Purdue University
College of Science

2012–2013
Undergraduate Academic Catalog

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The 2012-13 Undergraduate Academic Catalogs provide users with information about degree programs offered at the Purdue University West Lafayette campus.

In Fall Semester 2011-12, students were enrolled in 269 undergraduate majors in 10 overarching academic colleges and schools. Some of those students were at the same time taking graduate-level classes and/or pursuing professional degrees.

The information contained in these catalogs is subject to change as a result of action by federal and/or state governments, the trustees of Purdue University and the administration of Purdue University. Questions about the detailed content should be directed to the appropriate University college/school, department or office.

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, genetic information, marital status, parental status, sexual orientation, gender identity and expression, disability, or status as a 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 Purdue's Equal Opportunity, Equal Access and Affirmative Action policy 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 veterans through its affirmative action program.

Any question of interpretation regarding this Nondiscrimination Policy Statement shall be referred to the Vice President for Ethics and Compliance (www.purdue.edu/ethics) for final determination.

College of Science

Actuarial science; biological sciences; chemistry; computer science; earth, atmospheric and planetary sciences; mathematics; physics; statistics; math and science secondary school teaching; and interdisciplinary science programs prepare students for immediate careers or advanced study. Premedical, pre-dental and pre-veterinary options; a Professional Practice Program; study abroad and honors programs

are available. Students may pursue official minors in other areas outside their major. Enrollment in the 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.

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 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 provide opportunities 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 and 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 are also 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 college 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 the sophomore year, and often not until the 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. Alternatively, you may choose to supplement your major courses with those offered by other colleges or schools of the University.

Choosing a major is not always easy, but help is available. Science academic advisors and faculty members are 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 to outstanding students. Top students will receive invitations to apply for scholarships; however, the College of Science scholarship application is open to all students pursuing a science program.

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 participation in leadership activities and honors. Continuing students who compete successfully for scholarships usually have at least a 3.5 (out of a possible 4.0) overall GPA in addition to a strong record in leadership, community service and research.

For further information, visit the College of Science scholarship website at www.science.purdue.edu/index.php/scholarships.

Professional Practice Program

The College of Science Professional Practice 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 professional practice, it may take longer to earn your degree, but you will receive several important benefits. Based on past experience of students in Professional Practice Programs, you can expect that (1) your earnings from your employment will be enough to pay a substantial portion of your remaining years of study, 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 professional practice 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 professional practice employer. Your professional practice 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 participation and has a departmental coordinator of the program. (Departmental requirements are given in the departmental sections of this catalog.) The departmental coordinator counsels students in the program and has information about available jobs.

You must apply to the coordinator in your department to be accepted into the Professional Practice 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 professional practice coordinator. If you are interested in the program, you should contact the departmental coordinator as early as possible to facilitate job placement and to assure your eligibility.

The University, through a professional practice coordinator, supervises you and your employer during work periods. After each work period, you must write a comprehensive report about your work experience. At graduation, students who complete at least four work periods receive a certificate indicating that they have completed the Professional Practice Program.

While employed as a professional practice student, you must register for noncredit departmental courses numbered 09100, 09200, 09300, 09400 or 09500 and pay the special University fee for program registration.

College of Education and Teacher Education At Purdue

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 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 Teacher Education website at www.teach.purdue.edu programs. Students seeking additional clarification and guidance should consult with an academic advisor.

A person who already holds a bachelor's degree may wish to complete a teacher education program as an undergraduate or graduate "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 (OPPL) for a transcript evaluation. Eligibility requirements do apply.

Admission to the Teacher Education Program

1. Admission to Purdue University.
2. Admission to the respective academic college (i.e., colleges of Agriculture, Education, Health and Human Sciences, Liberal Arts, Science or Technology). This may require completing the changing of a degree (CODO) process. Students will work with an academic advisor in the teacher education college to initiate and complete this process.
3. Assignment to and guidance by an academic advisor. Consultation with academic advisors on a regular basis ensures that the required criteria are met and coursework and testing are successfully completed in the sequence authorized by the Purdue University Teacher Education Council (TEC).
4. Admission to the Teacher Education Program (TEP). Application to the TEP is a separate and distinct step beyond admission to the University.

Required Criteria and Suggested Time Line

Students need to 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 the student:

- Changes the degree objective or transfers
- Needs to successfully pass required tests
- Needs to overcome a GPA below the required Teacher Education Program standard
- Pursues an additional major or licensure area, and/or
- Encounters other unknown needs or circumstances

Student Services

- Accelerated Programs (www.purdue.edu/catalogs/science/student_service.html#ap)
- Academic Advising (www.purdue.edu/catalogs/science/student_service.html#aa)
- Career Counseling (www.purdue.edu/catalogs/science/student_service.html#cco)
- Science Diversity Office (www.purdue.edu/catalogs/science/student_service.html#sdo)
- Multicultural Science Programs (www.purdue.edu/catalogs/science/student_service.html#msp)
- Women in Science Programs (www.purdue.edu/catalogs/science/student_service.html#ws)
- Directors and Special Program Coordinators (www.purdue.edu/catalogs/science/student_service.html#dspc)

Accelerated Programs

The departments of the College of Science give a variety of honors and offer advanced placement. 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 can also 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, research 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 catalog 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 by email, at your campus address or through campus media.

Whether you are a prospective student or are already enrolled at the University, you are welcome to contact the Office of Undergraduate Education in Room 231, Mathematical Sciences Building. The office is open weekdays from 8 a.m. to 5 p.m. For additional information, contact 765-494-1771 or www.science.purdue.edu.

Career Counseling

A College of Science career counselor can help guide you to a particular career path, make sure you are in the right major to suit your interests, offer assistance technically to improve your resume and help guide 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 765-494-1771 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. Students have opportunities to 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

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Graduation Requirements

Students should check the College of Science website (www.science.purdue.edu/) 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:

A. Satisfaction of various University-wide requirements, i.e., academic scholarship, residence, etc., as described in Student Regulations (www.purdue.edu/studentregulations/).
B. Completion of the core requirements of the College of Science and of your departmental major, details of which are included in the applicable sections of this site.

If you successfully complete the requirements of one of the departmental honors programs (see information 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 (www.purdue.edu/catalogs/science/sci_chemistry.html) is awarded to those who complete the program approved by the American Chemical Society.)

In addition to meeting core curriculum requirements, students must complete major requirements established by their departments.

B.S. Degree Requirements: College of Science

Total 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.

Composition and Presentation	7-10 credits
Teambuilding and Collaboration	1-5 credits
Language and Culture	9 credits
General Education	9 credits
Multidisciplinary Experience	3 credits
Laboratory Science	6-10 credits
Mathematics	6-10 credits
Statistics	3 credits
Computing	3-4 credits

Core Curriculum Requirements

Composition and Presentation

First-Year Composition. All students must complete First-Year Composition — ENGL 10600 (First-Year Composition) or ENGL 10800 (Accelerated First-Year Composition). Students with a minimum SAT Verbal score of 710 or a composite ACT score of 32 will receive a waiver from the freshman English requirement. Credit will be posted by the English department at the conclusion of a student's first semester.

Technical Writing and Technical Presentation (TWTP). This core requirement may be met in multiple ways, including approved courses and experiential learning opportunities. Students in international or foreign status, however, are required to use a course or courses to meet the TWTP requirement. Approved experiential learning options may not be used by students with international or foreign status.

Technical Writing. This requirement can be met by completing one of the following options:

1. Science-based technical communication course: **or**
2. Course in technical writing from a list of approved courses; **or**
3. Scholarly publication:
    - Paper accepted for publication in a peer-reviewed journal or peer-reviewed conference proceedings in which the student is the lead author or has written the large majority of the paper; **or**
    - Paper that a College of Science faculty member with expertise in the area deems of publishable quality; **or**
    - Three approved papers of at least 1,500 words each, at least one of which makes a strong or persuasive argument.

Technical Presentation. Requirement can be met by completing one of the following options:

1. Science-based technical presentation course; **or**
2. Course in technical presentation skills from a list of approved courses; **or**
3. Presentation at a scientific meeting (sole or predominant presenter); **or**
4. Presentation of work at an adjudicated poster session
    - Presentation must be made in the presence of a certified judge; **and**
    - Written feedback must be provided to the student; **or**
5. Presentation of work during an internship or co-op; **or**
6. Three approved 10-minute (or longer) presentations within science course(s).

Teaming and Collaboration

Students learn the concepts involved in science teaming through this two-part teaming and collaboration requirement. Students must complete teaming principles, part I, before or concurrently with an approved teaming experience.

Part I, teaming principles, is met by the completion of SC 21000 (Teaming Principles). Part II, teaming experience, may be met through one of the following options:

1. Completion of an approved teaming experience course or approved course that meets both part I and part II of the requirement; **or**
2. Participation in an approved teaming experience; **or**
3. Completion of an approved teaming and collaboration experience that meets both part I and part II of the requirement.

Language and Culture

All College of Science students are expected to have an understanding of another culture in addition to their own culture. This requirement may be met through one of the following options:

1. Completion of three courses in the same language; **or**
2. Completion of two courses in the same language and an approved culture or diversity course; **or**
3. An approved Study Abroad experience that satisfies the following:

    - Must be at least one semester in duration or an approved internship program; **and**
    - Must take place outside the United States; **and**
    - Must consist of taking courses and/or working on a research project; **and**
    - Must include significant immersion in the local culture and language independent of any U.S.-based program in which a student may be participating.

Students whose native language is not English may also use demonstrated proficiency in their native language to fulfill this requirement. See an advisor for guidelines regarding this option.

Students may not earn credit toward graduation for courses below the 30000 level in their native language. The School of Languages and Cultures does not allow their native speaker to take 30100/30200 or 40100/40200 language development courses in their native language but will allow students to take history, literature and culture courses.

Students expecting to pursue graduate studies should note that some Ph.D. in science programs require 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

Great Issues in Science. The College of Science Great Issues course addresses the impact of science on society and the ramifications of scientific advances. The Great Issues requirement can be met by completing the College of Science Great Issues in Science course or another approved course. Please see an academic advisor for approved courses.

General Education Options

This requirement is divided into two components. Nine total credits are required. Courses must be taken from:

Humanities/Social Science and/or Management. All College of Science students will be required to select three courses (9 credits) from the areas listed below, according to the following guidelines:

A two-course sequence (6 credits) must be selected from area (a) Humanities/Social Sciences. The second course in the sequence should be an extension or enhancement of the first. (This could be a second course in a series or a course that adds an interdisciplinary approach, i.e., a course in U.S. history could be followed with a course in Women's Studies or in African American Studies.)

To complete the requirement, students must take one additional course (3 credits) from either of the two areas listed below.

1. Humanities/Social Science. Approved courses in literature, philosophy, history, political science, psychology, sociology, anthropology, interdisciplinary studies, communication, visual and performing arts, African American Studies, American Studies, Jewish Studies, Religious Studies, Women's Studies, Classics or School of Languages and Cultures courses on culture or civilization; **or**

2. Management. Approved courses in management, economics or organizational behavior and resources management or ENTR 20000.

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 15000 (Principles of Logic), PHIL 45000 (Symbolic Logic), PHIL 55000 (Advanced Symbolic Logic), PSY 20400 (Use Of Computers

in Psychology), PSY 50000 (Statistical Methods Applied to Psychology, Education, and Sociology), PSY 50100 (Mathematics Essential for Quantitative Psychology), SOC 38200 (Introduction to Methods of Social Research).

Multidisciplinary Experience

The multidisciplinary requirement can be met by completing one of the following options:

1. Complete a course, research project, internship or an entrepreneurship program project that involves a multidisciplinary approach to examining a problem or issue, preferably involving multidisciplinary teams at the junior level or above; **or**
2. Complete an additional major or minor that gives the student experience in another discipline's approach to examining important problems and issues in that discipline. Such an additional major or minor must require at least three courses not required for the student's major. Such additional majors and minors will be approved by each College of Science department for use by students to satisfy this requirement; **or**
3. Science Education (secondary education) students meet this requirement by completing degree requirements.

Laboratory Science

Students in the College of Science must complete a two-course sequence and related laboratory experiences in a science outside of the major department. These courses must be approved foundational laboratory science coursework in the biological sciences; chemistry; Earth, Atmospheric and Planetary Sciences; or physics.

Mathematics

Students must take a minimum of a one-year sequence of single variable calculus. The following courses are acceptable: MA 16100 (Plane Analytic Geometry and Calculus I) (5 cr.) and MA 16200 (Plane Analytic Geometry and Calculus II) (4 cr.); or an approved two-course mathematics sequence for a particular major.

Statistics

Students must take a statistics course from an approved list. The following courses and their equivalents are currently acceptable: STAT 30100 (Elementary Statistical Methods) (3 cr.); STAT 35000 (Introduction to Statistics) (3 cr.); STAT 50300 (Statistical Methods for Biology) (3 cr.); STAT 51100 (Statistical Methods) (3 cr.). Please check specific department and/or major requirements because there may be departmental restrictions on which courses are allowed.

Computing

Students must take a course in computing concepts taught using an interpreted or compiled programming language. Course content will include basic control structures and function calls. To fulfill this requirement, one of the following courses must be completed: CS 15800 (C Programming) (3 cr.); CS 15900 (Programming Applications for Engineers) (3 cr.); CS 17700 (Programming with Multimedia Objects) (4 cr.); CS 18000 (Programming I) (4 cr.); CS 1900C (Introduction to Computational Thinking) (3 cr.).

Academic Policies

"Pass/Not-Pass" Option. In addition to the grades "A," "B," "C," etc., traditionally assigned to indicate the level of performance in classwork, 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.

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 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 Student Regulations (www.purdue.edu/studentregulations/) 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/Forms/Equiv_Non-Equiv.html 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 percent 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 Purdue. See the list of currently approved minors for College of Science students: www.science.purdue.edu/Current_Students/minors/index.html#somelink.

Abbreviations

Some of the following abbreviations of subject fields are used in the Plans of Study section of this catalog. Alphabetization is according to abbreviation.

AAE — Aeronautical and Astronautical Engineering
AAS — African American Studies
ABE — Agricultural and Biological Engineering
AD — Art and Design
AFT — Aerospace Studies
AGEC — Agricultural Economics
AGR — Agriculture
AGRY — Agronomy
AMST — American Studies
ANSC — Animal Sciences
ANTH — Anthropology
ARAB — Arabic
ASAM — Asian American Studies
ASL — American Sign Language
ASM — Agricultural Systems Management
ASTR — Astronomy
AT — Aviation Technology
BAND — Bands
BCHM — Biochemistry
BCM — Building Construction Management Technology
BGR — Boiler Gold Rush
BIOL — Biological Sciences
BME — Biomedical Engineering
BMS — Basic Medical Sciences
BTNY — Botany and Plant Pathology
CDFS — Child Development and Family Studies
CE — Civil Engineering
CEM — Construction Engineering and Management
CFS — Consumer and Family Sciences
CGT — Computer Graphics Technology

CHE — Chemical Engineering
CHM — Chemistry
CLCS — Classics
CLPH — Clinical Pharmacy
CMPL — Comparative Literature
CNIT — Computer and Information Technology
COM — Communication
CPB — Comparative Pathobiology
CS — Computer Sciences
CSR — Consumer Sciences and Retailing
DANC — Dance
EAS — Earth and Atmospheric Sciences
ECE — Electrical and Computer Engineering
ECET — Electrical and Computer Engineering Technology
ECON — Economics
EDCI — Education-Curriculum and Instruction
EDFA — Education-Foundations and Administration
EDPS — Educational and Psychological Studies
EDST — Educational Leadership and Cultural Foundations
EEE — Environmental and Ecological Engineering
ENE — Engineering Education
ENGL — English
ENGR — First-Year Engineering
ENTM — Entomology
ENTR — Entrepreneurship
EPCS — Engineering Projects in Community Service
FLL — Foreign Languages and Literatures
FN — Foods and Nutrition
FNR — Forestry and Natural Resources
FR — French
FS — Food Science
FVS — Film and Video Studies
GEOG — Geography
GEOL — Geology
GEP — Global Engineering Program
GER — German
GREK — Greek
GS — General Studies
HDFS — Human Development and Family Studies
HEBR — Hebrew
HHS — Health and Human Sciences
HIST — History
HK — Health and Kinesiology
HONR — Honors

HORT — Horticulture
HPER — Health, Physical Education and Recreation
HSCI — Health Sciences
HTM — Hospitality and Tourism Management
IDE — Interdisciplinary Engineering
IDIS — Interdisciplinary Studies
IE — Industrial Engineering
IET — Industrial Engineering Technology
IPPH — Industrial and Physical Pharmacy
IT — Industrial Technology
ITAL — Italian
JPNS — Japanese
JWST — Jewish Studies
LA — Landscape Architecture
LALS — Latina American and Latino Studies
LCME — Lafayette Center for Medical Education
LING — Linguistics
LS — Land Surveying
MA — Mathematics
MARS — Medieval and Renaissance Studies
MCMP — Medicinal Chemistry and Molecular Pharmacology
ME — Mechanical Engineering
MET — Mechanical Engineering Technology
MGMT — Management
MSL – Military Science and Leadership
MUS — Music History and Theory
NRES — Natural Resources and Environmental Science
NS — Naval Science
NUCL — Nuclear Engineering
NUPH — Nuclear Pharmacy
NUR — Nursing
NUTR — Nutrition Science
OBHR — Organizational Behavior and Human Resources
OLS — Organizational Leadership and Supervision
PES — Physical Education Skills
PHAD — Pharmacy Administration
PHIL — Philosophy
PHPR — Pharmacy Practice
PHRM — Pharmacy
PHSL — Physiology
PHYS — Physics
POL — Political Science
PPE — Professional Practice-Engineering
PPT — Professional Practice-Technology

PSY — Psychology
PTGS — Portuguese
RECR — Recreation Leadership
REL — Religious Studies
RUSS — Russian
SA — Study Abroad
SCI — General Science
SLHS — Speech, Language and Hearing Science
SOC — Sociology
SPAN — Spanish
STAR — Summer Transition, Advising and Registration
STAT — Statistics
SWRK — Social Work
TECH — Technology
THTR — Theatre
USP — Undergraduate Studies Program
VCD — Visual Communication and Design
VCS — Veterinary Clinical Sciences
VM — Veterinary Medicine
WOST — Women's Studies
YDAE — Youth Development and Agricultural Education

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, Atmospheric and Planetary 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 these plans of study 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 catalog of the college/school offering the supplemental courses for a possible major in that field.

In charts throughout "Plans of Study," 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 the core curriculum requirements (www.purdue.edu/catalogs/science/grad_requirements.html) of the college and of a departmental major or the requirements of an interdisciplinary science major.

Seven academic departments offer 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 five 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 the societies, completing required coursework and satisfying additional requirements.

The Purdue actuarial science program provides preparation for the first five 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 their first year.

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

In meeting the following requirements, a student will also automatically fulfill the College of Science graduation requirements (www.purdue.edu/catalogs/science/grad_requirements.html).

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.

Actuarial Science Requirements

Actuarial Science Core	***38 credits***
ECON 25100 (Microeconomics) (3 cr.) and ECON 25200 (Macroeconomics) (3 cr.)	*6 cr.*
MA 37300 (Financial Mathematics) (4 cr.)	*4 cr.*
MGMT 20000 (Introductory Accounting) (3 cr.); MGMT 20100 (Management Accounting I) (3 cr.); MGMT 31000 (Financial Management) (3 cr.)	*9 cr.*

STAT 49000 (Actuarial Models) and STAT 47300 (Actuarial Models II) (7 cr.); STAT 51200 (Applied Regression Analysis) (3 cr.); MA/STAT 41600 (Probability) (3 cr.); STAT 41700 (Statistical Theory) (3 cr.); STAT 42000 (Time Series Analysis) (3 cr.)	*19 cr.*
Mathematics Requirements	***19-22 credits***
MA 16100 (Plane Analytic Geometry and Calculus I) (5 cr.); or MA 16500 (Analytic Geometry and Calculus I) (4 cr.)	*4-5 cr.*
One of: MA 16200 (Plane Analytic Geometry and Calculus II) (5 cr.); MA 16600 (Analytic Geometry and Calculus II) (4 cr.); MA 17300 (Calculus and Analytic Geometry II) (5 cr.); MA 18100 (Honors Calculus I) (5 cr.)	*4-5 cr.*
One of: MA 26100 (Multivariate Calculus) (4 cr.); MA 17400 (Multivariable Calculus) (4 cr.); MA 18200 (Honors Calculus II) (5 cr.); MA 27100 (Several Variable Calculus) (5 cr.)	*4-5 cr.*
MA 35100 (Elementary Linear Algebra) (3 cr.) or MA 35000 (Elementary Linear Algebra: Honors) (3 cr.)	*3 cr.*
MA 36600 (Ordinary Differential Equations) (4 cr.)	*4 cr.*

Free Electives 21-31 credits

Free electives can be selected from any department of Purdue 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 35100, MA 36600 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 47900 completes the material required for the fifth actuarial exam, Exam C. Students may enter the program at any time. Entering the honors program indicates an intention to meet the more rigorous requirements of graduation "with honors" as outlined in the following text. 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 overall; (b) obtain at least a "B-" in each of ECON 25100 (or 34000), ECON 25200 (or 35200), MGMT 31000, 41100; (c) take STAT 47900 (Honors Loss Models); (d) obtain an average GPA of at least 3.5 in the following set of classes: STAT 41700, 47300, 47900, 49000; (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 first-year students 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 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 we 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; genetics; health and disease; 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 upperclassmen 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 12100.

