BIOLOGY STUDENT HANDBOOK

2017-2018

Millersville University

Find this handbook electronically on the Biology homepage (www.millersville.edu/biology/) under "Quick Links".

Welcome!

Welcome to the community of biologists at Millersville University. We are delighted that you have chosen to study life science, and we share with you the conviction that the study of life processes is an exciting intellectual adventure. Making prudent use of all the opportunities which exist here for you is no simple task. Because you will reap the rewards of a superb education in life science, you have full responsibility for decisions pertaining to curricular and extracurricular matters. In order to help you we have prepared this *Biology Student Handbook. We hope that you will find this handbook useful throughout your career at Millersville.*

The Department of Biology is as diverse as life itself. Approximately 19 fulltime faculty do biology in laboratory and field environments. We encourage students to do science in the context of laboratory exercises, class projects, independent studies, honors theses, and research internships. Often results of these projects are presented at scientific seminars and professional meetings; some are published as articles in scientific journals. Through this interaction with faculty and others, our students do well when they seek further study or employment.

We are extremely proud of our students and our graduates. Many of our graduates are very successful biologists in a wide variety of endeavors including medicine, allied health, industry, and academia. Success in any area involves reaching one's potential. In a variety of ways, we provide opportunities for you to reach your full potential, but you must realize that **personal growth and learning are your responsibilities**. We hope that you will use our faculty and facilities to the fullest. We challenge you to learn and grow. If you leave Millersville University with an excitement for the study of life and a mastery of the major concepts of biology, and if you know how to define problems and to search for solutions to these problems, we all have succeeded.

Departmental Goal

The primary goal of the Department of Biology is to provide students with extensive, contemporary knowledge of life science in the context of a rigorous liberal arts education. The variety of our programs addresses the diverse biological careers found in our world of change. Creative teaching, an open collegial environment, and diverse forums such as colloquia, independent study, field trips, and student clubs help us achieve this goal.

We strongly believe that every student of biology (professors and undergraduates!) must be a creative scholar who actively participates in the acquisition and communication of knowledge. We encourage students to participate in a variety of scholarly activities so that they better appreciate the substance and challenge of biology.

A Brief History
of
The Department of Biology

The department of biology has a long history of academic excellence beginning with the founding of the Millersville Academy in 1854. Shortly thereafter, in December of 1859, the academy was transformed into Pennsylvania's first normal school. In 1928, Millersville Normal School became a state teacher's college and was empowered to grant the B.S. degree in education. Millersville State Teachers College became Millersville State College in 1959; this transformation was associated with an expansion of the liberal arts programs. Since July of 1983, we have been Millersville University of Pennsylvania.

The Millersville institutions, whatever their names, were fortunate to have gifted and dedicated professors to guide the development of science programs over these formative years. The most renowned of these individuals was Dr. H. Justin Roddy, an internationally known naturalist for whom our science building is named. In 1949, the college was organized into departments and Dr. Arthur H. Gerhart, a botanist, became the first chair of the Science Department. By 1958, a biology section was formed within the Science Department. Dr. Alex Henderson was appointed coordinator of this section with a staff of six biologists. In 1967, the large Science Department was separated into four individual departments and Dr. Henderson became biology's first chairperson.

In recent years, the department and its offerings have grown tremendously. We offer bachelor's programs in traditional, liberal arts biology as well as options in teacher education, marine biology, botany, ecology, molecular biology, medical technology, nuclear medicine technology and respiratory therapy. In addition, we provide pre-professional concentrations in podiatry, optometry, medicine, dentistry and veterinary medicine. A few students are also enrolled in a master's degree program.

Today, the department consists of 19 fulltime faculty members, several adjunct faculty members, a lab manager, one fulltime and one part-time secretary, and approximately 700 students who have chosen biology as their undergraduate major.

Table of Contents

Welcome and Departmental Goal i

A Brief History of the Department of Biology ii

Table of Contents ..... iii-iv

Sources of Information 1-3

Your Academic Advisor and You 3

Basic Responsibility of the Student in the Advising Process 4

Admission and Retention in the Major 5

Programs in Biology 6

Biology Colloquium 6

Health Professions Advisory Committee 7

Allied Health Programs 7

Departmental Honors 8

Independent Study in Biology 8-10

Procedures for Pursuing Departmental Honors in Biology 11-14

Research Facilities 15

Chincoteague Bay Field Station at Marine Science Consortium 16

Cooperative Education in Biology 16

Scholarship and Awards in Biology 17-19

Safety Guidelines. 20

Student Organizations 21-22

Planning a Career in Biology and Post-graduate Education 23-24

How to Write a Lab Report or Scientific Paper 25-27

Preparation of Tables and Graphs 28-29

Biological Literature 30-33

Faculty 34-45

Curriculum Record Forms 46

- General Education Requirements 46-47
- Bio Minor 48
- Bio Minor - Molecular/Biotechnology 49
- Comparison Narrative - BS BIOL and BS ALHT degrees 50
- Side by Side Comparison - Medical Technology 51
- Side-by-Side Comparison - Nuclear Medicine 52
- Side-by-Side Comparison - Respiratory Therapy 53

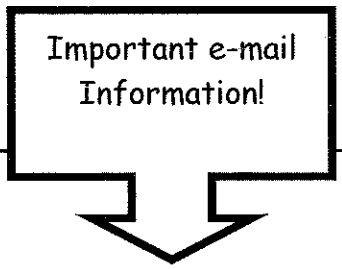
Curriculum Sheet - BS ALHT Medical Technology....54-55
Curriculum Sheet - BS ALHT Nuclear Medicine....56-57
Curriculum Sheet - BS ALHT Pre-Athletic Training....58-59
Curriculum Sheet - BS ALHT Respiratory Therapy....60-61
Curriculum Sheet - BS ALHT Sports Medicine....62-63
Curriculum Sheet BA BIOL....64-65
Curriculum Sheet BS BIOL....66-67
Curriculum Sheet BSE BIOL....68-69
Curriculum Sheet BS BIOL Animal Behavior....70-71
Curriculum Sheet BS BIOL Botany....72-73
Curriculum Sheet BS BIOL Environmental Biology....74-75
Curriculum Sheet BS BIOL Marine Biology....76-77
Curriculum Sheet BS BIOL Medical Technology....78-79
Curriculum Sheet BS BIOL Molecular Biology/Biotechnology....80-81
Curriculum Sheet BS BIOL Nuclear Medicine....82-83
Curriculum Sheet BS BIOL Pre-Optometry....84-85
Curriculum Sheet BS BIOL Pre-Podiatry....86-87
Curriculum Sheet BS BIOL Respiratory Therapy....88-89

Sample Student Schedules

Explanation Narrative....90
BS ALHT Medical Technology....91
BS ALHT Nuclear Medicine....92
BS ALHT Respiratory Therapy....93
BS ALHT Sports Medicine/Pre-Athletic Training....94-95
BS ALHT Sports Medicine....96
BA BIOL....97-98
BS BIOL....99-100
BSE BIOL....101-102
BS BIOL Animal Behavior....103-104
BS BIOL Botany....105-106
BS BIOL Environmental Biology....107-108
BS BIOL Marine Biology....109-110
BS BIOL Medical Technology....111-112
BS BIOL Molecular Biology/Biotechnology....113-114
BS BIOL Nuclear Medicine....115-116
BS BIOL Pre-Optometry....117-118
BS BIOL Pre-Podiatry....119-120
BS BIOL Respiratory Therapy....121-122

Sources of Information

Many sources of information can help you understand the workings of Millersville University. Be prudent; use several sources of information when confronted with a problem. Guidelines to help you comprehend University policy are published in a number of references and our staff can help you to interpret this material.



E-mail!

Note that the Biology Department requires that all Biology majors and minors use a campus e-mail address. We use e-mail to improve communication between students, the professors of their courses, and their academic advisors concerning a variety of issues, including course assignments and examinations, advising, etc. We regularly post e-mails about changes in course schedules, reminders about deadlines, job and co-op opportunities, etc. We urge you to check your campus e-mail regularly so that you do not miss important information!

Campus e-mail is free and easy to obtain. Visit the Help Desk in Boyer or the MU web page for instructions! The Biology Department also posts important announcements on our web page. You should check that page regularly!

Published Material

- ✓ **Millersville University Undergraduate Catalog.** General descriptions of academic policies and programs are described in this volume. Be sure to keep a copy of the catalog associated with the year you entered the University. This volume represents your agreement with the University. http://www.millersville.edu/catalogs/undergraduate/index.pdf

- ✓ **Biology Student Handbook.** Opportunities for students majoring in biology are described in this manuscript. Be sure to keep this handbook while you are a biology major, since it contains curriculum record forms for the different programs in biology. You must satisfy the requirements as stated on these forms if you remain enrolled as a biology major on a continuous basis; subsequent changes in the curricula will not apply to you. Find the handbook on the Biology homepage (www.millersville.edu/biology/) under "Quick Links".

- ✓ **Millersville University Student Handbook.** This booklet contains descriptions of policies on social and academic issues pertaining to students. In addition, narratives depicting student organizations will help you find extracurricular activities of interest. http://www.millersville.edu/judicialaffairs/files/StudentCodeofConduct.pdf

- ✓ **Millersville University Directory**. This online directory contains much more information than just telephone numbers; a large directory of services and offices are listed according to the specific help one may desire. http://www.millersville.edu/directory/index.php

- ✓ **Millersville University Governance Manual**. Your faculty advisor has a copy of this weighty tome; it describes University policies in detail. It is also available online.

Human Resources

- **Faculty Advisor**. Your faculty advisor is an excellent source of information. Not only is your advisor familiar with your academic records, she/he has knowledge of the requirements for your chosen major. Moreover, your advisor knows what the post-MU world expects of you.

  Faculty Advisor: Name _____ Phone Number: _____

- **Department Chair**: Dr. John E. Hoover (Caputo 312, x7427), Chairperson of Biology, is willing and ready to talk to any student with a problem. Suggestions on how we might improve the academic environment at MU are encouraged and welcome. E-mail: john.hoover@millersville.edu

- **Lab Manager**: Mr. Cyril Foray (Roddy 278, x4319), Lab Manager, maintains our greenhouse, animal care facility, WebPages, general biology labs, and cell biology labs. If you have any inquiries about any of these areas, please call Mr. Foray. E-mail: cforay@millersville.edu

- **Department Secretary**. Mrs. Beth Roberts (Roddy 288, 871-4321) is the fulltime secretary for the department. She welcomes your questions and can provide you with miscellaneous information, various forms, etc. E-mail: beth.roberts@millersville.edu.

- **Allied Health Coordinator**. Dr. Judith Cebra-Thomas (Roddy 281, x7441) is the person to talk with if you have an interest in one of the allied health programs or medical school. E-mail: judith.cebra-thomas@millersville.edu.

- **Respiratory Therapy Program Director**. Students who desire information about the respiratory therapy program should make an appointment to talk with Ms. Elaine Chrissos (717-291-8457). E-mail: elaine.chrissos@millersville.edu

- **Office of Academic Advisement**. The office of academic advisement is located in Lyle Hall (x5333). They can help clarify General Education requirements. http://www.millersville.edu/~advisement/?page=degreq

- **Career Services**. The Career Services staff (Bedford House, x7655) is always willing to help students find information on career opportunities. http://www.millersville.edu/elcm/careerservices/

- **Registrar's Office** (Lyle Hall, x5005). The registrar's office maintains the academic records of students. Contact this office with questions about your record. http://www.millersville.edu/registrar/

- **Counseling and Human Development Center**. (Lyle Hall, x7821). Should you have problems with learning skills, emotional difficulties, or adjusting to life at MU, use the services this center offers. http://www.millersville.edu/counsel/

- **Tutoring**. MU has free tutoring for students having difficulty with a particular subject. If you need help with biology, or would like to help others by being their tutor, contact the Tutoring Center, (Lyle Hall, 871-7222 or tutoringcenter@millersville.edu). Tutor request forms are available from that office. http://www.millersville.edu/tutoringcenter/apply-to-get-a-tutor.php

- **Center for Student Involvement & Leadership Office** (SMC, x7057). Information concerning student organizations and activities can be obtained through this office. http://www.millersville.edu/csil/index.php

- **Health Services**. MU Health Services (Witmer, x5250). Use the infirmary if you are ill (non-emergency medical call x5250). In case of serious injury or assault dial 911.

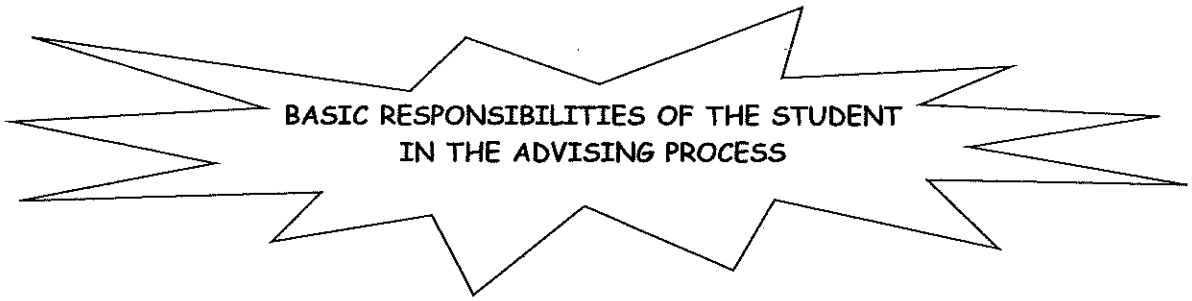
- **University Police**. Lebanon House, 237 N. George Street, x4357. The University Police are always ready to help students in need. http://www.millersville.edu/police/

Your Academic Advisor and You

Each entering student is assigned a faculty advisor based upon the stated interests of the student. We try to match the interests of the student with the expertise of the faculty member. Should you discover that your interests have changed, you may change advisors. Simply contact the department chairperson. **The function of the academic advisor is to guide the student in course and program selection, assist with academic difficulties, and provide counsel on careers and other goals.**

Students, who develop a good working relationship with their faculty advisor early in their careers, receive the most help and meet the academic requirements of a program with fewest complications. Moreover, they are more likely to develop and successfully pursue career goals. Should you have difficulty developing a satisfactory relationship with your faculty advisor, feel free to change advisors. A well-cultivated relationship with your advisor should be a source of an excellent letter of recommendation for graduate or professional schools and job applications.

Students are required to meet with their advisor during the registration period each semester for the purposes of counsel and guidance in course selection; in addition, your advisor will help you with the paperwork associated with registration. The faculty advisor, the instructors of the courses, the administrators, the University staff, and other students all play a role in student development. However, the greatest responsibility falls to the individual student for her/his own destiny. One of the important duties of the advisor is to assist the student in assuming this responsibility. Listed on the next page are a number of specific actions which advisees should take to enhance the advisement process.



- ✓ **Give thoughtful consideration to your personal goals.** Many new students have spent little time thinking about their future. That you have made final decisions about your future is of little concern; however, we urge you to begin an active sorting of your personal goals so that your education at MU can be the most meaningful possible. How can you make academic and professional plans without a direction? How can we help you plan your study?

- ✓ **Discuss your long-range goals with your advisor.** Unless you give your advisor some idea of what you really want to be doing four or five years from now, he/she will not be able to suggest what courses and activities would be most helpful for you. Just talking with your advisor about career possibilities in your area can help you to crystallize your thoughts. Remember, though, that no one can guarantee you will be employed when you finish your degree. You might want to include in your long-range goals ways of gaining ancillary skills that will make you more attractive to employers.

- ✓ **Know the basic requirements of your chosen major.** Once you have decided on a major and an option within that major, know the requirements. Be able to ask meaningful questions about requirements, options, electives, etc. Obtain a copy of the curriculum record form from your advisor, the Biology Office or the Registrar's Office.

- ✓ **Make a plan to map out your entire program of study for a degree.** Once you have identified a major and the option you desire, take a few moments to plan your study to completion. You should be able to identify when you will have to take required courses and at what point the prerequisites for these courses will have to be taken. Certainly, such a plan will tell you if it is possible to complete a program of study within a given time period.

- ✓ **Accept responsibility for making final decisions on academic matters.** Your advisor will tell you about the courses you "must take" and show you possible alternatives for electives. You must choose among these alternatives. Obviously, to make the best choices, you must know yourself and the direction in which you are headed.

- ✓ **Become familiar with the University Catalog and the Class Schedules.** Enroll in the courses you are required to take first. Not all courses are available every semester; in addition, conflicts could arise in the future which would delay your graduation.

- ✓ **Keep your advisor informed of changes in your schedule.** Your advisor is a great source of help, especially when you encounter problems. Keeping your advisor apprised of situations which bear upon your academic program makes it more likely that you will receive better advising.

- ✓ **Maintain copies of your academic records.** Keep a file of your academic records. Include the University Catalog, the Biology Student Handbook, the curriculum record forms for general education and major requirements, grade slips, approval forms, information denoting transfer of credit, and your degree audit report from DegreeWorks.

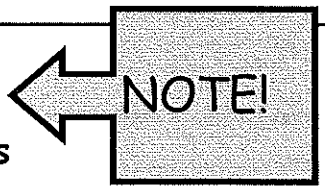
Admission to the Biology or Allied Health Technology Majors

1. New students (freshmen and transfers) must be admitted to the Biology or the Allied Health Technology majors by the Office of Admissions upon admission to the University.

2. Admission of Millersville University students to the majors (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described in the Undergraduate Catalog. Students who were dropped from a Biology or Allied Health Technology major also must satisfy the Retention in the Major criteria before being readmitted to a Biology major.

3. Non-degree and continuing education students must be admitted to these majors by the Office of Admissions.

Retention in the Biology or Allied Health Technology Majors



Since there are so many differences between the various options, please see the Retention in the Major requirements for each option on the following pages:

Biology Majors and Options:

BA BIOL - p. 64
BS BIOL - p.66
BSE BIOL - p. 68

BS BIOL Animal Behavior - p. 70
BS BIOL Botany - p. 72
BS BIOL Environmental Biology - p . 74
BS BIOL Marine Biology - p. 76
BS BIOL Medical Technology - p. 78
BS BIOL Molecular Bio/Biotechnology - p. 80
BS BIOL Nuclear Medicine - 82
BS BIOL Pre-Optometry - 84
BS BIOL Pre-Podiatry - 86
BS BIOL Respiratory Therapy - p. 88

Allied Health Technology Options:

BS ALHT Medical Technology - p. 54
BS ALHT Nuclear Medicine- p. 56
BS ALHT Pre-Athletic Training - p. 58
BS ALHT Respiratory Therapy - p. 60
BS ALHT Sports Medicine - p. 62

Programs in Biology

The Department of Biology offers a variety of programs and options, each of which has specific requirements. In addition, the University has a series of general education requirements which must be satisfied for graduation. Please refer to both the University Catalog and your faculty academic advisor for the details of these requirements. Questions about specific programs in biology can be answered by your academic advisor and by the following faculty with special interest in particular programs:

Animal Behavior Option:
Dr. Boal, Dr. Didier, Dr. Haines, Dr. Hoover

Botany Option:
Dr. Hardy, Dr. Stieha, Dr. Wagner

Environmental Option:
Dr. Boal, Dr. Haines, Dr. Horton, Dr. Wallace, Dr. Yocom

Marine Biology Option:
Dr. Boal, Dr. Didier

Medical Technology Options:
Dr. Cebra-Thomas, Dr. Cosentino, Dr. Whisenton-Davidson

Molecular Biology/Biotechnology Option:
Dr. Cebra-Thomas, Dr. Hepfer, Dr. Klosinska, Dr. Piperberg

Nuclear Medicine Options:
Dr. Cebra-Thomas, Dr. Cosentino, Dr. Hepfer, Dr. Ladd

Pre-Athletic Training Options:
Dr. Cebra-Thomas, Dr. Hoover, Dr. Ladd, Dr. Whisenton-Davidson

Pre-Optometry Option:
Dr. Cebra-Thomas, Dr. Cosentino, Dr. Ladd, Dr. Hoover

Pre-Podiatry Option:
Dr. Cebra-Thomas, Dr. Cosentino, Dr. Ladd

Respiratory Therapy Options:
Dr. Cebra-Thomas, Dr. Cosentino, Dr. Hoover, Dr. Ladd

Secondary Education in Biology:
Dr. Whisenton-Davidson, Dr. Didier, Dr. Piperberg

Biology Colloquium

The purpose of the Biology Colloquium is to bring outstanding scientists to campus to talk to and interact with our students. We strongly believe that these colloquia provide wonderful opportunities and expect that all students who are serious about biology will attend regularly. The colloquia are held at 4:00 pm on Wednesdays. Topics, speakers, and locations are announced via Millersville e-mail and posted around the building each semester.

Health Professions Advisory Committee

"Pre-Med Committee"

Admission to colleges of medicine, dentistry, podiatry, optometry, and veterinary medicine is highly competitive. The selection of students for a place in a class depends on a number of criteria such as the quality grade point average, performance in the required aptitude tests given for the specific profession, letters of recommendation from the University advisory committee, and personal interviews. Millersville University, being aware of the need to counsel those students planning a career in the health professions, has established a committee made up of faculty who are committed to helping qualified students gain admission to professional schools.

Students who indicate their desire to enter professional schools may request an advisor who is a member of this committee. The advisor will heed the needs of the student and supervise their program throughout the undergraduate career. The committee will keep the students informed of admission requirements of the various professional schools and keep them abreast of new developments. The committee will be the student's liaison with the admission officers of the professional school.

The Health Professions Advisory Committee is composed of the following persons: Dr. Judith Cebra-Thomas, Committee Chair (Biology), Dr. Kelly Banna (Psychology), Dr. Shawn P. Gallagher (Psychology), Dr. Heather Girvin (Social Work), Dr. Nazli Hardy (Computer Science), Dr. John E. Hoover (Biology), Dr. Timothy Ladd (Biology), Dr. Aimee Miller (Chemistry), Dr. Edward Rajaseelan (Chemistry), Dr. Ryan Wagner (Biology), and Dr. Jeffrey W. Wimer (Wellness and Sport Sciences).

Allied Health Programs

Our Allied Health programs allow students to become health care practitioners directly upon graduation from Millersville University. The Department of Biology sponsors formal programs in Medical Technology, Nuclear Medicine Technology, Respiratory Therapy, and Sports Medicine. In addition, we have informal associations with other allied health professions such as physical therapy. Admission into the clinical phase of the Nuclear Medicine Technology (QPA > 2.5) and Medical Technology (> 3.0) programs is very competitive. Admission into the clinical phase of the Respiratory Therapy program is also competitive (minimal QPA of 2.3). Students in these options must do well in their courses if they want to be considered for the limited number of clinical positions available in the hospital-based portion of their program.

Please consult Dr. Cebra-Thomas for details on these programs.

Departmental Honors

Students who are highly motivated and who wish to pursue a particular area of interest through intensive research are encouraged to consider Departmental Honors. Prior to embarking on an honors research project, students should have explored the problem with a faculty member through an independent study venture. Guidelines for completing Departmental Honors are shown on the next page. Upon successful completion of the thesis, a student will be recognized for achievement at graduation with the designation of *Departmental Honors* on their diploma and University record. The desire to receive this recognition is not sufficient reason to pursue departmental honors; you should possess a genuine desire to solve a problem in life science. To be eligible for this program, students must have a cumulative grade point average of at least 3.0 and the endorsement of a faculty member.

Independent Study in Biology

In addition to the courses listed in the University Catalog, all biology students are encouraged to complete either Independent Study (BIOL 498) or honor's thesis research (HNRS 499). Both independent study and thesis research provides the student with the opportunity to study a specific biological problem individually with a faculty member. In fact, one of the strengths of our biology program at MU is the opportunity for undergraduates to engage in significant research in close collaboration with faculty who are well-known and respected researchers in their areas of specialization. Generally, students should identify the area of biology they wish to pursue and make arrangements with the appropriate faculty.

Students find these experiences of great value; expanding not only their knowledge of biology, but their understanding and appreciation of scientific methodology. Independent study projects also have helped students to clarify career objectives and to make decisions concerning further professional education, as well as prepare for graduate study.

The form needed to apply for Independent Study is shown on the following page. Forms are available from the Biology Department Office.

MILLERSVILLE UNIVERSITY
REQUEST FOR SPECIAL STUDY ASSIGNMENT
PART 1: TO BE COMPLETED BY STUDENT REQUESTING SPECIAL STUDY

Student Last Name	First Name	MI
MAX ID Number	Degree and Major	Expected Graduation Date
Local Address		Local Phone
Student Signature	Date	Email
Student Adviser Signature	Date	
Student Adviser Information		

Please attach this form a justification for the student's needs for this course.

PART 2: TO BE COMPLETED BY COURSE INSTRUCTOR OR FACULTY SUPERVISOR

CHECK ONE:
____INDEPENDENT STUDY (ugrd -use 498; not for Honors Course)
____INDEPENDENT STUDY (grad – course number varies)
____INDEPENDENT STUDY (ugrd – use 489; for Honors Course)
____INDEPENDENT STUDY (ugrd – use 499; for Dept Honors Thesis)
____INDEPENDENT STUDY (ugrd – use 499, for Univ Hnrs College Thesis)
____INDIVIDUALIZED INSTRUCTION (ugrd or grad – use catalog number)
(Includes Graduate Practicum or other course in the grad or ugrd catalogs that are not scheduled in the special study term)

SPECIAL STUDY COURSE INFORMATION
(print year)
Fall _____ Summer 1 _____
Spring _____ Summer 2 _____
Winter _____ Summer 3 _____

FACULTY SUPERVISOR/INSTRUCTOR
Print name:
_____

Subject &Course Number (ex. ENGL 489)	**Credits**	**Short Course Title/Topic** (ex. Writings of Jane Austen)

For the term indicated above, list the total number of independent study credits ____ and individualized instruction credits ____ you will supervise, including the credits on this form.

NOTES: A maximum of 9 student credit hours of independent study and a separate minimum of 9 student credit hours of individualized instruction may be supervised in any one term. This applies to fall, spring/winter or the entire summer term (including Summer 1,2, and 3 combined).

Faculty Supervisor Signature Date MAX ID Number

_____

PART 3: SIGNATURES REQUIRED FOR APPROVAL AND PAYMENT AUTHRORIZATION

Chair of department in which study will occur **Date**

_____

Dean of College in which study will occur **Date**

_____

Estimated Cost: _____ For Registrar's Office use only: CRN_____
c: Registrar's Office 9/2015

INSTRUCTIONS FOR PROCESSING "REQUEST FOR SPECIAL STUDY" FORM

Person Responsible	Steps Required
Student	1. Discusses proposed special study with course instructor or faculty supervisor. Completes PART 1, discusses plan with academic adviser and obtains adviser's signature.
Adviser	2. Discusses request with student, attaches a clear and detailed justification for the study and signs form (PART 1) if approved.
Instructor/Supervisor	3. Completes all information in PART 2 and signs form. Forwards form to department chair.
Department Chair	4. Chairperson of department offering course will review special study request form and faculty load information, sign form (PART 3) if approved, and forward form to dean of his/her school.
School Dean	5. Dean of school offering course will review special study request form and faculty load information, sign form (PART 3) to authorize payment of faculty member, and forward it to Registrar's Office for processing.
Registrar's Office	6. Process student's registration for special study assignment. Notifies Bursar's Office if processing the special study results in a change to the student's billing status. Distributes copies of approved special study forms as follows: Faculty member supervising special study assignment Budget Office HR Technician in Provost's Office
HR Technician in Provost's Office	7. Verifies student's registration for and/or completion of special study assignment. Completes the SSHE form for calculation of faculty payment and forwards it to the Payroll Office for processing.
Student	8. Settles any additional cost resulting from registration for special study credits.
Payroll	9. Processes SSHE form so that faculty member will be paid. Forwards a copy of completed payment form to the Budget Office.

Procedures for Pursuing Departmental Honors* in Biology (Millersville University)

*NOTE: Although an attempt has been made to integrate University Honors College (UHC) requirements into these procedures, complete information should be obtained from the UHC Program Director.
In general, Biology Departmental Honors work should include original research (theoretical, laboratory or field) applied to answer a novel question in a specific discipline. The student should describe and analyze his/her results in a formal written report. The thesis must be defended in a public forum. The students should use the attached check list to document completion of the procedures below.

1. To be eligible for Departmental Honors, a student must have a cumulative QPA of 3.0 (3.35 for University Honors).

2. Normally, students pursuing Departmental Honors in Biology will explore the feasibility of a potential thesis project by taking one or more credits of BIOL 498 (Independent Study) before their senior year. Once a definite thesis project is planned, the students can take additional credits of BIOL 498 or BIOL/HNRS 489 in the first semester of their senior year and they must complete 1-2 credits of BIOL/HNRS 499 during their last semester. A grade for Departmental Honors (BIOL/HNRS 499) should not be assigned until after the thesis defense is completed and all Thesis Committee members have approved the final manuscript.

3. a. To earn Departmental Honors, a student must complete at least one credit of BIOL/HNRS 499 (Departmental Honors Thesis). BIOL/HNRS 499 credits should be completed during the student's final semester before graduation.

b. A biology student may earn up to 4.0 total credits for their Departmental Honors Thesis project. Usually one or two credits are awarded for BIOL/HNRS 499 (Departmental Honors Thesis), and the remaining credits are earned as students complete BIOL 498 (Independent Study) at the start of their thesis research. Students in the University Honors College (UHC) may substitute BIOL/HNRS 489 ((Honors Independent Study) for BIOL 498 (Independent Study). [NOTE: Additional credits of BIOL 498 (Independent Study) may be earned for work that is not directly related to the thesis project.]

c. BIOL/HNRS 499 credits (1-3) will satisfy the University's Advanced Writing requirement as long as total credit requirements for the major and for the degree are still met.

d. Students in the University Honors College (UHC) are required to complete a minimum of 3 credits for University Honors. UHC accepts credits for BIOL 498, BIOL/HNRS 489 and/or BIOL/HNRS 499 in any combination. Up to eight of these credits may to use to fulfill UHC requirements.

4. To apply for credit in BIOL 498, BIOL/HNRS 489 or BIOL/HNRS 499, a "Request for Special Study Assignment" form must be completed with a one-page proposal of the thesis project attached. Once signatures of the supervising faculty member and the student's advisor have been obtained, this form and the attachment must be submitted to the Biology Department Chair. This should be done before the start of the semester in which the credits will be earned.

5. At least six months before the student plans to defend his/her thesis, a thesis committee should be chosen. The committee shall consist of the faculty supervisor and at least two other Biology faculty members. If the student wishes to earn Honors from the University Honors College, then there must be at least one faculty member outside of the Biology department on the committee. The student, in consultation with the faculty supervisor, should choose faculty who can advise the student in his/her work.

6. The student should meet with his/her committee at least twice before the defense. The student and his/her supervisor are encouraged to involve other committee members in the planning and design of the research project. These meetings would be a good opportunity for the student and committee to discuss progress made or difficulties in the research as well as the committee's expectations for the finished thesis product.

7. The written thesis shall be a formal presentation and discussion of the student's results. Appropriate background on the thesis topic (Introduction), descriptions of how the results were obtained (Methods and Materials), presentations, descriptions, and analyses of data (Results), and how the results apply to the thesis question (Discussion) shall all be included. The format of the written thesis shall be appropriate for publication in journals of the applicable sub discipline of biology. In addition, no dissertation will be acceptable without proper citations of original literature in the respective field. The thesis paper must also include a title and signature page. Examples of honors theses are available for review in the Biology Department office.

8. A first draft of the entire thesis paper shall be submitted to all committee members at least four weeks before the thesis defense. Committee members shall return the draft to the student within one week of receipt with their comments.

9. The oral defense should occur no fewer than two weeks before the student graduates from Millersville University. Committee members shall be notified in writing of the date, time and place of the defense at least three weeks before the defense. The defense must be advertised one week in advance by posting notices in the building.

10. A revised copy of the thesis shall be distributed to all committee members at least two weeks before the defense. Committee members shall return the draft with their comments to the student immediately after the closed defense (see below).

11. The student's defense will include a formal and public presentation (open to all) given by the student and a question/answer session. The public presentation is followed by a closed defense of questions/ answers/discussion between the committee members and the student. Honors designation and a grade will be based on the quality of the work (research, paper and presentation) as determined by the thesis committee in a closed session immediately following the closed portion of the defense. To receive Honors credit, a grade of A or B must be earned. Failure in following these procedures may result in the loss of Honors credit so that the status of the credits will be reduced from HNRS 489 or 499 to BIOL 498 (independent study). Note: If Honors credit (HNRS/BIOL 499) is not granted, then the student will be unable to apply his/her thesis credits towards fulfilling the Advanced Writing Requirement in the GENED curriculum.

12. The student will prepare the necessary final revisions required for the thesis paper and distribute a final draft to the committee members for approval at least one week before graduation and not more than one week after the defense.

13. At least three days prior to graduation, the approved thesis paper shall be signed by the committee members, so that a grade can be issued by the supervising faculty. The committee members, the Biology Department office, and University Archives shall each receive a copy of the approved thesis paper. When appropriate, the University Honors College should also receive a copy.

Honors Thesis Procedures Check List

Directions: Please refer to Steps in written procedures. Decide on a graduation date: _____. Using a calendar, determine deadline dates for actions below by counting back from target graduation date. Fill in appropriate deadline dates. After an action is completed, write the completion date in the space provided and have it initialed by your supervisor.

Action	Step(s) in Written Procedures	Deadline (Academic Weeks Before Graduation)	Deadline Date (work backwards from Graduation Date)	Completion Date	Supervisor's Initials
QPA ≥ 3.0?	Step 1	30 weeks (two semesters)			
Register for BIOL 498, 489 or 499 (≥ 1 credit; optional)	Steps 2 - 4	29 weeks			
Choose Thesis Committee _____ Supervisor (Biology) _____ Member 1 (Biology) _____ Member 2 (Biology) _____ Member 3 ( )	Step 5	24 weeks (6 months)			
First Committee Meeting	Step 6	20 weeks			
Register for BIOL 489 or 499 (≥ 1 credit)	Steps 2 - 4	15 weeks (one semester)			
QPA ≥ 3.0?		15 weeks			
Begin writing thesis (Outline, Introduction, and M&M)	Step 7	14 weeks			
Second committee meeting	Step 6	12 weeks (3 months)			
Third committee meeting	Step 6	optional			
First full draft of thesis paper to thesis committee	Step 8	6 weeks			
Inform committee of date, time, and place of thesis defense	Step 9	5 weeks			
Second draft (defense-ready) to Committee	Step 10	4 weeks			
Advertise public oral defense	Step 8	3 weeks			
Public oral defense	Step 11	2 weeks			
Final revised draft to committee	Step 12	1 week			
Obtain signatures; copies to all committee members	Step 13	3 days			

Honors Thesis Procedures Check List:

Directions: Please refer to Steps in written procedures. Decide on a graduation date: May 2, 2009_. Using a calendar, determine deadline dates for actions below by counting back from target graduation date. Fill in appropriate deadline dates. After an action is completed, write the completion date in the space provided and have it initialed by your supervisor.

Action	Step(s) in Written Procedures	Deadline (Academic Weeks Before Graduation)	Deadline Date (work backwards from Graduation Date)	Completion Date	Supervisor's Initials
QPA ≥ 3.0?	Step 1	30 weeks (two semesters)	Aug. 25, 2008		
Register for BIOL 498, 489 or 499 (≥ 1 credit; optional)	Steps 2 - 4	29 weeks	Sep. 2, 2008		
Choose Thesis Committee _____ Supervisor (Biology) _____ Member 1 (Biology) _____ Member 2 (Biology) _____ Member 3 ( )	Step 5	24 weeks (6 months)	Oct. 8, 2008		
First Committee Meeting	Step 6	20 weeks	Nov. 3, 2008		
Register for BIOL 489 or 499 (≥ 1 credit)	Steps 2 - 4	15 weeks (one semester)	Jan. 12, 2009		
QPA ≥ 3.0?		15 weeks	Jan. 12, 2009		
Begin writing thesis (Outline, Introduction, and M&M)	Step 7	14 weeks	Jan. 19, 2009		
Second committee meeting	Step 6	12 weeks (3 months)	Feb. 2, 2009		
Third committee meeting	Step 6	optional			
First full draft of thesis paper to thesis committee	Step 8	6 weeks	Mar. 23, 2009		
Inform committee of date, time, and place of thesis defense	Step 9	5 weeks	Mar. 30, 2009		
Second draft (defense-ready) to Committee	Step 10	4 weeks	April 6, 2009		
Advertise public oral defense	Step 8	3 weeks	April 13, 2009		
Public oral defense	Step 11	2 weeks	April 20, 2009		
Final revised draft to committee	Step 12	1 week	April 27, 2009		
Obtain signatures; copies to all committee members	Step 13	3 days	April 29, 2009		

Research Facilities

Our facilities include space for microscopy, including phase contrast, fluorescent, epifluorescent, and polarizing microscopes and three ultramicrotomes, a knife maker, and rotary microtomes. A computer station is also available for image analysis. The histology lab is fully equipped for histochemical and paraffin microtechniques. We have dark room facilities, sterile hoods, fume hoods, carbon dioxide incubators, an ultracentrifuge, a scintillation counter, chromatography and electrophoresis apparati, gel dryers, thermocycler, inverted phase microscopes, spectrophotometers, and a variety of other types of equipment available for use by students under the supervision of appropriate faculty members. In addition we have herbarium and museum collections, cold rooms, a large limnological research pond, as well as the Keever Ecological Study Area located on campus for ecological investigations.

The department of biology maintains affiliation with two biological field stations. Both stations are available for use by students doing independent projects. The **Chincoteague Bay Field Station** at Wallops Island, Virginia (see "Chincoteague Bay Field Station at Marine Science Consortium") has a number of labs, classrooms, research vessels, and equipment for studies of marine and coastal biology. **Powdermill Biological Station** is a 2000 acre field site in the Laurel Highlands area of Pennsylvania and is operated by the Carnegie Museum of Natural History. Several cabins and laboratories as well as a variety of terrestrial ecosystems are available for use by researchers from Millersville. Although the primary focus of research at Powdermill is population, behavioral, and physiological ecology of vertebrates, opportunities for studies of invertebrates and plants also exist.

Millersville has four separate greenhouses covering over 1200 square feet which affords growing plants under different environmental conditions. Plants grown in these houses are used in research, the classroom, independent study, and for horticultural purposes. A modern potting room with a soil sterilizer and a temperature controlled propagating bench with automatic watering and lighting are a few of the features used often. Besides the greenhouses, there are four large environmental chambers where conditions of light, temperature, and moisture can be controlled and monitored for experimental studies.

Chincoteague Bay Field Station at Marine Science Consortium

Millersville University is a charter member of the Chincoteague Bay Field Station at Marine Science Consortium at Wallops Island, Virginia. The Consortium was established in 1968 to promote teaching and research in marine and environmental sciences. These goals are achieved by pooling faculty, students, and other resources of the member universities.

The marine station consists of classrooms, laboratories, workshops, dormitories, and a dining hall. The Consortium owns and operates several vessels and small boats used in courses and for student-oriented research.

During the summer, the student may enroll in one to four three-week courses. Each course carries three semester hours credit and involves intense, day-long study for the duration of the three-week session. All the courses offered in the college-level program are registered for at Millersville. Subjects include marine biology, marine ecology, oceanography, marine invertebrates, marine ichthyology, behavior of marine organisms, ornithology, tropical invertebrates, wetlands ecology, and others. Most courses involve considerable time working on board the research vessels. Students are exposed to a variety of marine and estuarine habitats learning about the physical and chemical factors that shape these ecosystems as well as studying the organisms themselves. See Dr. Didier, Dr. Boal or Dr. Haines for details about these courses.

