

INFORMATION FOR BIOLOGY MAJORS 2008-2009

Program Web Site: <http://bio.bd.psu.edu/>



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Erie The Behrend
College

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Biology Program

Penn State Erie, The Behrend College (<http://www.behrend.psu.edu/>)

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Information for Biology (BIOBD) Majors

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2008-2009 Academic Year

All students at Penn State University are assigned an academic adviser. At Penn State Erie, The Behrend College that adviser is a faculty member. You can find your assigned adviser through eLion (<http://elion.psu.edu/>). It is important to visit with your adviser at least once a semester to ensure proper progress towards the completion of your degree is being made. If you wish to change your adviser, stop by the School of Science Office (001 Prischak), they will help you do that.

The information provided should be understood and used as a guide for the academic program in Biology at Penn State Erie, The Behrend College. The curriculum in Biology is designed to provide students with a strong background in the biological sciences. It provides preparation for students who intend to secure advanced degrees through graduate study, students who intend to prepare for careers in medicine or health related fields, and students preparing for careers with companies or agencies requiring employees with biological backgrounds.

The curriculum has six options allowing students to choose an area of specialization which will best meet their career goals. In addition to selecting an option, students are strongly encouraged to participate in faculty supervised research or internships. The options are: **General Biology** – various areas of modern biology; **Ecology, Evolution, and Behavior** – theoretical, practical, and applied ecology and evolution of plants and animals; **Genetics and Developmental Biology** – genetics and developmental biology of plants and animals; **Molecular and Cellular Biology and Biochemistry** – molecular and cellular mechanisms of biology; **Accelerated Health Programs** – allows exceptional students, who gain early admission to a professional school, to fulfill option requirements with academic credits taken during the first professional year (*this option is in support of “3+4” programs only*), and **Medical Technology** – prepares students for careers in clinical laboratories. For the Bachelor of Science degree in biology, a minimum of 124 credits are required. The first four semesters of all six options are nearly identical¹.

¹ Students in the Accelerated Health Programs option will need to take five additional credits during semesters three and four in order to obtain the required credits during three years.

A student enrolled in the BIOBD major must earn at least a grade of C in each 200-, 300-, and 400-level course in the major field (BIOL, MICRB, B M B, and other life science course, as offered). A student must also earn a C or better in BIOL 110, CHEM 110, and MATH 140.

Course Scheduling

To the extent possible students in all options should take the 100- and 200-level courses in biology during the first two years. Postponing such courses until the junior and senior year may create serious conflicts with required courses in the option. Because 100- and 200-level courses may be offered at the same time as 400-level courses, dropping one of these courses may make it impossible to schedule the other courses needed the following semester. Be sure to plan the next semester before dropping a course.

Suggested Course Scheduling Sequence for Semesters 1-4

The following roster of courses is a suggested sequence to be taken during semesters 1 to 4 for students planning to major in Biology in any of the six options. This sequence may vary, depending on a particular background and any requirements for remedial course work. Some of the required courses are only offered in the semesters indicated. For example BIOL 240W is only offered fall semesters while BIOL 220W and 230W are only offered in the spring semester. CHEM 112 and 113 are only offered in the spring semester and the organic chemistry sequence CHEM 210, 212, 213 must be started during the fall semester or the organic chemistry sequence CHEM 202 and 203 must be started during the spring semester.

All Options – Semesters 1-4

<u>First Semester</u>	<u>Second Semester</u>
BIOL 110S or BIOL 110T Biology: Concepts	BIOL 220W Biology: Populations
ENGL 015 Composition & Rhetoric	MATH 140 Calculus I
CHEM 110 Chemical Principles I	CHEM 112 Chemical Principles II
CHEM 111 Chemistry Lab I	CHEM 113 Chemistry Lab II
GS/GH/GA General Education	GS/GH/GA General Education
GHA (Health and Physical Activity)	GHA (Health and Physical Activity)
<u>Third Semester</u>	<u>Fourth Semester</u>
BIOL 240W Biology: Systems	BIOL 220W Biology: Molecular
CHEM 210 and 213 Organic Chemistry I or Elective	CHEM 212 and 213 Org Chem II or CHEM 202 (Org Chem I)
MATH 141 Calculus II	CAS 100 Effective Speech
GS/GH/GA General Education	STAT 250 Biostatistics
² Two credits of electives (From School approved list)	GS/GH/GA General Education
	² GS/GH/GA General Education

² Accelerated Health Programs option only

Suggested Course Scheduling Sequence for Semesters 5-8

Suggested scheduling for each of the six options is listed on the following pages. All prescribed courses within all options are offered yearly, however, some of the supporting level 400-level courses are offered in alternate years. Thus, students need to be aware of when supporting 400-level courses are offered, in order to schedule the appropriate courses as necessary.

General Biology Option¹ – Semesters 5-8

<u>Fifth Semester</u>	<u>Sixth Semester</u>
BIOL 322 Genetic Analysis	BIOL, MICRB, or B M B 400-level selection
BIOL 223 Laboratory in Genetics	BIOL, MICRB, or B M B 400-level selection
BIOL, MICRB, or B M B 400-level selection or MICRB 201 and 203 (if interested in microbiology)	ENGL 202C Technical Writing
PHYS Selection – Physics I (PHYS 250 or PHYS 211)	PHYS Selection – Physics II (PHYS 251 or PHYS 212)
GS/GH/GA General Education	GS/GH/GA General Education
Elective (From School approved list) or CHEM 203 (Org Chem II) (if you take CHEM 202)	
<u>Seventh Semester</u>	<u>Eighth Semester</u>
BIOL, MICRB, or B M B 400-level selection	BIOL, MICRB, or B M B 400-level selection
BIOL, MICRB, or B M B 400-level selection	BIOL 427 Evolution
PHYS 213 or 214, if you take PHYS 211 and 212)	Electives (From School approved list)
Electives (From School approved list)	