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 website for the biology department can be found at www.biology.purdue.edu.

General Degree Requirements

Students should check the College of Science website (www.science.purdue.edu/) 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
(www.purdue.edu/catalogs/science/grad_requirements.html).

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 50000-level biology course other than BIOL 54200. 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 — ***19-21 credits***

BIOL 12100 (Diversity, Ecology, and Behavior) (2 cr.); — *19 cr.*
BIOL 13100 (Development, Structure and Function of Organisms) (3 cr.);
BIOL 13500 (First-Year Biology Lab) (2 cr.) **or**
BIOL 14501 (First-Year Lab New Research Project) (2 cr.) **or** BIOL 14502 (First-Year Lab Micro-Research Project) (2 cr.) **or** IT 22600 (Biology Lab 1) (2 cr.);
BIOL 23200 (Laboratory in Cell Structure and Function) (2 cr.); BIOL 24100 (Genetics and Molecular Biology) (3 cr.);
BIOL 24200 (Laboratory in Genetics and Molecular Biology) (2 cr.); BIOL 28600 (Ecology and Evolution) (2 cr.)

Intermediate-Level Biology*

One of: BIOL 32800 (Principles of Physiology) (4 cr.); or — *3-5 cr.*
BIOL 36600 (Principles of Development) (4 cr.); or
BIOL 39500 (Macromolecules) (3 cr.); or
both BIOL 43800 (General Microbiology) (3 cr.) and BIOL 43900 (Laboratory in General Microbiology) (2 cr.)
Some majors specify which option you may/must complete. See individual biology majors.

Upper-Level Biology — ***15-27 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* — ***25-35 credits***

One of the following two sequences: — *8-10 cr.*
a. CHM 11500 (General Chemistry) (4 cr.) and CHM 11600 (General Chemistry) (4 cr.)
b. CHM 12500 (Introduction to Chemistry I) (5 cr.) and CHM 12600 (Introduction to Chemistry II) (5 cr.)

One of the following three sequences: — *8 cr.*
a. CHM 25500 (Organic Chemistry) (3 cr.) and CHM 25501 (Organic

Chemistry Laboratory) (1 cr.); and CHM 25600 (Organic Chemistry) (3 cr.) and CHM 25601 (Organic Chemistry Laboratory) (1 cr.)

b. CHM 25700 (Organic Chemistry) (4 cr.) and 25701 (Organic Chemistry Laboratory) (1 cr.); and either CHM 33300 (Principles of Biochemistry) (3 cr.) or BCHM 30700 (Biochemistry) (3 cr.)

c. CHM 26505 (Organic Chemistry) (3 cr.) and CHM 26605 (Organic Chemistry) (3 cr.); and CHM 26300 (Organic Chemistry Laboratory) (1 cr.) and CHM 26400 (Organic Chemistry Laboratory) (1 cr.)

Plus one of the following: *3-4 cr.*

BCHM 22100 (Analytical Biochemistry) (3 cr.)
BCHM 56100 (General Biochemistry) (3 cr.)
CHM 22400 (Quantitative Analysis) (4 cr.)
CHM 32100 (Analytical Chemistry) (4 cr.)
CHM 37200 (Physical Chemistry) (4 cr.)
CHM 37300 (Physical Chemistry) (3 cr.)
CHM 53300 (Biochemistry) (3 cr.)

PHYS 22000 (General Physics) (4 cr.) **and** PHYS 22100 (General Physics) (4 cr.); **or** *8 cr.*

PHYS 17200 (Modern Mechanics) (4 cr.) **and** select one of the following:

a. PHYS 24100 (Electricity and Optics) (3 cr.); PHYS 25200 (Electricity and Optics Laboratory) (1 cr.), 8-9 cr.

b. PHYS 27200 (Electric and Magnetic Interactions) (4 cr.)

For specific chemistry sequences and additional requirements, see individual biology majors (www.purdue.edu/catalogs/science/biological_sciences.html)

For specific physics sequences and additional requirements, see individual biology majors (www.purdue.edu/catalogs/science/biological_sciences.html)

Mathematics Requirements* ***12-14 credits***

Select one of the following:

a. MA 23100 (Calculus for Life Sciences I) (3 cr.) and MA 23200 (Calculus for Life Sciences II) (3 cr.)

b. MA 16100 (Plane Analytic Geometry and Calculus I) (4 cr.) and MA 16200 (Plane Analytic Geometry and Calculus II) (5 cr.)

c. MA 16500 (Analytic Geometry and Calculus I) (4 cr.) and MA 16600 (Analytic Geometry and Calculus II) (4 cr.)

d. MA 17300 (Calculus and Analytic Geometry II) (5 cr.)

Biology majors must complete STAT 50300 (Statistical Methods for Biology) (3 cr.) for the statistics requirement.

For specific mathematics sequences and additional requirements, see individual biology majors.

** Some biology majors specify which option you may/must complete. See the descriptions of the majors for more information.*

Biological Sciences Majors

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.

Biology

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" (www.purdue.edu/catalogs/science/grad_requirements.html) 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 39500 (Macromolecules)* (3 cr.); *2-3 cr.*
BIOL 41500 (Introduction to Molecular Biology) (3 cr.)
BIOL 41600 (Viruses and Viral Disease) (3 cr.)
BIOL 42000 (Eukaryotic Cell Biology) (3 cr.)
BIOL 43600 (Introduction to Neurobiology) (3 cr.)
BIOL 43800 (General Microbiology)* (3 cr.)
BIOL 43900 (Laboratory in Microbiology)* (2 cr.)
BIOL 44400 (Human Genetics) (3 cr.)
BIOL 44600 (Cellular Microbiology) (3 cr.)
BIOL 47800 (Introduction to Bioinformatics) (3 cr.)
BIOL 48100 (Eukaryotic Genetics) (3 cr.)
BIOL 49500 (Biological and Structural Aspects of Drug Design and Action) (3 cr.);
BIOL 51100 (Introduction to X-Ray Crystallography) (3 cr.)
BIOL 51400 (Laboratory in Crystallography) (2 cr.)
BIOL 51600 (Molecular Biology of Cancer) (3 cr.)
BIOL 51700 (Molecular Biology: Proteins) (2 cr.)
BIOL 52900 (Bacterial Physiology) (3 cr.)
BIOL 53300 (Medical Microbiology) (3 cr.)
BIOL 53800 (Molecular, Cellular, and Developmental Neurobiology) (3 cr.)
BIOL 54100 (Molecular Genetics of Bacteria) (3 cr.)
BIOL 54900 (Microbial Ecology) (2 cr.)
BIOL 55000 (Plant Molecular Biology) (3 cr.)
BIOL 56200 (Neural Systems) (3 cr.)
BIOL 57300 (The Molecular Biology of Animal Cells) (3 cr.)
BIOL 59500 (Protein Bioinformatics) (2 cr.)
BIOL 59500 (Methods and Measurements in Physical Biochemistry) (3 cr.)
BIOL 59500 (Practical Biocomputing) (3 cr.)
BIOL 59500 (Practical Biocomputing) (3 cr.)

BCHM 56100 (General Biochemistry I)† (3 cr.); BCHM 56200 (General Biochemistry II) (3 cr.); or BCHM 57200 (Advanced Biochemical Techniques) (2-4 cr.) *2-4 cr.*

CHM 53300 (Introductory Biochemistry)† (3 cr.) *3 cr.*

Group B

Select from the following:

BIOL 30100 (Human Design: Anatomy and Physiology 1‡ (3 cr.); *3-4 cr.*
BIOL 30200 (Human Design: Anatomy and Physiology 2)‡ (3 cr.)
BIOL 32800 (Principles of Development)* (4 cr.)
BIOL 36600 (Principles of Physiology)* (4 cr.)
BIOL 43200 (Reproductive Physiology) (3 cr.)
BIOL 48300 (Environmental and Conservation Biology) (3 cr.)
BIOL 49300 (Introduction to Ethology) (3 cr.)
BIOL 53700 (Immunobiology) (3 cr.)
BIOL 55900 (Endocrinology) (3 cr.)
BIOL 58000 (Evolution) (3 cr.)
BIOL 58500 (Ecology) (3 cr.)
BIOL 58705 (Animal Communication) (3 cr.)
BIOL 59100 (Field Ecology) (4 cr.)
BIOL 59200 (The Evolution of Behavior) (3 cr.)
BIOL 59500 (Developmental Biology) (3 cr.)
BIOL 59700 (Sex and Evolution) (3 cr.)
BIOL 59900 (Quantitative Physiology) (3 cr.)
HORT 30100 (Plant Physiology) (4 cr.)

Laboratory Courses

Select from the following:

BIOL 43900 (Laboratory in General Microbiology) (2 cr.) *1-4 cr.*
BIOL 44201 (Introductory Module: Protein Expression)§ (2 cr.)
BIOL 44202 (Animal Physiology)§ (2 cr.)
BIOL 44203 (Bacterial Synthetic Biology Laboratory)§ (1 cr.)
BIOL 44204 (Animal Cell Culture)§ (1 cr.)
BIOL 44205 (Introduction to LabVIEW)§ (1 cr.)
BIOL 44207 (Exploration of Protein Structure)§ (1 cr.)
BIOL 44208 (DNA Sequencing Laboratory)§ (1 cr.)
BIOL 44209 (Exploring the Living Cell)§ (1 cr.)
BIOL 44210 (Introduction to DNA Sequences)§ (1 cr.)
BIOL 44211 (Laboratory in Anatomy and Physiology)§ (1 cr.)
BIOL 44212 (Microscopy and Cell Biology)§ (1 cr.)
BIOL 44214 (Microbial Pathogenesis)§ (1 cr.)
BIOL 54200 (Laboratory in Neurophysiology)§ (1 cr.)
BIOL 59100 (Field Ecology) (4 cr.)

BIOL 49400 (Biology Research) or BIOL 49900 (Biology Honors Thesis Research), taken during the junior or senior years 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.

If BIOL 43900 is used as part of the intermediate requirement, the laboratory portion of the 15-credit requirement is waived. Fifteen other credits of biology are still required.

** If this course is used for the intermediate requirement, it may not be used for the 15-credit requirement.*

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

‡ If both BIOL 30100 and 30200 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 30100 or 30200 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 44201 (Introduction to Protein Expression) and one additional 442XX or 54200 module. Advisors will have the complete list of available modules for any given semester.

Biochemistry

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 (www.purdue.edu/catalogs/science/general_chemistry.html) and the Department of Biochemistry in the College of Agriculture (https://ag.purdue.edu/biochem/Pages/default.aspx).

To complete the biochemistry major, the following courses must be selected when fulfilling the General Degree Requirements:

a. MA 16100 (Plane Analytic Geometry and Calculus I) (5 cr.) and MA 16200 (Plane Analytic Geometry and Calculus II) (5 cr.); or MA 16500 (Analytic Geometry and Calculus I) (4 cr.) and MA 16600 (Analytic Geometry and Calculus II) (4 cr.); or MA 17300 (Calculus and Analytic Geometry II) (5 cr.)	*5-10 cr.*
b. CHM 26505 (Organic Chemistry) (3 cr.) and CHM 26605 (Organic Chemistry) (3 cr.); and CHM 26300 (Organic Chemistry Laboratory) (1 cr.) and CHM 26400 (Organic Chemistry Laboratory) (1 cr.)	*8 cr.*

Biochemistry Major Requirements — 28-33 credits

Biochemistry majors must choose BIOL 39500 (Macromolecules) (3 cr.) to satisfy the intermediate-level requirement.

BCHM 22100 (Analytical Biochemistry) (3 cr.); or CHM 22400 (Introductory Quantitative Analysis) (4 cr.); or CHM 32100 (Analytical Chemistry I) (4 cr.)	*3-4 cr.*
One of the following: a. CHM 37200 (Physical Chemistry) (4 cr.) b. CHM 37300 (Physical Chemistry) (3 cr.) and CHM 37400 (Physical Chemistry) (3 cr.)	*4-6 cr.*
BCHM 56100 (General Biochemistry I) (3 cr.) and BCHM 56200 (General Biochemistry II) (3 cr.); BIOL 41500 (Introduction to Molecular Biology) (3 cr.); BIOL 42000 (Eukaryotic Cell Biology) (3 cr.); BIOL 44201 (Introduction to Protein Expression) (2 cr.) and BIOL 59500 (Methods and Measurements in Physical Biochemistry) (3 cr.)	*21 cr.*
Two of the following: BIOL 41600 (Molecular Virology) (3 cr.);	*5-6 cr.*

BIOL 43800 (General Microbiology) (3 cr.);
BIOL 47800 (Introduction to Bioinformatics) (3 cr.);
BIOL 48100 (Eukaryotic Genetics) (3 cr.);
BIOL 51100 (Introduction to X-Ray Crystallography) (3 cr.);
BIOL 51700 (Molecular Biology of Proteins) (2 cr.);
BIOL 52900 (Bacterial Physiology) (3 cr.); BIOL 53700 (Immunology) (3 cr.);
BIOL 53800 (Molecular, Cellular and Developmental Neurobiology) (3 cr.);
BIOL 54100 (Molecular Genetics of Bacteria) (3 cr.)

One of the following: *2-4 cr.*

a. Two additional 442XX or 54200 laboratory modules (various course titles) (2-3 cr.). See list of BIOL 442XX and 54200 modules (www.purdue.edu/catalogs/science/biology_major.html#labcourses)
b. BIOL 43900 (Microbiology Laboratory) (2 cr.)
c. Four credits of undergraduate research — BIOL 49400 (Biology Research) or BIOL 49900 (Biology Honors Thesis Research). Must be approved in advance by the Undergraduate Studies Committee (4 cr.).

Biochemistry Honors Curriculum

Additionally, students in the biochemistry honors curriculum must complete, as part of the General Degree Requirements, PHYS 17200 (Modern Mechanics) and PHYS 27200 (Electric and Magnetic Interaction) (4 cr.); or PHYS 24100 (Electricity and Optics) and PHYS 25200 (Electricity and Optics Laboratory).

Students must also complete one of the following:

a. CHM 32100 (Analytical Chemistry I) (4 cr.) (from "General Degree Requirements")
b. CHM 37300-37400 (Physical Chemistry) (6 cr.) (from "Biochemistry Major Requirements")

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

Biology Teaching

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: *2-3 cr.*

BIOL 39500 (Macromolecules) (3 cr.)
BIOL 41500 (Introduction to Molecular Biology) (3 cr.)
BIOL 41600 (Molecular Virology) (3 cr.)
BIOL 42000 (Eukaryotic Cell Biology) (3 cr.)
BIOL 43600 (Introduction to Neurobiology) (3 cr.)
BIOL 43800 (General Microbiology)* (3 cr.)
BIOL 43900 (Laboratory in Microbiology)* (2 cr.)
BIOL 44400 (Human Genetics)* (3 cr.)
BIOL 44600 (Cellular Microbiology) (3 cr.)
BIOL 47800 (Introduction to Bioinformatics) (3 cr.)
BIOL 48100 (Eukaryotic Genetics) (3 cr.)
BIOL 49500 (Biological and Structural Aspects of Drug Design and Action) (3 cr.)
BIOL 51100 (Introduction to X-Ray Crystallography) (3 cr.)
BIOL 51400 (Laboratory in Crystallography) (2 cr.)
BIOL 51500 (Molecular Genetics) (2 cr.)
BIOL 51600 (Molecular Biology of Cancer) (3 cr.)
BIOL 51700 (Molecular Biology: Proteins) (2 cr.)
BIOL 51900 (Molecular Biology: Nucleic Acids) (2 cr.)
BIOL 52900 (Bacterial Physiology) (3 cr.)
BIOL 53300 (Medical Microbiology) (3 cr.)
BIOL 53800 (Molecular, Cellular and Developmental Neurobiology) (3 cr.)
BIOL 54100 (Molecular Genetics of Bacteria) (3 cr.)
BIOL 54900 (Microbial Ecology) (2 cr.)
BIOL 55000 (Plant Molecular Biology) (3 cr.)
BIOL 56200 (Neural Systems) (3 cr.)
BIOL 57300 (The Molecular Biology of Animal Cells) (3 cr.)
BIOL 59500 (Protein Bioinformatics) (2 cr.)
BIOL 59500 (Methods and Measurements in Physical Biochemistry) (3 cr.)
BIOL 59500 (Practical Biocomputing) (3 cr.)

BCHM 56100 (General Biochemistry I) (3 cr.); BCHM 56200 (General Biochemistry II) (3 cr.); **or** BCHM 57200 (Advanced Biochemical Techniques) (2-4 cr.) *2-4 cr.*

CHM 53300 (Introductory Biochemistry) (3 cr.) *3 cr.*

Group B

Select from the following: *3-4 cr.*

BIOL 30100 (Human Design: Anatomy and Physiology I)† (3 cr.)
BIOL 30200 (Human Design: Anatomy and Physiology II)† (3 cr.)
BIOL 32800 (Principles of Physiology)* (4 cr.)
BIOL 36600 (Principles of Development)* (4 cr.)
BIOL 43200 (Reproductive Physiology) (3 cr.)
BIOL 48300 (Environmental and Conservation Biology) (3 cr.)
BIOL 49300 (Introduction to Ethology) (3 cr.)

BIOL 53700 (Immunobiology) (3 cr.)
BIOL 55900 (Endocrinology) (3 cr.)
BIOL 58000 (Evolution) (3 cr.)
BIOL 58500 (Ecology)* (3 cr.)
BIOL 58705 (Animal Communication) (3 cr.)
BIOL 59100 (Field Ecology) (4 cr.); BIOL 59200 (The Evolution of Behavior) (3 cr.)
BIOL 59500 (Developmental Biology) (3 cr.)
BIOL 59700 (Sex and Evolution) (3 cr.)
BIOL 59900 (Quantitative Physiology)* (3 cr.)

HORT 30100 (Plant Physiology)* (4 cr.) *4 cr.*

Laboratory Courses

Select from the following:

BIOL 43900 (Laboratory in General Microbiology) (2 cr.) *2-4 cr.*
BIOL 44201 (Introductory Module: Protein Expression)‡ (2 cr.)
BIOL 44202 (Animal Physiology)‡ (2 cr.)
BIOL 44203 (Bacterial Synthetic Biology Laboratory)‡ (1 cr.)
BIOL 44204 (Animal Cell Culture)‡ (1 cr.)
BIOL 44205 (Introduction to LabVIEW)‡ (1 cr.)
BIOL 44207 (Exploration of Protein Structure)‡ (1 cr.)
BIOL 44208 (DNA Sequencing Laboratory)‡ (1 cr.)
BIOL 44209 (Exploring the Living Cell)‡ (1 cr.)
BIOL 44210 (Introduction to DNA Sequences)‡ (1 cr.)
BIOL 44211 (Laboratory in Anatomy and Physiology)‡ (1 cr.)
BIOL 44212 (Microscopy and Cell Biology)‡ (1 cr.)
BIOL 44214 (Microbial Pathogenesis)‡ (1 cr.)
BIOL 54200 (Laboratory in Neurophysiology)‡ (1 cr.)
BIOL 59100 (Field Ecology) (4 cr.)

BIOL 49400 (Biology Research) **or** BIOL 49900 (Biology Honors Thesis Research) (maximum 2 cr.), taken during the junior or senior years 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. *2 cr.*

Professional Education Courses — 33 credits

The following education courses are required for certification to teach in Indiana schools. In addition, EDPS 23500 can be used in partial fulfillment of the College of Science general education requirement. *33 cr.*

EDCI 20500 (Exploring Teaching as a Career) (3 cr.)
EDCI 27000 (Introduction to Educational Technology and Computing) (3 cr.)
EDCI 28500 (Multiculturalism and Education) (3 cr.)
EDPS 23500 (Learning and Motivation) (3 cr.)
EDPS 26500 (The Inclusive Classroom) (3 cr.)
EDST 20000 (History and Philosophy of Education) (3 cr.)
EDCI 42100 (The Teaching of Biology in Secondary Schools) (3 cr.)
EDCI 42800 (Teaching Science in the Middle and Junior High School) (2 cr.)
EDCI 49800 (Supervised Teaching) (10 cr.)

** This course is recommended for teaching majors.*

† If both BIOL 30100 and 30200 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 30100 or 30200 is completed, the credits will count only as free-elective credits.

‡ Students who choose to meet the laboratory requirement for the biology education major with modular upper-division laboratory courses must take BIOL 44201 (Introduction to Protein Expression) and one additional 442XX or 54200 module. Advisors will have the complete list of available modules for any given semester.

