addition to those listed under "General Degree Requirements" on page 47:

One of the following:

a. BIOL 231 (Biology III: Cell Structure and Function) (3 cr.), BIOL 232 (Laboratory in Biology III: Cell Structure and Function) (2 cr.), BIOL 241 (Biology IV: Genetics and Molecular Biology) (3 cr.), and BIOL 242 (Biology IV: Genetics and Molecular Biology) (2 cr.)

b. EAS 243–244 (Earth Materials I and II) (8 cr.) *8–10 cr.*

C E 353 (Physico-Chemical Principles of Environmental Engineering) (4 cr.); CHM 481 (Topics in Environmental Chemistry) (3 cr.); CHM 424 (Analytical Chemistry II) (4 cr.) *11 cr.*

Undergraduate research: CHM 499 (Special Assignments) (6 cr.). (Undergraduate research in an environmentally related area. Need not be restricted to the Chemistry Department, e.g. C E 497 (Civil Engineering Projects), HSCI 490 (Special Topics), FNR 499 (Forestry & Natural Resources Honors Thesis), etc. Students must complete two semesters of research. In special cases, an additional 6 credits of environmental electives may be substituted). *6 cr.*

Environmental electives ***6 credits***

At least one must be at the 400/500 level. Choose from the following (or see your advisor):

Earth and Atmospheric Sciences: EAS 519 (Applications of Environmental Geosciences) (3 cr.)

Chemistry: CHM 533 (Introductory Biochemistry) (3 cr.); CHM 548 (Radiochemistry) (3 cr.)

Civil Engineering: C E 350 (Environmental Engineering) (3 cr.); C E 352 (Biological Principles of Environmental Engineering) (3 cr.); C E 456 (Wastewater Treatment) (3 cr.); C E 542 (Hydrology) (3 cr.)

Forestry and Natural Resources: FNR 488 (Global Environmental Issues) (3 cr.); FNR 581 (Environmental Impact Analysis) (3 cr.)

Health Sciences: HSCI 345 (Occupational Disease) (3 cr.); HSCI 347 (Industrial Hygiene Hazard Evaluation) (3 cr.)

Statistics: STAT 511 (Statistical Methods) (3 cr.)

In order to fulfill the general education requirement, it is suggested that students consider taking some or all of the following courses:

POL 223 (Introduction to Environmental Policy) (3 cr.) and POL 523 (Environmental Politics and Public Policy) (3 cr.); C E 553 (Environmental Law for Engineers) (3 cr.) (recommended as a free elective).

Materials Science Specialization

This plan of study meets the requirements for the B.S. with Chemistry major as well as providing a strong background in materials science and engineering. Please refer to the College of Engineering Catalog for more information on the materials science and engineering field.

Materials Science Specialization Additional Requirements **31 credits**

In addition to the requirements for the B.S. with Chemistry major, the following courses are required:

MA 262 (Linear Algebra and Differential Equations) (4 cr.) *4 cr.*

MSE 230 (Structure and Properties of Materials) (3 cr.); MSE 235 (Materials Properties Laboratory) (2 cr.); MSE 240 (Processing and Properties of Materials) (3 cr.); MSE 335 (Materials Characterization Laboratory) (3 cr.); MSE 340 (Transport Phenomena) (3 cr.); MSE 350 (Thermodynamics of Materials) (3 cr.); MSE 367 (Materials Processing Laboratory) (3 cr.); MSE 370 (Electrical, Optical, and Magnetic Properties of Materials) (3 cr.) *23 cr.*

CHE 544 (Structure and Physical Behavior of Polymer Systems) (3 cr.); CHM 342L (Inorganic Chemistry Lab) (1 cr.) *4 cr.*

Bachelor of Science Degree with Chemistry Teaching Major

This program of study meets the requirements for certification to teach chemistry in the secondary schools of Indiana in addition to meeting the requirements for the B.S. degree with chemistry major on page 48. Students preparing to teach in junior/high/middle/secondary schools (grades 5–12) must meet the requirements set by the Teacher Education Council. These requirements are outlined in the Guide to Teacher Preparation and Licensure from the Office of Professional Preparation (OPPL) at Purdue www.education.purdue.edu/oppl/home.

The program of study for prospective teachers differs from the program leading to the B.S. degree with a chemistry major in three requirements: CHM 533 (Introduction to Biochemistry) is required, foreign language is two semesters, and Organic Chemistry Laboratory can be substituted by CHM 263 and 264, which have one less credit respectively. However, all chemistry education students are encouraged to take CHM 265 and 266 to meet the regular chemistry major requirements in case they switch to a non-teaching option.

The following 32 credit hours of education courses are required for certification to teach in Indiana high schools. One of the courses, EDCI 428 is taken during the first six weeks of the professional semester, before student teaching.

Bachelor of Science Degree with Chemistry Teaching Major Requirements **32 credits**

Professional Education

EDCI 270 (Introduction to Educational Technology and Computing) (2 cr.), and EDST 200 (History and Philosophy of Education) (3 cr.) *5 cr.*

EDCI 205 (Exploring Teaching as a Career) (3 cr.), and EDCI 285 (Multiculturalism and Education) (3 cr.) *6 cr.*

EDPS 235S (Learning and Motivation) (3 cr.) and EDPS 265 (The Inclusive Classroom) (3 cr.) *6 cr.*

EDCI 424 (The Teaching of Earth/Physical Science in Secondary Schools) (3 cr.), EDCI 428 (Teaching Science in the Middle and Junior High School) (2 cr.), and EDCI 498 (Supervised Teaching) (10 cr.) *15 cr.*

Bachelor of Science in Chemistry/ Bachelor of Science in Chemical Engineering

The Department of Chemistry and the School of Chemical Engineering offer a joint program for students that lead to a dual degree of B.S. in Chemistry and B.S. in Chemical Engineering. Graduates of this program will be certified as having fulfilled the recommended requirements of the American Chemical Society. The curriculum in chemical engineering is accredited by the Engineer's Council for Professional Development.

B.S. in Chemistry/ B.S. in Chemical Engineering Requirements

First-year engineering requirements ***31–37 credits***

For admission to this degree program, students must complete the plan of study for first-year engineering (with a grade point index of 2.5), which is:

Chemistry: CHM 125 (Introduction to Chemistry I) (5 cr.), CHM 115 (General Chemistry) (4 cr.), or CHM 123 (General Chemistry for Engineers I) (4 cr.); and either CHM 126 (Introduction to Chemistry II) (5 cr.), CHM 116 (General Chemistry (4 cr.), or CHM 124 (General Chemistry for Engineers II) (4 cr.) *8–10 cr.*

Mathematics: MA 161–162 (Plane Analytic Geometry and Calculus, I and II) (10 cr.); or MA 165–166 (Analytic Geometry and Calculus, I

and II) (8 cr.) *8–10 cr.*
Physics: PHYS 172 (Modern Mechanics) (4 cr.) *4 cr.*
Computer science: C S 156 (C Programming for Engineers) (2 cr.) or C S 159 (Programming Applications for Engineers) (3 cr.) *2–3 cr.*
Engineering: ENGR 126 (Engineering Problem-Solving and Computer Tools) (3 cr.) and ENGR 100 (Freshman Engineering Lectures) (1 cr.) *3 cr.*
Communications: COM 114 (Fundamentals of Speech Communication) (3 cr.) *3 cr.*
English composition: ENGL 106 (English Composition) (4 cr.) or ENGL 108 (Accelerated First-Year Composition) (3 cr.) *3–4 cr.*

Additional requirements ***44 credits***

In addition to the requirements for the ACS B.S. in Chemistry degree on page 50 and First-Year Engineering described above, the following courses are required:

CHE 205 (Chemical Engineering Calculations) (3 cr.); CHE 211 (Introductory Chemical Engineering Thermodynamics) (3 cr.); CHE 306 (Design of Staged Separation Processes) (3 cr.); CHE 320 (Statistical Modeling and Quality Enhancement) (3 cr.); CHE 330 (Principles of Molecular Engineering) (3 cr.); CHE 348 (Chemical Reaction Engineering) (3 cr.); CHE 377 (Momentum Transfer) (3 cr.); MA 303 (Differential Equations and Partial Differential Equations for Engineering and the Sciences) (3 cr.); CHE 378 (Heat and Mass Transfer) (3 cr.); CHE 434–435 (Chemical Engineering Laboratory) (6 cr.); CHE 450 (Design and Analysis of Processing Systems) (3 cr.); CHE 456 (Process Dynamics and Control) (3 cr.) *36 cr.*
I E 343 (Engineering Economics) (3 cr.) *3 cr.*

Engineering electives ***6 credits***

The following courses satisfy particular requirements of the School of Chemical Engineering: 18 cr. of General Education, the general elective requirements; CHM 321 (Analytical Chemistry I) and CHM 424 (Analytical Chemistry II), two engineering electives; and CHM 342 (Inorganic Chemistry), and one technical elective. In the chemistry plan, CHE 211 (Introductory Chemical Engineering Thermodynamics) can replace CHM 373 (Physical Chemistry) and CHE 456 (Process Dynamics and Control) can count as a chemistry elective. Details about the requirements of the B.S. in Chemical Engineering curriculum as well as acceptable chemical engineering and engineering electives are explained in the College of Engineering Web site.

Bachelor of Science in Chemistry/ Bachelor of Science in Materials Science and Engineering

The Department of Chemistry and the School of Materials Engineering offer a joint program that leads to a dual degree of B.S. in Chemistry and B.S. in Materials Science and Engineering. Graduates of this program will be certified as having fulfilled the requirements of the American Chemical Society and accredited by the Accreditation Commission of the Accreditation Board for Engineering and Technology.

For admission to this degree program, students must complete the plan of study for First-Year Engineering (with an index of 2.5) which is:

CHM 125 (Introduction to Chemistry I) (5 cr.), CHM 115 (General Chemistry) (4 cr.), or CHM 123 (General Chemistry for Engineers I) (4 cr.); and either CHM 126 (Introduction to Chemistry II) (5 cr.), CHM 116 (General Chemistry) (4 cr.), or CHM 124 (General Chemistry for Engineers II) (4 cr.) *8–10 cr.*
MA 161–162 (Plane Analytic Geometry and Calculus, I and II) (10 cr.); or MA 165–166 (Analytic Geometry and Calculus, I and II) (8 cr.) *8–10 cr.*
PHYS 172 (Modern Mechanics) (4 cr.) *4 cr.*
C S 159 (Programming Applications for Engineers) *3 cr.*
ENGR 126 (Engineering Problem-Solving and Computer Tools) (3 cr.) and ENGR 100 (Freshman Engineering Lectures) (1 cr.) *4 cr.*
COM 114 (Fundamentals of Speech Communication) (3 cr.) *3 cr.*
ENGL 106 (English Composition) (4 cr.) *4 cr.*
In addition to the requirements for the ACS B.S. in Chemistry degree (page 48) and First-Year Engineering described above, the following courses are required:
M E 270 (Basic Mechanics I) (3 cr.) *3 cr.*
MSE 230 (Structure and Property of Materials) (3 cr.); MSE 235 (Materials Properties Laboratory) (2 cr.); MSE 240 (Processing and Properties of Materials) (3 cr.); MSE 335 (Materials Characterization Laboratory) (3 cr.); MSE 340 (Transport Phenomena) (3 cr.); MSE 350 (Thermodynamics of Materials) (3 cr.); MSE 367 (Materials Processing Laboratory) (3 cr.); MSE 370 (Electrical, Optical, and Magnetic Properties of Materials) (3 cr.); MSE 382 (Mechanical Response of Materials) (3 cr.); MSE 430

(Materials Processing and Design I) (3 cr.); MSE 440 (Materials Processing and Design II) (3 cr.) *33 cr.*

Engineering electives ***6 credits***

Details about the requirements of the B.S. in Materials Science and Engineering curriculum as well as acceptable engineering electives can be found in the College of Engineering Catalog.

Preprofessional Preparation

Any chemistry degree program can serve as an excellent basis of preparation for dental, medical, or veterinary school. Knowledge of chemistry is a valuable asset when studying biochemistry, physiology, endocrinology, pharmacology, and anatomy.

For example, a student who wants to apply to medical school, in addition to the courses in his or her chemistry program, will need one year of biology (Fundamentals of Biology I and II: BIOL 110–111 or Cell Structure and Function: BIOL 231/232 and Genetics and Molecular Biology: BIOL 241/242) to meet general admission requirements for most medical schools. Since admission requirements vary, it is essential to check the specific requirements for each school that interests the student.

Honors Program

The Department of Chemistry has an honors program for superior students. Participation can begin during the sophomore year, and a student will be assigned to advanced sections in chemistry courses taken during the sophomore year. During the junior and senior years, a student engages in undergraduate research, participates in research seminars, and completes honors courses in the selected degree plan. The undergraduate research experience (CHM 499) is to be a minimum of six credits. In addition, the student must write an honor's thesis based on the CHM 499 work. A committee of two faculty members will read the thesis, and the student will give a public presentation of the research.

Admission to the chemistry honors program must be made by the junior year. The honors student is expected to achieve and maintain a scholastic graduation index of at least 3.4. Students fulfilling requirements of the chemistry honors program will be graduated "with honors in chemistry."

Honors Program Courses

Except for CHM 499, the honors courses listed below replace the corresponding courses in the degree requirements.

Chemistry: CHM 267 (Organic Chemistry Laboratory [Honors]) (2 cr.), CHM 268 (Organic Chemistry Laboratory) (2 cr.), and CHM 323 (Analytical Chemistry I [Honors]) (4 cr.)

Undergraduate Research: CHM 499 (Special Assignments) (6 cr. minimum)

Special Programs and Opportunities

Cooperative Education Program

The Department of Chemistry participates in the Cooperative Education Program as described on page 9. This program requires five years and involves four work periods, either semesters or summer modules, with a cooperating company in the chemical industry. As a student gains experience, he or she is given increasingly responsible industrial assignments and receives more compensation.

A student can enter the program at the end of the freshman or sophomore year if he or she ranks in the upper half of the class, has completed two semesters of chemistry, and has a chemistry index greater than 2.80. Information is available from the Coordinator of Cooperative Education in the Department of Chemistry. Check with your advisor for further information.

Chemistry Minor

A student may earn a minor in chemistry upon completion of 16 credit hours of chemistry courses beyond general chemistry (CHM 115 and 116, 125 and 126, or 123 and 124). The following courses (designed for non-science majors) will not count toward a minor: CHM 224 (Introductory Quantitative Analysis), CHM 257 (Organic Chemistry [for non-science majors]), and CHM 333 (Principles of Biochemistry).

