I. INTRODUCTION

II. THE BIOLOGY CURRICULUM

Guidelines
Levels and Sequence of Courses
Frequency of Course Offerings
Laboratories
Laboratory Safety
Majoring in Biology
Declaration of Major
Courses from Other Departments
Biology Major Requirements
Biotechnology Track
Biochemistry Joint Major
Biochemistry Certificate
Biology Major with Secondary Education Certificate
Biology Minor Requirements
Environmental Biology Minor
Environmental Biology Certificate
Management of Environmental Biology Minor and Certificate
Bio-behavioral Studies Program

III. ACADEMIC ADVISING

Academic Support Services
Supplemental Instruction (SI)
CSM Student Success Center

IV. ACADEMIC DISHONESTY

V. SPECIAL PROGRAMS AND OPPORTUNITIES

Diverse Ways to Complete the Major
Independent Study
Honors
Nantucket Field Station
Summer School
Research Opportunities
- Research Experiences for Undergraduates (REU)
- Initiative for Maximizing Student Development (IMSD)
- Coastal Research in Environmental Science and Technology (CREST)
The Graduate Program in Biology

VI. SPECIAL CREDITS AND GRADES

AP and CLEP
Grades: Minimum/Pass-Fail/Incomplete
Repeating a Course
Transfer Credits

VII. CAREERS IN BIOLOGY

Graduate School
Health-Related Professions
Biotechnology Careers
Environmental Careers

VIII. LOCATIONS AND ACTIVITIES

Biology Seminar Series
Department Prizes and Awards
Student Organizations

IX. LIBRARY & ELECTRONIC RESOURCES

X. THE BIOLOGY FACULTY

Appendices
A. Biology Courses
B. Course Descriptions
I. INTRODUCTION

Biology is an enormously diverse discipline. A few of the many fields it encompasses are anatomy, animal behavior, botany, cell biology, developmental biology, ecology, microbiology, molecular biology, ornithology, physiology and zoology. Each of those (and others) is the title of a separate department in some educational institutions, but there is an increasing tendency nowadays for unification. The Biology Department of UMB reflects some of this diversity, not only in its faculty, but also in the students and in the curriculum.

In recent years about 6.8% of the undergraduates at UMB have been Biology majors and have had a wide range of interests and aims. Some have decided to major in Biology because they are curious about the world around them, or are concerned with environmental problems; others are looking to medical school or other career training, notably Biotechnology. There are considerable numbers of older students who have returned to college after other degrees or other careers.

The purpose of this booklet is to help you to get more out of your time at UMB and to help you make wise choices during your college career. We expect most of the readers will be Biology majors, although non-majors and graduate students also will find useful material here. The information provided is certainly not all inclusive; the intention is to indicate regulations and also to suggest courses of action and direct you to further useful sources. In some cases you will need to get important details and current information from the University Catalog (copies may be available in the Admissions Office), from the Chairman of the Department, the Biology Office, or from other offices in the University, as indicated. The University web site address www.umb.edu as well as our department web site http://www.umb.edu/academics/csm/biology/ can be very helpful. [Also see Academic Advising, page 9].

All Biology majors are expected to be conversant with all appropriate parts of the current handbook. New features in this edition reflect recent changes since the previous version was published in Spring 2012. Most notably, the changes reflect the newly installed pre-requisites now required for all upper-level Biology and Biochemistry courses as well as the addition of a required freshman seminar course for both Biology and Biochemistry majors. Additionally, a more in-depth explanation of the Biology Minor requirements is also explained in this latest edition of the handbook. The new General Education requirements are included, some new courses are listed, and there are numerous alterations to the text. If you are unclear about any of the policies, etc., described here, please consult your advisor. If you have suggestions for future editions of this handbook, please send them to the Chairman of the Department, currently Rick Kesseli (rick.kesseli@umb.edu).

II. THE BIOLOGY CURRICULUM

New General Education Guidelines
The undergraduate curriculum in the College of Sciences and Mathematics (CSM) is divided into three parts: preparation in general education; a major field of study; and electives that complement the major and provide the breadth and depth of a liberal education. To earn a degree, students must meet the general education requirements (in addition to fulfilling major, total credits, and grade point average requirements described elsewhere in this booklet). For complete information about these requirements, please see the Undergraduate Catalog, or visit (http://www.umb.edu/registrar/registration_courses/course_catalog/).

Levels and Sequence of Courses
The array of courses is intended to meet the needs of a variety of students, both those who will go on to graduate and professional schools, and those who adopt Biology as a terminal science major. The Biology core requirements are addressed on page 38. The numbering system indicates the level of the course and the prerequisites. The 100-level courses have no prerequisites, and include several introductory courses for non-majors, as well as the two-semester
introductory course for majors (Biology 111-112) which is a prerequisite for all biology courses numbered 200 or above. The 200-level, or intermediate, courses with prerequisites of introductory biology, include three that are required of all majors (210, 252 and 290), and several intermediate-level electives, most notably 207, 208 and 209 which are requirements for the Nursing Major and are NOT open to Biology majors. The 300-level or higher number courses have two or more prerequisites above introductory biology. The 600-level courses are intended for graduate students but also are open to qualified undergraduates at the discretion of the instructor. Appendix A lists, by title, all biology courses according to areas, and Appendix B gives course descriptions.

Because the study of biology is by necessity more structured than some subjects, a definite sequence of courses is recommended. Majors are encouraged to take Biology 111-112, Chemistry 115-116, and Math 135, 140, or 145 during their first year. In the second year, aim for Cell Biology (Biology 210), Genetics (Biology 252), Population Biology (Biology 290), and Physics with lab. If your schedule is too crowded, you can defer a course that is not a prerequisite for the first 300-level courses you plan to take (see pages 24-25). If you plan to take 300-level courses in evolutionary biology, take Genetics and Population Biology as soon as possible. The prerequisites for advanced courses are important. In general, it is appropriate to take all the 100-level and 200-level courses specifically required for the major before taking courses numbered 300 or higher. An average of "C-" or better in Biology 111-112 (or equivalent), or written permission of the course instructor, is required for registration in biology courses numbered 200 or above.

**Frequency of Course Offerings**
In general, all required courses are offered each semester, i.e., General Biology (Biology 111 and 112), Cell Biology with lab (Biology 210), Genetics with lab (Biology 252) and Population Biology (Biology 290). Advanced courses are offered once per year or in alternate years. At present, the Extended Day (Saturday and evening) program and summer school are limited to a few introductory courses (101, 102, 108, 111, & 112). A provisional schedule of biology courses for the next two years may be available in the Biology Office. If you are interested in a course that is listed in the Undergraduate Catalog but not in the course listing, inquire at the Biology Office as to when it may be offered again. Some advanced courses are offered only when there is sufficient demand.

**Laboratories**
Many biology courses include laboratory or field work, and there are extensive lab requirements for the major. In some cases it is possible to take only the lecture part of the course, but generally not the lab alone. Two systems exist for taking only the lecture: (1) for some courses, the lecture and lab have separate numbers, i.e., are different courses, usually with lecture a co-requisite for the lab, (2) in others, the course is listed with the lab and there is an alternate number listed for "lecture-only" option. Generally, students taking the lab portion perform substantially better on the lecture part of the course than those who are not taking lab, perhaps because they experience the material from another angle and also have more opportunities to discuss the work. Because you receive credit for the same material only once, you can not receive credit for both “lecture only” and “lecture & lab” versions of the same course.

**Laboratory Safety**
Working in laboratories requires certain precautions. You have a responsibility for your own safety, and for that of others. You are expected to comply with all safety rules laid down by the University, the Department or your instructor. Before you first start to work in a lab, familiarize yourself with the location and operation of the emergency shower, first-aid kit, eye-wash station, fire extinguisher, and the nearest telephone. Before using any equipment, apparatus, or chemicals read and heed the relevant instructions. Do not leave apparatus unattended without taking precautions to ensure that it is safe. In case of accident, inform your instructor immediately. Working alone in labs, darkrooms, etc. can cause extra hazards (for example, if you have a lab job that requires you to be in at unusual hours). For your own protection, take the following extra precautions: inform someone else where you are, what you are doing, and make sure you can contact them if necessary. Emergency numbers are listed beside phones in the labs.
Majoring in Biology
The undergraduate degree in Biology is the Bachelor of Science. In addition to the standard biology major, there is one specialization which is described below: the Biotechnology Track. The Biotechnology Track requires the same number of credit hours as the standard Biology major, but more courses are specified. An additional major in Biochemistry has been developed. The following describes the requirements of the Biology Department; those of the College and University can be found in the University’s Undergraduate Catalog and in the Graduate Studies Bulletin and Application.

Declaration of Major
To declare or change your major, file a form with the Registrar’s Office within the One Stop Shop, located on the UL of the Campus Center. The "Declaration of Major/Change of Major" form is available in the Biology Department Office, Wheatley Building, 3rd floor, Room 021, in the Academic Support Office on the first floor or in the Campus Center, in the “One Stop Shop” on the upper level in the Campus Center, and in the Registrar’s Office, 4th floor Campus Center. You are required to declare a major no later than the semester immediately following the accumulation of 60 credits. Transfer students who enter the University with 60 or more credits must declare a major during their first semester. If you are interested in a double major or a concentration (program of studies), complete and file the same declaration form. You must tell the Registrar in this way if you want these to be identified on your transcript. A student pursuing a double major may in some cases be able to use the same course(s) to satisfy the requirements of two departments.

