The administrative office for the academic programs in Biochemistry & Molecular Biology, Biotechnology and Microbiology is located on the first floor of Althouse Laboratory. Faculty offices are located in six nearby buildings: Althouse Lab, Chemistry Building, North & South Frear, Wartik Lab, and the Life Science Building.

Current Faculty .................................................................42

Fall 2010 Department Enrolled Undergraduate Students ....509
Fall 2010 Undergraduate Students (graduated)
  Biochemistry & Molecular Biology.................................11
  Biotechnology.................................................................03
  Microbiology.................................................................04

Spring 2011 Department Enrolled Undergraduate Students.....470
Spring 2011 Undergraduate Students (graduated)
  Biochemistry & Molecular Biology.................................35
  Biotechnology.................................................................45
  Microbiology.................................................................15

Song Tan, associate professor of biochemistry & molecular biology, and student marshal Tom Zikos.
Faculty Research Areas

Sarah Ades - Signal transduction and antibiotic-induced stress responses in bacteria.
Istvan Albert - Developing and integrating computational tools into life sciences research.
Paul Babitzke - Regulation of gene expression by RNA structure and RNA-binding proteins.
J. Martin Bollinger - Mechanisms of metalloenzymes and metallofactor assembly.
Squire J. Booker - Mechanisms of cofactor action in enzymatic reactions.
Donald A. Bryant - Physiology, biochemistry, genetics and genomics of photosynthetic bacteria.
Craig E. Cameron - Genome replication of hepatitis C virus.
Frank Dorman - Forensic Science
James G. Ferry - Enzymology and functional genomics.
Richard J. Frisque - Transcriptional regulation of the hsp70 heat shock gene in drosophila.
David S. Gilmour - Structure-function relationships with photosynthetic reaction centers.
John H. Golbeck - Mechanism of cellulose biosynthesis in arabidopsis.
Wendy Hanna-Rose - Molecular genetics of metabolism and development in c. elegans.
Ross C. Hardison - Genomics and gene regulation.
Mitchell Holland - Forensic science.
Teh-hui Kao - Biochemical and molecular bases of self/non-self recognition during plant reproduction.
Kenneth Keiler - Small RNAs and protein localization in bacterial development and antimicrobial drug discovery.
Andrey Krasilnikov - Structural biology of RNA and RNA-protein complexes.
Maria Krasilnikova - Mechanisms of trinucleotide repeats diseases.
Carsten Krebs - Bioinorganic chemistry - spectroscopic and kinetic studies on the mechanisms of iron-containing enzymes.
Zhi-Chun Lai* - Growth control and cancer genetics.
Arthur Lesk - Protein structure, function and evolution.
Bernhard Lüscher* - Structure, function and post-synaptic targeting of GABA\textsubscript{A} receptors.
Andrea M. Mastro - Breast cancer and the immune system.
Katsuhiko Murakami - Structural biology of RNA polymerase.
Anton Nekrutenko - Comparative genome analysis.
Ronald D. Porter - Director of graduate studies.
Kathleen Postle - Signal transduction and iron transport in bacteria.
Frank Pugh - Biochemistry and genomics of eukaryotic transcription regulation.
Joseph Reese - Chromatin structure and gene expression, DNA damage resistance pathways.
Melissa M. Rolls - Subcellular compartmentalization of neurons.
Facility Research Areas

Reena Roy - Forensic Science.
Lorraine Santy - Small GTPase regulation of epithelial motility.
Stephan C. Schuster - Genome evolution in host-adapted bacteria.
Scott B. Selleck - Regulation of growth factor signaling. Proteoglycan modulation of morphogen function. Nervous system assembly and synapse development.
Song Tan - Structural biology of eukaryotic gene regulation.
Graham H. Thomas* - Roles of the cytoskeleton in drosophila development: molecular and genetic approaches.
Ming Tien - Mechanism and regulation of fungal degradation of lignin.
C.-P. David Tu - Gene regulation, structure and function of glutathione S-transferase systems.
Yanming Wang - Epigenetic histone modifications in cell differentiation and cancer.

* faculty with joint appointments in the Dept. of Biochemistry and Molecular Biology

Members of the graduate program from other departments:
Nina V. Fedoroff - Plant transposable elements, epigenetic mechanisms, plant development.
Eric Harvill - Bacterial virulence factors, host immune functions, and molecular cross-talk between pathogen and host.
Pamela J. Mitchell - Developmental gene regulation in drosophila and mouse.
Robert Paulson - Genetic and biochemical analysis of hematopoiesis.
Gary H. Perdew - Molecular mechanism(s) of toxicity; dioxin mediated signal transduction; biochemistry of heat shock protein complexes.
Jeffrey M. Peters - Peroxisome proliferator-activated receptors.
### Instructional Faculty

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Institution Details</th>
</tr>
</thead>
</table>
| **ANJULI DATTA**   | Academic Program Adviser                                   | Instructor, Biochemistry & Molecular Biology  
B.S., Microbiology, Texas A&M University  
M.S., Biomedical Sciences, University of North Texas Health Sciences Center  
Courses taught: PSU 016, BI SC 001, 002, BMB 001, 211  
MICRB 107                                                                 |
| **MEREDITH DEFELICE** | Lecturer of Biochemistry & Molecular Biology | B.S., Biochemistry, Occidental College  
Ph.D., Cell Biology, Duke University  
Courses taught: BMB/MICRB 442, BMB 221, 401, 445W                                                                 |
| **REBECCA FALSONE** | Biotechnology CLS Program Adviser  
Prep-Room Supervisor |                                                                                                                                         |
| **STEVEN KEATING** | Senior Lecturer II, Biochemistry & Molecular Biology | B.S., Microbiology, University of Maryland  
Ph.D., Entomology, The Pennsylvania State University  
Courses taught: BI SC 002, 004, MICRB 106, 107, 201, 202                                                                 |
| **V. REDDY PADALA** | Senior Lecturer I, Biochemistry & Molecular Biology  | B.S., Agricultural Science, Agricultural College, Bapatla (AP) India  
M.S., Biochemistry, GB Pant University, Pantnagar (UP) India  
Ph.D., Biochemistry, Indian Institute of Science, Bangalore, India  
Courses taught: BMB 212, 408, 443W, 437, BMB/MICRB 442                                                                 |
<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Education</th>
<th>Courses Taught</th>
</tr>
</thead>
</table>
| CARL SILLMAN          | Senior Lecturer II, Biochemistry & Molecular Biology | B.S., Biology, Muhlenberg College  
M.S., Microbiology, The Pennsylvania State University  
Ph.D., Microbiology, The Pennsylvania State University | BMB 446, 498B, MICRB 106, 408, 421W, 422, 447, BIOTC/MICRB 416 |
| BEATRICE SIRAKAYA     | Instructor, Biochemistry & Molecular Biology  | B.S., Microbiology, The Pennsylvania State University  
Ph.D., Biotechnology, The Pennsylvania State University                     | BI SC 002, BIOTC/HORT 459, BIOTC 479 & 489                                  |
| OLA SODEINDE          | Senior Lecturer II, Biochemistry & Molecular Biology | B.S., Anatomy & Experimental Pathology, University of St. Andrews, Scotland  
Ph.D., Molecular Genetics & Microbiology, University of Massachusetts Medical School | PSU 016, MICRB 201, BMB 251H, 252, 252H, BIOTC/HORT 459                      |
| MICHAEL TROYAN        | Instructor, Biochemistry & Molecular Biology  | B.S., Microbiology, The Pennsylvania State University  
M.S., Physiology, The Pennsylvania State University                         | PSU 016, MICRB 106, MICRB 107, BI SC 004, BIOTC/VB SC 489                  |
| HEMANT YENNAWAR       | Instructor of Biochemistry & Molecular Biology | B.S., Physics, Chemistry & Mathematics, Nagpur University, India  
M.S., Physics, Nagpur University, India  
Ph.D., Physics (X-ray Crystallography), India Institute of Science, Bangalore | BMMB 598E                                                                    |
Determine which courses will fulfill my degree requirements?
To check on your degree requirements and progress, access your degree audit in eLion: https://elion.psu.edu/. Pluses (+) and minuses (-) and indicate whether degree requirements have been met. To graduate, all categories must display a (+) sign.

Add or drop a class?
There are three periods related to adding/dropping a course they are as follows:

Pre-semester period: begins on the first day of scheduling and ends the day before the semester starts. Click here to see your registration date.

Add/drop period: begins the day your courses start, and ends 10% of the way through a course. You can find the semester dates by checking the academic calendar’s posted on the University Registrar’s website. If you are looking to drop a course, be sure to find out the “last day of regular drop” for your course via eLion. Once you are logged in click on “Course Drop Dates”.

Late drop period: starts the day after the add/drop period finishes and ends approximately 80% of the way through a course. You can also find the late drop dates on eLion – click on “Course Drop Dates”. Additionally, during the late drop period, the University assesses a $6 per course processing fee for any course dropped or added. During the pre-semester period, you can add and drop courses as many times as needed to create a suitable schedule without financial implications.

Get into a class that is full?
Students cannot be added to classes that are filled to room capacity. If enrollment does not exceed the room capacity, you may try to obtain the instructor’s permission to enroll in the class, using an Add/Drop form. If the instructor signs the form, take it to the department that offers the course to schedule the class.

Get a grade changed?
If you disagree with a grade you have received for a course, speak with the instructor. Take whatever supporting material you may have to support the change of grade with you. Only course instructors are authorized to assign and change grades.

Meet with my adviser?
Your adviser’s name is available in eLion. Check your adviser’s office door for posted office hours. Knock on the door, email, and/or call. Most faculty prefer that you make an appointment.

Get access to the computer lab?
121 South Frear computer lab is open from 9:00 a.m. - 4:00 p.m.

Change my major?
To change your major to BMB, BIOTC or MICRB you must meet with Academic Program Adviser, Anjuli Datta. She is located 116E South Frear. Anjuli has the appropriate paper work for you to complete.

Schedule a World Campus course?
Visit Penn State Online at: http://www.worldcampus.psu.edu/, for an application and course selections.

Get involved with a student organization?
Go to general meetings and express an interest. General meetings are usually held at the beginning of the fall semester to recruit new members. Most groups publicize these meetings by posting notices university-wide. Penn State chapters of the Biochemistry Society and Microbiology Society post notices on the bulletin boards in Althouse and South Frear and also broadcast via email.
Introduction

Welcome to the Department of Biochemistry and Molecular Biology. The Department of Biochemistry and Molecular Biology offers undergraduate students a choice of majors in three of the most exciting areas of the life sciences:

- Biochemistry and Molecular Biology (BMB)
  - Biochemistry Option
  - Molecular & Cell Biology Option
- Microbiology (MICRB)
- Biotechnology (BIOTC)
  - General Option
  - Clinical Laboratory Science Option

In this handbook, we give an overview of the various options available within the biochemistry and molecular Biology Department and their course requirements. When planning your program of studies, use the check sheets in this program guide together with information available online (online advising service at https://elion.psu.edu/, undergraduate degree bulletin at http://www.psu.edu/bulletins/bluebook), and consult your academic advisor. For more information about anything pertaining to the undergraduate programs in BMB please consult your academic advisor (if you are currently a BMB/MICRB or BIOTC major) or Academic Program Adviser, Anjuli Datta, 116E South Frear, (814) 863-4172 or aud17@psu.edu.

Department Contacts:

Anjuli Datta
Academic Program Adviser
116E South Frear or email aud17@psu.edu

Dr. Wendy Hanna-Rose
Associate Department Head for Undergraduate Studies
104D Life Science Building or email wxh21@psu.edu

Lorraine Lewis
Coordinator Student Studies
107L Althouse or email lul4@psu.edu

Admission and Retention

Entrance to the Eberly College of Science

Any student entering the college may seek entrance to any major in the college if the following requirements have been met:

1. The student must have a 2.00 cumulative grade point average.
2. The student must have completed Math 140 with a C or better.

Entrance to the BMB, MICRB or BIOTC Majors

Completion of CHEM 110 GN(3), CHEM 111 GN(1), CHEM 112 GN(3), and MATH 140 GQ(4); and earned a grade of C or better in each of these courses.