Cooperative Education in Biology

Students in biology are encouraged to engage in cooperative education experiences. These projects are cooperative efforts among the University, students, and employers in which the student is employed on a full- or part-time, paid or volunteer, position closely aligned to the career interest and/or academic major of the student. Biology students have received college credit for their experiences and have found meaningful work related to their careers. For example, recently our students have worked in health care in the areas of physical and respiratory therapy and as research technicians at Hershey Medical Center and the National Institutes of Health. Others have worked in environmental regulation for both DER and EPA; some have been naturalists, park rangers, and have done ecological consulting for industry. In addition, students have performed horticultural work for commercial greenhouses and governmental agencies. Our students have found CO-OP experiences to be beneficial in making career decisions, providing breaks from the routine of academic life, and establishing contacts with prospective employers. Several of our students have moved from temporary employee status as CO-OP interns to full-time permanent employees after graduation. We are quite proud of the employment records of the CO-OP students from biology.

For details about this program, contact Dr. Aaron Haines (x7451).

Scholarships and Awards

Our department rewards excellent students in a number of ways. The following departmental and University programs are worth noting!

Scholarships for Incoming Freshmen

Biology Scholarships
Renewable scholarships to biology majors for eight semesters beginning in the freshman year. The annual spendable income will be disbursed equally to fund up to 50% of in-state tuition for qualifying full-time students pursuing a BS, BA, or BSEd in biology. Selection shall be based on merit demonstrated by high school class rank or GPA performance with emphasis on academic performance in math and science courses, standardized test scores (SAT or ACT), and other criteria as determined by the admission office and the biology department.

The James C. Parks Scholarship in Botanical Research
This is an annually renewable scholarship awarded to an incoming freshman with an interest in botany. The recipient of this scholarship is expected to develop a botanical research project in collaboration with a faculty member that will lead to the presentation of research results in the Dr. James C. Parks Memorial Lecture in the recipient's senior year.

Ratzlaff Scholarship Fund
A scholarship awarded to an incoming biology major. Selection shall be based on merit demonstrated by high school class rank or GPA performance with emphasis on academic performance in math and science courses, standardized test scores (SAT or ACT) , and other criteria as determined by the admission office and the biology department. The scholarship may be renewed for three additional years providing the student remains a biology major and maintains a QPA of 3.0 or greater.

The Syd Radinovsky Scholarship in Biological Research
This is an annually renewable scholarship awarded to an entering freshman with an interest in biological research. The recipient will develop a research project in collaboration with a faculty member that will lead to the presentation of research results in the student's senior year. Selection shall be based on merit demonstrated by high school class rank or GPA performance with emphasis on academic performance in math and science courses, standardized test scores (SAT or ACT) , and other criteria as determined by the admission office and the biology department. The recipient of this award shall be designated as the Syd Radinovsky Scholar.

Sophomore Secondary Education Academic Award

N.E. Shoemaker Biology Teaching Scholarship
A scholarship granted annually to the sophomore secondary education biology major who has earned the highest quality point average.

Research Scholarships – Students Apply for These

Arthur and Claribel Walker Gerhart Memorial Scholarship
Awarded annually to a biology major, usually a sophomore or junior in good academic standing, who is pursuing scientific investigation through independent study in biology.

Keever Biology Research Training Fund
Support provided through a fund established by Dr. Catherine Keever, emeritus faculty member of the Department of Biology, to train students in methods and values of scientific research. Awarded to undergraduate biology majors to support research investigations. Applications are available in the Biology Office.

Alex Henderson Scholarship
This award is given for a proposal for a project that is interdisciplinary in nature with preference given to sophomores and juniors. Applications are available in the Biology Office.

Biology Student Investigator Grant
Awarded to fund biology research expenses of students enrolled in BIOL 498 (Independent Study) or BIOL 499 (Independent Study leading to Departmental or University Honors College Thesis) and may include costs to attend, to prepare materials for presentation, and to travel to conferences helpful to the student's research efforts. The request for proposals is circulated via Millersville email.

Neimeyer-Hodgson Research Grant
The Millersville University Alumni Association has established the Neimeyer -Hodgson Fund to provide grants-in-aid for student research. Grants are awarded spring and fall semesters. Applications may be obtained from the Alumni Office.

Student Research Grant
MU's Student Research Grant (SRG) program is intended to encourage both undergraduate and graduate students to undertake research and creative projects which will contribute new insights in the student's chosen academic field. Funds requested must be related to the student's course-related research or creative project or to their undergraduate or graduate thesis. Grants will be made up to a maximum award of $400 and may be used for research-related travel, materials and supplies, research experiments and data collection, books and equipment, and other research needs. Grant submissions will be accepted in the fall and spring semesters for currently enrolled Millersville students, with up to one year from the grant award notification to complete the research project and expend any grant funds. The request for proposals is circulated via Millersville email.

Non-Research Scholarships – Students Apply for These

Rachel Carson Biology Field Course Scholarships
These scholarships will be disbursed as credit toward tuition, fees, room and board, and travel expenses for student pursuing credits in biology field courses. At least two awards will be given annually; the minimum award will be $1,000. Recipients must be in good academic standing overall

and within their academic major and pursuing a BA, BS or BSE in the sciences or mathematics. Preference may be given to marine biology option students.

Liddell Field Study Endowment
This award is given to students registered for field biology courses that require residence at Wallops Island (or other similar field studies).

Awards Selected by Department or School

Henry Franklin Bitner Science Prizes
Two Bitner Prizes are given annually, one in physical science and one in biological science. Teachers of these sciences, together with the Dean of the School of Science and Mathematics, shall recommend to the faculty the senior students best qualified for these awards.

Commonwealth of Pennsylvania University Biologists (CPUB) Award
Given on the bases of academic standing and excellence in biology and research potential.

The Antone K. Fontes Health Professions Award
Reference books presented to students who are completing their studies at MU and who have demonstrated outstanding ability in the premedical/predental, nursing, and allied health programs. One student is selected from each of the three areas on the basis of quality point average and recommendations.

James Groff Scholarship
Awarded to a student who has demonstrated strong academic performance in a course of study which may lead to a degree in medicine and who has demonstrated financial need.

Robertson Endowed Library Garden Botany Internship
Awarded to a rising sophomore, junior or senior with first preference to Botany option Biology majors, who must demonstrate an interest in pursuing advanced study or a career in horticulture, horticultural taxonomy, landscape design or other related disciplines in botany.

Charles D. Spotts Naturalist-Humanist Award
A cash award made to the upper division student who, in the opinion of the Entomology Club, has contributed most to the naturalist humanist ethic.

Charles R. Winter Award in Pre-Med
A cash award (in the form of a tuition credit) to a student who has demonstrated strong academic performance in a course of study which may lead to a degree in medicine.

Dr. William Yurkiewicz Undergraduate Research Fellowship
A fellowship to a student who is conducting research with a high probability of publication in a peer-reviewed journal.

VERY IMPORTANT!

Safety Guidelines

VERY IMPORTANT!

The joy of any investigation can be tarnished by an accident! Use prudent practices in your research at all times. Please employ the following precautions:

1. Report all accidents, however minor, to your instructor or supervisor immediately. Contact the University Police in case of an emergency (911).

2. Avoid working alone in the field and in the laboratory.

3. Obtain advice from your instructor or supervisor whenever you modify or design your experiments. When conducting experiments, ask yourself: "What are the worst possible things that could go wrong?" and "How will I respond to these problems?" Do not begin an experiment until you are certain of your answers. It is particularly important to be well informed about the toxicity of all chemicals you will use. Read the labels on all chemical containers and take appropriate precautions.

4. Wear sensible clothing; avoid loose sleeves, hanging jewelry, etc. A laboratory coat, safety glasses and disposable gloves should be worn in research laboratories and in course-related laboratories when you are instructed to do so. Wear appropriate field garb to protect you from the elements and field community.

5. Know the exact location of all safety equipment: eye wash stations, fire extinguishers, showers, first-aid kits, spill containment supplies, etc.

6. Use a fume hood when working with volatile substances.

7. Keep the laboratory bench and work area orderly, clean and free of items not related to the experiment. Organize fieldwork so that minimal equipment is needed.

8. Dispose of waste material, broken glass, and excess chemicals as indicated by your instructor or supervisor.

9. Food and drink are not allowed in the laboratory.

10. Special instructions and procedures are required before you are permitted to use radionuclides. You must complete a training form before using these substances. Be sure to obtain this form before you begin working with any radioactivity.

11. You are responsible for your safety during the course of an investigation.

Student Organizations are a great way to meet other students with your interests and to learn more about specific areas of Biology!

The Aesculapian Society: Advisor: Dr. Cebra-Thomas

The Aesculapian Society is a club open to all students interested in careers in medicine, dentistry, podiatry, and many areas of the allied health professions. The Society endeavors to cultivate and encourage scholarly excellence in the field of health-related sciences. The club sponsors seminars featuring speakers from a variety of health fields. The members make frequent visits to professional schools, hospitals, and industrial laboratories during the year. The club is dedicated to volunteer involvement in programs, such as the Heart Fund and the National Foundation of the March of Dimes.

Biology Club: Advisor: Dr. Wagner

The Biology Club invites members from the entire campus as well as from the Biology Department. The activities of the club are numerous and include speakers from other institutions; career seminars; field trips to greenhouses, zoos, and primate laboratories; government experimental stations; mushroom factories; biotechnology facilities; aquaria; and several arboreta and gardens including the National Arboretum in Washington, D.C. and Longwood Gardens. This club prepares the newsletter "Biorhythms". Its meetings often include films on various aspects of biology. There is often a visit to the Philadelphia Flower Show and an overnight trip to Washington, D.C. or New York. On Arbor Day, the Club presents a flowering tree to the University to be planted at some appropriate place on campus. The Club has also established and maintains a nursery of trees planted on campus. It financially supports itself by organizing raffles, car washes, plant and food sales.

Conestoga Club: Advisor: Dr. Haines

The Conestoga Club was formed in 1996 to educate the community about local natural environments. We are working on natural history brochures about the "Bush", a forested campus area along the Conestoga River. We plan to lead hikes and also encourage people to take self-guided tours. Restoration of native wildflowers and other vegetation is another club project. During Spring 1996, Virginia bluebells were planted. The club is now establishing seed beds for native wildflowers, which will be transplanted to the Bush and other local areas.

Entomology Club: Advisor: Dr. Wallace

The Entomology Club was organized in 1964. The purposes and functions of this club include local and extended field trips to study the flora and fauna of nearby and far-away habitats. Trips are taken to the Florida Keys, the Everglades, Central and Northern Florida, Okeefenokee Swamp, Cape Hatteras, Wallops Island, Chincoteague and Assateague, the pine barrens of New Jersey, and Big Bend National Park in Texas. Although the emphasis of the club is insects, all animal groups are studied.

Millersville University Society for Respiratory Care Practitioners: Advisor: Dr. Hoover

The Millersville University Society for Respiratory Care Practitioners, chartered in 1997, was founded to serve students who have interest in respiratory care practice. The society meets monthly during the academic year to plan and conduct field trips, make facility tours, and enjoy speakers who come to share their experiences and insights regarding respiratory care practice. The society maintains communication with representatives of the American Lung Association, and members volunteer their time to work with children and adults who seek its services. Its goal is to promote enthusiasm and scholarship of students in the respiratory therapy curriculum, increase awareness of the respiratory care profession, advance the role of the respiratory care practitioner in health care, and promote the cardiopulmonary wellness of all people in our community.

Ocean Sciences Club: Advisor: Dr. Didier

The Ocean Sciences Club is open to anyone interested in the marine environment. We have invited speakers to talk about their research, graduate schools, and career opportunities. Field trips include beach cleanups along the Delaware shore, visits to the National Aquarium in Baltimore, the Smithsonian Institute, the open house for graduate school at the University of Delaware, as well as a boat trip in the Chesapeake Bay.

Because of the very inter-disciplinary nature of biology and because many of the world's problems have a biological basis, we believe that our curricula in biology provide students with a strong preparation for many careers as well as for advanced study. The various options in biology permit students to explore specific areas of biological science while maintaining a strong foundation in the discipline.

Your academic record includes much more than a grade-point-average. The courses you take, the knowledge you gain from your courses and from study outside formal course material, the independent study project(s) you pursue, the work experience you receive, the colloquia and seminars in which you participate, the scientific meetings you attend, the papers you present at meetings or publish in scientific journals, the leadership roles you assume in student organizations, and your volunteer community service will all make you a very competitive candidate in your future endeavors. Students at Millersville find time to add the activities mentioned above to their busy schedules, even with a full course load. The best way to prepare for the future is to participate in the Millersville community today.

Career Services

The offices for Career Services are located in Bedford House and can be reached by phone at x7655. A modest library of career opportunities is located in Bedford House; in addition, personnel are available to help you match a career with your interests. Information on the development of a sound resume or *curriculum vitae* is also available at Bedford House.

McNairy Library & Learning Forum

In addition to a collection of all current catalogs for colleges, universities, graduate and professional schools, the reference section of McNairy Library contains a number of volumes which describe and evaluate graduate school programs. If you have an interest in a particular profession or sub-discipline of biology, perhaps you should use the *Encyclopedia of Associations* in the reference section of McNairy Library to identify the locations of the main office of the organization, the phone number(s), and chief officer(s). These organizations are most willing to provide literature which describes professions and employment prospects for the future. Use the computer data bases in the reference section of McNairy Library to evaluate the financial health of a company with which you may wish to work.

Cooperative Work Experience

Employers and graduate/professional schools are often impressed with students who have had some work experience in the discipline they are about to enter. Not only does work experience demonstrate a student's interest in a particular vocation, but it illustrates that the student has had a "taste" of the work and desires to do more; these candidates are more likely to be successful when compared with an inexperienced individual. See the section on Cooperative Education in Biology.

Department of Biology Information

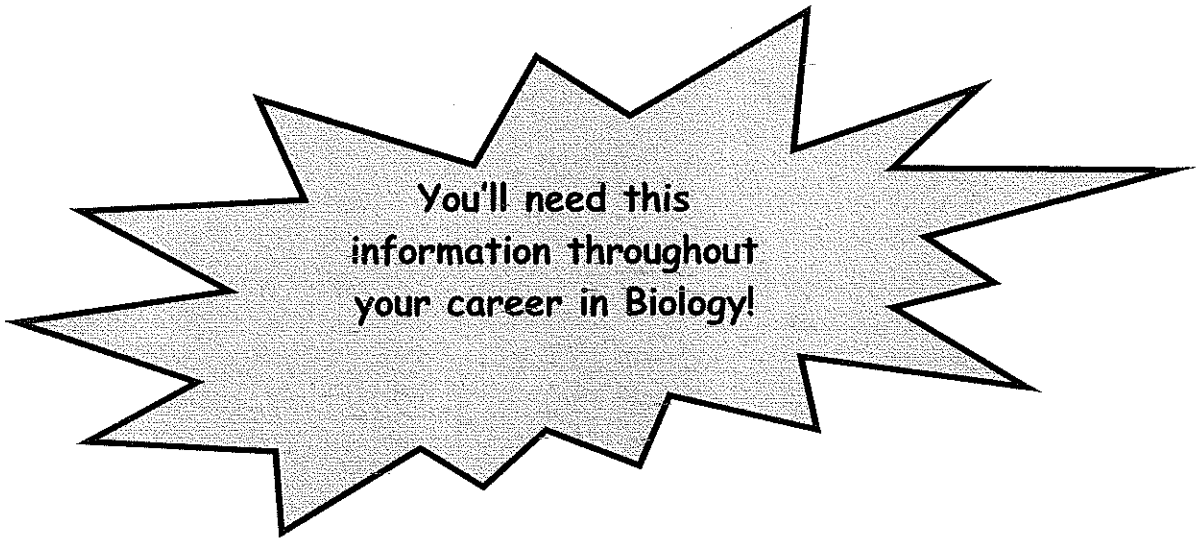
The Department of Biology receives thousands of fliers and informational bulletins about special courses, workshops, graduate and professional school programs. These are sorted according to discipline and filed in the file holders on the wall adjacent to Roddy 282. Should you locate some information of particular interest to you, feel free to copy the pertinent information and return the original to the holder so that others may use it.
Some of the short course or workshop material is placed in the bulletin board across from Roddy 288. The faculty of the Department of Biology is an excellent source of information.

Allied Health Coordinator: Dr. Cebra-Thomas

Dr. Ladd is the Allied Health Coordinator for all students with an interest in the health professions. In order to introduce students to a variety of opportunities in the health professions, the department of biology offers a one credit course: Introduction to the Allied Health Professions (BIOL 257). Information about the allied health programs and application procedures for internships and professional school admissions can be obtained from the Allied Health Coordinator.

Graduate and Professional Schools

Many students decide that they want to proceed with their education in graduate and/or professional schools. While it is often desirable for students to gain some work experience prior to proceeding to post-graduate education, the groundwork for advanced education should be initiated while the student is in his/her third year. Identify the profession and/or sub-discipline of biology you desire to pursue with advanced study. Then use the reference section of McNairy Library to learn about viable programs. You should write to schools of interest in order to obtain information on the major thrusts of inquiry within a particular department/school. In addition, you should begin to read the literature of professors with whom you may wish to work. Professional and graduate schools all have entrance requirements, obtain application forms early to learn what is required of you and develop a time line so that you will be able to complete applications in a timely fashion. Leave ample time to prepare for examinations, such as the Graduate Record Exam (GRE) or the MCAT required of students applying to medical schools.



How to Write a Laboratory Report or Scientific Paper

A scientific report is a method of communication, an attempt to tell others about some specific data that you have collected and about what you think the data mean. To enable the reader to quickly comprehend the main points of someone's work, the scientific paper is written in a clear and concise manner using the following standard format:

TITLE
INTRODUCTION
METHODS AND MATERIALS
RESULTS
DISCUSSION
LITERATURE CITED

The above format is the one that you may be required to use for your laboratory reports. Note that all the section headings are centered on their respective pages; the body of each section then follows immediately behind the section heading.

TITLE

The most important thing about the title is that it be self-explanatory; for example, a title such as *A Biology Lab Report* tells the reader nothing about the content of the paper. An example of a good self-explanatory title would be: *The Effects of Light and Temperature on the Growth of Sunflowers.* Here the title explains exactly what the worker has done.

INTRODUCTION

The Introduction contains the statement of the problem as well as background information. The researcher states the purpose of the investigation, that is, the specific question(s) that he or she is trying to answer as well as his or her hypothesis. The researcher also describes relevant information that has been found out about the problem, including research that has been done on the problem in the past. (This information is usually found through library research.) The author also discusses how the present experiment will help to clarify or expand understanding in this general area. All background information that the researcher has gathered from other sources (textbooks, journals, etc.) must be properly cited.

There are several ways to cite references in a scientific paper; the method used is usually determined by the journal in which that paper is to be published. The method described here applies to many scientific papers and is the method you will be expected to use in your reports. (note: scientific papers do not use footnotes)

If you have stated some information that needs referencing, put the name(s) of the author(s) of that information in parentheses at the end of the statement. The name(s) should be followed by the date of the publication in which the information appeared.
For example:
Ecdysone is a steroid hormone which is important in the growth and development of insects (Wigglesworth, 1970).

In some cases, you may have mentioned the name(s) of the author(s) in the statement itself. In that case, simply put the date of the author's publication in parentheses behind the name.
For example:
Pongs (1985) suggests that there is a limited number of ecdysone receptor proteins relative to puff binding sites.

If there are more than two (2) authors to be cited for any one reference, the citation is usually abbreviated as follows:
The ecdysone-receptor complex may directly induce late RNA puffing in fruit flies (Dworiczak et al, 1983).

If you mention information that was given to you by personal communication (letter, telephone, personal conversation), cite that reference as follows:
There is likely to be more than one type of ecdysone receptor in fruit flies (L. Riddiford, pers. comm.).

But it is always best to use a published reference rather than a personal communication, if that information is available in published form.

METHODS AND MATERIALS

In this section, the researcher describes in paragraph form the experimental design, the experimental apparatus, the methods of gathering data and the type of control that was used. If any work was done outdoors in a natural habitat, the researcher describes the study area and states its location. If any specimens were collected for the study, the researcher states where and when that material was collected. In this section, photographs, maps, diagrams, etc., can be used to aid in describing the experimental set-up. The rule to keep in mind is this: the Methods and Materials section should be detailed and clear enough so that readers could duplicate the experiment if they wished to do so. Assume that the reader has as much background in science as the author. For some lab reports, your instructor may indicate that this section can be modified so that you can just refer to your lab manual instead of repeating certain procedures.

RESULTS

The researcher presents the data for inspection by the reader. The results are presented in a straightforward manner, with no conclusions or value judgments as to what the data might mean. If possible, data are assembled into tables and/or graphs to supplement the text and to present the data in an easily understandable form. If tables and graphs are used, they must be accompanied by a narrative text. The text describes the results that are presented in the tables and graphs and calls attention to what the researcher considers to be the significant data. **Remember - this section contains text as well as graphs and tables!**

DISCUSSION

In this section, the researcher suggests what the results mean. The writer describes any patterns, relationships or correlations that emerged in this study. Basically, the researcher tries to tell why the results turned out the way they did. This includes any explanations as to why the results turned out differently than expected (the incubator broke down, errors in measurement, etc.). It is very important in the Discussion section to look critically at the procedures used and to discuss thoroughly the possible sources of error in the experiment.

In general, the researcher discusses whether the original hypothesis is supported or not supported by the data, and why or why not. The writer also compares the results to the information that is already known about the problem, such as from previous experiments or observations made by the author or by others (the background information that was mentioned in the Introduction). The author should not be afraid to indicate that the results do not support the original hypothesis. Perhaps another hypothesis can be suggested which may explain the problem or answer the question more accurately. The researcher might also suggest further investigations that could be done on the general problem.

LITERATURE CITED

This section lists, in alphabetical order by author's last name, all published information that was referred to in the paper. The actual details of punctuation and format vary somewhat depending on the journal. However, for the sake of uniformity, we will use a format, which is standard for most biological journals:

If your citation is from a journal article:

Cherbas, L., Lee, K. and P. Cherbas. 1991. Identification of ecdysone response elements. Genes Dev. 5: 120-131.

If your citation is from a book:

Sambrook, J., Fritsch, E.F., and T. Maniatis. 1989. *Molecular Cloning: A Laboratory Manual, 2nd ed.* Cold Spr. Harb. Lab. Press, New York.

REFERENCES:

Pechenik, J.A. 1987. *A Short Guide To Writing About Biology.* Little Brown and Co., Boston.

PREPARATION OF TABLES AND GRAPHS

Raw, unprocessed numbers derived from experiments are often difficult to comprehend. Converting such data to a thoughtfully prepared table or graph can make the interpretation and understanding of your lab findings much easier. A good table or a graph is, in essence, a snapshot that allows a reader to see the significance of your experimental findings at a glance. This should be your overriding concern when preparing a data summary; i.e., does your table or graph clearly and easily convey a biological story?

TABLES. Note the features of the following table:

-Tables are labeled and numbered.

-A table contains an explanatory caption. The caption should contain enough information so that the table 'stands by itself;' that is, the reader is able to understand the significance of the table without sorting through other materials.

-Headings are placed over each column and clearly indicate the units of measure.

Table I. World population by decade from 1950 - 2000 with projections for the years 2010 and 2020.

YEAR	POPULATION (billions)
1950	2.529
1960	3.023
1970	3.686
1980	4.438
1990	5.290
2000	6.115
2010	6.909
2020	7.674

Source: United Nations, 2009. *The 2008 Revision Population Database.* http://esa.un.org/unpp/

FIGURES. The information presented in Table I may also be presented as a graph:

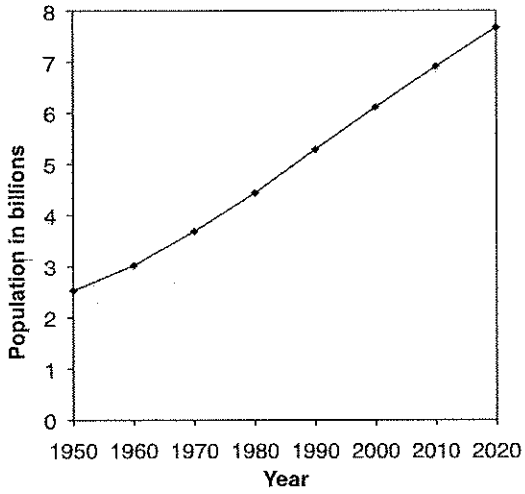


FIGURE 1. World Population by decade from 1950 - 2000 with projections for the years 2010 and 2020. (Source: United Nations, 2009. *The 2008 Revision Population Database.* http://esa.un.org/unpp/).

Graphs are commonly found in scientific publications because trends and relationships can be easily seen. These trends are often missed when perusing complicated tables. A quick glance at Table I might lead to the conclusion that there has been a steady (i.e., straight line) world population growth since 1950. Figure 1, however, clearly shows that population growth accelerated (curved up) each decade from 1950 to 1990 and after 1990 is slowing down slightly.

Note the features of Figure 1:

-Graphs are labeled and numbered. Note in particular that graphs are referred to as '**figures.**'

-Figures like tables, contain explanatory captions. The caption should contain enough information so that the figure 'stands by itself;' that is, the reader is able to understand the significance of the graph without sorting through other materials.
-The axes are clearly graduated and labeled; the units are evident. The graduations on each axis are consistent, covering the entire range of values. The graph is a size that appropriately fills the graph paper, which you may construct yourself using http://incompetech.com/graphpaper.
-Data points may be connected by a line or curve to illustrate a trend or relationship.
-If more than two lines are presented on one graph, the types of data points and lines should differ for the two sets of data.
-The x-axis (horizontal axis or abscissa) usually contains the parameter that we are able to manipulate in an experiment (the independent variable). The y-axis (vertical axis or ordinate) is the response (the dependent variable) to this manipulation. When dealing with a timed response, time is usually plotted on the x-axis.

SLOPE OF A LINE. Recall that a straight line on a graph can be described by the formula $y = mx + b$; where m is the slope and b is the y-intercept. The slope (or rate of change) tells us about the change of y in comparison to x. A rate of change you constantly deal with is the readout on an automobile's speedometer; your speed (also called velocity) is the change of your position in miles/hour. Rates that we deal with in biology lab include the rate of an enzymatic reaction, the rate of fermentation, the rate of photosynthesis, the rate of respiration and the rate of growth.

On a graph, with a straight line, the slope is determined by choosing two points on the line and then determining the y values and x values for these points. The slope is the difference in the y values divided by the difference in x values. In other words, $m = (y_1 - y_2) \div (x_1 - x_2)$ or $m = \Delta y/\Delta x$. Figure 2 demonstrates the determination of a slope.

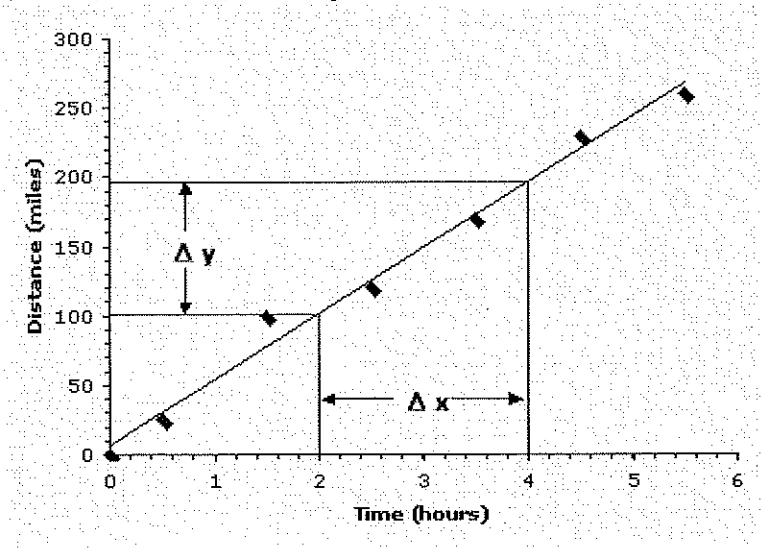


Figure 2. Distance traveled by an automobile over time. A straight line was fitted to the data points. The slope of this line represents the average rate (i.e., velocity) traveled by the automobile during this trip. The slope = $\Delta y/\Delta x$ = 94 miles / 2 hours = 47 miles per hour.

Reference:

J.A. Pechenik, 1987. *A Short Guide to Writing about Biology.*, Little, Brown and Co.
Custom Graph Paper: http://incompetech.com/graphpaper

BIOLOGICAL LITERATURE

The lifeblood of any modern scientific discipline is the written literature, and it is essential that students learn to use this body of information effectively, both inside and outside of the classroom setting. Often, the beginning student is unsure of what types of information resources are acceptable for use in an academic environment - there is so much available on the Internet and in the Library. Finding scholarly scientific literature on a topic requires information seeking skills and critical thinking skills to evaluate the material found. It is easy to become overwhelmed by the amount of information published on the Internet and, more specifically, the hundreds of thousands of articles published annually in the thousands of biological periodicals. This appendix is intended to familiarize you with ways of accessing the biological literature.

Types of Scientific Literature

There are four broad categories of scientific literature:

1. Primary Literature. These are reports of original research, usually appearing in scientific periodicals. Examples of primary literature are articles that appear in the widely circulated, multidisciplinary journals *Science* and *Nature.* These reports represent the factual foundation of any scientific discipline.
2. Secondary Literature. Often called 'review articles,' these papers examine a number of primary research articles and provide an overview and interpretations of recent developments in a specific area. *Scientific American* is an example of a secondary level journal.
3. Tertiary Literature. This literature includes textbooks, encyclopedias, bibliographies and other reference books. These works usually summarize the most important facts and ideas about general subjects. It may take several years for new ideas to appear in the tertiary literature.
4. Internet Sources. Today the Internet is a tremendous resource and its ready availability often makes it the first place a student turns for information. It can provide a wide range of material, including all of the categories of scientific literature mentioned above. It can also, just as easily, provide access to information that is untrue or biased. It is essential that a student know how to evaluate Internet material.

   The Internet also provides the means to access scientific literature through the Millersville University McNairy Library website. Scientific literature can be found by searching the Online Library Catalog (*Finding Information / books (and more)*) and the periodical indexes (*Finding Information / articles*). These materials are purchased to meet your research needs.

Searching the Biological Literature

Given a literature assignment, students frequently begin and end their search on the Internet. The Internet is a good place to start but it does not come close to fully covering scholarly scientific literature. Indexes to most scientific literature still must be purchased by individual subscribers or libraries. To get an accurate, complete picture of a scientific topic

you must move beyond the Internet and learn how to use Library provided materials and databases, most importantly the Online Library Catalog and Periodical Indexes.

To obtain a wide perspective as well as the current information on a biological topic, use the following research technique:

1. Consult a **general** information resource. Examples are:
   - Textbooks
   - Reference books - Encyclopedias, Dictionaries
   - Search the Internet, focusing on more credible sites such as Government (Science.Gov) or Educational sites. The Internet encyclopedia Wikipedia can also be consulted, paying attention to references cited and external links to other sites.

All of these resources will familiarize you with the general ideas and terminology of your topic of interest. You may use them to help you decide what it is that you want to research, what are the important questions and issues surrounding a scientific topic. None of these resources should be considered definitive in writing a college level paper, and all of the material should be verified with other resources. Again, look for references cited; they will provide you with additional sources of information.

2. Focus on your topic of interest by looking at the secondary literature.
   a. Check the Online Library Catalog (*Finding Information / books (and more)*) for books and government documents in the McNairy Library that address your research question.
   b. Search in a broad **Periodical Index** (*Finding Information / articles / General*) such as *Academic Search Premier*. This database indexes both primary and secondary literature in a wide range of disciplines and includes some magazine and newspaper content as well.
   c. Examine 'review serials' for current information. These serial publications exclusively contain review articles from specified areas. The advantage of a review article is that an authority in an area has examined many articles from the primary literature, has summarized them and has interpreted how they fit into 'a bigger picture.' Examples of review serials are: *Annual Review of Microbiology, Annual Review of Physiology, Annual Review of Plant Physiology, News in Physiological Sciences* (NIPS), *Physiological Reviews,* and many others. Access to these titles can be determined by using the Online Library Catalog (*Finding Information / books (and more)*) or the Journal Finder (*Finding Information / journal finder*).
3. Once you have formulated your research question, it is time to find out what is in the primary biological literature. What is known about this topic, what research has been done and what were the results? The contents of major biological journals are indexed in a **Periodical Index**. The publication titles, article titles, authors, publication dates, and pages numbers along with abstracts and more can be found in these indexes. Access to the most important biological periodical indexes is through electronic databases purchased by the Library and is available from the Library website (*Finding Information / articles*).

Major Indexes

Biological Abstracts: *Biological Abstracts®*, produced by BIOSIS, is a complete collection of bibliographic references covering life science and biomedical research literature published from more than 4,000 journals internationally. This database contains nearly 9.5 million archival records from as far back as 1926, with more than 370,000 citations added each year.

BioOne: The BioOne bibliographic database is an indexed and fully searchable collection of abstracts that link to the full-text articles available from the BioOne organization. BioOne provides a unique aggregation of over 65 high-impact bioscience research journals from more than 50 publishers.

Chemical Abstracts: An index that monitors over 14,000 periodicals, patent documents, conferences, government reports and books. Molecular, cellular and biochemical aspects of biology will be indexed in *Chemical Abstracts*.

Other Indexes

Academic Search Premier: This multi-disciplinary database provides full text for nearly 4,500 journals, including full text for more than 3,600 peer-reviewed titles. PDF backfiles to 1975 or further are available for well over one hundred journals, and searchable cited references are provided for 1,000 titles. *Academic Search Premier* is updated on a daily basis via EBSCO*host*.

Agricola: This database contains bibliographic records from the U.S. Department of Agriculture's National Agricultural Library. Coverage for *AGRICOLA* dates back to 1970 and includes more than 4.3 million citations.

MEDLINE: MEDLINE provides authoritative medical information on medicine, nursing, dentistry, veterinary medicine, the health care system, pre-clinical sciences, and much more. Created by the National Library of Medicine; search citations from over 4,800 current biomedical journals.

The information and concepts in many branches of biology are changing rapidly, and papers published only a few years ago may be out of date. Also, it should be noted that there is about a six month lag between publication of an article and its appearance in one of the above indexes.

An Example of a Literature Search

Suppose we are interested in finding some current research that deals with mercury in the environment.

1. First we must select appropriate keywords-words to describe what we want to know-words that we will find in articles about our topic. We may want to start with the keywords: mercury and environment.

   You can first check the Internet to get some general information about issues surrounding mercury in the environment. You will find many government websites addressing the issue and articles on Wikipedia. At the end of the Wikipedia article you will find references and external links to more information.

2. Next, use the Online Library Catalog to see if the Library has any books or government documents concerning mercury in the environment. Search with your keywords. Refine your search depending on the number and appropriateness of results.

3. Check the primary and secondary literature in *Academic Search Premier* for some articles about mercury in the environment.

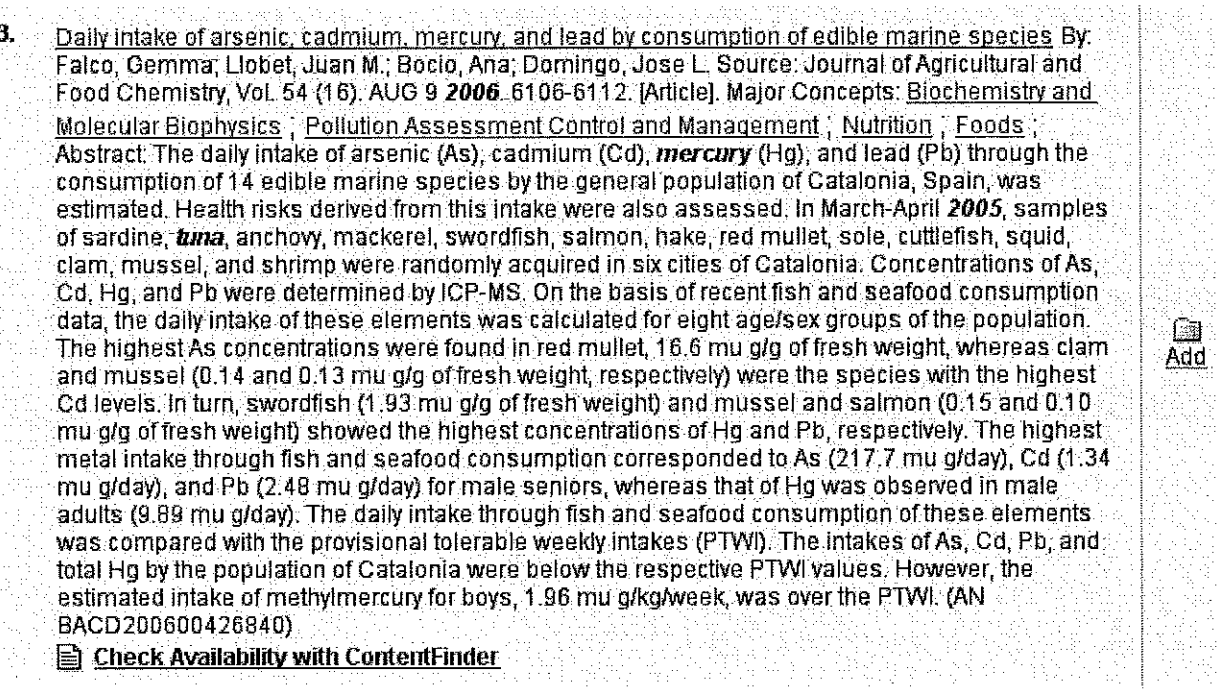
4. At this point you should know what the issues are concerning mercury in the environment and you may need to refine your research question and keywords to search the primary literature. Articles will be more focused in this literature, and to obtain a manageable number of results, you may need to be more focused with your keywords. For instance,

search *Biological Abstracts* (*Finding Information / articles / Biology*) for scholarly articles on mercury in tuna.

Type in your keywords (mercury and tuna)

Your search will provide you with abstracts of articles containing your key words.

Here is the third abstract that appeared from the search:



3. Daily intake of arsenic, cadmium, mercury, and lead by consumption of edible marine species By: Falco, Gemma; Llobet, Juan M.; Bocio, Ana; Domingo, Jose L. Source: Journal of Agricultural and Food Chemistry, Vol. 54 (16). AUG 9 **2006**. 6106-6112. [Article]. Major Concepts: Biochemistry and Molecular Biophysics ; Pollution Assessment Control and Management ; Nutrition ; Foods ; Abstract: The daily intake of arsenic (As), cadmium (Cd), ***mercury*** (Hg), and lead (Pb) through the consumption of 14 edible marine species by the general population of Catalonia, Spain, was estimated. Health risks derived from this intake were also assessed. In March-April ***2005***, samples of sardine, ***tuna***, anchovy, mackerel, swordfish, salmon, hake, red mullet, sole, cuttlefish, squid, clam, mussel, and shrimp were randomly acquired in six cities of Catalonia. Concentrations of As, Cd, Hg, and Pb were determined by ICP-MS. On the basis of recent fish and seafood consumption data, the daily intake of these elements was calculated for eight age/sex groups of the population. The highest As concentrations were found in red mullet, 16.6 mu g/g of fresh weight, whereas clam and mussel (0.14 and 0.13 mu g/g of fresh weight, respectively) were the species with the highest Cd levels. In turn, swordfish (1.93 mu g/g of fresh weight) and mussel and salmon (0.15 and 0.10 mu g/g of fresh weight) showed the highest concentrations of Hg and Pb, respectively. The highest metal intake through fish and seafood consumption corresponded to As (217.7 mu g/day), Cd (1.34 mu g/day), and Pb (2.48 mu g/day) for male seniors, whereas that of Hg was observed in male adults (9.89 mu g/day). The daily intake through fish and seafood consumption of these elements was compared with the provisional tolerable weekly intakes (PTWI). The intakes of As, Cd, Pb, and total Hg by the population of Catalonia were below the respective PTWI values. However, the estimated intake of methylmercury for boys, 1.96 mu g/kg/week, was over the PTWI. (AN BACD200600426840)

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Contact any librarian or professor for further assistance.

credits: This appendix was prepared by L. Reinking and updated by M. O'Malley (6/07).

Faculty
Department of Biology

DR. JEAN G. BOAL

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Areas of Specialization: Animal behavior and marine biology.