Cell, Molecular and Developmental Biology

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 Cell, Molecular and Developmental (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***
Cell, Molecular and Developmental majors must choose BIOL 36600 (Principles of Development) (3 cr.) to satisfy the intermediate-level requirement. Two courses from the following: BIOL 41500 (Introduction to Molecular Biology) (3 cr.) BIOL 42000 (Eukaryotic Cell Biology) (3 cr.); BIOL 48100 (Eukaryotic Genetics) (3 cr.)	*6 cr.*
BIOL 44201 (Introductory to Protein Expression) Two other BIOL 442XX or BIOL 54200 lab courses. See course listings in "Biochemistry."	*4-5 cr.*
BCHM 56100 (General Biochemistry I) (3 cr.) or CHM 53300 (Introductory Biochemistry) (3 cr.)	*3 cr.*
Select one of the following: BIOL 51600 (Molecular Biology of Cancer) (3 cr.) BIOL 55000 (Plant Molecular Biology) (3 cr.) BIOL 57300 (Molecular Biology of Animal Cells) (3 cr.) BIOL 59500 (Developmental Biology) BIOL 59500 (Cellular Biology of Plants) (3 cr.)	*3 cr.*
Electives	***6 credits***
Select six credits from: 1. Any advanced biology elective (40000- or 50000-level) with the exception of BIOL 49700 (Biology Honors Seminar), BIOL 49800 (Biology Teaching), or one-credit electives in biology. BIOL 49500 or 59500 (Special Assignments in Biology) requires the approval of the Cell, Molecular and Developmental Biology Area Committee. 2. BCHM 56200 (General Biochemistry II) (3 cr.)	

Ecology, Evolution and Environmental Biology

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 (www.purdue.edu/catalogs/science/interdisciplinary.html) and the College of Agriculture (https://ag.purdue.edu/Pages/default.aspx).

Ecology, Evolution and Environmental Biology Major Requirement — 17-20 credits

Ecology, Evolution and Environmental Biology Major Courses	***10-13 credits***
BIOL 58000 (Evolution) (3 cr.) BIOL 58500 (Ecology) (3 cr.)	*6 cr.*
BIOL 59100 (Field Ecology)*† (3 cr.) or BIOL 59200 (Evolution of Behavior)† (3 cr.); or BIOL 58705 (Animal Communication)† (3 cr.); or BIOL 59500 (Ecological Statistics)† (3 cr.); or BIOL 59500 (Sensory Ecology)† (3 cr.); or BIOL 59700 (Sex and Evolution)† (3 cr.)	*3-4 cr.*
One of the following: a. BIOL 49400 (Biology Research) (1-4 cr.) b. BIOL 49900 (Biology Honors Thesis Research) (1-4 cr.) c. BIOL 59100 (Field Ecology)* (4 cr.)	*1-4 cr.*
Electives	***7 credits***

Select from the following:

BIOL 41500 (Introduction to Molecular Biology) (3 cr.)
BIOL 43800 (General Microbiology) (3 cr.)
BIOL 43900 (Laboratory in Microbiology) (2 cr.)
BIOL 44400 (Human Genetics) (3 cr.)
BIOL 47800 (Introduction to Bioinformatics) (3 cr.)
BIOL 48100 (Eukaryotic Genetics) (3 cr.)
BIOL 48300 (Environmental and Conservation Biology) (3 cr.)
BIOL 49300 (Introduction to Ethology) (3 cr.)
BIOL 54100 (Genetic Biology) (3 cr.)
BIOL 54900 (Microbial Ecology) (2 cr.); BIOL 56200 (Neural Systems) (3 cr.)
BIOL 58705 (Animal Communication)† (3 cr.)
BIOL 59100 (Field Ecology)† (4 cr.)
BIOL 59200 (The Evolution of Behavior)† (3 cr.)
BIOL 59500 (Ecological Statistics)† (3 cr.); or BIOL 59500 (Sensory Ecology)† (3 cr.)
BIOL 59700 (Sex and Evolution)† (3 cr.)
ANSC 51100 (Population Genetics) (3 cr.)
ANTH 53500 (Foundations of Biological Anthropology) (3 cr.)
ANTH 53600 (Primate Ecology) (3 cr.)
BCHM 56100 (General Biochemistry I) (3 cr.)
BCHM 56200 (General Biochemistry II) (3 cr.)
BTNY 55500 (Aquatic Botany) (3 cr.)
EAS 57200 (Paleoecology) (3 cr.)
ENTM 50000 (Fundamentals of Entomology) (4 cr.)
FNR 50100 (Limnology) (3 cr.)
FNR 58100 (Ecological Impact Analysis) (3 cr.)

**BIOL 59100 can satisfy both of these requirements.*

† This course cannot be used to satisfy both of these requirements.

Genetics

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.

Genetics Major Requirements — 19-21 credits

Genetics Courses	***13-15 credits***
Genetics majors must choose BIOL 32800 (Principles of Physiology) (4 cr.); or BIOL 36600 (Principles of Development) (4 cr.); or BIOL 39500 (Macromolecules) (3 cr.) to satisfy the intermediate level requirement. BCHM 56100 (General Biochemistry I) or CHM 53300 (Introductory Biochemistry) (3 cr.); BIOL 41600 (Molecular Virology) (3 cr.); BIOL 44100 (Senior Seminar in Genetics) (1 cr.); BIOL 48100 (Eukaryotic Genetics) (3 cr.)	*10 cr.*
One of the following: a. BIOL 44201 (Introductory to Protein Expression) (2 cr.) and two other BIOL442XX or BIOL 54200 lab courses. See the complete list of course titles (www.purdue.edu/catalogs/science/biochemistry.html); (2-3 cr.) b. Three credits of BIOL 49400 (Biology Research), or BIOL 49900 (Biology Honors Thesis Research). Must be approved in advance by Undergraduate Studies Committee. (3 cr.)	*3-5 credits*

Electives	***6 credits***

Select from the following:

BIOL 43800 (General Microbiology) (3 cr.)
BIOL 44400 (Human Genetics) (3 cr.)
BIOL 47800 (Introduction to Bioinformatics) (3 cr.)
BIOL 51600 (Molecular Biology of Cancer) (3 cr.)
BIOL 54100 (Molecular Genetics of Bacteria) (3 cr.);
BIOL 55000 (Plant Molecular Biology) (3 cr.)
BIOL 57300 (The Molecular Biology of Animal Cells) (3 cr.)
BIOL 58000 (Evolution) (3 cr.)
AGRY 53000 (Plant Genetics) (3 cr.)
ANSC 51100 (Population Genetics) (3 cr.)
BCHM 56200 (General Biochemistry II) (3 cr.)

Health and Disease

Health and disease is a biology program of study with an emphasis on disease-related upper-level biology courses and general education electives that relate to health. The major provides a rigorous curriculum for students interested in health careers, thus giving the student many options after graduation.

Health and Disease Major Requirements — 19 credits

Health and Disease Courses ***9 credits***

Health and disease majors must choose BIOL 43800 (General Microbiology) (3 cr.) and BIOL 43900 (Laboratory in General Microbiology) to satisfy the intermediate-level requirement.
BIOL 30100 (Human Anatomy and Physiology) (3 cr.)
BIOL 30200 (Human Anatomy and Physiology) (3 cr.)
BIOL 41600 (Viruses and Viral Disease) (3 cr.)

Electives *9 cr.*

Select from the following: .

BCHM 56200 (General Biochemistry II) (3 cr.)
BCHM 57200 (Advanced Biochemical Techniques) (2-4 cr.)
BIOL 32800 (Principles of Physiology) (4 cr.)
BIOL 36600 (Principles of Development) (4 cr.)
BIOL 39500 (Macromolecules) (3 cr.)
BIOL 41500 (Introduction to Molecular Biology) (3 cr.)
BIOL 42000 (Eukaryotic Cell Biology) (3 cr.)
BIOL 43600 (Neurobiology) (3 cr.)
BIOL 442XX (Modular Laboratory Courses) (various titles) (1-2 cr.)
BIOL 44201 (Introductory Module: Protein Expression) (2 cr.)
BIOL 44400 (Human Genetics) (3 cr.)
BIOL 44600 (Cellular Microbiology) (3 cr.)
BIOL 47800 (Introduction to Bioinformatics) (3 cr.)
BIOL 48100 (Eukaryotic Genetics) (3 cr.)
BIOL 49500 (Biological and Structural Aspects of Drug Design and Action) (3 cr.)
BIOL 48300 (Environmental and Conservation Biology) (3 cr.)
BIOL 49300 (Introduction to Ethology) (3 cr.)
BIOL 51100 (Introduction to X-Ray Crystallography) (3 cr.)
BIOL 51600 (Molecular Biology of Cancer) (3 cr.)
BIOL 51700 (Molecular Biology: Proteins) (2 cr.)
BIOL 52900 (Bacterial Physiology) (3 cr.)
BIOL 53300 (Medical Microbiology) (3 cr.)
BIOL 53700 (Immunology) (3 cr.)
BIOL 53800 (Molecular, Cellular and Developmental Neurobiology) (3 cr.)
BIOL 54100 (Molecular Genetics of Bacteria (3 cr.)
BIOL 54200 (Neurophysiology Laboratory) (1 cr.)
BIOL 54900 (Microbial Ecology) (2 cr.)
BIOL 55000 (Plant Molecular Biology) (3 cr.)
BIOL 55900 (Endocrinology) (3 cr.)
BIOL 56200 (Neural Systems) (3 cr.)
BIOL 57300 (Molecular Biology of Animal Cells) (3 cr.)
BIOL 58000 (Evolution) (3 cr.)
BIOL 58500 (Ecology) (3 cr.)
BIOL 58705 (Animal Communication) (3 cr.)
BIOL 59100 (Field Ecology) (4 cr.)
BIOL 59200 (Evolution of Behavior) (3 cr.)
BIOL 59500 (Cellular Biology of Plants) (3 cr.)
BIOL 59500 (Developmental Biology) (3 cr.)
BIOL 59500 (Ecological Statistics) (3 cr.)
BIOL 59500 (Methods and Measurement in Physical Biochemistry) (3 cr.)
BIOL 59500 (Practical Biocomputing) (3 cr.)
BIOL 59500 (Protein Bioinfor-matics) (2 cr.)
BIOL 59500 (Sensory Ecology) (3 cr.)

BIOL 59700 (Sex and Evolution) (3 cr.)
BIOL 59900 (Quantitative Physiology) (3 cr.)
BCHM 56100 (General Biochemistry I) (3 cr.)
CHM 53300 (Introductory Bio-chemistry) (3 cr.)
HORT 30100 (Plant Physiology) (4 cr.)

Microbiology

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 — 21 credits

Microbiology Courses ***18 credits***

BIOL 41600 (Molecular Virology) (3 cr.) *18 cr.*
BIOL 43800 (General Microbiology) (3 cr.)
BIOL 43900 (Laboratory in Microbiology) (2 cr.)
BIOL 52900 (Bacterial Physiology) (3 cr.)
BCHM 56100 (General Biochemistry I) (3 cr.)
BIOL 44100 (Senior Seminar in Genetics) (1 cr.)
BIOL 54100 (Molecular Genetics of Bacteria) (3 cr.)

Electives ***3 credits***

Select from the following:

BIOL 44600 (Molecular Bacterial Pathogen) (3 cr.)
BIOL 47800 (Introduction to Bioinformatics) (3 cr.)
BIOL442XX or 54200 (Modular Upper-Division Laboratory Courses) (2 cr.); see "Biology Major" for complete list of titles (1-2 cr.)
BIOL 53300 (Medical Microbiology) (3 cr.)
BIOL 54900 (Microbial Ecology) (2 cr.)
BCHM 56200 (General Biochemistry II)

Microbiology Honors Curriculum

Microbiology Honors Course Requirements ***16-23 credits***

To complete the microbiology honors curriculum, the following courses must be selected: *12-19 cr.*

- MA 26100 (Multivariate Calculus) (4 cr.); or MA 17400 (Multivariable Calculus) (4 cr.); or MA 27100 (Several Variable Calculus) (5 cr.)
- CHM 26505-26605 (Organic Chemistry) (6 cr.) and CHM 26300-26400 (Organic Chemistry Laboratory) (2 cr.)

Students in the microbiology honors curriculum must complete three of these courses/course sequences:

a. CHM 32100 (Analytical Chemistry I) (4 cr.);
b. MA 26200 (Linear Algebra and Differential Equations) (4 cr.)
c. PHYS 17200 (Modern Mechanics) (4 cr.), PHYS 27200 (Electric and Magnetic Interactions) (4 cr.), or PHYS 24100 (Electricity and Optics) (3 cr.); PHYS 25200 (Electricity and Optics Laboratory) (1 cr.)
d. CHM 37200 (Physical Chemistry) (4 cr.) or both CHM 37300 and 37400 (Physical Chemistry) (3 cr.)

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

Neurobiology and Physiology

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 Requirements — 18-22 credits

Neurobiology and Physiology Courses ***12-16 credits***

Neurobiology and Physiology majors must choose BIOL 32800 (Principles of Physiology) (4 cr.) to satisfy the intermediate-level requirement. *6 cr.*

Two of the following courses:

- BIOL 43200 (Reproductive Physiology) (3 cr.)
- BIOL 43600 (Neurobiology) (3 cr.)
- BIOL 53800 (Cellular, Molecular, and Development Biology) (3 cr.)
- BIOL 55900 (Endocrinology) (3 cr.)
- BIOL 56200 (Neural Systems) (3 cr.)
- BIOL 59900 (Quantitative Physiology) (3 cr.)

Choose at least one of the following: *3-5 cr.*

a. BIOL 44202 (Animal Physiology Laboratory) (2 cr.), or BIOL 54200 (Laboratory in Neurophysiology) (1 cr.) plus any other two 442XX or 54200 laboratories. See “Biology Major” for the complete list of course titles.
b. Three credits of BIOL 49400 (Biology Research) or BIOL 49900 (Biology Honors Thesis Research). Must be approved in advance by the Undergraduate Studies Committee. (3 cr.)

One of the following: *3-4 cr.*

- BCHM 56100 (General Biochemistry I) (3 cr.)

CHM 37200 (Physical Chemistry) (4 cr.)
CHM 37300 (Physical Chemistry) (3 cr.); or
CHM 53300 (Introductory Biochemistry) (3 cr.)

Electives ***6 credits***

Select 6 credits from the following four options:

a. BIOL 30100 (Human Design: Anatomy and Physiology I) (3 cr.) and BIOL 30200 (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 (40000- or 50000-level) with the exception of BIOL 49700 (Biology Honors Seminar), BIOL 49800 (Biology Teaching) or one-credit electives in biology. BIOL 49500 or 59500 (Special Assignments in Biology) requires the approval of the Neurobiology and Physiology Area Committee.
c. Three (but no fewer) credits of advanced research (BIOL 49400 or 49900) can count toward the six-credit requirement, provided the research is not also used as a substitute for a modular laboratory course. Approval of Undergraduate Studies Committee is required.
d. BCHM 56200 (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
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 49700 (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 they 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 29400 or 49400, 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 19500, 29500, 39500 and 49500. The special study can be directed readings; independent study; supervised library, laboratory or fieldwork; 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. The Biology Counseling Office collects information about available summer internships.

Professional Practice Program

The Department of Biological Sciences participates in the Professional Practice Program (www.purdue.edu/catalogs/science/special_programs.html#h5). Interested students should contact the Coordinator of the Professional Practice Program, 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 Professional Practice 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 Professional Practice student employee, a student must register for the noncredit departmental course BIOL 39699 (Professional Practice Internship) and pay the special University fee for Professional Practice registration.

Under specified circumstances, students who want to participate in some form of independent study while off campus can register for Special Assignments: BIOL 39500 or 49500 (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 — 17-20 credits

All courses for the biology minor must be completed at Purdue University and at least one-half the courses for the minor must be completed on the West Lafayette campus.

The minor in biological sciences requires the following courses: *7-8 cr.*

I. One of these two sequences: *7 cr.*

a. BIOL 12100 (Diversity, Ecology and Behavior) (2 cr.); BIOL 13100 (Development, Structure and Function of Organisms) (3 cr.); BIOL 13500 (First-Year Biology Lab) (2 cr.)

b. BIOL 11000 (Fundamentals of Biology I) (4 cr.); and BIOL 11100 (Fundamentals of Biology II) (4 cr.)

II. And the following courses: *3 cr.*

BIOL 23100 (Cell Structure and Function) (3 cr.) or BIOL 23000 (Biology of the Living Cell) (3 cr.);

BIOL 24100 (Genetics and Molecular Biology) (3 cr.) or AGRY 320 (Genetics) (3 cr.)

III. One of the following courses: *2-4 cr.*

BIOL 28600 (Introduction to Ecology and Evolution) (2 cr.)
BIOL 30100 (Human Anatomy and Physiology)* (3 cr.)
BIOL 30200 (Human Anatomy and Physiology)* (3 cr.)
BIOL 39500 (Principle of Physiology)† (4 cr.)
BIOL 39500 (Principles of Development)† (4 cr.)
BIOL 39500 (Macromolecules)† (4 cr.)
BIOL 41500 (Introduction to Molecular Biology) (3 cr.)
BIOL 41600 (Molecular Virology) (3 cr.)
BIOL 42000 (Eukaryotic Cell Biology) (3 cr.)
BIOL 43200 (Reproductive Physiology) (3 cr.)
BIOL 43600 (Introduction to Neurobiology) (3 cr.)
BIOL 43800 (General Microbiology) (3 cr.)
BIOL 43900 (Microbiology Lab) (2 cr.)
BIOL 44400 (Human Genetics) (3 cr.)
BIOL 44600 (Cellular Microbiology) (3 cr.)
BIOL 47800 (Introduction to Bioinformatics) (3 cr.)
BIOL 48100 (Eukaryotic Genetics) (3 cr.)
BIOL 48300 (Environmental and Conservation Biology) (3 cr.)
BIOL 49300 (Introduction to Ethology) (3 cr.)
BIOL 51100 (Introduction to X-Ray Crystallography) (3 cr.);
BIOL 51400 (Laboratory in Crystallography) (2 cr.); fall;
BIOL 51600 (Molecular Biology of Cancer) (3 cr.);
BIOL 51700 (Molecular Biology: Proteins) (2 cr.);
BIOL 53700 (Immunology) (3 cr.);
BIOL 53800 (Molecular, Cellular, and Developmental Neurobiology) (3 cr.);
BIOL 55900 (Endocrinology) (3 cr.);
BIOL 56200 (Neural Systems) (3 cr.);
BIOL 57300 (Molecular Biology of Animal Cells) (3 cr.);
BIOL 58000 (Evolution) (3 cr.);
BIOL 58705 (Animal Communication) (3 cr.);
BIOL 59200 (Evolution of Behavior) (3 cr.);
BIOL 59500 (Developmental Biology) (3 cr.);
BIOL 59500 (Methods and Measurement in Physical Biochemistry) (3 cr.);
BIOL 59500 (Protein Bioinformatics) (3 cr.);
BIOL 59700 (Sex and Evolution) (3 cr.)

IV. One of the following laboratory courses: *2-4 cr.*

BIOL 23200 (Laboratory in Cell Structure and Function) (2 cr.)
BIOL 24200 (Laboratory in Genetics and Molecular Biology) (2 cr.)
BIOL 30100 (Human Anatomy and Physiology)* (3 cr.)
BIOL 30200 (Human Anatomy and Physiology)* (3 cr.)
BIOL 36600 (Developmental Biology)† (4 cr.)
BIOL 32800 (Principles of Physiology)† (4 cr.)
BIOL 39500 (Macromolecules)† (3 cr.)
AGRY 32100 (Genetics Laboratory) (3 cr.)

The following courses are prerequisite or corequisite for some of the above courses: CHM 11500 (General Chemistry) (4 cr.) and CHM 11600 (General Chemistry) (4 cr.)

** If both BIOL 30100 and 30200 are completed, they will meet the requirements for Parts III and IV of the minor. BIOL 30100 or 30200 alone will not meet any requirement for the minor.*

† Any one of BIOL 32800 (Principles of Physiology) or BIOL 36600 (Developmental Biology) or BIOL 39500 (Macromolecules) alone will meet the requirements for Parts III and IV of the minor.

Chemistry

The Department of Chemistry offers three baccalaureate programs:

A. Bachelor of Science in Chemistry, which is certified by the American Chemical Society (ACS). *124 credits*

B. Bachelor of Science degree, including specializations like bioinformatics. *124 credits*

C. Bachelor of Science degree and teacher licensure for chemistry education majors. *128 credits*

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

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

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

General Degree 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 (www.purdue.edu/catalogs/science/grad_requirements.html), also online at www.science.purdue.edu.

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

Chemistry Core ***39-41 credits***

CHM 12500 (Introduction to Chemistry I) (5 cr.); or CHM 11500 (General Chemistry) (4 cr.) *4-5 cr.*

CHM 12600 (Introduction to Chemistry II) (5 cr.); or CHM 11600 (General Chemistry) (4 cr.); or CHM 13600 (General Chemistry Honors) *4-5 cr.*

CHM 24100 (Introductory Inorganic Chemistry) (4 cr.) *31 cr.*

CHM 34200 (Inorganic Chemistry) (3 cr.)
CHM 26505 (Organic Chemistry) (3 cr.)
CHM 26500 (Organic Chemistry Laboratory) (2 cr.)
CHM 29400 (Sophomore Chemistry Seminar) (1 cr.)
CHM 26605 (Organic Chemistry) (3 cr.)
CHM 26600 (Organic Chemistry Laboratory) (2 cr.)
CHM 32100 (Analytical Chemistry) (4 cr.)
CHM 37300 (Physical Chemistry) (3 cr.)
CHM 37400 (Physical Chemistry) (3 cr.)
CHM 37600 (Physical Chemistry Laboratory) (2 cr.)
CHM 49400 (Junior- Senior Chemistry Seminar) (1 cr.)