To make an appointment with your adviser, please send him/her an email message. You can find his/her email at http://bmb.psu.edu/directory or on eLion under adviser Information.
Supporting Courses

These are optional courses that students may select. You can use these courses to fulfill requirements for a minor in another subject. You will find these listed on your major check sheet.

General Education

Every student must take 45 credits of General Education courses. The course selections are designed to provide a well-rounded academic experience within an integrated curriculum that allows for individual flexibility. General Education courses may be relevant to your major or to your particular interests. The baccalaureate degree General Education program consists of two components: (1) skills, and (2) knowledge domains for a total of 45 credits. The skills component includes writing/speaking (9 credits) and quantification (6 credits). The knowledge domains include health and physical activity (3 credits), natural science (9 credits), arts (6 credits), humanities (6 credits), and social and behavioral sciences (6 credits). For a complete listing of all approved courses in the skills and knowledge domains, please refer to the website: [http://bulletins.psu.edu/bulletins/bluebook/general_education.cfm](http://bulletins.psu.edu/bulletins/bluebook/general_education.cfm)

United States Cultures and International Cultures Requirement

Students admitted to baccalaureate degree must complete 3 credits in Unites States Cultures (US) and 3 credits in International Cultures (IL). If a student takes a 3-credit course that is both U.S. and IL, he/she must take another 3-credit course that is US, IL, or both US and IL to complete the requirement. Education abroad courses and other credit-bearing experiences such as internships that meet this requirement will be designated as US, IL, or both US and IL.

Foreign/Second Language Admission Requirement

A student can be admitted to a baccalaureate degree program whether or not he/she has completed two units of a single foreign/second language at the high school level. However, if a student has not attained this level of language prior to admission, he/she must correct this deficiency by the time he/she earns 60 credits.

This requirement applies to transfer students, students moving to baccalaureate programs after completing associate degree programs, and students entering directly from high school. This requirement does not apply to students who can demonstrate fluency in a foreign/second language.

To determine if a student has met this admission requirement, "OK" will be printed next to the statement, "HIGH SCHOOL FOREIGN/SECOND LANGUAGE ADMISSION REQUIREMENT." "NO" precedes the statement if a student has not met the requirement.

If you have not met the requirement, see [http://www.psu.edu/dus/handbook/langadmreq.html](http://www.psu.edu/dus/handbook/langadmreq.html)
Concurrent Majors

Two programs—two degrees. Concurrent majors and sequential majors—allow a baccalaureate or associate degree candidate to earn degrees in more than one Penn State major. When completing concurrent majors, the student simultaneously completes all academic requirements for his/her majors and graduates with two (or more) degrees in the same semester.

Some concurrent majors have been combined in an established curriculum with specified entrance and graduation requirements. A candidate receiving approval from the colleges involved may gain entrance to more than one major. The idea of majoring in two areas to broaden one’s knowledge is a good one, but such a program requires ability and diligence. Anyone interested in pursuing a second major should first speak with the director of undergraduate programs in both of the departments concerned. The final academic record shall indicate the completion of the requirements for each major. For more information, see http://dus.psu.edu/handbook/concurrent.html

Minors in other Disciplines

Students are strongly encouraged to consider minors in fields outside of their discipline. For a listing of available minors, visit the website http://www.psu.edu/dus/handbook/minors2.html

Honors Courses and the University Scholars Program

Several hundred of the most talented Penn State undergraduates are in the University Scholars Program. For incoming students, admission to this program is by a separate application reviewed by the Faculty Selection Committee. For students already here, admission to the program is on the basis of cumulative grade point average or, in some cases, by faculty nomination. To graduate in the program, a student must maintain a high average every semester, take a minimum number of credits in courses with an Honors designation, and write an Honors Thesis. More information about the Scholars Program is available at the Program Office in 10 Atherton Hall, Schreyer Honors College or at http://www.shc.psu.edu. The biochemistry and molecular biology department teaches Honors sections of several courses. It is possible for a student not in the Scholars Program to enroll in Honors sections. For more information, see the Academic Program Adviser Aujuli Datta, 116E South Frear or Dr. David Gilmour, Chair BMB Honor Advisers, 465A North Frear.

The Minor in Biochemistry & Molecular Biology

To earn the BMB minor, students must take the following prescribed courses: B M B 251 (3), B M B 252 (3), B M B 442 (3), B M B 400 (2), B M B 401 (3), B M B 402 (3) plus one other course from 400-level BMB course offering for total of $\geq 18$ credits. Note students may not use Independent Research (496) of Lab Instructor Practice (408) as an elective for the minor. A grade of “C” or better is required in ALL courses that apply to the minor. For more information, go to: http://bmb.psu.edu/undergraduate/bmb-majors/bmb-minor

The Minor in Microbiology

To earn the MICRB minor, students must take the following prescribed courses: MICRB 201 (3), MICRB 202 (2), MICRB 251 (3), MICRB 410 (3), MICRB 421W (3) or MICRB 422 (2), along with 4-5 credits of 400-level Microbiology course for a total of $\geq 18$ credits. Note the following courses are not accepted in this category: BMB/MICRB 442, MICRB 400, 408, 496, or 497. A grade of “C” or better is required in ALL courses that apply to the minor. To find out more, go to: http://bmb.psu.edu/undergraduate/bmb-majors/micrb-minor
Evaluation of Courses from Other Universities

Each student who applies for courses to be transferred to Penn State is required to have a transcript sent to the Office of Admissions, where it is evaluated. When a course taken elsewhere is deemed equivalent to a course given at Penn State, credit for that specific Penn State course is assigned and an entry made in the “Number” column. If such a correspondence cannot be made, general credits (denoted “GEN” in the “CREDITS” column) are assigned as appropriate. The general credit designation does not imply that the credits cannot be transferred, but merely that the Office of Admissions is unable to establish the degree of similarity between a course taken elsewhere and a course offered at Penn State. The general credit designation implies that the student has the responsibility for obtaining assessments of course equivalencies “as appropriate”. The determination of “appropriateness” is left to the individual colleges. For the Eberly College of Science, the policy depends on the type of course for which general credit has been assigned.

Degree Audit

The degree audit is an academic advising document that maps a student's degree requirements against their academic transcript. The purpose of the audit is to provide information to assist in academic planning and appropriate course scheduling.

* Degree audits are available to all currently enrolled undergraduate degree students by accessing eLion or request a current audit on a "walk-in" basis from their department office, advising center or campus registrar.

* Students with more than one major/option or with minors will have separate audits produced for each program.

* Students thinking about changing their major or adding a minor can request a "what if" audit. This audit will assist in determining how courses they have already completed would apply to the new major or minor and what courses they would need to complete.

If a student feels that their audit is not correctly analyzing their program requirements, they should contact their department office or advising center.

Career-Related Experience and Study Abroad Opportunities

Science Job Shadowing/Externship Program (First-Year, Sophomore Year)

Get a first-hand perspective on possible careers by registering for a job shadowing/externship during your freshman and/or sophomore years. The shadowing lasts one to four days; most students choose something close to your home since the shadowing happens after you’ve left school for the summer. You choose your top three favorites from the list of Penn State alumni extern hosts/sites, and you’ll be matched with one of them. To apply, visit http://cie.science.psu.edu.

Science Cooperative Education (Junior/Senior Years)

Co-op gives you extended work experience related to your major, while earning academic credit and getting paid. It’s a win-win-win! You do three co-op “rotations” before graduation, and at least one has to be completed during the fall or spring semester. Most students do a summer/fall or spring/summer assignment and then another summer. You don’t have to complete all three co-ops with the same organization, so it’s a great chance to get experience in a few different environments. You can use your co-op credits to meet course requirements, so plan ahead and talk with your advisor about how you can fit co-op into your degree. For more information, visit http://cie.science.psu.edu.
Science Internship

You can use the Science Career and International Education web-based database to search for opportunities and get leads on possible summer programs. Office staff will review your resume and cover letters, and answer your questions about applications. Then, you simply apply on-line to the organization web sites. Remember – summer is competitive, because you’re in the same applicant pool as everyone in the country, so you need to plan ahead and search for opportunities early. If want to earn academic credit for your internship, complete and return the Request for Academic Credit form at http://cie.science.psu.edu. If not, please let the Science Career and International Education staff know about your position, so they can track the data for their annual report.

International Opportunities

You have a lot of chances to get international experience during your time at Penn State. If you want to take upper-level courses abroad, there are places where you can do that. If you’re interested in studying a language, taking gen eds, or visiting some particular country or culture, Penn State’s Education Abroad Office offers almost 200 different study abroad options for Penn State students. If you’d like to get research experience abroad, there are several international REU (Research Experience for Undergraduates) programs available. If you’re not sure about studying abroad for a full semester, then you may want to look at the summer program options, or check out the embedded courses, which are courses that are offered here on campus during the regular semester, but that include some international travel component. A complete list of all study abroad programs and embedded courses can be found at www.global.psu.edu, and more science-specific information about international opportunities can be found at http://cie.science.psu.edu. You can visit either office at any point to get more information and to explore your options, but plan early, because most programs require early applications, and you should talk with your advisor about how you want to fit an international experience into your major.

Resources

Don’t have a resume or cover letter? Click “Student Handbook” on the Science Career & International Education web site at http://cie.science.psu.edu for samples and advice on getting an internship, co-op or full-time job. Please visit the Science Career and International Education Office in 108 Whitmore Lab or call 814.865.5000 for more information about gaining career-related or international experience.
The Bachelor of Science Degree in Biochemistry and Molecular Biology

Biochemistry and Molecular Biology is the most physical science-oriented of the three majors offered by the BMB department. While most of the foundation science courses are common to all three majors, the BMB major emphasizes the physical sciences to a greater extent than the department's other two majors. This explains the requirements for the calculus-based physics sequence, the year-long physical chemistry sequence and the additional quantification course that are specific to the Biochemistry option in this major. Advanced electives include courses with a distinct molecular and cell biology emphasis. The major provides excellent preparation for graduate and professional schools. Graduates are very well received by industry.

Biochemistry & Molecular Biology with the Biochemistry Option (125 credits)

B M B Bioch Option Check Sheet (125 credits)

1. GENERAL EDUCATION
   ARTS (6 cr)
   ______________________(GA) 3 crs
   ______________________ (GA) 3 crs
   ______________________ (GA) 3 crs

   HUMANITIES (6 cr)
   ______________________(GH) 3 crs
   ______________________ (GH) 3 crs
   ______________________ (GH) 3 crs

   SOCIAL & BEHAVIORAL SCIENCES (6 cr)
   ______________________(GS) 3 crs
   ______________________ (GS) 3 crs
   ______________________ (GS) 3 crs

   Students may petition to substitute 3 credits from one of the above knowledge domains for 3 credits in another domain, thereby substituting 9-6-3 credit pattern for the default 6-6-6 pattern in these general education courses.

   COMMUNICATIONS (GWS) (9 cr)
   _____ ENGL 015 or 030: Rhetoric & Comp 3 crs
   _____ ENGL 202C: Technical Writing 3 crs
   _____ CAS 100 A, B or C: Effective Speech 3 crs

   HEALTH & PHYSICAL ACTIVITIES (3 cr)
   ______________________ (GHA or GHS or GPE) crs
   ______________________ (GHA or GHS or GPE) crs
   ______________________ (GHA or GHS or GPE) crs

   WRITING ACROSS the CURRICULUM (W) (3cr)
   ______________________ (W) 3 crs

   US/INTERNATIONAL CULTURES (6 cr)
   ______________________ (US) 3 crs
   ______________________ (IL) 3 crs
## 2. Requirements for the Major

### Chemistry (22 cr)
- **CHEM 110: (H): Chemical Principles I**
- **CHEM 111: Experimental Chemistry I**
- **CHEM 112: (H): Chemical Principles II**
- **CHEM 113: Experimental Chemistry II**
- **CHEM 210: (H): Organic Chemistry I**
- **CHEM 212: (H): Organic Chemistry II**
- **CHEM 213: Organic Chemistry Lab**
- **CHEM 450: Physical Chemistry and**
- **CHEM 452: Physical Chemistry**

### Biochemistry & Molecular Biology (25 cr)
- **BMB 251: Molecular & Cell Biology I**
- **BMB 252: Molecular & Cell Biology II**
- **BMB 400: Molec. Biol. of the Gene**
- **BMB 401: General Biochemistry**
- **BMB 402: General Biochemistry**
- **BMB 442: Lab Prot, Nuc Acid, Molec Clon**
- **BMB 443W: Lab Protein Purifi./Enzymo**
- **BMB 445W: Lab Molecular Genetics**
- **BMB 474: Analytical Tech in BMB**

### Microbiology (5 cr)
- **MICRB 201: Intro. Microbiology**
- **MICRB 202: Intro. Microbiology Lab**

### Mathematics (8 cr)
- **MATH 140: Calculus I**
- **MATH 141: Calculus II**

### Biology (3 cr)
- **BIOL 322: Genetic Analysis**

### Physics Sequence (12 cr)
- **PHYS 211: Gen Phys: Mechanics**
- **PHYS 212: Gen Phys: Elec./Magnet.**
- **PHYS 213: Gen Phys: Fluids/Thermal**
- **PHYS 214: Gen Phys: Wave/Motion/Qu**

### First Year Seminar (1 cr)
- **PSU 016: First Year Seminar Science**

All of the above courses are **required** for the Biochemistry & Molecular Biology Major, Biochemistry option.