Research Interests: Cognitive behavior and sensory perception in animals, especially cephalopods.

Techniques/Procedures Commonly Used: A variety of observational techniques to quantify behavior in the lab and field, including ethograms, video image analysis, mazes and other apparatuses; statistics.

Courses Taught: General Biology, Marine Biology, Seminar in Marine Biology, Principles of Ecology & Evolution, the Natural History of the Mid-Atlantic Shore, Animal Behavior, Behavioral Biology, Seminar in Animal Behavior, Evolution, Special Topics (Animal Cognition, Fish Behavior, Cephalopod Biology).

Recent Publications: (*student)

In press. Navigation in cephalopods. In: Cephalopod Cognition. (A-S Darmaillacq, ed.) Cambridge Univ. Press (with C. Jozet-Alves and A-S Darmaillacq).

2012. A Preliminary Analysis of Sleep-Like States in the Cuttlefish *Sepia officinalis*. PLoS ONE 7(6): e38125. doi:10.1371/journal.pone.0038125 (with M. Frank M, R.H. Waldrop* M. Dumoulin*, and S.J. Aton).

2011. Behavioral research methods for working with octopuses and cuttlefishes. Vie et Milieu 61: 203-210.

2011. Distance chemoreception and the detection of conspecifics in *Octopus bimaculoides*. Journal of Molluscan Studies 77: 309-311. doi: 10.1093/mollus/eyr009 (with M.D. Walderon*, K. Nolt*, R.E. Haas*, K.N. Prosser*, J.B. Holm*, and G.T. Nagle).

2011. Extreme aggression in male squid induced by a ß-microseminoprotein-like pheromone. Current Biology 21(4): 322-327. doi: 10.1016/j.cub.2011.01.038. (with S.F. Cummins, K.C. Buresch, C. Kuanpradit, P. Sobhon, J.B. Holm*, B.M. Degnan, G.T. Nagle and R.T. Hanlon RT).

2010. Early explosure to odors changes later visual prey preferences in cuttlefish. Journal of Developmental Psychobiology 52(8):833-7. doi:10.1002/dev.20470 (with M. Guibé* and L. Dickel).

2010. Sexually mature cuttlefish are attracted to the eggs of conspecifics. Journal of Chemical Ecology 36(8):834-836 doi: 10.1007/s10886-010-9816-0 (with K.N. Prosser*, J.B. Holm*, T.L. Simmons*, R.E. Haas* and G.T. Nagle).

2008. Short-distance navigation in cephalopods: a review. Cognitive Processing 9(4): 239-247. doi: I 10.1007/s10339-007-0192-9 (with C. Alves and L. Dickel).

2007. Octopuses (*Octopus bimaculoides*) and cuttlefishes (*Sepia pharaonis, S. officinalis*) can conditionally discriminate. Animal Cognition 10(4):449-459. doi: 10.1007/s10071-007-0085-4 (with L.M. Hvorecny*, J.L. Grudowski*, C.J. Blakeslee*, T.L. Simmons*, P.R. Roy*, J.A. Brooks*, R.M. Hanner*, M.E. Beigel*, M.A. Karson, R.H. Nichols* and J.B. Holm*).

2007. UV Light Influences covering behavior in the urchin *Lytechinus variegatus*. Journal of the Marine Biological Association 87: 1257-1261. doi: 10.1017/@002531540705586S. (with J.E. Sigg* and K.M. Lloyd-Knight*).

2007. Laterality in Octopus Eye Use? Animal Behaviour Forum 74(3):e1-e2. doi: 1016/j.anbehav.2006.12.026 (with J.W. Fenwick).

2006. Social recognition: a top down view of cephalopod behaviour. Vie et Milieu.

2006. Orientation in the cuttlefish Sepia officinalis: response versus place learning. Animal Cognition (with C. Alves*, R. Chichery, and L. Dickel).

2005. Behavioral responses of juvenile cuttlefish Sepia officinalis to local water movements. Marine and Freshwater Behaviour and Physiology 38(2): 117-125 (with S. Komak, L. Dickel and B.U. Budelmann.

2004. Behavioral evidence for intraspecific signals with achromatic and polarized light by cuttlefish (Mollusca: Cephalopoda). Behaviour 141: 837-861 (with N. Shashar, M. Grable*, K. Vaughan*, E. Loew and R. Hanlon.

2004. Experimental evidence that ovary and oviducal gland extracts influence male agonistic behavior in squids. Biological Bulletin 206: 1-3 (with K.C. Buresch, G.T. Nagle, J.Knowles*, R. Nobuhara, K. Sweeney* and R.T Hanlon).

2003. Experimental evidence for spatial learning in cuttlefish (Sepia officinalis). Journal of Comparative Psychology 117(2): 149-155 (with M.A. Karson* and R.T. Hanlon).

2003. Contact chemosensory cues in egg bundles elicit male-male agonistic conflicts in the squid Loligo pealei (Mollusca: Cephalopoda). Journal of Chemical Ecology. Vol 29(3): 547-560 (with K.C. Buresch, J. Knowles*, J. DeBose*, A. Nichols*, A. Erwin*, S.D. Painter, G.T. Nagle and R.T. Hanlon).

2000. Observational Learning Does Not Explain Improvement in Predation Tactics by Cuttlefish (Mollusca: Cephalopoda). Behavioural Processes 52: 141-153 (with K.M Wittenberg* and R.T. Hanlon).

2000. Experimental evidence for spatial learning in octopuses. Journal of Comparative Psychology 114: 246-252 (with A. Dunham*, K. Williams* and R.T. Hanlon).

2000. Effect of early experience on learning and memory in cuttlefish. Developmental Psychobiology 36: 101-110 (with L. Dickel, J.G. Boal and B.U. Budelmann).

2000. Cuttlefish use polarization sensitivity in predation on silvery fish. Vision Research 40(1):71-75 (with N. Shashar, R. Hagan* and R.T. Hanlon).

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Areas of specialization: Developmental biology, evolution & development.

Research Interests: Development of the turtle shell; neural crest; bone formation.

Techniques/Procedures Commonly Used: Microscopy, immunohistochemistry, organ and tissue culture, in situ hybridization, polymerase chain reaction (PCR) analysis, molecular biology.

Courses taught: General Biology, Cell Biology, Seminar in Stem Cells & Human Cloning, Developmental Biology.

Recent publications: (*student)

2009. Reptilian heart development and the molecular basis of cardiac chamber evolution. Nature 461, 95-98 (with K. Koshiba-Takeuchi, et al)

2008. "How the turtle gets its shell", in Wyneken, J., Godfrey, M.H., and Bels, V. (editors). *Biology of Turtles.* CRC Press, Boca Raton (with S.F. Gilbert and A.C. Burke).

2007. A late-emerging population of trunk neural crest cells forms the plastron in the turtle *Trachemys scripta*, *Evolution & Development* 9, 267-277 (with E. Betters*, M. Yin, C Plafkin*, K McDow*, and S.F Gilbert).

2007. The contribution of neural crest cells to the nuchal bone and plastron of the turtle shell, *Integrative & Comparative Biology* 47, 401-408 (with S.F. Gilbert, G. Bender*, E. Betters*, and M.Yin).

2005. How the turtle forms its shell: a paracrine hypothesis of carapace formation. J. Exp. Zool. (Mol Dev Evol) 304B, 558-569 (with F. Tan*, S. Sistle*, E. Estes, G. Bender*, C. Kim*, P. Riccio* and S. Gilbert).

2004. Epithelial *Bmpr1a* regulates differentiation and proliferation in postnatal hair follicles and is essential for tooth development, Development 131, 2257-2268 (with T. Andl, K. Ahn, A. Kairo, E. Chu, L. Wine-Lee, S. Reddy, N. Croft, D. Metzger, P. Chambon, K. Lyons, Y. Mishina, J. seykora, E. Crenshaw, and S. Millar).

2003. *T-box* gene products are required for mesenchymal induction of epithelial branching in the embryonic mouse lung, Developmental Dynamics 226:82-90 (with J. Brommer*, R. Gardiner*, H. Sheipe* and S. Gilbert).

DR. M. JAMES COSENTINO

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Areas of Specialization: Physiology, endocrinology, nanotechnology

Research Interests: Contraception & infertility, nanotechnology biosensors, and International Science Education

Techniques/Procedures Commonly Used: Enzymology, pharmacology, small animal surgery, tissue culture, videomicrography, radioimmunoassay, histology, *in vitro* fertilization, and fluorescence microscopy.

Courses Taught: Human Anatomy and Physiology, Endocrinology, Histology, Pharmacology, Human Biology, Functional Human Anatomy, General Biology

Recent Publications:

2005. Nanowire Optical Sensor for Rapid Medical Diagnostics Innoventure, 2005: Pennsylvania State University, Hershey Medical Center. (with Habib, Y.M., Eklund, P.C., and Rickard, L.H.).

2002. The effects of oxytocin and arginine vasopressin *in vitro* on epididymal contractility in the rat. International Journal of Andrology 25:65-71 (with P.W. Studdard and J.L. Stein).

2001. Natural products for the treatment of tropical diseases. Trends in Parasitology, 17:2:58-60. (with Willcox, M.L., Pink, R. Wayling, Bodeck, S. and G.).

1998. Pharmacological developments in male contraception. Exp Opin Invest Drugs 6:1-19. (with S.A. Matlin).

1995. The contraceptive effects of etoprine on male mice and rats. J. Androl 16 (2):169-174. (with N.S. Malik, S.A. Matlin, J. Fried, and R.E.Pakyz).

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Areas of Specialization: Ichthyology; Systematics: Vertebrate Anatomy and Evolution.

Research Interests: Systematics of fish; Chondrichthyan biology and evolution; use of freshwater fish to monitor stream quality; sexuality and gender

Courses Taught: Zoology, Ichthyology, and Human Sexuality.

Recent Publications:

2012. Didier, D.A., Kemper, J.M., & Ebert, D.A. Phylogeny, biology, and classification of extant Holocephalans. *In*: Carrier, J.C., J.A. Musick, & M.R. Heithaus (Eds.), The Biology of Sharks and their Relatives, second edition. CRC Press, Boca Raton, pp. 97-121.

2010. Kemper, J.M., Ebert, D.A., **D.A. Didier**, and Compagno, L.J.V. Description of a new species of chimaerid, Chimaera Bahamaensis, from the Bahamas (Holocephali: Chimaeridae). Bull Mar. Sci. 86(3): 649-659.

2009. James, Kelsey C., D.A. Ebert, D. J. Long, & **D. A. Didier**. 2009. A new species of chimaeroid, *Hydrolagus melanophasma* sp. nov. (Chondrichthyes: Chimaeriformes: Chimaeridae) from the eastern North Pacific. Zootaxa 2218: 59-68.

2008. Didier, D.A. Two new species of the genus *Hydrolagus* Gill (Holocephali: Chimaeridae) from Australia, pp. 349 - 356. *In*: P.R. Last, W.T. White & J.J. Pogonoski (eds). Descriptions of New Australian Chondrichthyans. CSIRO Marine & Atmospheric Research Paper 022, 358 pp.

2008. Didier, D.A., Last, P.R. & White, W.T. Three new specis of the genus *Chimaera* Linnaeus (Chimaeriformes: Chimaeridae) from Australia, pp. 327 - 339. *In*: P.R. Last, W.T. White & J.J. Pogonoski (eds). Descriptions of New Australian Chondrichthyans. CSIRO Marine & Atmospheric Research Paper 022, 358 pp.

2006. Quaranta, K.L, D. A. Didier, D. J. Long, and D. A. Ebert. A new species of chimaeroid, *Hydrolagus alphus* sp. nov. (Chimaeriformes: Chimaeridae) from the Galapagos Islands. Zootaxa 1377: 33-45.

2006. Barnett, A.K., D.A. Didier, D.J. Long, and D.A. Ebert. *Hydrolagus mccoskeri* sp. nov., a new species of chimaeroid fish from the Galápagos Islands (Holocephali: Chimaeriformes: Chimaeridae). Zootaxa 1328: 27-38.

2002. Didier, D.A. and B. Séret. 2002. Chimaeroid fishes of New Caledonia with description of a new species of *Hydrolagus* (Chondrichthyes, Holocephali). Cybium 26:225-233.

2002. Didier, D.A. 2002. Two new species of chimaeroid fishes from the southwestern Pacific Ocean (Holocephali, Chimaeridae). Ichthyological Research 49:299-306.

2002. Didier, D.A. Chimaeras. *In*: The living marine resources of the Western Central Atlantic. Volume 1: Introduction, mollusks, crustaceans, hagfishes, sharks, batoid fishes, and chimaeras. FAO Species Identification Guide for Fishery Purposes and American Society of Ichthyologists and Herpetologists Special Publication No. 5. Rome, FAO, pp. 592-599.

Dr. AARON M. HAINES

B.S. in Forestry and Wildlife Management, Virginia Tech; M.S. in Wildlife & Range Management, Texas A&M University-Kingsville (2003); Ph.D. in Wildlife Science, Texas A&M University-Kingsville (2006).

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Areas of Specialization: Conservation Biology & Wildlife Ecology

Research Interests: Identifying approaches to implement on the ground conservation strategies to benefit species of conservation concern. Conservation strategies may include the use of spatial models to identify priority areas in need of protection, mitigation of poaching activity, evaluation of field techniques for conservation research, and evaluation of recovery efforts for threatened and endangered species.

Techniques/Procedures Commonly Used: Geographical Information Systems Analysis, Satellite Telemetry, Remote Trail Cameras.

Courses Taught: General Biology, Concepts of Zoology, Conservation Biology, Ornithology and Mammalogy.

Recent Publications:

2012. Spatially-explicit analysis of poaching activity as a conservation management tool. *Wildlife Society Bulletin.* (with D. Elledge, et al)

2012. By the numbers: How is recovery defined by the U.S. Endangered Species Act? BioScience 62: 646-657. (with M.C. Neel)

2012. Incorporating Wildlife Conservation into County Comprehensive Plans: GIS Approach. Northwest Science 86: 53-70. (with M. Leu et al)

2010. Comparing mammal capture effectiveness between scent stations and remote cameras in forest and prairie habitat. The Journal of the Iowa Academy of Science 117: 4-8. (M. McKinney)

2010. Conservation reliant species: and the future of conservation. Conservation Letters 3:71-78. (with J. M. Scott, et al)

2009. Habitat partitioning of sympatric ocelots and bobcats: implications for recovery of ocelots in southern Texas. Southwestern Naturalist 54:119-126. (with J. Horne, et al)

2009. Nest niche partitioning of Lewis's and Red-headed woodpeckers in burned pine forests. The Wilson Journal of Ornithology 121:89-96. (with K.T. Vierling and D.J. Gentry)

DR. CHRISTOPHER R. HARDY

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Areas of Specialization: Plant Systematics, Evolution, Biodiversity Informatics, Floral Anatomy & Development, GIS Modeling of Species Distributions, Natural History Education.

Research Interests: Floristics, Taxonomic Study, Phylogeny Reconstruction, Biodiversity Web Development, GIS & Biogeography.

Techniques/Procedures Commonly Used: PCR, DNA-sequencing, Scanning Electron Microscopy, Histology, Observations of Plants *in situ*, GIS.

Courses Taught: Foundations of Biology, Concepts of Botany, Plant Systematics.

Recent Publications:

2012. Algae in forensics investigations. Pp. 145-173 (Chapter 9) in D. W. Hall, J. H. Byrd (eds.) *Forensic Botany: A Practical Guide*. John Wiley & Sons, Ltd., London. (With J.R. Wallace.).

2011. Plants and wildlife forensics. Pp. 145-160 (Chapter 9) in J.E. Huffman, J.R. Wallace (eds.) *Wildlife Forensics*: Methods and Applications. Wiley-Blackwell Publishing, London. (With D.S. Martin.)

2010. A generic classification of the Restonieae (Restionaceae), southern Africa. *Bothalia* 40: 1-35. (With H.P. Linder.)

2009. Floral organogenesis and the developmental basis for pollinator deception in the Asiatic Dayflower, *Commelina communis* (Commelinaceae). *American Journal of Botany* 96: 1236-1244. (With L. Sloat and R.B. Faden.)

2008. Simple biodiversity mashups for non-tech-savvy biologists: a demonstration using the liana flora of Pennsylvania, USA. *Journal of the Torrey Botanical Society* 135: 585-594. (With N.W. Hardy.)

2007. Phylogeny and historical ecology in *Rhodocoma* (Restionaceae) from the Cape Floristic Region. *Aliso* 23: 213-226. (With H.P. Linder.)

2006. Are mitochondrial genes useful for the analysis of monocot relationships? *Taxon* 55: 857-870. (With J.I. Davis, G. Petersen, O. Seberg, D.W. Stevenson, M.P. Simmons, F.A. Michelangeli, D.H. Goldman, L.M. Campbell, C.D. Specht, J.I. Cohen.)

2006. Reconstructing ancestral ecologies: Challenges and possible solutions. *Diversity & Distributions* 12: 7-19.

2005. Speciation in the Cape flora: A macroevolutionary and macroecological perspective. Pp. 46-73 *in* F. T. Bakker, L. W. Chatrou, B. Gravendeel and P. B. Pelser, eds. *Plant species-level* systematics*: New perspectives on pattern & process*. Koeltz, Königstein. (With H.P. Linder.)

2004. *Plowmanianthus*, a new genus of Commelinaceae with five new species from tropical America. *Systematic Botany* 29 (2): 316-333. (With R.B. Faden.)

2004. Evolution of the species-rich Cape flora. *Philosophical Transactions of the Royal Society of London*, B: 1623-1632. (With H.P. Linder.)

DR. CAROL ELY HEPFER

B.A., Wilson College; Ph.D., Bryn Mawr College.

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Areas of Specialization: Genetics, cell and molecular biology.

Research Interests: Regulation of eukaryotic gene expression, yeast genetics and recombinational mechanisms, and molecular basis of sex determination in cephalopods.

Techniques/Procedures Commonly Used: Gene cloning and mapping, polymerase chain reaction, *in vitro* mutagenesis, electrophoresis, nucleic acid hybridization, DNA sequence analysis, microbial and molecular methodologies.

Courses Taught: Genetics, Human Genetics: Applications and Analysis, General Biology, Senior Seminar.

Recent Publications:

2012. Identification of Sex-Specific Genetic Sequences in the Squid *Doryteuthis pealed.* Pennsylvania Academy of Sciences Annual Meeting (with P. Behmer and D. Farnell). 2012.

2008. Effectiveness of Single Strand Conformation Polymorphism Analysis and Enzymatic Mismatch Cleavage for Mutation Detection in a Family with Complete AndrogenInsensitivity. Journal of the Pennsylvania Academy of Sciences 81:134 (with S. Rice).

2005. DEG1 encoding the tRNA: pseudouridine synthase Pus3p, impacts HOT1-stimulated recombination in *Saccharomyces cerevisiae.* Molecular Genetics and Genomics. (with H. Fogell, K.G. Steudel, S. Arnold-Croop, M. Moon, A. Roff, S. Zaikoski, A. Rickman, K. Komisisky, D.L. Harbaugh, G.I. Lang, and R.L. Keil).

1999. Effects of *DEG1* mutations on *HOT1*-dependent genetic recombination in Saccharomyces cerevisiae do not result solely from changes in transcription. Molecular Biology of the Cell 10(sup):93a. (with H. Fogell, R. Prusty, S. DiBartolomeis, and R. Keil).

DR. JOHN E. HOOVER, Department Chair

B.S., Indiana University of Pennsylvania; Ph.D., State University of New York Health Science Center at Syracuse.

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Areas of Specialization: Neuroscience, physiology.

Research Interests: Neural control of movement, sensorimotor integration.

Techniques/Procedures Commonly Used: Neurosurgery, microstimulation, neuroanatomic tracing, electrophysiological recording, histology, microscopy.

Courses Taught: General Biology, Concepts of Zoology, Human Anatomy and Physiology, Neurobiology, Functional Human Anatomy.

Recent Publications:

2010. An unbiased stereological estimate of the number of motor neurons in the cervical enlargement of the rat spinal cord. Journal of the Pennsylvania Academy of Science 84(1):26-30 (with R.R. Ritzel)

2003. Sensorimotor corticocortical projections from rat barrel cortex have an anisotropic organization that facilitates integration of inputs from whiskers in the same row. Journal of Comparative Neurology, 466:525-544. (with Z.S. Hoffer).

2003. Quantitative comparisons of the topographic organization in the ventrobasal complex and posterior nucleus of the rodent thalamus. Brain Research, 96:54-68. (with K.D. Alloway).

2003. Projections from primary somatosensory cortex to the neostriatum: the role of somatopic continuity in corticostriatal convergence. Journal of Neurophysiology, 89:1576-1587. (with K.D. Alloway).

2000. Overlapping corticostriatal projections from the rodent vibrissal representations in primary and secondary somatosensory cortex. Journal of Comparative Neurology, 426(1):51-67. (with K.D. Alloway, J.J. Mutic and Z. Hoffer).

Dr. BRENT M. HORTON

B.S., Colorado State University; Ph.D., University of Maine

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E-mail: Brent.Horton@millersville.edu

Areas of Specialization: Animal behavior, behavioral ecology, ecological physiology, behavioral endocrinology/neuroendocrinology, ornithology.

Research Interests: The neuroendocrine and genetic bases of social and reproductive behavior in birds. Using integrative approaches on natural models (wild animals) to understand the proximate and ultimate mechanisms underlying behavioral strategies and life history variation.

Techniques/Procedures Commonly Used: Hormone analyses; RNA and DNA extraction, preservation, and analysis; standard and quantitative (qRT) PCR; brain histology; *in situ* hybridization; diverse field techniques for study of physiology and behavior of wild birds.

Courses Taught: Foundations of Biology, Concepts of Zoology, Animal Physiology, Behavioral Ecology.

Recent Publications:

2014. New insights into the hormonal and behavioural correlates of polymorphism in white-throated sparrows, Zonotrichia albicollis. Animal Behaviour 93: 207-219 (with I.T. Moore & D.L. Maney)

2014. Promoter polymorphism and differential expression of estrogen receptor α in a species with alternative behavioral phenotypes. Proceedings of the National Academy of Sciences, 11: 1443-1448. (with W.H. Hudson, E.A. Ortlund, S. Shirk, J.W. Thomas, E.R. Young, W. Zinzow-Kramer, & D.L. Maney).

2014. Evaluation of reference genes for quantitative real-time PCR in songbird brain, pituitary, and gonad. Hormones and Behavior, 66: 267-275. (with W.M. Zinzow-Kramer & D.L. Maney).

2014. Hormonal regulation of vasotocin receptor mRNA in a seasonally breeding songbird. Hormones & Behavior 65: 254-263. (with A.V. Grozhik, C.P. Horoszko, Y. Hu, D.A. Voisin and D. L. Maney).

2013. Behavioral characterization of a white-throated sparrow homozygous for the ZAL2m chromosomal rearrangement. Behavior Genetics, 43(1): 60-70. (with Y. Hu, C.L. Martin, B.P. Bunke, E.S. Matthews, I.T. Moore, J. W. Thomas and D.L. Maney).

2013. Divergent selection on bills contributes to non-random mating between swamp sparrow subspecies. Animal Behaviour, 86: 467-473. (with B. Ballentine, E.T. Brown & R. Greenberg).

2012. Morph matters: Aggression bias in a polymorphic sparrow. PLoS ONE, 7(10): e48705. (with M.E. Hauber and D.L. Maney).

2012. Proximity data-loggers increase the quantity and quality of social network data. Biology Letters, 8: 917-920. (with T.B. Ryder, M. van den Tillaart, J. Morales and I.T. Moore).

2012. High levels of relatedness between brown-headed cowbird nestmates in a heavily-parasitized host community. The Auk, 129(4): 623-631. (with J.W. Rivers, S. Young, E. Gonzalez, J. Lock & R.C. Fleischer).

2011. Understanding testosterone variation in a tropical lek-breeding bird. Biology Letters, 7(4): 506-509. (with T.B. Ryder, and I.T. Moore).

2011. Movements and survival of black-footed ferrets associated with an experimental translocation in South Dakota. Journal of Mammalogy, 92(4): 742-750. (with D.E. Biggins, J.L. Godbey & T.M. Livieri).

2010. Variation in baseline corticosterone and the adrenocortical response in breeding white-throated sparrows. The Auk, 127(3): 540-548. (with R.L. Holberton).

2010. Seasonal and population variation in breeding testosterone in male orange-crowned warblers, Vermivora celata. General & Comparative Endocrinolgy, 168: 333-339. (with J. M. Yoon, C.K. Ghalambor, I.T. Moore, & T.S. Sillett).

2009. Corticosterone manipulations alter morph-specific nestling provisioning behavior in male white-throated Sparrows, Zonotrichia albicollis. Hormones & Behavior, 56: 510-518. (with R.L. Holberton).

2007. Intraperitoneal delivery of exogenous corticosterone via osmotic pump in a passerine bird. General & Comparative Endocrinology, 152: 8-13. (with J.A. Long & R.L. Holberton).

Dr. MAJA KLOSINSKA

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Areas of Specialization: Genetics, Molecular Biology, Epigenetics, Plant Biology

Research Interests: Gene imprinting in plants, DNA methylation, abiotic stress, apomictic plants.

Courses Taught: Foundations of Biology, Special Topics (Epigenetics)

Recent Publications:

2016. Conserved imprinting associated with unique epigenetic signatures in the Arabidopsis genus. *Nat Plants* 2:16145 (with Picard C., Gehring M.)

2011. Yeast cells can access distinct quiescent states. *Genes Dev.* **25**, 336-49 (with Crutchfield C., Bradley P., Rabinowitz J., Broach J.)

2004. Triple-stranded DNA and its applications. (review) *Postepy Biologii Komorki* **31**, 647-661 (with Blasiak J.)

DR. TIMOTHY I. LADD

B.S., M.S., University of Akron; Ph.D., University of Calgary.

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Areas of Specialization: Microbiology, microbial ecology, immunology, food microbiology.

Research Interests: Bacterial attachment to natural and man-made surfaces, heterotrophic activity of aquatic populations, biodegradation of labile and refractory compounds by microbial populations in streams and groundwater, antibiotic sensitivity measurement of attached bacteria.

Techniques/Procedures Commonly Used: Fluorescent microscopy, SEM, liquid scintillation counting, enzymology techniques, kinetic assays, radioisotope procedures.

Courses Taught: General Biology, Concepts of Botany, Microbiology, Human Biology, and Immunology.

Recent Publications:

2001. A demonstration of nitrogen dynamics in OXIC and hypoxic soils and sediments. American Biology Teacher vol. 63(3) 199-205. (with J. Ambler, K. Polovitz, & G. Steucek)

1990. Methods for studying biofilm bacteria. Methods in Microbiology 22:285-307 (with J.W. Costerton)

1987. Bacterial biofilms in nature and disease. Ann. Rev. Micro. 41:435-506 (with J.W. Costerton, K.J. Cheng, G.G. Geesey, J.C. Nickel, & T. Marrie)

1987. The use of a radiorespiratometric assay for testing the antibiotic sensitivity of catheter-associated bacteria. J. Urology 138:1451-1456. (with D. Schmeil, J.C. Nickel, & J.W. Costerton)

DR. JOEL B. PIPERBERG

B.A. and Ph.D., University of Pennsylvania

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Areas of Specialization: Cell, developmental, and molecular biology.

Research Interests: Molecular biology, control of gene expressions in development and morphogenesis; effect of various drugs on red blood cell membrane osmotic fragility.

Techniques/Procedures Commonly Used: Gel electrophoresis, column chromatography, tissue culture, spectrophotometry.

Courses Taught: General Biology (BIOL 100), Foundations of Biology (BIOL 101), Cell Biology, Developmental Biology, Molecular Biology, Molecular and Cellular Techniques, Human Biology, Human Sexuality, Frontiers in Biomolecular Science, Freshman Biology Honors Seminar (BIOL 108).

Recent Publications:

2013 Composition of Answers for the Essay-type Review Questions that appear at the end of each section of Gerald Karp's Cell and Molecular Biology: Concepts and Experiments, 7th ed. NY: John Wiley & Sons, Inc.

2013 Test Bank for Gerald Karp's Cell and Molecular Biology: Concepts and Experiments, 7th ed. NY: John Wiley & Sons, Inc.

2010. Instructor's Manual for Gerald Karp's Cell and Molecular Biology: Concepts and Experiments, 6th ed. NY: John Wiley & Sons, Inc.

2010. Test Bank for Gerald Karp's Cell and Molecular Biology: Concepts and Experiments, 6th ed. NY: John Wiley & Sons, Inc.

2008. Instructor's Manual for Gerald Karp's Cell and Molecular Biology: Concepts and Experiments, 5th ed. NY: John Wiley & Sons, Inc.
2008. Test Bank for Gerald Karp's Cell and Molecular Biology: Concepts and Experiments, 5th ed. NY: John Wiley & Sons, Inc.
2005. Instructor's Manual for Gerald Karp's Cell and Molecular Biology: Concepts and Experiments, 4th ed. NY: John Wiley & Sons, Inc.
2005. Test Bank for Gerald Karp's Cell and Molecular Biology: Concepts and Experiments, 4th ed. NY: John Wiley & Sons, Inc.
2003. Instructor's Manual for *BioInquiry:* Making Connections in Biology (Learning System 1.0) by Pruitt, Underwood and Surver, 2nd ed., NY: John Wiley & Sons, Inc.
2002. Instructor's Manual for Gerald Karp's Cell and Molecular Biology: Concepts and Experiments, 3rd ed. NY: John Wiley & Sons, Inc.
2000. Instructor's Manual for *BioInquiry:* Making Connections in Biology (Learning System 1.0) by Pruitt, Underwood and Surver. NY: John Wiley & Sons, Inc.
1999. Instructor's Manual for Gerald Karp's Cell and Molecular Biology: Concepts and Experiments, 2nd ed. NY: John Wiley & Sons, Inc.
1996. Instructor's Manual for Gerald Karp's Cell and Molecular Biology. NY: John Wiley & Sons, Inc.
1994. Comparison of the glucocorticoid receptors from retina and liver of the embryonic chick, Journal of the Pennsylvania Academy of Science 68(3):107-116 (with R. Ford, B. Archilla, K. Doolan and L. Remington).
1993. An introduction to DNA fingerprinting. American Biology Teacher 55:216-221 (with C. Hepfer and G. Farganis).

DR. CHRISTOPHER R STIEHA

B.A. Chemistry, B.S. Biology, University of Kentucky; M.S. Biology, University of Kentucky; Ph.D. Biology, University of Kentucky

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Areas of Specialization: Plant Ecology, Plant-Herbivore Interactions, Quantitative Ecology, Statistics

Research Interests: plant-herbivore interactions and the potential to use plant defenses to control pests in agricultural systems; competition between male and female plants and the loss of one sex

Courses Taught: General Biology, Concept of Botany Lab, Population and Community Ecology

Recent Publications:

2017. Maintenance of the sexes and persistence of a clonal organism in spatially complex metapopulations. Evolutionary Ecology. 31:363-386. (with R., García-Ramos, G., McLetchie, D.N., and Crowley, P.
2017. Current challenges in the modeling of population cycles. Ecology Letters. 20(8): 1074-1092 (with Barraquand, F., Louca, S., Abbott, K.C., Cobbold, C.A., Cordoleani, F., DeAngelis, D.L., Elderd, B.D., Fox, J.W., Greenwood, P., Hilker, F.M., Lutscher, F., Dennis Murray, D., Taylor, R.A., Vitense, K., Wolkowicz, G., and Tyson, R.C.)
2016. The Effects of Plant Compensatory Regrowth and Induced Resistance on Herbivore Population Dynamics. American Naturalist. 187(2): 167-181 (with Abbott, K, and Poveda, K.)
2016. A Comparison of Seed Predation, Seed Dispersal, and Seedling Herbivory in Oak and Hickory: Species with Contrasting Regenerating Abilities in a Bluegrass Savanna-Woodland Habitat. Northeastern Naturalist. 23(4): 466-481. (with Cilles, S., Coy, G., Cox, J., Crowley, P.H., Maehr, D.)
2016. QPot: An R package for stochastic differential equation quasi-potential analysis. The R Journal. 8(2): 19-38. (with Moore, C.M., Nolting, B.C., Cameron, M.K., and Abbott, K.C.)
2015. Tolerance responses to herbivory: implications for future management strategies in potato. Annals of Applied Biology. 166: 208-217. (with Poveda, K.)
2014. A Field Guide To Programming: A Tutorial for Learning Programming and Population Models. CODEE Journal. URL: http://www.codee.org/ref/CJ14-0876 (with Montovan, K, and Castillo-Guajardo, D.)
2014. The dispersal process of asexual offspring and the contribution to population persistence. American Journal of Botany. 101(2): 348-56. (with Middleton, A., Stieha, J., Trott, S., and McLetchie, D.N.)

DR. RYAN WAGNER

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Areas of Specialization: Plant physiology, Molecular Biology, Biochemistry and Plant-Insect Interactions

Courses Taught: General Biology, Plant Physiology, Plant Biochemistry, Concepts of Botany, Plants and People, Foundations in Biology.

Recent Publications:

2004. Protein phosphorylation is suppressed when wheat embryos are hydrated and remain growth arrested. See Science Research, 14: 287-296. (with M.K. Walker-Simmons).

2002. The ABA-responsive kinase PKABA1 interacts with a seed-specific ABA response element binding factor, TaABF, and phosphorylates TaABF peptide sequences. Plant Physiology, 130: 837-846. (with S.D. Verhey, R. Johnson, and M.K. Walker-Simmons).

DR. JOHN R. WALLACE, D-ABFE

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Areas of Specialization: Medical entomology, aquatic entomology, forensic entomology, and stream restoration ecology.

Research Interests: Medical Entomology - Mosquito Ecology (larval feeding and adult overwintering), Ecology of Buruli/Bairnsdale Ulcer; Black fly Surveillance and Control, Forensic Entomology and Carrion Ecology in Aquatic systems; Stormwater management and Mosquito Population Biology and Arbovirus Surveillance; Stream Ecology - Crayfish ecology of Lancaster County; Sediment Effects on Macroinvertebrate Community Structure.

Techniques/Procedures Commonly Used: Light and epifluorescent microscopy, chlorophyll pigment analyses, microdissection, photomicrography, immunoassay techniques and a variety of molecular techniques.

Courses Taught: Entomology, Aquatic Entomology, Aquatic Biology, Ecology & Evolution, Seminars in Forensic Entomology and Invasion Ecology, Perspectives of Environmental Awareness, General Biology.

Recent Publications:

2012. Algae in Forensic Investigations. In: Forensic Botany: A Practical Guide. (D. Hall and J. Byrd, eds.). Wiley-Blackwell Publishing. IN PRESS. (with C.R. Hardy)

2012. Wildlife Forensics: Techniques and Applications. Wiley Publishing, London, UK. 370pp. (with J. E. Huffman)

2012. History of Wildlife Forensics, In: Wildlife Forensics:Techniques and Applications (J.E. Huffman and J.R. Wallace, eds.). Wiley Publishing, London, UK pp 35-50. (with J. C. Ross)

2011. A Criminal 'Case' to be made with Caddisflies In: (J. Li, editor),Wading for Bugs: Discovering Stream Invertebrates with the Experts, Oregon State University Press, Corvalis, OR. Pp 61-64. (with R. W. Merritt)

2011. Conservation and Management of Crayfishes: Lessons from Pennsylvania. Fisheries, 36(10): Pp 489 - 507. (D.A. Lieb, et al)

2010. Ulcer Diseases: A systematic review of ecology and transmission. PLoS Negl Trop Dis 4(12): e911.doi:10.1371/journal.pntd.0000911. (with R.W. Merritt, et al)

2010. Interaction of *Mycobacterium ulcerans* with mosquito species: implications for transmission and trophic relationships. Appl. Environ. Microb, Vol 26(18):6215-6222. (with M.C. Gordon, et al)

2010. Environmental testing during an outbreak of Buruli ulcer in Victoria, Australia, suggests a role for mammals in the ecology of *Mycobacterium ulcerans*. PLoS Negl Trop Dis 4(8):e791. Doi:10.1371/journal.pntd.0000791. (with J.A.M. Fyfe, et al)

2009. Discovery of promoters involved in mycolactone gene expression and their application to studies of the pathogenesis and ecology of Mycobacterium ulcerans PLoS Negl Trop Dis 3(11):e553. Dol:10.137/journal.pntd.0000553 (with N.K. Tobias, et al)

2009. Forensic Meteorology: The application of weather and climate to forensic entomology. In: Utility of Arthropods in Legal Investigations (J. Byrd,ed.), CRC Press, Boca Raton, FL. Pp. 519 - 538. (with J. R. Scala)

2009. Persistent association of *Mycobacterium ulcerans* with West African predacious insects of the family Belostomatidae. *Applied and Environmental Microbiology*, p. 7036 - 6042 (with L.H. Mosi, et al)

2009. Biting Diptera of Freshwaters. In: The encyclopedia of Inland Waters. (G.Lykens, editor). Elsevier Publishers, London, UK pp. 280-287

2008. Estimating a postmortem submersion interval using algal diversity on mammalian carcasses inbrackish marshes. Journal of Forensic Science. 53(4): 935 - 941 (with MU'06 K. Zimmerman)

2008. Caddisfly cases assist homicide case: Determining a postmortem submersion interval (PMSI) using aquatic insects. Journal of Forensic Science, Vol. 53 (1): 1-3. (with R.W. Merritt, et al)

2008. Evaluation of VNTR typing for the identification of *Mycobacterium ulcerans* in enviornmental samples from Victoria, Australia. *FEMS Microbiology Letters:* 1-18 (with C.J. Lavender, et al)

2008. Culicidae. In: An introduction to aquatic insects in North America (R.W. Merritt, K.W. Cummins and M. Berg, editors). Kendall Hunt Publishers, Dubusque, IA. Pp 801-823. (with E.W. Walker).

2008. The use of aquatic insect evidence in criminal investigations. In: Entomology and Death, 2nd Edition, (N. Haskell and R. Williams, eds.), Joyce Publishing, North Carolina pp. 114 - 130. (with R.W. Merritt)

2007. Forensic Entomology. In: Forensic Investigation: Inside the Yellow Tape (L. Farr ed.). Hayen-McNeil Publishing, Plymouth, MI. Pp. 301-327. (with J. Tomberlin and J. Byrd).

2007. Stormwater management and mosquito ecology: A systems-based approach towards an integrative management strategy. Journal of Stormwater Management, Vol.8 (2):20-46.

2006. Forensic Entomology: Myths Busted. Forensic Magazine, Vol. 3(5): 10-14. (with J. Tomberlin and J. Byrd).

2005. Effects of Bacillus sphaericus (VectoLex®) on Nontarget Organisms in a Mosquito Control Program in southeastern Wisconsin: A Three-Year Study. J. Amer. Mosq. Contr. Assoc. 21: 201-212. (with R.W. Merritt, et al)

2004. Forensic Entomology: Proper Crime Scene Collection, Preservation, and Shipment of Entomological Evidence. http://insects.tamu.edu/extension/publications/epubs/eee_0000 4.html Texas Cooperative Extension Bulletin:1-7. (with J.K. Tomberlin, J.Olson)

2004. Forensic Entomology:History and Application of Entomology in Forensic Investigations http://insects.tamu.edu/extension/publications/epubs/eee_00003.html Texas Cooperative Extension Bulletin:1-4. (with J.K. Tomberlin, J. Olson)

2004. Diel feeding periodicity of larval anopheline mosquitoes on microorganisms and microinvertebrates: a spatial and temporal comparison of Anopheles quadrimaculatus (Say) (Diptera: Culicidae) diets in a Michigan pond. J. Med.Entomol.,41: 853-860. (with R.W. Merritt)

2004. Aquatic entomology and flyfishing. In: Encyclopedia of Entomology Vol. 1 pp. 177-179. (J.L. Capinera, ed.). Kluwar Academic Publishers, The Netherlands. 815 pp. (with F.D.L. Rinkevich [MU '02])

2004. Pig decomposition in lotic aquatic systems: the potential use of algal growth in establishing a postmortem submersion interval (PMSI).*Journal of Forensic Science*, 49(2):330-336. (J. Haefner [MU '04] and R.W. Merritt)

2002. A preliminary characterization of the physiological ecology of overwintering *Anopheles* mosquitoes in Midwestern USA.*Journal of the American Mosquito Control Association*, 18(2): 126-127. (with P.R. Grimstad)

1999. Influence of microclimate, food, and predation on *Anopheles quadrimaculatus* (Diptera: Culicidae) growth and developmental rates, survivorship, and adult size in a Michigan pond. *Journal of Environmental Entomology*, 32(2): 233-239. (with R.W. Merritt)

DR. LAVERN R. WHISENTON-DAVIDSON

B.S., Morningside College; M.S. and Ph.D., University of Notre Dame.