¹ One 400-level selection must be BIOL 402W Experimental Design

Ecology, Evolution, and Behavior Option¹ – Semesters 5-8

<u>Fifth Semester</u>	<u>Sixth Semester</u>
BIOL 322 Genetic Analysis	B M B 406 Molecular Biology
BIOL 223 Laboratory in Genetics	BIOL, MICRB, or B M B 400-level selection
BIOL, MICRB, or B M B 400-level selection	ENGL 202C Technical Writing
PHYS Selection – Physics I (PHYS 250 or PHYS 211)	PHYS Selection – Physics II (PHYS 251 or PHYS 212)
GS/GH/GA General Education	GS/GH/GA General Education
Elective (From School approved list) or CHEM 203 (Org Chem II) (if you take CHEM 202)	
<u>Seventh Semester</u>	<u>Eighth Semester</u>
BIOL, MICRB, or B M B 400-level selection	BIOL, MICRB, or B M B 400-level selection
BIOL, MICRB, or B M B 400-level selection	BIOL 427 Evolution
PHYS 213 or 214, if you take PHYS 211 and 212)	Electives (From School approved list)
Electives (From School approved list)	

¹ One 400-level selection must be BIOL 402W Experimental Design

Genetics and Development Option – Semesters 5-8

<u>Fifth Semester</u>	<u>Sixth Semester</u>
BIOL 322 Genetic Analysis	BIOL, MICRB, or B M B 400-level selection
BIOL 223 Laboratory in Genetics	BIOL, MICRB, or B M B 400-level selection
PHYS Selection – Physics I (PHYS 250 or PHYS 211)	PHYS Selection – Physics II (PHYS 251 or PHYS 212)
MICRB 201 Microbiology	ENGL 202C Technical Writing
MICRB 202 Microbiology Laboratory	Elective (From School approved list)
GS/GH/GA General Education	
<u>Seventh Semester</u>	<u>Eighth Semester</u>
BIOL, MICRB, or B M B 400-level selection	BIOL, MICRB, or B M B 400-level selection
BIOL, MICRB, or B M B 400-level selection	BIOL 427 Evolution
PHYS 213 or 214, if you take PHYS 211 and 212)	Electives (From School approved list)
Electives (From School approved list)	
GS/GH/GA General Education	

Molecular and Cellular Biology and Biochemistry Option – Semesters 5-8

<u>Fifth Semester</u>	<u>Sixth Semester</u>
BIOL 322 Genetic Analysis	B M B 406 Molecular Biology
BIOL 223 Laboratory in Genetics	BIOL, MICRB, or B M B 400-level selection
PHYS Selection – Physics I (PHYS 250 or PHYS 211)	PHYS Selection – Physics II (PHYS 251 or PHYS 212)
MICRB 201 Microbiology	ENGL 202C Technical Writing
MICRB 202 Microbiology Laboratory	Elective (From School approved list)
GS/GH/GA General Education	
<u>Seventh Semester</u>	<u>Eighth Semester</u>
BIOL, MICRB, or B M B 400-level selection	B M B 402 Cellular Biochemistry
BIOL, MICRB, or B M B 400-level selection	B M B 403 Biochemistry Laboratory
CHEM 472 General Biochemistry I	BIOL 427 Evolution
PHYS 213 or 214, if you take PHYS 211 and 212)	Electives (From School approved list)
Electives (From School approved list)	
GS/GH/GA General Education	

Accelerated Health Programs Option – Semesters 5-8

<u>Fifth Semester</u>	<u>Sixth Semester</u>
BIOL 322 Genetic Analysis	B M B 402 Cellular Biochemistry
BIOL 223 Laboratory in Genetics	B M B 403 Biochemistry Laboratory
BIOL 421 Comparative Anatomy	PHYS Selection – Physics II (PHYS 251)
PHYS Selection – Physics I (PHYS 250)	ENGL 202C Technical Writing
MICRB 201 Microbiology	GS/GH/GA General Education
MICRB 202 Microbiology Laboratory	Electives (From School approved list)
<u>Seventh and Eighth Semesters (21 credits)</u> Professional School Academic Courses	

Medical Technology Option – Semesters 5-8

<u>Fifth Semester</u>	<u>Sixth Semester</u>
BIOL 322 Genetic Analysis	BIOL, or B M B 400-level selection
BIOL 223 Laboratory in Genetics	GS/GH/GA General Education
MICRB 201 Microbiology	PHYS 251 - Physics II
MICRB 202 Microbiology Laboratory	ENGL 202C Technical Writing
CHEM 221 Analytical Chemistry (if needed)	GS/GH/GA General Education
PHYS 250 - Physics I	
CHEM 203 (Org Chem II) (if you take CHEM 202)	
<u>Seventh Semester</u>	<u>Eighth Semester</u>
MICRB 405A Chemistry	MICRB 405E Microbiology
MICRB 405C Hematology	MICRB 405B Urinalysis
MICRB 405F Serology and Immunology	MICRB 405D Immunohematology
MICRB 408 Laboratory	

School of Science Approved List of Courses

All courses listed in the Pennsylvania State University Bulletin except those specifically listed in the table of non-approved courses below are approved courses and can be used as supporting course electives.

School of Science Non-approved List of Courses

The following courses **MAY NOT** be used to fulfill any of the degree requirements for the Bachelor of Science in biology (BIOBD):

BIOL no course under 100	MATH no course under 140; 140A** (2 of 6 cr)
BI SC 001, 002, 003, 004	MICRB 106, 107
B M B 001, 003	PHYS 001, 150, 151
CHEM 001, 003, 101, 106** (2 of 5 cr) , 108	PH SC 007, 008, 011
CMPSC 001, 100	LL ED 005, 010
ENGL 004, 005	STAT 100, 200

** Please note that in some of the above courses only a specified number of the credits count towards graduation: CHEM 106 (only 3 out of 5 credits count), and MATH 140A (only 4 out of 6 credits count). However, all credits earned at Penn State count in determining your grade-point average (GPA). Any exceptions will be evaluated by the Biology Program Chair on a case-by-case basis.