Courses from Other Departments
The following paragraphs about Chemistry, Math and Physics courses apply to the Biology major and the Biotechnology track. Some knowledge of chemistry is essential for the study of biology. Chemistry 115-118 is required of all Biology majors. If possible you should take these in your freshman year as Chemistry 115/117 is a prerequisite for Biology 210 and 252 (Chemistry 107-108 does not meet this requirement). Organic Chemistry (Chemistry 251, 252, 255, 256) is a pre- or co-requisite for some advanced biology courses and is often required by graduate or professional schools. This course can be counted towards the biology major (but is not required), and it also counts towards the lab requirement. NOTE: that only one (1) credit from each two (2) credit organic chemistry lab can be applied toward the upper level biology major requirement. Courses in physical chemistry and biochemistry are sometimes advisable.

Mathematics is also necessary. Look for particular sections and/or courses intended for Biology majors. The Math Department offers a placement test which you must take. This test is offered frequently, especially before classes begin in the Fall semester and during the Registration period. Details are available from the Admissions Office. A new student must achieve placement by this test into Math 130 or higher as a pre-requisite for Biology 210, 252 and 290. In addition, each of the Biology majors requires mathematics through at least one semester of Calculus (Math 135 or 140). You should complete this requirement as soon as possible, and before you take Ecology (Biology 342) or Comparative Physiology (Biology 337). It is often advisable to take additional Calculus, Statistics or Computer Programming courses in preparation for jobs or further training. One year of Introductory Physics (either 107-108 or 113-114), plus lab (Physics 181-182) is also required, and it is advisable not to leave this requirement until the last moment!

Biology Major Requirements
The requirements for the standard Biology major were changed slightly in 1995; the current version is summarized below and presented fully in Appendix C. Other options for completing the major (described below) differ only in small ways from this. If you matriculated before Fall 1988, please consult with Dr. Robert Guimond about the appropriate requirements. Please see Appendices A, B, C, D and E for more detailed information related to the Biology major requirements.
1. A Biology "core" of 19 credits in Biology (General Biology 111 & 112 plus three specified 200-level courses: 210, 252, 290), and 24 credits in Math, Physics and Chemistry.
2. At least 20 credits of appropriate courses at 300-level or above in Biology. These must include at least 4 credits (or 12 class hours) in the laboratory. In two cases, up to 8 of these credits may be taken in departments other than Biology: (a) Organic Chemistry, or (b) courses taken to complete the requirements of the Biobehavioral Studies Program (see page 9 or Appendix C or Appendix J).

3. Final GPA of 2.0 in biology courses above Biology 111-112 which are used to meet the major requirements.

4. Not more than one course used to satisfy requirements 1 or 2 listed above shall be taken Pass/Fail.

Biotechnology Track
The Biotechnology Track in Biology is designed primarily for students who wish to work in research and development at Biotechnology companies. However, this track also provides training for work as a laboratory technician in university or medical research labs, or for graduate school in Biochemistry, molecular and cellular Biology. Like other Biology majors, those in the Biotechnology track complete a rigorous core of basic science courses in Biology, chemistry, physics and math. Intermediate level work includes Cell Biology, Genetics, and Population Biology. Advanced work focuses on techniques and areas of Biology that are important in the Biotechnology industry including Biochemistry I, Microbiology, Immunology, Molecular Biology, and Biotechnology. Elective courses may be chosen from Animal Physiology, Developmental Biology, Endocrinology, Histology, Biochemistry II, Neurobiology, and Plant Physiology. All intermediate and advanced courses should include lab work. Biotechnology companies strongly encourage undergraduates to acquire research experience and the Biology Department offers a variety of such opportunities (see page 7). The current Director of the Biotechnology track is TBD, please see the office staff. For more specific information see Appendix F.

Biochemistry Joint Major
The Biochemistry Joint Major provides an integrated and rigorous curriculum to those students who wish to concentrate their studies on the interface between Biology and chemistry. This major was established in 1995 and has specified courses that include 18 credits in Math and Physics, 30 in Chemistry, 17 in Biology and 12 in Biochemistry. The major amalgamates and integrates Biochemistry expertise from the Biology and Chemistry faculty, to present students with a comprehensive study in Biochemistry that coalesces the information into a congruous perspective of biological processes and chemical mechanisms in the cell and organism. The Biochemistry Joint Major curriculum follows the American Society of Biochemistry and Molecular Biology (ASBMB) guidelines. ASBMB guidelines signify that the student has completed a rigorous course of study that emphasizes critical thinking and a proficiency in the discipline of Biochemistry, including an emphasis on laboratory techniques. For additional information, consult Dr. Steven Ackerman, W-3-031, 617-287-6682, steven.ackerman@umb.edu. See Appendix K.

Biochemistry Certificate
The Biochemistry Certificate requires a minimum of 15 credits (5 courses, 21 credit hours). By allowing students who have completed Introductory Biology, General Chemistry, Cell Biology, Genetics, and Organic Chemistry to just complete the 300-level requirements, it is possible to complete the Biochemistry Certificate in one year. Students needing to complete the 100 and 200-level prerequisites could complete the program in two to three years. To receive the Biochemistry Certificate, a student must complete, at UMB, the following courses: Biochemistry 383 Lecture, Biochemistry 385 Lab, Biochemistry 384 Lecture, Biochemistry 386 Lab, and Biology 372 Molecular Biology. Successful completion of a course requires a minimum grade of C; the GPA for all completed required courses must be 2.5 or higher. For additional information, consult Dr. Steven Ackerman, W-3-031, 617-287-6682, steven.ackerman@umb.edu. See Appendix L.

Biology Major with Secondary Education Certification
Students who seek certification in Massachusetts for teaching Biology in Secondary Schools need to complete the requirements for the Biology or Biochemistry major as well as the requirements for the Teaching Certificate mandated through the Graduate College of Education (GCE). The program requires additional courses in Psychology and Secondary Education. Students must pass both the Communication & Literacy Test as well as the Biology Subject Test on the MTEL in order to participate in their Practicum course. Students in this program will also be
required to have a Biology or Biochemistry adviser as well as an adviser in the GCE to oversee all of their coursework. The Teaching Coordinator for the Biology Department is Dr. Brian White. He can be reached through email at brian.white@umb.edu. Please see Appendix N for more detailed information.

**Biology Minor Requirements**

Requirements for the Biology minor include Biology 111 and 112, and four additional Biology courses (at least 12 credits), with or without associated labs. Of these courses, two must be at the 200 level and two at the 300 level. At least three of the six required courses (including one course at the 300 level) must be taken at UMass Boston. The GPA for all courses taken to meet the Biology minor requirement must be at least a 2.0. Only one course for the minor can be taken pass/fail, provided all six courses are taken at UMass Boston. See Appendix G.

**Environmental Biology Minor**

The minor consists of students taking at least 7 courses (23-26 credits) from 5 core areas:

1) Environmental Science Core
2) 100 level Biology Core
3) 200 level Biology Core
4) 300 level Biology Electives
5) Environmental Capstone

However, it should be noted, that MATH 130 and CHEM 115 and 117 are pre-requisites for the 200 level courses, which would add additional credits if not already fulfilled for the students major. For the Environmental Science Core, there is one course: ENVSTY 101 - Nature of Environmental Problems. For the 100 Level Biology Core, there are two courses: BIOL 111 and 112. For the 200 Level Biology Core there are two courses: BIOL 252/254 and BIOL 290. For the 300 Level Biology Electives, there are 8 options [2 also have laboratory sections that are recommended but not required and are Ecology (BIOL 342) and Ecology Lab (BIOL 343) and Evolution (BIOL 352) and Evolution Lab (BIOL 353)]; see below for individual course listings, course descriptions, and course pre-requisites. Please note,

BIOL 334 Microbiology has additional pre-requisites beyond BIOL 252 and BIOL 290. Finally, for the Environmental Capstone, there is 1 course option: ENVSTY 401 - Environmental Problem Analysis and Policy Formulation. Students are encouraged to pursue independent research opportunities in Biology, but it is not a requirement. The target audience for the minor is students majoring in a different department in the College of Science and Mathematics as they are likely to have the pre-requisites for the minor courses. Students outside of CSM will likely have to take the established pre-requisite courses for the biology courses. See Appendix H.

**Environmental Biology Certificate**

The certificate consists of students taking at least 7 courses (23-26 credits) from 5 core areas:

1) Environmental Science Core
2) 100 level Biology Core
3) 200 level Biology Core
4) 300 level Biology Electives
5) Environmental Capstone

However, it should be noted, that MATH 130 and CHEM 115 and 117 are pre-requisites for the 200 level courses, which would add additional credits if not already fulfilled for the students major. For the Environmental Science Core, there is one course: ENVSTY 101 - Nature of Environmental Problems. For the 100 Level Biology Core, there are two courses: BIOL 111 and 112. For the 200 Level Biology Core there are two courses: BIOL 252/254 and BIOL...
For the 300 Level Biology Electives, there are 8 options [2 also have laboratory sections that are recommended, but not required and are Ecology (BIOL 342) and Ecology Lab (BIOL 343) and Evolution (BIOL 352) and Evolution Lab (BIOL 353)]; see below for individual course listings, course descriptions, and course pre-requisites. Please note, BIOL 334 Microbiology has additional pre-requisites beyond BIOL 252 and BIOL 290. Finally, for the Environmental Capstone, there is 1 course option: ENVSTY 401 - Environmental Problem Analysis and Policy Formulation. Students are encouraged to pursue independent research opportunities in Biology, but it is not a requirement. The target audience for the Environmental Biology certificate is students majoring in Biology that are not eligible to have a minor in their degree. It should be noted that it is possible that Biology Majors pursuing the certificate would only have to take ENVSTY 101 and ENVSTY 401 to fulfill the certificate due to CSM allowing all 100 and 200 courses and one 300 level course to double count. In other words, if a Biology Major chose one of the 300 level courses listed below for their major electives, they would only need ENVSTY 101 and 401 to get an Environmental Biology certificate. See Appendix I.