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Areas of Specialization: Insect biochemistry, endocrinology and neuroendocrinology.

Research Interests: Hormonal interactions responsible for molting and metamorphosis in insects, isolation and purification of neuropeptides involved in post-embryonic development and reproduction in mosquitoes.

Techniques/Procedures Commonly Used: Microsurgery, microdissection, light and fluorescent microscopy, HPLC, column chromatography and other protein purification techniques, radioimmunoassays, immunocytology, SEM and TEM.

Courses Taught: General Biology, Human Anatomy and Physiology, Endocrinology, Comparative Anatomy, Nutrition.

Recent Publications:

1997. Life cycle expression of a bombyxin-like neuropeptide in the tobacco hornworm, *Manduca sexta*. J. Insect Physiol. 43(1):47-53. (with B.V. Nogueira, D.P. Muehleisen, R.S. Gray and W. E. Bollenbacher)

1992. Steroidogenic activity in prothoracic gland cells of retrocerebral complexes of fourth instar mosquitoes. American Society Of Zoologists 31(5):87. (with D. Sonnen)

1989. Ecdysteroid titres during pupal-adult development in *Aedes aegypti*: Basic for a sexual dimorphism in the rate of development. J. Insect Physiol. 35(1):67-73.

1987. Isolation and partial purification of gonadotrophic factors in heads of pupal and adult *Aedes aegypti*. Mol. Cell. Endocrinol. 50:3-14. (with T. Kelly & W. Bollenbacher)

1987. Regulation of juvenile hormone biosynthesis by 20-hydroxyecdysone during the fourth larval instar of the tobacco hornworm, *Manduca sexta*. Gen. Comp. Endocrinol. 66:62-70. (with R. Watson, N. Granger, & W. Bollenbacher)

DR. DANIEL H. YOCOM

B.S., Lebanon Valley College; M.S., University of Pittsburgh; Ph.D., State University of New York (SUNY) at Stony Brook

Office: Caputo 201 Phone: 717-871-4291

E-mail: Daniel.Yocom@millersville.edu

Areas of Specialization: Microbiology, mycology, population biology.

Research Interests: Ecology and evolution of symbiotic relationships, such as mycorrhizae and diseases; role of mycorrhizae in higher plant succession; effect of mycorrhizae on host plant growth and reproduction; role of mycorrhizae in agricultural systems

Techniques/Procedures Commonly Used: Factorial experimental design and analysis, culturing of bacteria and fungi, aseptic techniques, staining and quantification of plant roots.

Courses Taught: General Biology, Concepts of Botany, Microbiology, Environmental Science, Ecology, Applied Ecology, Biodiversity, Mycology, Plant Ecology.

Recent Publications:

2000. The impact of habitat fragmentation on arthropod biological diversity. American Biology Teacher 62:414-420. (with M. Kishbaugh)

1994. The fungi of Southcentral Pennsylvania: A first look. *In*: Zegers, D., ed. At the Crossroads: A Natural History of Southcentral Pennsylvania.

1994. Are crop and weed interaction affected by mycorrhizae? J. Pa. Acad. Sci. 67:175. (with D.D. Drenner)

1994. Effects of mycorrhizae on competition between soybeans and weeds. J. Pa. Acad. Sci. 67:181. (with H. Hudock)

1993. Dependence of three Nebraska sandhills warm-season grasses on vesicular-arbuscular mycorrhizae. J. of Range Mgmt. 46:14-20. (with J.J. Brejda, L.E. Moser and S.S. Waller)

1991. Effect of mycorrhizae and nutrient exchange on the growth of interacting corn and bean plants. Bull. Ecol. Soc. Amer. 72(2):297-298. (with D. Weaver)

Additional General Education Requirements

Foundations for Lifelong Learning (4 courses minimum 12 credit hours)

This category requires: **1. ENGL 110, 2. COMM 100, 3. GenEd (G2) approved Mathematics course (MATH 1XX), and 4. Advanced Writing (AW) course (ENGL 311, 312, 313, or 316).**

Guidelines:

- ENGL 110 must be completed with a grade of C- or better.
- COMM 100 must be completed with a grade of C- or better.
- The upper level writing (AW) course has a prerequisite of ENGL 110 (C- or better) and a minimum of 60 credit hours completed. Many majors recommend or require a specific AW course. Check the catalog for further details.
- G2 Math course must be different from that used towards the G2 block in the Liberal Arts Core.

Subject/Course#	Course Title	Cr. Hrs.	Grade
1. ENGL 110	English Composition	3.0	
2. COMM 100	Fundamentals of Speech	3.0	
3. MATH			
4. ENGL			

Connections & Exploration Courses (minimum 9 credit hours)

Guidelines/Prerequisites:

1. **First-Year Inquiry (FYI) Seminar – UNIV 103 (3 credit hours) or Open Elective (3 credit hours)**
   - Open electives must be 100 level or above and must be taken outside of primary major.
   - For BSE students, required professional education courses **cannot** count as open electives.
2. **Perspectives (P) Course (3 credit hours)**
   - May be satisfied with approved courses from the major, the minor, the required related area, or general electives.
   - ENGL 110 and COMM 100 completed with grades of C- or better.
   - Minimum of 60 credit hours completed.
3. **Wellness/Health Education course (3 credit hours)**
   - Any WELL 175 course will fulfill this requirement.
   - Early Childhood Education or Early Childhood/Special Education majors are required to take WELL 240.

Subject/Course#	Course Title	Cr. Hrs.	Grade
1.			
2.			
3.			

Cultural Diversity & Community (D) Course

- May be satisfied with approved courses from the GenEd requirements (including Perspectives), the major, the minor, the required related area, or general electives.

Subject/Course#	Course Title	Cr. Hrs.	Grade
1.			

Writing Intensive (W) Courses (3 courses)

Guidelines/Prerequisites:

- May be satisfied with approved courses from the GenEd requirements, the major, the minor, the required related area, or general electives.
- ENGL 110 must be completed with a grade of C- or better.

Subject/Course#	Course Title	Cr. Hrs.	Grade
1.			
2.			
3.			

Developmental Courses (COMM 010, EDUC 090, ENGL 010, MATH 090)

These do not count toward the 120 credit hours required for graduation.

Effective Fall Semester, 2012

MILLERSVILLE UNIVERSITY

General Education Curriculum Guide *(Purple Sheet)*

Student Name:_____ **Student I.D. #**_____

Critical Thinking Across the Liberal Arts (G1-G3)

General Guidelines:

- Only approved General Education (GenEd) courses may be used.
- Courses must be taken from at least two departments within each G1, G2, and G3 block.
- At least three courses taken throughout blocks G1, G2 &/or G3 must be at the 200 level or above.
- Up to six "Required Related" courses may be counted toward GenEd requirements.
- Courses from the primary major may not fulfill the G1, G2, and G3 blocks; courses from a minor or secondary major may fulfill these blocks.

G1. Humanities and Fine Arts: Three courses minimum totaling at least 9 credit hours.

Select courses from: Art, Communications & Theatre, English, Foreign Language (which includes HUMN courses), Music or Philosophy. Students majoring in a Humanities & Fine Arts department may not count courses from the major department in this block.

Subject/Course#	Course Title	Cr. Hrs.	Grade
1.			
2.			
3.			

G2. Science and Mathematics: Three courses minimum totaling at least 9 credit hours.

Select courses from: Biology, Chemistry, Computer Science, Earth Sciences, Mathematics, Nursing or Physics. Students majoring in a Science or Mathematics department may not count courses from the major department in this block.

Additional Guidelines:

- At least two courses must be taken from the "natural sciences": Biology, Chemistry, Earth Sciences and Physics. This can be two courses from any one of these departments **OR** one course from any two of these departments.
- One course taken within the G2 block must be a Lab course.

Subject/Course#	Course Title	Cr. Hrs.	Grade	✓ 2 from Natural Sci.	✓ 1 Lab Course
1.					
2.					
3.					

G3. Social Sciences: Three courses minimum totaling at least 9 credit hours.

Select courses from: African-American Studies, Anthropology, Business Administration, Economics, Geography, Government, History, International Studies, Occupational Safety & Environmental Health, Psychology, Sociology, Social Work/Gerontology, or Women's Studies. Students majoring in the Social Sciences areas may not count courses from their major department in this block.

Subject/Course#	Course Title	Cr. Hrs.	Grade
1.			
2.			
3.			

MILLERSVILLE UNIVERSITY

Student Name:_____ Student I.D. #:_____

Curriculum Record Form for an Academic Minor in Biology

Minor: Biology
Department: Biology

Total credit hours required: 20.0 minimum

Regulations Governing Minor Course Work:

1. There shall be a minimum of 20.0 credit hours with a minimum Millersville QPA of 2.0.
2. Only one course which counts toward your major may be counted toward your minor.
3. Courses that count toward a minor are also eligible to be used to satisfy the current University-wide General Education requirements subject to normal distribution requirements.
4. At least two courses should be at the upper-division level (300-400). Exceptions may be requested upon evidence of program depth.
5. No course needed for the minor may be taken Pass-Fail.
6. One-half or more of the work required for the minor must be completed at Millersville University.
7. No student may minor in his or her major.

REQUIRED BIOLOGY COURSES (11.0-12.0 credits)

Course No.	Short Title	C.H.	Grade
BIOL 100	General Biology with a grade of B- or higher	3.0	____
	----------or----------		
BIOL 101	Foundations of Biology with a grade of C- or higher	4.0	____
	----------AND----------		
Choose TWO of the following:			
BIOL 211	Concepts of Zoology	4.0	____
BIOL 221	Concepts of Botany	4.0	____
BIOL 343	Ecology & Evolution	4.0	____
BIOL 362	Cell & Development	4.0	____
BIOL 364	Genetics & Mol. Biology	4.0	____

BIOLOGY ELECTIVES (8.0-9.0 credits)

Choose Biology electives at the 300 or 400 level to bring total Biology credits to 20 credits. One 200 level elective may be used upon adviser's approval.

Course No.		Short Title	C.H.	Grade
BIOL	____	_____	____	____
BIOL	____	_____	____	____
BIOL	____	_____	____	____
BIOL	____	_____	____	____
BIOL	____	_____	____	____

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your adviser to be aware of changes and curriculum details which are not incorporated on this form.*

BIM-0109 FALL 2009.2

MILLERSVILLE UNIVERSITY

Student Name:_____ Student I.D. #:_____

Curriculum Record Form for an Academic Minor in Molecular Biology/Biotechnology

Minor: Molecular Biology/Biotechnology Total credit hours required: 18.0 minimum
Department: Biology

Regulations Governing Minor Course Work:

1. There shall be a minimum of 18.0 credit hours with a minimum Millersville QPA of 2.0.
2. Only one course which counts toward your major may be counted toward your minor.
3. Courses that count toward a minor are also eligible to be used to satisfy the current University-wide General Education requirements subject to normal distribution requirements.
4. At least two courses should be at the upper-division level (300-400). Exceptions may be requested upon evidence of program depth.
5. No course needed for the minor may be taken Pass-Fail.
6. One-half or more of the work required for the minor must be completed at Millersville University.
7. No student may minor in his or her major.

Course No.	Short Title	C.H.	Grade	Course No.	Short Title	C.H.	Grade
REQUIRED BIOLOGY COURSES (18.0-19.0 credits)							
BIOL 100	General Biology with a grade of B- or higher	3.0	____				
	----------or----------						
BIOL 101	Foundations of Biology with a grade of C- or higher	4.0	____				
	----------AND----------						
BIOL 362	Cell & Development	4.0	____				
BIOL 364	Genetics & Mol. Biology	4.0	____				
BIOL 462	Molecular Biology	4.0	____				
BIOL 466	Molecular & Cell Tech.	3.0	____				

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your adviser to be aware of changes and curriculum details which are not incorporated on this form.*

BIM-004 FALL 2009.2

Comparison between BS Biology and BS Allied Health Technologies Degrees

Millersville University has traditionally offered three collaborative, university-hospital based degree programs. Each of these programs is designated as a 3/1 program in which students attend Millersville University for three years and then complete a one-year clinical program at an affiliated hospital. At the completion of the clinical phase of the program, the student is awarded a B.S. degree in Biology with an option in Medical Technology, Nuclear Medicine Technology, or Respiratory Therapy. Because the programs are all options within a biology degree program and include core courses required of all biology majors, the curriculum is rather rigid. There has been little opportunity to use courses that would better serve students who have chosen to prepare for a health care profession and stay within the 120-credit graduation limit. For example, our students are not required to take any courses that focus on the patient during the first three years at the university and generally do not take a biomedical-related course until their junior year.

A new degree program, begun in Fall 2009, awards a Bachelor of Science Degree in Allied Health Technologies. The restructuring of the curriculum creates a new degree that reduces some of the traditional Biology degree requirements, provides the flexibility to add important new courses, and allows the students to enroll in courses with a medical focus earlier in their academic career at Millersville University. Students will begin biomedical science courses in their freshman year.

This new B.S. Allied Health Technologies degree program will continue to meet all of the rigorous requirements needed to obtain certification in the health care professions but will provide a sharper focus on health care than does the B.S. Biology course of study that requires a broad base in the science of biology. The new degree is more likely to attract students whose interest's center on one of the health care professions. Many students who are interested in pursuit of a career in Allied Medical fields are more interested in the clinical aspects of those fields than in their biological underpinnings. The proposed B.S. in Allied Health Technology will still give these students a firm background in biology, chemistry, math, and physics while exposing them sooner and in greater depth to the courses that interest them most. This will afford students a greater opportunity for success and prepare them better for the careers to which they aspire.

The department also recognizes that some students will want to have an even stronger background in biology, math, and physics before they begin the clinical phase of their undergraduate education; therefore, it will keep its BS degree in Biology with options in Respiratory Therapy, Nuclear Medicine Technology, and Medical Technology for these students. This degree program is recommended for students who might be considering going to a graduate or professional school following completion of their clinical training.

MAJOR SEQUENCE AND DEGREE REQUIREMENTS
BS BIOL and BS ALHT Medical Technology
Side by Side Comparison

Major: **BS BIOLOGY**
Option: **MEDICAL TECHNOLOGY**
(Medical Laboratory Science)
Major Field Requirements: **31 credits**
Clinical Education ***30 credits***
Other Requirements: **20-21 credits**

REQUIRED BIOLOGY COURSES (16.0 credits)

BIOL 101	Foundations of Biology	4.0
BIOL 211	Concepts of Zoology	4.0
BIOL 362	Cell & Development	4.0
BIOL 364	Genetics & Molecular Bio	4.0

REQUIRED MED BIOL COURSES (6 credits)

BIOL 257	Intro to Allied Health	1.0
BIOL 454	Immunology	2.0
BIOL 461	General Micro	3.0

ELECTIVES (8 credits)
BIOL 356 or BIOL 254 & 255; and MATH 235 are strongly recommended

CLINICAL EDUCATION (30 credits)*
At an affiliated hospital site-
Clinical Education for
Medical Technology

REQUIRED RELATED (20.0-21.0 credits)

Chemistry (16.0 credits)

CHEM 111	Intro to Chemistry I	(4)
CHEM 112	Intro to Chemistry II	(4)
CHEM 235	Organic Chemistry	(4)
CHEM 326	Biochemistry	(4)

Mathematics (4-5 credits) – Math 160

Physics (4 credits) - Phys 131

GENERAL ELECTIVES (as necessary)

*Note: Clinical education credits are transfer credits, and the number of credits shown reflects the number of credits MU accepts to bring the total number of credits required for the degree to 120. The clinical education component for both BS BIOL and BS ALHT degrees in Medical Laboratory Science is identical.

Major: **BS ALLIED HEALTH TECHNOLOGIES**
Option: **MEDICAL TECHNOLOGY**
(Medical Laboratory Science)
Major Field Requirements: **30-32 credits**
Clinical Education: **26 credits**
Other Requirements: **27 credits**

REQUIRED BIOLOGY COURSES (25.0 credits)

BIOL 100	General Biology	(3)
BIOL 254	Human A&P 1	(4)
BIOL 255	Human A&P 2	(4)
BIOL 257	Intro to Allied Health	(1)
BIOL 362	Cell & Development	(4)
BIOL 364	Genetics & Molec Bio	(4)
BIOL 454	Immunology	(2)
BIOL 461	Microbiology	(3)

DIRECTED ELECTIVES:
Select from a minimum of two courses below **(6-8 credits)**

BIOL 211	Concepts of Zoology	(4)
BIOL 352	Nutritional Science	(3)
BIOL 360	Histology	(3)
BIOL 363	Medical Micro	(3)
BIOL 417	Parasitology	(3)
BIOL 437	Endocrinology	(3)
BIOL 438	Neurobiology	(3)
BIOL 455	CardioPulm Physio	(3)
BIOL 462	Molecular Biology	(4)
BIOL 463	Virology	(4)
BIOL 465	Developmental Bio	(3)
BIOL 467	Human Genetics	(3)
RESP 422	Pharmacology	(2)

CLINICAL EDUCATION (26 credits)*
At an affiliated hospital site
Clinical education for
Medical Technology)

REQUIRED RELATED (27 credits)

Chemistry (16.0 credits)

CHEM 111	Intro to Chemistry I	(4)
CHEM 112	Intro to Chemistry II	(4)
CHEM 235	Organic Chemistry	(4)
CHEM 326	Biochemistry	(4)

Mathematics (7 credits)

MATH 130	Statistics	(3)
MATH 160	Precalculus	(4)

Physics (4 credits) - Phys 131

The above is for informal comparison only. See curriculum sheets for complete listing of requirements.

Fall 2011

MAJOR SEQUENCE AND DEGREE REQUIREMENTS
BS BIOL and BS ALHT Nuclear Medicine Technology
Side by Side Comparison

Major: **BS BIOLOGY**
Option: **NUCLEAR MEDICINE TECHNOLOGY**
Major Field Requirements: **25 credits**
Clinical Education ***28 credits***
Other Requirements: **28-31 credits**

REQUIRED BIOLOGY COURSES (16.0 credits)

BIOL 101	Foundations of Biology	4.0
BIOL 211	Concepts of Zoology	4.0
BIOL 362	Cell & Development	4.0
BIOL 364	Genetics & Molecular Bio	4.0

REQUIRED NUC MED COURSES (9 credits)

BIOL 257	Intro to Allied Health	1.0
BIOL 356	Functional Human Anat	5.0
BIOL 375	Biometry	3.0

CLINICAL EDUCATION (28 credits)
At an affiliated hospital site-
Clinical Education for
Nuclear Medicine Technology

REQUIRED RELATED (28-31 credits)

Chemistry (16.0 credits)

CHEM 111	Intro to Chemistry I	(4)
CHEM 112	Intro to Chemistry II	(4)
CHEM 235	Organic Chemistry	(4)
CHEM 326	Biochemistry	(4)

Mathematics (4-5 credits) – Math 160 or 161

Physics (8-10 credits) -

PHYS 131	Phys I w/Algebra	(4)
PHYS 132	Phys II w/Algebra	(4)
	or	
PHYS 231	Phys I w/Calculus	(5)
PHYS 232	Phys II w/Calculus	(5)

GENERAL ELECTIVES (as necessary)

*Note: Clinical education credits are transfer credits, and the number of credits shown reflects the number of credits MU accepts to bring the total number of credits required for the degree to 120. The clinical education component for both BS BIOL and BS ALHT degrees in Medical Laboratory Science is identical

Major: **BS ALLIED HEALTH TECHNOLOGIES**
Option: **NUCLEAR MEDICINE TECHNOLOGY**
Major Field Requirements: **30-32 credits**
Clinical Education: **27 credits**
Other Requirements: **27 credits**

REQUIRED BIOLOGY COURSES (25.0 credits)

BIOL 100	General Biology	(3)
BIOL 254	Human A&P 1	(4)
BIOL 255	Human A&P 2	(4)
BIOL 257	Intro to Allied Health	(1)
BIOL 362	Cell & Development	(4)
BIOL 364	Genetics & Molec Bio	(4)
BIOL 454	Immunology	(2)
BIOL 461	Microbiology	(3)

DIRECTED ELECTIVES:
Select from two courses below **(6-8 credits)**

BIOL 211	Concepts of Zoology	(4)
BIOL 352	Nutritional Science	(3)
BIOL 360	Histology	(3)
BIOL 363	Medical Micro	(3)
BIOL 417	Parasitology	(3)
BIOL 437	Endocrinology	(3)
BIOL 438	Neurobiology	(3)
BIOL 455	CardioPulm Physio	(3)
BIOL 462	Molecular Biology	(4)
BIOL 463	Virology	(4)
BIOL 465	Developmental Bio	(3)
BIOL 467	Human Genetics	(3)
RESP 422	Pharmacology	(2)

CLINICAL EDUCATION (26 credits)
At an affiliated hospital site
Clinical Education for
Nuclear Medicine Technology

REQUIRED RELATED (27 credits)

Chemistry (16.0 credits)

CHEM 111	Intro to Chemistry I	(4)
CHEM 112	Intro to Chemistry II	(4)
CHEM 235	Organic Chemistry	(4)
CHEM 326	Biochemistry	(4)

Mathematics (7 credits)

MATH 130	Statistics	(3)
MATH 160	Precalculus	(4)

Physics (4 credits) - Phys 131

The above is for informal comparison only. See curriculum sheets for complete listing of requirements.

Fall 2011

MAJOR SEQUENCE AND DEGREE REQUIREMENTS
BS BIOL and BS ALHT Respiratory Therapy
Side by Side Comparison

Major: **BS BIOLOGY**
Option: **RESPIRATORY THERAPY**
Major Field Requirements: **57 credits**
Other Requirements: **24-26 credits**

REQUIRED BIOLOGY COURSES (12 credits)

BIOL 101	Foundations of Biology	4.0
BIOL 362	Cell & Development	4.0
BIOL 364	Genetics & Molecular Bio	4.0

REQUIRED RESP COURSES (9 credits)

BIOL 257	Intro to Allied Health	1.0
BIOL 356	Functional Human Anat	5.0
BIOL 461	General Microbiology	3.0

CLINICAL COURSEWORK I (32 credits)
Required for graduation from MU

CLINICAL COURSEWORK II (25 credits)
Required for certification as a Respiratory Therapist

REQUIRED RELATED (24.0-26.0 credits)

Chemistry (16 credits)

CHEM 111	Intro to Chemistry I	4.0
CHEM 112	Intro to Chemistry II	4.0
CHEM 235	Organic Chemistry	4.0
CHEM 326	Biochemistry	4.0

Mathematics (4-5 credits)

MATH 161	Calculus I	4.0
	OR	
MATH 163	Honors Calculus	5.0

Physics (4 credits)

PHYS 131	Physics I with Algebra	4.0

Major: **BS ALLIED HEALTH TECHNOLOGIES**
Option: **RESPIRATORY THERAPY**
Major Field Requirements: **17 credits**
Clinical Education: **54 credits**
Other Requirements: **13 credits**

REQUIRED BIOLOGY COURSES (17.0 credits)

BIOL 100	General Biology	3.0
BIOL 254	Human A&P 1	4.0
BIOL 255	Human A&P 2	4.0
BIOL 455	CardioPulm Physio	3.0
BIOL 461	General Microbiology	3.0

CLINICAL COURSEWORK (54 credits)
Required for graduation from MU

REQUIRED RELATED (13 credits)

Chemistry (6.0 credits)

CHEM 103	Gen Org & Biochem	3.0
CHEM 104	Gen Org & Biochem II	3.0

Mathematics (3 credits)

MATH 130	Statistics	3.0

Physics (4 credits)

PHYS 131	Physics 1 with Algebra	4.0

The above is for informal comparison only. See curriculum sheets for complete listing of requirements.

MILLERSVILLE UNIVERSITY

Student Name:_____ Student I.D.#_____

DEGREE:	BS	**MAJOR REQUIREMENTS FOR A BS DEGREE IN ALLIED HEALTH TECHNOLOGY: MEDICAL TECHNOLOGY**
MAJOR:	ALHT	Total credit hours required: 120.0 minimum
OPTION:	MEDT	

REQUIREMENTS AND POLICIES FOR THE BS ALLIED HEALTH TECHNOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Allied Health Technology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the Allied Health Technology major (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described in the Undergraduate Catalog. Students who were dropped from the Allied Health Technology major also must satisfy the Allied Health Technology Retention in the Major criteria before being readmitted to an Allied Health Technology major.
3. Non-degree and continuing education students must be admitted to the Allied Health Technology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. All Allied Health Technology ("ALHT") majors must earn grades of C- (C minus, 1.7) or higher in Biology courses required for their option (BIOL 254, 255, 362, 364, 454 and 461) and a satisfactory (S) grade in BIOL 257. All ALHT majors must earn a B- (B minus, 2.7) or higher in BIOL 100 or a C- (C minus, 1.7) or higher in BIOL 101. ALHT majors must also maintain a minimum 2.0 major GPA.
3. The requirements stated above must be satisfied before completion of 90 Millersville University credit hours.
4. Millersville University students changing majors, or Allied Health Technology majors changing options within the Allied Health Technology major, must satisfy the above requirements prior to completion of 45 additional Millersville University credit hours. Note: Students who desire to change their major to Allied Health Technology must refer to the Allied Health Technology Admission to the Major Policy (see above).
5. Transfer students with 60 credit hours or more must satisfy the above requirements prior to completion of 45 Millersville University credit hours. Transfer students with fewer than 60 credits should refer to the policy for all other majors (part #3 above).
6. Any students failing to meet the above requirements will be dropped from the Allied Health Technology major. Students who wish to re-enter the major, must follow the requirements stipulated in part 4 above.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.
2. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curriculum Requirements.
3. Completion of the clinical (hospital) phase is required for graduation in this option.

D. Admission to the clinical program is competitive and is not guaranteed.

Admission to the clinical (hospital) phase is competitive, and for acceptance, the following grades are recommended: B (3.0) or higher in CHEM 111, CHEM 112, BIOL 454, and BIOL 461.

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your adviser to be aware of changes and curriculum details which are not incorporated on this form.*

ALHT 101 FALL 2009.2

MILLERSVILLE UNIVERSITY

Student Name:_____ Student I.D.#_____

DEGREE:	BS	**MAJOR REQUIREMENTS FOR A BS DEGREE IN ALLIED HEALTH TECHNOLOGY: NUCLEAR MEDICINE TECHNOLOGY**
MAJOR:	ALHT	
OPTION:	NUCM	Total credit hours required: 120.0 minimum

REQUIREMENTS AND POLICIES FOR THE BS ALLIED HEALTH TECHNOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Allied Health Technology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the Allied Health Technology major (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described in the Undergraduate Catalog. Students who were dropped from an Allied Health Technology major also must satisfy the Allied Health Technology Retention in the Major criteria before being readmitted to an Allied Health Technology major.
3. Non-degree and continuing education students must be admitted to the Allied Health Technology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. All Allied Health Technology ("ALHT") majors must earn grades of C- (C minus, 1.7) or higher in Biology courses required for their option (BIOL 254, 255, 362, 364, 454 and 461) and a satisfactory (S) grade in BIOL 257. All ALHT majors must earn a B- (B minus, 2.7) or higher in BIOL 100 or a C- (C minus, 1.7) or higher in BIOL 101. ALHT majors must also maintain a minimum 2.0 major GPA.
3. The requirements stated above must be satisfied before completion of 90 Millersville University credit hours.
4. Millersville University students changing majors, or Allied Health Technology majors changing options within the Allied Health Technology major, must satisfy the above requirements prior to completion of 45 additional Millersville University credit hours. Note: Students who desire to change their major to Allied Health Technology must refer to the Allied Health Technology Admission to the Major Policy (see above).
5. Transfer students with 60 credit hours or more must satisfy the above requirements prior to completion of 45 Millersville University credit hours. Transfer students with fewer than 60 credits should refer to the policy for all other majors (part #3 above).
6. Any students failing to meet the above requirements will be dropped from the Allied Health Technology major. Students who wish to re-enter the major, must follow the requirements stipulated in part 4 above.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.
2. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curriculum Requirements.
3. Completion of the clinical (hospital) phase is required for graduation in this option.

D. Admission to the clinical program is competitive and is not guaranteed.

Admission to the clinical (hospital) phase is competitive, and for acceptance, the following grades are recommended: B (3.0) or higher in BIOL 254 and BIOL 255; B- (B minus, 2.7) or higher in PHYS 131.

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your adviser to be aware of changes and curriculum details which are not incorporated on this form.*

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS Allied Health Technology**
Option: **NUCLEAR MEDICINE TECHNOLOGY**
Major Field Requirements: **31.0-33.0 credits**
Clinical Education: **26.0 credits**
Other Requirements: **27.0 credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

REQUIRED BIOLOGY COURSES (25.0 credits)

Course No.	Short Title	C.H.	Grade	Q.P.
BIOL 100	General Biology	3.0		
BIOL 254	Human Anat & Phys I	4.0		
BIOL 255	Human Anat & Phys II	4.0		
BIOL 257	Intro Allied Health	1.0		
BIOL 362	Cell & Development	4.0		
BIOL 364	Genetics & Mol Biology	4.0		
BIOL 454	Immunology	2.0		
BIOL 461	General Microbiology	3.0		

DIRECTED ELECTIVES (6.0-8.0 credits)

Select from below a minimum of 2 courses:

Course No.	Short Title	C.H.	Grade	Q.P.
BIOL 211	Concepts of Zoology	4.0		
BIOL 352	Nutritional Science	3.0		
BIOL 360	Histology	4.0		
BIOL 363	Medical Microbiology	3.0		
BIOL 417	Parasitology	3.0		
BIOL 437	Endocrinology	3.0		
BIOL 438	Neurobiology	3.0		
BIOL 455	Cardiopulmonary Physio	3.0		
BIOL 462	Molecular Biology	4.0		
BIOL 463	Virology	4.0		
BIOL 465	Developmental Biology	3.0		
BIOL 467	Human Genetics	3.0		
RESP 422	Pharmacology	2.0		

NUCLEAR MED CLINICAL EDUCATION (26.0 credits)

Upon completion of one year at the Lancaster General Hospital College of Nursing and Allied Health, 26.0 credit hours will be credited toward the B.S. degree in Allied Health Technology with the Nuclear Medicine Technology option.

Lancaster General Hospital College of Nursing and Allied Health 26.0 credits ❑

REQUIRED RELATED (28.0-31.0 credits)

Chemistry (16.0 credits)

Course No.	Short Title	C.H.	Grade	Q.P.
CHEM 111*	Intro to Chemistry I	4.0		
CHEM 112*	Intro to Chemistry II	4.0		
CHEM 235	Short Course Org Chem	4.0		
CHEM 326	Biochemistry I	4.0		

Note: CHEM 231* and CHEM 232 (total 8.0 credits) may substitute for CHEM 235.
*Must earn a C- or better in these CHEM courses before completing CHEM 235 or CHEM 232.

Students who are considering going to graduate school or attending medical, dental, veterinary school or wanting to enroll in school to become a pharmacist, physical therapist, or physician assistant after completing their clinical training SHOULD TAKE CHEM 231 and 232.

Note: Those wishing to complete a Chemistry minor must complete CHEM 265 (Quantitative Analysis) in addition to those CHEM courses listed.

Mathematics (7.0 credits)

Course No.	Short Title	C.H.	Grade	Q.P.
MATH 130	Elements of Statistics	3.0		
MATH 160	Precalculus	4.0		

NOTE: Students who might be interested in attending graduate school or professional schools after completing their clinical program SHOULD ALSO TAKE MATH 161.

Physics (4.0 credits)

Course No.	Short Title	C.H.	Grade	Q.P.
PHYS 131	Physics I with Algebra	4.0		

NOTE: Students who might be interested in attending graduate school or professional schools after completing their clinical program SHOULD ALSO TAKE PHYS 132.

General Electives (as necessary)

ALHT-201 FALL 2009.2

MILLERSVILLE UNIVERSITY

Student Name:_____ Student ID #_____

DEGREE: BS MAJOR: ALHT OPTION: PATR	**MAJOR REQUIREMENTS FOR A BS DEGREE IN ALLIED HEALTH TECHNOLOGY: PRE-ATHLETIC TRAINING** Total credit hours required: 120.0 minimum

REQUIREMENTS AND POLICIES FOR THE BS ALLIED HEALTH TECHNOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Allied Health Technology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the Allied Health Technology major (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described in the Undergradu ate catalog. Students who were dropped from a Allied Health Technology major also must satisfy the Allied Health Technology Retention in the Major criteria before being readmitted to an Allied Health Technology major.
3. Non-degree and continuing education students must be admitted to the Allied Health Technology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. All Allied Health Technology ("ALHT") majors must earn grades of C- (C minus, 1.7) or higher in Biology courses required for their option (BIOL 254, 255, 352, 362, 364, 375, and 461). ALHT majors must earn a B- (B minus, 2.7) or higher in BIOL 100 or a C- (C minus, 1.7) or higher in BIOL 101 as a prerequisite for other BIOL courses. All majors must also maintain a minimum 2.0 major GPA.
3. The requirements stated above must be satisfied before completion of 90 Millersville University credit hours.
4. Millersville University students changing majors, or Allied Health Technology majors changing options within the Allied Health Technology major, must satisfy the above requirements prior to completion of 45 additional Millersville University credit hours. Note: Students who desire to change their major to Allied Health Technology must refer to the Allied Health Technology Admission to the Major Policy (see above).
5. Transfer students with 60 credit hours or more must satisfy the above requirements prior to completion of 45 Millersville University credit hours. Transfer students with fewer than 60 credits should refer to the policy for all other majors (part #3 above).
6. Any students failing to meet the above requirements will be dropped from the Allied Health Technology major. Students who wish to re-enter the major, must follow the requirements stipulated in part 4 above.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.
2. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curriculum Requirements.
3. Degree will be awarded after student has successfully completed one year of clinical education in an approved Athletic Training program.

D. Admission to the master's level clinical program is competitive and not guaranteed.

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your advisor to be aware of changes and curriculum details which are not incorporated on this form.*

ALHT-303 FALL 2017

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS Allied Health Technology**
Option: **PRE-ATHLETIC TRAINING**
Major Field Requirements: **53.0 credits**
Clinical Education: **variable # of credits**
Other Requirements: **31.0 credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

REQUIRED BIOLOGY COURSES (28.0 credits)

Course No.	Short Title	C.H.	Grade
BIOL 100	General Biology	3.0	
BIOL 254	Human Anatomy & Physiology I	4.0	
BIOL 255	Human Anatomy & Physiology II	4.0	
BIOL 352	Nutritional Science	3.0	
BIOL 362	Cell & Development	4.0	
BIOL 364	Genetics & Molecular Biology	4.0	
BIOL 375	Biometry	3.0	
BIOL 461	General Microbiology	3.0	

REQUIRED Wellness & Sports Sciences Courses (18.0 credits)

Course No.	Short Title	C.H.	Grade
WSSD 311	First Aid & CPR	3.0	
WSSD 375	Prevent. & Care	3.0	
WSSD 450	Kinesiology	3.0	
WSSD 452	Nutrition for Perf. Enhancement	3.0	
WSSD 582	Sport Psychololgy	3.0	
WSSD 591	Exercise Physiology	3.0	

CLINICAL EDUCATION (variable # of credits)

Upon completion of one year of clinical education in an affiliated Athletic Training Program, up to 40% of the graduate credits will be counted towards the B.S. degree in Allied Health Technology, Pre-Athletic Training option.

REQUIRED RELATED (23.0 credits)

Chemistry (12.0 credits)

Course No.	Short Title	C.H.	Grade
CHEM 111*	Introductory Chemisty I	4.0	
CHEM 112*	Introductory Chemistry II	4.0	
CHEM 235	Short Course Organic Chemistry	4.0	

Note: CHEM 231* and CHEM 232 (total 8.0 credits) may substitute for CHEM 235.
*Must earn a C- or better in these CHEM courses before completing CHEM 235 or CHEM 232.

Students who are considering going to graduate school or professional school (e.g., medical, physical therapy, physician assistant) after completing their clinical training SHOULD TAKE CHEM 231 and 232.

Mathematics (4.0 credits)

Course No.	Short Title	C.H.	Grade
MATH 160	Precalculus	4.0	

Note: Students considering attending graduate school or professional school SHOULD ALSO TAKE MATH 161.

Physics (4.0 credits)

Course No.	Short Title	C.H.	Grade
PHYS 131	Physics I with Algebra	4.0	

Psychology (3.0 credits)

Course No.	Short Title	C.H.	Grade
PSYC 356	Health Psychology	3.0	

NOTE: PSYC 100 and PSYC 227 or 228 (G3), should be taken as they are prerequisites for PSYC 356.

PHIL 100 (G1), SOC 101 or ANTH 121 (G3) BIOL 207 (D, W) and COMM 461 (P) are also recommended to help students fulfull graduate school prerequisites.

MILLERSVILLE UNIVERSITY

Student Name:_____ Student I.D.#_____

DEGREE:	BS	**MAJOR REQUIREMENTS FOR A BS DEGREE IN ALLIED HEALTH TECHNOLOGY: RESPIRATORY THERAPY**
MAJOR:	ALHT	Total credit hours required: 120.0 minimum
OPTION:	RESP	

REQUIREMENTS AND POLICIES FOR THE BS ALLIED HEALTH TECHNOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Allied Health Technology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the Allied Health Technology major (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described in the Undergraduate Catalog. Students who were dropped from an Allied Health Technology major also must satisfy the Allied Health Technology Retention in the Major criteria before being readmitted to an Allied Health Technology major.
3. Non-degree and continuing education students must be admitted to the Allied Health Technology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. Admission to the professional phase of the Respiratory Therapy program is competitive and not guaranteed. Allied Health Technology (ALHT) majors in the Respiratory Therapy option must earn a grade of B- (B minus) or higher in BIOL 100 and grades of C- (C minus) or higher in all other required Biology and required-related courses (BIOL 254, 255, 461; CHEM 103, 104; MATH 130; PHYS 131) and have a minimum GPA of 2.5 in these courses. Note: Students will need to earn a B- or better in several math/science courses to achieve this GPA. Students must also maintain an overall GPA of 2.0.
3. BS ALHT Respiratory Therapy students who meet the minimum math/science GPA of 2.5 can schedule an interview with the admission committee for the professional phase of the Respiratory Therapy program. The committee will assess students on her/his academic performance, letters of recommendation, communication skills, understanding of the profession, maturity, and potential to succeed in the professional phase of the program. Students who score poorly during her/his interview may be denied admission into the professional phase of the program even if they have met the minimum math/science GPA requirement. Students denied admission into the professional phase of the program will be advised on how she/he can strengthen her/his credentials for re-application the following year or how they can complete the degree requirements for an alternative program. If seats are available in the professional phase of the program, students who have not met the minimum math/science GPA may be interviewed and, if accepted, will be admitted on a probationary basis.
4. The BS ALHT Respiratory Therapy is a 2+2 year program. All of the above requirements must be satisfied before a student can begin the professional phase of the program, except for BIOL 352 which is completed during the professional phase.
5. Transfer students must meet all University requirements before she/he can begin the professional phase.
6. Any students failing to meet the above requirements will be dropped from the Allied Health Technology major.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements, except for the Perspectives (P) course, which is waived.
2. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curriculum Requirements.