*Note: a “C” or better grade is required in CHEM 110, 111, 112, MATH 140 and at least 2 of the following BMB 251, 252 or MICRB 201

Total Major Requirement Credits:__________
3. ELECTIVES IN THE MAJOR

LIST A select 7-9 credits from any 400 level BMB/MICRB or CHEM course with a maximum of 4-credits in 496:

____________________ _______ crs
____________________ _______ crs
____________________ _______ crs
____________________ _______ crs

Total LIST A credits _____

4. MATHEMATICAL SCIENCE

LIST B select 2-3 credits from:

___CmpSc 101 3___Stat 250 3___Math 220 2
___CmpSc 201 3___Stat 301 3___Math 231 2
     ___Stat 401 3___Math 250 3

Students should select 2-3 credits from the electives List B to fulfill the Mathematical Science area.

Total List B Credits:__________

5. LIST C FREE ELECTIVES

Select 7-10 credits from Department List

____________________ _______ crs
____________________ _______ crs
____________________ _______ crs
____________________ _______ crs

LIST C FREE ELECTIVES With the EXCEPTION of the courses listed below, ALL courses appearing in the University Bulletin are acceptable as elective courses: 6 credits of ROTC may be applied toward graduation requirements.

BI SC: 001,002; CHEM: 001, 003, 108, 101; ENGL: 004, 005; LL ED: 005, 010, 123; MATH: 001, 003, 004, 111, 017, 018, 021,022, 026, 030, 035, 036, 040, 041, 081, 082, 083, 110; PH SC: 007; PHYS: 001, 150, 151; STAT: 100

Total Free Elective Credits:__________
6. ENTRANCE TO MAJOR

A student enrolled in this major must receive a grade “C” or better in the following courses specified by Senate Policy 82-44:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 110(H): Chemical Principles I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 111: Experimental Chemistry I</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 112 (H): Chemical Principles II</td>
<td>3</td>
</tr>
<tr>
<td>MATH 140: Calculus I</td>
<td>4</td>
</tr>
</tbody>
</table>

2.0 GPA is required.

7. TO GRADUATE

A “C” grade or better is required in 2 of the following 3 courses. **All 3 courses are required.**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>MICRB 201: Intro. Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>BMB 251: Molecular &amp; Cell Biology I</td>
<td>3</td>
</tr>
<tr>
<td>BMB 252: Molecular &amp; Cell Biology II</td>
<td>3</td>
</tr>
</tbody>
</table>

Total ≥ 9

+ Earn “C” or Higher in 9 credits of any 400-level MICRB/BMB courses **except** BMB 443W, 444, 445W, 446, BMB/MICRB 442, 496, MICRB 421W, 422, 447:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<td></td>
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</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total ≥ 9

8. REMEDIAL & REPEATS

Courses that do not meet degree requirements:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. SENATE POLICY 8380

10. GPA/ CREDITS

Source/Time Credit acquisition:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>36 of last 60 credits at PSU?</td>
<td>________</td>
</tr>
<tr>
<td>60 credits in last 5 years?</td>
<td>________</td>
</tr>
</tbody>
</table>

Overall GPA must be ≥ 2.0:

Total Credits Earned (less repeats and remedial; must have at least 125 to graduate):

11. University Activities/Awards

12. Program Exceptions:
### Degree Requirements

**Recommended Academic Plan**

Biochemistry and Molecular Biology with Biochemistry Option

(BMB with Bioch option at UP)

**Effective** (For students entering Summer 2010 and later)

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Credits</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>~ MATH 140 (GQ) Calculus with Analytic Geometry I</td>
<td>4</td>
<td>MATH 141(GQ) Calculus with Analytic Geometry II</td>
</tr>
<tr>
<td>~ CHEM 110 (GN) Chemical Principles</td>
<td>3</td>
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</tr>
<tr>
<td>~ CHEM 111 (GN) Experimental Chemistry</td>
<td>1</td>
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<td>PSU 016 First-Year Seminar</td>
<td>1</td>
<td>ENGL 15 OR 30 (GWS) Composition/Honors Composition</td>
</tr>
<tr>
<td>Art (GA), Humanities (GH), or Social Behavioral Sciences (GS)</td>
<td>6</td>
<td>PHYS 211 (GN) General Physics: Mechanics</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td><strong>15</strong></td>
<td><strong>Total Credits:</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Credits</th>
<th>Semester 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 210 Organic Chemistry</td>
<td>3</td>
<td>CHEM 212 Organic Chemistry</td>
</tr>
<tr>
<td>PHYS 212 (GN) General Physics: Electricity And Magnetism</td>
<td>4</td>
<td>CHEM 213 Laboratory in Organic Chemistry</td>
</tr>
<tr>
<td>% BMB 251 Molecular &amp; Cell Biology I</td>
<td>3</td>
<td>PHYS 213 (GN) General Physics: Fluids and Thermal Physics</td>
</tr>
<tr>
<td>% MICRB 201 Introductory Microbiology</td>
<td>3</td>
<td>PHYS 214 (GN) General Physics: Wave Motion &amp; Quantum Physics</td>
</tr>
<tr>
<td>MICRB 202 Introductory Microbiology Laboratory</td>
<td>2</td>
<td>% BMB 252 Molecular &amp; Cell Biology II</td>
</tr>
<tr>
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<td>6</td>
<td>BIOL 322 Genetic Analysis</td>
</tr>
<tr>
<td>Health &amp; Physical Activity (GHA)</td>
<td>1.5</td>
<td>Health &amp; Physical Activity (GHA)</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td><strong>15</strong></td>
<td><strong>Total Credits:</strong></td>
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</table>

<table>
<thead>
<tr>
<th>Semester 5</th>
<th>Credits</th>
<th>Semester 6</th>
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<tbody>
<tr>
<td>BMB 400 Molecular Biology of the Gene</td>
<td>2</td>
<td>BMB 402 General Biochemistry</td>
</tr>
<tr>
<td>BMB 401 General Biochemistry</td>
<td>3</td>
<td>BMB 445W Laboratory in Molecular Genetics</td>
</tr>
<tr>
<td>BMB 442 Lab in Proteins, Nucleic Acids, &amp; Molecular Cloning</td>
<td>3</td>
<td>CHEM 452 Physical Chemistry</td>
</tr>
<tr>
<td>CHEM 450 Physical Chemistry</td>
<td>3</td>
<td>CAS 100 A, B, or C (GWS) Effective Speech</td>
</tr>
<tr>
<td>% LIST B ELECTIVE</td>
<td>2-3</td>
<td>Art (GA), Humanities (GH), or Social Behavioral Sciences (GS)</td>
</tr>
<tr>
<td>Health &amp; Physical Activity (GHA)</td>
<td>1.5</td>
<td><strong>Total Credits:</strong></td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td><strong>14.5 -15.5</strong></td>
<td><strong>Total Credits:</strong></td>
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</table>

<table>
<thead>
<tr>
<th>Semester 7</th>
<th>Credits</th>
<th>Semester 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMB 443W Laboratory in Protein Purification &amp; Enzymology</td>
<td>3</td>
<td>BMB 474 Analytical Techniques in BMB</td>
</tr>
<tr>
<td>#BMB, CHEM or MICRB 400 Level Course</td>
<td>3-6</td>
<td>ENGL 202C (GWS) Technical Writing</td>
</tr>
<tr>
<td>± LIST C FREE ELECTIVES</td>
<td>3</td>
<td>#BMB, CHEM or MICRB 400 Level Course</td>
</tr>
<tr>
<td>Art (GA), Humanities (GH), or Social Behavioral Sciences (GS)</td>
<td>3</td>
<td>± LIST C FREE ELECTIVES</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td><strong>15-18</strong></td>
<td><strong>Total Credits:</strong></td>
</tr>
</tbody>
</table>

### Notes

- **Bold** type indicates courses requiring a quality grade of C or better.
- *Italic type* indicates courses that satisfy both major and General Education requirements.
- *Italic Bold* type indicates courses requiring a quality grade of C or better and that satisfy both major and General Education requirements.
- GWS, GHA, GQ, GN, GA, GH, and GS are codes used to identify General Education requirements.
- US, IL, and US;IL are codes used to designate courses that satisfy University United States/International Cultures requirement.
- W is the code used to designate courses that satisfy University Writing Across the Curriculum requirements.
- ~ indicates courses required to enter into this major.
- % indicates all 3 courses are required to graduate; a quality grade of C or better is required in 2 of the 3 courses.
- * indicates List B Electives: CMPSC 101 (3), 201 (3), Math 220 (2), 231 (2), 250 (3), Stat 250 (3) 301 (3), 401 (3)
- * indicates see the Department List C for exclusions see reverse side
- To graduate, all students must earn C or higher in 9 credits of any 400-level BMB/ MICRB courses except BMB 443W, 444, 445W, 446, BMB/MICRB 442, 496, MICRB 421W, 422, 447

**Scheduling patterns for courses not taught each semester**

- **Fall** - only taught courses: BMB 251H, 400, 401H, 428, 430, 432, 433, 444, 445W, 446, 464 BMB/MICRB 435, 450 MICRB 401, 413, 421W and MICRB/BIOTC 416
- **Spring** - only taught courses: BMB 221, 252H, 402H, 433, 437, 444, 445W, 474, BMB/MICRB 432, 460, 480 MICRB 201H, 412, 415, 422, 447

**± LIST C FREE ELECTIVES** - With the EXCEPTION of the courses listed below, ALL courses appearing in the University Bulletin are acceptable as elective courses: 6 credits of ROTC may be applied toward graduation requirements.

- BI SC 001
- BI SC 002
- MATH 001
- MATH 003
- MATH 004
- MATH 111
- MATH 017
- MATH 018
- MATH 021
- MATH 022
- MATH 026
- MATH 030
- MATH 035
- MATH 036
- MATH 040
- MATH 041
- MATH 081
- MATH 082
- MATH 083
- MATH 110
- CHEM 001
- CHEM 100
- CHEM 101
- ENGL 004
- ENGL 005
- PH SC 007
- PHYS 001
- PHYS 150
- PHYS 151
- LL ED 005
- LL ED 010
- LL ED 123
- STAT 100

---

BMB - Biochemistry Option
## Degree Requirements

The Bachelor of Science Degree in Biochemistry and Molecular Biology with the Molecular and Cellular Biology Option (125 credits)

BMB MCB Option Check Sheet (125 credits)

### 1. GENERAL EDUCATION

<table>
<thead>
<tr>
<th>Domain</th>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTS (6 cr)</td>
<td>(GA)</td>
<td>3 crs</td>
</tr>
<tr>
<td>HUMANITIES (6 cr)</td>
<td>(GH)</td>
<td>3 crs</td>
</tr>
<tr>
<td>SOCIAL &amp; BEHAVIORAL SCIENCES (6 cr)</td>
<td>(GS)</td>
<td>3 crs</td>
</tr>
</tbody>
</table>

Students may petition to substitute 3 credits from one of the above knowledge domains for 3 credits in another domain, thereby substituting 9-6-3 credit pattern for the default 6-6-6 pattern in these general education courses.