Management of Environmental Minor and Certificate
Management of the Environmental Biology Minor and Certificate will be through the Biology Department. However, the minor and certificate are considered programs under the newly restructured Environmental Studies Program. The goal of that program is to offer individual departments across the university an opportunity to offer an “environmental” minor that incorporates civic engagement and responsibility as part of the offering through having all Environmental minors take ENVSTY101 and ENVSTY 401. Both ENVSTY 101 and ENVSTY 401 incorporate civic engagement and responsibility in their curriculum.

Bio-behavioral Studies Program
This interdisciplinary program of study is intended to provide a coordinated set of courses for majors in any of the three departments of Anthropology, Biology or Psychology who are interested in the subject of animal behavior. You will need to satisfy the Biology major requirements and take additional requirements to complete the program. The combined requirements are rather complex and need some advance planning. The additional requirements are a minimum of five Anthropology and/or Psychology courses chosen from an approved list, with certain distribution requirements. Eight of these appropriate credits can be applied towards your Biology major if you get prior approval from the Biology Department Chairman. The program requirements and the list of approved courses are available in the Biology Office. For advice and further information, please consult Dr. Alexia Pollack (617-287-6618, W-3-005, Biology) or Dr. Susan Zup, (617-287-6319, M-4-271, Psychology). See Appendix J.

III. ACADEMIC ADVISING

All Biology majors are assigned an academic advisor. You are encouraged to establish a continuing advising relationship with a member of the Biology Department. This will not only facilitate the planning of your academic career at UMB to meet your needs, but also will help you with career counseling, references, etc. as your work at UMB draws to a close. Simply go to someone in the Biology Department to choose (or to be assigned) an Advisor. If possible, choose one with interests related to your own, or you may wish to have a teacher of one of your courses as your advisor. If, at a later date, you wish to change advisors, you may do so at your discretion.

Early in your undergraduate career, in conjunction with your advisor, you should complete a plan of work (see Tally Sheet, Appendix D). The purpose of this plan is to help you develop a coherent and useful selection of courses consistent with your plans and prospects. The study of Biology differs from other non-science disciplines because it requires a theoretical foundation in the natural sciences combined with laboratory work. Both of these take time and demand forethought in the selection and scheduling of courses. The work plan is flexible and can be changed with the approval of your advisor.
If you are having problems with a Biology course, you can seek help for course-related matters from the lecturer or lab instructors in the course. For more general academic difficulties, you may wish to talk to your Advisor or with the Academic Support staff. Free individual or group tutoring is offered through Academic Support Programs to UMass Boston students enrolled in one or more College of Liberal Arts and/or College of Science and Mathematics 100-200 level courses for which tutoring is offered. Students must be enrolled in the course for which they are requesting tutoring. For additional information and to register for tutoring, please go to Academic Support Programs, CC-1-1300, and (617-287-6550). It is usually more effective to take action early, yourself, than to rely on advice from your classmates and/or trying to "muddle-through."

Supplemental Instruction (SI) offers free, out of class, study sessions for traditionally difficult courses. Any student enrolled in the class (regardless of section) is welcome to attend. Sessions are led by advanced undergraduates who have successfully completed the course. In consultation with the course instructor, the SI leader emphasizes important concepts from the lecture and facilitates group work for students to gain a deeper understanding of the material. Supplemental Instruction is available for the following courses: Biology 210/212, Biology 252/254, Chemistry 115, Chemistry 251, Chemistry 252 (Spring), Math 115, Math 130, and Math 140. Sign up through the Student Success Center (S-2-060). Most SI groups meet in the SSC Conference Room which is located on the second floor of the Science Center, next to the Lipke Auditorium, overlooking the track. For current information please go to: http://www.umb.edu/academics/csm/student_success_center/academic_support

The College of Science and Mathematics Student Success Center was established in September 2008 and aims to enhance advising in the academic home of CSM students, and to increase the number of places that students can find guidance and support as to improve student retention, reduce time to graduation and to provide academic enhancement opportunities for the young scientist. The CSM Student Success Center will ultimately provide comprehensive services for students in every phase of their academic career ranging from students struggling to adjust to university study, to outstanding young scientists seeking an opportunity to enhance their participation in first rate scientific research. The CSM Student Success Center is located in the Science building, second floor, room 60. For additional information, please contact Ella Robertson, Coordinator of the Student Success Center, at studentsuccesscenter@umb.edu or 617-287-3974.

IV. ACADEMIC DISHONESTY

The University defines violations of academic honesty to include, but not be limited to, the following: A. Submitting an author's published or unpublished work, in whole, in part, or in paraphrase, as one's own without fully and properly crediting the author. This includes, but is not limited to, submitting un-attributed, published work, e.g., material from a journal, newspaper, encyclopedia, website etc. without proper acknowledgment. B. Submitting as one's original work materials obtained from an individual or agency. C. Submitting as one's own original work material that has been produced through unacknowledged collaboration with others. D. Using any unauthorized material during an examination, such as notes, tests, calculators, etc. E. Obtaining answers to examination questions from another person with or without that person's knowledge; furnishing answers to examination questions to another student; using or distributing unauthorized copies of, or notes from, an examination. F. Submitting as one's own an examination taken by another person; or taking an examination in another person's place. G. Gaining or seeking to gain unauthorized access to the computer files of a fellow student, faculty member, or staff member, or altering or destroying those files. For further details on academic dishonesty and other University Policies & Regulation, visit the following website: http://www.umb.edu/life_on_campus/policies/code/.

V. SPECIAL PROGRAMS AND OPPORTUNITIES

Diverse Ways to Complete the Major

Of the many considerations involved in choosing courses to complete the major, an important one is how to achieve a well-rounded Biological training. The major requirements attempt to provide for both breadth and depth. In the past,
Biology was easily divided into segments based on the organisms studied (Botany, Entomology, Ichthyology, etc.). Recently, other kinds of divisions have become more significant. One of these suggests that the study of Biology has two major poles: one which seeks mechanistic explanations, eventually of cellular mechanisms, sometimes at the molecular level. On the other end are the evolutionary Biologists whose aim is to understand how natural selection produces the patterns we see. These two approaches are distinct, but they certainly do not account for all of Biology and many people find this division inadequate. An alternative is to consider the levels of organization studied -- "cells," "organisms," and "populations," which is how the Biology courses are listed in Appendix A. (Of course, these boundaries are arbitrary). No good Biologist can afford to be ignorant of the different approaches and levels, but at the same time a realistic program cannot cover everything.

The Department has informally recognized internal concentrations in (1) Evolutionary and Population Biology, (2) Cell and Molecular Biology, (3) Organismal Biology, and (4) the Biochemistry Program. If you are interested in pursuing any of the disciplines listed above, we urge you to get further information from your advisor or other faculty members after looking at Appendix A. In general, students interested in Evolutionary and Population Biology should take 290 in their sophomore year, followed by 342, 352, etc. Students of Cell Biology are encouraged to complete Organic Chemistry before or during their junior year, and may benefit from extra courses in chemistry and math.

**Independent Study**

Biology 478/479 offers a chance for qualified, advanced students to work on a specialized topic or research project in Biology with individual guidance from a faculty advisor. Juniors with a cumulative average of 3.0 who have completed at least two semesters of advanced Biology courses at UMB are eligible. If you are interested, talk it over with a prospective sponsor. The schedule number for registration is assigned in the Biology Office. The course is normally taken for 3 credits per semester, and it is recommended that you enroll for the full year. A research report or honors thesis is required. Because this work is specialized, these credits do not count towards the Biology major requirement, but up to 6 of the credits earned do count towards graduation. Independent study students also should attend the weekly departmental seminar held each Friday at 2:30pm in the Small Science Auditorium during the regular Fall and Spring academic semesters.

**Honors**

Students who have taken 3 or more credits of Independent Study (478, 479) may be eligible for Departmental Honors. You do not need to be in the CLA/CSM Honors Program to be eligible for Departmental Honors. Application materials are available from Dr. Alexia Pollack (617-287-6618, W-3-005, email: alexia.pollack@umb.edu). Honors theses presented in the past years are available in the Biology Office. To be awarded Honors, the student must have (1) an overall GPA of 3.0 or better, (2) have obtained satisfactory grades in advanced Biology courses (generally interpreted as no pass/fail enrollments, and a 3.0 average in all Biology courses numbered 200 or above), and (3) have written a thesis and made an oral presentation of this project to the faculty before graduating, usually in the last week of classes in the Spring semester, less frequently in December.

**Nantucket Field Station**

The University owns a small field station on the Coast of Nantucket Island; its primary purpose is teaching and research in Biology. In addition to housing, there are laboratory facilities, field equipment and an excellent range of diverse marine, estuarine, and terrestrial habitats suitable for field work. In recent years the field station has been used by Biologists for field trips throughout the year, for individual research, and for two summer courses. These courses are Biology 100 Coastal Ecology (a non-science majors course), and Biology 306 Marine and Coastal Ecological Research. Specific information about the field station and the courses taught there (including topics of student projects) are available from Dr. Greg Beck (617-287-6619, W-3-004, email: greg.beck@umb.edu).

**Summer School**

Summer courses on the Harbor Campus are offered through Continuing Education and usually are confined to a few lower-level courses such as Biology 101-102, 108, 111, 112, and some courses for related programs including
Biology 207, 208 and 209. A similar selection of courses is offered at several off-campus sites in the evenings during the academic year. Field courses are offered at the University Field Station on Nantucket; currently, an introductory course on coastal ecology and an advanced course involving individual research have been offered.