Requirements for Entrance to Major in Biology

A first-year student entering Science at Penn State Behrend with an intended major in Biology initially is placed as a student in BCSCN/BIOLOGY. During the third semester students will declare a **MAJOR** and **OPTION** in Biology, and thus will become a full-fledged major in the Biology program. In addition to the requirements described by University policies, all students applying for entrance to the biology major at Behrend College: 1) attained at least a 2.00 cumulative grade point average; 2) completed BIOL 110 GN(4), CHEM 110 GN(3), MATH 140 GQ(4), and earned a grade of C or better in each of these courses; and 3) completed at least one of the following courses with a grade of C or better: BIOL 220W GN(4), BIOL 230W GN(4), or BIOL 240W GN(4).

"C" Grades in Biology

To graduate, a student must have achieved a GPA of at least 2.00 in the prescribed, additional, and supporting courses in the major AND overall course work. In addition, a candidate must earn a grade of C or better in all 200-, 300-, and 400-level courses within courses in the major field. If a student receives a grade below C, in a 200-, 300-, or 400-level course, he/she must repeat that course or a School-approved alternative, and earn a grade of C or better ([Penn State Faculty Senate policy 82-44](http://www.psu.edu/ufs/policies/82-83.html#82-44) [<http://www.psu.edu/ufs/policies/82-83.html#82-44>]). Be very careful to note this requirement. Keep apprised of your major and overall grade-point averages throughout your collegiate career.

Writing Requirement in Biology

All students must complete at least three credits of writing-intensive courses ("W" courses) prior to graduation. These courses must be selected from "**W**" **courses offered within the major or college of enrollment**. Normally, for most majors in Behrend Biology, these courses will be BIOL 220W, 240W, and 220W. Each of these courses carries 1 credit of "W", for a total of 3 credits. One other required course in some options within the major with "W" credits is BIOL 402W (3 credits). All students who transfer into the major and do not take BIOL 220W, 230W and 240W must take BIOL 402W.

Unites States and International Cultures Requirements

All first-year and advanced standing baccalaureate degree candidates admitted in Summer 2005 or later are required to take 3 credits in United States Cultures (US) and 3 credits in International Cultures (IL) as part of their degree program. Note: you will benefit if you can schedule a general education course in the Humanities, Arts, or Social and Behavioral Sciences that also fulfills the United States or International Cultures requirement, thus meeting the two requirements with one course.

First Year Seminars

All first-year baccalaureate degree candidates are required to complete, during the first academic year, a seminar course (Penn State First-Year Seminar PSU 007) for a minimum of 1 credit (included in elective credits) or complete a course with an S, T, or X suffix. The purpose of this course is to engage students in learning and to orient them to the scholarly community from the onset of their undergraduate studies in a way that will bridge to later experiences in their chosen major. In addition, the course should facilitate students' adjustment to the high expectations, demanding workload, increased academic liberties, and aspects of the transition to college life.

Arts, Humanities, Social and Behavioral Sciences / Foreign Language

A student may, in consultation with their adviser and approval of the School of Science Director, develop a sequence of 9 credits in the arts, humanities, or social and behavioral sciences by substituting 3 credits from one of the other two areas. Baccalaureate degree candidates may also substitute 3 credits in a foreign/second language at the third or higher level for 3 credits in any of the categories, provided this will not lead to the complete elimination of any area of the general education requirements.

Courses in Chemistry, Physics, and Biochemistry

Select courses in organic chemistry, physics and biochemistry with career goals in mind.

Chemistry: Several options within the major allow choice (General; Ecology, Evolution, and Behavior; and Medical Technology) as to the organic chemistry sequence that is generally taken during the third, fourth, and fifth semesters. The organic chemistry sequence should be chosen with future goals in mind. Consider taking CHEM 210, 212, and 213 since these courses are preparatory to courses in biochemistry and most medical and veterinary schools require eight credits of organic chemistry. CHEM 202 and 203 provide six credits of organic chemistry. CHEM 202 and 203 are appropriate for those students who plan to stop with the B.S. degree or who are in areas not requiring eight credits of organic chemistry.

Physics: Instrumentation currently used in Biology was developed from principles that are covered in physics courses. PHYS 250 and 251 use many examples from biology. Students interested in biophysical aspects of biology, or who may wish to pursue a double major in a program requiring a more rigorous physics sequence, should take the calculus-based sequence (PHYS 211, 212, and 213 or 214). Note: the Physics sequence 250, 251 is acceptable background for most medical schools. For the biology major, either the Physics sequence 250, 251 or 211, 212, and 213 or 214 is acceptable. Note: Only in exceptional cases will combining sequences be allowed.

Biochemistry: Students planning a career in biology requiring knowledge of biochemistry should take courses in biochemistry.

400-Level Biology Course Work

A minimum of 21 credits of 400-level courses in biology, are required to fulfill the requirements for the Bachelor of Science Degree in Biology (BIOBD). All 400-level biology (BIOL, MICRB, B M B, any other life science courses that may be offered listed in the Pennsylvania State University Bulletin, but excluding BIOL 400, and BIOL, B M B, and MICRB 494, 495, 496, 497, 498, and 499) fulfill the 400-level requirement. (BIOL 400, and BIOL, B M B, and MICRB 494, 495, 496, 497, 498, and 499 will count as electives.) Plan ahead as some 400-level courses are offered on an alternate year basis, check with your adviser for courses following the alternate year offering schedule.

Electives (School Approved Supporting Courses)

Electives should be used with an objective in mind. Simultaneous degrees or multiple majors can be enriching. Certification to teach secondary school Biology can be partially achieved through a judicious selection of electives and will require an additional year at a location which offers teaching certification. Penn State Erie has an agreement for a fifth year education certification program in biology with Mercyhurst College (see below). Supporting course electives may also be used to fulfill the requirements for a formal minor in another area (such as Chemistry, Mathematics, or Psychology). You are permitted to take any classes as supporting course electives, except those listed as disallowed (see above). Use free electives wisely. Consider "hybridizing" Biology with another discipline (e.g., combine Biology with

Business to become a pharmaceutical or science products salesperson). Note: internships, teaching assistance, research, and independent study classes (BIOL or B M B or MICRB 296, 400, 494, 495, and 496) are listed as electives. Credits earned under these numbers will count as supporting course electives.