Science Requirements ***14-15 credits***

Physics:
PHYS 17200 (Modern Mechanics) (4 cr.);
PHYS 27200 (Electric and Magnetic Interactions) (4 cr.) **or** PHYS 24100 (Electricity and Optics) (3 cr.) and PHYS 25200 (Electricity and Optics Laboratory) (1 cr.)

Statistics:
One of: STAT 30100 (Elementary Statistical Methods) (3 cr.); STAT 35000 (Introduction to Statistics) (3 cr.); STAT 50300 (Statistical Methods for Biology) (3 cr.); STAT 51100 (Statistical Methods) (3 cr.); CHE 32000 (Statistical Modeling and Quality Enhancement) (3 cr.)

Computer Science:
One of: CS 15800 (C Programming) (3 cr.); CS 17700 (Programming with Multimedia Objects) (4 cr.); CS 18000 (Programming I) (4 cr.)

Mathematics Requirements ***12-15 credits***

MA 16100 (Plane Analytic Geometry and Calculus I) (5 cr.); or MA 16500 (Analytic Geometry and Calculus I) (4 cr.) *4-5 cr.*

One of: MA 16200 (Plane Analytic Geometry and Calculus II) (5 cr.); MA 16600 (Analytic Geometry and Calculus II) (4 cr.); MA 17300 (Calculus and Analytic Geometry II) (5 cr.); MA 18100 (Honors Calculus I) (5 cr.) *4-5 cr.*

One of: MA 26100 (Multivariate Calculus) (4 cr.); MA 17400 (Multivariable Calculus) (4 cr.); MA 18200 (Honors Calculus II) (5 cr.); MA 27100 (Several Variable Calculus) (5 cr.) *4-5 cr.*

Additional Requirements ***24-28 credits***

English Composition:
ENGL 10600 (First-Year Composition) (4 cr.); or ENGL 10800 (Accelerated First-Year Composition) (3 cr.)

Technical Writing and Technical Presentation:
COM 21700 (Science Writing and Presentation). For additional options, see description and list of approved courses at www.science.purdue.edu, College of Science Core Requirements.

Multidisciplinary Experience:
See description and list of approved courses at www.science.purdue.edu, College of Science Core Requirements.

Language and Culture:
All College of Science majors are expected to have proficiency in another language in addition to their native language. Competence in the second language must be demonstrated to the third semester, or to the second semester (with an additional culture or diversity class. See description and list of approved courses at www.science.purdue.edu, College of Science Core Requirements.

General Education:
Students must complete 3 credits of a course approved for Great Issues and 9 credits of Social Studies/Humanities and/or Management. See description and list of approved

courses at www.science.purdue.edu, College of Science Core Requirements.

Teambuilding and Collaboration:

Science students must learn the concepts involved in science team projects. Chemistry students can fulfill the principles portions with CHM 19400 or SCI 21000 (1 cr.). See description and list of approved courses at www.science.purdue.edu, College of Science Core Requirements.

Free Electives ***25-37 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, pursue a minor or 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 24100 (Introductory Organic Chemistry), CHM 26505 (Organic Chemistry), and CHM 26500 (Organic Chemistry Laboratory) or CHM 26700 (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

Chemistry is a rapidly changing science. The strong commitment to research excellence at Purdue results in faculty who are at the leading edge of this change and who can constantly revise courses to incorporate the latest advances in our understanding of chemistry.

Graduates of Purdue's undergraduate chemistry program have successfully pursued careers in higher education, medicine, drug discovery, teaching, forensics, consumer products, management, marketing, patent law, sales and venture capital.

Believing that research is integral to the education of chemists, we encourage student involvement in research. Many join research groups.

The chemistry undergraduate research program details are available at the CHM 49900 Web page (www.chem.purdue.edu/courses/chm49900/0. Working closely with faculty, graduate students and post-doctoral fellows, undergraduate students majoring in chemistry at Purdue are exposed to what chemistry is and begin to appreciate how new chemical knowledge is obtained.

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":	
CHM 34201 (Inorganic Chemistry Laboratory) (1 cr.); CHM 42400 (Analytical Chemistry II) (4 cr.); CHM 51300 (Chemical Literature) (1 cr.); Advanced chemistry elective (3 cr.); and CHM 53300 (Introductory Biochemistry) (3 cr.)	*12 cr.*
MA 26200 (Linear Algebra and Differential Equations) (4 cr.)	*4 cr.*

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 (www.purdue.edu/catalogs/science/biochemistry.html).

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":	
BIOL 23100 (Biology III: Cell Structure and Function) and BIOL 23200 (Laboratory in Biology III: Cell Structure and Function) (5 cr.); BIOL 24100 (Biology IV: Genetics and Molecular Biology) and BIOL 24200 (Laboratory in Biology IV: Genetics and Molecular Biology) (5 cr.)	*10 cr.*
CHM 53300 (Introductory Biochemistry) (3 cr.) and CHM 53800 (Molecular Biotechnology) (3 cr.); **or** BCHM 56100 (General Biochemistry I) (3 cr.) and BCHM 56200 (General Biochemistry II) (3 cr.)	*6 cr.*
CHM 49900 (Undergraduate Research in Biochemistry)	*6 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 "General Degree Requirements" 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, chemical literature, chemical physics, computer applications in chemistry, cosmochemistry, geochemistry, patent law, preprofessional and material science. Minors are encouraged.

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

Bioinformatics

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

Bioinformatics Requirements **11 credits**

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

CHM 53300 (Introductory Biochemistry) (3 cr.);
CHM 49900 (Undergraduate Research in Bioinformatics) (3 cr.);
BIOL 47800 (Introduction to Bioinformatics) (3 cr.);
MA 26200 (Linear Algebra and Differential Equations) (4 cr.);
STAT 5810 (Bioinformatics) (1 cr.).

Recommended — BIOL 23100 (Biology III: Cell Structure and Function) (3 cr.) or
BIOL 23000 (Biology of the Living Cell) (3 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 (www.purdue.edu/catalogs/science/sci_degree_chemistry.html). 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 and Licensure at Purdue, www.teach.purdue.edu. In teacher preparation, Purdue University has been accredited by the National Council for Accreditation of Teacher Education, the North Central Association of Secondary Schools and Colleges, and the Indiana Professional Standards Board. Students completing the chemistry education major will be licensed to teach chemistry in Indiana.

The program of study for prospective teachers differs from the program leading to the B.S. degree with a chemistry major. CHM 26300 and 26400 (which have one less credit, respectively) can be substituted for Organic Chemistry Laboratory. However, all chemistry education students are encouraged to take CHM 26500 and 26600 to meet the regular chemistry major requirements in case they switch to a non-teaching option.

The following 35 credit hours of education courses are required for certification to teach in Indiana high schools. One of the courses, EDCI 42800, is taken during the first six weeks of the professional semester, before student teaching.

Bachelor of Science Degree with Chemistry Teaching Major Additional **35 credits**

Requirements

Professional Education

CHM 33300 (Principles of Biochemistry) (3 cr.) or CHM 53300 (Introduction to Biochemistry) (3 cr.)	*3 cr.*
EDCI 27000 (Introduction to Educational Technology and Computing) (2 cr.) and EDST 20000 (History and Philosophy of Education) (3 cr.)	*5 cr.*
EDCI 20500 (Exploring Teaching as a Career) (3 cr.) and EDCI 28500 (Multiculturalism and Education) (3 cr.)	*6 cr.*
EDPS 23500 (Learning and Motivation) (3 cr.) and EDPS 26500 (The Inclusive Classroom) (3 cr.)	*6 cr.*
EDCI 42400 (The Teaching of Earth/Physical Science in Secondary Schools) (3 cr.); EDCI 42800 (Teaching Science in the Middle and Junior High School) (2 cr.); and EDCI 49800 (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 an opportunity for students that leads 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	***30-35 credits***
For admission to this degree program, students must first be admitted to First-Year Engineering.	
Chemistry: CHM 12500 (Introduction to Chemistry I) (5 cr.); CHM 11500 (General Chemistry) (4 cr.); or CHM 12300 (General Chemistry for Engineers I) (4 cr.); and either CHM 12600 (Introduction to Chemistry II) (5 cr.); CHM 11600 (General Chemistry (4 cr.); or CHM 12400 (General Chemistry for Engineers II) (4 cr.)	*8-10 cr.*
Mathematics: MA 16100 (Plane Analytic Geometry and Calculus I) (5 cr.) and MA 16200 (Plane Analytic Geometry and Calculus II) (5 cr.); or MA 16500 (Analytic Geometry and Calculus I) (4 cr.) and MA 16600 (Analytic Geometry and Calculus II) (4 cr.)	*8-10 cr.*
Physics: PHYS 17200 (Modern Mechanics) (4 cr.)	*4 cr.*
Engineering: ENGR 13100 (Transforming Ideas to Innovation I) (2 cr.) and ENGR 13200 (Transforming Ideas to Innovation II) (1 cr.)	*4 cr.*
Communications: COM 11400 (Fundamentals of Speech Communication) (3 cr.) or COM 21700 (Science Writing and Presentation) (3 cr.)	*3 cr.*
English composition: ENGL 10600 (First-Year Composition) (4 cr.) or ENGL 10800 (Accelerated First-Year Composition) (3 cr.)	*3-4 cr.*
Additional Requirements	***42 credits***
In addition to the requirements for the ACS B.S. in Chemistry degree (www.purdue.edu/catalogs/science/sci_chemistry.html) and First-Year Engineering described above, the following courses are required:	
CHE 20500 (Chemical Engineering Calculations) (3 cr.); CHE 21100 (Introductory Chemical Engineering Thermodynamics) (3 cr.); CHE 30600 (Design of Staged Separation Processes) (3	*42 cr.*

cr.); CHE 32000 (Statistical Modeling and Quality Enhancement) (3 cr.); CHE 34800 (Chemical Reaction Engineering) (3 cr.); CHE 37700 (Momentum Transfer) (3 cr.); MA 30300 (Differential Equations and Partial Differential Equations for Engineering and the Sciences) (3 cr.); CHE 37800 (Heat and Mass Transfer) (3 cr.); CHE 43500 (Chemical Engineering Laboratory) (4 cr.); CHE 45000 (Design and Analysis of Processing Systems) (4 cr.); CHE 45600 (Process Dynamics and Control) (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 32100 (Analytical Chemistry I) and CHM 42400 (Analytical Chemistry II), two engineering electives; and CHM 34200 (Inorganic Chemistry), and one technical elective.

In the chemistry plan, CHE 21100 (Introductory Chemical Engineering Thermodynamics) can replace CHM 37300 (Physical Chemistry) and CHE 45600 (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 on the College of Engineering website, www.engineering.purdue.edu.

Programs and Opportunities

Preprofessional Preparation

Medical schools recognize the importance of chemistry in medicine, because this science is fundamental to the study of all life processes and is the basis of the pharmaceutical industry. Specifically, the department provides leading-edge courses in both organic chemistry and biochemistry. Organic chemistry facilitates the understanding of the structural features in therapeutic agents used for curing or preventing human disease. Biochemistry provides the fundamental knowledge needed to understand cellular processes and the molecular bases of genetic and metabolic disorders. Several members of the chemistry faculty are carrying out research at the interface between chemistry and medicine, with many of these laboratories available to undergraduates who wish to have research experience. Chemistry majors have full access to the College of Science health sciences advisor, and those interested in medical school are encouraged to consult with that office as early as their freshman year.

Virtually any plan of study within the chemistry department can be easily modified to assure that all the requirements for admission to a medical school are satisfied. Typically, this requires only the inclusion of one year of biology in the plans of study. The B.S. in Biochemistry/Chemistry program is a departmental option that is accredited by the American Chemical Society and automatically includes biology within its curriculum.

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 49900) is to be a minimum of six credits. In addition, the student must write an honors thesis based on the CHM 49900 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 49900, the honors courses listed below replace the corresponding courses in the degree requirements:

Chemistry: CHM 26700 (Organic Chemistry Laboratory [Honors]) (2 cr.); CHM 26800 (Organic Chemistry Laboratory) (2 cr.); and CHM 32300 (Analytical Chemistry I [Honors]) (4 cr.)

Undergraduate Research: CHM 49900 (Special Assignments) (6 cr. minimum)

Professional Practice Program

The Department of Chemistry participates in the Professional Practice Program. 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 2.8. Information is available from the coordinator of the Professional Practice Program in the Department of Chemistry. Check with your advisor for further information.

Advanced Technical Experience Program

In this program, students spend all three work sessions with a single employer, much like five-session Co-Op students. Students begin in fall, spring or summer of their junior year. This program is a transcript-recorded experience and provides an academic certificate upon completion.

Applications are accepted at any time during the student's sophomore year. Applicants are chosen by the employer host organizations during on-campus interviews. Selection depends upon the student's academic achievement on campus (2.6/4.0 minimum GPA) and their success during the interview.

Additionally, students in the program who complete one term of work experience overseas have an international experience endorsement added to their certificates.

Information is available from the coordinator of ATEP 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 11500 and 11600, 12500 and 12600, or 13600). The following courses (designed for non-science majors) will not count toward a minor: CHM 22400 (Introductory Quantitative Analysis), CHM 25700 (Organic Chemistry [for non-science majors]) and CHM 33300 (Principles of Biochemistry).

Up to three credits of undergraduate research (CHM 49900) may be used toward fulfillment of the minor. All courses must be offered by the Department of Chemistry, Purdue University.

Computer Science

Using creativity, logic, teamwork and problem-solving skills, computer scientists solve problems throughout business, industry and government; discover new knowledge in research laboratories and universities; and help prepare students for careers in computing and many other areas. Today's computer scientists need imagination, determination and the skills provided by a rigorous program like the one described here.

The demand for well-trained and highly qualified computer scientists in the United States remains strong. Virtually every field of science and engineering is affected by computing, and computer scientists play a key role in a number of interdisciplinary efforts. There are challenging opportunities in areas as diverse as:

- 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

Because computer science is a young and rapidly developing field, the curriculum must be revised frequently to keep it up-to-date. The information herein reflects the state of the curriculum effective Fall 2011. The most recent description, sample plans of study and more detailed information are usually available at the Computer Science website, www.cs.purdue.edu, and at the Computer Science Undergraduate Advising Office, Lawson Computer Science Building, Room 1123; 765-494-6010.

The Department of Computer Science offers a Bachelor of Science (B.S.) degree program with majors in:

- Computer Science (CS major)
- Computer Science/Honors (Honors major)

Qualified students in the bachelor's program may participate in the Professional Practice Program.

The Department of Computer Science also offers a combined five-year B.S./M.S. program, a master's program and a doctoral program.

To earn the B.S., students must fulfill the requirements of the College of Science and the requirements of one of the computer science majors. The flexibility of the computer science curriculum comes from requiring only six foundational (core) courses followed by one or more tracks, which allow students to deepen their understanding in a specific area of computer science. The current list of tracks includes the following: Computational Science and Engineering, Computer Graphics and Visualization, Database and Information Systems, Foundations of Computer Science, Machine Intelligence, Programming Languages, Security, Software Engineering, and Systems Programming.

All courses used to fulfill CS core and track requirements, regardless of department, must be completed with a grade of "C" or higher ("C-" is not included).

Restrictions of College Requirements

To fulfill the Mathematics requirements of the College of Science, students may take only:

MA 16100 (Plane Analytic Geometry and Calculus I) (5 cr.) or MA 16500 (Analytic Geometry and Calculus I) (4 cr.)

And one of:
MA 16200 (Plane Analytic Geometry and Calculus II) (5 cr.); MA 16600 (Analytic Geometry and Calculus I) (4 cr.); MA 17300 (Calculus and Analytic Geometry II) (5 cr.); MA 18100 (Honors Calculus I) (5 cr.)

To fulfill the Statistics requirement of the College of Science, students may take only:

STAT 35000 (Introduction to Statistics) (3 cr.); or STAT 51100 (Statistical Methods) (3 cr.)

To fulfill the Multidisciplinary Experience requirement of the College of Science, students may NOT use the following:

Minors: Mathematics or End-User Computing

Courses: CS 31400 or CS/MA 51400, or any course required for the student's Computer Science Track

Free electives

Free electives are courses used to satisfy only the number of credits needed for the bachelor's degree. They do not satisfy any other requirements. Students in the Computer Science B.S. program may choose free electives from any department within the University; but courses from departments other than Computer Science must be approved by the student's academic advisor, and courses that significantly overlap courses taken to fulfill CS degree requirements are not permitted. In particular, introductory programming courses cannot be used as free electives, regardless of the language used.

Computer Science Major

Computer Science Core ***21 credits***

There are six specifically required (core) CS courses:

CS18000 (Problem Solving and Object-Oriented Programming)	4 cr.
CS18200 (Foundations of Computer Science)	3 cr.
CS 24000 (Programming in C)	3 cr.
CS 25000 (Computer Architecture)	4 cr.
CS 25100 (Data Structures and Algorithms)	3 cr.
CS 25200 (Systems Programming)	4 cr.

Computer science students are strongly urged to take the following courses, which are intended to promote students' success: CS 19100 (Freshman Resources Seminar) (1 cr.); CS 29100 (Sophomore Development Seminar) (1 cr.); CS 39100 (Junior Resources Seminar) (1 cr.)

Mathematics Courses ***7-8 credits***

In addition to the College of Science mathematics requirements:

One of: MA 17400 (Multivariable Calculus) (4 cr.); MA 18200 (Honors Calculus II) (5 cr.); MA 26100 (Multivariate Calculus) (4 cr.); MA 27100 (Several Variable Calculus) (5 cr.)

Also: MA 26500 (Linear Algebra) (3 cr.) or MA 35100 (Elementary Linear Algebra) (3 cr.).

Each student then selects a track in which to complete 6-7 advanced courses. Each track has 2-4 required courses and a list of potential electives for the remaining track requirements. Students do not need to select a track until their junior year, and they can change their track or complete more than one track, if desired. See "Computer Science Tracks."

Computer Science Major — Computer Science Tracks

18-22 credits

Once a computer science student completes required core courses and mathematics courses, he or she selects a track in which to complete 6-7 advanced courses. Each track has 2-4 required courses and a list of potential electives for the remaining track requirements. Students do not need to select a track until their junior year, and they can change their track or complete more than one track, if desired. Most tracks have an experiential course as a requirement or an available elective, such as a CS 49000 (Independent Study), CS 49700 (Honors Research), or participation in Engineering Projects in Community Service (EPICS) for at least three credits. Projects must be approved by the program track faculty. Available tracks as of the timeframe this information was gathered for this website are listed below. For the most recent list of available program tracks and their requirements, please see www.cs.purdue.edu.

Note: Course numbers CS 39000/49000 with a title other than "Independent Study" are temporary numbers; these courses will be assigned permanent numbers at a later date.

Computer Science Major — Computer Science Tracks

Computational Science and Engineering

This track is intended to introduce computer science basics of Computation Science and Engineering (CS&E). Students not intending to pursue an advanced degree are advised to choose Option 1 for electives and take courses in some area of pure or applied science with the objective of learning how to develop software useful for the chosen area. Students intending to pursue an advanced degree are advised to choose Option 2 for electives and also take the following courses: Physics laboratory science courses, MA 35100 (Elementary Linear Algebra) (3 cr.) rather than MA 26500 (Linear Algebra) (3 cr.), MA 36200 (Topics in Vector Calculus) (3 cr.) or MA 44200 (Multivariate Analysis I Honors) (3 cr.), MA 36600 (Ordinary Differential Equations) (4 cr.) rather than MA 26600 (Ordinary Differential Equations) (3 cr.); MA 34100 (Foundations of Analysis) (3 cr.) or MA 44000 (Real Analysis Honors) (3 cr.).

Course Requirements

21-22 credits

Required Courses:
MA 26600 (Ordinary Differential Equations) (3 cr.) or MA 36600 (Ordinary Differential Equations) (4 cr.), CS 31400 (Numerical Methods) (3 cr.)

Electives

Option I: Practical/Applied

Five additional courses, at least one from each list:

List 1: CS 30700 (Software Engineering I) (3 cr.); CS 33400 (Fundamentals of Computer Graphics) (3 cr.)