For all students considering careers in Biology, it is recommended that during their undergraduate years, one summer be spent at work on a different kind of academic activity such as research, or exploring a course at a marine lab or field station. Courses at marine labs or field stations are often field-oriented, but are not confined to ecology or natural history topics. Many of the students taking such classes will be seniors or beginning graduate students. Announcements posted near the Biology Office indicate the diversity of courses available at various locations around the world. Not surprisingly, some of these courses are likely to be expensive, but scholarships are available. The courses at our Nantucket Field Station are an unusually good value for the money.

Research Opportunities

If you are considering a career in Biology, you will find directed research to be of great value. Hands-on experience, paid or unpaid, is one of the best choices an undergraduate scientist can make, not only from a personal standpoint, but also as an asset when applying for graduate school or prospective employment. Opportunities include the federal Work-Study Program which provides paid employment, some of which may involve field or laboratory work. Alexa MacPherson of the Biology staff (W-3-021, 617-287-6600) can provide further information. Generally, jobs for the academic year are filled early in September, and summer jobs in late spring. However, applications to establish eligibility and support must be made to the Financial Aid Office much earlier. A variety of part-time jobs supported by faculty research grants are available throughout the year, and volunteers are always welcome. In addition, there are federally funded programs on campus that provide year-round research experiences and mentoring for under-represented minorities. For more information, consult the Initiatives for Maximizing Student Development (IMSD) Program and/or the McNair Program. One of the courses offered each summer at the UMass Nantucket Field Station is based on individual projects (Marine and Coastal Ecological Research, Bio 306). In the summer these jobs are more numerous, and full-time fellowships or other kinds of financial support may be available (see below for summer positions that may be available). For more information, consult the bulletin boards near the Biology Office, or speak with Alexa MacPherson in the Biology Department Office.

Several programs provide summer support (including salary) for research by undergraduates. For the past twenty years, The National Science Foundation (NSF) has supported a program of Research Experiences for Undergraduates (REU) in Biology at UMB, and similar opportunities are available elsewhere, funded by various organizations. These may be programs involving numbers of students or for single research labs. The announcements are posted in the late Fall near the Biology Office and can also be found online at http://www.umb.edu/academics/csm/biology/. (Individual faculty members also receive information and announcements about summer jobs in newsletters, etc.; please feel free to ask them if they know of any appropriate opportunities; most of these are unlikely to reach the bulletin boards, so ask in good time!) December is an appropriate month to start looking for this sort of summer experience. All student researchers are strongly encouraged to report their findings at scientific meetings (some funding may be available). There is also an Annual Science Meeting for undergraduates each spring at varying sites within the UMASS System; the information will be posted outside the Biology Office as it becomes available. Information regarding our REU Program is available on our web site at

The Initiative for Maximizing Student Development (IMSD) at UMass Boston is a year-round, research-intensive, skill-building, mentoring program for undergraduates interested in the biomedical sciences. Sponsored by the National Institutes of Health, the program aims to increase diversity among PhD-level researchers in biomedical fields. Students can apply to the program as either an IMSD Affiliate or Fellow. Affiliates are students who have received less than 60 credits towards graduation; they receive enrichment opportunities and an introductory research experience. Fellows have
demonstrated mastery of their coursework and are within 60 credits of graduation; they receive more advanced training and participate in intensive research experiences. All students receive tuition waivers and a competitive hourly wage for their participation; Fellows also receive research supply funds and a loaner laptop. The IMSD program provides numerous professional development opportunities, including year-round research experiences in laboratories at UMass Boston or Dana-Farber/Harvard Cancer Center, research skills training, biomedical career development workshops, facilitated study groups in science and math courses, journal club, intensive mentoring and advising, travel to scientific conferences, and the benefits of being part of a community of scientists.

To be eligible for the program, you must be enrolled as a full-time undergraduate student at UMass Boston, be a U.S. Citizen or permanent resident, and aspire to pursue a PhD in the biomedical field. Individuals belonging to racial, ethnic, or other under-represented groups in the sciences, as well as persons with disabilities, are strongly encouraged to apply. For more information, please contact the Program Coordinator, Claudia Heske, at claudia.heske@umb.edu or in the IMSD Program Office, Wheatley Hall, 2nd floor, Room 047. See Appendix Q. For the most current information go to: [http://www.umb.edu/academics/csm/biology/beyond_the_classroom/initiative_for_maximizing_student_development](http://www.umb.edu/academics/csm/biology/beyond_the_classroom/initiative_for_maximizing_student_development).

Additionally, a new REU Program has recently been added to the list of potential research opportunities for undergraduates. The “Coastal Research in Environmental Science and Technology (CREST)” program at the University of Massachusetts Boston (UMass Boston) is a 10-week immersive research experience serving 10 undergraduates per year. CREST exposes students to cutting edge, authentic, coastal environmental research at UMass Boston in an integrative transdisciplinary program across the ecological, environmental, and social sciences. CREST focuses on integrative coastal research crossing disciplinary boundaries that incorporates the ecological, earth, chemical, geographic, and social sciences and leverages the existing research and educational programs within the Environmental, Earth and Ocean Sciences and Biology departments at UMass Boston.

The CREST REU programs offer undergraduate students the opportunity to: 1) carry out independent research project in coastal environmental science (e.g. biology, ecology, geology, chemistry, policy, economics, and management), 2) work closely with a faculty advisor and research group, 3) develop laboratory skills, 4) develop a cohort and networking skills, 5) explore issues of science ethics, 6) exchange ideas with students and faculty at weekly seminars, 7) present summer research at a program wide symposium at the end of the program, 8) participate in field trips/social events in and around Boston Harbor.

For more information contact Dr. Alan D. Christian, CREST-REU Director and Co-Principle Investigator; Phone: 617-287-6639; Wheatley Hall, 3rd floor, Room 010; email: alan.christian@umb.edu or find the online application by going to: [http://www.umb.edu/crest-reu](http://www.umb.edu/crest-reu). See Appendix R.

**The Graduate Program in Biology**

The graduate program in Biology consists of diverse areas of study and research involving approximately 100 Master's and Ph.D. students. The Biology Department grants a Ph.D. under three tracks: Environmental Biology (EB), Molecular, Cellular and Organismal Biology (MCOB), and Biomedical Engineering and Biotechnology (BMEBT). The departmental Master's programs include (1) the M.S. in Biology in which students may elect to study in any of the major sub disciplines of Biology (30 credit hours), and (2) the M.S. in Biotechnology and Biomedical Science which focuses on cell and molecular Biology and laboratory techniques relevant to Biotechnology (30 credit hours). The Biology Department also shares the School for Marine Science PhD program with the School for the Environment. Information on the Ph.D. and the Master's Programs, as well as the research interests of the Biology Faculty is available on our web site at [http://www.umb.edu/academics/csm/biology/grad/](http://www.umb.edu/academics/csm/biology/grad/). The graduate teaching assistants from these programs are an invaluable asset to undergraduate Biology majors -- they assist in teaching
labs, tutor in certain courses, and give undergraduates the opportunity to interact with people at a more advanced stage in their professional training in Biology.

VI. SPECIAL CREDITS AND GRADES

AP and CLEP Exams

If your background, either in school or work-related experience, is strong you may qualify for exemption from Biology 111-112, or for an accelerated program. The Advanced Placement (AP) examination is offered by certain high schools. On the basis of interviews and their score on this exam, students may be exempted from taking Introductory Biology (score 3), or both exempted and granted 4 elective credits towards graduation (score 4 or more).

Certain work-related experiences can be translated into credits on the basis of a nationwide examination administered by the College Level Equivalency Program (CLEP). Students who score 50 or higher on the CLEP exam will be exempted from taking Introductory Biology and will be granted 6 elective credits towards graduation. For more information, ask the Admissions Office.

Minimum Grades

An average grade of "C-" or better in Biology 111-112 (or equivalent), or written permission of the student's advisor, is advised for registration in Biology courses numbered 200 or above. In order to graduate as a biology major, a final GPA of 2.0 is required in Biology courses above Biology 111-112 which are used to meet Biology major requirements.

Pass-Fail Option

Of the science courses required for the Biology major, a maximum of one course may be taken Pass-Fail. This option should be approved by your advisor. The same is true for the Biology minor —one course may be taken Pass-Fail.

Incompletes, Withdrawals and/or Failure

University policy on these matters is summarized in the catalog. An instructor may give a grade of Incomplete only when a portion of the assigned or required class work, or the final examination, has not been completed because of a student's serious illness or extreme personal circumstances. If the student's record is such that he/she would fail the course regardless of the missing work, he/she fails; an Incomplete is not appropriate. It is your responsibility to meet with the instructor to make a written agreement on the work to be done and the timetable for completion. Incompletes automatically change to "F" after one year. The appropriate Form for Grade Incomplete must be completed and signed by both the instructor and student. Incompletes will not be granted to students who remain in courses beyond the end of the withdrawal period and choose not to complete work because of concern for the anticipated grade.

Repeating a Course

A student may repeat any course, but only once, and may do this for a maximum of four courses during his/her undergraduate career at UMB. For all repeated courses both grades will appear on the transcript, the first will be bracketed, and only the second grade will contribute to the GPA. Waivers of these restrictions are handled by the Committee on Standards and Credits (see Academic Support). The preceding restrictions do not apply to Biology 444, 478 or 479, but note that these courses do not meet the Biology major requirements.

The preceding sentences do not refer to withdrawals. Approval by course instructor and the Department Chair are required to repeat a Biology course in which the student has twice received a grade of W (withdrawal).