Up to three credits of undergraduate research (CHM 499) may be used toward fulfillment of the minor. All courses must be offered by the Department of Chemistry, Purdue University.

Computer Science

Because computer science is a young and rapidly developing field, the curriculum must be revised frequently to keep it up-to-date.

The Department of Computer Science offers a Bachelor of Science (B.S.) degree program. An honors designation is available for students who fulfill requirements beyond those for the B.S. Qualified students in the bachelor's program may participate in the Cooperative Education Program.

Purdue computer science graduates are in demand in business, industry, research organizations, and government. They are faculty in highly ranked departments, researchers at internationally recognized labs, and leaders and innovators in industry and government. They apply skills in conceptualization and problem-solving to develop computational solutions for today and beyond.

While some of the more routine computer support and coding jobs are being relocated overseas, the demand for well-trained and highly qualified computer scientists in the U.S. remains strong. Virtually every field of science and engineering is affected by computing, and computer scientists play a key role in interdisciplinary efforts that bring the power of computing technology to these areas.

The demand for computer science graduates encompasses all sectors of business, industry, education, and government. Some of the exciting growth areas and opportunities include:

- Bioinformatics
- Computational nanotechnology
- Data integration and data mining
- Distributed and peer-to-peer computing
- Graphics and visualization
- Security and information assurance
- Mobile and wireless systems
- Software engineering

The most recent information is available at www.cs.purdue.edu.

General Degree Requirements 124 credits

The College of Science is in the process of reviewing its undergraduate curriculum. Students should check the College of Science Web site (www.science.purdue.edu/academic_programs/majors.asp) and speak with an academic advisor for the most up-to-date information and requirements.

The following requirements include the B.S. degree requirements of the College of Science. A total of 124 credits is required. Mathematics courses below the level of calculus (MA 161) cannot be used to satisfy any degree requirements.

Computer Science Core 38 credits*

C S 180 (Programming I) (4 cr.); C S 182 (Foundations of Computer Science) (3 cr.); C S 240 (Programming in C) (3 cr.); C S 250 (Computer Architecture) (4 cr.); C S 251 (Data Structures) (3 cr.); C S 352 (Compilers: Principles and Practice) (3 cr.); C S 354 (Operating Systems) (3 cr.); C S 381 (Introduction to the Analysis of Algorithms) (3 cr.) *26 cr.*

Four other computer science courses at or above the 300 level. (12 cr.) *12 cr.*

In addition, all new computer science majors are strongly urged to take C S 192 (Freshman Resources Seminar) (1 cr.), C S 291 (Sophomore Resources Seminar) (1 cr.), and C S 392 (Junior Resources Seminar) (1 cr.).

Science Requirements 12–18 credits

Four approved courses in biology, chemistry, earth and atmospheric sciences, physics, astronomy, or electrical and computer engineering. ECE 270 (Introduction to Digital System Design) (4 cr.) and ECE 362 (Microprocessor Systems and Interfacing) (4 cr.) are permitted.

Mathematics Requirements 15–17 credits

One of: MA 161 (Plane Analytic Geometry and Calculus I) (5 cr.) or MA 165 (Analytic Geometry and Calculus I) (4 cr.) *4–5 cr.*

One of: MA 162 (Plane Analytic Geometry and Calculus II) (5 cr.), MA 166 (Analytic Geometry and Calculus II) (4 cr.), MA 173 (Calculus and Analytic Geometry II) (5 cr.), MA 181 (Honors Calculus I) (5 cr.) *4–5 cr.*

One of: MA 261 (Multivariate Calculus) (4 cr.), MA 174 (Multivariable Calculus) (4 cr.), MA 182 (Honors Calculus II) (5 cr.), MA 271 (Several Variable Calculus) (5 cr.) *4–5 cr.*

Linear Algebra: MA 265 (Linear Algebra) (3 cr.), or MA 351 (Elementary Linear Algebra) (3 cr.) *3 cr.*

**All computer science courses must be completed with a grade of "C" or better.*

Additional Requirements ***36–37 credits***

English Composition: See page 29 for English composition requirements. *6–7 cr.*

Modern Foreign Language: All College of Science majors are expected to have proficiency in another language in addition to their native language. Competency in the second language must be demonstrated at the fourth-semester college level. (See Modern Foreign Language requirements on pages 29-30). *12 cr.*

General Education Requirements: You must complete 18 credit hours of study in the humanities, social sciences, and behavioral sciences. (See page 30 for requirements.) *18 cr.*

Free Electives ***10–26 credits***

Free electives can be selected from any department of the University. Students are encouraged to use free electives to broaden their knowledge. Courses from departments other than Computer Science must be approved by the student's academic advisor.

Free elective credit is not allowed for courses that significantly overlap courses taken to fulfill departmental degree requirements, in particular, introductory programming courses regardless of the language used. Students must take at least as many free electives as are needed to bring the credit hour total to 124.

Honors Program

The Department of Computer Science awards honors to graduating students who have satisfied the requirements listed below. Students enter the CS honors program in one of three ways:

1. By invitation to the science freshman honors program upon admission.
2. By invitation to the science freshman honors program after their first semester.
3. By application. Students may request admission to the computer science honors program to be effective in the semester following the completion of their lower-division core courses. The Undergraduate Committee may grant admission if they have at least a 3.25 cumulative grade point average, at least a 3.60 cumulative grade point average in computer science courses, and the recommendation of their advisor.

Honors students must maintain the above grade point requirements to remain in the honors program.

Honors students are encouraged, but not required, to take C S 197 (Freshman Honors Seminar) (class 1, credit 1, pass/not pass) in the spring semester of their freshman year. The seminar covers the history, context, and future of computer science.

Honors Course Requirements

The "four other computer science courses at or above the 300 level" required for the bachelor's degree must include C S 497 (see below) and an approved 500-level course. ("Approved" means approved by the Computer Science Undergraduate Committee for the purpose of achieving honors.)

Elementary Linear Algebra: MA 351 (Elementary Linear Algebra) (3 cr.)

An approved mathematics course beyond MA 351 or an approved statistics course beyond STAT 511.

ECE 270 (Introduction to Digital System Design) (4 cr.)

C S 397 (Honors Seminar) (no credit, eight meetings, offered each fall semester). Honors students should typically take C S 397 the semester before taking C S 497. C S 397 is required to be taken only once. C S 397 meetings focus on what is involved in research, how to select a research project, and presentations by C S 497 students on their research projects.

C S 497 (Honors Research Project) (3 cr., offered each semester). Each student in the honors program must complete a group research project directed by computer science faculty members. Each group must submit a technical report describing its work and results and must also give a short presentation in C S 397. One semester of the project may be counted as one of the "four computer science courses at or above the 300 level" required for the bachelor's degree. One more semester, if approved by the Undergraduate Committee, can be used as a free elective.

Honors students may use CS 490 courses only as free electives. Only one semester of research-oriented courses will count as a CS elective.

Special Programs and Opportunities

Cooperative Education Program

The department participates in the Cooperative Education Program described on page 9. To be eligible for the Cooperative Education Program, students must:

1. Be in the Computer Science bachelor's degree program.
2. Have a grade point average of at least 3.0 in Computer Science courses.
3. Have an overall grade point average of at least 2.8.

Students are normally expected to complete C S 180 (Programming I), C S 182 (Foundations of Computer Science), and C S 240 (Programming in C) before their first work session, and either C S 250 (Computer Architecture) or C S

251 (Data Structures) before their second work session.

To receive a Cooperative Education certificate of completion, students must complete at least four work sessions. At least two of the four sessions must be fall and/or spring semesters.

For additional information, please see www.cs.purdue.edu/courses/co-op.html, or send email to coop@cs.purdue.edu.

Minor Concentration in Computer Science

To obtain a minor concentration in Computer Sciences, students must pass, with grades of A, B, or C, five CS courses that fulfill CS major requirements. All five courses must be taken at Purdue University. For more information see http://www.cs.purdue.edu/academic_programs/undergraduate/curriculum/minor/index.sxhtml.

Earth and Atmospheric Sciences

Earth and atmospheric sciences (EAS) focus on the study of the atmosphere, oceans, and the solid earth. These disciplines are concerned with the quality of life and the physical environment in which we live. Earth and atmospheric scientists have accepted the challenge of arriving at solutions to basic and applied problems that affect our planet.

Faculty and students in the Department of Earth and Atmospheric Sciences study a wide range of geophysical phenomena. These phenomena include events that affect daily life on earth, such as mineral and oil exploration and weather forecasting, events that are the source of devastating natural disasters, such as earthquakes, landslides, and tornadoes, and events that explore the distant past or the projected future of our stay on earth, such as climate change, plate tectonics, and Arctic and Antarctic fossil discoveries.

The Department of Earth and Atmospheric Sciences prepares students to investigate a variety of problems. The basic core courses listed on pages 58-59, supplemented by courses relevant to each specialized area of interest, provide a broad scientific education that prepares students for graduate programs or for entry-level employment positions after completing the B.S. degree.

A master's degree is desirable for research, advancement in secondary school teaching in Indiana, and many positions in government or industry. The Ph.D. degree is required for advancement in university teaching and higher-level positions in research.

Earth and atmospheric sciences students have many career options. The following are several possible areas of emphasis, and the career options that may be available to students. For specific information on which core and option would best match a program, please speak with an advisor.

Careers in Earth and Atmospheric Sciences

Atmospheric Science (Meteorology). Meteorology is the study of atmospheric phenomena. This includes the physics, chemistry, and dynamics of the atmosphere; and many of the interactions between the atmosphere, solid earth, and oceans.

The undergraduate meteorology curriculum includes not only core courses in atmospheric science, but also complementary exposure to mathematics, physics, chemistry, and computer science. Thus, graduates are prepared to enter the work force in specialties such as weather forecasting and air pollution as well as to further their education by pursuing graduate degrees.

Geology. Geology is the study of the internal structure, materials, chemical/physical processes, and physical/biological history of the earth. Students of geology encounter science in the broadest sense because geology involves the application of principles of physics, mathematics, biology, and chemistry as well as many aspects of engineering and environmental sciences.

Because the scope of geology is broad, specialized branches have evolved. For example, geomorphologists investigate the nature and origin of land forms by studying the causes and effects of dynamic earth processes; structural geologists are concerned with the arrangement of rock masses in the earth's crust and the types of forces that have affected them; and stratigraphers investigate the thickness, geometry, and distribution of layered rocks to understand the chronology of geologic events.

Geologists also may specialize as economic geologists who explore the earth for various kinds of mineral deposits and supervise their development. Others may become ground-water geologists concerned with the distribution, movement, and chemical quality of our precious underground water supply. Many have become petroleum geologists who explore for and develop deposits of coal, oil, natural gas, and other earth resource materials. Another area that appeals to many geology majors is environmental geology, in which geological skills are required to help predict, avoid, or mitigate problems connected with pollution, urban development, and geologic hazards such as flooding and excessive erosion.

Students completing the B.S. curriculum in geology would be prepared to undertake graduate studies for advanced degrees or enter a variety of careers related to some of the specialty areas.

Paleontology and Paleoecology. Paleontology is the study of fossils, with the aim of discerning the nature, occurrence, and evolution of life throughout geologic time. Paleoecology deals with the relationship between fossil organisms and their inferred environments. Coursework in this area emphasizes methods by which data derived from fossils can be interpreted and applied to geologic and biologic problems.

Geochemistry, Mineralogy, and Petrology. This program uses concepts from disciplines such as chemistry, physics, and mathematics to help clarify geological phenomena and problems. In general, the problems are directly related to the basic materials comprising the earth, namely, the origin and occurrence of minerals, rocks, and ore deposits. Mineralogy, petrology, and geochemistry are so closely related that a combined treatment is necessary.

Engineering Geology. Engineering geology involves the use of geological data, techniques, and principles to interpret the geologic factors affecting the planning, design, and safety of engineering projects. The undergraduate curriculum should be a blend of engineering and geology courses designed to teach engineering principles and foster understanding of engineering problems.

Engineering geology work includes studies related to site location and investigation; environmental assessment; design recommendations; construction, monitoring, and maintenance of engineering structures such as dams, tunnels, bridges, buildings, mines, cut slopes in rocks, quarries, etc.; and analysis of the geology of urban areas.

Hydrogeology. The hydrogeologist is called on to assess an area for groundwater development potential for domestic, industrial, or agricultural supply. His or her skills may be required to determine the origin and fate of naturally occurring or man-made chemicals in ground water.

Hydrogeology is also intimately related to knowledge of earth surface processes (geomorphology), environmental studies, engineering geology, and exploration geophysics. A background in these related specialties is desirable.

Geophysics. Geophysics applies principles of physics to the study of the earth. Studies of natural gravity, magnetic and electrical fields, seismic wave propagation, and heat flow are used to deduce the nature of the earth's interior - the structure, composition, physical properties, and dynamic processes that cause earthquakes and move continents. Similar studies are used to explore for petroleum and mineral deposits, and to investigate the shallow portions of the earth's crust to determine conditions that influence the location of engineering structures.

Geophysics includes theoretical and laboratory studies as well as field investigations that may be located in interesting and remote areas of the world. Often geophysicists use sophisticated instrumentation, computer processing of data, and interpretation and integration of information from several related disciplines.

Environmental Geoscience. Using a broad background in geology as their foundation, environmental geoscientists use an interdisciplinary approach to study groundwater contamination, landfill management, landslide risk, urban planning, and many other contemporary environmental issues. These scientists must develop quantitative problem-solving skills acquired in an educational framework that couples their geological background with basic principles of chemistry, physics, mathematics, and engineering. They often are consulted on decisions regarding environmental public policy.

A special curriculum has been developed that is founded on a strong geology background supplemented by interdisciplinary work in science, engineering, and social science. Graduates of this program can expect to fill the growing

need for environmental scientists at the B.S. degree level or to move on to graduate work in one of the geological or environmental sciences.

Earth/Space Science Teaching. Students preparing to teach in junior high/middle/secondary schools (grades 5-12) must meet the requirements set by the University-wide Teacher Education Council. Copies of the sections of the booklet that apply to prospective high school earth/space science teachers are available in the College of Science Counseling Office.

It is possible to meet the College of Science humanities and social sciences requirements without meeting the humanities and social sciences requirements for teacher licensing in Indiana. For details about how to meet both requirements, see your counselor.

Prospective teachers are exempt from the second year of the foreign language requirement if they successfully complete the professional semester within the baccalaureate program. The professional semester is the one in which courses are taken at Purdue for six weeks, followed by a teaching practicum for 10 weeks.