List 2: CS 35200 (Compilers: Principles and Practice) (3 cr.);
CS 35400 (Operating Systems) (3 cr.);
CS 38100 (Introduction to the Analysis of Algorithms) (3 cr.);
CS 43400 (Advanced Computer Graphics) (3 cr.);
CS 44800 (Introduction to Relational Database Systems) (3 cr.);
CS 47100 (Introduction to Artificial Intelligence) (3 cr.);
Approved Senior Project from CS 49000 (Independent Study) (3 cr.), CS 49700 (Honors Research Project) (3 cr.) or EPCS 41100 (1 cr.) *an*d EPCS 41200 (2 cr.) (Senior Design Participation in EPICS)

Option 2: Academic

Five additional courses, at least one from each list:
List 3: CS 38100 (Introduction to Analysis of Algorithms) (3 cr.)
List 4: CS 35400 (Operating Systems) (3 cr.)
List 5: CS 51400 (Numerical Analysis) (3 cr.);
CS 51500 (Numerical Linear Algebra) (3 cr.);
CS 49700 (Honors Research Project) (3 cr.)
List 6: CS 33400 (Fundamentals of Computer Graphics) (3 cr.);
CS 35200 (Compilers: Principles and Practice) (3 cr.);
CS 45600 (Programming Languages) (3 cr.);
CS 47100 (Introduction to Artificial Intelligence) (3 cr.);
CS 48300 (Introduction to the Theory of Computation) (3 cr.)

Computer Science Major — Computer Science Tracks

Computer Graphics and Visualization

This track is designed to prepare students for work and/or graduate school in computer graphics, visualization and related areas. Computer graphics refers to modeling (including 3D acquisition) and rendering 3D objects and scenes. Visualization refers to using imagery to convey digital information and facilitate its interpretation and analysis.

Jobs and activities for students graduating from this track may include:

- Graphics-related industry jobs (e.g., Intel, NVIDIA, Microsoft, Adobe, IBM, Google) — working on graphics software, hardware and applications.
- CAD and architectural applications — developing CAD/engineering/architecture-related applications. Movie industry (e.g., Pixar, DreamWorks, Disney, Sony) — working on creating movies and related tools.
- Gaming industry (e.g., Electronic Arts, Midway Games, Disney, Sony) — working on game programming and related tools.
- Laboratories — working in one of several scientific visualization laboratories (although often a graduate degree is preferred).
- Graduate school — continuing studies toward an M.S. or Ph.D., which opens up other job opportunities, including research labs and academic positions.

Course Requirements

18 credits

Required Courses:
CS 33400 (Fundamentals of Computer Graphics) (3 cr.);
CS 31400 (Numerical Methods) (3 cr.) or CS 38100 (Introduction to the Analysis of Algorithms) (3 cr.)

Electives

Four additional courses from the following list:
CS 31400 (Numerical Methods) (3 cr.);
CS 35200 (Compilers: Principles and Practice) (3 cr.);
CS 35400 (Operating Systems) (3 cr.);
CS 38100 (Introduction to the Analysis of Algorithms) (3 cr.);
CS 42200 (Computer Networks) (3 cr.);
CS 43400 (Advanced Computer Graphics) (3 cr.);
CS 44800 (Introduction to Relational Database Systems) (3 cr.);
CS 47100 (Introduction to Artificial Intelligence) (3 cr.);
Approved Senior Project for 1-2 elective slots: CS 49000 (Independent Study) (3 cr.) and/or CS 49700 (Honors Research Project) (3 cr.)

Note: Neither CS 31400 (Numerical Methods) nor CS 38100 (Introduction to the Analysis of Algorithms) can be double-counted toward required and elective courses.

Computer Science Major — Computer Science Tracks

Database and Information Systems

Course Requirements

21 credits

Required Courses:
CS 34800 (Information Systems) (3 cr.);
CS 38100 (Introduction to the Analysis of Algorithms) (3 cr.);
CS 44800 (Introduction to Relational Database Systems) (3 cr.);
CS 47300 (Web Information Search and Management) (3 cr.)

Electives

Three additional courses, at least one from each category:
Category I — Computing Systems: CS 35200 (Compilers: Principles and Practice) (3 cr.) or CS 35400 (Operating Systems) (3 cr.)
Category II — Information Assurance: CS 35500 (Introduction to Cryptography) (3 cr.) or CS 42600 (Computer Security) (3 cr.)
Category III — Related Studies: CS 42200 (Computer Networks) (3 cr.); CS 47100 (Introduction to Artificial Intelligence) (3 cr.); CS 47800 (Introduction to Bioinformatics) (3 cr.); Approved Senior Project from CS 49000 (Independent Study) (3 cr.), CS 49700 (Honors Research Project) (3 cr.) or EPCS 41100 (1 cr.) and EPCS 41200 (2 cr.) (Senior Design Participation in EPICS)

Foundations of Computer Science

This track gives students a broad education on foundational concepts, tools and techniques underlying existing and future areas of computer science.

Course Requirements

18 credits

Required Courses:
CS 35200 (Compilers: Principles and Practice) (3 cr.);
CS 38100 (Introduction to the Analysis of Algorithms) (3 cr.)

Electives

Four additional courses from the following list:
CS 31400 (Numerical Methods) (3 cr.);
CS 33400 (Fundamentals of Computer Graphics) (3 cr.);
CS 35500 (Introduction to Cryptography) (3 cr.);
CS 44800 (Introduction to Relational Database Systems) (3 cr.);
CS 45600 (Programming Languages) (3 cr.);
CS 47100 (Introduction to Artificial Intelligence) (3 cr.);
CS 48300 (Introduction to the Theory of Computation) (3 cr.);
Any CS course at the 30000, 400000 or 50000 level, including CS 49000 (Independent Study) (3 cr.) or CS 49700 (Honors Research Project) (3 cr.)

Machine Intelligence

This track is designed to prepare students to work in fields related to management and analysis of data, including areas such as machine learning, information retrieval and data mining. The goal is to prepare students to understand and effectively apply in practice the principles and techniques of data and knowledge representation and search as well as learning and reasoning with data.

Course Requirements

18 credits

Required Courses:
CS 38100 (Introduction to Analysis of Algorithms) (3 cr.);
CS 39000 (Data Mining and Machine Learning) (3 cr.);
CS 47100 (Introduction to Artificial Intelligence) (3 cr.) or CS 47300 (Web Information Search and Management) (3 cr.);
MA/STAT 41600 (Probability) (3 cr.) or STAT 51200 (Applied Regression Analysis) (3 cr.)

Electives

Two additional courses from the following list:
CS 34800 (Information Systems) (3 cr.);
CS 35200 (Compilers: Principles and Practice) (3 cr.);
CS 44800 (Introduction to Relational Database Systems) (3 cr.);
CS 45600 (Programming Languages) (3 cr.);
CS 47100 (Introduction to Artificial Intelligence) (3 cr.);

CS 48300 (Introduction to the Theory of Computation) (3 cr.);
CS 49000 (Web Information Retrieval) (3 cr.);
Approved Senior Project — CS 49000 (Independent Study) (3 cr.), CS 49700 (Honors Research Project) (3 cr.), EPCS 41100 (1 cr.) and EPCS 41200 (2 cr.) (Senior Design Participation in EPICS)

Note: Neither CS 47100 (Artificial Intelligence) nor CS 39000 (Data Mining and Machine Learning) can be double-counted toward required and elective courses.

Programming Languages

This track is designed to prepare students to work in fields related to program understanding, analysis, manipulation and transformation. This includes run-time system engineering as well as domain-specific techniques (e.g., real-time computing or Web programming). They will acquire tools and techniques needed to specify and implement language-based solutions.

Course Requirements

18 credits

Required Courses:
CS 35200 (Compilers: Principles and Practice) (3 cr.);
CS 35400 (Operating Systems) (3 cr.);
CS 45600 (Programming Languages) (3 cr.)

Electives

Three additional courses from the following list:
CS 30700 (Software Engineering I) (3 cr.);
CS 38100 (Introduction to the Analysis of Algorithms) (3 cr.);
CS 35300 (Concurrency and Parallelism) (3 cr.);
CS 42200 (Computer Networks) (3 cr.);
CS 48300 (Introduction to the Theory of Computation) (3 cr.)

Security

This track is designed to prepare students to become computer scientists who:

- Understand the importance of, and are skilled in, designing and developing secure software
- Are familiar with the societal impact of insecure software and related infrastructure
- Are familiar with, and can use, techniques for testing and assessing systems for secure operation

Course Requirements

18 credits

Required Courses:
CS 35400 (Operating Systems) (3 cr.);
CS 35500 (Introduction to Cryptography) (3 cr.);
CS 42600 (Computer Security) (3 cr.)

Electives

Three additional courses from the following list:
CS 30700 (Software Engineering I) (3 cr.);
CS 34800 (Information Systems) (3 cr.);
CS 35200 (Compilers: Principles and Practice) (3 cr.);
CS 38100 (Introduction to the Analysis of Algorithms) (3 cr.);
CS 42200 (Computer Networks) (3 cr.);
CS 44800 (Introduction to Relational Database Systems) (3 cr.);
CS 40800 (Software Testing) (3 cr.).

Software Engineering

This track is designed to prepare students to become software engineers who:

- Understand and can use the principles and techniques of software engineering essential for the design and development of large software products
- Are familiar with, and can effectively use, a variety of tools for software analysis, design, testing and maintenance
- Can effectively work in teams and communicate orally and in writing

Course Requirements

18 credits

Required Courses:
CS 30700 (Software Engineering I) (3 cr.);
CS 35200 (Compilers: Principles and Practice) (3 cr.) or CS 35400 (Operating Systems) (3 cr.);
CS 40800 (Software Testing) (3 cr.);
Approved Senior Project, preferably team-based, from CS 49000 (Independent Study) (3 cr.), CS 49700 (Honors Research Project) (3 cr.), or EPCS 41100 (1 cr.) and EPCS 41200 (2 cr.) (Senior Design Participation in EPICS)

Electives

Two additional courses from the following list:
CS 34800 (Information Systems); (3 cr.) CS 35200 (Compilers: Principles and Practice) (3 cr.);
CS 35400 (Operating Systems) (3 cr.);
CS 38100 (Introduction to the Analysis of Algorithms) (3 cr.);
CS 42600 (Computer Security) (3 cr.);
CS 44800 (Introduction to Relational Database Systems) (3 cr.);
CS 45600 (Programming Languages) (3 cr.)

Note: Neither CS 35200 (Compilers: Principles and Practice) nor CS 35400 (Operating Systems) can be double-counted toward the required and selective courses.

Systems Programming

This track is designed to prepare students to become programmers who can build:

- Low-level software that uses or runs inside an operating system
- System tools for other users (e.g., compilers and assemblers)
- Programs that communicate over a computer network or the Internet (e.g., Web servers)

Course Requirements

18 credits

Required Courses:
CS 35200 (Compilers: Principles and Practice) (3 cr.);
CS 35400 (Operating Systems) (3 cr.);
CS 42200 (Computer Networks) (3 cr.)

Electives

Three additional courses from the following list:
CS 30700 (Software Engineering I) (3 cr.);
CS 33400 (Fundamentals of Computer Graphics) (3 cr.);
CS 38100 (Introduction to the Analysis of Algorithms) (3 cr.);
CS 42600 (Computer Security) (3 cr.);
CS 44800 (Introduction to Relational Database Systems) (3 cr.);
CS 45600 (Programming Languages) (3 cr.);
Approved Senior Project — CS 49000 (Independent Study) (3 cr.), CS 49700 (Honors Research Project) (3 cr.), or EPCS 41100 (1 cr.) and EPCS 41200 (2 cr.) (Senior Design Participation in EPICS)

Honors Major in Computer Science

Students enter the honors major in one of three ways:

1. By invitation upon admission.
2. By invitation after the first semester.
3. By application. Students may request admission to the honors major to be effective in the semester following the completion of the level 2 core courses. The Undergraduate Committee may grant admission if the student meets the grade-point-average requirements of the honors major and has the recommendation of his or her CS academic advisor.

Honors students must maintain a cumulative grade point average (GPA) of at least 3.25 and a cumulative GPA of at least 3.6 in CS courses used to fulfill major requirements from the time they are admitted to the honors major until they graduate.

Honors students are encouraged, but not required, to take CS 19700 (Freshman Honors Seminar) (1 cr.) in the spring semester of their freshman year.

Honors Major Course Requirements

The requirements for honors students are the same as for the CS major, but honors students must take the following courses:

MA 35100 (Elementary Linear Algebra) (3 cr.) in lieu of MA 26500; an approved* mathematics course beyond MA 35100 or an approved* statistics course beyond STAT 51100; ECE 27000 (Introduction to Digital System Design) (4 cr.); CS 39700 (Honors Seminar) (1 cr.) followed by CS 49700 (Honors Research Project) (3 cr.); and an approved* 50000-level CS course. CS 49700 and the CS 50000-level course may be used as CS track requirements with the approval of track faculty.

** Course must be approved by the Computer Science Undergraduate Committee for use in the honors major.*

Professional Practice

The Department of Computer Sciences offers professional practice whereby students in the Computer Science B.S. program can gain practical experience as employees in business, industry or government in conjunction with their studies. More information can be found at the CS website, www.cs.purdue.edu.

Five-Year combined B.S./M.S. Program

The five-year combined B.S./M.S. Degree program enables outstanding students to complete the B.S. and the M.S. in a total of five years, rather than the usual six years.

The program entails no alteration of the requirements for either degree but does allow students to count up to nine credits of level 5 and/or level 6 courses toward both degrees, which reduces the total time to the M.S. degree by about one semester. With Advanced Placement credit, credit by examination at Purdue, full course loads, summer courses or a combination of them in the B.S. program, students can then complete the combined program within five years of the beginning of their B.S. studies.

Interested students should consult with their academic advisor as early as possible to arrange the B.S. program of study to prepare for the B.S./M.S. program.

Students apply for the program at the beginning of what, in an ordinary B.S. program, would be their third-from-last semester (typically the second semester of the junior year) to begin graduate study the following semester. Requirements for admission include a cumulative GPA of at least 3.0; a cumulative GPA of at least 3.5 in CS courses; and projected completion, before entering the B.S./M.S. program, of at least 100 of the 124 credits required for the B.S.

More information is available at the CS website, www.cs.purdue.edu.

Minor in Computer Science

To obtain a minor in computer science, students must pass, with a "C" or better ("C-" and "P" for "pass" are not included), five CS courses at or above CS 18000 that can be used to fulfill CS major requirements. All five courses must be taken at Purdue University West Lafayette.

None of the following courses can be used to fulfill a minor in CS:

- Independent Study (CS 19000, 29000, 39000, 49000, 59000, 69000). However, courses using these as temporary course numbers may be used for minor requirements. Verify with a CS advisor.
- EPCS (EPICS) courses.

Earth, Atmospheric and Planetary Sciences

Earth, atmospheric and planetary sciences (EAPS) focus on the study of the atmosphere, oceans, the solid earth, and in a new, interdisciplinary area of planetary science. These disciplines are concerned with the quality of life and the physical environment in which we live and those we hope to explore. Earth, atmospheric and planetary scientists have accepted the challenge of arriving at solutions to basic and applied problems that affect our planet and those of our neighbors in space.

Faculty and students in the Department of Earth, Atmospheric and Planetary 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 sources of devastating natural disasters, such as earthquakes, landslides and tornadoes; events that explore the distant past or the projected future of our stay on Earth, such as climate change, plate tectonics, impact cratering, and Arctic and Antarctic fossil discoveries; and our exploration beyond Earth.

The Department of Earth, Atmospheric and Planetary Sciences prepares students to investigate a variety of problems. The basic core courses (www.purdue.edu/catalogs/science/earth_general_requirements.html), 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. A Ph.D. degree is required for advancement in university teaching and higher-level positions in research.

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

Careers in Earth, Atmospheric and Planetary Sciences

Atmospheric Science (Meteorology). Meteorology is the study of atmospheric phenomena. This includes the physics, chemistry and dynamics of the atmosphere as well as 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.

With the atmospheric science major, students may also choose to focus on employment with the National Weather Service or other government agencies, broadcasting (media), a business-related career or environmental monitoring, or they may pursue graduate school/research.

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.

Structural Geology. Structural geology is the study of how earth deforms. To understand rock deformation, we might examine rocks at any scale from microscopic to continental. We study the forces that cause folds, faults and even whole mountain ranges. We investigate rocks that have flowed quietly for millions of years, and others that have ruptured catastrophically in earthquakes. These types of processes are responsible for much of the large-scale configuration of the Earth's surface.

Structural geology is one of the keys to understanding the geologic history of the Earth and hazards such as earthquakes, tsunamis and landslides. It is also an essential tool in the search for petroleum and mineral resources.

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 Geosciences. Using a background in geology and/or atmospheric science as their foundation, environmental scientists can use an interdisciplinary approach to study ground-water contamination, landfill management, landslide risk, urban planning, climate change and many other contemporary environmental issues. These scientists must develop quantitative problem-solving skills acquired in an educational framework that couples their geological and/or atmospheric science background with basic principles of chemistry, physics, mathematics and engineering to meet the challenges facing the environment.

Environmental employment areas include science, engineering and consulting, particularly on decisions regarding environmental public policy. There are also many opportunities for graduate education in these areas.

Earth/Space Science Teaching. This program provides a broad earth science core as well as a strong background in math, chemistry and physics along with required courses in education to prepare students to teach in junior high/middle/secondary schools (grades 5-12) and meet the requirements set by the University-wide Teacher Education Council.

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 www.purdue.edu/eas.

General Degree Requirements

Science core requirements for the College of Science are listed under "Core Requirements." To qualify for a B.S. degree, students must complete the requirements for one of the following options:

- Atmospheric science
- Geology and geophysics
- Earth/space science teaching
- Environmental geosciences

Earth, Atmospheric and Planetary Sciences Requirements

Laboratory Science Requirements (all options)	***14-16 credits***
Chemistry: CHM 11500 and 11600 (General Chemistry). Earth/space science teaching majors can substitute CHM 11100 and 11200 (General Chemistry) (3 cr. each).	*6-8 cr.*
Physics: PHYS 17200 (Modern Mechanics) (4 cr.) and PHYS 27200 (Electric and Magnetic Interactions) (4 cr.). Earth/space science teaching majors can substitute PHYS 22000 and 22100 (General Physics) (4 cr. each). Geology and Geophysics and Environmental Geosciences majors can consult an advisor for options for this second lab sequence.	*8 cr.*
Mathematics Requirements (all options)	***8-21 credits***
MA 16100 (Plane Analytic Geometry and Calculus I) (5 cr.) or MA 16500 (Analytic Geometry and Calculus I) (4 cr.)	*4-5 cr.*
One of: MA 16200 (Plane Analytic Geometry and Calculus II) (5 cr.); MA 16600 (Analytic Geometry and Calculus II) (4 cr.); MA 17300 (Calculus and Analytic Geometry II) (5 cr.); MA 18100 (Honors Calculus I) (5 cr.)	*4-5 cr.*
One of: MA 26100 (Multivariate Calculus) (4 cr.); MA 17400 (Multivariable Calculus) (4 cr.); MA 18200 (Honors Calculus II) (5 cr.); MA 27100 (Several Variable Calculus) (5 cr.). Required for Atmospheric Science and Earth/Space Science Teaching majors only.	*4-5 cr.*
MA 26500 (Linear Algebra) (3 cr.) and MA 26600 (Ordinary Differential Equations) (3 cr.). Required for Atmospheric Science and Earth/Space Science Teaching majors only	*6 cr.*
Computer Science	***3-4 credits***
CS 15800 (C Programming) (3 cr.) for Atmospheric Science. Earth/Space Science Teaching, Environmental Geosciences, and Geology and Geophysics majors can enroll in either CS 15800 (C Programming) or CS 17700 (Programming with Multimedia Objects) (4 cr.)	
Statistics	***3 credits***
STAT 30100 (Elementary Statistical methods) (3 cr.); STAT 35000 (Introduction to Statistics) (3 cr.); STAT 50300 (Statistical Methods for Biology) (3 cr.); STAT 51100 (Statistical Methods) (3 cr.)	
Additional Science Core Requirements	***24-31 credits***
See "Graduation Requirements" for details on all but the "General Education" listing below.	*6-10 cr.*
English Composition and Technical Writing and Presentation	
Teambuilding and Collaboration: Students must learn the concepts involved in science team projects.	*1-3 cr.*
Multidisciplinary Experience	*3-9 cr.*
Language and Culture: Science majors are expected to have proficiency in another language in addition to their native language. Competence in the second language must be demonstrated to the third semester, or to the second semester (with an additional culture or diversity class), or an approved study abroad experience.	*9 cr.*
General Education: Students must complete 3 credits of a course approved for Great Issues and 9 credits of Social Studies/Humanities and/or Management. See	*12 cr.*

"General Education Requirements for details, including the two-course sequence in Social Studies or Humanities.

Free Electives ***3-24 credits***

Free electives can be selected from almost any department of the University, and 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 degree requirements or that do not count for credit in the College of Science. Students must take as many free electives as is needed to bring the credit hour total to 124 credits, and the number of free electives may depend on the student's option and the courses taken to meet core and degree requirements. Students in atmospheric science who wish to be qualified for employment as meteorologists in the federal government must elect EAS 43400 (Weather Analysis and Forecasting) (3 cr.).

Additional Requirements for Entry into the Upper Division in All EAPS Options

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

1. Completion of MA 16100 (Plane Analytic Geometry and Calculus I) (5 cr.), and MA 16200 (Plane Analytic Geometry and Calculus II) (5 cr.); CHM 11500 (General Chemistry) (4 cr.) and CHM 11600 (General Chemistry) (4 cr.); and PHYS 17200 (Modern Mechanics) (4 cr.); or equivalents — each with a grade of "C-" or better; **and**
2. Completion of required lower-division EAS 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 35300 (Surface Processes) (3 cr.) or EAS 35400 (Plate Tectonics) (3 cr.) for geology and geophysics or earth/space science teaching; or EAS 42100 (Atmospheric Thermodynamics) (3 cr.) for atmospheric science.