### COMMUNICATIONS (GWS) (9 cr)

- ENGL 015 or 030: Rhetoric & Comp 3 crs
- ENGL 202C: Technical Writing 3 crs
- CAS 100 A, B or C: Effective Speech 3 crs

### HEALTH & PHYSICAL ACTIVITIES (3 cr)

- (GHA or GHS or GPE) 3 crs

### WRITING ACROSS the CURRICULUM (W) (3cr)

- (W) 3 crs

### US/INTERNATIONAL CULTURES (6 cr)

- (US) 3 crs
- (IL) 3 crs

Total General Education Credits:__________

BMB - Molecular and Cellular Biology Option
# Degree Requirements

## 2. REQUIREMENTS FOR THE MAJOR

### CHEMISTRY (16 cr)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>___</td>
<td>*CHEM 110: (H): Chemical Principles I</td>
<td>3</td>
</tr>
<tr>
<td>___</td>
<td>*CHEM 111: Experimental Chemistry I</td>
<td>1</td>
</tr>
<tr>
<td>___</td>
<td>*CHEM 112: (H): Chemical Principles II</td>
<td>3</td>
</tr>
<tr>
<td>___</td>
<td>CHEM 113: Experimental Chemistry II</td>
<td>1</td>
</tr>
<tr>
<td>___</td>
<td>CHEM 210: (H): Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>___</td>
<td>CHEM 212: (H): Organic Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>___</td>
<td>CHEM 213: Organic Chemistry Lab</td>
<td>2</td>
</tr>
</tbody>
</table>

### PHYSICAL CHEMISTRY SEQUENCE (3 or 6 cr)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>___</td>
<td>CHEM 450: Physical Chemistry and</td>
<td>3</td>
</tr>
<tr>
<td>___</td>
<td>CHEM 452: Physical Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>or</td>
<td>BMB 428 Physical Chemistry with</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Biological Applications</td>
<td></td>
</tr>
</tbody>
</table>

### BIOCHEMISTRY & MOLECULAR BIOLOGY (28 cr)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>___</td>
<td>*BMB 251: Molecular &amp; Cell Biology I</td>
<td>3</td>
</tr>
<tr>
<td>___</td>
<td>*BMB 252: Molecular &amp; Cell Biology II</td>
<td>3</td>
</tr>
<tr>
<td>___</td>
<td>BMB 400: Molecular Biol. of the Gene</td>
<td>2</td>
</tr>
<tr>
<td>___</td>
<td>BMB 401: General Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>___</td>
<td>BMB 402: General Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>___</td>
<td>BMB 430: Developmental Biology</td>
<td>3</td>
</tr>
<tr>
<td>___</td>
<td>BMB 442: Lab Prot, Nuc Acid, Molec Clon</td>
<td>3</td>
</tr>
<tr>
<td>___</td>
<td>BMB 443W: Lab Protein Purifi./Enzymo</td>
<td>3</td>
</tr>
<tr>
<td>___</td>
<td>BMB 445W: Lab Molecular Genetics</td>
<td>2</td>
</tr>
<tr>
<td>___</td>
<td>BMB 460: Cell Growth &amp; Differentiation</td>
<td>3</td>
</tr>
</tbody>
</table>

### MICROBIOLOGY (8 cr)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>___</td>
<td>*MICRB 201: Intro. Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>___</td>
<td>MICRB 202: Intro. Microbiology Lab</td>
<td>2</td>
</tr>
<tr>
<td>___</td>
<td>MICRB 410: Principles of Immunology</td>
<td>3</td>
</tr>
</tbody>
</table>

### MATHEMATICS (8 cr)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>___</td>
<td>*MATH 140: Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>___</td>
<td>MATH 141: Calculus II</td>
<td>4</td>
</tr>
</tbody>
</table>

### BIOLOGY (3 cr)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>___</td>
<td>BIOL 322: Genetic Analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

### PHYSICS SEQUENCE (8 or 12 cr)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>___</td>
<td>PHYS 211: Gen Phys: Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>___</td>
<td>PHYS 212: Gen Phys: Elec./Magnet.</td>
<td>4</td>
</tr>
<tr>
<td>___</td>
<td>PHYS 213: Gen Phys: Fluids/Thermal</td>
<td>2</td>
</tr>
<tr>
<td>___</td>
<td>PHYS 214: Gen Phys: Wave/Motion/Qu</td>
<td>2</td>
</tr>
<tr>
<td>or</td>
<td>PHYS 250: Intro Physics I</td>
<td>4</td>
</tr>
<tr>
<td>___</td>
<td>PHYS 251: Intro Physics II</td>
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</tr>
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</table>

### FIRST YEAR SEMINAR (1 cr)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>___</td>
<td>PSU 016: First Year Seminar Science</td>
<td>1</td>
</tr>
</tbody>
</table>

---

**Note:**

- All courses on this page are **required** for the Biochemistry and Molecular Biology Major, Molecular and Cellular Biology option.

- This option contains two sequences.

1. student should take one of the two sequences: PHYS 211, 212, 213, 214 or PHYS 250 & 251.

2. student should take one of the two sequences: CHEM 450 & 452 or take BMB 428.

*Note: a “C” or better grade is required in CHEM 110, 111, 112, MATH 140 and at least 2 of the following BMB 251, 252 or MICRB 201*

**Total Major Requirement Credits:**

---

**BMB Molecular and Cellular Biology Option**
3. ELECTIVES IN THE MAJOR

LIST A select 5-6 credits from any 400 level BMB or MICRB course with a maximum of 4-credits in 496:

____________________  ________ crs
____________________  ________ crs
____________________  ________ crs
____________________  ________ crs

Total LIST A credits _____

4. MATHEMATICAL SCIENCE

LIST B select 2-3 credits from:

_____CmpSc 101  3  _____Stat 250  3  _____Math 220  2
_____CmpSc 201  3  _____Stat 301  3  _____Math 231  2
  _____Stat 401  3  _____Math 250  3

Students should select 2-3 credits from the electives List B to fulfill the Mathematical Science area.

Total List B Credits:__________

5. LIST C FREE ELECTIVES

Select 4-13 credits from Department List

____________________  ________ crs
____________________  ________ crs
____________________  ________ crs
____________________  ________ crs

LIST C FREE ELECTIVES With the EXCEPTION of the courses listed below, ALL courses appearing in the University Bulletin are acceptable as elective courses: 6 credits of ROTC may be applied toward graduation requirements.

BI SC: 001,002; CHEM: 001, 003, 108, 101; ENGL: 004, 005; LL ED: 005, 010, 123; MATH: 001, 003, 004, 111, 017, 018, 021,022, 026, 030, 035, 036, 040, 041, 081, 082, 083, 110; PH SC: 007; PHYS: 001, 150, 151; STAT: 100

Total Free Elective Credits:__________
### 6. ENTRANCE TO MAJOR

A student enrolled in this major must receive a grade “C” or better in the following courses specified by Senate Policy 82-44:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____ CHEM 110(H): Chemical Principles I</td>
<td>3</td>
<td></td>
</tr>
<tr>
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<td>_____ CHEM 112 (H): Chemical Principles II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>_____ MATH 140: Calculus I</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

2.0 GPA is required

### 7. TO GRADUATE

A “C” grade or better is required in 2 of the following 3 courses. **All 3 courses are required.**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____ MICRB 201: Intro. Microbiology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>_____ BMB 251: Molecular &amp; Cell Biology I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>_____ BMB 252: Molecular &amp; Cell Biology II</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Total ≥ 9

**+**

Earn “C” or Higher in **9 credits** of any 400-level MICRB/BMB courses except BMB 443W, 444, 445W, 446 BMB/MICRB 442, 496 MICRB 421W, MICRB 422, MICRB 447

<table>
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<tr>
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<tbody>
<tr>
<td></td>
<td></td>
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Total ≥ 9

### 8. REMEDIAL & REPEATS

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</tbody>
</table>

Total ≥ 9

### 9. SENATE POLICY 8380

Source/Time Credit acquisition:

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<tr>
<th>Credit Source/Time</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>36 of last 60 credits at PSU?</td>
<td>_____</td>
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<tr>
<td>60 credits in last 5 years?</td>
<td>_____</td>
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Overall GPA must be ≥ 2.0: __________

Total Credits Earned (less repeats and remedial; must have at least 125 to graduate): __________

### 10. GPA/CREDITS

- Overall GPA must be ≥ 2.0: __________
- Total Credits Earned (less repeats and remedial; must have at least 125 to graduate): __________

### 11. University Activities/Awards

### 12. Program Exceptions:

---

**BMB - Molecular and Cellular Biology Option**
Degree Requirements

Recommended Academic Plan
Biochemistry and Molecular Biology with Molecular & Cell Biology Option
(B M B with MCB option at UP)
Effective (For students entering Summer 2010 and later)

<table>
<thead>
<tr>
<th>Semester 1</th>
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<th>Semester 2</th>
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<td>MATH 141(GQ) Calculus with Analytic Geometry II</td>
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<tr>
<td>PSU 016 First-Year Seminar</td>
<td>1</td>
<td>ENGL 15 OR 30 (GWS) Composition/Honors Composition</td>
<td>3</td>
</tr>
<tr>
<td>Art (GA), Humanities (GH), or Social Behavioral Sciences (GS)</td>
<td>6</td>
<td>PHYS 211 (GN) General Physics Mechanics (must be taken in sequence with PHYS 212, 213, 214) or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-6</td>
<td>Art (GA), Humanities (GH), or Social Behavioral Sciences (GS)</td>
<td>3-6</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td><strong>15</strong></td>
<td><strong>Total Credits:</strong></td>
<td><strong>14-17</strong></td>
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<thead>
<tr>
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<th>Credits</th>
<th>Semester 4</th>
<th>Credits</th>
</tr>
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<td>3</td>
<td>CHEM 212 Organic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>% BMB 251 Molecular &amp; Cell Biology I</td>
<td>3</td>
<td>% BMB 212 Introductory Organic Chemistry</td>
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<tr>
<td>PHYS 212 (GN) General Physics Electricity and Magnetism (must be taken in sequence with PHYS 211, 213, 214) or</td>
<td>4</td>
<td>PHYS 251 Introductory Physics I (must be taken in sequence with PHYS 251)</td>
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<td>or</td>
<td>4</td>
<td>or</td>
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<tr>
<td>% MICRB 201 Introductory Microbiology</td>
<td>3</td>
<td>% BMB 252 Molecular &amp; Cell Biology II</td>
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<tr>
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<tbody>
<tr>
<td>BMB 400 Molecular Biology of the Gene</td>
<td>2</td>
<td>BMB 402 General Biochemistry</td>
<td>3</td>
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<td>BMB 401 General Biochemistry</td>
<td>3</td>
<td>BMB 445W Laboratory in Molecular Genetics</td>
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</tr>
<tr>
<td>BMB 442 Lab in Proteins, Nucleic Acids, &amp; Molecular Cloning</td>
<td>3</td>
<td>BMB 460 Cell Growth and Differentiation</td>
<td>3</td>
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<tr>
<td>MICRB 410 Principal of Immunology</td>
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<td>CAS 100 A, B, or C (GWS) Effective Speech</td>
<td>3</td>
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<tr>
<td><strong>LIST B ELECTIVE</strong></td>
<td>2-3</td>
<td><strong>Health &amp; Physical Activity (GHA)</strong></td>
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<tbody>
<tr>
<td>CHEM 450 Physical Chemistry – Thermodynamics (must be taken in sequence with CHEM 452) or</td>
<td>3</td>
<td>CHEM 452 Physical Chemistry - Quantum Chemistry (must be taken in sequence with CHEM 451)</td>
<td></td>
</tr>
<tr>
<td>or</td>
<td>3</td>
<td>or</td>
<td></td>
</tr>
<tr>
<td>BMB 428 Physical Chemistry with Biological Applications</td>
<td>3</td>
<td>ENGL 202C (GWS) Technical Writing</td>
<td>3</td>
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<tr>
<td>BMB 430 Developmental Biology</td>
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<td>Art (GA), Humanities (GH), or Social Behavioral Sciences (GS)</td>
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<tr>
<td>BMB 443W Laboratory in Protein Purification &amp; Enzymology</td>
<td>3</td>
<td>% LIST C FREE ELECTIVES</td>
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<tr>
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<td>2-3</td>
<td>#BMB or MICRB 400 Level Course</td>
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<td>± LIST C FREE ELECTIVES</td>
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<td><strong>Total Credits:</strong></td>
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- **Bold** type indicates courses requiring a quality grade of C or better.
- **Italic** type indicates courses that satisfy both major and General Education requirements.
- **Italic Bold** type indicates courses requiring a quality grade of C or better and that satisfy both major and General Education requirements.
- GWS, GHA, GN, GA, GH, and GS are codes used to identify General Education requirements.
- US, IL, and US;IL are codes used to designate courses that satisfy University United States/International Cultures requirement.
- W is the code used to designate courses that satisfy University Writing Across the Curriculum requirements.
- ~ indicates courses required to enter into this major.
- % indicates all 3 courses are required to graduate; a quality grade of C or better is required in 2 of the 3 courses.
- # indicates any 400 level Biochemistry & Molecular Biology (BMB) or Microbiology (MICRB) course with a maximum of 4-credits in 496.
- * indicates List B Electives: CMPSC 101 (3), 201 (3), Math 220 (2), 231 (2), 250 (3), Stat 250 (3) 301 (3), 401 (3)
- ± indicates see the Department List C for exclusions
- To graduate, all students must earn C or higher in 9 credits of any 400-level BMB/ MICRB courses except BMB 443W, 444, 445W, 446, BMB/MICRB 442, 496, MICRB 421W, 422, 447