Marine Science. Students interested in pursuing a career in marine sciences are encouraged to major in earth or atmospheric sciences, or another basic science such as biology. A program can be arranged that will qualify students to study marine science in graduate school.

The most recent web information can be found at: http://www.purdue.edu/eas/

General Degree Requirements

The College of Science is in the process of reviewing its undergraduate curriculum. Students should check the College of Science Web site (www.science.purdue.edu/academic_programs/majors.asp) and speak with an academic advisor for the most up-to-date information and requirements.

Students must complete the requirements for one of the following options:

1. Solid Earth Science: 51 credits
2. Atmospheric Science: 42-50 credits, depending on option
3. Environmental Geoscience: 73-74 credits
4. Earth/Space Science Teaching: 83-86 credits

The following courses are required of all B.S. students in earth and atmospheric sciences. In meeting these general degree requirements, students automatically will fulfill the College of Science graduation requirements listed on pages 28-30. Students transferring into the Department of Earth and Atmospheric Sciences after the freshman year should talk to the departmental counselor about specific earth and atmospheric sciences requirements that may be waived by the department's Undergraduate Committee.

Earth and Atmospheric Sciences Requirements

Science Requirements (all options) ***17 credits***

Chemistry: CHM 115 and 116 (General Chemistry) (Earth/space science teaching majors can substitute CHM 111 and CHM 112 (General Chemistry)). *8 cr.*

Physics: PHYS 172 (Modern Mechanics) (4 cr.); PHYS 241 (Electricity and Optics) (3 cr.); PHYS 252 (Electricity and Optics Lab) (1 cr.); and PHYS 290D (Thermo Unit) (1 cr.). (Earth/space science teaching majors can substitute PHYS 220 and 221 (General Physics) (4 cr. each). *9 cr.*

Mathematics Requirements (all options) ***19–21 credits***

MA 161 (Plane Analytic Geometry and Calculus I) (5 cr.) or MA 165 (Analytic Geometry and Calculus I) (4 cr.) *4–5 cr.*

One of: MA 162 (Plane Analytic Geometry and Calculus II) (5 cr.), MA 166 (Analytic Geometry and Calculus II) (4 cr.), MA 173 (Calculus and Analytic Geometry II) (5 cr.), MA 181 (Honors Calculus I) (5 cr.) *4–5 cr.*

One of: MA 261 (Multivariate Calculus) (4 cr.), MA 174 (Multivariable Calculus) (4 cr.), MA 182 (Honors Calculus II) (5 cr.), MA 271 (Several Variable Calculus) (5 cr.) *4–5 cr.*

MA 262 (Linear Algebra and Differential Equations) (4 cr.), or MA 272 (Differential Equations and Linear Algebra) (4 cr.) *4 cr.*

(Environmental geosciences majors can substitute MA 266 (Ordinary Differential Equations) (3 cr.).

C S 158 (Programming I) (3 cr.) *3 cr.*

(Earth/Space science teaching can substitute C S 177).

Additional Requirements 31–36 credits

English Composition: See page 29 for English composition requirements. *6–7 cr.*

Modern Foreign Language: All College of Science majors are expected to have proficiency in another language in addition to their native language. Competency in the second language must be demonstrated at the fourth-semester college level. (See Modern Foreign Language requirements on pages 29-30). *12–16 cr.*

General Education Requirements: You must complete 18 credit hours of study in the humanities, social sciences and behavioral sciences. (See page 30 for requirements.) *18 cr.*

Free Electives 12–21 credits

Free electives can be selected from any department of the University. Students are encouraged to use free electives to broaden their knowledge. However, free elective credit is not allowed for courses that significantly overlap courses taken to fulfill departmental degree requirements. This excludes, in particular, introductory courses. Students must take at least as many free electives as is needed to bring the credit hour total to 124.

The earth/space science teaching program has additional option requirements, which include 18 credit hours of education courses. The number of free electives that can be selected to complete the 124 credit hours needed for graduation will depend on a student's option and the courses taken to meet the general degree requirements. Students in atmospheric science who wish to be qualified for employment as meteorologists in the federal government must elect EAS 433 (Synoptic Laboratory II) (1 cr.) and EAS 434 (Weather Analysis and Forecasting) (3 cr.).

Additional Requirements for Entry into the Upper Division in All Options

A student pursuing a major in solid earth geosciences, environmental geosciences, earth/space science teaching, or atmospheric science must satisfy the following requirements before being permitted to enter the upper division:

1. Completion of MA 161 (Plane Analytic Geometry and Calculus I) (5 cr.), and MA 162 (Plane Analytic Geometry and Calculus II) (5 cr.), CHM 115 (General Chemistry) (4 cr.) and CHM 116 (General Chemistry) (4 cr.), and PHYS 172 (Modern Mechanics) (4 cr.), or equivalents with a grade of "C" or better; and

2. Completion of required lower-division courses in the student's major area, each with a grade of "C" or better.

For the application of these requirements, entry into the upper division is defined as registration for the semester that includes EAS 351 (Structural, Tectonic, and Basis Analysis) (4 cr.) (for solid earth geosciences); or EAS 421 (Atmospheric Thermodynamics) (3 cr.) (for atmospheric science) in the course selection.

Grade Requirement

To graduate in any EAS major, a student must have an average grade point average of 2.0 or above in EAS courses required for the major.

Earth and Atmospheric Science majors and options

Students must complete the general degree requirements on page 58-59, plus one of four cores:

1. Solid earth science (geology and geophysics)
2. Atmospheric science
3. Environmental geoscience
4. Earth/space science teaching

Within the atmospheric science core, students may choose from four options: synoptic meteorology, atmospheric dynamics, atmospheric physics, and atmospheric chemistry.

Solid Earth Science Requirements 51 credits

Solid Earth Geology Science Core 39 credits

EAS 109 (The Dynamic Earth) (3 cr.); EAS 143 (Freshman Seminar in Earth Science) (1 cr.); EAS 112 (Historical Geology) (4 cr.); EAS 243 (Earth Materials I) (4 cr.); EAS 244 (Earth Materials II) (4 cr.); EAS 351 (Structural, Tectonic, and Basin Analysis) (4 cr.); EAS 352 (Structural Geology) (3 cr.); EAS 390 (Geologic Field Methods) (3 cr.); EAS 309 (Computer-Aided Analysis for Geosciences) (3 cr.); EAS 450 (Physics and Chemistry of Solid Earth) (4 cr.); EAS 490 (Field Geology Summer Field Camp) (6 cr.). *39 cr.*

Students participate in the field experience the summer before the senior year. Additional information about the field experience is on page 62.

You must complete one option in addition to the core requirements above.

Additional Science and Engineering

In the solid earth curriculum, at least 6 credits are required in EAS regular courses (exclusive of seminar and reading courses) numbered 300 and above in EAS to fulfill the EAS curriculum electives. At least 6 credits numbered 200 and above in science, engineering, or agriculture are required to fulfill the science/engineering electives. Students can consult their academic advisors for appropriate courses. *12 cr.*

Atmospheric Science Requirements — 57 credits

Atmospheric Science Core — *30 credits*

EAS 109 (The Dynamic Earth) (3 cr.); EAS 133 (Freshman Seminar in Atmospheric Science) (1 cr.); EAS 225 (Science of the Atmosphere) (3 cr.); EAS 320 (Physics of Climate) (3 cr.); EAS 421 (Atmospheric Thermodynamics) (3 cr.); EAS 422 (Atmospheric Dynamics I) (3 cr.); EAS 431 (Synoptic Laboratory I) (1 cr.); EAS 432 (Synoptic Laboratory II) (1 cr.); EAS 532 (Atmospheric Physics I) (3 cr.); EAS 535 (Atmospheric Observations and Measurements) (3 cr.); EAS 423 (Atmospheric Dynamics II) (3 cr.). *27 cr.*

Statistics elective (select one): STAT 301 (Elementary Statistical Methods) (3 cr.), STAT 501 (Experimental Statistics I) (3 cr.), STAT 511 (Statistical Methods) (3 cr.). *3 cr.*

Electives — *27 credits*

Elective courses could be within the College of Science or in other areas. Please contact an advisor to discuss your plan of study.

At least 21 credits of approved elective courses are required. *21 cr.*

Mathematics elective: 3 cr. from 300-level or above mathematics courses. *3 cr.*

Computer applications elective (select one): EAS 309 (Computer-Aided Analysis for Geosciences) (3 cr.); EAS 409 (Application of Microcomputers to Meteorology) (3 cr.); EAS 509 (Data Analysis Techniques in Geosciences) (3 cr.); C S 314 (Numerical Methods) (3 cr.). *3 cr.*

Environmental Geoscience Requirements — 73–74 credits

Environmental Geoscience Core — *40 credits*

EAS 109 (The Dynamic Earth) (3 cr.); EAS 143 (Freshman Seminar in Earth Science) (1 cr.); EAS 113 (Environmental Geology) (3 cr.); EAS 243 (Earth Materials I) (4 cr.); EAS 313 (Applied Geomorphology) (3 cr.); EAS 351 (Structural, Tectonic, and Basin Analysis) (4 cr.); EAS 474 (Sedimentation and Stratigraphy) (4 cr.); EAS 385 (Principles of Engineering Geology) (3 cr.); EAS 390 (Geologic Field Methods) (3 cr.); EAS 490 (Field Geology Summer Field Camp) (6 cr.); EAS 584 (Hydrogeology) (3 cr.); EAS 519 (Applications of Environmental Geosciences) (3 cr.). .

Additional Science and Engineering — *33–34 credits*

CHM 257 (Organic Chemistry) (4 cr.); CHM 257L (Organic Chemistry Laboratory) (1 cr.); AGRY 255 (Soil Science) (3 cr.); BIOL 121 (Biology I: Diversity, Ecology and Behavior) (2 cr.); BIOL 287 (Laboratory in Introduction to Ecology) (2 cr.); BIOL 483 (Environmental and Conservation Biology) (3 cr.). *15 cr.*

CE 352 (Biological Principles of Environmental Engineering) (3 cr.) or CE 353 (Physio-Chemical Principles of Environmental Engineering) (4 cr.). *3–4 cr.*

Environmental electives: 6 cr. from a list of specified courses. Must be approved by the student's academic advisor. *6 cr*

For the Environmental Geoscience option, the following three courses must be taken, and may also counts towards the General Education Requirement: POL 223 (Introduction to Environmental Policy) (3 cr.), and POL 523 (Environmental Politics and Public Policy) (3 cr.), and PHIL 290 (Environmental Ethics) (3 cr.). *6 cr.*

Earth/Space Science Teaching 86–89 credits

To complete the earth/space science requirements for Indiana certification, grades 5-12, the following are required:

Science courses *51–54 credits*

EAS 109 (The Dynamic Earth) (3 cr.); EAS 143 (Freshman Seminar in Earth Science) (1 cr.); EAS 112 (Historical Geology) (4 cr.); EAS 243 (Earth Materials I) (4 cr.); EAS 351 (Structural, Tectonic, and Basin Analysis) (4 cr.); EAS 352 (Structural Geology) (3 cr.); EAS 390 (Geologic Field Methods) (3 cr.); EAS 490 (Field Geology Summer Field Camp) (6 cr.). *28 cr.*

One of the following: CHM 111 and 112 (General Chemistry); or CHM 115 and 116 (General Chemistry). *6–8 cr.*

One of the following:

a. PHYS 172 (Modern Mechanics), PHYS 241, PHYS 252 (Electricity and Optics)

b. PHYS 220 and 221 (General Physics). *8 cr.*

C S 177 (Programming With Multimedia Objects) (4 cr.) or C S 158 (C Programming) (3 cr.) *3 cr.*

Two of the following:

EAS 104 (Oceanography) (3 cr.); EAS 105 (The Planets) (3 cr.); EAS 115 (Dinosaurs) (3 cr.); EAS 116 (Earthquakes and Volcanoes) (3 cr.); EAS 120 (Introduction to Geography) (3 cr.); EAS 138 (Thunderstorms and Tornadoes) (3 cr.); EAS 221 (Survey of Atmospheric Science) (3 cr.); EAS 225 (Science of the Atmosphere) (3 cr.); ASTR 263 (Descriptive Astronomy: The Solar System) (3 cr.); ASTR 264 (Descriptive Astronomy: Stars and Galaxies) (3 cr.). *6 cr.*

Professional Education *35 credits*

EDCI 270 (Introduction to Educational Technology and Computing) (2 cr.); EDST 200 (History and Philosophy of Education) (3 cr.); EDCI 205 (Exploring Teaching as a Career) (3 cr.); EDCI 285 (Multiculturalism and Education) (3 cr.); EDPS 235 (Learning and Motivation) (3 cr.); EDPS 265 (The Inclusive Classroom) (3 cr.); EDCI 424 (The Teaching of Earth/Physical Science in the Secondary Schools) (3 cr.); EDCI 428 (Teaching Science in the Middle and Junior High School) (2 cr.); EDCI 498 (Supervised Teaching) (10 cr.). *35 cr.*

EDCI 428 is taken during the first six weeks of the professional semester, before student teaching. A student can choose either the seventh or eighth semester for the professional semester.

Honors Research Program

Outstanding students are invited to participate in the Earth and Atmospheric Sciences Honors Research Program. The focus of this program is the completion of an undergraduate research thesis and the oral presentation of this research in a departmental seminar. The thesis can be a laboratory, field, or theoretical investigation. This program offers students the opportunity to have closer contact with the faculty of the department and to explore in depth a specific topic of their interest through tutorials, independent research, and seminars. The student thus obtains a better preparation for advanced study or a career in the geosciences after completion of the B.S. degree.

A student can graduate with honors in earth and atmospheric sciences by completing the following requirements:

1. At least a 3.25 cumulative graduation index;
2. Successful completion of EAS 494 (Undergraduate Seminar);
3. A research thesis supervised and approved by a member of the faculty; and
4. Submission of application for graduation with honors during the semester before graduation.

If you are interested in this program, contact the Chair of the Undergraduate Committee, Department of Earth and Atmospheric Sciences.

Special Programs and Opportunities

Summer Field Experience

Earth science majors must take a four- to six-week summer field experience. The experience brings together the various solid earth courses and helps students make the transition from classroom scholar to field-based geologist. Through the experience, they gain an appreciation of the problems professional scientists encounter.

Students generally find it easier to comprehend the subject matter of subsequent courses as a result of the summer field experience, which they are encouraged to attend between the junior and senior years.

The department offers a summer session module 1 (4-week session in May) course, however, other options for satisfying this requirement are available.

Earth and Atmospheric Sciences Minor

Students who wish to complement their major area of study with coursework in the earth and atmospheric sciences may be interested in the department's minor program.