D. Admission to the professional phase is competitive and is not guaranteed (see part B above).

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your advisor to be aware of changes and curriculum details which are not incorporated on this form.*

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS Allied Health Technology: 2 + 2 program**
Option: **Respiratory Therapy**
Major Field Requirements: **17.0 credits**
Professional Education: **54.0 credits**
Other Requirements: **13.0 credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

REQUIRED BIOLOGY COURSES (17.0 credits)

Course No.	Short Title	C.H.	Grade
BIOL 100	General Biology	3.0	
BIOL 254	Human Anatomy & Physiology I	4.0	
BIOL 255	Human Anatomy & Physiology II	4.0	
BIOL 352	Nutritional Science	3.0	
BIOL 461	General Microbiology	3.0	

RESP THER PROFESSIONAL EDUCATION (54.0 credits)

Upon completion of approximately 2 years at the Lancaster Regional Medical Center (MU/LRMC Consortium), 54.0 credit hours will be credited toward the B.S. degree in Allied Health Technology with the Respiratory Therapy option.

Professional Education at Lancaster RMC (54.0 credits) ☐

Course No.	Short Title	C.H.	Grade
RESP 410	Acute Cardiopulmonary Care	2.0	
RESP 411	Respiratory Care Techniques I	2.0	
RESP 412	Prin. Aerosol & Gas Therapy	3.0	
RESP 413	Respiratory Assess & Therap.	4.0	
RESP 414	Respiratory Care Techniques II	3.0	
RESP 415	Tech Aspects Mech Ventilation	3.0	
RESP 417	Respiratory Care Techniques III	3.0	
RESP 419	Respiratory Care in Alt Sites	2.0	
RESP 420	Arterial Blood Gas Analysis	3.0	
RESP 421	Physio Mechnical Ventilation	2.0	
RESP 422	Pharmacology	2.0	
RESP 423	Infectious Diseases	2.0	
RESP 424	Noninfectious Diseases	2.0	
RESP 425	Neonatology for Resp Therapist	2.0	
RESP 460	Clinical Practice I	1.0	
RESP 461	Clinical Practicum I	2.0	
RESP 462	Clinical Practice II	1.0	
RESP 463	Clinical Practicum II	3.0	
RESP 464	Clinical Practicum III	10.0	
RESP 495	Respiratory Care Research	2.0	

NOTE: RESP 417 will count towards the Writing (W) general education requirement.

REQUIRED RELATED (13.0 credits)

Chemistry (6.0 credits) (G2 Courses)

Course No.	Short Title	C.H.	Grade
CHEM 103	General, Organic & Biochem I	3.0	
CHEM 104	General, Organic & Biochem II	3.0	

Note: Students who are considering going to graduate school or attending medical, dental, veterinary school or wanting to enroll in school to become a pharmacist, physical therapist, or physician assistant after completing their clinical training SHOULD TAKE CHEM 111*, 112*, 231* and 232; completing all four can substitute for CHEM 103 and 104.

*Must earn a C- or better in these CHEM courses before completing CHEM 232.

Mathematics (3.0 credits)

Course No.	Short Title	C.H.	Grade
MATH 130	Elements of Statistics I	3.0	

Note: Students who might be interested in attending graduate school or professional schools after completing their professional phase SHOULD ALSO TAKE MATH 161.

Physics (4.0 credits) (G2 Course)

Course No.	Short Title	C.H.	Grade
PHYS 131	Physics I with Algebra	4.0	

NOTE: Students who might be interested in attending graduate school or professional school programs after completing their professional phase SHOULD ALSO TAKE PHYS 132.

Suggested Additional Courses (no minimum)

Course No.	Short Title	C.H.	Grade
BIOL 375	Biometry	3.0	
BIOL 454	Immunology	2.0	
BIOL 463	Virology	4.0	
CSCI* ___	_____	3.0	
GERT 100	Intro to Gerontology	3.0	
PHIL 285	Moral Problems in Medicine	3.0	

*Numbered CSCI 140 or above.

Note: Students may instead follow the B.S. Biology option in Respiratory Therapy to prepare for the professional phase of the MU Respiratory Therapy program.

Respiratory Therapy students who might be interested in medical or graduate school should select the B.S. in Biology, Respiratory Therapy option and select CHEM 231 & 232 in lieu of CHEM 235. This option also meets the full-year-of-physics requirement for medical school.

MILLERSVILLE UNIVERSITY

Student Name:_____ Student ID #_____

DEGREE: BS MAJOR: ALHT OPTION: SPMD	**MAJOR REQUIREMENTS FOR A BS DEGREE IN ALLIED HEALTH TECHNOLOGY: SPORTS MEDICINE** Total credit hours required: 120.0 minimum

REQUIREMENTS AND POLICIES FOR THE BS ALLIED HEALTH TECHNOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Allied Health Technology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the Allied Health Technology major (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described in the Undergraduate catalog. Students who were dropped from an Allied Health Technology major also must satisfy the Allied Health Technology Retention in the Major criteria before being readmitted to an Allied Health Technology major.
3. Non-degree and continuing education students must be admitted to the Allied Health Technology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. All Allied Health Technology ("ALHT") majors must earn grades of C- (C minus, 1.7) or higher in Biology courses required for their option (BIOL 254, 255, 352, 362, 364, 375, and 461). ALHT majors must earn a B- (B minus, 2.7) or higher in BIOL 100 or a C- (C minus, 1.7) or higher in BIOL 101 as a prerequisite for other BIOL courses. All majors must also maintain a minimum 2.0 major GPA.
3. The requirements stated above must be satisfied before completion of 90 Millersville University credit hours.
4. Millersville University students changing majors, or Allied Health Technology majors changing options within the Allied Health Technology major, must satisfy the above requirements prior to completion of 45 additional Millersville University credit hours. Note: Students who desire to change their major to Allied Health Technology must refer to the Allied Health Technology Admission to the Major Policy (see above).
5. Transfer students with 60 credit hours or more must satisfy the above requirements prior to completion of 45 Millersville University credit hours. Transfer students with fewer than 60 credits should refer to the policy for all other majors (part #3 above).
6. Any students failing to meet the above requirements will be dropped from the Allied Health Technology major. Students who wish to re-enter the major, must follow the requirements stipulated in part 4 above.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.
2. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curriculum Requirements.

D. Admission to graduate and professional schools is competitive and not guaranteed.

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your advisor to be aware of changes and curriculum details which are not incorporated on this form.*

ALHT-304 FALL 2017

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS Allied Health Technology**
Option: **SPORTS MEDICINE**
Major Field Requirements: **53.0 credits**
Other Requirements: **31.0 credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

Course No.	Short Title	C.H.	Grade
REQUIRED BIOLOGY COURSES (28.0 credits)			
BIOL 100	General Biology	3.0	
BIOL 254	Human Anatomy & Physiology I	4.0	
BIOL 255	Human Anatomy & Physiology II	4.0	
BIOL 352	Nutritional Science	3.0	
BIOL 362	Cell & Development	4.0	
BIOL 364	Genetics & Molecular Biology	4.0	
BIOL 375	Biometry	3.0	
BIOL 461	General Microbiology	3.0	
REQUIRED Wellness & Sports Sciences Courses (19.0 credits)			
WSSD 311	First Aid & CPR	3.0	
WSSD 375	Prevent. & Care	3.0	
WSSD 450	Kinesiology	3.0	
WSSD 452	Nutrition for Perf. Enhancement	3.0	
WSSD 582	Sport Psychololgy	3.0	
WSSD 591	Exercise Physiology	3.0	
WSSD 492	Seminar in Sports Science	1.0	
ELECTIVES (6.0 credits)			
In consultation with your advisor, choose a minimum of 6 credits from the following recommended courses. At least 2 credits must be in Biology courses.			
BIOL 300	Co-op Biology	3.0	
BIOL 454	Immunology	2.0	
BIOL 363	Medical Microbiology	3.0	
BIOL 438	Neurobiology	3.0	
BIOL 463	Virology	3.0	
BIOL 465	Developmental Biology	3.0	
BIOL 498	Independent Study	1.0-3.0	
WSSD 483	Legal Aspects of Sport	3.0	
WSSD 300	Co-op in Wellness	3.0	
WSSD 400	Co-op in Wellness	3.0	
WSSD 490	Independent Study	1.0-3.0	

Course No.	Short Title	C.H.	Grade
REQUIRED RELATED (31.0 credits)			
Chemistry (16.0 credits)			
CHEM 111*	Introductory Chemisty I	4.0	
CHEM 112*	Introductory Chemistry II	4.0	
CHEM 235	Short Course Organic Chemistry	4.0	
CHEM 326	Biochemistry 1	4.0	

Note: CHEM 231* and CHEM 232 (total 8.0 credits) may substitute for CHEM 235.
*Must earn a C- or better in these CHEM courses before completing CHEM 235 or CHEM 232.

Students who are considering going to graduate school or attending professional school (e.g., medical, physical therapy, physician assistant) SHOULD TAKE CHEM 231 and 232.

Mathematics (4.0 credits)			
MATH 160	Precalculus	4.0	

Note: Students considering attending graduate school or professional school SHOULD ALSO TAKE MATH 161.

Physics (4.0 credits)			
PHYS 131	Physics I with Algebra	4.0	
PHYS 132	Physics II with Algebra	4.0	
Psychology (3.0 credits)			
PSYC 356	Health Psychology	3.0	

NOTE: PSYC 100 and PSYC 227 or 228 (G3) should be taken as they are prequisites for PSYC 356.

PHIL 100 (G1), SOC 101 or ANTH 121 (G3) BIOL 207 (D, W) and COMM 461 (P) are also recommended to help students fulfull graduate school prerequisites.

MILLERSVILLE UNIVERSITY

Student Name:_____ Student ID# _____

DEGREE: BA
MAJOR: BIOL
OPTION:

MAJOR REQUIREMENTS FOR A BA DEGREE IN BIOLOGY

Total credit hours required: 120.0 minimum

REQUIREMENTS AND POLICIES FOR THE BA BIOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Biology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the Biology major (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described in the Undergraduate Catalog. Students who were dropped from a Biology major also must satisfy the Biology Retention in the Major criteria before being readmitted to a Biology major.
3. Non-degree and continuing education students must be admitted to the Biology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. All Biology majors must earn grades of C- (C minus) or higher in all core courses (BIOL 101, 211, 221, 343, 362, 364) required for their option.
3. The requirements stated above must be satisfied before completion of 90 Millersville University credit hours.
4. Millersville University students changing majors, or Biology majors changing options within the Biology major, must satisfy the above requirements prior to completion of 45 additional Millersville University credit hours.

Note: Students who desire to change their major to Biology must refer to the Biology department's Admission to the Major Policy. Those transferring into the major may substitute BIOL 100 for BIOL 101 if they earn a grade of B- (B minus) or higher in this course.

5. Transfer students with 60 credit hours or more must satisfy the above requirements prior to completion of 45 Millersville University credit hours. Transfer students with fewer than 60 credits should refer to the policy for all other majors (part #3 above).
6. Any students failing to meet the above requirements will be dropped from the Biology major. Students who wish to re-enter the major must follow the requirements stipulated in part 4 above.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.
2. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curriculum Requirements.

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your adviser to be aware of changes and curriculum details which are not incorporated on this form.*

BI-128 FALL 2009.2

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BA BIOLOGY**
Option:
Major Field Requirements: **33.0 credits**
Other Requirements: **34.0-51.0credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

Course No.	Short Title	C.H.	Grade
REQUIRED BIOLOGY COURSES (25.0-26.0 credits)			
BIOL 101	Foundations of Biology	4.0	
BIOL 211	Concepts of Zoology	4.0	
BIOL 221	Concepts of Botany	4.0	
BIOL 343	Ecology & Evolution	4.0	
BIOL 362	Cell & Development	4.0	
BIOL 364	Genetics & Mol. Biology	4.0	
	--- --- AND --- ---		
BIOL 470	Biology Colloquium	1.0-2.0	
	--- --- OR --- ---		
BIOL 472	Seminar in Biology	1.0-2.0	
BIOLOGY ELECTIVES (7.0-8.0 credits)			
In consultation with your advisor, choose additional biology courses approved for the major to bring total biology credits to 33.0.			
BIOL ___	_____	____	____
BIOL ___	_____	____	____
BIOL ___	_____	____	____
BIOL ___	_____	____	____
BIOL ___	_____	____	____

Course No.	Short Title	C.H.	Grade
REQUIRED RELATED (34.0 - 51.0 credits)			
Chemistry (16.0 credits)			
CHEM 111*	Intro Chemistry I	4.0	
CHEM 112	Intro Chemistry II	4.0	
CHEM** ___	_____	4.0	
CHEM** ___	_____	4.0	
*Must earn a C- or better in order to take CHEM 112.			
** At the 200 level or above.			
Earth Sciences (3.0-4.0 credits)			
ESCI* ___	_____	___	____
* At the 200 level or above.			
Mathematics & Computer Science (7.0-9.0 credits)			
MATH 161	Calculus I	4.0	
	--- --- or --- ---		
MATH 163	Honors Calculus	5.0	
	--- ---AND--- ---		
MATH*	_____	___	____
	--- --- or --- ---		
CSCI*	_____	4.0	
*Note: Only MATH courses numbered 160 or above OR CSCI courses numbered 140 or above may be used to fulfill these requirements.			
Physics (8.0 - 10.0 credits)			
PHYS 131	Physics I with Algebra	4.0	
PHYS 132	Physics II with Algebra	4.0	
	---- ---- or ---- ----		
PHYS 231	Physics I with Calculus	5.0	
PHYS 232	Physics II with Calculus	5.0	
Foreign Language (0 - 12.0 credits)			
Competency through the intermediate level is required. Pass/fail may be elected.			
____ 101	Elementary I	3.0	
____ 102	Elementary II	3.0	
____ 201	Intermediate I	3.0	
____ 202	Intermediate II	3.0	
General Electives (as necessary)			
_____	_____	____	____
_____	_____	____	____
_____	_____	____	____

MILLERSVILLE UNIVERSITY

Student Name:_____ Student ID #_____

DEGREE: BS
MAJOR: BIOL
OPTION:

MAJOR REQUIREMENTS FOR A BS DEGREE IN BIOLOGY

Total credit hours required: 120.0 minimum

REQUIREMENTS AND POLICIES FOR THE BS BIOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Biology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the Biology major (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described in the Undergraduate catalog. Students who were dropped from a Biology major also must satisfy the Biology Retention in the Major criteria before being readmitted to a Biology major.
3. Non-degree and continuing education students must be admitted to the Biology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. All Biology majors must earn grades of C- (C minus) or higher in all core courses (BIOL 101, 211, 221, 343, 362, 364) required for their option.
3. The requirements stated above must be satisfied before completion of 90 Millersville University credit hours.
4. Millersville University students changing majors, or Biology majors changing options within the Biology major, must satisfy the above requirements prior to completion of 45 additional Millersville University credit hours. Note: Students who desire to change their major to Biology must refer to the Biology department's Admission to the Major Policy. Those transferring into the major may substitute BIOL 100 for BIOL 101 if they earn a grade of B- (B minus) or higher in this course.
5. Transfer students with 60 credit hours or more must satisfy the above requirements prior to completion of 45 Millersville University credit hours. Transfer students with fewer than 60 credits should refer to the policy for all other majors (part 3 above).
6. Any students failing to meet the above requirements will be dropped from the Biology major. Students who wish to re-enter the major, must follow the requirements stipulated in part 4 above.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.
2. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curriculum Requirements.

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your adviser to be aware of changes and curriculum details which are not incorporated on this form.*

BI-229 FALL 2009.2

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS BIOLOGY**
Option:
Major Field Requirements: **43.0 credits**
Other Requirements: **35.0-39.0credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

Course No.	Short Title	C.H.	Grade

REQUIRED BIOLOGY COURSES (25.0-26.0 credits)

BIOL	101	Foundations of Biology	4.0	____
BIOL	211	Concepts of Zoology	4.0	____
BIOL	221	Concepts of Botany	4.0	____
BIOL	343	Ecology & Evolution	4.0	____
BIOL	362	Cell & Development	4.0	____
BIOL	364	Genetics & Mol. Biology	4.0	____
		--- --- AND --- ---		
BIOL	470	Biology Colloquium	1.0-2.0	____
		--- --- OR --- ---		
BIOL	472	Seminar in Biology	1.0-2.0	____

BIOLOGY ELECTIVES (17.0-18.0 credits)

In consultation with your advisor, choose additional biology courses approved for the major to bring total biology credits to 43.0. A minimum of 12 elective credits must be at the 300-level or higher and approved for the major.

BIOL ___	_____	____	____
BIOL ___	_____	____	____
BIOL ___	_____	____	____
BIOL ___	_____	____	____
BIOL ___	_____	____	____
BIOL ___	_____	____	____
BIOL ___	_____	____	____
BIOL ___	_____	____	____

*Note: Those planning to apply to graduate or professional school should inquire about specific admissions requirements for the program of their choice.

REQUIRED RELATED (35.0 - 39.0 credits)

Chemistry (20.0 credits)

CHEM	111*	Intro Chemistry I	4.0	____
CHEM	112*	Intro Chemistry II	4.0	____
CHEM	231*	Organic Chemistry I	4.0	____
CHEM	232	Organic Chemistry II	4.0	____
CHEM	326	Biochemistry I	4.0	____

*Must earn a C- or better in these CHEM courses before completing CHEM 232.

Note: Those wishing to complete a Chemistry minor must complete CHEM 265 (Quantitative Analysis) in addition to those CHEM courses listed.

Mathematics & Computer Science (7.0-9.0 credits)

MATH	161	Calculus I	4.0	____
		--- --- or --- ---		
MATH	163	Honors Calculus	5.0	____
		--- ---AND--- ---		
MATH*		_____	____	____
		--- --- or --- ---		
CSCI*		_____	4.0	____

*Note: Only MATH courses numbered 160 or above OR CSCI courses numbered 140 or above may be used to fulfill these requirements.

Physics (8.0 - 10.0 credits)

PHYS	131	Physics I with Algebra	4.0	____
PHYS	132	Physics II with Algebra	4.0	____
		---- ---- or ---- ----		
PHYS	231	Physics I with Calculus	5.0	____
PHYS	232	Physics II with Calculus	5.0	____

General Electives (as necessary)

_____	_____	____	____
_____	_____	____	____
_____	_____	____	____

MILLERSVILLE UNIVERSITY

Student Name:_____ Student I.D.#_____

DEGREE: BSE
MAJOR: BIOL
OPTION:

MAJOR REQUIREMENTS FOR A BSE DEGREE IN BIOLOGY

Total credit hours required: 126.0 minimum

REQUIREMENTS AND POLICIES FOR THE BSE BIOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Biology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the Biology major (from other departments or undeclared status) requires that the student is in satisfactory standing as described in the Undergraduate Catalog. Students who were dropped from a Biology major also must satisfy the Biology Retention in the Major criteria before being readmitted to a Biology major.
3. Non-degree and continuing education students must be admitted to the Biology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. All Biology majors must earn grades of C- (C minus) or higher in all core courses (BIOL 101, 211, 221, 343, 362, 364) required for their option.
3. The requirements stated above must be satisfied before completion of 90 Millersville University credit hours.
4. Millersville University students changing majors, or Biology majors changing options within the Biology major, must satisfy the above requirements prior to completion of 45 additional Millersville University credit hours.
   Note: Students who desire to change their major to Biology must refer to the Biology department's Admission to the Major Policy. Those transferring into the major may substitute BIOL 100 for BIOL 101 if they earn a grade of B- (B minus) or higher in this course.
5. Transfer students with 60 credit hours or more must satisfy the above requirements prior to completion of 45 Millersville University credit hours. Transfer students with fewer than 60 credits should refer to the policy for all other majors (part 3 above).
6. Any students failing to meet the above requirements will be dropped from the Biology major. Students who wish to re-enter the major, must follow the requirements stipulated in part 4 above.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements, except for the Perspectives (P) course, which is waived.
2. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curriculum Requirements.
3. Admission to Advanced Professional Studies, whose several requirements include an overall GPA of 3.0, completion of a literature course in the English department, and appropriate clearances.

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your adviser to be aware of changes and curriculum details which are not incorporated on this form.*

BI-1024 FALL 2012.2

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BSE BIOLOGY**
Option:
Major Field Requirements: **32.0 credits**
Other Requirements: **64.0-68.0credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

Course No.	Short Title	C.H.	Grade

REQUIRED BIOLOGY COURSES (28.0 credits)

BIOL	101	Foundations of Biology	4.0	____
BIOL	211	Concepts of Zoology	4.0	____
BIOL	221	Concepts of Botany	4.0	____
BIOL	343	Ecology & Evolution	4.0	____
BIOL	362	Cell & Development	4.0	____
BIOL	364	Genetics & Mol. Biology	4.0	____
BIOL	375	Biometry	3.0	____
BIOL	473	Methods Teach Biology	1.0	____

BIOLOGY ELECTIVES (4.0 credits)

In consultation with your advisor, choose additional biology courses approved for the major to bring total biology credits to 32.0.

BIOL ___ _____ ____ ____
BIOL ___ _____ ____ ____
BIOL ___ _____ ____ ____

PROFESSIONAL EDUCATION (33.0 credits)

Foundations Bloc

EDFN	211	Foundation Modern Ed	3.0	____
EDFN	241	Psyc Found Teach	3.0	____

EDFN 001: Prof. Bloc, Science (*requires APS status*)

EDFN	321	Issues in Sec. Educ.	3.0	____
EDFN	330	Instruct. Tech. Des.	3.0	____
EDSE	340	Content Area Literacy	3.0	____
SPED	346	Sec Students w/Disabilities	3.0	____
EDSE	435	Teaching of Science*	3.0	____

* EDSE 435 offered in Fall semester only.

Professional Bloc II

EDSE	471	Differentiating Instruction	3.0	____
EDSC	461	Student Teaching	9.0	____

Admission to Advanced Professional Studies & Certification (APS)

All students enrolled in teacher preparation programs must be admitted to Advanced Professional Studies and meet Pennsylvania state requirements and university requirements prior to being enrolled in their initial advanced Professional Studies course. Students must meet additional Pennsylvania state requirements in order to be certified. Listings of Advanced Professional Studies courses and requirements are available in each department office, the Early Field Experiences office, and on the Early Experiences website.

Course No.	Short Title	C.H.	Grade

REQUIRED RELATED (31.0 - 35.0 credits)

Chemistry (16.0 credits)

CHEM	111*	Intro Chemistry I	4.0	____
CHEM	112*	Intro Chemistry II	4.0	____
CHEM	235	Short Course Org. Chem	4.0	____
CHEM	326	Biochemistry I	4.0	____

Note: CHEM 231* and CHEM 232 (total 8.0 credits) may substitute for CHEM 235.

*Must earn a C- or better in these CHEM courses before completing CHEM 235 or 232.

Note: Students who are considering going to graduate school to earn an advanced degree in Biology SHOULD TAKE CHEM 231 and 232.

Note: Those wishing to complete a Chemistry minor must complete CHEM 265 (Quantitative Analysis) in addition to those CHEM courses listed.

Earth Sciences (3.0-4.0 credits)

ESCI* ___ _____ ___ ____
* At the 200 level or above.

Mathematics (4.0-5.0 credits)

MATH	160	Precalculus	4.0	____
		--- --- or --- ---		
MATH	161	Calculus I	4.0	____
		--- --- or --- ---		
MATH	163	Honors Calculus	5.0	____

*Note: Students who might be interested in graduate school or professional school SHOULD TAKE MATH 161.

Physics (8.0 - 10.0 credits)

PHYS	131	Physics I with Algebra	4.0	____
PHYS	132	Physics II with Algebra	4.0	____
		---- ---- or ---- ----		
PHYS	231	Physics I with Calculus	5.0	____
PHYS	232	Physics II with Calculus	5.0	____

General Electives (as necessary)

_____ _____ ____ ____
_____ _____ ____ ____
_____ _____ ____ ____

BI-1024 FALL 2012.2

MILLERSVILLE UNIVERSITY

Student Name:_____ Student ID #_____

DEGREE:	BS	**MAJOR REQUIREMENTS FOR A BS DEGREE IN BIOLOGY : ANIMAL BEHAVIOR**
MAJOR:	BIOL	Total credit hours required: 120.0 minimum
OPTION:	ANBE	

REQUIREMENTS AND POLICIES FOR THE BS BIOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Biology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the Biology major (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described in the Undergraduate catalog. Students who were dropped from a Biology major also must satisfy the Biology Retention in the Major criteria before being readmitted to a Biology major.
3. Non-degree and continuing education students must be admitted to the Biology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. All Biology majors must earn grades of C- (C minus) or higher in all core courses (BIOL 101, 211, 221, 343, 362, 364) required for their option.
3. The requirements stated above must be satisfied before completion of 90 Millersville University credit hours.
4. Millersville University students changing majors, or Biology majors changing options within the Biology major, must satisfy the above requirements prior to completion of 45 additional Millersville University credit hours. Note: Students who desire to change their major to Biology must refer to the Biology department's Admission to the Major Policy. Those transferring into the major may substitute BIOL 100 for BIOL 101 if they earn a grade of B- (B minus) or higher in this course.
5. Transfer students with 60 credit hours or more must satisfy the above requirements prior to completion of 45 Millersville University credit hours. Transfer students with fewer than 60 credits should refer to the policy for all other majors (part 3 above).
6. Any students failing to meet the above requirements will be dropped from the Biology major. Students who wish to re-enter the major, must follow the requirements stipulated in part 4 above.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.
2. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curriculum Requirements.

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your advisor to be aware of changes and curriculum details which are not incorporated on this form.*

BIOL-1302 FALL 2017

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS BIOLOGY**
Option: **ANIMAL BEHAVIOR**
Major Field Requirements: **46.0 credits**
Other Requirements: **34.0-37.0credits**

When applicable, required related courses may be credited toward the Liberal Arts Core, subject to normal substitution rules.

Course No.	Short Title	C.H.	Grade
REQUIRED BIOLOGY COURSES (24.0 credits)			
BIOL 101	Foundations of Biology	4.0	
BIOL 211	Concepts of Zoology	4.0	
BIOL 221	Concepts of Botany	4.0	
BIOL 343	Ecology & Evolution	4.0	
BIOL 362	Cell & Development	4.0	
BIOL 364	Genetics & Molecular Biology	4.0	
REQUIRED ANIMAL BEHAVIOR COURSES (11.0-14.0 credits)			
Foundations (10.0 credits)			
BIOL 385	Principles of Animal Behavior	3.0	
BIOL 484	Mechanisms of An. Behavior	3.0	
--OR--			
BIOL 435	Animal Physiology	3.0	
BIOL 486	Behavioral Ecology	3.0	
--OR--			
BIOL 483	Applied Ethology	3.0	
BIOL 472	Seminar on Animal Behavior	1.0	
Practical Experience in Animal Behavior (1.0-4.0 credits)			
In consultation with your advisor, select a Co-op, internship, or research project in animal behavior.			
BIOL 300	400 or 500 Co-op	3.0	
BIOL 489	Honors Independent Study	1.0-4.0	
BIOL 498	Independent Study in Biology	1.0-3.0	
BIOL 499	Honors Thesis in Biology	1.0-4.0	
REQUIRED ELECTIVES (9.0-11.0 credits)			
In consultation with your advisor, select additional courses from Foundations, above, or from the list below that will best prepare you for your area of interest in animal behavior.			
Organism-Based Biology			
BIOL 295	Marine Invertebrates	3.0	
BIOL 346	Ornithology	3.0	
BIOL 396	Ichthyology	3.0	
BIOL 415	Mammology	3.0	
BIOL 416	Entomology	3.0	
BIOL 418	Aquatic Entomology	3.0	
Mechanisms of Behavior			
BIOL 318	Compar Vertebrate Anatomy	4.0	
BIOL 352	Nutritional Science	3.0	
BIOL 437	Endocrinology	3.0	
BIOL 438	Neurobiology	3.0	
Other Relevant Electives			
BIOL 329	Plant-Insect Interactions	3.0	
BIOL 443	Conservation Biology	3.0	

Course No.	Short Title	C.H.	Grade
REQUIRED RELATED (34.0 - 37.0 credits)			
Chemistry (16.0 credits)			
CHEM 111	Introductory Chemistry I	4.0	
CHEM 112	Introductory Chemistry II	4.0	
CHEM 235	Short Course Organic Chemistry	4.0	
CHEM 326	Biochemistry I	4.0	
--OR--			
CHEM 375	Environmental Chemistry	4.0	
Note: Students aiming for Veterinary Schools should take CHEM 231 and CHEM 232 in lieu of CHEM 235, and should take CHEM 326 rather than CHEM 375.			
Mathematics (4.0-5.0 credits)			
MATH 151	Calculus for Management	4.0	
--OR--			
MATH 161	Calculus I	4.0	
--OR--			
MATH 163	Honors Calculus	5.0	
Statistics (3.0 credits)			
BIOL 375	Biometry	3.0	
--OR--			
MATH 235	Survey of Statistics	3.0	
--OR--			
PSYC 211	Statistics & Exper Design I	3.0	
Physics (8.0 - 10.0 credits)			
PHYS 131	Physics I with Algebra	4.0	
PHYS 132	Physics II with Algebra	4.0	
	---- ---- OR ---- ----		
PHYS 231	Physics I with Calculus	5.0	
PHYS 232	Physics II with Calculus	5.0	
Pyschology (3.0 credits)			
PSCY 100	General Pyschology	3.0	

Note: Students may consider completing a minor in Pyschology. Particularly appropriate courses for biology majors include the following: PSYC 216, PSYC 315 and PSYC 316.

Additional Note: Students interested in Veterinary School should also take BIOL 461 General Microbiology.

BIOL-1302 FALL 2017

MILLERSVILLE UNIVERSITY

Student Name:_____ Student ID #_____

DEGREE:	BS	**MAJOR REQUIREMENTS FOR A BS DEGREE IN BIOLOGY: BOTANY**
MAJOR:	BIOL	Total credit hours required: 120.0 minimum
OPTION:	BOT	

REQUIREMENTS AND POLICIES FOR THE BS BIOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Biology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the Biology major (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described in the Undergraduate catalog. Students who were dropped from a Biology major also must satisfy the Biology Retention in the Major criteria before being readmitted to a Biology major.
3. Non-degree and continuing education students must be admitted to the Biology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. All Biology majors must earn grades of C- (C minus) or higher in all core courses (BIOL 101, 211, 221, 343, 362, 364) required for their option.
3. The requirements stated above must be satisfied before completion of 90 Millersville University credit hours.
4. Millersville University students changing majors, or Biology majors changing options within the Biology major, must satisfy the above requirements prior to completion of 45 additional Millersville University credit hours. Note: Students who desire to change their major to Biology must refer to the Biology department's Admission to the Major Policy. Those transferring into the major may substitute BIOL 100 for BIOL 101 if they earn a grade of B- (B minus) or higher in this course.
5. Transfer students with 60 credit hours or more must satisfy the above requirements prior to completion of 45 Millersville University credit hours. Transfer students with fewer than 60 credits should refer to the policy for all other majors (part 3 above).
6. Any students failing to meet the above requirements will be dropped from the Biology major. Students who wish to re-enter the major, must follow the requirements stipulated in part 4 above.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.
2. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curriculum Requirements.

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your adviser to be aware of changes and curriculum details which are not incorporated on this form.*

BI-510 FALL 2009.2

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS BIOLOGY**
Option: **BOTANY**
Major Field Requirements: **45.0 credits**
Other Requirements: **35.0-39.0credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

Course No.	Short Title	C.H.	Grade
REQUIRED BIOLOGY COURSES (24.0 credits)			
BIOL 101	Foundations of Biology	4.0	
BIOL 211	Concepts of Zoology	4.0	
BIOL 221	Concepts of Botany	4.0	
BIOL 343	Ecology & Evolution	4.0	
BIOL 362	Cell & Development	4.0	
BIOL 364	Genetics & Mol. Biology	4.0	
REQUIRED BOTANY COURSES (10.0-11.0 credits)			
BIOL 325	Plant Systematics	3.0	
BIOL 429	Develop Plant Biology	3.0	
BIOL 436	Plant Physiology	3.0	
BIOL 470	--- --- **AND** --- ---		
	Biology Colloquium	1.0-2.0	
BIOL 472	--- --- **OR** --- ---		
	Seminar in Biology	1.0-2.0	
BIOLOGY ELECTIVES (10.0-11.0 credits)			
In consultation with your advisor, choose additional courses at the 300 level or higher and approved for the biology major to bring total biology credits to 45.0.			
BIOL ___	_____		
BIOL ___	_____		
BIOL ___	_____		
BIOL ___	_____		
BIOL ___	_____		
BIOL ___	_____		

*Note: Those planning to apply to graduate or professional school should inquire about specific admissions requirements for the program of their choice.

Course No.	Short Title	C.H.	Grade
REQUIRED RELATED (35.0 - 39.0 credits)			
Chemistry (20.0 credits)			
CHEM 111*	Intro Chemistry I	4.0	
CHEM 112*	Intro Chemistry II	4.0	
CHEM 231*	Organic Chemistry I	4.0	
CHEM 232	Organic Chemistry II	4.0	
CHEM 326	Biochemistry I	4.0	

*Must earn a C- or better in these CHEM courses before completing CHEM 232.

Note: Those wishing to complete a Chemistry minor must complete CHEM 265 (Quantitative Analysis) in addition to those CHEM courses listed.

Mathematics & Computer Science (7.0-9.0 credits)

MATH 161	Calculus I	4.0	
	--- --- **or** --- ---		
MATH 163	Honors Calculus	5.0	
	--- ---**AND**--- ---		
MATH*	_____	___	
	--- --- **or** --- ---		
CSCI*	_____	4.0	

*Note: Only MATH courses numbered 160 or above OR CSCI courses numbered 140 or above may be used to fulfill these requirements.

Physics (8.0 - 10.0 credits)

PHYS 131	Physics I with Algebra	4.0	
PHYS 132	Physics II with Algebra	4.0	
	---- ---- **or** ---- ----		
PHYS 231	Physics I with Calculus	5.0	
PHYS 232	Physics II with Calculus	5.0	

General Electives (as necessary)

_____	_____	___	
_____	_____	___	
_____	_____	___	

MILLERSVILLE UNIVERSITY

Student Name:_____ Student I.D.#_____

DEGREE: BS
MAJOR: BIOL
OPTION: EBIO

MAJOR REQUIREMENTS FOR A BS DEGREE IN BIOLOGY: ENVIRONMENTAL BIOLOGY

Total credit hours required: 120.0 minimum

REQUIREMENTS AND POLICIES FOR THE BS BIOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Biology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the biology major (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described inthe Undergraduate Catalog. Students who were dropped from a Biology major also must satisfy the Biology Retention in the Major criteria before being readmitted to a Biology major.
3. Non-degree and continuing education students must be admitted to the Biology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. All Biology majors must earn grades of C- (C minus) or higher in all core courses (BIOL 101, 211, 221, 343, 362, 364) required for their option.
3. The requirements stated above must be satisfied before completion of 90 Millersville University credit hours.
4. Millersville University students changing majors, or Biology majors changing options within the Biology major, must satisfy the above requirements prior to completion of 45 additional Millersville University credit hours. Note: Students who desire to change their major to Biology must refer to the Biology department's Admission to the Major Policy. Those transferring into the major may substitute BIOL 100 for BIOL 101 if they earn a grade of B- (B minus) or higher in this course.
5. Transfer students with 60 credit hours or more must satisfy the above requirements prior to completion of 45 Millersville University credit hours. Transfer students with fewer than 60 credits should refer to the Biology department's Admission to the Major Policy.
6. Any students failing to meet the above requirements will be dropped from the Biology major. Students who wish to re-enter the major, must follow the requirements stipulated in part 4 above.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.
2. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curriculum Requirements.

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your advisor to be aware of changes and curriculum details which are not incorporated on this form.*

BIOL-1221 FALL 2017

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS BIOLOGY**
Option: **ENVIRONMENTAL BIOLOGY**
Major Field Requirements: **46.0 credits**
Other Requirements: **37.0 - 40.0 credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

REQUIRED BIOLOGY COURSES (24.0 credits)

Course No.		Short Title	C.H.	Grade
BIOL	101	Foundations of Biology	4.0	
BIOL	211	Concepts of Zoology	4.0	
BIOL	221	Concepts of Botany	4.0	
BIOL	343	Ecology & Evolution	4.0	
BIOL	362	Cell & Development	4.0	
BIOL	364	Genetics & Molecular Biology	4.0	

REQUIRED ENV BIOL COURSES (7.0-8.0 credits)

BIOL	344	Population Community Ecology	3.0	
BIOL	446	Ecosystems	3.0	
BIOL	472	Seminar (Env. Biology)	1.0-2.0	

DIRECTED ELECTIVES in Adv. Ecology (6.0 credits)

Select two of the following courses:

BIOL	325	Plant Systematics*	3.0	
BIOL	329	Plant/Insect Interactions	3.0	
BIOL	442	Wildlife Ecology & Management	3.0	
BIOL	443	Conservation Biology	3.0	
BIOL	445	Aquatic Biology	3.0	
BIOL	486	Behavioral Ecology	3.0	

NOTE: BIOL 325 is recommended.

Organismal Biology (3.0-4.0 credits)

In consultation with your advisor, choose one course from the following: BIOL 346, 396, 415, 416, 417, 418, 424, 461.

BIOL _____ _____ _____ _____

Practical Experience in Env. Biology (1.0-3.0 credits)

Choose one of the following for a minimum of 1.0 credit. Co-op must involve research approved by advisor, and result in co-op/ internship and scientific research papers.

BIOL	300	Co-op	3.0	
BIOL	489	Honors Independent Study	1.0-3.0	
BIOL	498	Independent Study in Biology	1.0-3.0	
BIOL	499	Honors Thesis in Biology	1.0-3.0	

Other BIOL Electives (1.0-5.0 credits to bring total Biology credits to 46.0)

In consultation with your advisor, choose additional courses that would count towards the Biology major. Note: BIOL 375 cannot be used as an elective if used to fulfill the statistics requirement in Required Related courses.

BIOL _____ _____ _____ _____
BIOL _____ _____ _____ _____

REQUIRED RELATED (37.0 - 40.0 credits)

Chemistry (16.0 credits)

Course No.		Short Title	C.H.	Grade
CHEM	111*	Introductory Chemistry I	4.0	
CHEM	112*	Introductory Chemistry II	4.0	
CHEM	235	Short Course Organic Chemistry	4.0	
CHEM	375	Environmental Chemistry I & Lab	4.0	

NOTE: CHEM 231* and CHEM 232 (total 8.0 credits) may substitute for CHEM 235.
*Must earn a C- or better in these courses before completing CHEM 235 or 232.

Mathematics (4.0 - 5.0 credits)

MATH	151	Calculus for Management	4.0	
--OR--				
MATH	161	Calculus I	4.0	
--OR--				
MATH	163	Honors Calculus	5.0	
AND				
BIOL	375*	Biometry	3.0	
--OR--				
MATH	235	Survey of Statistics	3.0	

*NOTE: Biometry is recommended.

Physics (8.0 credits)

PHYS	131	Physics I with Algebra	4.0	
PHYS	132	Physics II with Algebra	4.0	
		--- --- OR --- ---		
PHYS	231	Physics I with Calculus	5.0	
PHYS	232	Physics II with Calculus	5.0	

NOTE: Some graduate programs may require PHYS 231 and 232 (Physics with Calculus).