~ continued next page ~
Scheduling patterns for courses not taught each semester

Fall - only taught courses: BMB 251H, 400, 401H, 428, 430, 443W, 446, 464 BMB/MICRB 435, 450 MICRB 401, 413, 421W and MICRB/BIOTC 416


± LIST C FREE ELECTIVES - With the EXCEPTION of the courses listed below, ALL courses appearing in the University Bulletin are acceptable as elective courses: 6 credits of ROTC may be applied toward graduation requirements.

| BI SC 001 | BI SC 002 | MATH 001 | MATH 003 | MATH 004 | MATH 111 | MATH 017 |
| MATH 018 | MATH 021 | MATH 022 | MATH 026 | MATH 030 | MATH 035 | MATH 036 |
| MATH 040 | MATH 041 | MATH 081 | MATH 082 | MATH 083 | MATH 110 | CHEM 001 |
| CHEM 003 | CHEM 108 | CHEM 101 | ENGL 004 | ENGL 005 | PH SC 007 | PHYS 001 |
| PHYS 150 | PHYS 151 | LL ED 005 | LL ED 010 | LL ED 123 | STAT 100 |
The Bachelor of Science Degree in Biotechnology

The General Option of the Biotechnology major requires a strong foundation in the sciences and then builds on that foundation with courses that teach students some of the specialized cultural, genetic and molecular techniques used by the biotechnology/biopharmaceutical industries. The heart of the General option consists of a lecture course in industrial microbiology and two, largely laboratory courses that teach students how to grow and genetically modify animal and plant cells. A third laboratory course introduces students to the use of biofermenters and to the team approach that many industries use to develop new products for commercialization. Students who graduate from the General option of the Biotechnology major quickly find employment in the industrial sector and discover that their undergraduate preparation makes the transition from student to employee quite easy.

BIOTC Gen Check Sheet (125 credits)

1. GENERAL EDUCATION

   ARTS (6 cr)
   ________________________ (GA) 3 crs
   ________________________ (GA) 3 crs
   ________________________ (GA) 3 crs

   HUMANITIES (6 cr)
   ________________________ (GH) 3 crs
   ________________________ (GH) 3 crs
   ________________________ (GH) 3 crs

   SOCIAL & BEHAVIORAL SCIENCES (6 cr)
   ________________________ (GS) 3 crs
   ________________________ (GS) 3 crs
   ________________________ (GS) 3 crs

   Students may petition to substitute 3 credits from one of the above knowledge domains for 3 credits in another domain, thereby substituting 9-6-3 credit pattern for the default 6-6-6 pattern in these general education courses.

   COMMUNICATIONS (GWS) (9 cr)
   _____ ENGL 015 or 030: Rhetoric & Comp 3 crs
   _____ ENGL 202C: Technical Writing 3 crs
   _____ CAS 100 A, B or C: Effective Speech 3 crs

   HEALTH & PHYSICAL ACTIVITIES (3 cr)
   ________________________ (GHA or GHS or GPE) __ crs
   ________________________ (GHA or GHS or GPE) __ crs
   ________________________ (GHA or GHS or GPE) __ crs

   WRITING ACROSS the CURRICULUM (W) (3 cr)
   ________________________ (W) 3 crs

   US/INTERNATIONAL CULTURES (6 cr)
   ________________________ (US) 3 crs
   ________________________ (IL) 3 crs

Total General Education Credits:__________
2. REQUIREMENTS FOR THE MAJOR

**CHEMISTRY (8 cr)**
- **CHEM 110**: (H): Chemical Principles I 3
- **CHEM 111**: Experimental Chemistry I 1
- **CHEM 112**: (H): Chemical Principles II 3
- **CHEM 113**: Experimental Chemistry II 1

**BIOCHEMISTRY & MOLECULAR BIOLOGY (14 cr)**
- **BMB 211**: Elementary Biochemistry 3
- **BMB 221**: Applied Biochemistry 2
- **BMB 251**: Molecular & Cell Biology I 3
- **BMB 252**: Molecular & Cell Biology II 3
- **BMB 442**: Lab Prot, Nuc Acid, Molec Clon 3

**BIOTECHNOLOGY (11 cr)**
- **BIOTC 416**: Microbial Biotechnology 2
- **BIOTC 459**: Plant Tissue Culture Biotc 3
- **BIOTC 479**: Methods Biofermentations 3
- **BIOTC 489**: Animal Cell Culture Meth. 3

**MICROBIOLOGY (11 cr)**
- **MICRB 201**: Intro. Microbiology 3
- **MICRB 202**: Intro. Microbiology Lab 2
- **MICRB 410**: Principals of Immunology 3
- **MICRB 421W**: Lab Gen/ Applied Micro 3

**MATHEMATICS (8 cr)**
- **MATH 140**: Calculus I 4
- **MATH 141**: Calculus II 4

**STATISTICS (3 cr)**
- **STAT 250**: Introduction Biostatistics 3

**BIOLOGY (3 cr)**
- **BIOL 322**: Genetic Analysis 3

**PHYSICS (8 cr)**
- **PHYS 250**: Intro Physics I 4
- **PHYS 251**: Intro Physics II 4

**FIRST YEAR SEMINAR (1 cr)**
- **PSU 016**: First Year Seminar Science 1

All of the above courses are **required** for the Biotechnology Major, General Option.

*Note: a “C” or better grade is required in CHEM 110, 111, 112, MATH 140 and at least 2 of the following BMB 251, 252 or MICRB 201

Total Major Requirement Credits:__________
3. ELECTIVES IN THE MAJOR

a. Select 6 or 8 credits from chemistry sequence:

- CHEM 210: (H): Organic Chemistry I 3
- CHEM 212: (H): Organic Chemistry II 3
- CHEM 213: Organic Chemistry Lab 2

or

- CHEM 202: Fund. of Organic Chem I 3
- CHEM 203: Fund. of Organic Chem II 3

+ 

b. Select 6 credits from any 400-level BMB/MICRB/BIOTC lecture course or FD SC 408

- crs
- crs
- crs
- crs
- crs

Total ≥ 6

4. LIST C FREE ELECTIVES

Select 14-16 credits from Department List

- crs
- crs
- crs
- crs

LIST C FREE ELECTIVES With the EXCEPTION of the courses listed below, ALL courses appearing in the University Bulletin are acceptable as elective courses: 6 credits of ROTC may be applied toward graduation requirements.

BI SC: 001,002; CHEM: 001, 003, 108, 101; ENGL: 004, 005; LL ED: 005, 010, 123; MATH: 001, 003, 004, 111, 017, 018, 021,022, 026, 030, 035, 036, 040, 041, 081, 082, 083, 110; PH SC: 007; PHYS: 001, 150, 151; STAT: 100

Total Free Elective Credits:_________
5. TO GRADUATE

A "C" grade or better is required in 2 of the following 3 courses. **All 3 courses are required.**

- MICRB 201: Intro. Microbiology 3
- BMB 251: Molecular & Cell Biology I 3
- BMB 252: Molecular & Cell Biology II 3

Total ≥ 9

+ Earn "C" or Higher in **9 credits** of any 400-level MICRB/BMB/BIOTC courses except BMB 443W, 444, 445W, 446, BMB/MICRB 442, 496, MICRB 421W, MICRB 422, MICRB 447

7. REMEDIAL & REPEATS

Courses that do not meet degree requirements:

- crs
- crs
- crs
- crs

6. ENTRANCE TO MAJOR

A student enrolled in this major must receive a grade “C” or better in the following courses specified by Senate Policy 82-44

- CHEM 110(H): Chemical Principles I 3
- CHEM 111: Experimental Chemistry I 1
- CHEM 112(H): Chemical Principles II 3
- MATH 140: Calculus I 4

2.0 GPA is required

8. SENATE POLICY 8380

Source/Time Credit acquisition:

- 36 of last 60 credits at PSU? ________ crs
- 60 credits in last 5 years? ________ crs

Overall GPA must be ≥ 2.0: ________

Total Credits Earned (less repeats and remedial; must have at least 125 to graduate): ________
## Recommended Academic Plan
### Biotechnology General Option (BIOTC Gen at UP)
**Effective** (For students entering Summer 2010 and later)

<table>
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<tr>
<th>Semester 1</th>
<th>Credits</th>
<th>Semester 2</th>
<th>Credits</th>
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<tbody>
<tr>
<td>~MATH 140 (GQ) Calculus with Analytic Geometry I</td>
<td>4</td>
<td>~MATH 141(GQ) Calculus with Analytic Geometry II</td>
<td>4</td>
</tr>
<tr>
<td>~CHEM 110(GN) Chemical Principles</td>
<td>3</td>
<td>~CHEM 112(GN) Chemical Principals</td>
<td>3</td>
</tr>
<tr>
<td>~CHEM 111 (GN) Experimental Chemistry</td>
<td>1</td>
<td>CHEM 113 (GN) Experimental Chemistry</td>
<td>1</td>
</tr>
<tr>
<td><strong>PSU 016 First-Year Seminar</strong></td>
<td>1</td>
<td><strong>ENGL 15 OR 30 (GWS) Composition/Honors Composition</strong></td>
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<td>Arts (GA), Humanities (GH) or Social Behavioral Sciences (GS)</td>
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<td>PHYS 250 (GN) Introduction Physics I</td>
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<td>CHEM 203 (must be taken in sequence with CHEM 202)</td>
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<td>CHEM 210 Organic Chemistry (must be taken in sequence with CHEM 212 &amp; 213)</td>
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<td>CHEM 212 Organic Chemistry (must be taken in sequence with CHEM 210 &amp; 212)</td>
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<tr>
<td><strong>%BMB 251 Molecular &amp; Cell Biology I</strong></td>
<td>3</td>
<td>%BMB 252 Molecular &amp; Cell Biology II</td>
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<tr>
<td>PHYS 251 (GN) Introduction Physics II</td>
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<td>%MICRB 201 Introductory Microbiology</td>
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<tr>
<td>Arts (GA), Humanities (GH) or Social Behavioral Sciences (GS)</td>
<td>3</td>
<td>MICRB 202 Introductory Microbiology Laboratory</td>
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<td>± LIST C FREE ELECTIVES</td>
<td>3</td>
<td>BIOL 322 Genetics Analysis</td>
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<tr>
<td>BMB 211 Elementary Biochemistry</td>
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<td>BMB 221 Applied Biochemistry</td>
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<td>MICRB 410 Principles of Immunology</td>
<td>3</td>
<td>BIOTC 459 Plant Tissue Culture &amp; Biotechnology</td>
<td>3</td>
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<tr>
<td>MICRB 421W Laboratory of General &amp; Applied Microbiology</td>
<td>3</td>
<td>BMB 442 Lab in Proteins, Nucleic Acids, &amp; Molecular Cloning</td>
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<tr>
<td>± LIST C FREE ELECTIVES</td>
<td>3</td>
<td>ENGL 202C Technical Writing</td>
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<tr>
<td>CAS 100 A, B, or C (GWS) Effective Speech</td>
<td>3</td>
<td>Health &amp; Physical Activity (GHA)</td>
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<td>Health &amp; Physical Activity (GHA)</td>
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<td>STAT 250 (GQ) Introduction to Biostatistics</td>
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<tbody>
<tr>
<td>BIOTC 416 Microbial Biotechnology</td>
<td>2</td>
<td>Arts (GA), Humanities (GH) or Social Behavioral Sciences (GS)</td>
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<td>Arts (GA), Humanities (GH) or Social Behavioral Sciences (GS)</td>
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<td># 400 LEVEL ELECTIVE</td>
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<td>BIOTC 489 Animal Cell Culture Methods</td>
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<td>BIOTC 479 Methods in Biofermentations</td>
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<td>± LIST C FREE ELECTIVES</td>
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<td><strong>Total Credits:</strong></td>
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- **Bold** type indicates courses requiring a quality grade of C or better.
- **Italic** type indicates courses that satisfy both major and General Education requirements.
- **Italic Bold** type indicates courses requiring a quality grade of C or better and satisfy both major and General Education requirements.
- GWS, GHA, GQ, GN, GA, GH, and GS are codes used to identify General Education requirements.
- US, IL, and US;IL are codes used to designate courses that satisfy University United States/International Cultures requirement.
- W is the code used to designate courses that satisfy University Writing Across the Curriculum requirements.
- ~ indicates courses required to enter into this major.
- % indicates all 3 courses are required to graduate; a quality grade of C or better is required in 2 of the 3 courses.
- # any 400 level Biochemistry & Molecular Biology (BMB), Microbiology (MICRB), or Biotechnology (BIOTC) lecture course or Food Science (FD SC) 408.
- ± indicates see the Department List for exclusions see reverse side.
- To graduate, all students must earn a C or higher in 9 credits of any 400-level BMB/MICRB/BIOTC courses except BMB 443W, 444, 445W, 446 BMB/MICRB 442, 496, MICRB 421W, 422, 447.