Earth and Atmospheric Sciences Minor Course Requirements	**17 credits**
EAS 111 (Physical Geology), or EAS 109 (The Dynamic Earth) (3 cr.).	*3 cr.*
EAS 221 (Survey of Atmospheric Science), or EAS 225 (Science of the Atmosphere) (3 cr.).	*3 cr.*
EAS 230 (Laboratory in Atmospheric Science) (1 cr.).	*1 cr.*
Ten additional credits selected from any 200-level or above EAS courses. One 100-level EAS course may be used to meet this requirement.	*10 cr.*

Mathematics

The Department of Mathematics offers a broad range of programs leading to the Bachelor of Science degree. Students majoring in another area of science may also choose to pursue a minor in mathematics. Detailed descriptions of these programs and brief summaries of the kinds of careers for which graduates are prepared can be found in the "Plans of Study" section. More information about career opportunities is available from the College of Science Counseling Office and by taking MA 108 (Mathematics as a Profession and a Discipline) (1 cr.).

Some math graduates choose to continue their education in professional schools such as law schools, business schools, or medical schools. Others choose to teach. Many graduates choose to go on to graduate school in mathematics, engineering, computational finance, and other areas. Job options include positions such as database managers, programming, actuarial work, software engineering, defense work, insurance, banking, and finance.

The most recent web information can be found at: www.math.purdue.edu/

General Degree Requirements

The College of Science is in the process of reviewing its undergraduate curriculum. Students should check the College of Science Web site (www.science.purdue.edu/academic_programs/majors.asp) and speak with an academic advisor for the most up-to-date information and requirements.

All mathematics majors must satisfy the following general degree requirements. In doing so, they will automatically fulfill the College of Science requirements listed on pages 28–30. A total of 124 credit hours is required. Mathematics courses below MA 161 (except MA 108) do not count as credit toward graduation.

Mathematics Requirements 43–81 credits

One of the following calculus sequences 12–15 credits

a. MA 161–162 (Plane Analytic Geometry and Calculus, I and II) (10 cr.) and MA 261 (Multivariate Calculus) (4 cr.); *14 cr.*

b. MA 165–166 (Analytic Geometry and Calculus, I and II) (8 cr.), and MA 261 (Multivariate Calculus) (4 cr.) *12 cr.*

c. Calculus: MA 173 (Calculus and Analytic Geometry II) (5 cr.) and MA 174 (Multivariable Calculus) (4 cr.); *9 cr.*

d. MA 181 (Honors Calculus I) (5 cr.) and MA 182 (Honors Calculus II) (5 cr.) *10 cr.*

e. MA 271 (Several Variable Calculus) (5 cr.) *5 cr.*

MA 366 (Differential Equations) (4 cr.) (except for the statistics option). Students transferring from other majors and those getting a second major in mathematics may replace MA 366 with MA 266 (with a "B" or better). *4 cr.*

MA 351 (Linear Algebra) (3 cr.) or MA 350 (Algebra: Honors) (3 cr.). Students transferring from other majors and those getting a second major in mathematics may replace MA 351 with MA 265 (with a "B" or better). *3 cr.*

One of the following seven programs (Courses required in these programs are listed beginning on page 70.): *24–57 credits*

Core Mathematics Option	*24 cr.*
Applied Mathematics Option	*27 cr.*
Business Mathematics Option	*30 cr.*
Computer Science Option	*24 cr.*
Mathematics Education Option	*56–57 cr.*
Operations Research Option	*24 cr.*
Statistics Option	*27–28 cr.*

Science Requirements 12–19 credits

Four courses. See page 30 for requirements.

Additional Requirements 36–41 credits

English Composition: See page 29 for English composition requirements. *6–7 cr.*

Modern Foreign Language: All College of Science majors are expected to have proficiency in another language in addition to their native language. Competency in the second language must be demonstrated at the fourth-semester college level. (See Modern Foreign Language requirements on pages 29-30). *12–16 cr.*

General Education Requirements: You must complete 18 credit hours of study in the humanities, social sciences and behavioral sciences. (See page 30 for requirements.) *18 cr.*

Free Electives 20–46 credits

Free electives can be selected from any department of the University. Students are encouraged to use free electives to broaden their knowledge. Free elective credit is not allowed for courses that significantly overlap courses taken to fulfill departmental degree requirements. This excludes, in particular, introductory courses. Students must take at least as many free electives as is needed to bring the credit hour total to 124.

It is recommended that all mathematics majors take MA 108 as a free elective in their first semester.

Grade requirement

All mathematics majors must have a graduation index of 2.0 in MA 351 (or MA 350), MA 366, and the courses used to fulfill one of the options.

Service courses

The following courses are recommended for undergraduate students outside the Department of Statistics or the Department of Mathematics and may not be taken by students within the departments: STAT 113, 225, 301, 501, 502, and 503.

Other courses recommended for undergraduates outside the department are STAT 311, 511, 512, 513, and 514. These courses often are taken by undergraduates in statistics or mathematics, or by graduate students in other fields.

Entry into Upper-Division and Honors Courses

The Department of Mathematics accepts students as upper-division majors after they complete MA 351 (Linear Algebra) (3 cr.) or MA 350 (Algebra – Honors) (3 cr.).

Any of the options can be enriched under the honors program described on page 67. Students who want to maximize their educational opportunities are urged to consider this program.

Many of the required courses can be replaced by more advanced courses. Consult academic advisors for details.

MA 181–182 and 350, 440, and 450 are, respectively, honors versions of Calculus 351, 341, and 453. The honors version of a course has content: material is covered in greater depth and/or more material is covered. Honors courses are recommended for students intending to pursue graduate work in any area involving mathematics or simply for those interested in a more challenging and rewarding educational experience.

Mathematics Options

Seven options for mathematics majors are described in this section. They are designed to provide foundations for a variety of careers in fields that use mathematics. Students in any option are encouraged to use their electives to build breadth in all of the mathematical sciences (pure and applied mathematics, computer science, and statistics). Such breadth is especially appreciated by employers in business, industry, and government.

Core Mathematics Option

This option provides preparation for graduate study in pure mathematics or for advanced work in theoretical sciences and in other fields where strong mathematical backgrounds are valuable, such as business administration, economics, computer science, statistics, educational research, psychology, law, and medicine.

Core Mathematics Option
Course Requirements **24 credits**

MA 353 (Linear Algebra II) *3 cr.*
MA 362 (Vector Calculus), or MA 510 (Vector Calculus) *3 cr.*
MA 341 (Foundations of Analysis) or MA 440 (Real Analysis: Honors) *3 cr.*
MA 453 (Elements of Algebra) or MA 450 (Algebra: Honors) *3 cr.*
Any four courses from among the following (but no more than two from each group):

a. C S 240 (Programming Laboratory C), C S 251 (Data Structures) (3 cr.)
b. C S 314 (Numerical Methods), C S 514 (Numerical Analysis), C S 515 (Numerical Analysis of Linear Systems), C S 520 (Computational Methods in Analysis) (3 cr.)
c. MA 454 (Galois Theory) (3 cr.)
d. MA 520 (Boundary Value Problems), MA 523 (Introduction to PDEs), MA 543 (Introduction to the Theory of Differential Equations) (3 cr.)
e. MA 375 (Introduction to Discrete Mathematics), MA 385 (Introduction to Logic), MA 387 (Set Theory and the Real Numbers), C S 381 (Introduction to the Analysis of Algorithms), C S 483 (Introduction to the Theory of Computation) (3 cr.)
f. MA 425 (Complex Analysis), MA 440 (Real Analysis), MA 442 (Multivariate Analysis I), MA 521 (Introduction to Optimization Problems) (3 cr.)
g. MA 462 (Elementary Differential Geometry), MA 571 (Elementary Topology) (3 cr.)
h. MA/STAT 416 (Probability), STAT 516 (Basic Probability and

Applications), STAT 417 (Statistical Theory), STAT 517 (Statistical Inference) (3 cr.) *12 cr.*

Applied Mathematics Option

Graduates with training in applied mathematics are employed in business, industry, and government. Their jobs involve working with scientists in other fields, so some breadth is desirable, for instance, in physics, computer science, statistics, economics, or engineering.

This option also provides good preparation for graduate studies in applied mathematics and in subjects that use mathematics.

Applied Mathematics Option Course Requirements	**27 credits**
MA 362 (Topics in Vector Calculus) or MA 510 (Vector Calculus)	*3 cr.*
C S 314 (Numerical Methods) or C S 514 (Numerical Analysis)	*3 cr.*
MA 353 (Linear Algebra II)	*3 cr.*
MA 303 (Differential Equations for Engineering and the Sciences), or MA 304 (Differential Equations and Partial Differential Equations for Engineering and the Sciences).	*3 cr.*
MA 341 (Foundations of Analysis); MA 440 (Real Analysis: Honors)	*3 cr.*
MA 425 (Elements of Complex Analysis), MA 525 (Introduction to Complex Analysis)	*3 cr.*
MA 453 (Elements of Algebra I) or MA 450 (Algebra: Honors)	*3 cr.*
MA 520 (Boundary Value Problems of PDEs), or MA 523 (Introduction to PDEs), or special topics course with approval of the undergraduate committee chairman.	*3 cr.*
One of the following: MA 375 (Introduction to Discrete Mathematics), MA 421(Linear Programming and Optimization Techniques), MA 521 (Introduction to Optimization Problems), MA/STAT 416 (Probability), STAT 516 (Advanced Probability and Options with Numerical Methods)	*3 cr.*

Business Mathematics Option

An analytical background is becoming increasingly valuable for students who wish to pursue careers in business. This option, designed with the help of business and financial professionals, gives a strong mathematical foundation and courses in related areas to provide a suitable background for such a career. Students choosing this option should consider obtaining a minor in management.

Business Mathematics Option Course Requirements	**30 credits**
MGMT 200 (Introductory Accounting)	*3 cr.*
Two of: MA 375 (Introduction to Discrete Mathematics), C S 314 (Numerical Methods), STAT 417 (Statistical Theory), STAT 517 (Statistical Inference), or MA 421 (Linear Programming and Optimization Techniques).	*6 cr.*
Two of: MA 370 (Mathematical Theory of Interest), MGMT 310 (Financial Management), MGMT 411 (Investment Management), MGMT 544 (Database Management Systems), or MGMT 323 (Introduction to Market Analysis).	*6 cr.*
MA/STAT 416 (Probability), or STAT 516 (Basic Probability and Applications)	*3 cr.*
MA 341 (Foundations of Analysis), or MA 440 (Real Analysis: Honors)	*3 cr.*
MA 353 (Linear Algebra II)	*3 cr.*
MA 453 (Elements of Algebra I) or MA 450 (Algebra: Honors)	*3 cr.*
STAT 512 (Applied Regression Analysis)	*3 cr.*

Computer Science Option

This option provides a substantial mathematical background while preparing students for computer-related careers.

Computer Science Option Course Requirements	**24 credits**
C S 240 (Programming Laboratory C)	*3 cr.*
C S 251 (Data Structures)	*3 cr.*
C S 314 (Numerical Methods)	*3 cr.*
One of: C S 334 (Fundamentals of Computer Graphics), C S 381 (Introduction to the Analysis of Algorithms), C S 483 (Introduction to the Theory of Computation), C S 514 (Numerical Analysis), C S 515 (Numerical Analysis of Linear Systems), or C S 520 (Computational Methods in Analysis)	*3 cr.*
Two of: MA 353 (Linear Algebra II), MA 385 (Introduction to Logic), MA 453 (Elements of Algebra), or MA 450 (Algebra: Honors)	*6 cr.*
MA 375 (Introduction to Discrete Mathematics)	*3 cr.*
One of: MA 341 (Foundations of Analysis), MA 362 (Vector Calculus), MA 387 (Set Theory and the Real Numbers), MA/STAT 416 (Probability), STAT 516	

(Basic Probability and Applications), MA 421 (Linear Programming and Optimization Techniques) (3 cr.), MA 425 (Elements of Complex Analysis), MA 525 (Introduction to Complex Analysis), MA 453 (Elements of Algebra), MA 450 (Algebra: Honors), MA 462 (Elementary Differential Geometry), or MA/STAT 474 (Random Modeling).	*3 cr.*

Operations Research Option

Roughly speaking, operations research is the science of decision making. It uses mathematics, statistics, and computer science to determine the optimal way of performing a sequence of operations or to choose which of several competing programs is best. In this way, operations research can be an important component of the management of large projects.

Operations Research Option Course Requirements	**24 credits**
Numerical Analysis: C S 314 (Numerical Methods), or C S 514 (Numerical Analysis)	*3 cr.*
MA 353 (Linear Algebra II)	*3 cr.*
MA 362 (Topics in Vector Calculus) or MA 510 (Vector Calculus)	*3 cr.*
MA 453 (Elements of Algebra I) or MA 450 (Algebra: Honors)	*3 cr.*
MA/STAT 416 (Probability) or STAT 516 (Basic Probability and Applications), and STAT 417 (Statistical Theory) or STAT 517 (Statistical Inference)	*6 cr.*
One of: C S 520 (Computational Methods in Analysis), MA 341 (Foundations of Analysis), MA 440 (Real Analysis: Honors), MA/STAT 474 (Random Modeling) (3 cr.), MA 523 (Introduction to PDEs), MA 543 (Introduction to the Theory of Differential Equations)	*3 cr.*
One of: MA 375 (Introduction to Discrete Mathematics), MA 421 (Linear Programming and Optimization Techniques), MA 521 (Introduction to Optimization Problems), IE 335 (Operations Research – Optimization)	*3 cr.*

Statistics Option

Professional statisticians deal with — among other things — the collection and statistical analysis of data, the design of experiments, and quality control.

This option prepares students for work in statistics. A dual degree in mathematics and statistics can be obtained. See page 76.

Statistics Option Course Requirements	**27–28 credits**
One of: MA 366 (Ordinary Differential Equations), MA 375 (Introduction to Discrete Mathematics), MA 421 (Linear Programming and Optimization Techniques), MA 425 (Complex Analysis), MA 525 (Introduction to Complex Analysis), MA 453 (Elements of Algebra), MA 450 (Algebra: Honors), or MA 520 (Boundary Value Problems of Differential Equations)	*3–4 cr.*
MA 353 (Linear Algebra II)	*3 cr.*
MA 362 (Vector Calculus), or MA 442 (Multivariate Analysis I: Honors), or MA 510 (Vector Calculus)	*3 cr.*
STAT 350 (Introduction to Statistics)	*3 cr.*
MA 341 (Foundations of Analysis), or MA 440 (Real Analysis: Honors)	*3 cr.*
MA/STAT 416 (Probability), or STAT 516 (Basic Probability and Applications)	*3 cr.*
STAT 417 (Statistical Theory), or STAT 517 (Statistical Inference)	*3 cr.*
STAT 512 (Applied Regression Analysis)	*3 cr.*
One of: MA/STAT 474 (Random Modeling), I E 530 (Quality Control), STAT 513 (Statistical Quality Control), or STAT 514 (Design of Experiments)	*3 cr.*

Mathematics Education Option

This option provides the mathematical preparation necessary for teaching secondary school mathematics in Indiana.