Environmental Science (6.0 - 8.0 credits)

Students are encouraged to complete a minor in environmental science and to choose courses from the list below that count in the desired minor. For more information on environmental minors, see: http://www.millersville.edu/ces/minors.php

CHEM	265	Quantitative Analysis	4.0	
CHEM	476	Environmental Chem II	4.0	
ESCI	281	GIS App for Earth Sciences	3.0	
ESCI	322	Hydrology	3.0	
ESCI	349	Chemistry of the Atmosphere	3.0	
GEOG	227	Urban Geography	3.0	
GEOG	281	Map Interpretation & Analysis	3.0	
GEOG	295	Geo. Information Systems	3.0	
GEOG	304	Water Resources Mgmt	3.0	
GEOG	306	Environment Impact Assess	3.0	
GEOG	372	Urban & Reg Planning	3.0	
OSEH	220	Legal Aspects Environ Safe	3.0	
OSEH	321	Environ & Indus Health	3.0	

MILLERSVILLE UNIVERSITY

Student Name:_____ Student I.D.#_____

DEGREE: BS MAJOR: BIOL OPTION: MAR	**MAJOR REQUIREMENTS FOR A BS DEGREE IN BIOLOGY: MARINE BIOLOGY** Total credit hours required: 120.0 minimum

REQUIREMENTS AND POLICIES FOR THE BS BIOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Biology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the Biology major (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described in the Undergraduate Catalog. Students who were dropped from a Biology major also must satisfy the Biology Retention in the Major criteria before being readmitted to a Biology major.
3. Non-degree and continuing education students must be admitted to the Biology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. All Biology majors must earn grades of C- (C minus) or higher in all core courses (BIOL 101, 211, 221, 343, 362, 364) required for their option.
3. The requirements stated above must be satisfied before completion of 90 Millersville University credit hours.
4. Millersville University students changing majors, or Biology majors changing options within the Biology major, must satisfy the above requirements prior to completion of 45 additional Millersville University credit hours. Note: Students who desire to change their major to Biology must refer to the Biology department's Admission to the Major Policy. Those transferring into the major may substitute BIOL 100 for BIOL 101 if they earn a grade of B- (B minus) or higher in this course.
5. Transfer students with 60 credit hours or more must satisfy the above requirements prior to completion of 45 Millersville University credit hours. Transfer students with fewer than 60 credits should refer to the policy for all other majors (part #3 above).
6. Any student failing to meet the above requirements will be dropped from the Biology major. Students who wish to re-enter the major, must follow the requirements stipulated in part 4 above.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.
2. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curriculum Requirements.

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your advisor to be aware of changes and curriculum details which are not incorporated on this form.*

BIOL-527 FALL 2017

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS BIOLOGY**
Option: **MARINE BIOLOGY**
Major Field Requirements: **47.0 credits**
Other Requirements: **31.0 - 35.0 credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

Course No.	Short Title	C.H.	Grade
REQUIRED BIOLOGY COURSES (24.0 credits)			
BIOL 101	Foundations of Biology	4.0	
BIOL 211	Concepts of Zoology	4.0	
BIOL 221	Concepts of Botany	4.0	
BIOL 343	Ecology and Evolution	4.0	
BIOL 362	Cell & Development	4.0	
BIOL 364	Genetics & Molecular Biology	4.0	
REQUIRED MARINE BIOLOGY COURSES (17.0-18.0 credits)			
BIOL 291	Marine Biology	4.0	
--OR--			
BIOL 290	Coastal Marine Biology *	3.0	
--and--			
BIOL 292	Problem Solving Marine Biol *	1.0	
BIOL 295	Marine Invertebrates	3.0	
BIOL 375	Biometry	3.0	
BIOL 396	Ichthyology	3.0	
BIOL 472	Marine Biology Seminar	1.0-2.0	
BIOL 495/ ESCI 465	Biological Oceanography	3.0	
BIOLOGY ELECTIVES (5.0-6.0 credits)			
In consultation with your advisor, chooose additional courses at the 300-level or higher and approved for BIOL majors to bring total BIOL credits to 47.			
BIOL ___	_____	____	____
BIOL ___	_____	____	____
BIOL ___	_____	____	____
FIELD COURSES			
At least 2 courses (6 credits) of a student's biology courses (required marine biology courses or biology electives) must be taken at a marine field station.			

Course No.	Short Title	C.H.	Grade
REQUIRED RELATED (31.0 - 35.0 credits)			
Chemistry & Earth Sciences (19.0-20.0 credits)			
ESCI 261	Intro to Oceanography	4.0	
CHEM 111*	Introductory Chemistry I	4.0	
CHEM 112*	Introductory Chemistry II	4.0	
CHEM 235	Short Course Organic Chemistry	4.0	
--AND--			
CHEM 375	Environmental Chemistry	4.0	
--or--			
ESCI 363	Chemical Oceanography	3.0	
Note: CHEM 231* and CHEM 232 (total of 8.0 credits) may substitute for CHEM 235.			
*Must earn a C- or better in these courses before completing CHEM 235 or 231.			
Mathematics (4.0 - 5.0 credits)			
MATH 151	Calculus for Mgmt, Life & SS	4.0	
--OR--			
MATH 161	Calculus I	4.0	
--OR--			
MATH 163	Honors Calculus	5.0	
Physics (8.0-10.0 credits)			
PHYS 131	Physics I with Algebra	4.0	
PHYS 132	Physics II with Algebra	4.0	
--OR--			
PHYS 231	Physics I with Calculus	5.0	
PHYS 232	Physics II with Calculus	5.0	
Note: Students are encouraged to consider completing a minor in Oceanography and, in consultation with their advisor, to take further courses in mathematics.			
General Electives (as necessary)			
_____	_____	____	____
_____	_____	____	____
_____	_____	____	____
_____	_____	____	____

MILLERSVILLE UNIVERSITY

Student Name:_____ Student I.D.#_____

DEGREE:	BS	**MAJOR REQUIREMENTS FOR A BS DEGREE IN BIOLOGY: MEDICAL TECHNOLOGY**
MAJOR:	BIOL	Total credit hours required: 120.0 minimum
OPTION:	MEDT	

REQUIREMENTS AND POLICIES FOR THE BS BIOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Biology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the Biology major (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described in the Undergraduate Catalog. Students who were dropped from a Biology major also must satisfy the Biology Retention in the Major criteria before being readmitted to a Biology major.
3. Non-degree and continuing education students must be admitted to the Biology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. All Biology majors must earn grades of C- (C minus) or higher in all core courses (BIOL 101, 211, 362, 364) required for their option.
3. The requirements stated above must be satisfied before completion of 90 Millersville University credit hours.
4. Millersville University students changing majors, or Biology majors changing options within the Biology major, must satisfy the above requirements prior to completion of 45 additional Millersville University credit hours. Note: Students who desire to change their major to Biology must refer to the Biology department's Admission to the Major Policy. Those transferring into the major may substitute BIOL 100 for BIOL 101 if they earn a grade of B- (B minus) or higher in this course.
5. Transfer students with 60 credit hours or more must satisfy the above requirements prior to completion of 45 Millersville University credit hours. Transfer students with fewer than 60 credits should refer to the policy for all other majors (part #3 above).
6. Any students failing to meet the above requirements will be dropped from the Biology major. Students who wish to re-enter the major, must follow the requirements stipulated in part 4 above.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.
2. Degree will be awarded after student has successfully completed a year of clinical education at an approved Medical Technology school.
3. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curruculum Requirements.

D. Admission to the clinical program is competitive and is not guaranteed.

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your adviser to be aware of changes and curriculum details which are not incorporated on this form.*

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS BIOLOGY**
Option: **MEDICAL TECHNOLOGY (Clinical Labratory Science)**
Major Field Requirements: **60.0 credits**
Other Requirements: **24.0-25.0 credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

Course No.	Short Title	C.H.	Grade	Q.P.

REQUIRED BIOLOGY COURSES (16.0 credits)

BIOL	101	Foundations of Biology	4.0	____	____
BIOL	211	Concepts of Zoology	4.0	____	____
BIOL	362	Cell & Development	4.0	____	____
BIOL	364	Genetics & Mol. Biology	4.0	____	____

REQUIRED MEDICAL TECH COURSES (6.0 credits)

BIOL	257	Intro to Allied Health	1.0	____	____
BIOL	454	Immunology	2.0	____	____
BIOL	461	General Microbiology	3.0	____	____

BIOLOGY ELECTIVES (8.0 credits)

BIOL 356 or 254 & 255; and BIOL 375 are strongly recommended.

BIOL	___	_____	____	____	____
BIOL	___	_____	____	____	____
BIOL	___	_____	____	____	____

CLINICAL LAB SCIENCE EDUCATION (30.0 credits)

Upon completion of one year of Clinical Laboratory Science education at an affiliated hospital site, 30.0 credit hours will be credited toward the B.S. degree in Biology with the Medical Technology (Clinical Laboratory Science) option.

Clinical Laboratory Science Courses (30 credits) ☐

Course No.	Short Title	C.H.	Grade	Q.P.

REQUIRED RELATED (24.0-25.0 credits)

Chemistry (16.0 credits)

CHEM	111*	Intro to Chemistry I	4.0	____	____
CHEM	112*	Intro to Chemistry II	4.0	____	____
CHEM	235	Short Course Org. Chem	4.0	____	____
CHEM	326	Biochemistry I	4.0	____	____

Note: CHEM 231* and CHEM 232 (total 8.0 credits) may substitute for CHEM 235.
* Must earn a C- or better in these CHEM courses before completing CHEM 235 or CHEM 232.

Note: Those wishing to complete a Chemistry Minor must complete CHEM 265 (Quantitative Analysis) in addition to those Chemistry courses listed above.

Note: Students who are considering going to graduate school or attending medical, dental, veterinary school or wanting to enroll in school to become a pharmacist, physical therapist, or physician assistant after completing their clinical training SHOULD TAKE CHEM 231 and 232.

Mathematics (4.0 - 5.0 credits)

MATH	160	Precalculus	4.0	____	____
		---- ---- **or** ---- ----			
MATH	161	Calculus I	4.0	____	____
		---- ---- **or** ---- ----			
MATH	163	Honors Calculus	5.0	____	____

NOTE: Some clinical sites require a course in statistics, such as MATH 130, MATH 235, or BIOL 375.

NOTE: Students who might be interested in graduate school or professional school after their clinical program SHOULD TAKE MATH 161.

Physics (4.0 credits)

PHYS	131	Physics 1 with Algebra	4.0	____	____

NOTE: Students who might be interested in attending graduate school or professional school after completing their clinical program SHOULD ALSO TAKE PHYS 132.

Suggested Additional Course (no minimum)

PSYC	100	General Psychology	3.0	____	____

NOTE: Students considering going to graduate school or attending medical, dental, veterinary school or wanting to enroll in school to become a pharmacist, physical therapist, or physician assistant after completing their clinical training SHOULD ALSO consider taking General Psychology (PSYC 100), which can be used toward the G3 general education requirement.

General Electives (as necessary)

_____	_____	____	____	____
_____	_____	____	____	____

BI-624 FALL 2009.2

MILLERSVILLE UNIVERSITY

Student Name:_____ Student I.D.#_____

DEGREE: BS
MAJOR: BIOL
OPTION: MOL

MAJOR REQUIREMENTS FOR A BS DEGREE IN BIOLOGY: MOLECULAR/BIOTECHNOLOGY

Total credit hours required: 120.0 minimum

REQUIREMENTS AND POLICIES FOR THE BS BIOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Biology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the Biology major (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described in the Undergraduate Catalog. Students who were dropped from a Biology major must satisfy the Biology Retention in the Major criteria before being readmitted to a Biology major.
3. Non-degree and continuing education students must be admitted to the Biology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. All Biology majors must earn grades of C- (C minus) or higher in all core courses (BIOL 101, 211, 221, 343, 362, 364) required for their option.
3. The requirements stated above must be satisfied before completion of 90 Millersville University credit hours.
4. Millersville University students changing majors, or Biology majors changing options within the Biology major, must satisfy the above requirements prior to completion of 45 additional Millersville University credit hours. Note: Students who desire to change their major to Biology must refer to the Biology department's Admission to the Major Policy. Those transferring into the major may substitute BIOL 100 for BIOL 101 if they earn a grade of B- (B minus) or higher in this course.
5. Transfer students with 60 credit hours or more must satisfy the above requirements prior to completion of 45 Millersville University credit hours. Transfer students with fewer than 60 credits should refer to the policy for all other majors (part #3 above).
6. Any students failing to meet the above requirements will be dropped from the Biology major. Students who wish to re-enter the major, must follow the requirements stipulated in part 4 above.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.
2. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curriculum Requirements.

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your adviser to be aware of changes and curriculum details which are not incorporated on this form.*

BI-328 FALL 2010.2

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS BIOLOGY**
Option: **MOLECULAR/BIOTECHNOLOGY**
Major Field Requirements: **39.0 credits**
Other Requirements: **39.0-43.0 credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

Course No.	Short Title	C.H.	Grade	Q.P.
REQUIRED BIOLOGY COURSES (24.0 credits)				
BIOL 101	Foundations of Biology	4.0		
BIOL 211	Concepts of Zoology	4.0		
BIOL 221	Concepts of Botany	4.0		
BIOL 343	Ecology & Evolution	4.0		
BIOL 362	Cell & Development	4.0		
BIOL 364	Genetics & Mol. Biology	4.0		
REQUIRED MOL/BIOLTECH COURSES (8.0-9.0 credits)				
BIOL 462	Molecular Biology	4.0		
BIOL 466	Molecular/Cell Tech	3.0		
BIOL 472	Seminar in Biology(Mol)	1.0-2.0		
BIOLOGY ELECTIVES (6.0-7.0 credits)				
In consultation with your advisor, choose additional courses at the 300-level or higher and approved for BIOL majors to bring total BIOL credits to 39. The following courses are recommended.				
BIOL 463	Virology	4.0		
BIOL 465	Developmental BIOL	3.0		
BIOL 467	Human Genetics	3.0		
BIOL ___	_____	___		
BIOL ___	_____	___		
BIOL ___	_____	___		
BIOL ___	_____	___		

Course No.	Short Title	C.H.	Grade	Q.P.
REQUIRED RELATED (39.0-43.0 credits)				
Chemistry (24.0 credits)				
CHEM 111*	Intro to Chemistry I	4.0		
CHEM 112*	Intro to Chemistry II	4.0		
CHEM 231*	Organic Chemistry I	4.0		
CHEM 232	Organic Chemistry II	4.0		
CHEM 326**	Biochemistry I	4.0		
	---AND---			
CHEM 327	Biochemistry II	4.0		
	----OR----			
BIOL/CHEM 324	Plant Biochemistry	4.0		

NOTE: A student may complete a Biochemistry minor by completing CHEM 328 (Analytical Biochemistry Laboratory) in addition to all the above Chemistry courses OR a student may complete a Chemistry minor by completing CHEM 265 (Quantitative Analysis) in addition to CHEM 111, 112, 231 and 232.

*Must earn a C- or better in these courses before completing CHEM 232.
** Must earn a C- or better in CHEM 326 before completing CHEM 327.

Mathematics & Computer Science (7.0 - 9.0 credits)				
MATH 161	Calculus I	4.0		
	---- ---- or ---- ----			
MATH 163	Honors Calculus	5.0		
	---- ---- **AND** ---- ----			
MATH* ___	_____	___		
	---- ---- **or** ---- ----			
CSCI* ___	_____	4.0		
Physics (8.0 - 10.0 credits)				
PHYS 131	Physics I with Algebra	4.0		
PHYS 132	Physics II with Algebra	4.0		
	---- ---- **or** ---- ----			
PHYS 231	Phys I with Calculus	5.0		
PHYS 232	Phys II with Calculus	5.0		
General Electives (As necessary)				
_____	_____	___		
_____	_____	___		
_____	_____	___		

*Note: Only MATH courses numbered 160 or above OR CSCI courses numbered 140 or above may be used to fulfill these requirements.

MILLERSVILLE UNIVERSITY

Student Name:_____ Student I.D.#_____

DEGREE: BS
MAJOR: BIOL
OPTION: NUCM

MAJOR REQUIREMENTS FOR A BS DEGREE IN BIOLOGY: NUCLEAR MEDICINE TECHNOLOGY

Total credit hours required: 120.0 minimum

REQUIREMENTS AND POLICIES FOR THE BS BIOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Biology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the Biology major (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described in the Undergraduate Catalog. Students who were dropped from a Biology major also must satisfy the Biology Retention in the Major criteria before being readmitted to a Biology major.
3. Non-degree and continuing education students must be admitted to the Biology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. All Biology majors must earn grades of C- (C minus) or higher in all core courses (BIOL 101, 211, 362, 364) required for their option.
3. The requirements stated above must be satisfied before completion of 90 Millersville University credit hours.
4. Millersville University students changing majors, or Biology majors changing options within the Biology major, must satisfy the above requirements prior to completion of 45 additional Millersville University credit hours. Note: Students who desire to change their major to Biology must refer to the Biology department's Admission to the Major Policy. Those transferring into the major may substitute BIOL 100 for BIOL 101 if they earn a grade of B- (B minus) or higher in this course.
5. Transfer students with 60 credit hours or more must satisfy the above requirements prior to completion of 45 Millersville University credit hours. Transfer students with fewer than 60 credits should refer to the policy for all other majors (part #3 above).
6. Any students failing to meet the above requirements will be dropped from the Biology major. Students who wish to re-enter the major, must follow the requirements stipulated in part 4 above.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.
2. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curriculum Requirements.

D. Admission to the clinical program is competitive and is not guaranteed.

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your adviser to be aware of changes and curriculum details which are not incorporated on this form.*

BI-724 FALL 2009.2

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS BIOLOGY**
Option: **NUCLEAR MEDICINE TECHNOLOGY**
Major Field Requirements: **53.0 credits**
Other Requirements: **28.0 - 31.0 credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

Course No.	Short Title	C.H.	Grade	Q.P.
REQUIRED BIOLOGY COURSES (16.0 credits)				
BIOL 101	Foundations of Biology	4.0		
BIOL 211	Concepts of Zoology	4.0		
BIOL 362	Cell & Development	4.0		
BIOL 364	Genetics & Mol. Biology	4.0		
REQUIRED NUC. MED. COURSES (9.0 credits)				
BIOL 257	Intro to Allied Health	1.0		
BIOL 356	Functional Human Anat	5.0		
BIOL 375	Biometry	3.0		
NUCLEAR MED CLINICAL EDUCATION (28.0 credits)				

Upon completion of one year at the Lancaster General Hospital College of Nursing and Allied Health, 28.0 credit hours will be credited toward the B.S. degree in Biology with the Nuclear Medicine Technology option.

Lancaster General Hospital College of Nursing and Allied Health 28.0 credits ❑

Course No.	Short Title	C.H.	Grade	Q.P.
REQUIRED RELATED (28.0 - 31.0 credits)				
Chemistry (16.0 credits)				
CHEM 111*	Intro to Chemistry I	4.0		
CHEM 112*	Intro to Chemistry II	4.0		
CHEM 235	Short Course Org Chem	4.0		
CHEM 326	Biochemistry I	4.0		

Note: CHEM 231* and CHEM 232 (total 8.0 credits) may substitute for CHEM 235.
* Must earn a C- or better in these CHEM courses before completing CHEM 235 or 232.

Note: Those wishing to complete a Chemistry minor must complete CHEM 265 (Quantitative Analysis) in addition to those CHEM courses listed.

Note: Students who are considering going to graduate school or attending medical, dental, veterinary school or wanting to enroll in school to become a pharmacist, physical therapist, or physician assistant after completing their clinical training SHOULD ALSO TAKE CHEM 231 and 232.

Mathematics (4.0 - 5.0 credits)				
MATH 160	Precalculus	4.0		
	---- ---- **or** ---- ----			
MATH 161	Calculus I	4.0		
	---- ---- **or** ---- ----			
MATH 163	Honors Calculus	5.0		

Note: Students who are considering going to graduate school or professional school after their clinical program SHOULD TAKE MATH 161.

Physics (8.0 - 10.0 credits)				
PHYS 131	Physics I with Algebra	4.0		
PHYS 132	Physics II with Algebra	4.0		
	---- ---- **or** ---- ----			
PHYS 231	Physics I with Calculus	5.0		
PHYS 232	Physics II with Calculus	5.0		

General Electives (as necessary)

MILLERSVILLE UNIVERSITY

Student Name:_____ Student I.D.#_____

DEGREE: BS
MAJOR: BIOL
OPTION: POPT

MAJOR REQUIREMENTS FOR A BS DEGREE IN BIOLOGY: PRE-OPTOMETRY

Total credit hours required: 120.0 minimum

REQUIREMENTS AND POLICIES FOR THE BS BIOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Biology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the biology major (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described in the Undergraduate Catalog. Students who were dropped from a Biology major also must satisfy the Biology Retention in the Major criteria before being readmitted to a Biology major.
3. Non-degree and continuing education students must be admitted to the Biology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. All Biology majors must earn grades of C- (C minus) or higher in all core courses (BIOL 101, 211, 362, 364) required for their option.
3. The requirements stated above must be satisfied before completion of 90 Millersville University credit hours.
4. Millersville University students changing majors, or Biology majors changing options within the Biology major, must satisfy the above requirements prior to completion of 45 additional Millersville University credit hours. Note: Students who desire to change their major to Biology must refer to the Biology department's Admission to the Major Policy. Those transferring into the major may substitute BIOL 100 for BIOL 101 if they earn a grade of B- (B minus) or higher in this course.
5. Transfer students with 60 credit hours or more must satisfy the above requirements prior to completion of 45 Millersville University credit hours. Transfer students with fewer than 60 credits should refer to the policy for all other majors (part #3 above).
6. Any students failing to meet the above requirements will be dropped from the Biology major. Students who wish to re-enter the major, must follow the requirements stipulated in part 4 above.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.
2. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curriculum Requirements.

D. Admission to the Pennsylvania College of Optometry at Salus University is competitive and is not guaranteed.

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your adviser to be aware of changes and curriculum details which are not incorporated on this form.*

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS BIOLOGY**
Option: **PRE-OPTOMETRY**
Major Field Requirements: **46.0-47.0 credits**
Other Requirements: **35.0-39.0 credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

Course No.	Short Title	C.H.	Grade	Q.P.
REQUIRED BIOLOGY COURSES (16.0 credits)				
BIOL 101	Foundations of Biology	4.0		
BIOL 211	Concepts of Zoology	4.0		
BIOL 362	Cell & Development	4.0		
BIOL 364	Genetics & Mol. Biology	4.0		
REQUIRED PRE-OPTOMETRY COURSES (7.0-8.0 credits)				
BIOL 375	Biometry	3.0		
BIOL 461	General Microbiology	3.0		
BIOL 472	Seminar in Biology	1.0-2.0		

OPTOMETRY CLINICAL EDUCATION (23.0 credits)

Upon completion of one year at the Pennsylvania College of Optometry at Salus University, 23.0 credit hours will be credited toward the B.S. degree in Biology with the Pre-Optometry Option.

Pennsylvania College of Optometry at Salus University

23.0 credits ☐

Course No.	Short Title	C.H.	Grade	Q.P.
REQUIRED RELATED (35.0-39.0 credits)				
Chemistry (20.0 credits)				
CHEM 111*	Intro to Chemistry I	4.0		
CHEM 112*	Intro to Chemistry II	4.0		
CHEM 231*	Organic Chemistry I	4.0		
CHEM 232	Organic Chemistry II	4.0		
CHEM 326	Biochemistry I	4.0		

*Must earn a C- or better in these CHEM courses before completing CHEM 232

Note: Those wishing to complete a Chemistry minor must complete CHEM 265 (Quantitative Analysis) in addition to those Chemistry courses listed.

Mathematics & Computer Science (7.0 - 9.0 credits)

MATH 161	Calculus I	4.0		
	---- ---- or ---- ----			
MATH 163	Honors Calculus	5.0		
	---- ---- AND ---- ----			
MATH* ___	_____	___		
	---- ---- or ---- ----			
CSCI* ___	_____	___		

*Note: Only MATH courses numbered 160 or above OR CSCI courses numbered 140 or above may be used to fulfill these requirements.

Physics (8.0 - 10.0 credits)

PHYS 131	Physics I with Algebra	4.0		
PHYS 132	Physics II with Algebra	4.0		
	---- ---- or ---- ----			
PHYS 231	Physics I with Calculus	5.0		
PHYS 232	Physics II with Calculus	5.0		

Recommended Psychology Course (G3)

PSYC 100	General Psychology	3.0		

*Note: PSYC 100 will count towards the G3 general education requirement.

General Electives (as necessary)

_____	_____	___		
_____	_____	___		
_____	_____	___		

MILLERSVILLE UNIVERSITY

Student Name:_____ Student I.D.#_____

DEGREE: BS
MAJOR: BIOL
OPTION: PPOD

MAJOR REQUIREMENTS FOR A BS DEGREE IN BIOLOGY: PRE-PODIATRY

Total credit hours required: 120.0 minimum

REQUIREMENTS AND POLICIES FOR THE BS BIOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Biology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the biology major (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described in the Undergraduate Catalog. Students who were dropped from a Biology major also must satisfy the Biology Retention in the Major criteria before being readmitted to a Biology major.
3. Non-degree and continuing education students must be admitted to the Biology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. All Biology majors must earn grades of C- (C minus) or higher in all core courses (BIOL 101, 211, 362, 364) required for their option.
3. The requirements stated above must be satisfied before completion of 90 Millersville University credit hours.
4. Millersville University students changing majors, or Biology majors changing options within the Biology major, must satisfy the above requirements prior to completion of 45 additional Millersville University credit hours. Note: Students who desire to change their major to Biology must refer to the Biology department's Admission to the Major Policy. Those transferring into the major may substitute BIOL 100 for BIOL 101 if they earn a grade of B- (B minus) or higher in this course.
5. Transfer students with 60 credit hours or more must satisfy the above requirements prior to completion of 45 Millersville University credit hours. Transfer students with fewer than 60 credits should refer to the policy for all other majors (part #3 above).
6. Any students failing to meet the above requirements will be dropped from the Biology major. Students who wish to re-enter the major, must follow the requirements stipulated in part 4 above.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.
2. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curriculum Requirements.

D. Admission to the clinical program is competitive and is not guaranteed.

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your adviser to be aware of changes and curriculum details which are not incorporated on this form.*

BI-822 FALL 2009.2

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS BIOLOGY**
Option: **PRE-PODIATRY**
Major Field Requirements: **49.0 credits**
Other Requirements: **32.0-35.0 credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

Course No.	Short Title	C.H.	Grade	Q.P.
REQUIRED BIOLOGY COURSES (16.0 credits)				
BIOL 101	Foundations of Biology	4.0		
BIOL 211	Concepts of Zoology	4.0		
BIOL 362	Cell & Development	4.0		
BIOL 364	Genetics & Mol. Biology	4.0		
REQUIRED PRE-PODIATRY COURSES (9.0 credits)				
BIOL 257	Intro to Allied Health	1.0		
BIOL 356	Functional Human Anat	5.0		
BIOL 435	Animal Physiology	3.0		

PODIATRY CLINICAL EDUCATION (24.0 credits)

Upon completion of one year at Temple University College of Podiatric Medicine, 24.0 credit hours will be credited toward the B.S. degree in Biology with the Pre-podiatry option.

Temple U. College of Podiatric Med. (24.0 credits) ❑

Course No.	Short Title	C.H.	Grade	Q.P.
REQUIRED RELATED (32.0-35.0 credits)				
Chemistry (20.0 credits)				
CHEM 111*	Intro to Chemistry I	4.0		
CHEM 112*	Intro to Chemistry II	4.0		
CHEM 231*	Organic Chemistry I	4.0		
CHEM 232	Organic Chemistry II	4.0		
CHEM 326	Biochemistry I	4.0		

* Must earn a C- or higher in these CHEM courses before completing CHEM 232.

Note: Those wishing to complete a Chemistry minor must complete CHEM 265 (Quantitative Analysis) in addition to those Chemistry courses listed.

Mathematics (4.0-5.0 credits)

MATH	161	Calculus I	4.0		
		---- ---- or ---- ----			
MATH	163	Honors Calculus	5.0		

Physics (8.0 - 10.0 credits)

PHYS	131	Physics I with Algebra	4.0		
PHYS	132	Physics II with Algebra	4.0		
		---- ---- or ---- ----			
PHYS	231	Physics I with Calculus	5.0		
PHYS	232	Physics II with Calculus	5.0		

Recommended General Education Courses (G3)

PSYC	___	_____	___	___	___
PSYC	___	_____	___	___	___
SOCY	___	_____	___	___	___

Note: Many Psychology and Sociology courses will count towads the G3 general education requirement.

General Electives (as necessary)

_____	_____	___	___	___
_____	_____	___	___	___
_____	_____	___	___	___
_____	_____	___	___	___
_____	_____	___	___	___

MILLERSVILLE UNIVERSITY

Student Name:_____ Student I.D.#_____

DEGREE:	BS	**MAJOR REQUIREMENTS FOR A BS DEGREE IN BIOLOGY: RESPIRATORY THERAPY**
MAJOR:	BIOL	
OPTION:	RESP	Total credit hours required: 120.0 minimum

REQUIREMENTS AND POLICIES FOR THE BS BIOLOGY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Biology major by the Office of Admissions upon admission to the University.
2. Admission of Millersville University students to the biology major (from other departments or undeclared status) requires that the student is in satisfactory academic standing as described in the Undergraduate Catalog. Students who were dropped from a Biology major also must satisfy the Biology Retention in the Major criteria before being readmitted to a Biology major.
3. Non-degree and continuing education students must be admitted to the Biology major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention must be met.
2. Admission to the professional phase of the Respiratory Therapy program is competitive and not guaranteed. Biology majors in the Respiratory Therapy option must earn grades of C- (C minus) or higher in all required Biology and required-related courses (BIOL 101, 356, 362, 461; CHEM 111, 112, 235, 326; MATH 161 or 163; PHYS 131 or 231), a satisfactory (S) grade in BIOL 257, and have a minimum GPA of 2.3 in these courses. Students must also maintain an overall GPA of 2.0.
3. BS Biology Respiratory Therapy students who meet the minimum math/science GPA of 2.3 can schedule an interview with the admission committee for the professional phase of the Respiratory Therapy program. The committee will assess students on her/his academic performance, letters of recommendation, communication skills, understanding of the profession, maturity, and potential to succeed in the professional phase of the program. Students who score poorly during her/his interview may be denied admission to the professional phase of the program even if she/he has met the minimum math/science GPA requirement. Students denied admission into the professional phase of the program will be advised on how he/she can strengthen her/his credentials for re-application the following year or how she/he can complete the degree requirements for an alternative program. If seats are available in the professional phase of the program, students who have not met the minimum math/science GPA may be interviewed and, if accepted, will be admitted on a probationary basis.
4. The requirements stated above must be satisfied before completion of 90 Millersville University credit hours.
5. Millersville University students changing majors, or Biology majors changing options within the Biology major, must satisfy the above requirements prior to completion of 45 additional Millersville University credit hours.
   Note: Students who desire to change their major to Biology may substitute BIOL 100 for BIOL 101 if they earn a grade of B- (B minus) or higher in this course.
6. Transfer students with 60 credit hours or more must satisfy the above requirements prior to completion of 45 Millersville University credit hours. Transfer students with fewer than 60 credits should refer to the policy for all other majors (part 4 above).
7. Any students failing to meet the above requirements will be dropped from the Biology major. Students who wish to re-enter the major, must follow the requirements stipulated in part 5 above.

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.
2. ENGL 312, Technical Writing, is the recommended course for the Upper Level Writing Requirement under the General Education Curriculum Requirements.

D. Admission to the professional phase is competitive and is not guaranteed (see part B above).

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your advisor to be aware of changes and curriculum details which are not incorporated on this form.*

BI-924 SUMMER 2015

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS BIOLOGY**
Option: **RESPIRATORY THERAPY**
Major Field Requirements: **53.0 credits**
Other Requirements: **24.0-26.0 credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

Course No.	Short Title	C.H.	Grade
REQUIRED BIOLOGY COURSES (12.0 credits)			
BIOL 101	Foundations of Biology	4.0	
BIOL 362	Cell & Development	4.0	
BIOL 364	Genetics & Molecular Biology	4.0	
REQUIRED RESP THER COURSES (9.0 credits)			
BIOL 257	Intro Allied Health Professions	1.0	
BIOL 356	Functional Human Anatomy	5.0	
BIOL 461	General Microbiology	3.0	
RESP THER PROFESSIONAL PHASE I (32.0 credits)			
Upon completion of 32.0 credit hours of clinical coursework at the Lancaster Regional Medical Center (MU/LRMC Consortium), 32.0 credit hours will be credited toward the B.S. degree in Biology with the Respiratory Therapy option.			
RESP 410	Acute Cardiopulmonary Care	2.0	
RESP 411	Respiratory Care Techniques I	2.0	
RESP 412	Prin. Aerosol & Gas Therapy	3.0	
RESP 413	Respiratory Assess & Therap.	4.0	
RESP 414	Respiratory Care Techniques II	3.0	
RESP 419	Respiratory Care in Alt Sites	2.0	
RESP 420	Arterial Blood Gas Analysis	3.0	
RESP 421	Physio Mechanical Ventilation	2.0	
RESP 422	Pharmacology	2.0	
RESP 423	Infectious Diseases	2.0	
RESP 424	Noninfectious Diseases	2.0	
RESP 425	Neonatology for Resp Therapist	2.0	
RESP 460	Clinical Practice I	1.0	
RESP 461	Clinical Practicum I	2.0	
After completion of the Phase I coursework, the student may graduate with a B.S. degree in Biology, Respiratory Therapy; however, the graduate must complete the Phase II coursework in order to be employed and certified as a respiratory therapist.			
RESP THER PROFESSIONAL PHASE II (25.0 credits)			
Following the completion of 25.0 credit hours of Phase II coursework at Lancaster Regional Medical Center, the student will receive a Respiratory Therapy certificate, which will permit them to seek employment as a respiratory therapist and qualifies them to take the certification exam.			
BIOL 352	Nutritional Science	3.0	
RESP 415	Tech Aspects Mech Ventilation	3.0	
RESP 417	Respiratory Care Techniques III	3.0	
RESP 462	Clinical Practice II	1.0	
RESP 463	Clinical Practicum II	3.0	
RESP 464	Clinical Practicum III	10.0	
RESP 495	Respiratory Care Research	2.0	

Course No.	Short Title	C.H.	Grade
REQUIRED RELATED (24.0-26.0 credits)			
Chemistry (16.0 credits)			
CHEM 111*	Introductory Chemistry I	4.0	
CHEM 112*	Introductory Chemistry II	4.0	
CHEM 235	Short Course Organic Chem	4.0	
CHEM 326	Biochemistry I	4.0	
Note: CHEM 231* and CHEM 232 (total 8.0 credits) may substitute for CHEM 235. *Must earn a C- or better in these CHEM courses before completing CHEM 235 or CHEM 232.			
Note: Those wishing to complete a Chemistry minor must complete CHEM 265 (Quantitative Analysis) in addition to those Chemistry courses listed above.			
Note: Students who are considering going to graduate school or attending medical, dental, veterinary school or wanting to enroll in school to become a pharmacist, physical therapist, or physician assistant after completing their professional phase SHOULD TAKE CHEM 231 and 232.			
Mathematics (4.0 - 5.0 credits)			
MATH 161	Calculus I	4.0	
	---- ---- or ---- ----		
MATH 163	Honors Calculus	5.0	
Physics (4.0-5.0 credits)			
PHYS 131	Physics I with Algebra	4.0	
	---- ---- or ---- ----		
PHYS 231	Physics I with Calculus	5.0	
Note: Students who might be interested in attending graduate school or professional school after completing their professional phase SHOULD ALSO TAKE PHYS 132 OR PHYS 232.			
Suggested Additional Course (no minimum)			
PSYC 100	General Psychology	3.0	
Note: Students who are considering going to graduate school or attending medical, dental, veterinary school or wanting to enroll in school to become a pharmacist, physical therapist, or physician assistant after completing their professional phase SHOULD ALSO consider taking General Psychology (PSYC 100), which can be used toward the G3 general education requirement.			
General Electives (as necessary)			

Sample Student Schedules

The schedules on the following pages are idealized. Each provides one example of how courses could be scheduled to enable completion of degree requirements within four years (eight semesters). There are certainly alternative schedules that could also achieve this goal. Although included in some of the sample schedules, credit loads above 16 hours per semester are not recommended. Students may want to consider taking winter or summer courses to lighten course loads and improve learning.

The sample schedule marked "highly prepared at admission" is designed for a student who enters Millersville University with a strong background in biology, chemistry and math that allows them to take Chem 111 and Math 161 or 160 during their first semester as a freshman. Schedules marked "less prepared at admission" are designed for students who will benefit by completing prerequisite courses before enrolling in these more advanced science classes.

If you have questions about course scheduling, please contact your academic advisor.

Bachelor of Science in Allied Health Technologies - Medical Technology Option								
SAMPLE PROGRAM (120 s.h. minimum)								
	FIRST SEMESTER					**SECOND SEMESTER**		
BIOL	100	General Biology[§]	3		G3	___	Social Sciences #1	3
CHEM	111†	Intro Chemistry I	4		COMM	100	Fundamentals of Speech	3
ENGL	110	English Composition	3		MATH	160*	Precalculus	4
G1	___	Humanities #1	3		CHEM	112†	Intro Chemistry II	4
BIOL	257[a]	Intro to Allied Health	1		WELL	175	Wellness	3
		TOTAL S.H.	*14*				*TOTAL S.H.*	*17*
	THIRD SEMESTER					**FOURTH SEMESTER**		
BIOL	362	Cell & Devel. Biology, W	4		BIOL	255	Human Anat & Phys II	4
BIOL	254	Human Anat & Phys I	4		BIOL	364	Genetics & Molecular Bio	4
CHEM	235[a]	Short Course Organic Chem	4		G3	___	Social Sciences #2, W	3
G1	___	Humanities #2, W	3		G1	___	Humanities #3, D	3
					MATH	130†	Elements of Statistics	3
		TOTAL S.H.	*15*				*TOTAL S.H.*	*17*
	FIFTH SEMESTER					**SIXTH SEMESTER**		
BIOL	461	General Microbiology	3		BIOL	454[a]	Immunology	2
BIOL	___	Directed Elective[b] #1	2-4		CHEM	326	Biochemistry I	4
ELEC	___	General Elective**	3		G3	___	Social Sciences #3, W	3
P	___	Perspectives Course (P)	3		BIOL	___	Dir Elec[b] #2 to ≥ 6 s.h. BIOL Electives	2-4
PHYS	131	Physics I with Algebra	4		ENGL	312 or alt.	Advanced Writing (AW)	3
		TOTAL S.H.	*15-17*				*TOTAL S.H.*	*14-16*
CLINICAL PROGRAM								
		TRANSFER CREDITS	*26*					
[a] BIOL 257 and CHEM 235 offered only in Fall Semester; BIOL 454 offered only in Spring Semester.								
† Can serve as a non-BIOL G2 course / *Can serve as a G2 required MATH course								
§ Must earn a B- or higher as prerequisite for BIOL 362 and 364.							Revised 6-28-13	
** Credits required if needed to bring overall total to 120 s.h.								