Undergraduate Research

If the idea of becoming involved in an undergraduate research project (BIOL 296, 494, or 496) appeals to you, there are a number of steps you should be aware of that will improve your chances of reaching your goal. First, become knowledgeable about the research that is conducted in biology by talking to faculty members. Second, prepare a list of faculty whose research activities are close to your interests. Third, speak with the selected faculty to determine such things as: (a) available lab space/ faculty time/ funding to accept you as a research student; (b) hours/week of your time needed for the research effort; (c) the number of additional semesters you can give to the research; and (d) the number of credits for which you should register. Fourth, be aware that you do not register for BIOL 296, 494, or 496 through eLion registration. You must submit an undergraduate independent study / internship / research project information form signed by the professor with whom you are enrolling for research credit to the Office of the Registrar before the course can be added to your schedule.

Late Course Drops

Dropping a course after the tenth day but before the end of the twelfth week of the semester constitutes a late drop and will be duly noted on your transcript. The designation on your transcript is made regarding your status when you dropped the course: "WN" – withdrew no grade (no course work or tests completed); "WP" – withdrew passing; "WF" – withdrew failing. Moreover, you are allowed only **16 credits** of late drops throughout your entire collegiate career, and **NO** course drops are permitted during the final three weeks of the semester. Before dropping/adding a course, be sure to consult your adviser.

Satisfactory/Unsatisfactory (SA/UN) Grades

Up to 12 credits of free electives may be earned on a satisfactory/unsatisfactory (SA/UN) basis. Courses required for the major, including general education credits, are not permitted for satisfactory/unsatisfactory grading. You must request this designation through the Registrar's Office between the 11th and 21st calendar days of the semester you are enrolled in the course. SA/UN credits count towards graduation, but are not computed in your GPA.

Advanced Placement (AP) Credits in Biology

For a grade of three, no biology credits are awarded. For a grade of 4, credit is awarded for BIOL 011/012 (4 credits). For a grade of five, credit is awarded for BIOL 110 (4 credits). No credits are awarded for BIOLOGY 220W, 230W, and 240W. If you have taken courses other than biology for AP credit, the following web site has the AP scores required by Penn State for credit in specific courses (<http://www.psu.edu/dept/admissions/steps/understanding/ap.htm>). Consult with the admissions office to determine if your AP score(s) are applicable toward fulfilling the requirements of your major.

Credits Earned At Other Institutions

Earning credits at a college or university other than Penn State is possible while you are a student enrolled at Penn State. **Before** enrolling in course work at another school, be sure to receive prior approval by: (1) checking with the web site listed below (evaluation of transfer credit) to see whether the credits earned at College "X" are transferable to Penn State, if the course has a direct PSU course designation – take the course. If the course transfers as a "GEN" course then: (2) arrange to meet our transfer admissions

counselor (currently Donna Fuller, dmf9@psu.edu) to fill out the approval form, and (3) students must get the signature of Biology Program Chair for course approval. The student then returns the form to the admissions counselor.

Evaluation of Transfer Courses on the Web

The Undergraduate Admissions Office's (UAO) database of evaluations of courses from other institutions is available to the public on the UAO Web site. To access the information, go to http://admissions.psu.edu/my_admissions/tas/. Use the interactive tool bar and click on "Evaluate Transfer Courses." Users can search for a course at another institution and view the Penn State evaluation. In addition, Penn State students can search for a specific Penn State course equivalent at another institution.

At least 36 of the last 60 credits required for a baccalaureate degree must be earned at a Penn State Campus (see Penn State Senate Policy 83-80, No.1).

Foreign Studies

Register under BIOL 199 or 399 for courses offered in foreign countries by individual or group instruction (variable credits 1-12). Consult with your adviser **before** undertaking courses in this program.

Education Abroad Programs

Education Abroad Programs (EAP) allows students to enrich their on-campus studies through an academic experience and cross-cultural contacts in a foreign country. Such programs are available to a select number of qualified students from all colleges and degree-granting units in the university. More than forty-five officially sponsored group programs are currently available in a number of countries throughout Europe, the Middle East, Asia, Latin America, Africa, and Australia. More than 500 PSU undergraduates per year enroll in a wide variety of course offerings. No transfer of credit is involved since students remain registered at Penn State while abroad. In addition to semester and year-long programs, several Summer Education Abroad opportunities are available. Contact the study abroad adviser, Ruth Pfleuger, in the Learning Resource Center, for more information (e-mail: rcp1@psu.edu, 814-898-6418).

Internships and Co-ops

Arrangements for practical off-campus internship experience under the supervision of a professional biologist (preceptor) and a faculty member must be student initiated. A project is developed with a preceptor and a faculty member prior to the internship. Students may receive credit for the internship experiences under BIOL 495 Internship in Biology. In addition, Penn State's Eberly College of Science Cooperative Education Program provides an excellent opportunity for Penn State Behrend students to integrate academic study with relevant experience in the workplace through alternating semesters of work and study. Co-op assignments allow the student to develop insight into the relationship between knowledge gained in the classroom and the application of that knowledge in both academic and non-academic settings. Ask your adviser for more details. In addition, a counselor in the Career Development Center can provide specific guidance.

The Certification Program in Secondary Education in Biology

Information about the fifth year secondary education certification program can be found at <http://www.pserie.psu.edu/academic/dus/educ/index.htm> or contact the coordinator of the program (currently Emily Artello, eca109@psu.edu, 814-898-6260).