Teacher certification requires a professional semester consisting of six weeks of coursework at Purdue followed by 10 weeks of student teaching. EDCI 426 is taken during the first six weeks of the professional semester, before student teaching. A student can choose either the seventh or eighth semester for the professional semester.

Students completing this option are exempt from the second year of modern foreign language.

Requirements for teacher certification vary from state to state. They can be obtained by writing to the Certification Office, Department of Public Instruction, in the capital city of the state of interest.

Mathematics Education Course Requirement	**56–57 credits**
Mathematics Courses	***24–25 credits***
MA 301 (Introduction to Real Analysis) (3 cr.)	*3 cr.*
One of the following: MA 341(Foundations of Analysis), 353 (Linear Algebra II), MA 375 (Introduction to Discrete Mathematics), MA 425 (Elements of Complex Analysis) (3 cr.), MA 525 (Introduction to Complex Analysis) (3 cr.), or MA 440 (Real Analysis) (3 cr.)	*3 cr.*
MA 453(450) (Elements of Algebra)(3 cr.)	*3 cr.*
MA 460 (Geometry) (3 cr.)	*3 cr.*
STAT 311 (Introductory Probability) (3 cr.), MA/STAT 416 (Probability) (3 cr.), or STAT 516 (Basic Probability and Applications) (3 cr.)	*3 cr.*
One of the following: C S 158 (C Programming) (3 cr.), C S 154 (Fortran Programming) (3 cr.), C S 177 (Programming with Multimedia Objects), or C S 180 (Programming I) (4 cr.).	*3–4 cr.*
Two additional three-credit courses in mathematics, statistics, or computer sciences at the 300-level or above, approved by the Undergraduate Mathematics Committee. At least one of these must be in mathematics.	*6 cr.*
Professional Education Courses	***32 credits***
EDCI 270 (Introduction to Educational Technology and Computing) (2 cr.), EDST 200 (History and Philosophy of Education) (3 cr.), EDCI 205 (Exploring Teaching as a Career) (3 cr.), EDCI 285 (Multiculturalism and Education) (3 cr.), EDPS 235 (Learning and Motivation) (3 cr.), EDPS 265 (The Inclusive Classroom) (3 cr.), EDCI 425 (Teaching of Mathematics in Secondary Schools) (3 cr.), EDCI 426 (Teaching Mathematics in the Middle and Junior High School) (3 cr.), EDCI 498M (Supervised Teaching in Secondary Mathematics Education) (3 cr.)	

Actuarial Science

An interdisciplinary program in actuarial science is offered jointly by the Department of Mathematics and the Department of Statistics. See page 33.

Honors Program

The Department of Mathematics offers a wide variety of educational opportunities for superior students. Honors courses are available from the freshman level to the senior level. Qualified undergraduates may also substitute graduate-level classes for undergraduate classes.

Most honors classes are taught in small sections (usually fewer than 20 students). This provides a unique opportunity for students to experience a small college atmosphere in the midst of a large university. Honors work also gives the student the opportunity to obtain a richer and deeper knowledge of mathematics. This is particularly important for individuals contemplating graduate work, either in mathematics or some mathematics-related discipline.

There is also an official "honors option." Students who successfully complete the requirements for this program are certified at the time of graduation as having graduated "with honors in mathematics." Students may enter the program any time after completing MA 351 (or MA 350). Entering the honors program indicates an intention to meet the more rigorous requirements of graduation "with honors" as outlined below. There is no penalty if a student later changes plans.

In the honors program, students must satisfy the general degree requirements via one of the options listed and include MA 440, 442, and 450 in all options except Education, which requires only 440 and 442. In either case, a grade point average of at least 3.35 is required in these courses.

Special Programs and Opportunities

Cooperative Education Program. The Department of Mathematics participates in the Cooperative Education Program as described on page 9. If interested, a student should contact the Coor-

dinator of Cooperative Education, Mathematics Department, Mathematical Sciences Building.

To be eligible for the Cooperative Education Program, a student must:

1. Have completed one of the following calculus sequences:
   a. MA 161–162 (Plane Analytic Geometry and Calculus, I and II) (10 cr.) and MA 261 (Multivariate Calculus) (4 cr.)
   b. MA 165–166 (Analytic Geometry and Calculus, I and II) (8 cr.), and MA 261 (Multivariate Calculus) (4 cr.)
   c. Calculus: MA 173 (Calculus and Analytic Geometry II) (5 cr.) and MA 174 (Multivariable Calculus) (4 cr.)
   d. MA 181 (Honors Calculus I) (5 cr.) and MA 182 (Honors Calculus II) (5 cr.)
   e. MA 271 (Several Variable Calculus) (5 cr.)
2. Have at least a 3.0 grade index in all mathematics, statistics, and computer science courses and;
3. Have an overall graduation index of at least 2.8.

Although it is not required, students are encouraged to take C S 154 (Fortran Programming) (3 cr.), C S158 (C Programming) (3 cr.), C S 177 (Programming with Multimedia Objects) (4 cr.), or C S 180 (Programming I) (4 cr.) before starting their work experience.

Mathematics Minor

The mathematics minor provides a strong background in mathematics for students majoring in some other discipline. To qualify for the minor, the following classes must be completed with an average grade index of at least 2.0.

Mathematics Minor Course Requirements	**12–13 credits**
One of the following: MA 351 (Elementary Linear Algebra) (3 cr.), MA 350 (Elementary Linear Algebra: Honors) (3 cr.), MA 511 (Linear Algebra with Applications) (3 cr.), MA 265* (Linear Algebra) (3 cr.).	*3 cr.*
One of the following: MA 453 (Elements of Algebra) (3 cr.), MA 450 (Algebra: Honors) (3 cr.), MA 341 (Foundations of Analysis) (3 cr.), MA 440 (Real Analysis: Honors) (3 cr.).	*3 cr.*
Two additional courses selected from the following:	
MA 301 (An Introduction to Proof Through Real Analysis) (3 cr.), or MA 341 (Foundations of Analysis) (3 cr.), or MA 362 (Topics in Vector Calculus) (3 cr.), or MA 510 (Vector Calculus) (3 cr.), or MA 425 (Elements of Complex Analysis) (3 cr.), or MA 525 (Introduction to Complex Analysis) (3 cr.), or MA 440 (Real Analysis: Honors) (3 cr.).	*3 cr.*
MA 375 (Introduction to Discrete Mathematics) (3 cr.), MA 453 (Elements of Algebra) (3 cr.), MA 450 (Algebra: Honors) (3 cr.), or MA 454 (Galois Theory) (3 cr.).	*3 cr.*
MA 353 (Linear Algebra II with Applications) (3 cr.).	*3 cr.*
MA 366† (Differential Equations) (4 cr.) or MA 520 (Boundary Value Problems of Differential Equations) (3 cr.), or MA 523 (Introduction to PDEs) (3 cr.)	*3–4 cr.*

** For many students, MA 265 may not be adequate preparation for upper-division mathematics classes. Students planning to minor in mathematics should consider taking MA 351 instead. Only students with a very firm grasp of the MA 265 material should contemplate taking MA 353 without MA 351.*

† MA 266, with at least a "B", can be used in place of MA 366. MA 262 will not be acceptable for the minor.

Physics

Physics is the study of matter and energy, and the fundamental forces of nature that govern the interactions between particles. Physicists study a wide range of physical phenomena, from quarks to black holes, from individual atoms to the many-body systems of superconductors. It is the foundation of all the physical sciences. The knowledge and problem-solving skills acquired by physics graduates enable them to pursue careers in a wide range of scientific and professional disciplines.

A Bachelor of Science degree from the Department of Physics prepares students to investigate a variety of problems in physics, chemistry, biology, and engineering. The basic core courses, supplemented by courses relevant to each specialized major option, provide a broad scientific education that prepares students for entry into many careers as well as for graduate schools in physics, engineering, other sciences, and professions such as law, medicine, and finance.

A master's degree is desirable for research, advancement in secondary school teaching in Indiana, and many positions in government or industry. The Ph.D. degree is required for advancement at a university and higher level positions in research in several areas.

The undergraduate program in Purdue's Department of Physics prepares students for participation in the frontiers of discovery in nanotechnology, condensed matter, nuclear physics, high energy particle physics, astronomy, biophysics, medical physics, and other branches of physics.

The Department of Physics emphasizes undergraduate research as an integral part of the learning experience that reinforces and amplifies skills acquired in the classroom. A seminar class is offered in the first semester to introduce freshman students to "Current Topics in Physics Research." The class serves to familiarize students with research being carried out currently in the department and prepares them to become involved in undergraduate research as early as their second semester at Purdue.

In their sophomore year, students are encouraged to enroll in a one-credit-hour seminar class that helps them explore different careers in physics. It offers an opportunity for students to meet with alumni and professors in the Department of Physics and to learn valuable career development skills from these experiences.

The Department of Physics offers a Bachelor of Science with a major in physics with different specializations, including joint programs with the College of Engineering. A physics/math double major is also available to physics majors by taking additional courses in math.

A bachelor's degree in physics prepares students to pursue careers in an extraordinary variety of areas, including technical and managerial careers in industry, and basic research in universities, industrial laboratories, and national laboratories. The general problem solving skills developed in physics studies serve students well not only in careers in physics, but also in careers in other sciences, engineering, law, medicine, management, finance, and government.

Some examples of careers chosen by physics majors include: teacher, doctor, research scientist, lawyer, physician, architect, technical salesperson, electrical engineer, aeronautical engineer, astronaut, geophysicist, software designer, technical analyst, reliability engineer, and process engineer.

The most recent information on careers can be found at www.physics.purdue.edu/career

The following courses are required of all Bachelor of Science physics majors. In meeting these requirements, candidates will also automatically fulfill the College of Science graduation requirements listed on pages 28–30. The core courses taken by all physics majors provide a solid foundation in classical mechanics, electricity and magnetism, waves and optics, quantum mechanics, thermal and statistical physics, modern physics, relativity, electronics, and computational physics. Choices are offered in advanced laboratory.

General Degree Requirements

The College of Science is in the process of reviewing its undergraduate curriculum. Students should check the College of Science Web site (www.science.purdue.edu/academic_programs/majors.asp) and speak with an academic advisor for the most up-to-date information and requirements.

Physics Requirements **28–54 credits**

Students must complete the requirements for one of the following options:

1. Physics (39-41 credit hours in physics)
2. Honors Physics (53-54 credit hours in physics)

3. Applied Physics (35-37 credit hours in physics)
4. Applied Honors Physics (36 credit hours in physics)
5. Physics Teaching (35-38 credit hours in physics)
6. Dual B.S. degrees in Physics and Materials Science and Engineering (28 credit hours in physics)

Science Requirements (All Options) ***14–18 credits***

CHM 115 or 123 or 125 (Chemistry I) *4–5 cr.*
CHM 116 or 124 or 126 (Chemistry II) *4–5 cr.*
Six to eight additional credit hours of two laboratory sciences selected from allowed courses in biology, chemistry, earth and atmospheric science, astronomy, computer science or engineering.* *6–8 cr.*

Mathematics Requirements (All Options) ***21–23 credits***

Choose one course from each group:
a. MA 161 (Plane Analytic Geometry and Calculus I) (5 cr.), or MA 165 (Analytic Geometry and Calculus I) (4 cr.) *4–5 cr.*
b. MA 162 (Plane Analytic Geometry and Calculus II) (5 cr.), MA 166 (Analytic Geometry and Calculus II) (4 cr.), MA 173 (Calculus and Analytical Geometry II) (5 cr.), or MA 181 (Honors Calculus I) (5 cr.) *4–5 cr.*
c. MA 261 (Multivariate Calculus) (4 cr.), MA 174 (Multivariable Calculus) (4 cr.), MA 182 (Honors Calculus) (5 cr.), or MA 271 (Several Variable Calculus) (5 cr.) *4–5 cr.*
d. MA 262 (Linear Algebra and Differential Equations) (4 cr.), MA 266 (Ordinary Differential Equations) (3 cr.), MA 366 (Ordinary Differential Equations) (4 cr.) *3–4 cr.*
Six additional credit hours of approved courses in mathematics. *6 cr.*

Additional Requirements ***36–41 credits***

English Composition: See page 29 for English composition requirements. *6–7 cr.*
Modern Foreign Language: All College of Science majors are expected to have proficiency in another language in addition to their native language. Competency in the second language must be demonstrated at the fourth-semester college level. (See Modern Foreign Language requirements on pages 29-30). *12–16 cr.*
General Education Requirements: You must complete 18 credit hours of study in the humanities, social sciences and behavioral sciences. (See page 30 for requirements.) *18 cr.*

Free Electives: (All Options) ***0–22 credits***

Free electives can be selected from any department of the University. Students are encouraged to use free electives to broaden their knowledge. However, free elective credit is not allowed for courses that significantly overlap courses taken to fulfill departmental degree requirements. Students must take at least as many free electives as are needed to bring the credit hour total to 124.

A student can also use free electives to acquire a minor in a related field or in other departments at Purdue University.

Grade Requirement

Students majoring in physics or applied physics must have a grade point average of 2.0 or above in all physics courses. For students majoring in honors physics program or in honors applied physics program, grades of "A" or "B" must be maintained in all physics and mathematics courses. For teaching majors, the minimum grade requirement is 2.5 in content areas and 3.0 in professional education courses.

Physics Major – Options

Students wishing to major in physics should complete the "General Degree Requirements" on pages 69–70, plus requirements specific to the physics option as stated in this catalog.

Physics

This program offers a specialization in physics as the core of a broad general education. By using free electives in the program, a student can include concentrations in condensed matter physics, nuclear physics, astrophysics, particle physics, and other areas. Students also are encouraged to participate in one or two semesters of individual research projects with a selected faculty member.

Opportunities for employment in fields related to physics will be enhanced by taking free-electives in other science courses, such as biological sciences, chemistry, computer science, geosciences, geophysics, mathematicis, meteorology, statistics, and/or in various branches of engineering. With assistance from an advisor, a student can prepare an individualized program suited to career plans by selecting electives from these areas or from any other area within the University. Normally, these courses are taken as juniors or seniors (see the sample program at www.physics.purdue.edu).