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. Information is also available on the Department of Earth, Atmospheric and Planetary Sciences website, www.purdue.edu/eas, or by consulting with an advisor.

Atmospheric Science Requirements

Atmospheric Science Core ***48 credits***

EAS 10900 (The Dynamic Earth) (3 cr.); *30 cr.*
EAS 11700 (Introduction to Atmospheric Science) (2 cr.);
EAS 13700 (First-Year Seminar in Earth, Atmospheric and Planetary Sciences) (1 cr.);
EAS 22500 (Science of the Atmosphere) (3 cr.)
EAS 32000 (Physics of Climate) (3 cr.)
EAS 42100 (Atmospheric Thermodynamics) (3 cr.)
EAS 42200 (Atmospheric Dynamics I) (3 cr.)
EAS 42300 (Atmospheric Dynamics II) (3 cr.)
EAS 43100 (Synoptic Laboratory I) (1 cr.)
EAS 43200 Synoptic Laboratory II) (1 cr.)
EAS 43300 (Synoptic Laboratory III) (1 cr.)
EAS 53200 (Atmospheric Physics I) (3 cr.)

EAS 53500 (Atmospheric Observations and Measurements) (3 cr.).

Electives ***18 credits***

Elective courses (at least 6 courses, 3 credits each).

Geology and Geophysics Core

EAS 10900 (The Dynamic Earth) (3 cr.); *27-29 cr.*
EAS 11800 (Introduction to Earth Science) (3 cr.);
EAS 13700 (First-Year Seminar in Earth, Atmospheric and Planetary Sciences) (1 cr.);
EAS 24300 (Earth Materials I) (4 cr.)
EAS 31900 (Exploring Earth through Time) (3 cr.)
EAS 30900 (Computer-Aided Analysis for Geosciences) (3 cr.)
EAS 35300 (Surface Processes) (3 cr.)
EAS 35400 (Plate Tectonics) (3 cr.)
EAS 49000 (Field Geology Summer Field Camp) (4-6 cr.).

Students participate in the field experience the summer before the senior year. See "Special Programs and Opportunities" for additional information about the field experience.

Electives ***33 credits***

Environmental Geosciences Requirements — 61-63 credits

Environmental Geosciences Core

AGRY 33700 (Environmental Hydrology) (3 cr.) *22-23 cr.*
EAS 10900 (The Dynamic Earth) (3 cr.) or EAS 11300 (Introduction to Environmental Science) (3 cr.);
EAS 11800 (Introduction to Earth Science) (3 cr.);
EAS 13700 (First-Year Seminar in Earth, Atmospheric and Planetary Sciences) (1 cr.);
EAS 22500 (Science of the Atmosphere) (3 cr.);
EAS 44000 (Geochemistry of the Solid Earth) (3 cr.) or CE 35300 (Physico-Chemical Principles of Environmental Engineering) (4 cr.);
EAS 30900 (Computer-Aided Analysis for Geosciences) (3 cr.);
FNR 40600 (Environmental Economics) (3 cr.)

Additional Core — 9-10 credits

EAS courses in biogeochemistry (3 cr.), a capstone research experience (3-4 cr.) and a capstone course in environmental geosciences will also be required (3 cr.).

Electives ***30 credits***

One environmental elective (3 cr.), one science or engineering elective (20000 level or above) (3 cr.), five EAS environmental electives (two of which must be 30000 level or above) (3 cr. each) and at least three free elective courses (3 cr. each).

Earth/Space Science Teaching Requirements — 86-89 credits

Earth/Space Science Teaching Core ***62-64 credits***

EAS 10900 (The Dynamic Earth) (3 cr.); *24-26 cr.*
EAS 11800 (Introduction to Earth Science) (3 cr.);
EAS 13700 (First-Year Seminar in Earth, Atmospheric and Planetary Sciences) (1 cr.);

EAS 24300 (Earth Materials I) (4 cr.); EAS 31900 (Exploring Earth through Time) (3 cr.); EAS 35300 (Surface Processes) (3 cr.); EAS 35400 (Plate Tectonics) (3 cr.); EAS 49000 (Field Geology Summer Field Camp) (4-6 cr.)	
Students participate in the field experience the summer before the senior year. See "Special Programs and Opportunities" for additional information about the field experience.	
Two of the following (3 credits each): ASTR 26300 (Description Astronomy: The Solar System); ASTR 26400 (Descriptive Astronomy: Stars and Galaxies); EAS 10400 (Oceanography); EAS 10500 (The Planets); EAS 11500 (Dinosaurs); EAS 11600 (Earthquakes and Volcanoes); EAS 12000 (Introduction to Geography); EAS 13800 (Thunderstorms and Tornadoes); EAS 22100 (Survey of Atmospheric Science); EAS 22500 (Science of the Atmosphere)	*6 cr.*
Professional Education	***33 credits***
EDCI 27000 (Introduction to Educational Technology and Computing) (3 cr.); EDST 20000 (History and Philosophy of Education) (3 cr.); EDCI 20500 (Exploring Teaching as a Career) (3 cr.) and EDCI 28500 (Multiculturalism and Education) (3 cr.); EDPS 23500 (Learning and Motivation) (3 cr.) and EDPS 26500 (The Inclusive Classroom) (3 cr.); EDCI 42400 (The Teaching of Earth and Physical Science in the Secondary Schools) (3 cr.); EDCI 49800 (Supervised Teaching) (10 cr.);	*31 cr.*
EDCI 42800 (Teaching Science in the Middle and Junior High School) (2 cr.) is taken before student teaching during the first six weeks of the professional semester. A student can choose either the seventh or eighth semester for the professional semester.	*2 cr.*

Honors Research Program

Outstanding students are invited to participate in the earth, atmospheric and planetary 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 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.

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

1. At least a 3.25 cumulative graduation index**, and**

2. Successful completion of EAS 49400 (Earth, Atmospheric and Planetary Sciences Undergraduate Seminar) (1 cr.), **and**

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 in the Department of Earth, Atmospheric and Planetary 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.

Earth, Atmospheric and Planetary Sciences Minor

Students who wish to complement their major area of study with coursework in the Earth, Atmospheric and Planetary Sciences may be interested in the department's minor program.

Earth, Atmospheric and Planetary Sciences Minor Course Requirements	**17 credits**
EAS 11100 (Physical Geology) (3 cr.) or EAS 10900 (The Dynamic Earth) (3 cr.).	*3 cr.*
EAS 22100 (Survey of Atmospheric Science) (3 cr.) or EAS 22500 (Science of the Atmosphere) (3 cr.).	*3 cr.*
EAS 23000 (Laboratory in Atmospheric Science) (1 cr.).	*1 cr.*
Ten additional credits selected from any 20000-level or above EAS courses. One 10000-level EAS course may be used to meet this requirement.	*10 cr.*
Note: EAS 11100 (Physical Geology) (3 cr.) and EAS 11200 (Earth Through Time) (3 cr.) are an approved laboratory sequence for the College of Science core requirements.	

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. Additional information about career opportunities is available from the College of Science Counseling Office and by taking MA 10800 (Mathematics as a Profession and a Discipline) (1 cr.).

Some math graduates choose to continue their education in 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 or other areas. Job options include positions such as database managers, programming, actuarial work, software engineering, defense work, insurance, banking and finance.

The most recent information can be found on the website www.math.purdue.edu.

General Degree Requirements

All mathematics majors must satisfy the following general degree requirements. A total of 124 credit hours is required. Mathematics courses below MA 16100 (except MA 10800) do not count as credit toward graduation.

Mathematics Requirements	**43-81 credits**
One of the following calculus sequences	***12-15 credits***
a. MA 16100 (Plane Analytic Geometry and Calculus I) (5 cr.); MA 16200 (Plane Analytic Geometry and Calculus II) (5 cr.); and MA 26100 (Multivariate Calculus) (4 cr.)	*14 cr.*
b. MA 16500 (Analytic Geometry and Calculus I) (4 cr.); MA 16600 (Analytic Geometry and Calculus II) (4 cr.); and MA 26100 (Multivariate Calculus) (4 cr.)	*12 cr.*
c. Calculus: MA 17300 (Calculus and Analytic Geometry II) (5 cr.) and MA 17400 (Multivariable Calculus) (4 cr.)	*9 cr.*
d. MA 18100 (Honors Calculus I) (5 cr.) and MA 18200 (Honors Calculus II) (5 cr.)	*10 cr.*
e. MA 27100 (Several Variable Calculus)	*5 cr.*
MA 36600 (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 36600 with MA 26600 (with a “B-” or better).	*4 cr.*
MA 35100 (Linear Algebra) (3 cr.) Students transferring from other majors and those getting a second major in mathematics may replace MA 35100 with MA 26500 (with a “B-” or better).	*3 cr.*
One of the following seven programs: (See "Mathematics Options"):	*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.*
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 10800 (Mathematics as a Profession and a Discipline) as a free elective in their first semester.

Grade Requirement

All mathematics majors must have a graduation index of 2.0 in MA 35100 (Elementary Linear Algebra), MA 36600 (Ordinary Differential Equations) 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 11300 (Statistics and Society), 22500 (Introduction to Probability Models), 30100 (Elementary Statistical Methods), 50100 (Experimental Statistics I), 50200 (Elementary Statistics II) and 50300 (Statistical Methods for Biology).

Other courses recommended for undergraduates outside the department are STAT 31100 (Introductory Probability), 51100 (Statistical Methods), 51200 (Applied Regression Analysis), 51300 (Statistical Quality Control) and 51400 (Design of Experiments). 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 35100 (Elementary Linear Algebra) (3 cr.).

Any of the options can be enriched under the honors program (www.purdue.edu/catalogs/science/math_honors.html). 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 your academic advisor for details.

MA 18100 (Honors Calculus I), MA 18200 (Honors Calculus II), MA 44000 (Real Analysis Honors) and MA 45000 (Algebra Honors) are, respectively, honors versions of Calculus, MA 34100 (Foundations of Analysis) and MA 45300 (Elements of Algebra I). The honors version of a course has more 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

The seven mathematics options offered by the College of Science 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

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	**21 credits**
MA 35300 (Linear Algebra II)	*3 cr.*
MA 36200 (Vector Calculus), MA 51000 (Vector Calculus) or MA 44200 (Multivariate Analysis I Honors) (3 cr.)	*3 cr.*
MA 34100 (Foundations of Analysis) (3 cr.) or MA 44000 (Real Analysis: Honors) (3	*3 cr.*

cr.)

MA 45300 (Elements of Algebra) (3 cr.) or MA 45000 (Algebra: Honors) (3 cr.)	*3 cr.*
Any three courses from among the following (but no more than two from each group): a. CS 24000 (Programming Laboratory C) (3 cr.); CS 25100 (Data Structures) (3 cr.) b. CS 31400 (Numerical Methods) (3 cr.); CS 51400 (Numerical Analysis) (3 cr.); CS 51500 (Numerical Analysis of Linear Systems) (3 cr.); CS 52000 (Computational Methods in Analysis) (3 cr.) c. MA 45400 (Galois Theory) (3 cr.) d. MA 52000 (Boundary Value Problems) (3 cr.); MA 52300 (Introduction to PDEs) (3 cr.); MA 54300 (Introduction to the Theory of Differential Equations) (3 cr.) e. MA 37500 (Introduction to Discrete Mathematics) (3 cr.); MA 38500 (Introduction to Logic) (3 cr.); CS 38100 (Introduction to the Analysis of Algorithms) (3 cr.); MA 38700 (Set Theory of Computation) (3 cr.); CS 48300 (Introduction to the Theory of Computation) (3 cr.) f. MA 42500 (Complex Analysis) (3 cr.); MA 42800 (Introduction to Fourier Analysis) (3 cr.); MA 44000 (Real Analysis) (3 cr.); MA 44200 (Multivariate Analysis I) (3 cr.); MA 52100 (Introduction to Optimization Problems) (3 cr.); MA 52500 (Introduction to Complex Analysis) (3 cr.) g. MA 46200 (Elementary Differential Geometry) (3 cr.); MA 57100 (Elementary Topology) (3 cr.) h. MA 41600 or STAT 41600 (Probability) (3 cr.); STAT 51600 (Basic Probability and Applications) (3 cr.); STAT 41700 (Statistical Theory) (3 cr.); STAT 51700 (Statistical Inference) (3 cr.)	*9 cr.*

Applied Mathematics

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	**24 credits**
MA 36200 (Topics in Vector Calculus) (3 cr.); MA 44200 (Multivariate Analysis I Honors) (3 cr.); MA 51000 (Vector Calculus) (3 cr.)	*3 cr.*
CS 31400 (Numerical Methods) (3 cr.); CS 51400 (Numerical Analysis) (3 cr.)	*3 cr.*
MA 35300 (Linear Algebra II)	*3 cr.*
MA 30300 (Differential Equations for Engineering and the Sciences) (3 cr.); MA 30400 (Differential Equations and Partial Differential Equations for Engineering and the Sciences) (3 cr.)	*3 cr.*
MA 34100 (Foundations of Analysis) (3 cr.); MA 44000 (Real Analysis: Honors) (3 cr.)	*3 cr.*
MA 42500 (Elements of Complex Analysis) (3 cr.); MA 42800 (Introduction to Fourier Analysis) (3 cr.); MA 52500 (Introduction to Complex Analysis) (3 cr.); MA 52000 (Boundary Value Problems of PDEs) (3 cr.); MA 52300 (Introduction to PDEs) (3 cr.); special topics course with approval of the undergraduate committee chairman.	*3 cr.*
MA 45300 (Elements of Algebra I) (3 cr.) or MA 45000 (Algebra: Honors) (3 cr.)	*3 cr.*

One of the following: MA 37500 (Introduction to Discrete Mathematics) (3 cr.); MA 41600/STAT 41600 (Probability) (3 cr.); MA 42100 (Linear Programming and Optimization Techniques) (3 cr.); MA 42500 (Complex Analysis) (3 cr.); MA 42800 (Introduction to Fourier Analysis) (3 cr.); STAT 51600 (Advanced Probability and Options with Numerical Methods) (3 cr.)	*3 cr.*

Business Mathematics

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	**30-31 credits**
MGMT 20000 (Introductory Accounting)	*3 cr.*
Two of: MA 37500 (Introduction to Discrete Mathematics) (3 cr.); CS 31400 (Numerical Methods) (3 cr.); STAT 41700 (Statistical Theory) (3 cr.); STAT 51700 (Statistical Inference) (3 cr.); MA 42100 (Linear Programming and Optimization Techniques) (3 cr.)	*6 cr.*
Two of: MA 37300 (Financial Mathematics) (4 cr.); MGMT 31000 (Financial Management) (3 cr.); MGMT 41100 (Investment Management) (3 cr.); MGMT 54400 (Database Management Systems) (3 cr.); MGMT 32300 (Introduction to Market Analysis) (3 cr.)	*6-7 cr.*
MA 41600/STAT 41600 (Probability) (3 cr.) or STAT 51600 (Basic Probability and Applications) (3 cr.)	*3 cr.*
MA 34100 (Foundations of Analysis) (3 cr.) or MA 44000 (Real Analysis Honors) (3 cr.)	*3 cr.*
MA 35300 (Linear Algebra II)	*3 cr.*
MA 45300 (Elements of Algebra I) (3 cr.) or MA 45000 (Algebra Honors) (3 cr.)	*3 cr.*
STAT 51200 (Applied Regression Analysis)	*3 cr.*

Computer Science

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

Computer Science Option Course Requirements	**24 credits**
CS 24000 (Programming in C)	*3 cr.*
CS 25100 (Data Structures)	*3 cr.*
CS 31400 (Numerical Methods)	*3 cr.*
One of: CS 33400 (Fundamentals of Computer Graphics) (3 cr.); CS 38100 (Introduction to the Analysis of Algorithms) (3 cr.); CS 48300 (Introduction to the Theory of Computation) (3 cr.); CS 51400 (Numerical Analysis) (3 cr.); CS 51500 (Numerical Analysis of Linear Systems) (3 cr.); or CS 52000 (Computational Methods in Analysis) (3 cr.)	*3 cr.*

Two of: MA 35300 (Linear Algebra II) (3 cr.); MA 38500 (Introduction to Logic) (3 cr.); MA 45300 (Elements of Algebra) (3 cr.); or MA 45000 (Algebra Honors) (3 cr.)	*6 cr.*
MA 37500 (Introduction to Discrete Mathematics)	*3 cr.*
One of: MA 34100 (Foundations of Analysis) (3 cr.); MA 36200 (Topics in Vector Calculus) (3 cr.); MA 41600/STAT 41600 (Probability) (3 cr.); MA 42100 (Linear Programming and Optimization Techniques) (3 cr.); MA 42500 (Elements of Complex Analysis) (3 cr.); MA 44000 (Real Analysis Honors) (3 cr.); MA 44200 (Multivariate Analysis I Honors) (3 cr.); MA 45000 (Algebra: Honors) (3 cr.); MA 45300 (Elements of Algebra) (3 cr.); MA 46200 (Elementary Differential Geometry) (3 cr.); STAT 51600 (Basic Probability and Applications) (3 cr.); MA 51800 (Advanced Discrete Mathematics) (3 cr.); MA 52500 (Introduction to Complex Analysis) (3 cr.); or STAT 42000 (Time Series) (3 cr.)	*3 cr.*

Operations Research

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: CS 31400 (Numerical Methods) (3 cr.) or CS 51400 (Numerical Analysis) (3 cr.)	*3 cr.*
MA 35300 (Linear Algebra II)	*3 cr.*
MA 36200 (Topics in Vector Calculus) (3 cr.), MA 44200 (Multivariate Analysis I Honors) (3 cr.) or MA 51000 (Vector Calculus) (3 cr.)	*3 cr.*
MA 45300 (Elements of Algebra I) (3 cr.) or MA 45000 (Algebra Honors) (3 cr.)	*3 cr.*
MA 41600/STAT 41600 (Probability) (3 cr.) or STAT 51600 (Basic Probability and Applications); and STAT 41700 (Statistical Theory) (3 cr.) or STAT 51700 (Statistical Inference) (3 cr.)	*6 cr.*
One of: CS 52000 (Computational Methods in Analysis) (3 cr.); MA 34100 (Foundations of Analysis) (3 cr.); MA 44000 (Real Analysis Honors) (3 cr.); MA 52300 (Introduction to PDEs) (3 cr.); MA 54300 (Introduction to the Theory of Differential Equations) (3 cr.); or STAT 42000 (Time Series) (3 cr.)	*3 cr.*
One of: MA 37500 (Introduction to Discrete Mathematics) (3 cr.); MA 42100 (Linear Programming and Optimization Techniques) (3 cr.); MA 52100 (Introduction to Optimization Problems) (3 cr.); or IE 33500 (Operations Research — Optimization) (3 cr.)	*3 cr.*

Statistics

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.

Statistics Option Course Requirements	**27-28 credits**
One of: MA 36600 (Ordinary Differential Equations) (4 cr.); MA 37500 (Introduction to Discrete Mathematics), MA 42100 (Linear Programming and Optimization Techniques) (3 cr.); MA 42500 (Complex Analysis) (3 cr.); MA 52500 (Introduction to Complex Analysis) (3 cr.); MA 45300 (Elements of Algebra I) (3 cr.); MA 45000 (Algebra Honors) (3 cr.); MA 52000 (Boundary Value Problems of Differential Equations) (3 cr.); or MA 42800 (Introduction to Fourier Analysis) (3 cr.)	*3-4 cr.*
MA 35300 (Linear Algebra II)	*3 cr.*
MA 36200 (Vector Calculus) (3 cr.); MA 44200 (Multivariate Analysis I Honors) (3 cr.); or MA 51000 (Vector Calculus) (3 cr.)	*3 cr.*
STAT 35000 (Introduction to Statistics)	*3 cr.*
MA 34100 (Foundations of Analysis) (3 cr.) or MA 44000 (Real Analysis Honors) (3 cr.)	*3 cr.*
MA 41600/STAT 41600 (Probability) (3 cr.) or STAT 51600 (Basic Probability and Applications) (3 cr.)	*3 cr.*
STAT 41700 (Statistical Theory) (3 cr.) or STAT 51700 (Statistical Inference) (3 cr.)	*3 cr.*
STAT 51200 (Applied Regression Analysis)	*3 cr.*
One of: IE 53000 (Quality Control) (3 cr.); STAT 51300 (Statistical Quality Control) (3 cr.); STAT 51400 (Design of Experiments) (3 cr.); or STAT 42000 (Time Series) (3 cr.)	*3 cr.*

Mathematics Education

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 42600 (Teaching Mathematics in the Middle and Junior High School) 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.