Bachelor of Science in Allied Health Technologies - Nuclear Medicine Technology Option								
SAMPLE PROGRAM (120 s.h. minimum)								
	FIRST SEMESTER					**SECOND SEMESTER**		
BIOL	100	General Biology[§]	3		G3	___	Social Sciences #1	3
CHEM	111†	Intro Chemistry I	4		COMM	100	Fundamentals of Speech	3
ENGL	110	English Composition	3		MATH	160*	Precalculus	4
G1	___	Humanities #1	3		CHEM	112†	Intro Chemistry II	4
BIOL	257[a]	Intro to Allied Health	1		WELL	175	Wellness	3
		TOTAL S.H.	*14*				*TOTAL S.H.*	*17*
	THIRD SEMESTER					**FOURTH SEMESTER**		
BIOL	362	Cell & Devel. Biology, W	4		BIOL	255	Human Anat & Phys II	4
BIOL	254	Human Anat & Phys I	4		CHEM	326	Biochemistry I	4
CHEM	235[a]	Short Course Organic Chem	4		G3	___	Social Sciences #2, W	3
G1	___	Humanities #2, W	3		G1	___	Humanities #3, D	3
					MATH	130†	Elements of Statistics	3
		TOTAL S.H.	*15*				*TOTAL S.H.*	*17*
	FIFTH SEMESTER					**SIXTH SEMESTER**		
BIOL	461	General Microbiology	3		BIOL	454[a]	Immunology	2
BIOL	364	Genetics & Molecular Bio	4		BIOL	___	Directed Elective[b] #1	2-4
ELEC	___	General Elective**	3		G3	___	Social Sciences #3, W	3
P	___	Perspectives Course (P)	3		BIOL	___	Dir Elec[b] #2 to ≥ 6 s.h. BIOL Electives	2-4
PHYS	131	Physics I with Algebra	4		ENGL	312 or alt.	Advanced Writing (AW)	3
		TOTAL S.H.	*17*				*TOTAL S.H.*	*14-16*
CLINICAL PROGRAM								
		TRANSFER CREDITS	*26*					
[a] BIOL 257 and CHEM 235 offered only in Fall Semester; BIOL 454 offered only in Spring Semester.								
† Can serve as a non-BIOL G2 course / *Can serve as a G2 required MATH course								
§ Must earn a B- or higher as prerequisite for BIOL 362 and 364.							Revised 6-28-13	
** Credits required if needed to bring overall total to 120 s.h.								
[b] Minimum of two directed electives								

Bachelor of Science in Allied Health Technologies - Respiratory Therapy Option

SAMPLE PROGRAM (120 s.h. minimum)

FIRST SEMESTER										**SECOND SEMESTER**									
BIOL	100	General Biology	3							COMM	100	Fundamentals of Speech	3						
CHEM	103†	Gen, Org. & Biochem I	3							MATH	130*	Elements of Statistics	3						
ENGL	110	English Composition	3							CHEM	104†	Gen, Org & Biochem II	3						
G1	___	Humanities #1	3							G1	___	Humanities #2	3						
G3	___	Social Sciences #1	3							WELL	175	Wellness	3						
		TOTAL S.H.	*15*									*TOTAL S.H.*	*15*						
THIRD SEMESTER										**FOURTH SEMESTER**					**SUMMER**				
BIOL	461	General Microbiology	3							BIOL	255	Human Anat & Phys II	4		RESP	410	Acute Cardiopulmonary Care	2	
BIOL	254	Human Anat & Phys I	4							G3	___	Social Sciences #3, W	3		RESP	411	Resp Care Techniques 1	2	
PHYS	131†	Physics I with Algebra	4							ENGL	312 or alt.	Advanced Writing (AW)	3		RESP	412	Princ of Aerosol & Gas Therapy	3	
G1	___	Humanities #3, W	3							ELEC	___	General Elective**	3		RESP	422	Pharmacology	2	
G3	___	Social Sciences #2, D	3							ELEC	___	General Elective**	3		RESP	420	Arterial Blood Gas Analysis	3	
		TOTAL S.H.	*17*									*TOTAL S.H.*	*16*				*TOTAL S.H.*	*12*	
FIFTH SEMESTER					**WINTER SESSION**					**SIXTH SEMESTER**					**SUMMER**				
RESP	413	Resp Assessment & Therap.	4		RESP	461	Clinical Practicum I	1		BIOL	455	Cardiopulmonary Phys	3		RESP	463	Clinical Practicum II	2	
RESP	421	Phys. Mechanical Ventilation	2							RESP	417	Resp Care Techniques III, W	3						
RESP	414	Resp Care Techniques II	3							RESP	415	Tech Aspects Mech Vent	3						
RESP	460	Clinical Practice I	2							RESP	423	Infectious Diseases	2						
RESP	425	Neonatology	2							RESP	424	Non-Infectious Diseases	2						
RESP	419	Resp Care in Alt. Sites	2							RESP	462	Clinical Practice II	2						
		TOTAL S.H.	*15*				*TOTAL S.H.*	*1*				*TOTAL S.H.*	*15*				*TOTAL S.H.*	*2*	
SEVENTH SEMESTER																			
RESP	464	Clinical Practicum III	10														*TOTAL S.H.*	*120*	
RESP	495	Resp Care Research	2																
		TOTAL S.H.	*12*																

† Can serve as a non-BIOL G2 course / *Can serve as a G2 required MATH course

** Credits required if needed to bring overall total to 120 s.h.

Revised 6-28-13

Note: The perspectives course (P) is waived for BS ALHT Resp Th.

Three+ years of Allied Health B.S. Degree in Sports Medicine/Pre-Athletic Training for Bloomsburg

Fall 1			Spring 1			Summer 1		
Course	**Title**	**Credits**	**Course**	**Title**	**Credits**			
BIOL 100	Gen. Biology	3	CHEM 112	Chemistry 2	4	BIOL 254	A&P 1	4
CHEM 111	Chemistry 1	4	COMM 100	Speech	3	BIOL 255	A&P 2	4
ENG 110	English	3	MATH 160	Pre-calculus	4			
WELL 175	Wellness	3	WSSD 311	First Aid	3			
G3	Psychology 100 recommended	3	G1	Philosophy 100 recommended	3			
TOTAL CREDITS		**16**			**17**			**8**
Fall 2			**Spring 2**			**Winter/Summer 2**		
CHEM 235	Short Organic	4	G1	Elective	3			
BIOL 362	Cell Biology	4 (W)	BIOL 352	Nutritional Science	3 (W)	D(W) course	BIOL 207 Human Sexuality Recommended	3 (W)
PHYS 131	Physics 1	4	WSSD 450	Kines & Phys	3			
WSSD 375	Prevent and Care	3	G3	SOC101/ANTH 121recommended	3			
			G3	PSYC 227or 228 recommended	3			
TOTAL CREDITS		**15**			**15**			**3**
APPLY TO MS PROGRAMS AT END OF 2nd YEAR or BEGINNING OF 3rd YEAR OF STUDY AT MU								

Fall 3			**Spring 3**			**Winter/Summer 3**		
ENGL 312	Adv. Writing	3	BIOL 364	Genetics	4			
WSSD 452	Nutri Performance	3	WSSD 582	Sports Psyc	3			
WSSD 591	Exercise Physiology	3	BIOL 375	Biometry	3			
BIOL 461	Microbiology	3	G1	elective	3			
PSYC 356	Health Psych	3	P course	COMM 461 Recommended	3			
TOTAL CREDITS		**15**			**16**			

Allied Health B.S. Degree in Sports Medicine

Fall 1			Spring 1		
Course	**Title**	**Credits**	**Course**	**Title**	**Credits**
BIOL 100	Gen. Biology	3	CHEM 112	Chemistry 2	4
CHEM 111	Chemistry 1	4	COMM 100	Speech	3
ENG 110	English	3	MATH 160	Pre-calculus	4
WELL 175	Wellness	3	WSSD 311	First Aid	3
G3	Psychology 100 recommended	3	G1	Philosophy 100 recommended	3
TOTAL CREDITS		**16**			**17**
Fall 2			**Spring 2**		
BIOL 254	A&P 1	4	BIOL 255	A&P 2	4
BIOL 362	Cell Biology	4 (W)	BIOL 352	Nutritional Science	3 (W)
CHEM 235	Short Organic	4	WSSD 450	Kines & Phys	3
WSSD 375	Prevent and Care	3	G3	SOC101/ANTH 121recommended	3
			G3	PSYC 227or 228 recommended	3
TOTAL CREDITS		**15**			**16**
Fall 3			**Spring 3**		
Course	**Title**	**Credits**	**Course**	**Title**	**Credits**
ENGL 312	Adv. Writing	3	BIOL 364	Genetics	4
WSSD 452	Nutri Performance	3	WSSD 582	Sports Psyc	3
WSSD 591	Exercise Physiology	3	BIOL 375	Biometry	3
BIOL 461	Microbiology	3	G1	Elective	3
PSYC 356	Health Psych	3	P course	COMM 461 Recommended	3
TOTAL CREDITS		**15**			**16**
Fall 4			**Spring 4**		
Course	**Title**	**Credits**	**Course**	**Title**	**Credits**
G1	Elective	3	CHEM 326	Biochemistry	4
PHYS 131	Physics 1	4	PHYSICS 132	Physics 2	4
D(W) course	BIOL 207 Human Sexuality Recommended	3 (W)	WSSD 492	Capstone seminar	1
BIOL/WWSD	Elective	2-4	BIOL/WWSD	Elective	2-4
TOTAL CREDITS		**12-14**			**11-13**

BACHELOR OF ARTS IN BIOLOGY

SAMPLE PROGRAM (120 s.h. minimum) (Well-Prepared at Admission)

FIRST SEMESTER				SECOND SEMESTER			
BIOL	101	Foundations of Biology	4	BIOL	211	Concepts of Zoology	4
CHEM	111†	Intro. Chemistry I	4	or	221	Concepts of Botany	
MATH	160* or 161(163)*	Precalculus or Calculus I	4-5	CHEM	112†	Intro. Chemistry II	4
COMM	100	Fundamentals of Speech	3	MATH	161† or other	Calculus I or (II, Stats or CSCI)	3-4
				ENGL	110	English Composition	3
		TOTAL S.H.	*15-16*			*TOTAL S.H.*	*14-15*
THIRD SEMESTER				**FOURTH SEMESTER**			
BIOL	221	Concepts of Botany	4	BIOL	362	Cell & Devel. Biology, W	4
or	211	Concepts of Zoology		CHEM	___	Chemistry, ≥200 level	4
CHEM	___	Chemistry, ≥200 level	4	G3	___	Social Sciences #1	3
G1	Non-FORL	Humanities (G1)	3	FORL	102§	Foreign Language (G1)	3
FORL	101§	Foreign Language (G1)	3	WELL	175	Wellness Course	3
		TOTAL S.H.	*14*			*TOTAL S.H.*	*17*
FIFTH SEMESTER				**SIXTH SEMESTER**			
BIOL	364	Genetics & Molecular	4	BIOL	343	Ecology & Evolution	4
or	343	Ecology & Evolution		or	364	Genetics & Molecular	
PHYS	131	Physics I with Algebra	4	PHYS	132	Physics II with Algebra	4
FORL	201§	Foreign Language (G1)	3	FORL	202§	Foreign Language (G1)	3
G3	___	Social Sciences #2, W	3	P	___	Perspectives Course (P)	3
		TOTAL S.H.	*14*			*TOTAL S.H.*	*14*
SEVENTH SEMESTER				**EIGHTH SEMESTER**			
BIOL	___	Biology Elective #1	3-4	BIOL	___	Biology Elective #2	3-4
ESCI	___	Earth Science, ≥ 200 level	3-4	BIOL	470 or 472	Seminar in Biology	1-2
G3	___	Social Sciences #3, W	3	BIOL	Elective§	For total of 33 BIOL s.h.	0-2
D	___	Diversity Course (D)	3	ENGL	312 or alt	Advanced Writing (AW)	3
ELEC	___	General Elective**	3	ELEC	___	General Elective**	3
				ELEC	___	General Elective(s)**	2-5
		TOTAL S.H.	*15-17*			*TOTAL S.H.*	*13-17*

† Can serve as a non-BIOL G2 course

*Can serve as a G2 required MATH course

Revised 7-8-13

§The General Education requirement for 2 additional Humanities Courses (G1) is met by taking beginning or intermiediate FORL courses.

** Credits required if needed to bring overall total to 120.

BACHELOR OF ARTS IN BIOLOGY

SAMPLE PROGRAM (120 s.h. minimum) (Less Prepared at Admission)

FIRST SEMESTER					**SECOND SEMESTER**				
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4	
MATH	101	College Algebra	3		or	221	Concepts of Botany		
ENGL	110	English Composition	3		CHEM	111†	Intro. Chemistry I	4	
G1	___	Humanities #1	3		MATH	110/160*	Trigonometry/Precalculus	4-6	
WELL	175	Wellness	3		COMM	100	Fundamentals of Speech	3	
		TOTAL S.H.	*16*				*TOTAL S.H.*	*15-17*	
THIRD SEMESTER					**FOURTH SEMESTER**				
BIOL	221	Concepts of Botany	4		BIOL	362	Cell & Devel. Biology, W	4	
or	211	Concepts of Zoology			ESCI	___	Earth Science, ≥ 200 level	3-4	
CHEM	112†	Intro. Chemistry II	4		G3	___	Social Sciences #1	3	
MATH	161†	Calculus I	4		G1	Non-FORL	Humanities (G1)	3	
FORL	101§	Foreign Language (G1)	3		FORL	102§	Foreign Language (G1)	3	
		TOTAL S.H.	*15*				*TOTAL S.H.*	*16-17*	
FIFTH SEMESTER					**SIXTH SEMESTER**				
BIOL	364	Genetics & Molecular	4		BIOL	343	Ecology & Evolution	4	
or	343	Ecology & Evolution			or	364	Genetics & Molecular		
CHEM	___	Chemistry, ≥200 level	4		CHEM	___	Chemistry, ≥200 level	4	
G3	___	Social Sciences #2, W	3		G3	___	Social Sciences #3, W	3	
FORL	201§	Foreign Language (G1)	3		FORL	202§	Foreign Language (G1)	3	
		TOTAL S.H.	*14*				*TOTAL S.H.*	*14*	
SEVENTH SEMESTER					**EIGHTH SEMESTER**				
BIOL	___	Biology Elective #1	3-4		BIOL	___	Biology Elective #2	3-4	
PHYS	131	Physics I with Algebra	4		BIOL	Elective§	For total of 33 BIOL s.h.	0-2	
P	___	Perspectives Course (P)	3		BIOL	470 or 472	Seminar in Biology	1-2	
D	___	Diversity Course (D)	3		PHYS	132	Physics II with Algebra	4	
ELEC	___	General Elective**	1-3		ENGL	312 or alt	Advanced Writing (AW)	3	
					ELEC	___	General Elective**	0-3	
		TOTAL S.H.	*14-17*				*TOTAL S.H.*	*12-16*	

† Can serve as a non-BIOL G2 course

*Can serve as a G2 required MATH course

Revised 7-8-13

§The General Education requirement for 2 additional Humanities Courses (G1) is met by taking beginning or intermiediate FO

** Credits required if needed to bring overall total to 120.

BACHELOR OF SCIENCE IN BIOLOGY

SAMPLE PROGRAM (120 s.h. minimum) (Well-Prepared at admission)

FIRST SEMESTER					**SECOND SEMESTER**				
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4
CHEM	111†	Intro. Chemistry I	4		or	221	Concepts of Botany	
MATH	160* or 161(163)*	Precalculus or Calculus I	4-5		CHEM	112†	Intro. Chemistry II	4
COMM	100	Fundamentals of Speech	3		MATH	161† or other	Calculus I or (II, Stats or CSCI)	3-4
			___		ENGL	110	English Composition	3
		TOTAL S.H.	*15-16*				*TOTAL S.H.*	*14-15*
THIRD SEMESTER					**FOURTH SEMESTER**				
BIOL	221	Concepts of Botany	4		BIOL	362	Cell & Devel. Biol., W	4
or	211	Concepts of Zoology			CHEM	232	Organic Chem II	4
CHEM	231	Organic Chem I	4		PHYS	132	Physics II with Algebra	4
PHYS	131	Physics I with Algebra	4		G1	___	Humanities #1	3
WELL	175	Wellness	3					
		TOTAL S.H.	*15*				*TOTAL S.H.*	*15*
FIFTH SEMESTER					**SIXTH SEMESTER**				
BIOL	364	Genetics & Molecular	4		BIOL	343	Ecology & Evolution	4
or	343	Ecology & Evolution			or	364	Genetics & Molecular	
CHEM	326	Biochemistry I	4		BIOL	___	Biology Elective§ #1	3
___	___	Diversity Course (D)	3		BIOL	___	Biology Elective§ #2, W	3
G3	___	Social Sciences #1, W	3		G1	___	Humanities #2	3
			___		G3	___	Social Sciences #2	3
		TOTAL S.H.	*14*				*TOTAL S.H.*	*16*
SEVENTH SEMESTER					**EIGHTH SEMESTER**				
BIOL	472 or 470	Seminar in Biology	1-2		BIOL	___	Biology Elective§ #5	3
BIOL	___	Biology Elective§ #3	3-4		BIOL	Elective§ #6	For total of 43 BIOL s.h.	0-3
BIOL	___	Biology Elective§ #4	3		G3	___	Social Sciences #3	3
ENGL	312 or alt	Advanced Writing (AW)	3		___	___	Perspectives Course (P)	3
G1	___	Humanities #3	3		ELEC	___	General Elective**	3
					ELEC	___	General Elective**	0-3
		TOTAL S.H.	*13-15*				*TOTAL S.H.*	14-18

† Can serve as a non-BIOL G2 course

*Can serve as a G2 required MATH course

Revised 6-28-13

§At least 12 s.h. of electives must be 300-level or above

** Credits required if needed to bring overall total to 120.

BACHELOR OF SCIENCE IN BIOLOGY								
SAMPLE PROGRAM (120 s.h. minimum) (Less Prepared at admission)								
FIRST SEMESTER					**SECOND SEMESTER**			
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4
MATH	101	College Algebra	3		or	221	Concepts of Botany	
ENGL	110	English Composition	3		CHEM	111†	Intro. Chemistry I	4
G1	___	Humanities #1	3		MATH	110/160*	Trigonometry/Precalculus	4-6
WELL	175	Wellness	3		COMM	100	Fundamentals of Speech	3
		TOTAL S.H.	*16*				*TOTAL S.H.*	*15-17*
THIRD SEMESTER					**FOURTH SEMESTER**			
BIOL	221	Concepts of Botany	4		BIOL	362	Cell & Devel. Biol. W	4
or	211	Concepts of Zoology			CHEM	231	Organic Chem I	4
CHEM	112†	Intro. Chemistry II	4		G1		Humanities #3	3
MATH	161†	Calculus I	4		G3	___	Social Science #1	3
G1	___	Humanities #2	3					___
		TOTAL S.H.	*15*				*TOTAL S.H.*	*14*
FIFTH SEMESTER					**SIXTH SEMESTER**			
BIOL	364	Genetics & Molecular	4		BIOL	343	Ecology & Evolution	4
or	343	Ecology & Evolution			or	364	Genetics & Molecular	
CHEM	232	Organic Chem II	4		BIOL	___	Biology Elective§ #3, W	3
BIOL	___	Biology Elective§ #1	3		CHEM	326	Biochemistry I	4
BIOL	___	Biology Elective§ #2	3-4		G3	___	Social Sciences #2, D	3
		TOTAL S.H.	*14-15*				*TOTAL S.H.*	*14*
SEVENTH SEMESTER					**EIGHTH SEMESTER**			
PHYS	131	Physics I with Algebra	4		PHYS	132	Physics II with Algebra	4
BIOL	___	Biology Elective§ #4	3-4		BIOL	472 or 470	Seminar in Biology	1-2
BIOL	___	Biology Elective§ #5	3		BIOL	Elective§ #6	For total of 43 BIOL s.h.	0-3
ENGL	312 or alt	Advanced Writing (AW)	3		G3	___	Social Sciences #3, W	3
___	___	Perspectives Course (P)	3		ELEC	___	General Elective**	3
					ELEC	___	General Elective**	0-2
		TOTAL S.H.	*16-17*				*TOTAL S.H.*	*12-16*
† Can serve as a non-BIOL G2 course								
*Can serve as a G2 required MATH course							Revised 6-28-13	
§At least 12 s.h. of electives must be 300-level or above								
** Credits required if needed to bring overall total to 120.								

BACHELOR'S DEGREE: BSE									
SAMPLE PROGRAM (126 s.h. minimum) (Well-Prepared at Admission)									
NOTE: Education students must fill out state and federal forms (Criminal Clearance Acts 34 and 151) EACH year.									
NOTE: The student must take the PRAXIS test (required by the PDE) at least a semester before student teaching.									
FIRST SEMESTER					**SECOND SEMESTER**				
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4	
CHEM	111†	Intro. Chemistry I	4		or	221	Concepts of Botany		
MATH	160* or 161(163)*	Precalculus or Calculus I	4-5		CHEM	112†	Intro. Chemistry II	4	
ENGL	110	English Composition	3		ENGL	___	Literature Course, G1 #1	3	
PPST[a]		Pre-Professional Skills Test	---		G3	___	Social Sciences #1, W	3	
					COMM	100	Fundamentals of Speech	3	
		TOTAL S.H.	*15-16*				*TOTAL S.H.*	*17*	
THIRD SEMESTER					**FOURTH SEMESTER**				
BIOL	221	Concepts of Botany	4		BIOL	362	Cell & Dev. Biology, W	4	
or	211	Concepts of Zoology			CHEM	326	Biochemistry	4	
CHEM	235[b]	Short Course Organic Chem.	4		ESCI	___	Earth Science, ≥ 200 leve	3-4	
EDFN	211	Fdns of Modern Ed	3		G3	___	Social Sciences #2	3	
EDFN	241	Psyc Fdns Teaching	3						
WELL	175	Wellness	3						
		TOTAL S.H.	*17*				*TOTAL S.H.*	*14-15*	
FIFTH SEMESTER					**SIXTH SEMESTER (Take PRAXIS)**				
BIOL	364	Genetics & Molecular	4		BIOL	343	Ecology & Evolution	4	
BIOL	375	Biometry	3		PHYS	132	Physics with Algebra	4	
PHYS	131	Physics with Algebra	4		G3	___	Social Sciences #3, D	3	
BIOL	___	Biology Elective #1	3-4		G1	___	Humanities #3	3	
BIOL	Elective #2	For total of 32 BIOL s.h.	0-1		ENGL	312 or alt	Advanced Writing (AW)	3	
G1	___	Humanities #2, W	3						
		TOTAL S.H.	*18*[§]				*TOTAL S.H.*	*17*	
SEVENTH SEMESTER (Last chance to take PRAXIS)					**EIGHTH SEMESTER**				
BIOL	473[b]	Methods Teach Biology	1		EDSC	461	Student Teaching	9	
EDFN 001: EDFN	321	Issues in Teaching Sec. Ed.	3		EDSE	471	Differentiated Instruction	3	
EDFN 001: EDFN	330	Instruc. Technology Desigr	3						
EDFN 001: EDSE	340	Content Area Literacy	3						
EDFN 001: SPED	346	Sec. Students w/ Disabilitie	3						
EDSE	435[b]	Teaching of Science	3						
		TOTAL S.H.	*16*				*TOTAL S.H.*	*12*	
[a]Students should take the Pre-Professional Skills Tests (PPST) the 1st semester of freshman year.									
[b] CHEM 235, BIOL 473, and EDSE 435 are only offered in the Fall semester							Revised 7-8-13		
*Can serve as a G2 required MATH course / † Can serve as a non-BIOL G2 course									
[§]Note: Student will need to wait until the end of registration to enroll in >17 credits, or one of these courses could be completed during Winter or Summer									
Note: The perspectives course (P) is waived for BSE program.									

BACHELOR'S DEGREE: BSE									
SAMPLE PROGRAM (126 s.h. minimum) (Less Prepared at Admission)									
NOTE: Education students must fill out state and federal forms (Criminal Clearance Acts 34 and 151) EACH year.									
NOTE: The student must take the PRAXIS test (required by the PDE) at least a semester before student teaching.									
FIRST SEMESTER					**SECOND SEMESTER**				
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4	
MATH	101	College Algebra	3		or	221	Concepts of Botany		
ENGL	110	English Composition	3		CHEM	111†	Intro. Chemistry I	4	
G1	___	Humanities #1	3		MATH	110/160*	Trigonometry/Precalculu	4-6	
WELL	175	Wellness	3		COMM	100	Fundamentals of Speech	3	
PPST		Pre-Professional Skills Test	---						
		TOTAL S.H.	*16*				*TOTAL S.H.*	*15-17*	
THIRD SEMESTER					**FOURTH SEMESTER**				
BIOL	221	Concepts of Botany	4		BIOL	362	Cell & Dev. Biology, W	4	
or	211	Concepts of Zoology			BIOL	364	Genetics & Molecular	4	
CHEM	112†	Intro. Chemistry II	4		ESCI	___	Earth Science, ≥ 200 lev	3-4	
EDFN	211	Fdns of Modern Ed	3		G1	___	Literature Course, G1 #2	3	
EDFN	241	Psyc Fdns Teaching	3		G3	___	Social Sciences #2	3	
G3	___	Social Sciences #1, W	3						
		TOTAL S.H.	*17*				*TOTAL S.H.*	*7-18*[§]	
FIFTH SEMESTER					**SIXTH SEMESTER (Take PRAXIS)**				
CHEM	235[b]	Short Course Organic Chem.	4		BIOL	343	Ecology & Evolution	4	
PHYS	131†	Physics with Algebra	4		PHYS	132	Physics with Algebra	4	
G1	___	Humanities #3, W	3		G3	___	Social Sciences #3, D	3	
BIOL	375	Biometry	3		ENGL	312 or alt	Advanced Writing (AW)	3	
BIOL	___	Biology Elective #1	3-4		CHEM	326	Biochemistry	4	
BIOL	Elective #2	For total of 32 BIOL s.h.	0-1						
		TOTAL S.H.	*18*[§]				*TOTAL S.H.*	*18*[§]	
SEVENTH SEMESTER (Last chance to take PRAXIS)					**EIGHTH SEMESTER**				
BIOL	473[b]	Methods Teach Biology	1		EDSC	461	Student Teaching	9	
EDFN 001: EDFN	321	Issues in Teaching Sec. Ed.	3		EDSE	471	Differentiated Instructio	3	
EDFN 001: EDFN	330	Instruc. Technology Design	3						
EDFN 001: EDSE	340	Content Area Literacy	3						
EDFN 001: SPED	346	Sec. Students w/ Disabilitie	3						
EDSE	435[b]	Teaching of Science	3						
		TOTAL S.H.	*16*				*TOTAL S.H.*	*12*	
[a]Students should take the Pre-Professional Skills Tests (PPST) the 1st semester of freshman year.									
[b] CHEM 235 and BIOL 473 are only offered in the Fall semester							Revised 7-8-13		
*Can serve as a G2 required MATH course / † Can serve as a non-BIOL G2 course									
[§]Note: Student will need to wait until the end of registration to enroll in >17 credits, or one of these courses could be completed during Winter or Summer									
Note: The perspectives course (P) is waived for BSE program.									

BACHELOR OF SCIENCE IN BIOLOGY: ANIMAL BEHAVIOR OPTION

SAMPLE PROGRAM (120 s.h. minimum) (Well-Prepared at admission)

FIRST SEMESTER				**SECOND SEMESTER**			
BIOL	101	Foundations of Biology	4	BIOL	211	Concepts of Zoology	4
CHEM	111†	Intro. Chemistry I	4	CHEM	112†	Intro. Chemistry II	4
MATH	161*	Calculus I	4	WELL	175	Wellness	3
ENGL	110	English Composition	3	COMM	100	Fundamentals of Speech	3
		TOTAL S.H.	*15*			*TOTAL S.H.*	*14*
THIRD SEMESTER				**FOURTH SEMESTER**			
BIOL	221	Concepts of Botany	4	BIOL	343	Ecology & Evolution	4
CHEM	235◆	Short Course Organic Chem.	4	CHEM	326 or 375	Biochem I or Environ Chem	4
PSYC	100⌘	General Psychology, G3 #	3	BIOL	385	Principles of Animal Behavior	3
G1		Humanities #1	3	G3		Social Sciences #2, W	3
		TOTAL S.H.	*14*			*TOTAL S.H.*	*14*
SUMMER SESSION							
BIOL	381 or 486	Applied Ethol or Behav Ecol	3				
FIFTH SEMESTER				**SIXTH SEMESTER**			
BIOL	362	Cell & Devel. Bio, W	4	BIOL	364	Genetics & Molecular	4
BIOL		Anim Behav Elective #1	3	BIOL	435 or 484	Anim Phys or Mech Anim Behav	3
PHYS	131	Physics I	4	PHYS	132	Physics II	4
G1		Humanities #2, D	3	ENGL		Advanced Writing (AW)	3
Statistics		BIOL 375, MATH 235 or PSYC 211	3				
		TOTAL S.H.	*17*			*TOTAL S.H.*	*14*
SEVENTH SEMESTER				**EIGHTH SEMESTER**			
BIOL		Anim Behav Elective #2	3	BIOL		Anim Behav Elective #3	3
P		Perspectives Course (P)	3	BIOL	472	Sem. in Biology: Anim. Behav.	1-2
G1		Humanities #3, W	3	BIOL		For total of 46 BIOL s.h.	0-2
G3		Social Sciences #3	3	ELEC		General Electives**	8-10
BIOL		Practical Experience	1-3				
		TOTAL S.H.	*13-15*			*TOTAL S.H.*	*14-16*

⌘ PSYC 100 is a required-related course and serves as a G3 course; it is also required for PSYC 211 (statistics elective).

◆ CHEM 235 is only offered in the Fall. Students aiming for vet school should take CHEM 231 and 232 in lieu of CHEM 235.

† Can serve as a non-BIOL G2 course / * Can serve as a MATH G2 course

** Credits needed to bring overall total to 120. Be sure you have taken three 'W' courses, as well as a P & D course. Revised 07-24-17

BACHELOR OF SCIENCE IN BIOLOGY: ANIMAL BEHAVIOR OPTION								
SAMPLE PROGRAM (120 s.h. minimum) (Less-Prepared at admission)								
FIRST SEMESTER					**SECOND SEMESTER**			
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4
G1	____	Humanities #1	3		G3	____	Social Sciences #1, W	3
MATH	101	College Algebra	3		MATH	151*	Calculus for Mgmt. & Life Sci.	4
WELL	175	Wellness	3		COMM	100	Fundamentals of Speech	3
ENGL	110	English Composition	3				*TOTAL S.H.*	*14*
		TOTAL S.H.	*16*					
THIRD SEMESTER					**FOURTH SEMESTER**			
BIOL	221	Concepts of Botany	4		BIOL	343	Ecology & Evolution	4
CHEM	111†	Intro. Chemistry I	4		CHEM	112†	Intro. Chemistry II	4
PSYC	100⌘	General Psychology, G3 #2	3		BIOL	385	Principles of Animal Behavior	3
G1	____	Humanities #2, D	3		G3	____	Social Sciences #3	3
		TOTAL S.H.	*14*				*TOTAL S.H.*	*14*
SUMMER SESSION								
BIOL	381 or 486	Applied Ethol or Behav Ecol	3					
FIFTH SEMESTER					**SIXTH SEMESTER**			
BIOL	362	Cell & Devel. Bio, W	4		BIOL	364	Genetics & Molecular	4
BIOL	____	Anim Behav Elective #1	3		BIOL	435 or 484	Anim Phys or Mech Anim Behav	3
CHEM	235□	Short Course Organic Chem.	4		CHEM	326 or 375	Biochem I or Environ Chem	4
Statistics	____	BIOL 375, MATH 235 or PSYC 211	3		ENGL	____	Advanced Writing (AW)	3
		TOTAL S.H.	*14*				*TOTAL S.H.*	*14*
SEVENTH SEMESTER					**EIGHTH SEMESTER**			
BIOL	____	Anim Behav Elective #2	3		BIOL	____	Anim Behav Elective #3	3
P	____	Perspectives Course (P)	3		BIOL	472	Sem. in Biology: An. Beh.	1-2
PHYS	131	Physics I	4		PHYS	132	Physics II	4
BIOL	____	Practical Experience	1-3		BIOL	____	For total of 46 BIOL s.h.	0-2
G1	____	Humanities #3, W	3		ELEC	____	General Elective**	3-7
		TOTAL S.H.	*14-16*				*TOTAL S.H.*	*15-17*
⌘ PSYC 100 is a required-related course and serves as a G3 course; it is also required for PSYC 211 (statistics elective).								
□ CHEM 235 is only offered in the Fall. Students aiming for vet school should take CHEM 231 and 232 in lieu of CHEM 235.								
† Can serve as a non-BIOL G2 course / * Can serve as a MATH G2 course								
** Credits required as needed to bring overall total to 120.							Revised 07-24-17	

BACHELOR OF SCIENCE IN BIOLOGY: BOTANY OPTION

SAMPLE PROGRAM (120 s.h.) (Well-Prepared at Admission)

FIRST SEMESTER				SECOND SEMESTER			
BIOL	101	Foundations of Biology	4	BIOL	211	Concepts of Zoology	4
CHEM	111†	Intro. Chemistry I	4	or	221	Concepts of Botany	
MATH	160* or 161(163)*	Precalculus or Calculus I	4-5	CHEM	112†	Intro. Chemistry II	4
COMM	100	Fundamentals of Speech	3	MATH	161† or other	Calculus I or (II, Stats or CSCI)	3-4
			___	ENGL	110	English Composition	3
		TOTAL S.H.	*15-16*			*TOTAL S.H.*	*14-15*
THIRD SEMESTER				**FOURTH SEMESTER**			
BIOL	221	Concepts of Botany	4	BIOL	362	Cell & Devel. Biology, W	4
or	211	Concepts of Zoology		CHEM	232	Organic Chemistry II	4
CHEM	231	Organic Chemistry I	4	G3	___	Social Sciences #1	3
WELL	175	Wellness	3	G1	___	Humanities #2	3
G1	___	Humanities #1, W	3				
		TOTAL S.H.	*14*			*TOTAL S.H.*	*14*
FIFTH SEMESTER				**SIXTH SEMESTER**			
BIOL	364	Genetics & Molecular	4	BIOL	343	Ecology & Evolution	4
PHYS	131	Physics I with Algebra	4	PHYS	132	Physics II with Algebra	4
BIOL	325	Plant Systematics	3	BIOL	436	Plant Physiology	3
CHEM	326	Biochemistry I	4	G1	___	Humanities #3	3
			___	ENGL	312 or alt.	Advanced Writing (AW)	3
		TOTAL S.H.	*15*			*TOTAL S.H.*	*17*
SEVENTH SEMESTER				**EIGHTH SEMESTER**			
BIOL	429	Plant Developmental Bio	3	BIOL	___	Biology Elective§ #3	3-4
BIOL	___	Biology Elective§ #1	3-4	BIOL	Elective§ #4	For total of 45 BIOL s.h.	3
BIOL	___	Biology Elective§ #2	3	BIOL	470 or 472	Seminar in Biology	1-2
G3	___	Social Sciences #2, W	3	ELEC		General Elective**	3
P	___	Perspectives Course (P)	3	G3	___	Social Sciences #3, D	3
				ELEC		General Elective(s)**	2-4
		TOTAL S.H.	*15-16*			*TOTAL S.H.*	*13-16*

† Can serve as a non-BIOL G2 course

*Can serve as a G2 required MATH course

§Must be 300-level or above

Revised 6-28-13

		BACHELOR OF SCIENCE IN BIOLOGY: BOTANY OPTION						
		SAMPLE PROGRAM (120 s.h.) (Less Prepared at Admission)						
FIRST SEMESTER					**SECOND SEMESTER**			
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4
MATH	101	College Algebra	3		or	221	Concepts of Botany	
ENGL	110	English Composition	3		CHEM	111†	Intro. Chemistry I	4
G1	___	Humanities #1	3		MATH	110/160*	Trigonometry/Precalculus	4-6
WELL	175	Wellness Course	3		COMM	100	Fundamentals of Speech	3
		TOTAL S.H.	*16*				*TOTAL S.H.*	*15-17*
THIRD SEMESTER					**FOURTH SEMESTER**			
BIOL	221	Concepts of Botany	4		BIOL	362	Cell & Devel. Biology, W	4
or	211	Concepts of Zoology			CHEM	231	Organic Chemistry I	4
MATH	161†	Calculus I	4		G1	___	Humanities #2	3
CHEM	112†	Intro. Chemistry II	4		G3	___	Social Sciences #2,	3
G3	___	Social Sciences #1, W	3		G1	___	Humanities #3, W	3
		TOTAL S.H.	*15*				*TOTAL S.H.*	*17*
FIFTH SEMESTER					**SIXTH SEMESTER**			
BIOL	364	Genetics & Molecular	4		BIOL	343	Ecology & Evolution	4
CHEM	232	Organic Chemistry II	4		P	___	Perspectives Course (P)	3
PHYS	131	Physics I with Algebra	4		PHYS	132	Physics II with Algebra	4
BIOL	325	Plant Systematics	3		G3	___	Social Sciences #3, D	3
		TOTAL S.H.	*15*				*TOTAL S.H.*	*14*
SEVENTH SEMESTER					**EIGHTH SEMESTER**			
BIOL	429	Plant Developmental Bio	3		BIOL	436	Plant Physiology	3
CHEM	326	Biochemistry	4		BIOL	Elective§	Biology Elective #3	2-3
BIOL	Elective§	Biology Elective #1	3-4		BIOL	Elective #4§	For total of 45 BIOL s.h.	0-2
BIOL	Elective§	Biology Elective #2	3-4		ENGL	312 or alt.	Advanced Writing (AW)	3
BIOL	470 or 472	Seminar in Biology	1-2		ELEC	___	General Elective**	1-2
		TOTAL S.H.	14-17				*TOTAL S.H.*	*9-14*
† Can serve as a non-BIOL G2 course							Revised 6-28-13	
*Can serve as a G2 required MATH course								
§Must be 300-level or above								
** Credits required if needed to bring total to 120.								

BACHELOR OF SCIENCE IN BIOLOGY: Environmental Biology Option

SAMPLE PROGRAM (120 s.h.) (Well-Prepared at Admission)

FIRST SEMESTER					**SECOND SEMESTER**				
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4
CHEM	111†	Intro. Chemistry I	4		or	221	Concepts of Botany	
MATH	151*	Calculus for Mgmt. & Life Sci.	4		CHEM	112†	Intro. Chemistry II	4
or	161*	Calculus I			WELL	175	Wellness	3
ENGL	110	English Composition	3		COMM	100	Fundamentals of Speech	3
		TOTAL S.H.	*15*				*TOTAL S.H.*	*14*
THIRD SEMESTER					**FOURTH SEMESTER**				
BIOL	221	Concepts of Botany	4		BIOL	375	Biometry or MATH 235	3
or	211	Concepts of Zoology			BIOL	343	Ecology & Evolution	4
CHEM	235[a]	Short Course Organic Chem.	4		BIOL	362	Cell & Devel. Biology, W	4
PHYS	131†	Physics I with Algebra	4		PHYS	132	Physics II with Algebra	4
G1	___	Humanities #1, W	3					___
		TOTAL S.H.	*15*				*TOTAL S.H.*	*15*
FIFTH SEMESTER					**SIXTH SEMESTER**				
BIOL	346-461	Organismal Biology Course [b]	3		BIOL	364	Genetics & Molecular	4
G3††	___	Non-BIOL Environ. Science #1	3-4		G3††	___	Non-BIOL Environ. Science #2	3-4
CHEM	375[a]	Environmental Chemistry	4		BIOL	446	Ecosystems, W	3
G1	___	Humanities #2, D	3		G1	___	Humanities #3	3
BIOL	325-486	Directed Elective in Advanced Ecology[c]	3		BIOL	498	Practical Experience	1-3
		TOTAL S.H.	*16-17*		or	300	Co-op (research)	(1-3)
							TOTAL S.H.	*14-17*
SEVENTH SEMESTER								
BIOL	325-486	Directed Elective in Advanced Ecology[c]	3		**EIGHTH SEMESTER**			
BIOL	344[§§]	Pop & Comm Ecology	3		BIOL	Elective #2[§]	For total of 49 BIOL s.h.	0-2
or P	___	Perspectives Course (P)			ENGL	312 or alt.	Advanced Writing (AW)	3
G3	___	Social Science #1 or #3, W	3		G3/ELEC	___	Social Science #2 or General Elective**	3
BIOL	___	Biology Elective #1[§]	3.0		P	___	Perspectives Course (P)	3
BIOL	472	Environ. Bio. Seminar	1-2		or BIOL	344[§§]	Pop & Comm Ecology	
		TOTAL S.H.	*13-14*		G3/ELEC	___	Social Science #3 or General Elective**	3
					ELEC	___	General Elective(s)**	2-4
							TOTAL S.H.	*14-18*

*Can serve as a G2 required MATH course / † Can serve as a non-BIOL G2 course / †† Only GEOG 281/295 or ECON 102/207 serve as G3; ECON 207 is a W course

[a] Offered in Fall only / [§§]Offered in the Fall or Spring, but not both.