**May be used for applied electives.*

Physics Major Course Requirements	39–41 credits
PHYS 172H (or 172) (Modern Mechanics)	*4 cr.*
PHYS 272H (or 272) (Electric and Magnetic Interactions)	*4 cr.*
PHYS 290G (Special/General Relativity)	*3 cr.*
PHYS 290M (Mathematical Methods for Physics)	*3 cr.*
PHYS 342 or 344* (Modern Physics)	*3–4 cr.*
PHYS 342L (Modern Physics Laboratory) and PHYS 450 (Optics Laboratory)	*3 cr.*
PHYS 310 Intermediate Mechanics)	*4 cr.*
PHYS 322 (Optics)	*3 cr.*
PHYS 330 (Intermediate Electricity and Magnetism)	*3 cr.*
PHYS 360 or 550 (Quantum Mechanics)	*3 cr.*
PHYS 515 (Thermal and Statistical Physics)	*3 cr.*
Advanced Physics Laboratory Requirement: Electronic Techniques for Physical Research: PHYS 536; or approved advanced laboratory courses e.g. PHYS 580 (Advanced Computational Physics), or PHYS 670F (Advanced Physics Laboratory)	*3–4 cr.*

Physics: Honors

The honors program offers an intensive concentration in physics that provides a solid foundation for advanced studies. Successful graduates of this challenging program are recognized for both the depth and breadth of their physics education, and they have gone on to the premier graduate schools in the country and ultimately to many different career choices.

The honors program provides a solid theoretical and experimental background in mechanics, electromagnetism, optics, thermal physics, quantum mechanics, and the micro-structure of matter. See the sample program at www.physics.purdue.edu.

A very important feature of this plan is a senior-year research project (PHYS 593) in some area of modern physics, such as condensed matter physics, nuclear physics, elementary particle physics, biophysics, geophysics, etc. Students receive individual supervision and guidance from a faculty member whose specialty matches the area of their research project. PHYS 593 introduces students to the type of research atmosphere they later might encounter as professional physicists, and it promotes self-motivation and independence in their work.

Students interested in the honors program typically start by taking PHYS 162 and 163 as freshmen. Students from other majors who have taken PHYS 152 and 241/261 may switch into the Honors Physics major. However, it is advisable that all students pursuing the honors program take PHYS 344, 422, and 450 during the second semester of the sophomore year. Admission to, and continuation in, the honors program requires a grade of "A" or "B" in all physics and mathematics courses or special permission from the Physics Undergraduate Committee.

Physics: Honors Course Requirements	53–54 credits
PHYS 172H (or 172) (Modern Mechanics)	*4 cr.*
PHYS 272H (or 272) (Electric and Magnetic Interactions)	*4 cr.*
PHYS 290G (Special/General Relativity)	*3 cr.*
PHYS 290M (Mathematical Methods for Physics)	*3 cr.*
PHYS 344 (Modern Physics: Honors)	*4 cr.*
PHYS 422 (Optics: Honors)	*3 cr.*
PHYS 342L and PHYS 450 (Intermediate Laboratories)	*3 cr.*
PHYS 410 and PHYS 411 (Physical Mechanics I, II: Honors)	*5 cr.*
PHYS 430 and PHYS 431 (Electricity and Magnetism I, II: Honors)	*5 cr.*
PHYS 460 and PHYS 461 (Quantum Mechanics I, II: Honors)	*6 cr.*
PHYS 416 (Thermal and Statistical Physics: Honors)	*4 cr.*
Advanced Physics Laboratory Requirement	
PHYS 536 (Electronic Techniques for Physical Research) or approved advanced laboratory courses, e.g. PHYS 580 (Advanced Computational Physics) or PHYS 670F (Advanced Physics Laboratory)	*3–4 cr.*
Senior Honors Project: PHYS 593, two-semester-total of 6 credits or approved by the department.	*6 cr.*

Applied Physics

The applied physics plan of study is especially geared toward providing the physics graduate with specific expertise in preparation for imme-

**Required for honors. May be used as substitute with the permission of the department.*

diate employment in the corporate research world or in government laboratories, in addition to further graduate study. Students obtain a solid physics background plus significant experience in one or more specialties of their own choosing, selected from a wide range of choices from Purdue's Science and Engineering colleges.

The basic plan of study combines about 35–37 credit hours of physics with 30 credit hours of applied electives.

Applied Physics Course Requirements	**65–67 credits**
PHYS 172H (or 172) (Modern Mechanics)	*4 cr.*
PHYS 272H (or 272) (Electric and Magnetic Interactions)	*4 cr.*
PHYS 290G (Special/General Relativity)	*3 cr.*
PHYS 290M (Mathematical Methods for Physics)	*3 cr.*
Modern Physics: PHYS 342 (3 cr.) or 344* (4 cr.)	*3–4 cr.*
Intermediate Laboratories: PHYS 450 (Optics Laboratory) (2 cr.) and PHYS 342L (Modern Physics Laboratory) (1 cr.) (if PHYS 342 is taken)	*2–3 cr.*
Intermediate Mechanics: PHYS 310	*4 cr.*
Intermediate Optics: PHYS 322	*3 cr.*
Intermediate Electricity and Magnetism: PHYS 330	*3 cr.*
Quantum Mechanics: PHYS 360 or 550	*3 cr.*
Thermal and Statistical Physics: PHYS 515	*3 cr.*

Applied physics elective courses totaling 30 credit hours are required in addition to the above courses. These must be approved and signed by the advisor. A number of recommended specialties for this major have been listed below. New combinations are also possible to arrange in consultation with the department. Each student is required to have a major concentration in one specialty (14 credit hours or more), or a minor concentration in two specialties (9 credit hours or more each). Four of the elective courses must involve laboratory work.

Note: Only six credit hours of foreign language are required for regular or honors applied physics programs. Applied electives with laboratory components may be used to satisfy part of the College of Science Laboratory Science requirement (see the sample program at www.physics.purdue.edu).

Applied Physics — Specialties

The specialties under the applied physics curriculum include nanoscience and nanotechnology, nuclear engineering, aeronautical and astronautical engineering, biophysics and biomedical engineering, medical physics, computer science, electrical and computer engineering, and geophysics. Individually tailored specialties may be chosen by the student in consultation with an advisor.

Materials Specialty. This program of study is based on the currently existing model for the Bachelor of Science with the Applied Physics Specialization. It incorporates a core of nine physics (31 credits) courses and seven MSE (20 credits) courses and, in addition, provides for 16 credits of technical electives for building a strong background in the area of materials and applied physics. The sample study plan requires a total of 132 credits for graduation. (see the sample program at www.physics.purdue.edu.)

Applied Physics with Honors

A Bachelor of Science degree with a major in applied physics with honors can be obtained by replacing several required courses in the regular applied physics program with the corresponding honors courses. All other applied physics requirements must still be met. In addition, grades of "A" or "B" must be maintained in all physics and mathematics courses.

Applied Physics: Honors Course Requirements	**66 credits**
PHYS 172H (or 172) (Modern Mechanics)	*4 cr.*
PHYS 272H (or 272) (Electric and Magnetic Interactions)	*4 cr.*
PHYS 290G (Special/General Relativity)	*3 cr.*
PHYS 290M (Mathematical Methods for Physics)	*3 cr.*
PHYS 344 (Modern Physics)	*4 cr.*
PHYS 422 (Optics)	*3 cr.*
PHYS 430 (Intermediate Electricity and Magnetism)	*3 cr.*
PHYS 460 (Quantum Mechanics)	*3 cr.*
PHYS 416 (Thermal and Statistical Physics)	*4 cr.*
PHYS 450 (Intermediate Laboratory)	*2 cr.*
PHYS 461 (Quantum Mechanics II: Honors)	*3 cr.*

**Required for Honors.*

Applied physics elective courses totaling 30 credit hours are required in addition to the above courses. These must be approved and signed by the advisor. A number of recommended specialties for this major were listed in the previous section. New combinations are also possible to arrange in consultation with the department. Each student is required to have a major concentration in one specialty (14 credit hours or more), or a minor concentration in two specialties (9 credit hours or more each). Four of the elective courses must involve laboratory work. Note: Only six credit hours of foreign language are required for regular or honors applied physics programs. Applied electives with laboratory components may be used to satisfy part of the College of Science laboratory science requirement.

Physics Teaching

This degree provides a strong background in physics, in addition to a license to teach physics at a high school and middle school level. The requirements for this degree are listed below. Additional guidelines are available at the College of Science Counseling Office (www.science.purdue.edu/counseling/) and the Office of Professional Preparation and Licensure (http://admin2.soe.purdue.edu/oppl/program.html).

Since teacher certification requirements are determined by each individual state, a student will need to contact the state education licensing agency in the state(s) where he or she plans to teach. This information is available online at www.nasdtec.org/state-info.tpl. Prospective teachers are exempt from the second year of the foreign language requirement, provided they successfully complete the professional semester within the baccalaureate program. The professional semester is the one that includes six weeks of a methods course at Purdue and 10 weeks of teaching.

To receive a Bachelor of Science with a major in physics teaching, a student must maintain a grade-point average of 2.5 or above in all physics courses, and 3.0 or above in education courses required to meet licensing requirements.

Physics Teaching Course Requirements **67–70 credits**

Physics Courses	***31–39 credits***
PHYS 172H (or 172) (Modern Mechanics)	*4 cr.*
PHYS 272H (or 272) (Electric and Magnetic Interactions)	*4 cr.*
PHYS 290G (Special/General Relativity)	*3 cr.*
PHYS 290M (Mathematical Methods for Physics)	*3 cr.*
PHYS 342 (Modern Physics) or 344 (Modern Physics: Honors)	*3–4 cr.*
PHYS 342L (Modern Physics Laboratory) and PHYS 450 (Optics Laboratory I: Honors)	*3 cr.*
PHYS 310 (Intermediate Mechanics) or 410 (Physical Mechanics I: Honors)	3–4 cr.
PHYS 322 (Intermediate Optics) or 422 (Intermediate Optics: Honors)	*3 cr.*
PHYS 330 (Intermediate Electricity and Magnetism) or 430 (Intermediate Electricity and Magnetism: Honors)	*3 cr.*
One of: PHYS 360 (Quantum Mechanics), PHYS 460 (Quantum Mechanics: Honors), PHYS 550 (Introduction to Quantum Mechanics)	*3 cr.*
One of: PHYS 536 (Electronics Techniques for Research), PHYS 580 (Computational Physics), PHYS 670F (Advanced Physics Laboratory) (3-4 cr.)	*3–4 cr.*
Professional Education courses	***32 credits***
EDCI 270 (Introduction to Educational Technology and Computing) (2 cr.), EDST 200 (History and Philosophy of Education) (3 cr.), EDCI 205 (Exploring Teaching as a Career) (3 cr.), EDCI 285 (Multiculturalism and Education) (3 cr.), EDPS 235 (Learning and Motivation) (3 cr.), EDPS 265 (The Inclusive Classroom) (3 cr.), EDCI 425 (Teaching of Mathematics in Secondary Schools) (3 cr.), EDCI 428 (Teaching Mathematics in the Middle and Junior High School) (2 cr.), EDCI 498M (Supervised Teaching in Secondary Mathematics Education) (10 cr.)	*32 cr.*

Bachelor of Science with a major in Physics and Bachelor of Science in Materials Science and Engineering

This is a five-year joint program for the dual degree of Bachelor of Science with a major in Physics and Bachelor of Science in Materials Science and Engineering. The program requires 10 semesters and is designed to satisfy the accreditation requirements for both degrees. As indicated in the sample plan, a total of 159 credits is required (see the sample program at www.physics.purdue.edu). Students need to complete the requirements of the Physics core major and those courses required for the Materials Science and Engineering.

Special Programs and Opportunities

Fifth-Year M.S. Option. Many positions for physicists require a Master of Science in physics. Students who complete the Bachelor of Science requirements in Applied Physics at Purdue with at least a 3.0 grade-point average can apply for admission to the Graduate School as a Master's candidate in Applied Physics. The Master's degree requirements (12 credit hours in physics and 18 credit hours in applied electives) can be completed in one year under the usual rules of the Graduate School.

Cooperative Education Program. The Department of Physics participates in the Cooperative Education Program. Interested students can contact the Cooperative Education Coordinator, Department of Physics, Physics Building at 765-494-5383.

Under the physics or applied physics honors programs, a student with a grade index of 2.8 or better, or under the physics or applied physics regular programs, a student with a grade index of 3.0 or better (or in the upper half of class) is eligible to apply for the Cooperative Education Program. Normally, a student would complete the curriculum through the third or fourth semester before leaving campus for a work period.

The department also encourages students to participate in study abroad, summer internship programs, and summer undergraduate research opportunities offered around the world.

Physics Minor

The physics minor provides a strong background in physics for students majoring in some other discipline at Purdue University. To qualify for the minor, the following classes must be completed with an average grade index of at least 2.0.

Physics Minor Course Requirements	**18–19 credits**
PHYS 172H (or 172) (Modern Mechanics)	*4 cr.*
PHYS 272H (or 272) (Electric and Magnetic Interactions)	*4 cr.*
One of the following: PHYS 342 (Modern Physics), PHYS 344 (Modern Physics: Honors)	*3–4 cr.*
One of the following: PHYS 252 (Electricity and Magnetism) or PHYS 342L (Modern Physics Laboratory)	*1 cr.*
Six additional credit hours from 300-, 400-, and 500-level Physics or Astronomy courses until the minimum of 18 credits has been reached.	*6 cr.*

Statistics

Statistics is the mathematical and computational study of data and chance. It is a methodological discipline — statisticians often work closely with people in other fields to design production of data, analyze data, and draw conclusions from data.

The Department of Statistics offers two plans of study leading to the Bachelor of Science degree:

1. Applied statistics option - emphasizes applied statistics, prepares for employment with the B.S. degree.
2. Mathematical statistics option – prepares for graduate study in statistics or other quantitative fields; leads to double major in mathematics (see page 76).

Students who complete the mathematical statistics option can arrange to obtain the M.S. in Applied Statistics degree in one additional calendar year of study (see page 77).

Students majoring in another discipline may also choose to pursue a minor in statistics.

Students interested in becoming actuaries should consider the interdisciplinary program in actuarial science (page 33) jointly administered by the Department of Statistics and the Department of Mathematics. Only one additional recommended course in the actuarial science program is required for the statistics major and most actuarial majors also obtain a statistics degree with a management minor.

The department also participates in the Cooperative Education Program (see page 9).