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 Requirements	**56-57 credits**
Mathematics Courses	***24-25 credits***
MA 30100 (Introduction to Real Analysis)	*3 cr.*
One of the following: MA 34100 (Foundations of Analysis) (3 cr.); MA 35300 (Linear Algebra II) (3 cr.); MA 37500 (Introduction to Discrete Mathematics) (3 cr.); MA 42500 (Elements of Complex Analysis) (3 cr.); MA 52500 (Introduction to Complex Analysis) (3 cr.); or MA 44000 (Real Analysis) (3 cr.)	*3 cr.*
MA 45300 (Elements of Algebra) (3 cr.) or MA 45000 (Honors Algebra) (3 cr.)	*3 cr.*
MA 46000 (Geometry)	*3 cr.*
STAT 31100 (Introductory Probability) (3 cr.); MA 41600/STAT 41600 (Probability) (3 cr.); **or** STAT 51600 (Basic Probability and Applications) (3 cr.)	*3 cr.*

One of the following: CS 15800 (C Programming) (3 cr.); CS 15900 (Programming Applications for Engineers) (3 cr.); CS 17700 (Programming with Multimedia Objects) (3 cr.); or CS 18000 (Programming I) (4 cr.).	*3-4 cr.*
STAT 35000 (Introduction to Statistics) (3 cr.)	*3 cr.*
One additional three-credit course in mathematics at 30000 level or above, approved by the Undergraduate Mathematics Committee.	*3 cr.*
Professional Education Courses	***33 credits***

EDCI 27000 (Introduction to Educational Technology and Computing) (3 cr.)
EDST 20000 (History and Philosophy of Education) (3 cr.)
EDCI 20500 (Exploring Teaching as a Career) (3 cr.)
EDCI 28500 (Multiculturalism and Education) (3 cr.)
EDPS 23500 (Learning and Motivation) (3 cr.)
EDPS 26500 (The Inclusive Classroom) (3 cr.)
EDCI 42500 (Teaching of Mathematics in Secondary Schools) (3 cr.)
EDCI 42600 (Teaching Mathematics in the Middle and Junior High School) (2 cr.);
EDCI 49800 (Supervised Teaching in Secondary Mathematics Education) (10 cr.)

Actuarial Science Interdisciplinary Program

An interdisciplinary program in actuarial science (www.purdue.edu/catalogs/science/actuarial.html) is offered jointly by the Department of Mathematics and the Department of Statistics.

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 35100. Entering the honors program indicates an intention to meet the more rigorous requirements of graduation "with honors" as outlined in the following text. 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 44000 (Real Analysis Honors), 44200 (Multivariate Analysis I Honors) and 45000 (Algebra Honors) in all options except Education, which requires only MA 44000 and 45000. In either case, a grade-point average of at least 3.5 is required in these courses.

Professional Practice Program

The Department of Mathematics participates in the Professional Practice Program (www.purdue.edu/catalogs/science/practice.html). If interested, a student should contact the Coordinator of the Professional Practice Program, Mathematics Department, Mathematical Sciences Building.

To be eligible for the Professional Practice Program, a student must:

1. Have completed one of the following calculus sequences:
    a. MA 16100 (Plane Analytic Geometry and Calculus I)/MA 16200 (Plane Analytic Geometry and Calculus II) (10 cr.) and MA 26100 (Multivariate Calculus) (4 cr.)
    b. MA 16500 (Analytic Geometry and Calculus I)/MA 16600 (Analytic Geometry and Calculus II) (8 cr.) and MA 26100 (Multivariate Calculus) (4 cr.)
    c. Calculus: MA 17300 (Calculus and Analytic Geometry II) (5 cr.) and MA 17400 (Multivariable Calculus) (4 cr.)
    d. MA 18100 (Honors Calculus I) (5 cr.) and MA 18200 (Honors Calculus II) (5 cr.)
    e. MA 27100 (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 CS 15800 (C Programming) (3 cr.); CS 17700 (Programming with Multimedia Objects) (4 cr.); or CS 18000 (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, with no grade lower than "C-."

Mathematics Minor Course Requirements	**12-13 credits**
One of the following: MA 35100 (Elementary Linear Algebra) (3 cr.); MA 51100 (Linear Algebra with Applications) (3 cr.); or MA 26500* (Linear Algebra) (3 cr.)	*3 cr.*
One of the following: MA 45300 (Elements of Algebra) (3 cr.); MA 45000 (Algebra Honors) (3 cr.); MA 34100 (Foundations of Analysis) (3 cr.); or MA 44000 (Real Analysis Honors) (3 cr.)	*3 cr.*
Two additional courses selected from the following: MA 30100 (An Introduction to Proof Through Real Analysis) (3 cr.); MA 34100 (Foundations of Analysis) (3 cr.); MA 36200 (Topics in Vector Calculus) (3 cr.) or MA 51000 (Vector Calculus) (3 cr.); MA 42500 (Elements of Complex Analysis) (3 cr.) or MA 52500 (Introduction to Complex Analysis) (3 cr.); MA 44000 (Real Analysis Honors) (3 cr.)	*3 cr.*
MA 37500 (Introduction to Discrete Mathematics) (3 cr.); MA 38500 (Introduction to Logic) (3 cr.); MA 45300 (Elements of Algebra) (3 cr.) or MA 45000 (Algebra Honors) (3 cr.); MA 45400 (Galois Theory) (3 cr.)	*3 cr.*
MA 35300 (Linear Algebra II with Applications)	*3 cr.*
MA 36600* (Differential Equations) (4 cr.) or MA 30300 (Differential Equations and Partial Differential Equations for Engineering and the Sciences) (3 cr.) or MA 30400 (Differential Equations and Analysis of Nonlinear Systems for Engineering and the Sciences) (3 cr.); MA 42800 (Fourier Analysis) (3 cr.); MA 52000	*3-4 cr.*

(Boundary Value Problems of Differential Equations) (3 cr.); MA 52300 (Introduction to PDEs); or (3 cr. MA 42800 (Fourier Analysis).

MA/STAT 41600 (Probability) (3 cr.) *3 cr.*

** MA 26600 with at least a "B-" can be used in place of MA 36600. MA 26200 will not be acceptable for the minor. Only one of MA 36600, 26600, 30300 or 30400 may be used in the minor.*

† For many students, MA 26500 may not be adequate preparation for upper-division mathematics classes. Students planning to minor in mathematics should consider taking MA 35100 instead. Only students with a very firm grasp of the MA 26500 material should contemplate taking MA 35300 without MA 35100.

Physics

Physics is the study of matter and energy and of 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 for professions such as law, medicine and finance.

A master's degree is desirable for research, advancement in secondary-school teaching in Indiana and for 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 "Introduction to Current Physics and Forefront Research" is offered in the first semester to introduce first-year students to 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. 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 (www.purdue.edu/catalogs/science/grad_requirements.html). 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. Advanced laboratory choices are available.

General Degree Requirements

Students should check the College of Science website, at www.science.purdue.edu, and speak with an academic advisor for the most up-to-date information and requirements on the College of Science.

Physics Requirements	**37-57 credits**
Students must complete the requirements for one of the following options: 1. Physics (49-50 credit hours in physics) 2. Physics Honors (62-63 credit hours in physics) 3. Applied Physics (67 credit hours in physics) 4. Applied Physics Honors (70 credit hours in physics) 5. Physics Teaching (46-47 credit hours in physics) Note: Option 5 (Physics Teaching) can be selected simultaneously with one of the other four options culminating in a double major that includes both programs.	
Science Requirements (All Options)	***8-10 credits***
CHM 11500 (General Chemistry) (4 cr.); CHM 12300 (General Chemistry for Engineers I) (4 cr.); or CHM 12500 (Introduction to Chemistry I) (5 cr.)	*4-5 cr.*
CHM 11600 (General Chemistry) (4 cr.); CHM 12400 (General Chemistry for Engineers II) (4 cr.); or CHM 12600 (Introduction to Chemistry II) (5 cr.)	*4-5 cr.*
Mathematics Requirements (All Options)	***12-15 credits***
MA 16500 (Analytic Geometry and Calculus I) (4 cr.) or MA 16100 (Plane Analytic Geometry and Calculus I) (5 cr.)	*4-5 cr.*
MA 16600 (Analytic Geometry and Calculus II) (4 cr.); MA 16200 (Plane Analytic Geometry and Calculus II) (5 cr.); MA 17300 (Calculus and Analytic Geometry II) (5 cr.); or MA 18100 (Honors Calculus II) (5 cr.).	*4-5 cr.*
MA 26100 (Multivariate Calculus) (4 cr.); MA 17400 (Multivariate Calculus) (4 cr.); MA 18200 (Honors Calculus II) (5 cr.); or MA 27100 (Several Variable Calculus) (5 cr.)	*4-5 cr.*
There are additional requirements of mathematical methods of physics for all physics programs. Information follows.	
Additional Requirements	***33-45 credits***
Students must also satisfy all additional requirements as stipulated by the College of Science. This includes: Statistics: STAT 30100 (Elementary Statistical Methods) (3 cr.); STAT 35000 (Introduction to Statistics) (3 cr.); STAT 50300 (Statistical	*3 cr.*

Methods for Biology) (3 cr.); STAT 51100 (Statistical Methods) (3 cr.); or equivalent.	
Computing: CS 15800 (C Programming) (3 cr.); CS 17700 (Programming with Multimedia Objects) (4 cr.); CS 18000 (Programming I) (4 cr.); or equivalent.	*3-4 cr.*
Composition, Technical Writing and Presentation	*6-7 cr.*
Teambuilding and Collaboration	*0-3 cr.*
Multidisciplinary Requirement	*0-4 cr.*
Language and Culture	*9-12 cr.*
General Education	*9 cr.*
Great Issues	*3 cr.*

There are many different ways to satisfy these requirements that may change over time. Therefore, there is no way to describe them fully here. Please refer to the College of Science website, www.science.purdue.edu, for more details. Also, some of the physics (and other) courses that satisfy physics requirements may simultaneously satisfy some of these college requirements as well. Please consult an academic advisor for more details.

Free Electives: (All Options) ***0-22 credits***

Free electives can be selected from any department within 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 the minimum set by the College of Science (currently 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 programs must have a grade-point average of 2.0 or above in all physics courses. For students majoring in Physics Honors or Applied Physics Honors programs, grades of "B-" or above must be maintained in all physics courses as well as a grade-point average of 3.0 or above in all physics courses. In addition, these honors students must maintain an overall grade-point average of 3.0 or above in all courses, and they cannot have a grade of "D" or below in any course. For students in the Physics Teaching Program, the minimum grade-point average requirement is 2.5 in content areas and 3.0 in professional education courses.

Physics Major

Students wishing to major in physics should complete the General Degree Requirements (www.purdue.edu/catalogs/science/physics_general.html) plus requirements specific to the physics option.

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,

mathematics, 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.)

Physics Major Course Requirements	**49-50 credits**
PHYS 17200 (Modern Mechanics)	*4 cr.*
PHYS 27200 (Electric and Magnetic Interactions)	*4 cr.*
PHYS 30600 (Mathematical Methods of Physics I)	*3 cr.*
PHYS 30700 (Mathematical Methods of Physics II)	*3 cr.*
PHYS 34000 (Modern Physics Laboratory)	*1 cr.*
PHYS 34400 (Modern Physics)	*4 cr.*
PHYS 31000 (Intermediate Mechanics)	*4 cr.*
PHYS 33000 (Intermediate Electricity and Magnetism)	*3 cr.*
PHYS 36000 (Quantum Mechanics)	*3 cr.*
PHYS 42200 (Waves and Oscillations)	*3 cr.*
PHYS 45000 (Intermediate Laboratory)	*2 cr.*
PHYS 51500 (Thermal and Statistical Physics)	*3 cr.*
Advanced Physics Laboratory Requirement: PHYS 53600 (Electronic Techniques for Research) (4 cr.) or approved advanced laboratory courses, e.g., PHYS 58000 (Computational Physics) (3 cr.)	*3-4 cr.*
Science/Engineering Electives Requirement: Two courses offered by any Science/ Engineering department at 30000 level or higher (or by approval)	*6 cr.*
Physics/Astronomy Elective Requirement: One physics or astronomy course at the 30000 level or higher (or by approval)	*3 cr.*
The two mathematical methods courses can be replaced by courses from the math department by petition, depending on the content and performance.	

Physics Honors Program

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. Some 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 microstructure 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 59300) 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 59300 introduces students to the type of research atmosphere that 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 17200 (Modern Mechanics) and PHYS 27200 (Electric and Magnetic Interactions) as freshmen. Transfer students or students from other majors who have taken PHYS 15200 (Mechanics) and PHYS 24100 (Electricity and Optics) (3 cr.) or PHYS 26100 (Electricity and Optics) (4 cr.) may switch into the physics honors major by taking PHYS 24200 (Introduction to Heat and Thermal Physics) (1 cr.) and PHYS 25200 (Electricity and Optics Laboratory) (1 cr.). All students should take PHYS 34000 (Modern Physics Laboratory); PHYS 34400 (Modern Physics); PHYS 42200 (Waves and Oscillations), and the two mathematical methods courses during the sophomore year. Admission to, and continuation in, the honors program is contingent upon satisfying the grade requirement described earlier.

Physics Honors Major Course Requirements	**62-63 credits**
PHYS 17200 (Modern Mechanics)	*4 cr.*
PHYS 27200 (Electric and Magnetic Interactions)	*4 cr.*
PHYS 30600 (Mathematical Methods of Physics I)*	*3 cr.*
PHYS 30700 (Mathematical Methods of Physics II)*	*3 cr.*
PHYS 34000 (Modern Physics Laboratory)	*1 cr.*
PHYS 34400 (Modern Physics)	*4 cr.*
PHYS 41000 (Physical Mechanics I Honors)	*3 cr.*
PHYS 41100 (Physical Mechanics II Honors)	*2 cr.*
PHYS 41600 (Thermal and Statistical Physic Honors)	*4 cr.*
PHYS 42200 (Waves and Oscillations)	*3 cr.*
PHYS 43000 (Electricity and Magnetism I Honors)	*3 cr.*
PHYS 43100 (Electricity and Magnetism II Honors)	*2 cr.*
PHYS 45000 (Intermediate Laboratory)	*2 cr.*
PHYS 46000 (Quantum Mechanics I Honors)	*3 cr.*
PHYS 46100 (Quantum Mechanics II Honors)	*3 cr.*
Advanced Physics Laboratory Requirement	
PHYS 53600 (Electronic Techniques for Research) (4 cr.) or approved advanced laboratory courses, e.g., PHYS 58000 (Advanced Computational Physics) (3 cr.)	*3-4 cr.*
Science/Engineering Electives Requirement: Two courses offered by any Science/Engineering department at the 30000 level or higher (or by approval)	*6 cr.*
Physics Specialty Electives Requirement: Two physics specialty courses at 50000 level	*6 cr.*
Senior Honors Project Requirement: PHYS 59300 (Independent Research), which leads to an approved written final report	*3 cr.*

*The two mathematical methods courses can be replaced by courses from the math department by petition, depending on the content and performance.

Applied Physics

The applied physics plan of study is especially geared toward providing the physics graduate with specific expertise in preparation for immediate employment in the corporate research world or in government laboratories or 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 offered by the colleges of Science and Engineering at Purdue.

The basic plan of study combines 37 credit hours of physics with 30 credit hours of applied electives. (See links on www.physics.purdue.edu.)

Applied Physics Course Requirements	**67 credits**
PHYS 17200 (Modern Mechanics)	*4 cr.*
PHYS 27200 (Electric and Magnetic Interactions)	*4 cr.*
PHYS 30600 (Mathematical Methods of Physics I)	*3 cr.*
PHYS 30700 (Mathematical Methods of Physics II)	*3 cr.*
PHYS 34000 (Modern Physics Laboratory)	*1 cr.*
PHYS 34400 (Modern Physics)	*4 cr.*
PHYS 31000 (Intermediate Mechanics)	*4 cr.*
PHYS 33000 (Intermediate Electricity and Magnetism)	*3 cr.*
PHYS 36000 (Quantum Mechanics)	*3 cr.*
PHYS 42200 (Waves and Oscillations)	*3 cr.*
PHYS 45000 (Intermediate Laboratory)	*2 cr.*
PHYS 51500 (Thermal and Statistical Physics)	*3 cr.*
Applied Electives Requirement: Additional courses in chosen applied area(s) as approved by the Department of Physics	*30 cr.*

Applied physics elective courses totaling 30 credit hours must be approved and signed by the advisor. A number of recommended specialties for this major are listed below. New combinations may possibly be arranged 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.

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.

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 and adding a senior honors project. All other applied physics requirements must still be met. In addition, the grade requirements must be satisfied as described earlier.

Applied Physics Honors Major Course Requirements	**70 credits**
PHYS 17200 (Modern Mechanics)	*4 cr.*
PHYS 27200 (Electric and Magnetic Interactions)	*4 cr.*
PHYS 30600 (Mathematical Methods of Physics I)*	*3 cr.*
PHYS 30700 (Mathematical Methods of Physics II)*	*3 cr.*
PHYS 34000 (Modern Physics Laboratory)	*1 cr.*
PHYS 34400 (Modern Physics)	*4 cr.*
PHYS 41000 (Physical Mechanics I Honors)	*3 cr.*
PHYS 41600 (Thermal and Statistical Physics Honors)	*4 cr.*
PHYS 42200 (Waves and Oscillations)	*3 cr.*

PHYS 43000 (Electricity and Magnetism I Honors)	*3 cr.*
PHYS 45000 (Intermediate Laboratory)	*2 cr.*
PHYS 46000 (Quantum Mechanics I: Honors)	*3 cr.*
Applied Electives Requirement: Additional courses in chosen applied area(s) as approved by the Department of Physics	*30 cr.*
Senior Honors Project Requirement: PHYS 59300 (Independent Research), which leads to an approved written final report	*3 cr.*

*The two mathematical methods courses can be replaced by courses from the math department by petition, depending on the content and performance.

Applied physics elective courses totaling 30 credit hours must be approved and signed by the advisor. A number of recommended specialties for this major were listed in the previous section. New combinations may possibly be arranged 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.

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 Undergraduate Academic Advising Office (www.science.purdue.edu/Current_Students/advising/index.html) and the Office of Professional Preparation and Licensure, www.teach.purdue.edu/licensure. Students completing this major have an option of simultaneously completing and earning one of the other four physics majors.

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.teach.purdue.edu/licensure/outstate.html. The professional semester 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 content area courses and 3.0 or above in education courses required to meet licensing requirements.

Physics Teaching Major Course Requirements	**46-47 credits**
PHYS 17200 (Modern Mechanics)	*4 cr.*
PHYS 27200 (Electric and Magnetic Interactions)	*4 cr.*
PHYS 30600 (Mathematical Methods of Physics I)	*3 cr.*
PHYS 30700 (Mathematical Methods of Physics II)	*3 cr.*
PHYS 31000 (Intermediate Mechanics)	*4 cr.*
PHYS 33000 (Intermediate Electricity and Magnetism)	*3 cr.*
PHYS 34000 (Modern Physics Laboratory)	*1 cr.*
PHYS 34400 (Modern Physics)	*4 cr.*
PHYS 36000 (Quantum Mechanics)	*3 cr.*
PHYS 42200 (Waves and Oscillations)	*3 cr.*
PHYS 45000 (Intermediate Laboratory)	*2 cr.*
Advanced Physics Laboratory Requirement: PHYS 53600 (Electronic Techniques for Research) (4 cr.) or approved advanced	*3-4 cr.*

laboratory courses, e.g., PHYS 58000 (Computational Physics) (3 cr.)

Science/Engineering Electives Requirement: *6 cr.*
Two courses offered by any Science/ Engineering department at the 30000 level or higher (or by approval)

Physics/Astronomy Elective Requirement: *3 cr.*
One Physics or Astronomy course at the 30000 level or higher (or by approval)

The two mathematical methods courses can be replaced by courses from the math department by petition, depending on the content and performance. In addition, there are 32 credits of professional education courses required.

Professional Education Courses ***33 credits***

EDCI 20500 (Exploring Teaching as a Career) (3 cr.)
EDCI 27000 (Introduction to Educational Technology and Computing) (3 cr.)
EDCI 28500 (Multiculturalism and Education) (3 cr.)
EDCI 42400 (The Teaching of Earth and Physical Sciences in the Secondary Schools) (3 cr.)
EDCI 42800 (Teaching Science in the Middle and Junior High School) (2 cr.)
EDCI 49800 (Supervised Teaching in Secondary Mathematics Education) (10 cr.);
EDPS 23500 (Learning and Motivation) (3 cr.)
EDPS 26500 (The Inclusive Classroom) (3 cr.)
EDST 20000 (History and Philosophy of Education) (3 cr.)

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 Purdue Graduate School as a master's candidate in physics with a specialization 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 Purdue Graduate School. Note: Physics hours include 6 hours of mathematics or mathematical methods.

Professional Practice Program. The Department of Physics participates in the Professional Practice Program. Interested students can contact the Professional Practice Coordinator, Department of Physics, Physics Building, 765-494-5383.

A student with a grade index of 3.0 or better in physics and 2.8 or better overall is eligible to apply for the Professional Practice Program. The program typically starts after the student's first year.

The department 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 at Purdue University. In addition, the GPA over all physics (PHYS) courses must be 2.0 or higher.