Transfer Credits

The transfer of credit for courses completed at other institutions prior to registration at UMB involves two stages: (1) Review by the Admissions Office will determine how many and which of these credits will be accepted towards
UMB's graduation requirements; this information will be placed on your official UMB transcripts; (2) Review by the Chairman of the Department Advising Committee (Dr. Robert Guimond) or by the Chairman of the Biology Department to determine which courses satisfy the major requirement. This review should be initiated by the student early in his/her career at UMB. Courses at State, Community, and Junior Colleges in Massachusetts have been evaluated for transfer and UMB equivalence. This information is available in the Admissions Office and the Biology Office. After review, the form summarizing the evaluation is stored in the Biology Department, and will be needed to confirm that you have satisfied the major requirements when you file for graduation. The acceptable minimum grade for transferring a course for major credit is "C-." A grade of "P" (Pass) is not transferable.

A transfer student must include at least 12 credit hours (including a minimum of 2 hours [6 class hours] in laboratory work) taken within the Biology Department at UMASS/Boston. These courses must be at the 300 level or above unless the Chair's approval is obtained for lower level courses. Biology 444, 478-479, 483 and 672-673 do not fulfill this requirement. The University also requires that at least 30 of the 120 semester credits required for graduation must be completed at the University of Massachusetts/Boston.

To take courses for transfer credits at other institutions while registered at UMB requires prior approval of the department(s) concerned, and the completion of a form which can be acquired from Dr. Guimond or from the Registrar’s Office. At present, courses offered through the Mass Bay Marine Studies Consortium do not count for major credit.

VII. CAREERS IN BIOLOGY

The main resources for help with career planning and job placement are located in the University Advising Center on the 1st floor of the Campus Center, Room 1100. Counselors in the Career Services Office and the Coop/Internship Office (Campus Center, 1st floor, Room 1100, telephone 617-287-5519) can help with individual career and job searches. In the Career Library, you will find pamphlets which have been prepared by several agencies of the U.S. Government, as well as various professional societies, describing opportunities for careers in the life sciences. These pamphlets explain the kind of work in the different areas, employment opportunities, salaries to be expected, and more importantly, the kinds of academic preparation needed at various professional levels. One such pamphlet, with reference to many other publications, is the Occupational Outlook Handbook, published by the U.S. Department of Labor (http://www.bls.gov). Two books, Careers in Science and Engineering, A Student Planning Guide to Grad School and Beyond (National Academy Press 1996), and Rethinking Science as a Career (Research Corporation 1996), are excellent resources. (More recent editions may be available). Many Biological organizations have their own excellent career advice and information on their web sites, e.g., www.asmusa.org if you are interested in a career in Microbiology.

Two areas of biology clearly are growing in terms of the number of people employed. One of these involves private and governmental groups that detect, monitor, and ameliorate environmental problems, including impacts on biodiversity. Second, the field of biotechnology is rapidly expanding in medical, agricultural, and industrial applications of modern technology and offers many entry-level positions for students with particular skills. Appropriate courses taken as a biology major may be sufficient, but you are encouraged to consult the description of the undergraduate Biotechnology Track, as well as the M.S. program in Biotechnology and Biomedical Sciences for more information about both undergraduate and graduate courses.

Graduate School

Some kind of advanced degree is necessary for many careers in Biology, particularly if one wishes to advance beyond the laboratory technician ranks. There are many different kinds of programs and many different kinds of graduate schools. In contrast to expensive professional schools such as Law or Medicine, most graduate students in Biology are paid in the form of fellowships or assistantships. Depending upon the scope of the program selected, a Master's degree may require anywhere from one to three years and a PhD four to seven years from the start of graduate study. The PhD is generally required for teaching and research positions at universities, and for leadership positions in other scientific laboratories.
If you are thinking about graduate school, talk to faculty members in your field of interest and to those who have studied or taught at the graduate schools that attract you. The web is a particularly rich source of information on graduate programs. The graduate program in the Biology Department is briefly described on page 13. Further information can be found at [http://www.umb.edu/academics/csm/biology/](http://www.umb.edu/academics/csm/biology/). The criteria for admissions vary widely from school to school, and the following generalizations are not precise: the Graduate Record Exam is usually required, and the three general tests may be more important than the Biology test. Good letters of recommendation from persons who know you are very important, the overall GPA is less so, although grades in particular courses are likely to be significant. Research and/or other relevant experience are always a strong point: naturally, such experience is very helpful for deciding on career directions as well as for admission. As a general rule, maintain a broad perspective and, if possible, take more science courses than the minimum required to complete the major. Some graduate courses may also be appropriate, although not essential.

The courses you take to complete the Biology major are likely to satisfy the requirements of most graduate schools, but bear in mind that if you have to make up deficiencies after arrival, you will not get graduate school credit for undergraduate courses. Thus, it is important to check graduate school catalogs to ensure that you are well-prepared. Many catalogs are available in the Career Services Library, and there are individual counselors who can help you. Every applicant to graduate school should be computer-literate: at the very least competent in spreadsheets, information retrieval, and word-processing. In addition, depending on your interests, you may benefit from additional courses to provide extra dimensions: for instance in chemistry, statistics, geographical information systems, programming, electronics, or the history and philosophy of science.

**Health-Related Professions**

For the student who is seriously considering medicine, dentistry, veterinary medicine or one of the allied health professions, it is important to plan one's academic program in advance and with attention to timing and scheduling. If you are interested in these fields, you should consult with Michelle Pare in the Student Success Center (S-2-060) or the as early as possible in your college career. You will then be identified as a student with pre-med/ pre-dental/pre-vet interests, properly advised as to what courses to take, when to apply, and in general what to do to further your application for admission (See Appendix O). It is equally important to look into and plan for alternative careers in the health fields as competition for admission to medical school results in the rejection of many highly qualified individuals -- the number of applicants exceeds the number of available places by almost three to one. The admissions situation is even more limited in relation to veterinary school, but more encouraging in relation to dental school. There are increasing numbers of opportunities in other health professions, and students would do well to consider these as alternative career possibilities. The pre-medical requirements can serve as a strong academic background for both allied health and primary care fields. For more information about the pre-med program, go to: [http://www.umb.edu/academics/vpass/uac/pre-med/](http://www.umb.edu/academics/vpass/uac/pre-med/).

There is no formal pre-medical or pre-dental major here, or at many other universities. Pre-medical preparation involves completion of basic science courses, usually Biology 111-112, Chemistry 115-118, Organic Chemistry, Elementary Physics (with Lab) and a year of Calculus. Some medical schools might prefer more course work, or expect that specific courses be completed. One can major in any field and be a pre-med student simply by taking the above courses, although non-Biology majors are well advised to take a second year of Biology for the specific purpose of preparing for the admission test. Biology majors satisfy pre-med requirements as a normal part of the Biology major if they include Organic Chemistry as part of their course load. Pre-medical students often are urged to gain experience in a job (volunteer or paid, clinical or research) which is related to health care. See Appendix M for more information.

Criteria for acceptance to the various health professions differ, as does the degree of difficulty in gaining admission. Information on admissions criteria is available from catalogs and from various reference materials in the Office of Career Services.
The Biology Department offers courses in Anatomy and Physiology, Medical Microbiology (Biology 209), and Nutrition, which are required courses of students enrolled in the College of Nursing (i.e. Nursing Program and Exercise Science majors) and are NOT open to Biology majors.

**Biotechnology Careers**
A career in the Biotechnology industry deserves consideration as an attractive alternative to medicine or academia. Biotechnology is a dynamic new industry that applies techniques of genetics, molecular and cellular biology and microbiology to the production of commercial products. Biotechnology is revolutionizing a broad range of commercial fields including pharmaceuticals, organic chemistry, agriculture, and environmental remediation. The Greater Boston area is the second largest Biotechnology center in the world, with approximately 215 companies that provide many employment opportunities for students with undergraduate and post-graduate degrees in Biology.

Hard working individuals with aptitudes for leadership and learning new skills will find careers in Biotechnology to be financially rewarding and intellectually challenging. Employees in the research and development divisions perform experiments to evaluate the commercial potential of new products. Employees in the process/quality assurance divisions devise reproducible, cost-effective techniques to make large amounts of commercial products, while those in the manufacturing and production divisions are responsible for making a safe and effective product. Technical support and marketing representatives have great opportunities for personal and professional interactions. Most salary packages include health and dental benefits, retirement plans, stock options, and educational reimbursement.

The Biology Department offers three programs of study to train students for careers in Biotechnology. The Masters Program in Biotechnology and Biomedical Sciences prepares students for careers in research and development divisions of Biotechnology companies, and virtually all of the graduates of this program have been able to find good positions in Biotechnology companies or biomedical research laboratories. The Graduate Certificate in Biotechnology is designed to provide a sound theoretical background for individuals already working in the research and development divisions of Biotechnology companies or biomedical research laboratories. At the undergraduate level, the Biotechnology track leads to a BS in Biology and emphasizes disciplines such as Molecular Biology, Biochemistry, Cell Biology, Genetics, Immunology, and Microbiology.

Graduate and undergraduate students who wish to work in a Biotechnology company should obtain independent research experience. The Masters Program in Biotechnology and Biomedical Sciences includes a thesis research project that most graduates find to be the single most important factor in obtaining satisfactory postgraduate employment. Undergraduates can acquire research experience by independent study in faculty laboratories. Financially qualified students can be supported through the Work-Study Program or research grants to individual faculty members. In addition, some Biotechnology companies offer internships or co-op positions that provide invaluable experience and contacts. For additional information, contact the biology office staff). See **Appendix F**.

**Environmental Careers**
Employment opportunities in the ecological and environmental fields are expected to grow enormously. Students completing a Biology major in the Environmental Studies Program have opportunities to enter a broad range of environmental fields, although further training is usually required if the goal is technically oriented job or a research career. The range of jobs include: environmental specialist with a municipal, regional, state or federal department of environmental quality or wildlife management; environmental enforcement officer in a governmental regulatory agency; environmental educator in a school system, a government environmental department, or non-government environmental/conservation organizations; health and safety specialist; or as a science journalist.