Statistics is one of the few major disciplines in which the expertise of a professional can have significant effect in fields as diverse as bioinformatics and medicine, finance and insurance, management and marketing, agriculture and forestry, economics and education, as well as communications and software design, to name a few. Statisticians design methods for collecting and interpreting data gathered by government, business and industry, and academia to aid in the planning, decision making, and research crucial to modern society. Statisticians use computers as a tool for analyzing complex or massive data sets and solving mathematical problems. They use statistical techniques to discover relationships between disease and differences in the DNA sequences among individuals; predict election results, population growth, or the behavior of financial instruments; establish insurance or quality control standards; determine new drug effectiveness through clinical trials; or estimate the number of animals remaining in a vanishing species. The statisticians who hold advanced degrees develop and analyze statistical methods along with the mathematical and computational theories behind them.

The most recent information is available at http://www.stat.purdue.edu/academics/undergradProgram/index.html

General Degree Requirements

The College of Science is in the process of reviewing its undergraduate curriculum. Students should check the College of Science Web site (www.science.purdue.edu/academic_programs/majors.asp) and speak with an academic advisor for the most up-to-date information and requirements.

All statistics majors must satisfy the following general degree requirements. Students who meet these requirements also automatically fulfill the College of Science graduation requirements listed on pages 28–30. A total of 124 credit hours is required. Statistics courses numbered 310 or lower and mathematics courses numbered 159 and lower cannot be used as credit toward the degree. A higher-level course in the same subject area can be substituted for a requirement below. Consult academic advisors for details.

Statistics Major Course Requirements	**124 credits**
Mathematics and Statistics Requirements	***18 credits***
STAT 350 (Introduction to Statistics) (3 cr.)	*3 cr.*
MA 351 or 350 (Linear Algebra) (3 cr.)	*3 cr.*
MA 362, 440, or 510 (Advanced Calculus) (3 cr.)	*3 cr.*
STAT 416 or 516 (Probability) (3 cr.)	*3 cr.*
STAT 417 or 517 (Statistical Theory) (3 cr.)	*3 cr.*
STAT 512 (Applied Regression Analysis) (3 cr.)	*3 cr.*
One of the following two options	***6–9 credits***
Applied Statistics Option (6 cr.)	
Mathematical Statistics Option (9 cr.) (Courses required in these options are listed on page 76–77.)	

Science Requirements ***12–19 credits***

Four laboratory science courses.
See page 30 for requirements. *12–19 cr.*
Students are strongly encouraged to elect C S 177 (Programming with Multimedia Objects) or equivalent as one of the four courses for the laboratory science requirement.

Mathematics Requirements ***12–14 credits***

MA 161 (Plane Analytic Geometry and Calculus I) (5 cr.) or MA 165 (Analytic Geometry and Calculus I) (4 cr.) *4–5 cr.*
One of: MA 162 (Plane Analytic Geometry and Calculus II) (5 cr.), MA 166 (Analytic Geometry and Calculus II) (4 cr.), MA 173 (Calculus and Analytic Geometry II) (5 cr.), MA 181 (Honors Calculus I) (5 cr.) *4–5 cr.*
One of: MA 261 (Multivariate Calculus) (4 cr.), MA 174 (Multivariable Calculus) (4 cr.), MA 182 (Honors Calculus II) (5 cr.), MA 271 (Several Variable Calculus) (5 cr.) *4–5 cr.*

Additional Requirements ***36–41 credits***

English Composition: See page 29 for English composition requirements. *6–7 cr.*
Modern Foreign Language: All College of Science majors are expected to have proficiency in another language in addition to their native language. Competency in the second language must be demonstrated at the fourth-semester college level. (See Modern Foreign Language requirements on pages 29-30). *12–16 cr.*
General Education Requirements: You must complete 18 credit hours of study in the humanities, social sciences and behavioral sciences. (See page 30 for requirements.) *18 cr.*

Free Electives ***23–40 credits***

Free electives can be selected from any department of the University. Students are encouraged to use free electives to broaden their knowledge. However, free elective credit is not allowed for courses that significantly overlap courses taken to fulfill departmental degree requirements. This excludes, in particular, introductory courses. Students must take at least as many free electives as is needed to bring the credit hour total to 124.

Grade Requirement

A 2.0 GPA in all mathematics and statistics courses used to meet the requirements of the major, and an overall GPA of 2.0 are required for graduation.

The two options for statistics majors are described in this section. Students are encouraged to select some free electives that will strengthen their major program. Such electives include additional courses in computer science, mathematics, or statistics, as well as courses in a discipline to which statistics is applied. Note that free electives can be selected from any department within the university.

Statistics Options

Applied Statistics Option

This option prepares students for careers in applied statistics, statistical programming, or other areas that require broad knowledge of statistical ideas and techniques. Students are encouraged to choose electives or a minor program in a field to which statistics is applied. Such breadth is appreciated by employers in business, industry, and government. Statistics faculty can suggest appropriate areas and courses. Because statisticians often manage and analyze large quantities of complex data, additional courses in computer science also are helpful. Advisors can help in selecting appropriate courses.

Applied Statistics Course Requirements **6 credits**

Two of the following: STAT 472 (Actuarial Models), STAT 473 (Actuarial Models), STAT 513 (Statistical Quality Control), STAT 514 (Design of Experiments), STAT 522 (Sampling and Survey Techniques).

Mathematical Statistics Option

This is a rigorous program that can lead to a double major in statistics and mathematics with the addition of MA 453 (Elements of Algebra I) or MA 450 (Algebra: Honors), and MA 366 (Ordinary Differential Equations). It prepares students for graduate work in either applied and mathematical statistics or a quantitative field. Students should consider electives in mathematics or additional courses in applied statistics. MA 301 (Introduction to Proof Through Real Analysis) is encouraged for most students as preparation for MA 341 (Foundations of Analysis).

Mathematical Statistics Course Requirements	9 credits
MA 353 (Linear Algebra II With Applications)	*3 cr.*
MA 341(Foundations of Analysis) or MA 440 (Real Analysis: Honors)	*3 cr.*
STAT 513 (Statistical Quality Control) or STAT 514 (Design of Experiments)	*3 cr.*

Honors

The designation "with honors in statistics" may be awarded at commencement to students who have completed the statistics major with the mathematical statistics option with distinction and with at least three of these course substitutions:

Statistics Honors Course Substitution Requirements

MA 350 (Elementary Linear Algebra: Honors) for MA 351 (Elementary Linear Algebra) (3 cr.)
MA 440 (Real Analysis: Honors) for MA 341 (Foundations of Analysis) (3 cr.)
MA 442 (Multivariate Analysis I: Honors), or MA 510 (Vector Calculus), for MA 362 (Topics in Vector Calculus) (3 cr.)
STAT 516 (Basic Probability and Applications) for STAT 416 (Probability) (3 cr.)
STAT 517 (Statistical Inference) for STAT 417 (Statistical Theory) (3 cr.)

Actuarial Science

An interdisciplinary program in actuarial science is offered jointly by the Department of Mathematics and the Department of Statistics. See page 33.

Special Programs and Opportunities

Cooperative Education Program

The Department of Statistics participates in the Cooperative Education Program as described on page 9. Interested students should contact the Coordinator of Cooperative Education, Department of Statistics, Mathematical Sciences Building. The department coordinator will have information about available programs and will be able to offer advice.

Fifth-Year M.S. Program

Many positions for statisticians require the M.S. in Applied Statistics degree. This is normally a two-year degree program. However, a student who elects the statistics major with mathematical statistics option can earn the M.S. in one additional year of study. Details appear in the Graduate School Bulletin. Students who are considering the fifth-year program should consult a faculty advisor about suitable electives in their undergraduate program.

Statistics Minor

The statistics minor offers a strong quantitative background for students majoring in another discipline. Five courses are required. At least three of these courses must be listed in the statistics department.

Statistic Minor Course Requirements	15 credits
1. Any introductory statistics course: STAT 350 (Introduction to Statistics) (3 cr.) STAT 503 (Statistical Methods for Biology) (3 cr.) STAT 511 (Statistical Methods) (3 cr.)	*3 cr.*
2. An introductory probability course: STAT 225 (Introduction to Probability Models) (3 cr.) STAT 311 (Introductory Probability) (3 cr.) STAT 416 (Probability) (3 cr.)	*3 cr.*
3. Applied Regression Analysis course: STAT 512 (Applied Regression Analysis) (3 cr.)	*3 cr.*
4. Two of the following courses: STAT 416 (Probability) (3 cr.) (if not used to satisfy requirement Number 2) STAT 417 (Statistical Theory) (3 cr.) STAT 513 (Statistical Quality Control) (3 cr.) STAT 514 (Design of Experiments) (3 cr.) IE 336 (Operations Research – Stochastic Models) (3 cr.)	*6 cr.*

Interdisciplinary Science

The Interdisciplinary Science major is designed to give the student a Bachelor of Science degree with a broad base in the sciences. The major consists of a primary area, a supporting area, and the broad education of all College of Science majors. The core courses are common across the major, but the student customizes the major by selecting a departmental or interdepartmental primary area based in science and a supporting area that may come from any school at the University. There is a primary area representing each department in the College of Science, and cross-disciplinary areas will be explored and added as appropriate. Several supporting areas have been suggested, and a student may petition for approval of others.

Students completing the Interdisciplinary Science major have gone on to a variety of careers in and out of the world of science. These careers include medicine, law, and other advanced-study professions, scientific sales, technical and scientific writing, computer programming, and engineering.

The most recent information is available at: http://www.science.purdue.edu/current_students/majors.asp#inter

General Degree Requirements

The College of Science is in the process of reviewing its undergraduate curriculum. Students should check the College of Science Web site (www.science.purdue.edu/academic_programs/majors.asp) and speak with an academic advisor for the most up-to-date information and requirements.

Interdisciplinary Science
Major Course Requirements 69–85 credits

Interdisciplinary Core (Check primary area prerequisites before selecting core courses.) ***39–49 credits***

Biology (select one option): 8–9 credits

BIOL 232 (Lab in Cell Biology) *2 cr.*
BIOL 242 (Lab in Genetics) *2 cr.*
BIOL 270 (Molecular and Cellular Biology) *3 cr.*
BIOL 271 (Genetics) *3 cr.*
BIOL 272 (Ecology & Evolution) *2 cr.*
One of:
BIOL 370 (Development)
BIOL 371 (Physiology)
BIOL 438 (General Microbiology) *3 cr.*

Chemistry (select one option): 8–10 credits

a. CHM 115 and 116 (General Chemistry I and II)
b. CHM 125 and 126 (Introduction to Chemistry I and II)

Computer Science (select one course): 3–4 credits

C S 159 (Programming Applications for Engineers), C S 177 (Programming with Multimedia Objects), C S 180 (Programming I)

EAS (select one option): 3–4 credits

a. One of: EAS 100 (Planet Earth), EAS 109 (The Dynamic Earth), EAS 111 (Physical Geology), EAS 225 (Science of the Atmosphere) (3 cr.)
b. Both EAS 230 (Laboratory in Atmospheric Science) and EAS 221 (Survey of Atmospheric Science) (4 cr.)

Math (select one option): 6–10 credits

a. MA 161 (Plane Analytic Geometry and Calculus I) (5 cr.) or MA 165 (Analytic Geometry and Calculus I) (4 cr.) or MA 223 (Introduction Analysis I) (3 cr.) *4–5 cr.*
b. One of: MA 162 (Plane Analytic Geometry and Calculus II) (5 cr.), MA 166 (Analytic Geometry and Calculus II) (4 cr.), MA 173 (Calculus and Analytic Geometry II) (5 cr.), MA 181 (Honors Calculus I) (5 cr.) or MA 224 (Introductory Analysis II) (3 cr.) *4–5 cr.*

Physics (select one option): 8–9 credits

a. PHYS 172 (Modern Mechanics), PHYS 241 (Electricity and Optics), PHYS 252 (Electricity and Optics Laboratory), PHYS 290D (Heat and Thermal)
b. PHYS 220 and 221 (General Physics)

Statistics (select one course): 3 credits

STAT 350 (Introduction to Statistics), or STAT 503 (Statistical Methods for Biology), or STAT 511 (Statistical Methods).

Primary Area: ***12–18 credits***

Biological Sciences: 15 credits

BIOL 232 (Lab in Cell Biology) *2 cr.*
BIOL 242 (Lab in Genetics) *2 cr.*
BIOL 270 (Molecular and Cellular Biology) *3 cr.*
BIOL 271 (Genetics) *3 cr.*
BIOL 272 (Ecology & Evolution) *2 cr.*

One of:
BIOL 370 (Development)
BIOL 371 (Physiology)
BIOL 438 (General Microbiology)

Chemistry: 16 credits

CHM 241 (Inorganic Chemistry) (4 cr.) *4 cr.*
One of the following:
a. CHM 255, 255L, 256 and 256L (Organic Chemistry) (_cr.)
b. CHM 261, 262, 263, and 264 (Organic Chemistry) (8 cr.) *8 cr.*
CHM 372 (Physical Chemistry) (4 cr.) *4 cr.*

Computer Science: 16 credits

Note: For this primary area, C S 180 and MA 161 or equivalent must be part of the interdisciplinary core.
C S 182 (Foundations in Computer Science) (3 cr.) *3 cr.*
C S 240 (Programming in C) (3 cr.) *3 cr.*
C S 250 (Computer Architecture) (4 cr.) *4 cr.*
C S 251 (Data Structures) (3 cr.) *3 cr.*
C S elective at or above 300 level. (3 cr.) *3 cr.*

Earth and Atmospheric Sciences: 16 credits

Note: For this primary area, EAS 111 or equivalent must be part of the interdisciplinary core.
EAS 230, EAS 221, or EAS 225 (Atmospheric Science) (4 cr.) *3 cr.*
Any EAS at or above 200 level; or EAS 112 (Historical Geology) *12 cr.*

Mathematics: 17 credits

Note: For this primary area, MA 161 and MA 162 or equivalent must be part of the Interdisciplinary Core.
MA 261 (Multivariate Calculus) or equivalent (4 cr.) *4 cr.*
MA 366 or 262 (Differential Equations) (4 cr.) *4 cr.*
MA 351 or 350 (Linear Algebra) (3 cr.) *3 cr.*
One of the following:
a. MA 450 and 453 (Modern Algebra)
b. MA 341 (Analysis)
c. MA 440 (Analysis) *3 cr.*
MA elective at or above 300 level. (3 cr.) *3 cr.*

Physics: 13–14 credits

Note: For this primary area, PHYS 172, 272, and MA 161, MA 162 or equivalent must be part of the Interdisciplinary Core.
MA 261 (Multivariate Calculus) or equivalent (4 cr.) *4 cr.*
PHYS 342 or 344 (Modern Physics) (3-4 cr.) *3–4 cr.*
PHYS or ASTR electives at or above 300 level. (6 cr.) *6 cr.*

Statistics: 12–13 credits

Note: For this primary area, MA 161 and MA 162 or equivalent must be part of the interdisciplinary core.
One of the following: STAT 225, 311, 416, 516 (Probability) (3 cr.) *3 cr.*
STAT 512 (Applied Regression Analysis) (3 cr.) *3 cr.*
STAT 513 or 514 (Statistical Methods) (3 cr.) *3 cr.*
One of the following: STAT 513 (Statistical Quality Control) (3 cr.), STAT 514 (DEsign of Experiments) (3 cr.), STAT 417 (Statistical Theory) (3 cr.), or MA 261 (Multivariate Calculus) (4 cr.) *3–4 cr.*

Environmental Biology: 17 credits

BIOL 270 (Molecular and Cellular Biology) *3 cr.*
BIOL 271 (Genetics) *3 cr.*
BIOL 272 (Ecology & Evolution) *2 cr.*
BIOL 483 (Environmental and Conservation Biology) *3 cr.*
BIOL 585 (Ecology) *3 cr.*
One of:
BIOL 370 (Development)
BIOL 371 (Physiology)
BIOL 438 (General Microbiology) *3 cr.*

Supporting Area 18 credits

Supporting area courses may not overlap core or primary area courses, but may overlap the General Education area. The supporting area may be built on the numerous minors (see www.science.purdue.edu/academic_programs/minors.asp), or may be built on any coherent grouping of courses with a central unifying theme. These might include management, preprofessional, international studies, foreign language, history, creative writing, science policy, ethics, psychology, women's studies, African American studies, etc. Any plan must be approved by the dean or designee.