Special Penn State Behrend Health Care Programs
(Dr. James T Warren, Health Professions Adviser, Nick 161, 814-898-6986, jtw4@psu.edu)

We have several special programs for qualified students, including “3+4” Accelerated Programs in Primary Care, Dentistry, Pharmacy, and Optometry. There is also an **Early Assurance Program** that provides the opportunity to apply for a provisional early acceptance to a medical school. In addition, the **Medical Technology option** within the biology major prepares students for careers in clinical laboratories.

"3+4" Accelerated Programs

Professional school seats for any of these Accelerated Programs are limited, so application and acceptance into these programs is highly competitive. Interested students should contact Dr. Warren for application information. The "3+4" Accelerated Programs permits selected undergraduate students who have successfully completed specific core course requirements at Penn State Behrend to continue their education at a professional school in an accelerated program of study. The accelerated programs are comprised of two phases: *Phase I* consists of the first three years of undergraduate education in biology (Accelerated Health Programs option) at Penn State Behrend; *Phase II* consists of the remaining professional school education at the affiliated school. Penn State Behrend will confer the Bachelor of Science (B.S.) degree in Biology after the successful completion of Phase I (minimum 103 credits) and the first year of the professional school’s academic curriculum. The specific “3+4” Accelerated Programs are:

- **3+4 Accelerated Program in Primary Care with the Lake Erie College of Osteopathic Medicine**
Academic criteria for application to *Phase II* are the achievement of an SAT score of at least 1200 (math and verbal scores combined), a cumulative GPA of 3.3 at the end of the third year, and the Medical College Admissions Test (MCAT) scores of 7 or better in each subtest with an overall score of 24 or better.
- **3+4 Accelerated Program in Dentistry with Temple University School of Dentistry**
Academic criteria for application to *Phase II* are a cumulative and a science GPA of 3.3 or better and completion of 103 Penn State credits and the Dental Admissions Test (DAT) in the junior year with minimum scores of 18 in Total Science and 17 in Academic Average.
- **3+4 Accelerated Program in Pharmacy with the State University of New York at Buffalo School of Pharmacy and Pharmaceutical Science**
Academic criteria for application to *Phase II* are a cumulative and a science and mathematics GPA of 3.5 or better and completion of 103 Penn State credits and the Pharmacy College Admissions Test (PCAT) by October of the junior year with a minimal score of 400 (computed by combining the percentile scores in Verbal Ability, Reading Comprehension, Biology, Chemistry, and Quantitative Ability).
- **3+4 Accelerated Program in Optometry with the Ohio State University College of Optometry**
Academic criteria for application to *Phase II* consist of minimal science and overall GPAs of 3.3 and 3.5, respectively, as well as meeting the minimal scores on the Optometry Admission Test (OAT).

Early Assurance Program

The Early Assurance program provides exceptional second-year college students, in excellent academic standing, with the opportunity to apply for a provisional early acceptance to medical school (after the sophomore year) for matriculation after the confirmation Bachelor of Science (B.S.) degree in Biology. The current program has an affiliation with The Pennsylvania State University College of Medicine at Hershey:

- **Early Assurance Program with The Pennsylvania State University College of Medicine**
The Academic criteria for applying to the program are the achievement of an SAT score of at least 1300 (math and verbal scores combined), and a cumulative GPA of 3.6 at the end of the sophomore year. Competitive students for the program must demonstrate high academic achievement in both science and non-science curricula. Extra-curricular activities and student involvement in human service experiences are also considered in determining admission to the program. Following acceptance, the student must maintain at least a 3.5 GPA. Final admission to the College of Medicine is determined by the College of Medicine which reviews all above criteria, along with the results of the Medical College Admissions Test (MCAT).

Medical Technology Option

The Medical Technology option within the biology major prepares students for careers in clinical laboratories. Following a rigorous science program in the first six semesters, students spend approximately twelve months at an affiliated hospital during their senior year to complete the clinical phase of their baccalaureate studies. The current program has an affiliation with Saint Vincent Health Center, School of Medical Technology, Erie, PA.

- **Four-year Program in Medical Technology**
A fixed number of spaces are available on a competitive basis of grade-point average and hospital approval. The B.S. degree in biology is awarded upon successful completion of the clinical study. Graduates are also eligible to take the national examination for certification and registry as medical technologists.

Check Sheets

The accompanying set of check sheets for the BIOBD major outline the specific requirements for each of the six options currently offered in Biology and the fifth-year secondary education certification program. If you have questions or problems, consult with your adviser. Check sheets for the [General Option](#), [Ecology, Evolution, and Behavior Option](#), [Genetics and Development Option](#), [Molecular and Cellular Biology and Biochemistry Option](#), [Accelerated Health Programs Option](#), and [Medical Technology Option](#) are attached below.

When consulting with your adviser, be sure to have your CHECK SHEETS up-to-date. Retain a copy of your check sheets; they are a record of your requirements when you entered the Biology major. This last point is important, because the requirements of various options may change. You will be required to fulfill the requirements of the option at the time you entered the major in Biology or you may choose to meet all new requirements as they become available. For academic advising information and to view your academic records, visit Penn State's eLion web page (<http://eLion.psu.edu/>).

Current Information

Check the Biology program web site (<http://bio.bd.psu.edu/>) and your adviser for a list of course offerings and other curricular changes not included on your check sheets or listed in the latest Baccalaureate Degree Program Bulletin (<http://bulletins.psu.edu/bulletins/bluebook/>).

Degree Audit

Periodically, you should retrieve a copy of your degree audit, via eLion, discuss any discrepancies or questions you might have resulting from that information with your adviser. It is strongly recommended that you consult with your adviser at least once a year to review your progress. A sixth-semester audit should be reviewed closely, **it is very important to review your course work at this time!** This will allow two semesters to complete needed requirements, thus avoiding surprises as you prepare to graduate. Be sure you keep an up-to-date log on the number of acceptable credits you have earned. Use the CHECK SHEETS for this purpose. Suggestion: add the credits of each course taken, and do NOT count remedial course (or partial remedial course) credits required for graduation. The variable credits required in the supporting courses area of most options are dependent upon the CHEM sequences (CHEM 202 and 203 or CHEM 210, 212, and 213) and the PHYS sequences (PHYS 250 and 251 or PHYS 211, 212 and 213/214) that are taken. The bottom line is that 124 credits are needed to graduate.