**VIII. ACTIONS AND ACTIVITIES**

The Biology Department Office at UMass Boston is located in the Wheatley Building on the 3rd Floor in Room 021 (telephone 617-287-6600, Fax 617-287-6650, email for the two office assistants are: alexa.macpherson@umb.edu or
anshika.verma@umb.edu). Here you can obtain useful information and/or leave notes and lab reports in faculty or graduate students’ mailboxes. The faculty has individual offices and labs in Wheatley and McCormack, and the teaching labs are also in these buildings. The **Greenhouse** is in the Science Building. To arrange a visit to the Greenhouse, please call Jim Allen, Greenhouse Manager at 617-287-6580.

The bulletin boards outside the Biology Office are used for: (1) announcements of seminars and colloquia at nearby colleges and universities, (2) brochures about summer schools, graduate schools and special courses, etc., (3) current course listings, faculty office hours and locations, job postings, summer research opportunities etc.

**Biology Seminar Series**

Students are warmly invited to attend the weekly seminar series, held on Fridays at 2:30 p.m. in the Small Science Auditorium (S-1-006). These talks, usually by outside speakers, generally describe recent or ongoing research. Information about the seminar is emailed each week as well as posted outside the Biology Office and elsewhere. The semester schedule is available online. Students enrolled in Biology 478 and 479 (Independent Study) as well as Grad Students are expected to attend these seminars. To find the most up-to-date seminar information go to: [http://www.umb.edu/academics/csm/biology/](http://www.umb.edu/academics/csm/biology/).

**Department Prizes and Awards**

Departmental prizes are awarded each year to a few graduating Biology majors who have demonstrated superior abilities in their course work, have high over-all averages (at least Cum Laude level), and have made special contributions to the Department. The Prize winners, along with Biology Honors students, are invited to the CSM Honors Convocation. This special occasion, held shortly before graduation, recognizes and applauds the best students in the college along with their families and friends. Outstanding teaching by undergraduates or graduate students is recognized by the Harrison Prize, an award established by Dr. Bettina Hall Harrison when she retired.

**Student Organizations**

The liveliness of these clubs varies greatly from year to year (and their names may change). If a club is not listed by the current Student Activities SAC, this may signal your chance to revive it! The Biology Club (student run), has organized in recent years outside speakers, films, field-trips and the like, sometimes in a very convivial atmosphere. As a Registered Student Organization the club is eligible for funds from the Student Activities Committee. The Biology Club is located in the Campus Center, 2nd Floor, Room 2100 inside the Student Life Office. In the Club's room there are not only various academic resource materials such as reference books, texts, course outlines and old exams. Students can join at any time by paying the $5.00/semester membership fee.

**Biology Alumni**

Since our first Commencement in 1969, the Biology Department has graduated thousands of majors. Many of our former students have built careers in Biology and in the allied professions; many have gone into other fields. The Department is constantly renewing its contacts with all former students and has an active alumni organization. We hope that those who are students in the department at the present time will begin to think of themselves as future alumni and will drop off an up-to-date mailing and email address in the Department Office.

**Beta Beta Beta (TriBeta) Biological Honors Society** ([www.tri-beta.org](http://www.tri-beta.org)) Theta Omicron Chapter at UMass-Boston. Tri-Beta is a national Biological Honors Society founded in 1922, with over 430 chapters and more than 175,000 members. The goals of Tri-Beta are to promote interest in the biological sciences and to support and promote student research. Tri-Beta holds national and regional conventions and publishes a journal, BIOLS, in which students can publish their work. Chapters have regular meetings and organize activities in the spirit of the goals of Tri-Beta. For applications and more information please contact Dr. Alexia Pollack, 617-287-6618; email: alexia.pollack@umb.edu.

**IX. LIBRARY AND COMPUTER RESOURCES**
We urge Biology majors to take advantage of the resources of the Joseph Healey Library. The library has good holdings in Biology. A student with a valid I.D. may borrow circulating materials. Most of the books (monographs) and bound periodicals (journals, serials, etc.) will be found on Floors 6 and 7. Current unbound periodicals are on Floor 5. Reference materials are in the Main Reference Room on the 4th floor. The Reserve Desk is on the 3rd floor. You can access many of these from home if you have a current UMB Library bar code. However, there are some databases that are only accessible in the library, including one that is often useful for Biologists: the Science Citation Index. Often, searches of specialized databases are much more effective than diffuse web-based searches. Knowing how to find information from printed and electronic sources is an important skill to develop. The electronic availability is changing too fast for a brief summary. The Library’s website is a very useful starting point: home page http://www.umb.edu/library/. To see a list of electronic sources, visit the databases and indices page.

The Library staff encourages you to join one of their tours of the facilities. For information about these tours, or other services offered, inquire at the Circulation Desk, or call 617-287-5900. The Library holdings are substantial; however, for special projects you may need to visit other nearby libraries, or obtain materials through Interlibrary Loan. The Library staff will help you with such tasks but bear in mind that this takes some time. If you have any suggestions for new books, it may be possible to request them if you provide publication data (or a review) to an interested faculty member. For Library hours, please see the following link: http://www.umb.edu/library/about/hours/. Most holidays the hours are 9:00 a.m.-5:00 p.m. but to confirm the hours for any particular holiday, please call 617-287-5940.

Word processing and other computer software application workshops are offered by UMASS Computing Center. Consult their bulletin board for times and dates. If you already have microcomputer skills, you may use manuals and word-processing instruction disks at any UMASS computing room. If you do not yet have a user account, go to Lower level of the Healey Library to obtain one. At each location Academic Computing Services provides an attendant who will assist you. Additional information about services, and the hardware and software available, can be obtained from the Consulting Office at Healey Library Lower Level.
Sadowski CS, et al. Microbiology 2013
X. THE BIOLOGY FACULTY

The information provided below will help you to identify individual faculty members and discover their major interests. Telephone numbers (617-287-xxxx) are listed along with locations of offices and/or labs in McCormack or Wheatley. Faculty with temporary appointments are not listed. Additional information about research interests is available in the Biology Office and on our web site at http://www.umb.edu/academics/csm/biology/.

Steven M. Ackerman (Associate Professor & Biochemistry Program Director) 617-287-6682, W-3-031, steven.ackerman@umb.edu. Gene regulation in plants and animals, specifically transcription initiation mechanisms. We investigate the function of the general transcription proteins for basal transcription, and the mechanism of action of activator transcription from plants in animal systems, both in vitro and in vivo.

Kamaljit S. Bawa (Professor) 617-287-6657, M-2-310, kamal.bawa@umb.edu. Conservation genetics; conservation and management of biodiversity; ecology and economics of non-timber forest products; tropical biology. Website: http://www.atree.org/

Gregory Beck (Associate Professor) 617-287-6619, W-3-004, greg.beck@umb.edu. Evolutionary immunology; evolution of host defense mechanisms, phagocyte-bacteria interaction, acute-phase response, and molecular immunology.

Jennifer Bowen (Assistant Professor) 287-6626, W-3-008, jennifer.bowen@umb.edu. Microbial ecology, microbial diversity, ecosystems ecology, urban ecosystems, aquatic biogeochemistry, salt marsh and estuarine ecology, functional genomics of nitrogen cycling bacteria and archaea.

Solange Brault (Associate Professor) 617-287-6683, W-3-032, solange.brault@umb.edu. Population and conservation ecology, population dynamics models, marine mammal and bird demography.

Jarrett Byrnes (Assistant Professor) 287-3145, W-3-017, jarrett.byrnes@umb.edu. Community ecology of marine ecosystems, biodiversity and ecosystem function, climate change, food web ecology, ecological networks, kelp forest ecology, quantitative ecology, structural equation modeling.

Kenneth L. Campbell (Professor) 617-287-6676, M-3-322, kenneth.campbell@umb.edu. Reproductive endocrinology - the mechanism of action of the gonadotropic protein hormones on their target cells and the metabolism of these hormones in culture; biological determinants of human reproduction. Website: http://kcampbell.bio.umb.edu/

Alan Christian (Associate Professor and co-Graduate Program Director) 617-287-6639, W-3-010, alan.christian@umb.edu. Aquatic and fresh water mussel ecology and conservation; ecosystem ecology: structure, function, and nutrient cycling; landscape ecology: watershed land use, land cover and spatial patterns of organisms and abiotic factors; food web and community ecology: age and growth, fecundity, life history analysis; and molecular ecology: population genetics and phylogenetics. Website: http://faculty.uml.edu/alan.christian/index.php

Adán Colón-Carmona (Associate Professor) 617-287-6680, W-3-029, adan.colon-carmona@umb.edu. Cell Biology, genetics, and molecular biology of plants: environmental and developmental control of cell division in Arabidopsis thaliana, and phytoremediation. Website: http://www.acc.umb.edu/
John P. Ebersole (Associate Professor) 617-287-6681, W-3-030, john.ebersole@umb.edu. Community structure of coral reef fishes as influenced by natural events (hurricanes) and by human activities involving mechanical damage (ship groundings), and toxic releases.

Ron J. Etter (Professor) 617-287-6613, W-3-025, ron.etter@umb.edu. Evolution and ecology of marine invertebrates, geographic variation in mitochondrial DNA; life history evolution; the effects of spatial and temporal variation in biotic interactions on population dynamics and community structure.
Website: http://www.etterlab.umb.edu/

Katherine Gibson (Assistant Professor) 617-287-6614; W-3-012; katherine.gibson@umb.edu. Molecular genetics of bacterial-plant symbiosis; signal transduction; regulation of bacterial cell cycle progression.

Robert W. Guimond (Professor and Director of Undergraduate Advising) 617-287-6654, M-2-127, robert.guimond@umb.edu. Vertebrate physiology, Bio-medical Law; comparative respiratory physiology and gas exchange patterns in amphibious vertebrates.