Sample Supporting Area for Environmental Biology:

AGR 490 (Special Problems) (3 cr.), C E 350 (Environmental Engineering) (3 cr.), EAS 420 (Global Change Modeling) (3 cr.), FNR 488 (Global Environmental Issues) (3 cr.), PHIL 290 (Environmental Ethics) (3 cr.), POL 523 (Environmental Policy and Public Policy) (3 cr.)
Other courses may be used on approval.

Additional Requirements 36–41 credits

English Composition: See page 29 for English composition requirements *6–7 cr.*
Modern Foreign Language: All College of Science majors are expected to have proficiency in another language in addition to their native language.

Competency in the second language must be demonstrated at the fourth-semester college level. (See Modern Foreign Language requirements on pages 29-30). *12–16 cr.*

General Education Requirements: You must complete 18 credit hours of study in the humanities, social sciences and behavioral sciences. (See page 30 for requirements.) *18 cr.*

Free Electives

Free electives can be selected from any department of the University. Students are encouraged to use free electives to broaden their knowledge. However, free elective credit is not allowed for courses that significantly overlap courses taken to fulfill departmental degree requirements. This excludes, in particular, introductory courses. Students must take at least as many free electives as is needed to bring the credit hour total to 124.

Information About Courses

Official Purdue University course information is available on the Web at www.purdue.edu/Purdue/course_info. Click on the "Course Information — All Campuses" link at the top of the page.

The Official Purdue University Course Repository is maintained by the Office of the Registrar and is updated instantaneously. It contains a multitude of information, including course descriptions and requisites for retired, current, and future courses offered at the West Lafayette campus as well as at Purdue Calumet, Purdue North Central, Indiana University-Purdue University Fort Wayne, Indiana University-Purdue University Indianapolis, and the College of Technology locations around the state.

The course information available online is organized by campus, program, and subject area, which enables you to tailor your search.

You also may want to consult your academic advisor if you have questions about the courses required for your plan of study.

College of Science Administration and Faculty

Administration

Jeffrey S. Vitter, *Ph.D.,* Dean of the College of Science

Jeffrey T. Bolin, *Ph.D.,* Associate Dean of the College of Science, Research

George McCabe, *Ph.D.,* Associate Dean of the College of Science, Academic Affairs

Aditya Mathur, *Ph.D.,* Associate Dean of the College of Science, Graduate Studies and International Programs

Christie L. Sahley, *Ph.D.,* Associate Dean of the College of Science, Undergraduate Education

Heads of Instructional Departments

Mary Ellen Bock, *Ph.D.,* Head of the Department of Statistics

Susanne Hambrusch, *Ph.D.,* Head of the Department of Computer Science

Larry W. Braile, *Ph.D.,* Head of the Department of Earth and Atmospheric Sciences

Andrew S. Hirsch, *Ph.D.,* Head of the Department of Physics

Richard Kuhn, *Ph.D.,* Head of the Department of Biological Sciences

Leonard Lipshitz, *Ph.D.,* Head of the Department of Mathematics

Timothy S. Zwier, *Ph.D.,* Head of the Department of Chemistry

Biological Sciences

R. J. Kuhn, Head of the Department

P. J. Hollenbeck, Associate Head of the Department

D. J. Minchella, Associate Head of the Department

Distinguished Professors: W. A. Cramer, *Ph.D., Henry Koffler Distinguished Professor of Biological Sciences;* W. L. Pak, *Ph.D., Paul F. Oreffice Distinguished Professor of Biological Sciences;* M. G. Rossmann, *Ph.D., Hanley Distinguished Professor of Biological Sciences*

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Professors Emeriti: J. Altman, *Ph.D.;* A. I. Aronson, *Ph.D.;* T. S. Baker, *Ph.D.;* A. W. Berkovitz, *M.S.;* J. A. Chiscon, *Ph.D.;* M. O. Chiscon, *Ph.D.;* F. L. Crane, *Ph.D.;* R. A. Dilley, *Ph.D.;* D. L. Filmer, *Ph.D.;* M. Forman, *Ph.D.;* P. T. Gilham, *Ph.D.;* D.Sc.; R. N. Hurst, Ph.D.; M. Levinthal, *Ph.D.;* F. H. Nordland, *Ph.D.;* S. E. Ostroy, *Ph.D.;* S. N. Postlethwait, *Ph.D.;* W. J. Ray, *Ph.D.;* M. L. Stiller, *Ph.D.;* I. Tessman, *Ph.D.;* J.W. Vanable, *Ph.D.;* J. E. Wiebers, *Ph.D.*

Associate Professors: D. C. Eichinger, *Ph.D.;* A. M. Friedman, *Ph.D.;* L. E. Iten, *Ph.D.;* M. McCann, *Ph.D.;* D. A. Sanders, *Ph.D.;* A. Stein, *Ph.D.*; D. Zhou, *Ph.D.*

Assistant Professors: C. Aguilar, *Ph.D.;* E. Bartlett, Ph.D.*; E. Barton, *Ph.D.;* I. Camarillo, *Ph.D.;* H. Chang, *Ph.D.;* J. Chen, *Ph.D.;* J. Fargione, *Ph.D.*†; D. S. Franklin, *Ph.D.;*W. Jiang, *Ph.D.;* S. J. Karcher, *Ph.D.;* D. Kihara, *Ph.D.* ‡; Z.-Q. Luo, *Ph.D.;* Y. Mizukami, *Ph.D.;* K. Nichols, *Ph.D.* †; K. Otto, *Ph.D.* *; D. Suter, *Ph.D.;* D. Szeto, *Ph.D.;* D. Thompson, *Ph.D.;* D. Yernool, *Ph.D.*

Chemistry

T. S. Zwier, Head of the Department

S. A. McLuckey, Associate Head of the Department

F. E. Lytle, Associate Head of the Department

Distinguished Professors: G. M. Bodner, *Ph.D., Arthur Kelly Distinguished Professor of Chemistry and Education;* J. A. Chmielewski, *Ph.D, Alice Watson Kramer Distinguished Professor of Chemistry;* R. G. Cooks, *Ph.D., Henry Bohn Hass Distinguished Professor of Chemistry.;* J. S. Francisco, *Ph.D., William Moore Distinguished Professor of Chemistry §*; P. S. Low, *Ph.D., Ralph C. Corley Distinguished Professor of Chemistry;* D. W. Margerum, *Ph.D., Harvey Washington Wiley Distinguished Professor of Chemistry;* E. Negishi, *Ph.D., Herbert C. Brown Distinguished Professor of Chemistry;* F. E. Regnier, *Ph.D., Distinguished Professor of Chemistry;* R. A. Walton, *Ph.D., John A. Leighty Distinguished Professor of Chemistry*

Named Professor: P. L. Fuchs, *Ph.D., R. B. Wetherill Professor of Chemistry*

Professors: S. A. Adelman, *Ph.D.;* D. Ben-Amotz, *Ph.D.;* M. Bina, *Ph.D;* P. J. Daly, *Ph.D.;* A. Ghosh, *Ph.D.;* J. B. Grutzner, *Ph.D.;* S. Kais, *Ph.D.;* H. I. Kenttämaa, *Ph.D.;* P. T. Kissinger, *Ph.D.;* M. E. Lipschutz, *Ph.D.;* F. E. Lytle, *Ph.D.;* S. McLuckey, *Ph.D.;* D. R. McMillin, *Ph.D.;* H. A. Morrison, *Ph.D;* M. B. Nakhleh, *Ph.D.||;* N. T. Porile, *Ph.D.;* D. Raftery, *Ph.D.;* T. Ren, *Ph.D.;* W. R. Robinson, *Ph.D.;* P. B. Shepson, *Ph.D. §*; I. Szleifer, *Ph.D.;* D. H. Thompson, *Ph.D.;* R. L. Van Etten, *Ph.D.;* T. S. Zwier, *Ph.D.*

Professors Emeriti: J. W. Amy, *Ph.D.;* R. A. Benkeser, *Ph.D.;* J. H. Brewster, *Ph.D.;* D. A. Davenport, *Ph.D.;* H. Feuer, *Ph.D.;* R. Grimley, *Ph.D.;* J. M. Honig, *Ph.D.;* A. Light, *Ph.D.;* N. Muller, *Ph.D.;* H. L. Pardue, *Ph.D.;* J. Richardson, *Ph.D.;* W. E. Truce, *Ph.D.;* J. Wolinksy, *Ph.D.*

Associate Professors: M. Abu-Omar, *Ph.D.;* A. Davidson, *Ph.D.;* C. Hrycyna, *Ph.D;* M. A. Lipton, *Ph.D.;* M. P. V. Ramachandran, *Ph.D.;* K. Shah, *Ph.D;* G. J. Simpson, *Ph.D.;* M. H. Towns, *Ph.D.;* G. C. Weaver, *Ph.D.;* A. Wei, *Ph.D.;* P. G. Wenthold, *Ph.D.;* J. J. Wilker, *Ph.D.*

Assistant Professors: K. Choi, *Ph.D.;* Brian Dian, *Ph.D.,* J. S. Hovis, *Ph.D.;* C. Mao, *Ph.D.;* S. N. Savinov, *Ph.D.;* N. R. Skrynnikov, *Ph.D.*

**Joint appointment with the Department of Biomedical Engineering.*
†Joint appointment with the Department of Forestry and Natural Resources.
‡Joint appointment with the Department of Computer Science.
§ Joint appointment with the Department of Earth and Atmospheric Sciences.
|| Joint appointment with the College of Education, Department of Curriculum and Instruction.

Computer Science

S. E. Hambrusch, Head of the Department

J. T. Korb, Assistant Department Head

W. J. Gorman, Assistant to the Head of the Department

Distinguished Professors: M. J. Atallah, *Ph.D., Distinguished Professor of Computer Science;* D. E. Comer, *Ph.D., Distinguished Professor of Computer Science; A.* H. Sameh, *Ph.D., Samuel D. Conte Professor of Computer Science;* J. S. Vitter, *Ph.D., Frederick L. Hovde Dean of the College of Science and Professor of Computer Science*

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Research Assistant Professor: R. Shah, *Ph.D.*

Courtesy Appointments: S. Abhyankar, *Ph.D.;* D. C. Anderson, *Ph.D.;* S. Bagchi, *Ph.D.;* A. R. Chaturvedi, *Ph.D.;* W. Cleveland, *Ph.D.;* M. J. Dark, *Ph.D.;* D. S. Ebert, *Ph.D.;* M. Gribskov, *Ph.D.;* Y. C. Hu, *Ph.D.;* S. Kais, *Ph.D.;* Y. Lu, *Ph.D.;* N. B. Shroff, *Ph.D.;* T. N. Vijaykumar, *Ph.D.*

Lecturers: W. Crum, *M.S.*, E. King, *M.S.*, G. Rodriguez-Rivera, *Ph.D.;* K. L. VanZandt, *Ph.D.*

Earth and Atmospheric Sciences

L. W. Braile, Head of the Department

E. M. Agee, Associate Head of the Department

T. R. Filley, Associate Head of the Department

S. M. Zurn-Birkhimer, Assistant Department Head

Distinguished Professors: J. H. Cushman, *Ph.D., University Distinguished Professor of Earth and Atmospheric Sciences* ‡; J. S. Francisco, *Ph.D.*, *William Moore Distinguished Professor of Earth and Atmospheric Sciences* ¶

Professors: E. M. Agee, *Ph.D.;* L. W. Braile, *Ph.D.;* M. V. de Hoop, *Ph.D.* ‡; A. Gabrielov, *Ph.D.* ‡ ; Harshvardhan, *Ph.D.;* S. D. King, *Ph.D.;* G. H. Krockover, *Ph.D.* ◊; R. L. Nowack, *Ph.D.;* J. G. Ogg, *Ph.D.;* K. D. Ridgway, *Ph.D.;* D. P. Shepardson, *Ph.D.* ◊ ; P. B. Shepson, *Ph.D.* ¶ ; Y. N. Shieh, *Ph.D.;* P. J. Smith, *Ph.D.;* W. Y. Sun, *Ph.D.;* T. R. West, *Ph.D.;* W. J. Zinsmeister, *Ph.D.*

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* *Joint appointment with Electrical and Computer Engineering.*
† *Joint appointment with Discovery Park; Director of Cyber Center.*
‡ *Joint appointment with the Department of Mathematics.*
§ *Joint appointment with the Department of Biological Sciences.*
‖ *Joint appointment with the Department of Statistics.*
¶ *Joint appointment with the Department of Chemistry.*
◊ *Joint appointment with the College of Education, Department of Curriculum and Instruction.*

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Mathematics

L. M. Lipshitz, Head of the Department

A. W. Weitsman, Associate Head of the Department

A. J. Bronstein, Assistant to the Head

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