Physics Minor Course Requirements	**10-11 credits**
PHYS 34000 (Modern Physics Laboratory)	*1 cr.*
PHYS 34200 (Modern Physics) (3 cr.) or PHYS 34400 (Modern Physics) (4 cr.)	*3-4 cr.*
Physics Electives Requirement: Six additional credits at the 30000 level or higher in physics	*6 cr.*

Astronomy Minor

The astronomy minor provides a strong background in astronomy and astrophysics. This program is administered by the Department of Physics.

The following courses describe the minimum coursework necessary to earn a minor in astronomy. All courses must be taken at Purdue University. In addition, the GPA over all Physics (PHYS) and Astronomy (ASTR) courses must be 2.0 or higher.

Astronomy Minor Course Requirements	**15-16 credits**
PHYS 34200 (Modern Physics) (3 cr.) or PHYS 34400 (Modern Physics) (4 cr.)	*3-4 cr.*
ASTR 36300 (Solar System Astronomy)	*3 cr.*
ASTR 36400 (Stars and Galaxies)	*3 cr.*
ASTR 37000 (Cosmology)	*3 cr.*
Physics/Astronomy Electives Requirement: Three credits chosen from PHYS/ASTR 56000 (Stellar Evolution) (3 cr.); PHYS/ASTR 56100 (Galaxies and Large Scale Structure) (3 cr.); PHYS/ASTR 56200 (Introduction to High Energy Astrophysics) (3 cr.); PHYS/ASTR 56300 (Astroparticle Physics) (3 cr.); or an unapproved PHYS/ASTR course at or above the 40000 level.	*3 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 and experiments, 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 — prepares students for careers in applied statistics, statistical programming and other areas that require broad knowledge of statistical ideas and techniques.
2. Mathematical statistics option — prepares students for graduate work in both applied and mathematical statistics or a quantitative field; can lead to a double major in statistics and mathematics (www.purdue.edu/catalogs/science/statistics_general.html).

Students who complete the mathematical statistics option can arrange to obtain the M.S. in Applied Statistics degree (www.purdue.edu/catalogs/science/statistics_opportunities.html) in one additional calendar year of study.

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 (www.purdue.edu/catalogs/science/actuarial.html) jointly administered by the Department of Statistics and the Department of Mathematics. Students who complete a major in actuarial science will also, as a subset of these requirements, already fulfill the requirement for an applied statistics major. Most actuarial science majors also obtain a management minor.

The department also participates in the Professional Practice Program (www.purdue.edu/catalogs/science/practice.html).

Statistics is one of the few major disciplines in which having expertise can have a significant effect in fields as diverse as analytics, 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 develop methods for collecting and interpreting data gathered in science, 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 methods to discover relationships between disease state 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.

Statisticians with advanced degrees develop and evaluate statistical methods along with the mathematical and computational theories supporting these methods.

The most recent information about the statistics plans of study and opportunities is available at the department website (www.stat.purdue.edu/academic_programs/undergraduate/majorIndex.html).

Statistics

General Degree Requirements

All statistics majors must satisfy the following general degree requirements. A total of 124 credit hours is required. Some lower-level courses cannot be used as credit toward the degree. A higher-level course in the same subject area can be substituted for a requirement listed below. Consult academic advisors for details.

Statistics Major Course Requirements — Mathematical Statistics Option	**124 credits**
This rigorous program can lead to a double major in statistics and mathematics with the addition of MA 45300 (Elements of Algebra I) or MA 45000 (Algebra Honors), and MA 36600 (Ordinary Differential Equations). It prepares students for graduate work in both applied and mathematical statistics or a quantitative field. Students should consider electives in mathematics or additional courses in applied statistics. MA 30100 (Introduction to Proof through Real Analysis) is encouraged for most students as preparation for MA 34100 (Foundations of Analysis).	
MA 26100 (Multivariate Calculus) (4 cr.), MA17400 (Multivariate Calculus) (4 cr.), MA 18200 (Honors Calculus II) (5 cr.), or MA 27100 (Several Variable Calculus) (5 cr.)	*4-5 cr.*
STAT 35000 (Introduction to Statistics)	*3 cr.*
MA 35100 (Elementary Linear Algebra)	*3 cr.*

MA 35300 (Linear Algebra)	*3 cr.*
MA 36200 (Topics in Vector Calculus) (3 cr.); MA 44200 (Multivariate Analysis Honors I) (3 cr.); or MA 51000 (Vector Calculus) (3 cr.)	*3 cr.*
MA 34100 (Foundations of Analysis) (3 cr.) or MA 44000 (Real Analysis Honors) (3 cr.)	*3 cr.*
STAT 41600 (Probability)	*3 cr.*
STAT 41700 (Statistical Theory)	*3 cr.*
STAT 51200 (Applied Regression Analysis)	*3 cr.*
Statistics Elective:	
One of STAT 42000 (Introduction to Time Series); STAT 51300 (Statistical Quality Control); STAT 51400 (Design of Experiments); or IE 53000 (Quality Control)	*3 cr.*
Mathematics Elective:	
One of the following: MA 36600 (Ordinary Differential Equations) (4 cr.); MA 37500 (Introduction to Discrete Math) (3 cr.); MA 42100 (Linear Programming and Optimization Techniques) (3 cr.); MA 42500 (Elements of Complex Analysis) (3 cr.); MA 45000 (Algebra Honors) (3 cr.); MA 45300 (Elements of Algebra I) (3 cr.); or MA 52000 (Fourier Series and Boundary Value Problems) (3 cr.)	*3 cr.*
Statistics Major Course Requirements — Applied Statistics Option	**124 credits**

This option prepares students for careers in applied statistics, statistical programming or other areas that require broad knowledge of statistical ideas and techniques. Employers in science, government, business and industry appreciate this breadth. Students are encouraged to choose electives or a minor program in a field to which statistics is applied. 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.

MA 26100 (Multivariate Calculus) (4 cr.), MA17400 (Multivariate Calculus) (4 cr.), MA 18200 (Honors Calculus II) (5 cr.), or MA 27100 (Several Variable Calculus) (5 cr.)	*4-5 cr.*
STAT 35000 (Introduction to Statistics)	*3 cr.*
MA 35100 (Linear Algebra)	*3 cr.*
MA 36200 (Topics in Vector Calculus) or STAT 42000 (Introduction to Time Series)	*3 cr.*
STAT 41600 (Probability)	*3 cr.*
STAT 41700 (Statistical Theory)	*3 cr.*
STAT 51200 (Applied Regression Analysis)	*3 cr.*
Statistics Electives:	
Two of the following: STAT 42000 (Introduction to Time Series) (3 cr.); STAT 49000 (Actuarial Models) (4 cr.); STAT 47300 (Actuarial Models II) (3 cr.); STAT 50600 (Statistical Programming and Data Management) (3 cr.); STAT 51300 (Statistical Quality Control) (3 cr.); STAT 51400 (Design of Experiments) (3 cr.); STAT 52200 (Sampling and Survey Techniques) (3 cr.).	*6-7 cr.*

See "Additional Requirements" for both major options in Statistics.

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. 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, although some lower-level courses cannot be used.

Honors Program

The designation "statistics honors" 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 44000 (Real Analysis Honors) (3 cr.) for MA 34100 (Foundations of Analysis) (3 cr.)
• MA 44200 (Multivariate Analysis I Honors) (3 cr.) or MA 51000 (Vector Calculus) (3 cr.) for MA 36200 (Topics in Vector Calculus) (3 cr.)
• STAT 51600 (Basic Probability and Applications) (3 cr.) for STAT 41600 (Probability) (3 cr.)
• STAT 51700 (Statistical Inference) (3 cr.) for STAT 41700 (Statistical Theory) (3 cr.)

Actuarial Science

An interdisciplinary program in actuarial science (www.purdue.edu/catalogs/science/actuarial.html) is offered jointly by the Department of Mathematics and the Department of Statistics.

Special Programs and Opportunities

Professional Practice Program

The Department of Statistics participates in the Professional Practice Program (www.purdue.edu/catalogs/science/practice.html). Interested students should contact the Coordinator of the Professional Practice Program, Department of Statistics, Mathematical Sciences Building. The department coordinator will have information about available programs and will be able to offer advice.

Fifth-Year 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 are available from the Purdue Graduate School and on the Department of Statistics website (www.stat.purdue.edu/). Students considering the fifth-year program should consult a faculty advisor as early as possible about suitable electives in their undergraduate program.

Statistics Minor

The statistics minor offers a strong quantitative background for students majoring in another discipline. Because first courses in probability and statistics are taught in several departments, the minor allows some courses taken outside the Department of Statistics. Five courses are required. At least three of these courses must be listed in the Department of Statistics.

Statistic Minor Course Requirements	**15 credits**
1. An introductory statistics course:	*3 cr.*
STAT 35000 (Introduction to Statistics); STAT 50300 (Statistical Methods for Biology); STAT 51100 (Statistical Methods) (3 cr.)	
2. An introductory probability course: STAT 22500 (Introduction to Probability Models); STAT 31100 (Introductory Probability); STAT 41600 (Probability); or an equivalent course in another department.	*3 cr.*
3. Applied Regression Analysis course: STAT 51200 (Applied Regression Analysis)	*3 cr.*
4. Two of the following courses:	*6 cr.*
STAT 41600 (Probability) (3 cr.) (if not used to satisfy requirement #2) STAT 41700 (Statistical Theory) (3 cr.) STAT 51300 (Statistical Quality Control) (3 cr.) STAT 51400 (Design of Experiments) (3 cr.) IE 33600 (Operations Research-Stochastic Models) (3 cr.)	

Interdisciplinary Science

The interdisciplinary science major is designed to provide College of Science students with a broad base in the sciences. By combining a primary area of science study, an interdisciplinary science core, a supporting area of academic interest and the core curriculum shared by all College of Science programs, students explore how the disciplines of science come together to identify and solve scientific challenges. Students customize the major by selecting a departmental or interdepartmental primary area based in science and a supporting area that complements or enhances the primary area. This supporting area may be an approved minor from any college or school at the University or a concentration of 18 credits of courses with a unifying theme. There is a primary area representing each department in the College of Science; however, cross-disciplinary areas may be explored and added as appropriate. With the help of either a faculty member or an academic advisor, students are encouraged to petition for approval of their supporting area.

Students completing the interdisciplinary science major have gone on to a variety of careers — some in, and others out of, the world of science. These careers include medicine, lay and other advanced-study professions, scientific sales, technical and scientific writing, computer programming and engineering.

The most recent information is available at the College of Science website (www.science.purdue.edu/).

General Degree Requirements

Students should check the College of Science website (www.science.purdue.edu/) and speak with an academic advisor for the most up-to-date information and requirements.

Interdisciplinary Science Major Course Requirements **50-66 credits**

Interdisciplinary Core: (Check primary area prerequisites before selecting core courses.) **38-48 credits**

Biology (select one option): **7-8 credits**

1. BIOL 11000 (Fundamentals of Biology I) (4 cr.) and BIOL 11100 (Fundamentals of Biology II) (4 cr.)
2. BIOL 12100 (Biology I: Diversity, Ecology, and Behavior) (2 cr.) BIOL 13100 (Biology II: Development, Structure, and Function of Organisms); and BIOL 13500 (First-Year Biology Laboratory) (2 cr.)

Chemistry (select one option): **8-10 credits**

1. CHM 11500 (General Chemistry) (4 cr.) and CHM 11600 (General Chemistry) (4 cr.)
2. CHM 12500 (Introduction to Chemistry I) (5 cr.) and CHM 12600 (Introduction to Chemistry II) (5 cr.)

Computer Science (select one course): **3-4 credits**

1. CS 15800 (C Programming) (3 cr.)
2. CS 15900 (Programming Applications for Engineers) (3 cr.)
3. CS 17700 (Programming with Multimedia Objects) (4 cr.)
4. CS 18000 (Programming I) (4 cr.)

EAS (select one option): **3-4 credits**

1. One of: EAS 10000 (Planet Earth) (3 cr.); EAS 10900 (The Dynamic Earth) (3 cr.); EAS 11100 (Physical Geology) (3 cr.)
2. Both EAS 22100 (Survey of Atmospheric Science) (3 cr.) or EAS 22500 (Science of the Atmosphere) (3 cr.); and EAS 23000 (Laboratory in Atmospheric Science) (1 cr.)

Math (select one option): **6-10 credits**

1. MA 16100 (Plane Analytic Geometry and Calculus I) (5 cr.) and MA 16200 (Plane Analytic Geometry and Calculus II) (5 cr.)
2. MA 16500 (Analytic Geometry and Calculus I) (4 cr.) and MA 16600 (Analytic Geometry and Calculus II) (4 cr.)
3. MA 22300 (Introductory Analysis I) (3 cr.) and MA 22400 (Introductory Analysis II) (3 cr.)
4. MA 23100 (Calculus for Life Sciences I) (3 cr.) and MA 23200 (Calculus for Life Sciences II) (3 cr.)

Physics (select one option): **8-9 credits**

1. PHYS 17200 (Modern Mechanics) (4 cr.); PHYS 24100 (Electricity and Optics) (3 cr.); PHYS 25200 (Electricity and Optics Laboratory) (1 cr.)
2. PHYS 17200 (Modern Mechanics) (4 cr.) and PHYS 27200

(Electric and Magnetic Interactions) (4 cr.)

3. PHYS 22000 (General Physics) (4 cr.) and PHYS 22100 (General Physics) (4 cr.)

Statistics (select one course):	**3 credits**
STAT 35000 (Introduction to Statistics) (3 cr.); STAT 50300 (Statistical Methods for Biology) (3 cr.); or STAT 51100 (Statistical Methods) (3 cr.)	
Primary Area	***12-18 credits***
Biological Sciences:	**15 credits**
BIOL 23100 (Cell Structure and Function)	*3 cr.*
BIOL 23200 (Laboratory in Cell Biology)	*2 cr.*
BIOL 24100 (Genetics and Molecular Biology)	*3 cr.*
BIOL 24200 (Laboratory in Genetics and Molecular Biology)	*2 cr.*
BIOL 28600 (Introduction to Ecology and Evolution)	*2 cr.*
One of: BIOL 39500 (Macromolecules) (3 cr.); BIOL 36600 (Principles of Development) (4 cr.); BIOL 32800 (Principles of Physiology) (4 cr.) BIOL 43800 (General Microbiology) (3 cr.) and BIOL 43900 (Laboratory in Microbiology) (2 cr.)	*3-5 cr.*
Chemistry:	**16 credits**
CHM 24100 (Introductory Inorganic Chemistry)	*4 cr.*
One of the following: a. CHM 25500 (Organic Chemistry (3 cr.), CHM 25501 (Organic Chemistry Laboratory) (1 cr.), CHM 25600 (Organic Chemistry) (3 cr.) and CHM 25601 (Organic Chemistry Laboratory) (1 cr.) (8 cr.) b. CHM 26505 (Organic Chemistry) (3 cr.), CHM 26300 (Organic Chemistry Laboratory) (1 cr.), CHM 26605 (Organic Chemistry) (3 cr.) and CHM 26400 (Organic Chemistry Laboratory) (1 cr.)	*8 cr.*
CHM 37200 (Physical Chemistry)	*4 cr.*
Computer Science:	**16 credits**
Note: For this primary area, CS 18000 (Programming I) (4 cr.) and MA 16100 (Plane Analytic Geometry and Calculus I) (5 cr.) or equivalent must be part of the Interdisciplinary core.	
CS 18200 (Foundations of Computer Science)	*3 cr.*
CS 24000 (Programming in C)	*3 cr.*
CS 25000 (Computer Architecture)	*4 cr.*
CS 25100 (Data Structures)	*3 cr.*
CS elective at or above the 30000 level	*3 cr.*
Earth, Atmospheric and Planetary Sciences:	**16 credits**
Note: For this primary area, EAS 11100 (Physical Geology) (3 cr.) or equivalent must be part of the Interdisciplinary core.	
EAS 23000 (Laboratory in Atmospheric Science (1 cr.) and either 22100 (Survey of Atmospheric Science) (3 cr.) or EAS 22500 (Science of the Atmosphere) (3 cr.)	*4 cr.*
Any EAS course at or above the 20000 level or EAS 11200 (Earth through Time)	*12 cr.*

Mathematics:	**17 credits**
Note: For this primary area, MA 16100 (Plane Analytic Geometry and Calculus I) (5 cr.) and MA 16200 (Plane Analytic Geometry and Calculus II) (5 cr.) or equivalent must be part of the Interdisciplinary core.	
MA 26100 (Multivariate Calculus) (4 cr.) or MA 27100 (Several Variable Calculus) (5 cr.)	*4 cr.*
MA 36600 (Ordinary Differential Equations) (3 cr.) or MA 26200 (Linear Algebra and Differential Equations) (4 cr.)	*3 cr.*
MA 35100 (Elementary Linear Algebra)	*3 cr.*
One of the following: a. MA 45000 (Algebra Honors) (3 cr.) or MA 45300 (Elements of Algebra I) (3 cr.) b. MA 34100 (Foundations of Analysis) (3 cr.) c. MA 44000 (Real Analysis Honors) (3 cr.)	*3 cr.*
MA elective at or above 30000 level	*3 cr.*
Physics:	**13-14 credits**
Note: For this primary area, PHYS 17200 (Modern Mechanics) (4 cr.), PHYS 27200 (Electric and Magnetic Interactions) (4 cr.), and MA 16100 (Plane Analytic Geometry and Calculus I) (5 cr.), MA 16200 (Plane Analytic Geometry and Calculus II) (5 cr.), or equivalent must be part of the Interdisciplinary core.	*4 cr.*
MA 26100 (Multivariate Calculus) (4 cr.) or equivalent	
PHYS 34200 (Modern Physics) (3 cr.) or PHYS 34400 (Modern Physics) (4 cr.)	*3-4 cr.*
Physics elective at or above the 30000 level	*6 cr.*
Statistics:	**12-13 credits**
Note: For this primary area, MA 16100 (Plane Analytic Geometry and Calculus I) (5 cr.) and MA 16200 (Plane Analytic Geometry an Calculus II) (5 cr.), or equivalent must be part of the Interdisciplinary core.	
One of the following: STAT 22500 (Introduction to Probability Models) (3 cr.), STAT 31100 (Introductory Probability) (3 cr.), STAT 41600 (Probability) (3 cr.), STAT 51600 (Statistical Consulting Problem) (3 cr.)	*3 cr.*
STAT 51200 (Applied Regression Analysis)	*3 cr.*
STAT 51300 (Statistical Quality Control) (3 cr.) or STAT 51400 (Design of Experiments) (3 cr.)	*3 cr.*
One of the following: STAT 51300 (Statistical Quality Control) (3 cr.), STAT 51400 (Design of Experiments) (3 cr.), STAT 41700 (Statistical Theory) (3 cr.), MA 26100 (Multivariate Calculus) (4 cr.), IE 333500 (Operations Research — Optimization) (3 cr.) or IE 33600 (Operations Research Stochastic Models) (3 cr.)	*3-4 cr.*
Environmental Biology:	**17 credits**
BIOL 23100 (Cell Structure and Function)	*3 cr.*
BIOL 24100 (Genetics and Molecular Biology)	*3 cr.*
BIOL 28600 (Introduction to Ecology and Evolution)	*2 cr.*
BIOL 48300 (Environmental and Conservation Biology)	*3 cr.*
BIOL 58500 (Ecology)	*3 cr.*
One of: a. BIOL 39500 (Macromolecules) (3 cr.); BIOL 36600 (Principles	*3-5 cr.*

of Development) (4 cr.); BIOL 32800 (Principles of Physiology) (4 cr.)

b. BIOL 43800 (General Microbiology) (3 cr.) and BIOL 43900 (Laboratory in Microbiology) (2 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 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. See the list of minors (www.science.purdue.edu/Current_Students/minors/index.html#somelink). Any plan must be approved by the dean or designee.

Sample Supporting Area for Environmental Biology:

CE 35000 (Environmental Engineering) (3 cr.); FNR 48800 (Global Environmental Issues) (3 cr.); PHIL 29000 (Environmental Ethics) (3 cr.); POL 42900 (Carbon, Climate and Society) (3 cr.); POL 52000 (Models in Climate Change) (3 cr.); POL 52300 (Environmental Policy and Public Policy) (3 cr.). Other courses may be used upon approval.

Additional Requirements General Degree Requirements ***30-44 credits***

Composition and presentation — see related section. *6-10 credits*

Teambuilding and collaboration — see related section. *1-3 credits*

Multidisciplinary experience — see related section. *3-9 credits*

Language and culture *9 credits*

Science majors are expected to have proficiency in another language in addition to their native language. Competence in the second language must be demonstrated to the third semester, or to the second semester (with an additional culture or diversity class) or by an approved study abroad experience. See "Language and Culture" section.

General education *12 credits*

Students must complete three credits of a course approved for Great Issues and nine credits of social studies, humanities and/or management. Includes the two-course sequence in social studies or humanities. See "General Education" section.

Free Electives

Free electives can be selected from almost any department of the University, and 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 degree requirements or that do not count for credit in the College of Science. Students must take as many free electives as is needed to bring the credit hour total to 124 credits.

Course Information

See courses at https://selfservice.mypurdue.purdue.edu/prod/bwckctlg.p_disp_dyn_ctlg

Contact Science

For information about undergraduate programs in the College of Science contact:

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Phone: 765-494-1771