William Hagar (Associate Professor and Associate Dean of the College of Mathematics and Science) 617-287-6669, M-3-312, william.hagar@umb.edu. Environmental monitoring and photonbiology: monitoring anthropogenic inputs into water systems and factors influencing the photosynthetic rates.

Linda Huang (Associate Professor and co-Graduate Program Director) 617-287-6674, W-3-006, linda.huang@umb.edu. Cell biology, signal transduction, and regulation of cell morphology.

Rick Kesseli (Professor and Department Chair) 617-287-6627, W-3-024, rick.kesseli@umb.edu. Population genetics; molecular evolution; evolution and genetic bases of host-pathogen interactions; evolution and genetic bases of sex determination; conservation genetics. Website: http://www.genetics.umb.edu/

Kenneth C. Kleene (Professor) 617-287-6679, W-3-028, kenneth.kleene@umb.edu. Molecular and developmental Biology; use of recombinant DNA technology to study gene regulation during spermatogenesis in the mouse.

Jill A. Macoksa (Professor and Director, Center for Personalized Cancer Therapy) 287-5783, VDC Wet Lab 1, jill.macoska@umb.edu. Mesenchymal cell biology, tumor microenvironment interactions, inflammation, fibrosis. http://www.umb.edu/macoska

Alexia Pollack (Associate Professor) 617-287-6618, W-3-005, alexia.pollack@umb.edu. Neurobiology; research focuses on the role of dopamine in regulating motor behavior and neuronal activity in the rat basal ganglia.

Liam Revell (Assistant Professor) 287-7259, W-3-015, liam.revell@umb.edu. Phylogenetic methods for evolutionary biology, quantitative genetics, herpetology, evolutionary ecology, tropical biology.

Michael A. Rex (Professor) 617-287-6678, W-3-027, michael.rex@umb.edu. Systematics, zoogeography and ecology of deep-sea gastropod mollusks in the Atlantic Ocean: theoretical, comparative and experimental aspects of island biogeography.

Todd Riley (Assistant Professor) 287-3236, W-3-019, todd.riley@umb.edu. Gene regulation, cancer genomics, protein-DNA and protein-RNA affinity modeling, computational biology, molecular biophysics, systems biology and bioinformatics

Michael P. Shiaris (Professor) 617-287-6675, M-3-321, michael.shiaris@umb.edu. Microbial ecology, especially the biodegradation of organic pollutants in aquatic ecosystems and the population dynamics and diversity of pollutant- degraders and public health bacteria in aquatic sediments.
Kellee Siegfried-Harris (Assistant Professor) 287-6671, W-3-011, kellee.siegfried@umb.edu. Germ cell development and sex determination in zebrafish: developmental biology, genetic regulation of development, molecular biology.

Rachel C. Skvirsky (Associate Professor) 617-287-6617, W-3-007, rachel.skvirsky@umb.edu. Molecular genetics; microbiology; extracellular secretion in bacteria.

Robert Stevenson (Associate Professor) 617-287-6572, M-1-523, robert.stevenson@umb.edu. Animal physiology, physiological ecology, conservation Biology, conservation physiology, conservation education, micrometeorology, energetics, locomotion, temperature regulation, muscle physiology, scaling, insect flight. Website: http://efg.cs.umb.edu/

Manickam Sugumaran (Professor) 617-287-6598, W-4-075, manickam.sugumaran@umb.edu. Protein chemistry and enzymology pertaining to insect cuticle, insect immunity, melanogenesis, Bioprospecting, oxidative browning of plant products, metabolism of xenobiotic compounds and biodegradation of organic pollutants (especially aromatic compounds). Website: http://www.faculty.umb.edu/yvonne_vaillancourt/Biology/Biochem.htm

Alexey Veraksa (Assistant Professor) 617-287-6665, M-3-116, alexey.veraksa@umb.edu. Cell and molecular biology of Drosophila development; cell signaling; proteomics and mass spectrometry; developing new methods to analyze protein-protein interactions; network biology.

Brian T. White (Associate Professor) 617-287-6630, W-3-003, brian.white@umb.edu. Science education; investigation of students changing conceptions of science (especially Biology); development and evaluation of teaching materials including computer software.
# Appendix A
## Biology Courses

Course descriptions can be found in Appendix B, and current offerings in the Course Listings Catalog for each semester. A course appears only once on the list below although some courses could fit into more than one category. To find out when a course will be offered see the course listing for the appropriate semester and more information.

<table>
<thead>
<tr>
<th></th>
<th>Lecture Only</th>
<th>Rarely offered</th>
<th>Not acceptable for major</th>
</tr>
</thead>
</table>

Note: Because you may receive credit for the same material only once, you may not receive credit for both “lecture only” and “lecture & lab” versions of the same course.

### Required Biology Courses for Majors

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>111 &amp; 112</td>
<td>General Biology I /II (prerequisites for all Biology courses 200 level and above)</td>
</tr>
<tr>
<td>210 (212*†)</td>
<td>Cell Biology (with Lab) (prerequisites: Chemistry 115, 117)</td>
</tr>
<tr>
<td>252 (254*†)</td>
<td>Genetics (with Lab) (prerequisites: Chemistry 115, 117)</td>
</tr>
<tr>
<td>290</td>
<td>Population Biology (prerequisite: Math 130)</td>
</tr>
</tbody>
</table>

### Advanced Courses (Prerequisites as indicated)

### Cell Biology and Related Fields

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>334</td>
<td>Microbiology (prerequisites: 210, 252; Chemistry 115-118)</td>
</tr>
<tr>
<td>335 (365 Lab)</td>
<td>Genomics (prerequisites: 210, 252; Chemistry 115-118; Math 130)</td>
</tr>
<tr>
<td>360</td>
<td>Bioinformatics (prerequisites: 210, 252 and 290)</td>
</tr>
<tr>
<td>370 (372*)</td>
<td>Molecular Biology (prerequisites: 383 &amp; 385 [*383 only])</td>
</tr>
<tr>
<td>378 (380*)</td>
<td>Introduction to Immunology (prerequisites: 210, 252; Chemistry 115, 117)</td>
</tr>
<tr>
<td>383</td>
<td>Biochemistry I (lecture) (prerequisites: 210 or 212; Chemistry 252, 256)</td>
</tr>
<tr>
<td>384</td>
<td>Biochemistry II (lecture) (prerequisite: 383)</td>
</tr>
<tr>
<td>385</td>
<td>Biochemistry I (lab) (co-req. 383)</td>
</tr>
<tr>
<td>386</td>
<td>Biochemistry II (lab) (prerequisite: 385, co-req. 384)</td>
</tr>
<tr>
<td>395</td>
<td>Biotechnology (prerequisites: 210/212, 252/254; Biochem 383)</td>
</tr>
</tbody>
</table>
Plant Molecular Biology & Physiology (prerequisites: 320, 321, 322 or 323, 675 or 676) 612
Advanced Cell Biology (permission) 614† Advanced Cell Chemistry (permission)
615 Immunology (prerequisites: 378 or 380) 622† Concepts and Methods in Cytology (permission)
626 Molecular Genetics of Bacteria (prerequisites: 252) 627 Bacterial Physiology (prerequisites: 334 & 383)
629 Host-Microbe Interactions 631 Microbial Genome Evolution
666 Mammalian Toxicology (prerequisites: 317; or Biochem 383, Chemistry 251, 255) 670 Tissue Culture (prerequisites: 313 or 383)
674 Cell Signaling 675 Molecular Biology (prerequisites: 385, 670, & permission) 677 Advanced Eukaryotic Genetics (prerequisites: 252)
678 Protein Chemistry and Enzymology (prerequisites: Biochem 383 & 384 & permission) 681 Network Biology
685 Biomedical Tracers (prerequisites: 317 or 319; or Biochem 383; Chemistry 251, 255) 690 Concepts in Modern Biology (permission)
697 Special Topics in Biology (permission)
Organismal Biology and Related Fields
313 (314*) Developmental Biology (prerequisites: 210 & 252; Chemistry 115-118)
316 (318*) Neurobiology (prerequisites: 210, 252)
317 (319*) Endocrinology (prerequisites: 210, 252)
321 (323*) Plant Physiology (prerequisites: 210; Chemistry 115-118; Math 130)
328 (329*) Plant Life (prerequisites: 210, 252 and 290)
337 (339*) Comparative Animal Physiology (prerequisites: 210; Chemistry 115-118; Math 130)
333 (332*) Biology of Marine Invertebrates (prerequisites: 252, 290)
338 Insect Life (prerequisites: 252, 290) 627 Bacterial Physiology (prerequisites: 334; Biochem 383)
629 Host-Microbe Interactions 631 Microbial Genome Evolution
658 Environmental Physiology (prerequisites: Biochem 383) 692 Advanced Physiology (prerequisites: 316; Biochem 383; Chemistry 251, 255; Physics 107)
Evolutionary Biology and Related Fields
306 Marine and Coastal Ecological Research (prerequisite 210 or 252 or 290)
330 Biology of Fishes (prerequisites: 252, 290) 336 Ecosystems Ecology (prerequisites: 252, 290)
340 (341) Marine Mammals (prerequisites: 252, 290) 342 Ecology (prerequisite: 252, 290)
343 Ecology Lab (co-requisite: Bio 342) 348 Animal Behavior (prerequisites: 252, 290)
349 Methods in Ethology (co-requisite: Bio 348) 352 Evolution (prerequisite: 252, 290)
353 Evolution Lab (co-requisite Bio 352) 384L Game Theory and Evolution
601 Marine Ecosystems (permission) 603 Theories of Community Structure (prerequisites: 342)
605 Field Methods (prerequisites: 342 & 343)
628  Microbial Ecology (prerequisites: 334 or 342 & 384)
632  Advanced Evolution (permission)
635  Advanced Genetics and Diversity (prerequisite: 352)
638  Advanced Ecology (prerequisites: 342)
640  Qualitative Modeling in Biology (permission)
642  Biogeography (prerequisites: 342 and 352)
645  Plant and Animal Interactions (prerequisites: 290, 342 or 352)
660L Coastal Ecological Processes
690  Advanced Ethology (prerequisites: 290 and 348)