Graduation Requirements

BEFORE BEGINNING your final semester, check with the Biology Program Chair to confirm that you will have the minimum number of 124 credits, including all your prescribed requirements necessary for graduation.

BIOBD Curriculum, 2008

GENERAL BIOLOGY Option

B.S Degree - 124 Credits required

General Education (46 credits)	Prescribed Courses,	Supporting Courses for Option (31-35 cr)
	All Options (23 credits)	
First Year Seminar (included in Prescribed courses)	BIOL 110S (4) BIOL 220W (4) BIOL 240W (4)	Select 15 credits of 400- level BIOL, B M B, or MICRB (excluding 495, 496, 497, 498, 499, and BIOL 400)
Communications (GWS)	BIOL 230W (4)	
ENGL 015 (3)	BIOL 322 (3)	()
ENGL 202C (3)	BIOL 223 (1)	()
CAS 100 (3)	STAT 250 (3)	()
		()
Quantification (GQ)	Additional Courses, for	()
MATH 140 (4)	General option (20-24 cr)	()
MATH 141 (4)	BIOL 427 (3) BIOL 402W (3)	
Natural Sciences (GN)		Select 16-20 credits from School-approved list
CHEM 110 (3)	Select one organic chem seq	
CHEM 111 (1)	CHEM 202 (3)	()
CHEM 112 (3)	CHEM 203 (3)	()
CHEM 113 (1)	or	()
	CHEM 210 (3)	()
Arts (GA)	CHEM 212 (3)	()
(3)	CHEM 213 (2)	()
(3)		()
	Select one physics seq	()
Humanities (GH)	PHYS 250 (4)	
(3)	PHYS 251 (4)	
(3)	or	
	PHYS 211 (4)	These two requirements can
Social and Behavioral Science (GS)	PHYS 212 (4) PHYS 213 or 214 (2)	be fulfilled with other General Education courses
(3)		
(3)		United States Cultures (US)
		(3)
Health and Physical Activity (GHA)		International Cultures (IL)
(1.5)		(3)
(1.5)		

Students graduating from this major must achieve at least a 2.00 average in the prescribed, additional, and supporting courses in the major AND in their overall course work. In addition, a student must earn a grade of C or better in all 200-, 300-, and 400-level courses within the major field. If a student receives a grade below C in a 200-, 300-, or 400-level course, the student must repeat that course or a School-approved alternative, and earn a grade of C or better.

School Approved List of Courses for Electives

All courses listed in the Pennsylvania State University Bulletin except those specifically listed in the table of non-approved courses below are approved courses and can be used as supporting course electives.

School of Science Non-Approved List of Courses for the BIOBD Major

BIOL no course under 100	MATH no course under 140, 140A (2 of 6 cr)
BI SC 001, 002, 003, 004	MICRB 106 and 107
B M B 001, 003	PHYS 001, 150, 151
CHEM 001, 003, 101, 106 (2 of 5 cr), 108	PH SC 007, 008, 011
CMFSC 001, 100	LL ED 005, 010
ENGL 004, 005	STAT 100, 200

BIOBD Curriculum, 2008

ECOLOGY, EVOLUTION, and BEHAVIOR Option

B.S Degree - 124 Credits required

General Education (46 credits)	Prescribed Courses,	Supporting Courses for Option (22-26 cr)
	All Options (23 credits)	
First Year Seminar (included in Prescribed courses)	BIOL 110S (4)	Select 6 credits of 400-
	BIOL 220W (4)	level BIOL, B M B, or MICRB
	BIOL 240W (4)	(excluding 495, 496, 497,
Communications (GWS)	BIOL 230W (4)	498, 499, and BIOL 400)
ENGL 015 (3)	BIOL 322 (3)	()
ENGL 202C (3)	BIOL 223 (1)	()
CAS 100 (3)	STAT 250 (3)	()
Quantification (GQ)	Additional Courses, for	
MATH 140 (4)	Ecology option (29-33 cr)	Select 16-20 credits from
MATH 141 (4)	BIOL 427 (3)	school-approved list
	BIOL 402W (3)	()
Natural Sciences (GN)	B M B 406 (3)	()
CHEM 110 (3)		()
CHEM 111 (1)	Select one organic chem seq	()
CHEM 112 (3)	CHEM 202 (3)	()
CHEM 113 (1)	CHEM 203 (3)	()
	or	()
Arts (GA)	CHEM 210 (3)	()
(3)	CHEM 212 (3)	
(3)	CHEM 213 (2)	
Humanities (GH)	Select one physics seq	
(3)	PHYS 250 (4)	
(3)	PHYS 251 (4)	
	or	These two requirements can
Social and Behavioral	PHYS 211 (4)	be fulfilled with other
Science (GS)	PHYS 212 (4)	General Education courses
(3)	PHYS 213 or 214 (2)	
(3)		United States Cultures (US)
	Select 6 credits from:	(3)
Health and Physical	BIOL 428 (3)	
Activity (GHA)	BIOL 429 (3)	International Cultures (IL)
(1.5)	BIOL 435 (3)	(3)
(1.5)	BIOL 438 (3)	
	BIOL 446 (3)	

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School Approved List of Courses for Electives

All courses listed in the Pennsylvania State University Bulletin except those specifically listed in the table of non-approved courses below are approved courses and can be used as supporting course electives.