### Scheduling patterns for courses not taught each semester
**Fall** - only taught courses: BMB 251H, 400, 401H, 428, 430, 443W, 446, 464 BMB/MICRB 435, 450 MICRB 401, 413, 421W and MICRB/BIOTC 416 BIOTC 489
**Spring** - only taught courses: BMB 221, 252H, 402H, 433, 437, 444, 445W, 474, 497B BMB/MICRB 432, 460, 480 MICRB 201H, 412, 415, 422, 447 BIOTC 459, 460

± **LIST C FREE ELECTIVES** - With the EXCEPTION of the courses listed below, ALL courses appearing in the University Bulletin are acceptable as elective courses: 6 credits of ROTC may be applied toward graduation requirements.

<table>
<thead>
<tr>
<th>BI SC 001</th>
<th>BI SC 002</th>
<th>MATH 001</th>
<th>MATH 003</th>
<th>MATH 004</th>
<th>MATH 111</th>
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<td>ENGL 004</td>
<td>ENGL 005</td>
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<td>PHYS 151</td>
<td>LL ED 005</td>
<td>LL ED 010</td>
<td>LL ED 123</td>
<td>STAT 100</td>
<td></td>
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</tbody>
</table>
The Bachelor of Science Degree in Biotechnology with the Clinical Laboratory Science Option

The Clinical Laboratory Science (CLS) option of the Biotechnology major is offered for students who enjoy laboratory work and would consider a career as a scientist in the laboratory of a hospital or physician office laboratory. CLS positions typically call for certified individuals. To become certified, students need a BS degree and formal clinical education, and they must pass a national test to demonstrate understanding of the science they will practice. Thus, the CLS option requires a 10-month period of course work at an affiliated School of Clinical Laboratory Science. This is undertaken during the senior year after students have completed all basic science and general education courses of their undergraduate program. Current affiliations exist with Mt. Nittany Medical Center and with Pennsylvania Hospital in Philadelphia. Graduates enjoy outstanding job opportunities, in the clinical environment as well as the industrial sector.

**BIOTC CLS Option Check Sheet (125 credits)**

1. **GENERAL EDUCATION**

   ARTS (6 cr)
   
   1. __________________________ (GA) 3 crs
   2. __________________________ (GA) 3 crs
   3. __________________________ (GA) 3 crs

   HUMANITIES (6 cr)
   
   1. __________________________ (GH) 3 crs
   2. __________________________ (GH) 3 crs
   3. __________________________ (GH) 3 crs

   SOCIAL & BEHAVIORAL SCIENCES (6 cr)
   
   1. __________________________ (GS) 3 crs
   2. __________________________ (GS) 3 crs
   3. __________________________ (GS) 3 crs

   Students may petition to substitute 3 credits from one of the above knowledge domains for 3 credits in another domain, thereby substituting 9-6-3 credit pattern for the default 6-6-6 pattern in these general education courses.

2. **COMMUNICATIONS (GWS) (9 cr)**

   1. ENGL 015 or 030: Rhetoric & Comp 3 crs
   2. ENGL 202C: Technical Writing 3 crs
   3. CAS 100 A, B or C: Effective Speech 3 crs

3. **HEALTH & PHYSICAL ACTIVITIES (3 cr)**

   1. __________________________ (GHA or GHS or GPE) ___ crs
   2. __________________________ (GHA or GHS or GPE) ___ crs
   3. __________________________ (GHA or GHS or GPE) ___ crs

4. **WRITING ACROSS the CURRICULUM (W) (3cr)**

   1. _________________________ (W) 3 crs

5. **US/INTERNATIONAL CULTURES (6 cr)**

   1. __________________________ (US) 3 crs
   2. __________________________ (IL) 3 crs

Total General Education Credits: __________
## Degree Requirements

### 2. REQUIREMENTS FOR THE MAJOR

**CHEMISTRY (8 cr)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHEM 110: (H): Chemical Principles I</td>
<td>3</td>
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</tr>
<tr>
<td>CHEM 111: Experimental Chemistry I</td>
<td>1</td>
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<tr>
<td>CHEM 112: (H): Chemical Principles II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CHEM 113: Experimental Chemistry II</td>
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**BIOCHEMISTRY & MOLECULAR BIOLOGY (6 cr)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMB 211: Elementary Biochem</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BMB 212: Elementary Biochem Lab</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>BMB 221: Applied Biochemistry</td>
<td>2</td>
<td></td>
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</tbody>
</table>

**MICROBIOLOGY (52 cr)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICRB 201: Intro. Microbiology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MICRB 202: Intro. Microbiology Lab</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>MICRB 251: Molecular &amp; Cell Biology I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MICRB 252: Molecular &amp; Cell Biology II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MICRB 410: Principals of Immunology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MICRB 412: Medical Microbiology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MICRB 421W: Lab Gen/ Applied Micro</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MICRB 422: Medical Microbiology Lab</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>MICRB 405 AF Seminar/Practicum</td>
<td>30</td>
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</table>

**MATHEMATICS (8 cr)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 140: Calculus I</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>MATH 141: Calculus II</td>
<td>4</td>
<td></td>
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</table>

**BIOLOGY (3 cr)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 322: Genetic Analysis</td>
<td>3</td>
<td></td>
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</tbody>
</table>

**PHYSICS (8 cr)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 250: Intro Physics I</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>PHYS 251: Intro Physics II</td>
<td>4</td>
<td></td>
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</tbody>
</table>

**FIRST YEAR SEMINAR (1 cr)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSU 016: First Year Seminar Science</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

All of the above courses are **required** for the Biotechnology Major, Clinical Laboratory Science Option.

*Note: a “C” or better grade is required in CHEM 110, 111, 112, MATH 140 and at least 2 of the following MICRB 251, 252 or MICRB 201

Total Major Requirement Credits:__________
3. ELECTIVES IN THE MAJOR

Select 6 or 8 credits from chemistry sequence:

- _____CHEM 210: (H): Organic Chemistry I 3
- _____CHEM 212: (H): Organic Chemistry II 3
- _____CHEM 213: Organic Chemistry Lab 2

Or
- _____CHEM 203: Fund. of Organic Chem II 3

4. LIST C FREE ELECTIVES

Select 1-3 credits from Department List

____________________ __________ crs
____________________ __________ crs
____________________ __________ crs
____________________ __________ crs

LIST C FREE ELECTIVES With the EXCEPTION of the courses listed below, ALL courses appearing in the University Bulletin are acceptable as elective courses: 6 credits of ROTC may be applied toward graduation requirements.

BI SC: 001,002; CHEM: 001, 003, 108, 101; ENGL: 004, 005; LL ED: 005, 010, 123; MATH: 001, 003, 004, 111, 017, 018, 021,022, 026, 030, 035, 036, 040, 041, 081, 082, 083, 110; PH SC: 007; PHYS: 001, 150, 151; STAT: 100

Total Free Elective Credits:__________

5. TO GRADUATE

A “C” grade or better is required in 2 of the following 3 courses. All 3 courses are required.

- _____MICRB 201: Intro. Microbiology 3
- _____MICRB 251: Molecular & Cell Biology I 3
- _____MICRB 252: Molecular & Cell Biology II 3

Total ≥ 9

+ Earn “C” or Higher in 9 credits of any 400-level MICRB/BMB/BIOTC courses except BMB 443W, 444, 445W, 446, BMB/MICRB 442, 496, MICRB 421W, MICRB 422, MICRB 447

____________________ __________ crs
____________________ __________ crs
____________________ __________ crs
____________________ __________ crs

Total ≥ 9

Biotechnology - Clinical Laboratory Science Option
6. ENTRANCE TO MAJOR

A student enrolled in this major must receive a grade “C” or better in the following courses specified by Senate Policy 82-44

[Courses listed with grades and credits]

_____ 2.0 GPA is required

7. REMEDIAL & REPEATS

Courses that do not meet degree requirements:

[Grades and credits listed]

8. SENATE POLICY 8380

Source/Time Credit acquisition:

36 of last 60 credits at PSU? _________crs
60 credits in last 5 years? _________crs

9. GPA/CREDITS

Overall GPA must be ≥ 2.0: __________

Total Credits Earned (less repeats and remedial; must have at least 125 to graduate): _______

10. University Activities/Awards

11. Program Exceptions:
<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Credits</th>
<th>Semester 2</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>~ MATH 140 (GQ) Calculus with Analytic Geometry I</td>
<td>4</td>
<td>MATH 141 (GQ) Calculus with Analytic Geometry II</td>
<td>4</td>
</tr>
<tr>
<td>~ CHEM 110 (GN) Chemical Principles</td>
<td>3</td>
<td>~ CHEM 112 (GN) Chemical Principles</td>
<td>3</td>
</tr>
<tr>
<td>~ CHEM 111 (GN) Experimental Chemistry</td>
<td>1</td>
<td>CHEM 113 (GN) Experimental Chemistry</td>
<td>1</td>
</tr>
<tr>
<td>PSU 016 First-Year Seminar</td>
<td>1</td>
<td>ENGL 015 OR 030 (GWS) Composition/Honors Composition</td>
<td>3</td>
</tr>
<tr>
<td>Arts (GA), Humanities (GH) or Social Behavioral Sciences (GS)</td>
<td>6</td>
<td>PHYS 250 (GN) Introduction Physics I</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td>15</td>
<td><strong>Total Credits:</strong></td>
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<table>
<thead>
<tr>
<th>Semester 3</th>
<th>Credits</th>
<th>Semester 4</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 202 (must be taken in sequence with CHEM 203)</td>
<td>3</td>
<td>CHEM 203 (must be taken in sequence with CHEM 202)</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 210 Organic Chemistry (must be taken in sequence with CHEM 212 &amp; 213)</td>
<td>3</td>
<td>CHEM 212 Organic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 213 Laboratory in Organic Chemistry (must be taken in sequence with CHEM 210 &amp; 212)</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% MICRB 251 Molecular &amp; Cell Biology I</td>
<td>3</td>
<td>% MICRB 252 Molecular &amp; Cell Biology II</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 251 (GN) Introductory Physics II</td>
<td>4</td>
<td>% MICRB 201 Introductory Microbiology</td>
<td>3</td>
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<tr>
<td>Arts (GA), Humanities (GH) or Social Behavioral Sciences (GS)</td>
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<td>MICRB 202 Introductory Microbiology Laboratory</td>
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<tr>
<td><strong>Total Credits:</strong></td>
<td>16</td>
<td><strong>Total Credits:</strong></td>
<td>15.5 - 17.5</td>
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<table>
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<tr>
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<th>Semester 6</th>
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<tr>
<td>BMB 211 Elementary Biochemistry</td>
<td>3</td>
<td>BMB 221 Applied Biochemistry</td>
<td>2</td>
</tr>
<tr>
<td>BMB 212 Elementary Biochemistry Laboratory</td>
<td>1</td>
<td>MICRB 412 Medical Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>MICRB 410 Principles of Immunology</td>
<td>3</td>
<td>MICRB 422 Medical Microbiology Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>MICRB 421W Laboratory of General &amp; Applied Microbiology</td>
<td>3</td>
<td>ENGL 202C Technical Writing</td>
<td>3</td>
</tr>
<tr>
<td>CAS 100 A, B, or C (GWS) Effective Speech</td>
<td>3</td>
<td>± LIST C FREE ELECTIVES</td>
<td>1-3</td>
</tr>
<tr>
<td>Arts (GA), Humanities (GH) or Social Behavioral Sciences (GS)</td>
<td>3</td>
<td>Health &amp; Physical Activity (GHA)</td>
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</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td>16</td>
<td><strong>Total Credits:</strong></td>
<td>15.5 - 17.5</td>
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<table>
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<tr>
<th>Semester 7</th>
<th>Credits</th>
<th>Semester 8</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>MICRB 405A Seminar &amp; Practicum in Medical Technology</td>
<td>8</td>
<td>MICRB 405D Seminar &amp; Practicum in Medical Technology</td>
<td>5</td>
</tr>
<tr>
<td>MICRB 405B Seminar &amp; Practicum in Medical Technology</td>
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<td>MICRB 405E Seminar &amp; Practicum in Medical Technology</td>
<td>7</td>
</tr>
<tr>
<td>MICRB 405C Seminar &amp; Practicum in Medical Technology</td>
<td>6</td>
<td>MICRB 405F Seminar &amp; Practicum in Medical Technology</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td>15</td>
<td><strong>Total Credits:</strong></td>
<td>15</td>
</tr>
</tbody>
</table>