[b]Organismal biology courses are BIOL 346, 396, 415, 416, 417, 418, 424 and 461

[c] Directed electives in advanced ecology are BIOL 325, 329, 442, 443, 445, and 486 (BIOL 325 is recommended).

§Must be 300-level or above / ** Credits required if needed to bring overall total to 120.

Revised 5-17-17

BACHELOR OF SCIENCE IN BIOLOGY: Environmental Biology Option

SAMPLE PROGRAM (120 s.h.) (Less Prepared at Admission)

	FIRST SEMESTER					**SECOND SEMESTER**		
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4
WELL	175	Wellness	3		or	221	Concepts of Botany	
MATH	101	College Algebra	3		CHEM	111†	Intro. Chemistry I	4
G1	___	Humanities #1	3		MATH	151*	Calculus for Mgmt. & Life Sci.	4
ENGL	110	English Composition	3		COMM	100	Fundamentals of Speech	3
		TOTAL S.H.	*16*				*TOTAL S.H.*	*15*
	THIRD SEMESTER					**FOURTH SEMESTER**		
BIOL	221	Concepts of Botany	4		BIOL	362	Cell & Devel. Biology, W	4
or	211	Concepts of Zoology			BIOL	343	Ecology & Evolution	4
CHEM	112†	Intro. Chemistry II	4		G3††	___	Non-BIOL Environ. Science #2	3-4
G3††	___	Non-BIOL Environ. Science #1	3-4		G1	___	Humanities #2, D	3
G3	___	Social Science #1, W	3					
		TOTAL S.H.	*14-15*				*TOTAL S.H.*	*14-15*
	FIFTH SEMESTER					**SIXTH SEMESTER**		
BIOL	346-461	Organismal Biology Course [b]	3		BIOL	364	Genetics & Molecular	4
PHYS	131†	Physics I with Algebra	4		PHYS	132	Physics II with Algebra	4
CHEM	235[a]	Short Course in Organic Chem.	4		BIOL	446	Ecosystems, W	3
BIOL	375	Biometry or MATH 235	3		G1	___	Humanities #3, W	3
BIOL	325-486	Directed Elective in Advanced Ecology[c]	3		BIOL	498	Practical Experience	1-3
		TOTAL S.H.	*17*		or	300	Co-op (research)	(1-3)
							TOTAL S.H.	*15-17*
	SEVENTH SEMESTER							
BIOL	325-486	Directed Elective in Advanced Ecology[c]	3			**EIGHTH SEMESTER**		
BIOL	344[§§]	Pop & Comm Ecology	3		BIOL	___	Biology Elective #2[§]	1-3
or	___	Biology Elective #2[§]	(1-3)		or	344[§§]	Pop & Comm Ecology	(3)
G3/ELEC	___	Social Science #2 or General Elective**	3		BIOL	Elective(s)[§]#3	For total of 49 BIOL s.h.	0-4
CHEM	375[a]	Environmental Chemistry	4		ENGL	312 or alt.	Advanced Writing (AW)	3
BIOL	472	Environ. Bio. Seminar	1-2		P	___	Perspectives Course (P)	3
		TOTAL S.H.	*12-16*		G3/ELEC	___	Social Science #3 or General Elective**	2-3
					ELEC	___	General Elective**	0-1
							TOTAL S.H.	*9-17*

*Can serve as a G2 required MATH course / † Can serve as a non-BIOL G2 course / †† Only GEOG 281/295 or ECON 102/207 serve as G3; ECON 207 is a W course

[a] Offered in Fall only / [§§]Offered in the Fall or Spring, but not both.

[b]Organismal biology courses are BIOL 346, 396, 415, 416, 417, 418, 424 and 461

[c] Directed electives in advanced ecology are BIOL 325, 329, 442, 443, 445, and 486 (BIOL 325 is recommended).

§Must be 300-level or above / ** Credits required if needed to bring overall total to 120.

Revised 5-17-17

BACHELOR OF SCIENCE IN BIOLOGY: MARINE OPTION

SAMPLE PROGRAM (120 s.h. minimum) (Well-prepared at admission)

FIRST SEMESTER					**SECOND SEMESTER**								
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4					
CHEM	111†	Intro. Chemistry I	4		CHEM	112†	Intro. Chemistry II	4					
MATH	160	Precalculus	4		MATH	161	Calculus I	4					
ENGL	110	English Composition	3		COMM	100	Fund. of Speech	3					
		TOTAL S.H.	*15-16*				*TOTAL S.H.*	*14-15*					
THIRD SEMESTER					**FOURTH SEMESTER**					**SUMMER SESSION[c]**			
BIOL	221	Concepts of Botany	4		BIOL	343	Ecology & Evolution	4		BIOL	295	Marine Invertebrates	3
BIOL	291[d]	Marine Biology	4		BIOL	375	Biometry	3		BIOL	396	Marine Ichthyology	3
CHEM	235[a]	Short Course in Organic Chem.	4		G3	___	Social Sciences #1	3					
WELL	175	Wellness	3		ESCI	261†	Intro. Oceanography	4					
		TOTAL S.H.	*15*				*TOTAL S.H.*	*14*				*TOTAL S.H.*	*6*
FIFTH SEMESTER					**SIXTH SEMESTER**					**SUMMER SESSION[c]**			
BIOL	362	Cell & Devel. Biol., W	4		BIOL	364	Genetics & Molecular	4		BIOL	___	Biological Oceanography	3
PHYS	131	Physics I with Algebra	4		PHYS	132	Physics II with Algebra	4					
CHEM 375a or G1		Chem. Elective or Humanities #1	3-4		ESCI 363 or G1		Chem. Elective or Humanities #1	3-4					
G3	___	Social Sciences #2, D	3		G3	___	Social Sciences #3, W	3					
		TOTAL S.H.	*14-15*				*TOTAL S.H.*	*14*				*TOTAL S.H.*	*3*
SEVENTH SEMESTER					**EIGHTH SEMESTER**								
BIOL	472	Marine Biology Seminar	1-2		BIOL	___	Biology Elective[§] #2	3-4					
BIOL	___	Biology Elective[§] #1	2-4		P	___	Perspectives Course (P)	3					
ENGL	___	Advanced Writing (AW)	3		___	___	General Elective**	3					
G1	___	Humanities #2	3		G1	___	Humanities #3, W	3					
___		General Elective**	3					___					
		TOTAL S.H.	*12-15*				*TOTAL S.H.*	*12-13*					

[a] CHEM 235 and CHEM 375 are offered in Fall only; [b]ESCI 363 is offered in Spring of odd years.

[c] At a marine field station, such as the Chincoteague Bay Field Station, Wallops Island VA.

[d] BIOL 291, taken at MU, may be replaced by BIOL 290 & BIOL 292, taken in combination, at a field station (not counting as field station courses--see footnote c)

*Can serve as a G2 required MATH course / † Can serve as a non-BIOL G2 course

§Must be 300-level or above; must have a total of 47 BIOL s.h.

** Credits required if needed to bring overall total to 120.

Revised 7-21-17

BACHELOR OF SCIENCE IN BIOLOGY MARINE OPTION

SAMPLE PROGRAM (120 s.h. minimum) (Less prepared at admission)

FIRST SEMESTER				SECOND SEMESTER				SUMMER SESSION[c]			
BIOL	101	Foundations of Biology	4	BIOL	211	Concepts of Zoology	4				
MATH	101	College Algebra	3	MATH	151*	Calculus for Mgmt. & Life Sci.	4				
ENGL	110	English Composition	3	COMM	100	Fund. of Speech	3				
WELL	175	Wellness	3	G3	___	Social Sciences #1	3				
G1	___	Humanities #1	3								
		TOTAL S.H.	*16*			*TOTAL S.H.*	*14*				
THIRD SEMESTER				**FOURTH SEMESTER**							
BIOL	291[d]	Marine Biology	4	BIOL	221	Concepts of Botany	4	BIOL	295	Marine Invertebrates	3
CHEM	111†	Intro. Chemistry I	4	CHEM	112†	Intro. Chemistry II	4	BIOL	396	Marine Ichthyology	3
BIOL	375	Biometry	3	ESCI	261†	Intro. Oceanography	4				
G3	___	Social Sciences #2, D	3	G1	___	Humanities #2, W	3				
		TOTAL S.H.	*14*			*TOTAL S.H.*	*15*			*TOTAL S.H.*	*6*
FIFTH SEMESTER				**SIXTH SEMESTER**				**SUMMER SESSION[c]**			
BIOL	343	Ecology & Evolution	4	BIOL	362	Cell & Devel. Biol., W	4	BIOL	___	Biological Oceanography	3
CHEM	235[a]	Short Course in Organic Chem	4	ESCI 363 or G1		Chem. Elective or Humanities #3	3-4				
ENGL	___	Advanced Writing (AW)	3	P	___	Perspectives (P)	3				
BIOL	___	Biology Elective[§] #1	2-4	BIOL	___	Biology Elective[§] #2	1-4				
		TOTAL S.H.	*13-15*			*TOTAL S.H.*	*13-14*			*TOTAL S.H.*	*3*
SEVENTH SEMESTER				**EIGHTH SEMESTER**							
BIOL	472	Marine Biology Seminar	1-2	___	___	General Elective**	3				
BIOL	364	Genetics & Molecular	4	___	___	General Elective**	3				
PHYS	131	Physics I with Algebra	4	PHYS	132	Physics II with Algebra	4				
CHEM 375a or G1		Chem. Elective or Humanities #3	3-4								
		TOTAL S.H.	*12-14*			*TOTAL S.H.*	*10*				

[a] CHEM 235 and CHEM 375 are offered in Fall only; [b]ESCI 363 is offered in Spring of odd years.

[c] At a marine field station, such as the Chincoteague Bay Field Station, Wallops Island VA.

[d] BIOL 291, taken at MU, may be replaced by BIOL 290 & BIOL 292, taken in combination, at a field station (not counting as field station courses--see footno

*Can serve as a G2 required MATH course / † Can serve as a non-BIOL G2 course

§Must be 300-level or above; must have a total of 47 BIOL s.h.

** Credits required if needed to bring overall total to 120.

Revised 7-21-17

Bachelor of Science in Biology: Medical Technology

SAMPLE PROGRAM (120 s.h. minimum) (Well Prepared at admission)

FIRST SEMESTER					**SECOND SEMESTER**			
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4
CHEM	111†	Intro. Chemistry I	4		CHEM	112†	Intro. Chemistry II	4
G1	___	Humanities #1	3		MATH	160* or 161(163)*	Precalculus or Calculus I	4-5
COMM	100	Fundamentals of Speech	3		ENGL	110	English Composition	3
		TOTAL S.H.	*14*				*TOTAL S.H.*	*15-16*
THIRD SEMESTER					**FOURTH SEMESTER**			
BIOL	257[b]	Intro to Allied Health	1		BIOL	362	Cell & Devel. Biol., W	4
CHEM	235[b]	Short Course in Organic Chem	4		BIOL	___	Biology Elective #2[a]	3-5
BIOL	___	Biology Elective #1[a]	3-5		CHEM	326	Biochemistry I	4
G3		Social Sciences #1, W	3		G3	___	Social Sciences #2, D	3
WELL	175	Wellness	3					
		TOTAL S.H.	*14-16*				*TOTAL S.H.*	*14-16*
FIFTH SEMESTER					**SIXTH SEMESTER**			
BIOL	364	Genetics & Molecular	4		BIOL	454[b]	Immunology	2
BIOL	461	General Microbiology	3		BIOL	Elective #3[a]	To a total of ≥8 s.h. BIOL electives	0-2
PHYS	131†	Physics I with Algebra	4		ENGL	312 or alt.	Advanced Writing (AW)	3
G1	___	Humanities #2, W	3		P	___	Perspectives Course (P)	3
G3	___	Social Sciences #3	3		G1	___	Humanities #3	3
			___		ELEC	___	General Elective(s)**	0-4
		TOTAL S.H.	*17*				*TOTAL S.H.*	*11-17*

Clinical year is worth 30 transfer credits

† Can serve as a non-BIOL G2 course / *Can serve as a G2 required MATH course

[a]Recommended Biology Electives: BIOL 356 (5 s.h.) or BIOL 254 (4 s.h.) & BIOL 255 (4 s.h.); and BIOL 375 (3 s.h.)

[b] BIOL 257 and CHEM 235 offered only in Fall Semester; BIOL 454 offered only in Spring Semester.

** Credits required if needed to bring overall total to 120. Revised 6-28-13

Bachelor of Science in Biology: Medical Technology								
SAMPLE PROGRAM (120 s.h. minimum) (Less prepared at admission)								
FIRST SEMESTER					**SECOND SEMESTER**			
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4
MATH	101	College Algebra	3		MATH	110/160*	Trigonometry/Precalculus	4-6
ENGL	110	English Composition	3		CHEM	111†	Intro. Chemistry I	4
G1	___	Humanities #1	3		COMM	100	Fundamentals of Speech	3
WELL	175	Wellness	3					
		TOTAL S.H.	*16*				*TOTAL S.H.*	*15-17*
THIRD SEMESTER					**FOURTH SEMESTER**			
BIOL	257[b]	Intro to Allied Health	1		BIOL	362	Cell & Devel. Biol., W	4
CHEM	112†	Intro. Chemistry II	4		BIOL	___	Biology Elective #2[a]	3-5
G1	___	Humanities #2, W	3		BIOL	364	Genetics & Molecular	4
BIOL	___	Biology Elective #1[a]	3-5		G1	___	Humanities #3	3
G3	___	Social Sciences #1, D	3					___
		TOTAL S.H.	*14-16*				*TOTAL S.H.*	*14-16*
FIFTH SEMESTER					**SIXTH SEMESTER**			
BIOL	461	Microbiology	3		BIOL	454[b]	Immunology	2
PHYS	131†	Physics I with Algebra	4		CHEM	326	Biochemistry I	4
CHEM	235[b]	Short Course in Organic Chem	4		ENGL	312 or alt.	Advanced Writing (AW)	3
G3	___	Social Sciences #2, W	3		BIOL	Elective #3[a]	To a total of ≥8 s.h. BIOL electives	0-3
G3	___	Social Sciences #3	3		P	___	Perspectives Course (P)	3
					ELEC	___	General Elective**	0
		TOTAL S.H.	*17*				*TOTAL S.H.*	*12-15*
Clinical year is worth 30 transfer credits								
† Can serve as a non-BIOL G2 course / *Can serve as a G2 required MATH course								
[a]Recommended Biology Electives: BIOL 356 (5 s.h.) or BIOL 254 (4 s.h.) & BIOL 255 (4 s.h.); and BIOL 375 (3 s.h.)								
[b] BIOL 257 and CHEM 235 offered only in Fall Semester; BIOL 454 offered only in Spring Semester.								
** Credits required if needed to bring overall total to 120.							Revised 6-28-13	

BACHELOR OF SCIENCE IN BIOLOGY: Molecular Biology/Biotechnology Option								
SAMPLE PROGRAM (120 s.h.) (Well-Prepared at Admission)								
FIRST SEMESTER					**SECOND SEMESTER**			
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4
CHEM	111†	Intro. Chemistry I	4		or	221	Concepts of Botany	
MATH	160* or 161(163)*	Precalculus or Calculus I	4-5		CHEM	112†	Intro. Chemistry II	4
COMM	100	Fundamentals of Speech	3		MATH	161† or other	Calculus I or (II, Stats or CSCI)	3-4
			___		ENGL	110	English Composition	3
		TOTAL S.H.	*15-16*				*TOTAL S.H.*	*14-15*
THIRD SEMESTER					**FOURTH SEMESTER**			
BIOL	221	Concepts of Botany	4		BIOL	362	Cell & Devel. Biology, W	4
or	211	Concepts of Zoology			CHEM	232	Organic Chemistry II	4
CHEM	231	Organic Chemistry I	4		PHYS	132	Physics II with Algebra	4
PHYS	131†	Physics I with Algebra	4		G1	___	Humanities #1	3
WELL	175	Wellness	3					___
		TOTAL S.H.	*15*				*TOTAL S.H.*	*15*
FIFTH SEMESTER					**SIXTH SEMESTER**			
BIOL	364	Genetics & Molecular	4		BIOL	343	Ecology & Evolution	4
CHEM†	326	Biochemistry I	4		CHEM†	327	Biochemistry II	4
G1	___	Humanities #2	3		G3	___	Social Science #2	3
G3	___	Social Science #1, W	3		ENGL	312 or alt	Advanced Writing (AW)	3
		TOTAL S.H.	*14*				*TOTAL S.H.*	*14*
SEVENTH SEMESTER					**EIGHTH SEMESTER**			
BIOL	462	Molecular Biology, W	4		BIOL	466	Molecular & Cell Techniqu	3
BIOL	Elective§	463, 465 or 467 recommende	3-4		BIOL	472	Seminar in Biology (MOL)	1-2
G3	___	Social Science #3	3		BIOL	Elective§	463, 465 or 467 recommended	3-4
G1	___	Humanities #3	3		BIOL	Elective§	For total of 39 BIOL s.h.	0-1
D	___	Diversity Course (D)	3		ELEC	___	General Elective**	3
					P	___	Perspectives Course (P)	3
			___		ELEC	___	General Elective**	1-3
		TOTAL S.H.	*16-17*				*TOTAL S.H.*	*14-17*
** Credits required if needed to bring total to 120.								
† Can serve as a non-BIOL G2 course								
*Can serve as a G2 required MATH course							Revised 6-28-13	
§Must be 300-level or above								

BACHELOR OF SCIENCE IN BIOLOGY: Molecular Biology/Biotechnology Option								
SAMPLE PROGRAM (120 s.h.) (Less Prepared at Admission)								
FIRST SEMESTER					**SECOND SEMESTER**			
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4
COMM	100	Fundamentals of Speech	3		or	221	Concepts of Botany	
MATH	101	College Algebra	3		CHEM	111†	Intro. Chemistry I	4
WELL	175	Wellness	3		MATH	110/160*	Trigonometry/Precalculus	4-6
G1	___	Humanities #1	3		ENGL	110	English Composition	3
		TOTAL S.H.	*16*				*TOTAL S.H.*	*15-17*
THIRD SEMESTER					**FOURTH SEMESTER**			
BIOL	221	Concepts of Botany	4		BIOL	362	Cell & Devel. Biology, W	4
or	211	Concepts of Zoology			CHEM	231	Organic Chemistry I	4
MATH	161†	Calculus I	4		D	___	Diversity Course (D)	3
G1	___	Humanities #2	3		G3	___	Social Sciences #1	3
CHEM	112†	Intro. Chemistry II	4		G1	___	Humanities #3	3
		TOTAL S.H.	*15*				*TOTAL S.H.*	*17*
FIFTH SEMESTER					**SIXTH SEMESTER**			
BIOL	364	Genetics & Molecular	4		BIOL	343	Ecology and Evolution	4
CHEM	232	Organic Chemistry II	4		G3	___	Social Sciences #3, W	3
PHYS	131	Physics I with Algebra	4		PHYS	132	Physics II with Algebra	4
G3	___	Social Sciences #2	3		BIOL	Elective§	463, 465 or 467 recommended	3-4
		TOTAL S.H.	*15*				*TOTAL S.H.*	*14-15*
SEVENTH SEMESTER					**EIGHTH SEMESTER**			
BIOL	462	Molecular Biology, W	4		BIOL	466	Molecular & Cell Technique	3
CHEM	326	Biochemistry I	4		BIOL	472	Seminar in Biology (MOL)	1-2
BIOL	Elective§	463, 465 or 467 recommende	3-4		CHEM†	327 or 324	Biochem II or Plant Biochem	4
BIOL	Elective§	For total of 39 BIOL s.h.	0-1		P	___	Perspectives Course (P)	3
ENGL	312 or alt	Advanced Writing (AW)	3		ELEC	___	General Elective**	0-2
							TOTAL S.H.	*11 -14*
		TOTAL S.H.	*14-15*					
** Credits required if needed to bring total to 120.								
† Can serve as a non-BIOL G2 course							Revised 6-28-13	
*Can serve as a G2 required MATH course								
§Must be 300-level or above								

Bachelor of Science in Biology for Nuclear Medicine Option								
SAMPLE PROGRAM (120 s.h. minimum) (Well Prepared at admission)								
FIRST SEMESTER					**SECOND SEMESTER**			
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4
CHEM	111†	Intro. Chemistry I	4		CHEM	112†	Intro. Chemistry II	4
G1	___	Humanities #1	3		MATH	160* or 161(163)*	Precalculus or Calculus I	4-5
COMM	100	Fundamentals of Speech	3		ENGL	110	English Composition	3
		TOTAL S.H.	*14*				*TOTAL S.H.*	*15-16*
THIRD SEMESTER					**FOURTH SEMESTER**			
BIOL	257[a]	Intro to Allied Health	1		BIOL	356[a]	Functional Human Anatom	5
CHEM	235[a]	Short Course in Organic Chem	4		CHEM	326	Biochemistry I	4
BIOL	362	Cell & Devel. Biol., W	4		BIOL	375	Biometry	3
G3	___	Social Sciences #1	3		G3	___	Social Sciences #2, W	3
WELL	175	Wellness	3					
		TOTAL S.H.	*15*				*TOTAL S.H.*	*15*
FIFTH SEMESTER					**SIXTH SEMESTER**			
BIOL	364	Genetics & Molecular	4		PHYS	132	Physics with Algebra II	4
PHYS	131†	Physics with Algebra I	4		ENGL	312 or alt.	Advanced Writing (AW)	3
G1	___	Humanities #2, W	3		G1	___	Humanities #3	3
G3	___	Social Sciences #3, D	3		ELEC	___	General Elective**	3
P	___	Perspectives Course (P)	3		ELEC	___	General Elective**	2-3
		TOTAL S.H.	*17*				*TOTAL S.H.*	*15-16*
Clinical year is worth 28 credits								
† Can serve as a non-BIOL G2 course / *Can serve as a G2 required MATH course							Revised 6-28-13	
[a] BIOL 257 and CHEM 235 offered only in Fall Semester; BIOL 356 offered only in Spring semester								
** Credits required if needed to bring overall total to 120 s.h.								

Bachelor of Science in Biology for Nuclear Medicine Option								
SAMPLE PROGRAM (120 s.h. minimum) (Less prepared at admission)								
FIRST SEMESTER					**SECOND SEMESTER**			
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4
MATH	101	College Algebra	3		MATH	110/160*	Trigonometry/Precalculus	4-6
ENGL	110	English Composition	3		CHEM	111†	Intro. Chemistry I	4
G1	___	Humanities #1	3		COMM	100	Fundamentals of Speech	3
WELL	175	Wellness	3					
		TOTAL S.H.	*16*				*TOTAL S.H.*	*15-17*
THIRD SEMESTER					**FOURTH SEMESTER**			
BIOL	257[a]	Intro to Allied Health	1		BIOL	356[a]	Functional Human Anatomy	5
CHEM	112†	Intro. Chemistry II	4		BIOL	364	Genetics & Molecular	4
BIOL	362	Cell & Devel. Biol., W	4		G1	___	Humanities #3, W	3
G3	___	Social Sciences #1	3		G3	___	Social Sciences #2	3
G1	___	Humanities #2, D	3					
		TOTAL S.H.	*15*				*TOTAL S.H.*	*15*
FIFTH SEMESTER					**SIXTH SEMESTER**			
PHYS	131†	Physics with Algebra I	4		PHYS	132	Physics with Algebra II	4
CHEM	235[a]	Short Course in Organic Chem	4		CHEM	326	Biochemistry I	4
BIOL	375	Biometry	3		ENGL	312 or alt.	Advanced Writing (AW)	3
G3	___	Social Sciences #3, W	3		P	___	Perspectives Course (P)	3
					ELEC	___	General Elective**	1-3
		TOTAL S.H.	*14*				*TOTAL S.H.*	*15-17*
Clinical year is worth 28 credits							Revised 6-28-13	
† Can serve as a non-BIOL G2 course / *Can serve as a G2 required MATH course								
[a] BIOL 257 and CHEM 235 offered only in Fall Semester; BIOL 356 offered only in Spring semester								
** Credits required if needed to bring overall total to 120 s.h.								

Bachelor of Science in Biology for Pre-Optometry

SAMPLE PROGRAM (120 s.h. minimum) (Well Prepared at admission)

FIRST SEMESTER					SECOND SEMESTER			
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4
CHEM	111†	Intro. Chemistry I	4		CHEM	112†	Intro. Chemistry II	4
MATH	160* or 161(163)*	Precalculus or Calculus I	4-5		MATH	161† or other	Calculus I or (II, Stats or CSCI)	3-4
COMM	100	Fundamentals of Speech	3		ENGL	110	English Composition	3
			___		G1	___	Humanities #1	3
		TOTAL S.H.	*15-16*				*TOTAL S.H.*	*17-18*[§]
THIRD SEMESTER					**FOURTH SEMESTER**			
PSYC	100	General Psychology, G3	3		BIOL	362	Cell & Devel. Biol., W	4
CHEM	231	Organic Chemistry I	4		CHEM	232	Organic Chemistry II	4
PHYS	131	Physics I with Algebra	4		PHYS	132	Physics II with Algebra	4
BIOL	375	Biometry	3		WELL	175	Wellness	3
G1	___	Humanities #2, W	3					
		TOTAL S.H.	*17*				*TOTAL S.H.*	*15*
FIFTH SEMESTER					**SIXTH SEMESTER**			
BIOL	364	Genetics & Molecular	4		CHEM	326	Biochemistry I	4
BIOL	461	General Microbiology	3		ENGL	312 or alt.	Advanced Writing (AW)	3
P	___	Perspectives Course (P)	3		G3	___	Social Sciences #3, D	3
G1	___	Humanities #3	3		BIOL	472	Senior Seminar	1-2
G3	___	Social Sciences #2, W	3		ELEC	___	General Elective(s)**[a]	3-6
		TOTAL S.H.	*16*				*TOTAL S.H.*	*15-17*

Clinical Year is worth 23 credits

§Note: Student will need to wait until the end of registration to enroll in >17 credits, or one of these courses could be completed during Winter or S

† Can serve as a non-BIOL G2 course / *Can serve as a G2 required MATH course

** Credits required if needed to bring overall total to 120.

Revised 6-28-13

[a]BIOL 356 Functional Human Anatomy (5 s.h.) and/or BIOL 438 Neurobiology (3 s.h.) are recommended.

Bachelor of Science in Biology for Pre-Optometry									
SAMPLE PROGRAM (120 s.h. minimum) (Less prepared at admission)									
FIRST SEMESTER					**SECOND SEMESTER**				
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4	
MATH	101	College Algebra	3		MATH	110/160*	Trigonometry/Precalculus	4-6	
ENGL	110	English Composition	3		CHEM	111†	Intro. Chemistry I	4	
G1	___	Humanities #1	3		COMM	100	Fundamentals of Speech	3	
WELL	175	Wellness	3						
		TOTAL S.H.	*16*				*TOTAL S.H.*	*15-17*	
THIRD SEMESTER					**FOURTH SEMESTER**				
PSYC	100	General Psychology, G3 #1	3		BIOL	362	Cell & Devel. Biol., W	4	
CHEM	112†	Intro. Chemistry II	4		PHYS	132	Physics II with Algebra	4	
PHYS	131†	Physics I with Algebra	4		CHEM	231	Organic Chemistry I	4	
BIOL	375	Biometry	3		G1	___	Humanities #2, D	3	
MATH	161	Calculus I	4						
		TOTAL S.H.	*18*[§]				*TOTAL S.H.*	*15*	
FIFTH SEMESTER					**SIXTH SEMESTER**				
BIOL	364	Genetics & Molecular	4		ENGL	312 or alt.	Advanced Writing (AW)	3	
BIOL	461	General Microbiology	3		CHEM	326	Biochemistry I	4	
CHEM	232	Organic Chemistry II	4		BIOL	472	Senior Seminar	1-2	
G3	___	Social Sciences #2, W	3		G3	___	Social Sciences #3, W	3	
G1	___	Humanities #3	3		P	___	Perspectives Course (P)	3	
					ELEC	___	General Electives**[a]	0-2	
		TOTAL S.H.	*17*				*TOTAL S.H.*	*14-17*	
Clinical Year is Worth 23 credits									
§Note: Student will need to wait until the end of registration to enroll in >17 credits, or one of these courses could be completed during Winter or									
† Can serve as a non-BIOL G2 course / *Can serve as a G2 required MATH cours							Revised 6-28-13		
** Credits required if needed to bring overall total to 120.									
[a]BIOL 356 Functional Human Anatomy (5 s.h.) and/or BIOL 438 Neurobiology (3 s.h.) are recommended.									

Bachelor of Science in Biology for Pre-Podiatry									
SAMPLE PROGRAM (120 s.h. minimum) (Well Prepared at admission)									
FIRST SEMESTER					**SECOND SEMESTER**				
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4	
CHEM	111†	Intro. Chemistry I	4		CHEM	112†	Intro. Chemistry II	4	
MATH	160* or 161(163)*	Precalculus or Calculus I	4-5		MATH[§]	161†	Calculus I	4	
COMM	100	Fundamentals of Speech	3		ENGL	110	English Composition	3	
		TOTAL S.H.	*15-16*				*TOTAL S.H.*	*15*	
THIRD SEMESTER					**FOURTH SEMESTER**				
BIOL	257[a]	Intro to Allied Health	1		BIOL	356[a]	Functional Human Anatomy	5	
CHEM	231	Organic Chemistry I	4		CHEM	232	Organic Chemistry II	4	
PHYS	131	Physics I with Algebra	4		PHYS	132	Physics II with Algebra	4	
BIOL	362	Cell & Devel. Biol., W	4		WELL	175	Wellness	3	
G3	___	Social Sciences #1	3						
		TOTAL S.H.	*16*				*TOTAL S.H.*	*16*	
FIFTH SEMESTER					**SIXTH SEMESTER**				
BIOL	364	Genetics & Molecular	4		P	___	Perspectives Course (P)	3	
BIOL	435[a]	Animal Physiology	3		ENGL	312 or alt.	Advanced Writing (AW)	3	
G1	___	Humanities #1	3		G3	___	Social Science #3, D	3	
G3	___	Social Science #2, W	3		G1	___	Humanities #2, W	3	
CHEM	326	Biochemistry	4		G1	___	Humanities #3	3	
					ELEC	___	General Elective**	1-2	
		TOTAL S.H.	*17*				*TOTAL S.H.*	*16-17*	
Clinical Year is worth 24 credits									
[§]Take a General Elective for ≥3 s.h. if Calculus I requirement has already been completed.									
[†] Can serve as a non-BIOL G2 course / *Can serve as a G2 required MATH course									
[a] BIOL 257 and BIOL 435 offered only in Fall Semester; BIOL 356 offered only in Spring semester									
** Credits required if needed to bring overall total to 120.							Revised 6-28-13		

Bachelor of Science in Biology for Pre-Podiatry								
SAMPLE PROGRAM (120 s.h. minimum) (Less prepared at admission)								
FIRST SEMESTER					**SECOND SEMESTER**			
BIOL	101	Foundations of Biology	4		BIOL	211	Concepts of Zoology	4
MATH	101	College Algebra	3		MATH	110/160*	Trigonometry/Precalculus	4-6
ENGL	110	English Composition	3		CHEM	111†	Intro. Chemistry I	4
G1	___	Humanities #1	3		COMM	100	Fundamentals of Speech	3
WELL	175	Wellness	3					
		TOTAL S.H.	*16*				*TOTAL S.H.*	*15-17*
THIRD SEMESTER					**FOURTH SEMESTER**			
BIOL	257[a]	Intro to Allied Health	1		BIOL	356[a]	Functional Human Anatomy	5
BIOL	362	Cell & Devel. Biol., W	4		PHYS	132	Physics II with Algebra	4
CHEM	112†	Intro. Chemistry II	4		CHEM	231	Organic Chemistry I	4
PHYS	131†	Physics I with Algebra	4		G3	___	Social Sciences #1, W	3
MATH	161	Calculus I	4					
		TOTAL S.H.	*17*				*TOTAL S.H.*	*16*
FIFTH SEMESTER					**SIXTH SEMESTER**			
BIOL	364	Genetics & Molecular	4		P	___	Perspectives Course (P)	3
BIOL	435[a]	Animal Physiology	3		ENGL	312 or alt	Advanced Writing (AW)	3
CHEM	232	Organic Chemistry II	4		G3	___	Social Sciences #3, W	3
G3	___	Social Sciences #2, D	3		CHEM	326	Biochemistry I	4
G1	___	Humanties #2	3		G1	___	Humanities #3	3
		TOTAL S.H.	*17*				*TOTAL S.H.*	*16*
Clinical Year is worth 24 credits								
† Can serve as a non-BIOL G2 course / *Can serve as a G2 required MATH course								
[a] BIOL 257 and BIOL 435 offered only in Fall Semester; BIOL 356 offered only in Spring semester								

Bachelor of Science in Biology for Respiratory Therapy

SAMPLE PROGRAM (120 s.h. minimum) (Well Prepared at admission)

FIRST SEMESTER			
BIOL	101	Foundations of Biology	4
CHEM	111†	Intro. Chemistry I	4
MATH	160* or 161(163)*	Precalculus or Calculus I	4-5
COMM	100	Fundamentals of Speech	3
		TOTAL S.H.	*5-16*

SECOND SEMESTER			
CHEM	112†	Intro. Chemistry II	4
MATH	161†	Calculus I	4
ENGL	110	English Composition	3
G1	___	Humanities #1	3
		TOTAL S.H.	*13-14*

THIRD SEMESTER			
BIOL	257§	Intro to Allied Health	1
CHEM	235§	Short Course in Organic Chem	4
PHYS	131	Physics I with Algebra	4
G3	___	Social Sciences #1, W	3
G1	___	Humanities #2, D	3
		TOTAL S.H.	*15*

FOURTH SEMESTER			
BIOL	362	Cell & Devel. Biol., W	4
G3	___	Social Sciences #2[a]	3
WELL	175	Wellness	3
G1	___	Humanities #3	3
		TOTAL S.H.	*13*

FIFTH SEMESTER			
BIOL	364	Genetics & Molecular	4
BIOL	461	General Microbiology	3
P	___	Perspectives	3
G3	___	Social Sciences #3, W[b]	3
ELEC	___	General Elective[b]	3
		TOTAL S.H.	*16*

SIXTH SEMESTER			
CHEM	326	Biochemistry I	4
ENGL	312 or alt.	Advanced Writing (AW)	3
BIOL	356§	Functional Human Anatomy	5
ELEC	___	General Elective[c]	2-3
ELEC	___	General Elective[c]	0-1
		TOTAL S.H.	*14-15*

SUMMER SESSION			
RESP	410	Acute Cardiopulmonary Care	2
RESP	411	Resp Care Techniques 1	2
RESP	412	Princ of Aerosol & Gas Therapy	3
RESP	422	Pharmacology	2
RESP	420	Arterial Blood Gas Analysis	3
		TOTAL S.H.	*12*

SEVENTH SEMESTER			
RESP	413	Resp Assessment & Therap	4
RESP	421	Phys. Mechanical Ventilatic	2
RESP	414	Resp Care Techniques II	3
RESP	460	Clinical Practice I	2
RESP	425	Neonatology	2
RESP	419	Resp Care in Alt. Sites	2
		TOTAL S.H.	*15*

WINTER SESSION			
RESP	461	Clinical Practicum	1
		TOTAL S.H.	1

EIGHTH SEMESTER**			
BIOL	455	Cardiopulmonary Phys	3
RESP	417	Resp Care Techniques III (W	3
RESP	415	Tech Aspects Mech Vent	3
RESP	423	Infectious Diseases	2
RESP	424	Non-Infectious Diseases	2
RESP	462	Clinical Practice II	2
		TOTAL S.H.	*15*

SUMMER SESSION			
RESP	463	Clinical Practicum II	2
		TOTAL S.H.	*2*

** Students will have earned enough credits to graduate after completion of this spring term.

NINTH SEMESTER			
RESP	464	Clinical Practicum III	10
RESP	495	Resp Care Research	2
		TOTAL S.H.	*12*

† Can serve as a non-BIOL G2 course / *Can serve as a G2 required MATH course

Revised 6-28-13

[a] Psychology 100 is a recommended G3 course.

§ BIOL 257 and CHEM 235 offered only in Fall Semester; BIOL 356 offered only in Spring semester

[b] It is recommended that students take their 3rd writing course on campus; however, RESP 417 offered in the clinical phase of the program can be counted as a 3rd writing course at the completion of the program.

[c] Credits required if needed to bring overall total to 120.

Bachelor of Science in Biology for Respiratory Therapy

SAMPLE PROGRAM (120 s.h. minimum) (Less prepared at admission)

FIRST SEMESTER				SECOND SEMESTER			
BIOL	101	Foundations of Biology	4	G3	___	Social Sciences #1[a]	3
MATH	101	College Algebra	3	CHEM	111†	Intro. Chemistry I	4
COMM	100	Fundamentals of Speech	3	MATH	110/160*	Trigonometry/Precalculus	4-6
G1	___	Humanities #1	3	ENGL	110	English Composition	3
WELL	175	Wellness	3				
		TOTAL S.H.	*16*			*TOTAL S.H.*	*14-16*

THIRD SEMESTER				FOURTH SEMESTER			
BIOL	257[§]	Intro to Allied Health	1	BIOL	364	Genetics & Molecular	4
CHEM	112†	Intro Chemistry II	4	BIOL	356[§]	Functional Human Anatomy	5
BIOL	362	Cell & Devel. Biol., W	4	G1	___	Humanities #3	3
MATH	161†	Calculus I	4	G3	___	Social Sciences #2, W	3
G1	___	Humanities #2, D	3				
		TOTAL S.H.	*16*			*TOTAL S.H.*	*15*

FIFTH SEMESTER				SIXTH SEMESTER				SUMMER SESSION			
BIOL	461	General Microbiology	3	CHEM	326	Biochemistry I	4	RESP	410	Acute Cardiopulmonary Care	2
CHEM	235[§]	Short Course in Organic Chem	4	ENGL	312 or alt.	Advanced Writing (AW)	3	RESP	411	Resp Care Techniques 1	2
PHYS	131	Physics I with Algebra	4	P	___	Perspectives Course (P)	3	RESP	412	Princ of Aerosol & Gas Therapy	3
G3	___	Social Sciences #3, W[b]	3	ELEC	___	General Elective[c]	1-3	RESP	422	Pharmacology	2
								RESP	420	Arterial Blood Gas Analysis	3
		TOTAL S.H.	*14*			*TOTAL S.H.*	*11-13*			*TOTAL S.H.*	12

SEVENTH SEMESTER				WINTER SESSION				EIGHTH SEMESTER**				SUMMER SESSION			
RESP	413	Resp Assessment & Therap.	4	RESP	461	Clinical Practicum	1	BIOL	455	Cardiopulmonary Phys	3	RESP	463	Clinical Practicum II	2
RESP	421	Phys. Mechanical Ventilation	2					RESP	417	Resp Care Techniques III	3				
RESP	414	Resp Care Techniques II	3					RESP	415	Tech Aspects Mech Vent	3				
RESP	460	Clinical Practice I	2					RESP	423	Infectious Diseases	2				
RESP	425	Neonatology	2					RESP	424	Non-Infectious Diseases	2				
RESP	419	Resp Care in Alt. Sites	2					RESP	462	Clinical Practice II	2				
		TOTAL S.H.	*15*			*TOTAL S.H.*	1			*TOTAL S.H.*	*15*			*TOTAL S.H.*	*2*

** Students will have earned enough credits to graduate after completion of this spring term.

NINTH SEMESTER			
RESP	464	Clinical Practicum III	10
RESP	495	Resp Care Research	2
		TOTAL S.H.	*12*

† Can serve as a non-BIOL G2 course / *Can serve as a G2 required MATH course

Revised 6-28-13

[a] Psychology 100 is a recommended G3 course.

[§] BIOL 257 and CHEM 235 offered only in Fall Semester; BIOL 356 offered only in Spring semester

[b] It is recommended that students take their 3rd writing course on campus; however, RESP 417 offered in the clinical phase of the program can be counted as a 3rd writing course at the completion of the progra

[c] Credits required if needed to bring overall total to 120.