School of Science Non-Approved List of Courses for the BIOBD Major

BIOL no course under 100	MATH no course under 140, 140A (2 of 6 cr)
BI SC 001, 002, 003, 004	MICRB 106 and 107
B M B 001, 003	PHYS 001, 150, 151
CHEM 001, 003, 101, 106 (2 of 5 cr), 108	PH SC 007, 008, 011
CMFSC 001, 100	LL ED 005, 010
ENGL 004, 005	STAT 100, 200

BIOBD Curriculum, 2008

GENETICS AND DEVELOPMENTAL BIOLOGY Option

B.S Degree - 124 Credits required

General Education (46 credits)	Prescribed Courses,	Supporting Courses for Option (20-22 cr)
	All Options (23 credits)	
First Year Seminar (included in Prescribed courses)	BIOL 110S (4) BIOL 220W (4) BIOL 240W (4)	Select 9 credits of 400- level BIOL, B M B, or MICRB (excluding 495, 496, 497, 498, 499, and BIOL 400)
Communications (GWS)	BIOL 230W (4)	
ENGL 015 (3)	BIOL 322 (3)	()
ENGL 202C (3)	BIOL 223 (1)	()
CAS 100 (3)	STAT 250 (3)	()
		()
Quantification (GQ)	Additional Courses, for Gen and Dev option (33-35 cr)	
MATH 140 (4)		
MATH 141 (4)	BIOL 427 (3) MICRB 201 (3)	Select 11-13 credits from School-approved list
Natural Sciences (GN)	MICRB 202 (2)	()
CHEM 110 (3)		()
CHEM 111 (1)	CHEM 210 (3)	()
CHEM 112 (3)	CHEM 212 (3)	()
CHEM 113 (1)	CHEM 213 (2)	()
		()
Arts (GA)	Select one physics seq	()
(3)	PHYS 250 (4)	()
(3)	PHYS 251 (4)	
	or	
Humanities (GH)	PHYS 211 (4)	
(3)	PHYS 212 (4)	
(3)	PHYS 213 or 214 (2)	
		These two requirements can be fulfilled with other
Social and Behavioral Science (GS)	Select 9 credits from: B M B 406 (3) BIOL 410 (3) BIOL 428 (3) BIOL 430 (3)	General Education courses United States Cultures (US) (3)
Health and Physical Activity (GHA)	BIOL 460 (3)	International Cultures (IL) (3)
(1.5)		(3)
(1.5)		

Students graduating from this major must achieve at least a 2.00 average in the prescribed, additional, and supporting courses in the major AND in their overall course work. In addition, a student must earn a grade of C or better in all 200-, 300-, and 400-level courses within the major field. If a student receives a grade below C in a 200-, 300-, or 400-level course, the student must repeat that course or a School-approved alternative, and earn a grade of C or better.

School Approved List of Courses for Electives

All courses listed in the Pennsylvania State University Bulletin except those specifically listed in the table of non-approved courses below are approved courses and can be used as supporting course electives.

School of Science Non-Approved List of Courses for the BIOBD Major

BIOL no course under 100	MATH no course under 140, 140A (2 of 6 cr)
BI SC 001, 002, 003, 004	MICRB 106 and 107
B M B 001, 003	PHYS 001, 150, 151
CHEM 001, 003, 101, 106 (2 of 5 cr), 108	PH SC 007, 008, 011
CMFSC 001, 100	LL ED 005, 010
ENGL 004, 005	STAT 100, 200

BIOBD Curriculum, 2008

MOLECULAR AND CELLULAR BIOLOGY AND BIOCHEMISTRY Option

B.S Degree - 124 Credits required

General Education (46 credits)	Prescribed Courses,	Supporting Courses for Option (16-18 cr)
	All Options (23 credits)	
First Year Seminar (included in Prescribed courses)	BIOL 110S (4)	Select 5 credits of 400-
	BIOL 220W (4)	level BIOL, B M B, or MICRB
	BIOL 240W (4)	(excluding 495, 496, 497,
Communications (GWS)	BIOL 230W (4)	498, 499, and BIOL 400)
ENGL 015 (3)	BIOL 322 (3)	()
ENGL 202C (3)	BIOL 223 (1)	()
CAS 100 (3)	STAT 250 (3)	()
		()
Quantification (GQ)	Additional Courses, for MCB and Bioch option (34-36 cr)	
MATH 140 (4)		
MATH 141 (4)	BIOL 427 (3)	Select 11-13 credits from
	B M B 402 (3)	School-approved list
Natural Sciences (GN)	B M B 403 (1)	()
CHEM 110 (3)	B M B 406 (3)	()
CHEM 111 (1)	MICRB 201 (3)	()
CHEM 112 (3)	MICRB 202 (2)	()
CHEM 113 (1)		()
	CHEM 210 (3)	()
Arts (GA)	CHEM 212 (3)	()
(3)	CHEM 213 (2)	()
(3)	CHEM 472 (3)	
Humanities (GH)	Select one physics seq	
(3)	PHYS 250 (4)	
(3)	PHYS 251 (4)	
	or	These two requirements can
Social and Behavioral Science (GS)	PHYS 211 (4)	be fulfilled with other
(3)	PHYS 212 (4)	General Education courses
(3)	PHYS 213 or 214 (2)	
		United States Cultures (US)
	Select 3 credits from:	(3)
Health and Physical Activity (GHA)	B M B 465 (3)	
(1.5)	BIOL 404 (3)	International Cultures (IL)
(1.5)	MICRB 410 (3)	(3)

Students graduating from this major must achieve at least a 2.00 average in the prescribed, additional, and supporting courses in the major AND in their overall course work. In addition, a student must earn a grade of C or better in all 200-, 300-, and 400-level courses within the major field. If a student receives a grade below C in a 200-, 300-, or 400-level course, the student must repeat that course or a School-approved alternative, and earn a grade of C or better.

School Approved List of Courses for Electives

All courses listed in the Pennsylvania State University Bulletin except those specifically listed in the table of non-approved courses below are approved courses and can be used as supporting course electives.