- **Bold** type indicates courses requiring a quality grade of C or better.
- **Italic** type indicates courses that satisfy both major and General Education requirements.
- **Italic Bold** type indicates courses requiring a quality grade of C or better and that satisfy both major and General Education requirements.
- GWS, GHA, GQ, GN, GA, GH, and GS are codes used to identify General Education requirements.
- US, IL, and US;IL are codes used to designate courses that satisfy University United States/International Cultures requirements.
- W is the code used to designate courses that satisfy University Writing Across the Curriculum requirements.
- ~ indicates courses required to enter into this major.
- % indicates all 3 courses are required to graduate; a quality grade of C or better is required in 2 of the 3 courses.
- ± indicates see the Department List for exclusions see reverse side
- To graduate, all students must earn a C or higher in 9 credits of any 400-level BMB/MICRB/BIOTC courses except BMB 443W, 444, 445W, 446 BMB/MICRB 442, 496, MICRB 421W, 422, 447

**Scheduling patterns for courses not taught each semester**
Fall - only taught courses: BMB 251H, 400, 401H, 428, 430, 443W, 446, 464 BMB/MICRB 435, 450 MICRB 401, 413, 421W and MICRB/BIOTC 416 BIOTC 489


± **LIST C FREE ELECTIVES** - With the EXCEPTION of the courses listed below, ALL courses appearing in the University Bulletin are acceptable as elective courses: 6 credits of ROTC may be applied toward graduation requirements.

- BI SC 001
- BI SC 002
- MATH 001
- MATH 003
- MATH 004
- MATH 111
- MATH 017
- MATH 018
- MATH 021
- MATH 022
- MATH 026
- MATH 030
- MATH 035
- MATH 036
- MATH 040
- MATH 041
- MATH 081
- MATH 082
- MATH 083
- MATH 110
- CHEM 001
- CHEM 108
- CHEM 101
- ENGL 004
- ENGL 005
- PH SC 007
- PHYS 001
- PHYS 150
- PHYS 151
- LL ED 005
- LL ED 010
- LL ED 123
- STAT 100

**Biotechnology - Clinical Laboratory Science Option**
The Bachelor of Science Degree in Microbiology (125 credits)

The Microbiology major is the major of choice for students interested in such fields as virology, immunology, and bacteriology. Whether it is tackling questions about the molecular biology of how a virus replicates inside a living cell, or how the body is able to defend itself against foreign agents, or how a bacterium controls its metabolism to live exclusively on the energy of inorganic compounds or in association with animal or human hosts in biofilms, it is the discipline of microbiology that focuses on such problems. The Micrb major requires 8-credits of physics, but otherwise shares the same basic science foundation with the BMB major. Some advanced courses in the major are viral pathogenesis, microbial diversity, tumor viruses and oncogenes, industrial, and food microbiology. Graduates are well-prepared for graduate and professional schools and for positions in the biopharmaceutical industry.

MICRB Check Sheet (125 credits)

1. GENERAL EDUCATION
   ARTS (6 cr)
   ______________________(GA) 3 crs
   ______________________(GA) 3 crs
   ______________________(GA) 3 crs
   HUMANITIES (6 cr)
   ______________________(GH) 3 crs
   ______________________(GH) 3 crs
   ______________________(GH) 3 crs
   SOCIAL & BEHAVIORAL SCIENCES (6 cr)
   ______________________(GS) 3 crs
   ______________________(GS) 3 crs
   ______________________(GS) 3 crs

   Students may petition to substitute 3 credits from one of the above knowledge domains for 3 credits in another domain, thereby substituting 9-6-3 credit pattern for the default 6-6-6 pattern in these general education courses.

   COMMUNICATIONS (GWS) (9 cr)
   _____ ENGL 015 or 030: Rhetoric & Comp 3 crs
   _____ ENGL 202C: Technical Writing 3 crs
   _____ CAS 100 A, B or C: Effective Speech 3 crs

   HEALTH & PHYSICAL ACTIVITIES (3 cr)
   ______________________(GHA or GHS or GPE) ____ crs
   ______________________(GHA or GHS or GPE) ____ crs
   ______________________(GHA or GHS or GPE) ____ crs

   WRITING ACROSS the CURRICULUM (W) (3cr)
   ______________________ (W) 3 crs

   US/INTERNATIONAL CULTURES (6 cr)
   ______________________ (US) 3 crs
   ______________________ (IL) 3 crs

Total General Education Credits:__________
2. REQUIREMENTS FOR THE MAJOR

CHEMISTRY (16 cr)
- *CHEM 110: (H): Chemical Principles I 3
- *CHEM 111: Experimental Chemistry I 1
- *CHEM 112: (H): Chemical Principles II 3
- CHEM 113: Experimental Chemistry II 1
- CHEM 210: (H): Organic Chemistry I 3
- CHEM 212: (H): Organic Chemistry II 3
- CHEM 213: Organic Chemistry Lab 2

MICROBIOLOGY (17 cr)
- *MICRB 201: Intro. Microbiology 3
- MICRB 202: Intro. Microbiology Lab 2
- *MICRB 251: Molecular & Cell Biology I 3
- *MICRB 252: Molecular & Cell Biology II 3
- MICRB 421W: Lab Gen/ Applied Micro 3
- MICRB 442: Lab Prot., Nuc. Acid, Molec Clon 3

BIOCHEMISTRY & MOLECULAR BIOLOGY (11 cr)
- BMB 400: Molec. Biol. of the Gene 2
- BMB 401: General Biochemistry 3
- BMB 402: General Biochemistry 3
- BMB 428: Physical Chem w/Biological Apps 3

MATHEMATICS (8 cr)
- *MATH 140: Calculus I 4
- MATH 141: Calculus II 4

BIOLOGY (3 cr)
- BIOL 322: Genetic Analysis 3

PHYSICS (8 cr)
- PHYS 250: Intro Physics I 4
- PHYS 251: Intro Physics II 4

FIRST YEAR SEMINAR (1 cr)
- PSU 016: First Year Seminar Science 1

All of the above courses are **required** for the Microbiology Major.

*Note: a “C” or better grade is required in CHEM 110, 111, 112, MATH 140 and at least 2 of the following BMB 251, 252 or MICRB 201

Total Major Requirement Credits:__________
3. ELECTIVES IN THE MAJOR

a. Select any 4 of the following courses

- MICRB 401: Microb Physiology 3
- MICRB 410: Principals of Immunology 3
- MICRB 412: Medical Microbiology 3
- MICRB 415: General Virology 3
- MICRB 450: Micrb/Molec Genetics 2

b. Select 3 credits in 400-level laboratory courses

- MICRB 422: Medical Microbiology Lab 2
- MICRB 447: Molec Immunology Lab 1
- BMB 444: Lab in Carbohydrates/ Lipids 1
- BMB 445W: Lab Molec Genetics I 2
- BMB 446: Lab Molec Genetics II 1

+ 

+ c. Select 6-7 credits from FD SC 408(2), or any 400-level MICRB course except MICRB 400 & 496

Total Electives in the Major ≥ 21

4. LIST C FREE ELECTIVES

Select 9-11 credits from Department List

__ __ __ __ __ __ __ __ __ __ crs

LIST C FREE ELECTIVES With the EXCEPTION of the courses listed below, ALL courses appearing in the University Bulletin are acceptable as elective courses: 6 credits of ROTC may be applied toward graduation requirements.

BI SC: 001,002; CHEM: 001, 003, 108, 101; ENGL: 004, 005; LL ED: 005, 010, 123; MATH: 001, 003, 004, 111, 017, 018, 021,022, 026, 030, 035, 036, 040, 041, 081, 082, 083, 110; PH SC: 007; PHYS: 001, 150, 151; STAT: 100

Total Free Elective Credits:__________
## Degree Requirements

### 5. TO GRADUATE

A "C" grade or better is required in 2 of the following 3 courses. **All 3 courses are required.**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICRB 201</td>
<td>Intro. Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>MICRB 251</td>
<td>Molecular &amp; Cell Biology I</td>
<td>3</td>
</tr>
<tr>
<td>MICRB 252</td>
<td>Molecular &amp; Cell Biology II</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total ≥ 9**

+ Earn "C" or Higher in **9 credits** of any 400-level MICRB/BMB courses **except** BMB 442, BMB 443, BMB 444, BMB 445W, BMB/MICRB 495, BMB/MICRB 496, MICRB 421W, MICRB 422, MICRB 447

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

**Total ≥ 9**

### 6. ENTRANCE TO MAJOR

A student enrolled in this major must receive a grade “C” or better in the following courses specified by Senate Policy 82-44

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 110(H)</td>
<td>Chemical Principles I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 111</td>
<td>Experimental Chemistry I</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 112 (H)</td>
<td>Chemical Principles II</td>
<td>3</td>
</tr>
<tr>
<td>MATH 140</td>
<td>Calculus I</td>
<td>4</td>
</tr>
</tbody>
</table>

2.0 GPA is required

### 7. REMEDIAL & REPEATS

Courses that do not meet degree requirements:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 8. SENATE POLICY 8380

Source/Time Credit acquisition:

- 36 of last 60 credits at PSU? _________crs
- 60 credits in last 5 years? _________crs

### 9. GPA/CREDITS

Overall GPA must be ≥ 2.0: _________

Total Credits Earned (less repeats and remedial; must have at least 125 to graduate): _________

### 10. University Activities/Awards

### 11. Program Exceptions:

Microbiology
## Recommended Academic Plan
**Microbiology (MICRB at UP)**
**Effective (For students entering Summer 2010 and later)**

### Semester 1
<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 140 (GQ) Calculus with Analytic Geometry I</td>
<td>4</td>
</tr>
<tr>
<td>~&lt;br&gt;~CHEM 110 (GN) Chemical Principles</td>
<td>3</td>
</tr>
<tr>
<td>~&lt;br&gt;~CHEM 111 (GN) Experimental Chemistry</td>
<td>1</td>
</tr>
<tr>
<td>PSU 016 First-Year Seminar</td>
<td>1</td>
</tr>
<tr>
<td>Arts (GA), Humanities (GH) or Social Behavioral Sciences (GS)</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
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</table>