School of Science Non-Approved List of Courses for the BIOBD Major

BIOL no course under 100	MATH no course under 140, 140A (2 of 6 cr)
BI SC 001, 002, 003, 004	MICRB 106 and 107
B M B 001, 003	PHYS 001, 150, 151
CHEM 001, 003, 101, 106 (2 of 5 cr), 108	PH SC 007, 008, 011
CMFSC 001, 100	LL ED 005, 010
ENGL 004, 005	STAT 100, 200

BIOBD Curriculum, 2008
ACCELERATED HEALTH PROGRAMS Option
 B.S Degree - 124 Credits required

General Education (46 credits)	Prescribed Courses,	Supporting Courses for Option (24-26 cr)
	All Options (23 credits)	
First Year Seminar (included in Prescribed courses)	BIOL 110S (4)	Select 3-5 credits from School-approved list
	BIOL 220W (4)	
	BIOL 240W (4)	()
Communications (GWS)	BIOL 230W (4)	()
ENGL 015 (3)	BIOL 322 (3)	()
ENGL 202C (3)	BIOL 223 (1)	
CAS 100 (3)	STAT 250 (3)	
		Professional school
Quantification (GQ)	Additional Courses, for Acc	Academic courses (21 cr)
MATH 140 (4)	Health option(29-31 cr)	()
MATH 141 (4)	BIOL 421 (4)	()
	B M B 402 (3)	()
Natural Sciences (GN)	B M B 403 (1)	()
CHEM 110 (3)	MICRB 201 (3)	()
CHEM 111 (1)	MICRB 202 (2)	()
CHEM 112 (3)		()
CHEM 113 (1)	CHEM 210 (3)	()
	CHEM 212 (3)	()
Arts (GA)	CHEM 213 (2)	
(3)		
(3)	Select one physics seq	
	PHYS 250 (4)	
Humanities (GH)	PHYS 251 (4)	
(3)	or	
(3)	PHYS 211 (4)	
	PHYS 212 (4)	These two requirements can
Social and Behavioral Science (GS)	PHYS 213 or 214 (2)	be fulfilled with other
(3)		General Education courses
(3)		
		United States Cultures (US)
		(3)
Health and Physical Activity (GHA)		International Cultures (IL)
(1.5)		(3)
(1.5)		

Students graduating from this major must achieve at least a 2.00 average in the prescribed, additional, and supporting courses in the major AND in their overall course work. In addition, a student must earn a grade of C or better in all 200-, 300-, and 400-level courses within the major field. If a student receives a grade below C in a 200-, 300-, or 400-level course, the student must repeat that course or a School-approved alternative, and earn a grade of C or better.

School Approved List of Courses for Electives

All courses listed in the Pennsylvania State University Bulletin except those specifically listed in the table of non-approved courses below are approved courses and can be used as supporting course electives.

School of Science Non-Approved List of Courses for the BIOBD Major

BIOL no course under 100	MATH no course under 140, 140A (2 of 6 cr)
BI SC 001, 002, 003, 004	MICRB 106 and 107
B M B 001, 003	PHYS 001, 150, 151
CHEM 001, 003, 101, 106 (2 of 5 cr), 108	PH SC 007, 008, 011
CMFSC 001, 100	LL ED 005, 010
ENGL 004, 005	STAT 100, 200

BIOBD Curriculum, 2008

MEDICAL TECHNOLOGY Option

B.S Degree - 124-125 Credits required

General Education (46 credits)	Prescribed Courses,	Supporting Courses for Option (33-34 cr)
	All Options (23 credits)	
First Year Seminar (included in Prescribed courses)	BIOL 110S (4)	Select 3 credits from:
	BIOL 220W (4)	BIOL 402W (3)
	BIOL 240W (4)	BIOL 437 (3)
Communications (GWS)	BIOL 230W (4)	BIOL 460 (3)
ENGL 015 (3)	BIOL 322 (3)	BIOL 472 (3)
ENGL 202C (3)	BIOL 223 (1)	B M B 402 (3)
CAS 100 (3)	STAT 250 (3)	B M B 406 (3)
Quantification (GQ)	Additional Courses, for	Select 0-1 credits from
MATH 140 (4)	Med Tech option (21-23 cr)	School-approved list
MATH 141 (4)	MICRB 201 (3)	()
	MICRB 202 (2)	()
Natural Sciences (GN)		
CHEM 110 (3)	PHYS 250 (4)	
CHEM 111 (1)	PHYS 251 (4)	These prescribed courses
CHEM 112 (3)		are taken at an affiliated
CHEM 113 (1)	Select one organic chem seq	hospital (30 cr)
	CHEM 202 (3)	MICRB 405A (8)
Arts (GA)	CHEM 203 (3)	MICRB 405B (1)
(3)	CHEM 221 (4)	MICRB 405C (6)
(3)	or	MICRB 405D (5)
	CHEM 210 (3)	MICRB 405E (7)
Humanities (GH)	CHEM 212 (3)	MICRB 405F (3)
(3)	CHEM 213 (2)	MICRB 408 (1)
(3)		
		These two requirements can
Social and Behavioral Science (GS)		be fulfilled with other
(3)		General Education courses
(3)		
		United States Cultures (US)
		(3)
Health and Physical Activity (GHA)		International Cultures (IL)
(1.5)		(3)
(1.5)		

Students graduating from this major must achieve at least a 2.00 average in the prescribed, additional, and supporting courses in the major AND in their overall course work. In addition, a student must earn a grade of C or better in all 200-, 300-, and 400-level courses within the major field. If a student receives a grade below C in a 200-, 300-, or 400-level course, the student must repeat that course or a School-approved alternative, and earn a grade of C or better.

School Approved List of Courses for Electives

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School of Science Non-Approved List of Courses for the BIOBD Major

BIOL no course under 100	MATH no course under 140, 140A (2 of 6 cr)
BI SC 001, 002, 003, 004	MICRB 106 and 107
B M B 001, 003	PHYS 001, 150, 151
CHEM 001, 003, 101, 106 (2 of 5 cr), 108	PH SC 007, 008, 011
CMFSC 001, 100	LL ED 005, 010
ENGL 004, 005	STAT 100, 200