### Semester 2
<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 141 (GQ) Calculus with Analytic Geometry II</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 112 (GN) Chemical Principles</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 113 (GN) Experimental Chemistry</td>
<td>1</td>
</tr>
<tr>
<td>ENGL 15 OR 30 (GWS) Composition/Honors Composition</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 250 (GN) Introduction Physics I</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td>15</td>
</tr>
</tbody>
</table>

### Semester 3
<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 210 Organic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>% MICRB 251 Molecular &amp; Cell Biology I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 251 (GN) Introduction Physics II</td>
<td>4</td>
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<tr>
<td>± LIST C FREE ELECTIVE</td>
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</tr>
<tr>
<td>Arts (GA), Humanities (GH) or Social Behavioral Sciences (GS)</td>
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<td><strong>Total Credits:</strong></td>
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### Semester 4
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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>MATH 212 Organic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>% MICRB 252 Molecular &amp; Cell Biology II</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 252 (GN) Laboratory in Organic Chemistry</td>
<td>2</td>
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<tr>
<td>MICRB 201 Introductory Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 322 Genetic Analysis</td>
<td>3</td>
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<tr>
<td><strong>Total Credits:</strong></td>
<td>16</td>
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### Semester 5
<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Arts (GA), Humanities (GH) or Social Behavioral Sciences (GS)</td>
<td>3</td>
</tr>
<tr>
<td>BMB 402 General Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>*MICRB ELECT</td>
<td>3</td>
</tr>
<tr>
<td>MICRB 442 Laboratory of General &amp; Applied Microbiology</td>
<td>2</td>
</tr>
<tr>
<td>CAS 100 A, B, or C (GWS) Effective Speech</td>
<td>3</td>
</tr>
<tr>
<td>Health &amp; Physical Activity (GHA)</td>
<td>1.5</td>
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<tr>
<td><strong>Total Credits:</strong></td>
<td>16.5</td>
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### Semester 6
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<tr>
<td>BMB 401 General Biochemistry</td>
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<tr>
<td>%MICRB ELECT</td>
<td>2-3</td>
</tr>
<tr>
<td>@MICRB ELECT</td>
<td>3-4</td>
</tr>
<tr>
<td>@MICRB ELECT</td>
<td>1-3</td>
</tr>
<tr>
<td>@MICRB ELECT</td>
<td>3-4</td>
</tr>
<tr>
<td>BMB 400 Molecular Biology of the Gene</td>
<td>2</td>
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<tr>
<td>BMB 428 Physical Chemistry with Biological Applications</td>
<td>3</td>
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<tr>
<td>± LIST C FREE ELECTIVES</td>
<td>1-3</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td>15-16</td>
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### Semester 7
<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BMB/MICRB 421W Laboratory of General &amp; Applied Microbiology</td>
<td>2</td>
</tr>
<tr>
<td>BMB/MICRB 424, 496, MIRC 421W, 422, 447</td>
<td>2-3</td>
</tr>
<tr>
<td>± LIST C FREE ELECTIVES</td>
<td>1-3</td>
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<tr>
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### Semester 8
<table>
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<th>Course</th>
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</thead>
<tbody>
<tr>
<td>BMB/MICRB 442, 496, MIRC 421W, 422, 447</td>
<td>2-3</td>
</tr>
<tr>
<td>± LIST C FREE ELECTIVES</td>
<td>1-3</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td>15-16</td>
</tr>
</tbody>
</table>

- **Bold** type indicates courses requiring a quality grade of C or better.
- **Italic** type indicates courses that satisfy both major and General Education requirements.
- **Italic Bold** type indicates courses requiring a quality grade of C or better and that satisfy both major and General Education requirements.
- W is the code used to designate courses that satisfy University Writing Across the Curriculum requirements.
- ~ indicates courses required to enter into this major.
- % indicates all 3 courses are required to graduate; a quality grade of C or better is required in 2 of the 3 courses.
- * indicates select 4 courses from: MICRB 401 (3), 410 (3), 412 (3), 415 (3), 450 (2)
- # indicates select 3 credits from: MICRB 422 (2), 447 (1), BMB 444, (1), 445W (2), 446 (1)
- @ indicates select 6-7 credits from: FdSc 408 (2), or any 400 level MICRB course except MICRB 400 and 496
- ± indicates see the Department List C for exclusions see reverse side
- To graduate, all students must earn a C or higher in 9 credits of any 400-level BMB/ MICRB courses except BMB 443W, 444, 445W, 446, BMB/MICRB 442, 496, MICRB 421W, 422, 447

### Scheduling patterns for courses not taught each semester
- **Fall** - only taught courses: BMB 251H, 400, 401H, 428, 430, 443W, 446, 464 BMB/MICRB 435, 450 MICRB 401, 413, 421W and MICRB/BIO 416
- **Spring** - only taught courses: BMB 221, 252H, 402H, 433, 437, 444, 445W, 474, 497B BMB/MICRB 432, 460, 480 MICRB 201H, 412, 415, 422, 447

### Degree Requirements
- Microbiology
**Student Organizations**

**The Biochemistry Society**

In its promotional flier, the Biochemistry Society states the following:

If you are looking for other students interested in biochemistry/molecular biology, a study partner for one of your classes, or advice from more experienced students, then the Biochemistry Society of Penn State is for you! You will meet all varieties of people - pre-med students, research lovers, and double majors just to list a few. Learn about the different things you can do with your major and all the opportunities available at Penn State. In addition to the vast array of experiences represented among our members, you can gain new perspectives by participation in seminars and listening to our guest speakers.

Meeting times and places are announced via the BMB list server, in the lobbies of Frear and Althouse buildings, in The Daily Collegian and on the Biochemistry Society's web page at [http://www.clubs.psu.edu/up/biochem/](http://www.clubs.psu.edu/up/biochem/)

**Student Chapter of the American Society for Microbiology**

According to its own promotional flier, the Student Chapter of the American Society for Microbiology exists for at least three purposes:

1. to serve as a resource for current and prospective microbiology majors
   - answer questions on course selection, research, our major, etc.
   - participate in Eberly College of Science open houses and give tours to prospective students
   - provide information about graduate school and other career options

2. to provide a forum for socializing
   - get to know other microbiology majors at club meetings
   - participate in social and charitable events
   - get to meet and know more about undergraduate instructors
   - take exciting trips to the ASM branch meetings

3. promote public awareness of relevant microbiological topics

Meeting times are announced on the club bulletin board in South Frear. Visit the club's web page at [http://www.clubs.psu.edu/up/asm_psu/index.html](http://www.clubs.psu.edu/up/asm_psu/index.html)
496 Independent Research in the Department of Biochemistry & Molecular Biology

As a university, Penn State has a vigorous and extensive research enterprise. Faculty are awarded grants by government and private agencies to conduct research in the many academic disciplines within the university structure. Undergraduates who qualify are invited to participate in the on-going research programs of BMB faculty. Typically, between 65 and 65 students are engaged in undergraduate research during the fall and spring semesters. Most of these students are juniors and seniors. Participation in undergraduate research requires that an application be submitted which will be reviewed by faculty members selected by the student. Packets are available in 107 Althouse approximately six weeks into the start of each semester.

Scholarships in the Department of Biochemistry & Molecular Biology

The BMB department awards about ten department scholarships to its undergraduate students each year. In addition, the Eberly College of Science has a number of awards that circulate to designated departments within the college. Typically, BMB has about six of these awards to confer on a yearly basis. Students should think of these as awards, rather than scholarships, as the monies for each award come from the proceeds of endowments established by donors and, in many cases, carry restrictions for potential recipients (particular major, class standing, financial need, etc.). There is no application process. Rather, a department committee reviews all students who qualify for the various awards. Award recipients are generally selected at the end of each spring semester and are notified of their selection sometime during the summer months.

The BMB department currently has three to four awards that are designated for the support of students who are undertaking research during the summer. These awards are highly competitive, and there is an application process. Interested students should contact the BMB department office shortly after the start of spring semester to obtain application forms.
University Learning Centers
The University Learning Centers (ULC) provide a trained staff of peer tutors, an encouraging learning environment and technology tools to enhance your academic success. A staff of over one hundred peer tutors provide free out-of-class assistance through the ULC's eight centers at three campus locations: 220 Boucke Building, 122 Findlay, or 7 Sparks Building. The Learning Centers provide free peer tutoring for individual and group work, access to reserve course materials and a variety of technology. The centers feature digital video-editing equipment, access to the Penn State backbone, video and audio tape players and more. For detailed information on their service, please go to http://pennstatelearning.psu.edu/

Office for Disability Services
At every Penn State location, there is an office designated to provide services for students with disabilities. Each designated office requests and maintains disability-related documents; certifies eligibility for services; determines academic adjustments, auxiliary aids, and/or services; and develops plans for the provision of academic adjustments, auxiliary aids, and/or services as mandated under Title II of the Americans with Disabilities Act (ADA) of 1990 and Section 504 of the Rehabilitation Act of 1973.

The Office for Disability Services (ODS) is the designated office that provides services to students with disabilities who are enrolled at the University Park location. At other Penn State locations, services are provided through the Disability Contact Liaisons. A list of the Disability Contact Liaisons (DCL) at other Penn State locations can be found at the following link http://www.equity.psu.edu/ods/index.html

To contact the Disability Service Office at University Park:

The Office for Disability Services
The Pennsylvania State University
116 Boucke Building
University Park, PA 16802-5902
Phone: 814-863-1807 (V/TTY)
Fax: 814-863-3217
Climate & Diversity

“Climate” & Diversity within the Department of Biochemistry and Molecular Biology

A central goal of the biochemistry and molecular biology department is to establish a welcoming environment in which all students, researchers, faculty, and staff can contribute fully in the shared mission of education, research, and service. Doing so requires a climate in which the diversity of our membership in terms of racial and cultural heritage, gender, physical ability, sexual orientation, and educational background is both recognized and appreciated. It requires a climate in which individuals are intrinsically valued and respected, irrespective of such differences, and where everyone is encouraged to achieve his/her maximum potential.

The Biochemistry and Molecular Biology Department Climate & Diversity Committee

The Biochemistry and Molecular Biology Department Climate & Diversity Committee was instituted in 2002 at the request of Dean Larson. The purpose of this committee is to continuously monitor the climate within the department, to serve as a contact point for persons seeking help with workplace relationships, to maintain communications among different groups within the department among different groups within the department, and to provide suggestions for ways to achieve the goals set forth above.

Current members of the committee can be found at: http://bmb.psu.edu/about-us/climate-and-diversity

The committee members welcome input concerning general issues related to improving the environment of the BMB department as a place to work and study. Contact anyone of the members and he/she will bring comments and suggestions to the committee for discussion.

In addition, feel free to contact individual committee members to discuss personal concerns related to workplace climate/interaction issues. Any such contacts will be kept strictly confidential.

Sexual Harassment

Sexual harassment by faculty, staff, or students will not be tolerated at Penn State. The University takes an active role in providing information and/or training to students and employees on the seriousness of such behavior and the importance of ensuring an educational work environment in which all individuals are respected.

Any member of the University community who experiences sexual harassment should bring this problem to the attention of appropriate individuals. Sexual harassment complaints, you can contact the Campus Life Assistance Center (863-1809), the Affirmative Action Office (863-0471), or the Office of Human Resources (865-1412).

This publication is available in alternative media on request. The Pennsylvania State University is committed to the policy that all persons shall have equal access to programs, facilities, admission, and employment without regard to personal characteristics not related to ability, performance, or qualifications as determined by University policy or by state or federal authorities. It is the policy of the University to maintain an academic and work environment free of discrimination, including harassment. The Pennsylvania State University prohibits discrimination and harassment against any person because of age, ancestry, color, disability or handicap, national origin, race, religious creed, sex, sexual orientation, gender identity, or veteran status. Discrimination or harassment against faculty, staff, or students will not be tolerated at The Pennsylvania State University. Direct all inquiries regarding the nondiscrimination policy to the Affirmative Action Director, The Pennsylvania State University, 328 Boucke Building, University Park, PA 16802-5901; Tel 814-865-4700/V, 814-863-1150/TTY. U.Ed.SCI 11-169

The Department of Biochemistry and Molecular Biology, 107 Althouse Laboratory, University Park, PA 16802 Tel. (814) 865-5497; Fax. (814) 863-7024.