General
381  Special Topics
444  Cooperative Education
478-479  Independent Study I and II (This also serves as the route to Honors in Biology, see page 10).
672-673  Directed Readings I and II (permission)
650  Scientific Communication (Biology graduate students only)
697  Special Topics in Biology (permission)

Courses for Non-Majors (may be taken as electives but do not satisfy Biology major requirements)

100  Coastal Ecology
101  Basis of Life
102  Evolutionary Biology
103  Biology of Human Disease
104  Human Biology
108  Introduction to Nutrition
207  Anatomy and Physiology I
208  Anatomy and Physiology II
209  Medical Microbiology

Appendix B UNDERGRADUATE

COURSE DESCRIPTIONS

Biol 100
Coastal Ecology
Investigations of the natural history and community dynamics of salt marshes, sea grass beds, mudflats, and beaches. Field and laboratory exercises on the adaptations and interactions of marine organisms are emphasized. Meets every weekday during five weeks in summer at the field station on Nantucket. Distribution Area: NS 40 hrs wk, 3 Credits Mr Beck

Biol 101
Basis of Life
The uniqueness of life within the physical universe. The matter and energy of life, the genetic code, molecular Biology, and the origin and evolution of life.

Biol 102
Evolutionary Biology
Designed for students in the social sciences and humanities. Those areas of genetics, ecology, and evolution that form a unified approach to the study of organisms and populations. No background in the natural sciences is required. Distribution Area: NS 3 Lect Hrs, 3 Credits Staff

Biol 103
Biology of Human Disease
This course uses human disease as a vehicle to study Biology in a context that is relevant to students' lives. We will focus specifically on cancer, AIDS, and sickle cell anemia. These diseases will be used to illustrate concepts in genetics and cell and molecular biology. The course will provide experience in scientific problem solving and in evaluation of scientific evidence, so that students develop an appreciation of how science works. Students will also examine ethical and social policy issues associated with these diseases. Distribution Area: NS 3 Lect Hrs, 3 Credits Ms Skvirsky
Biol 104
**Human Biology**
A one-semester course designed for those who do not intend to major in Biology. Topics are drawn from among the following: reproduction and development, human evolution and diversity, disease, and genetics. No background in natural sciences is required.
*Distribution Area: NS 3 Lect Hrs, 3 Credits Staff*

Biol 108
**Introduction to Nutrition**
Introduction to the elements of nutrition with emphasis on nutrition for humans, examination of food stuffs and nutritional quality, physiology of food utilization, food quality regulations, and the global ecology of food production. No background in natural science
*Distribution Area: NS 3 Lect Hrs, 3 Credits Staff*

Biol 111
**General Biology I** An introduction to the fundamental principles of Biology at the molecular, genetic and cellular levels. Emphasis on the biological features common to all living things. Intended for students majoring in Biology or for non-majors who wish to take advanced Biology courses.
*Distribution Area: NS 3 Lect Hrs, 3 Lab Hrs, 4 Credits Mr B. White*

Biol 112
**General Biology II** An introduction to the fundamental principles of Biology at the organismal and population levels. Emphasis on evolution, diversity and interactions between living things. Intended for students majoring in Biology or for non-majors who wish to take advanced Biology courses.
*Prerequisite: Bio 111*
*Distribution Area: NS 3 Lect Hrs, 3 Lab Hrs, 4 Credits Mr B. White*

Bio 187S/188S Gateway Seminar I/II
Two semester seminar based course organized along a theme of inquiry-based learning for students. Understanding topics that are prevalent in the scientific community along with developing new information that might form the basic science investments of the future. Students will be co-developers of this freshman seminar series that is based on inquiry-based science education. Desired outcomes will focus on students developing discovery skills, becoming self-driven learners, learning to work in groups and being successful.
*2 Lect Hrs, 2 Credits Staff*

Biochem 187S/188S Gateway Seminar
Two-semester sequence that will fulfill the student's First-Year Seminar requirement. Course content varies with instructor, with focus on discussion of topics with broad societal impact, and important scientific underpinnings, with a particular focus on biochemistry. Using this approach, students will become increasingly familiar with and experienced in scientific discourse, the scientific method, and important new scientific findings. 2 Lect Hrs, 2 Credits Staff
Biol 207
Anatomy and Physiology I
A study of the human organism, correlating structure and physiological mechanisms. Emphasis on skin, the special senses, and the skeletal, articular, muscular, nervous, and endocrine systems. Required of nursing and EHS majors. Prerequisite: Bio 111 or equivalent. Distribution Area: NS
3 Lect Hrs, 3 Lab Hrs, 4 Credits
Mr Guimond

Biol 208
Anatomy and Physiology II
Emphasis on the digestive, circulatory, respiratory, excretory, and reproductive systems. Required of nursing and EHS majors. Prerequisite: Bio 111 and 207. Distribution Area: NS
3 Lect Hrs, 3 Lab Hrs, 4 Credits
Mr Guimond

Biol 209
Medical Microbiology
An introduction to viruses, bacteria, fungi, and protozoa of enzyme action, cell-to-cell communication, and membrane functions such which may be pathogenic to humans and animals; and to immunology, epidemiology, and clinical microbiology. The laboratory introduces sterile techniques, maintenance of pure cultures, isolation, identification, and immunological methods. For nursing majors. Biology majors should take Biol 334 for microbiology. Prerequisites: Bio 111; Chem 115-118; or Chem 130
Distribution Area: NS
3 Lect Hrs, 3 Lab Hrs, 4 Credits
Ms Skvirsky, Mr Veraksa

as transport. Note:
Students (non-Biology majors) who do not wish to take the laboratory portion of this course should register for Bio 212. Prerequisites: Bio 111 and 112; Chem 115, 117; Co-req: Math 130 or higher using the UMB Math Placement Test.
3 Lect Hrs, 3 Lab Hrs, 4 Credits
Ms Huang, Mr Veraksa

Biol 212
Cell Biology (Lecture)
The description of this course is the same as Bio 210; this course consists of lecture sections only; there is no laboratory. Biology majors should take Bio 210. Prerequisites: Same as Bio 210.
3 Lect Hrs, 3 Credits
Ms Huang, Mr Veraksa

Biol 252
Genetics
The basic principles of heredity, studied through an integrated presentation of molecular and classical (Mendelian) genetics. Topics include the nature of the developing principles and applying them to such issues as interaction among species, social behavior, preservation of genetic variation in domestic species, ecology of human pathogens, control of insect pests, and the organization of ecosystems. The course includes two field trips. Prerequisite: Math 130. 3 Lect Hrs, 3 Credits
Ms Brault, Mr Christian

Biol 210
Cell Biology
A study of structure and function of cells including physiological and biochemical processes of cells, membranes, subcellular organelles, and of specialized cells. Specific topics include synthesis and mode of action of Biological macromolecules, flow of information and energy, mode hereditary material, structure of chromosomes, and patterns of inheritance. Note: Students (non-Biology majors) who wish to not take the laboratory portion of this course should register for Bio 254. Prerequisites: Bio 111 and 112; Chem 115, 117; Co-req: Math 130 or higher using the UMB Math Placement Test.
3 Lect Hrs, 3 Lab Hrs, 4 Credits
Mr Kesseli, Ms Skvirsky
Biol 254  
Genetics (Lecture)  The description of this course is the same as Bio 252; this course consists of lecture sections only; there is no laboratory. Biology majors should take Bio 252. Prerequisites: Same as Bio 252 3 Lect Hrs, 3 Credits  Mr Kesseli, Ms Skvirsky

Biol 290  
Population Biology This course examines evolution and the growth of populations. This course analyzes the development of multicellular animals and plants by examining major developmental processes: growth, gene expression, cell interaction, morphogenesis, and pattern regulation. Lectures use experimental evidence to explore the commonality of mechanisms in differing organisms. Basic labs provide experience with materials and methods, and help clarify changing three-dimensional relationships. Additional labs investigate vertebrate embryology in greater detail. Prerequisites: Bio 210 and 252; Chem 115, 117 3 Lect Hrs, 3 Lab Hrs, 4 Credits Ms Pollack

Biol 316  
Neurobiology  Examination of the nervous system beginning at the membrane and cellular level, and then moving on to the organization of sensory and motor systems. Special topics include the Biological bases of various neurological and psychiatric diseases. Note: Students who do not wish to take the laboratory portion of this course should register for Bio 318. Prerequisite: Bio 210 and 252 3 Lect Hrs, 3 Lab Hrs, 4 Credits Mr Campbell

Biol 317  
Endocrinology  The study of hormone physiology and Biochemistry in the context of organismal regulation and coordination. Includes hormone chemistry, control and regulation of hormone production, and the cellular and Biochemical nature of hormone action. Emphasis on mammalian systems and on laboratory and clinical investigations of the endocrine system. Note: Students who do not wish to take the laboratory portion of this course should register for Bio 319. Prerequisite: Bio 210 and 252 3 Lect Hrs, 3 Lab Hrs, 4 Credits Mr Campbell

Biol 314  
Development Biology  The description of this course is the same as Bio 313. This course consists of lecture only; there is no laboratory. Prerequisites: Bio 210 and 252; Chem 115, 117 3 Lect Hrs, 3 Credits Ms Siegfried-Harris

Biol 321  
Plant Physiology A study of plant function with emphasis on nutrition, translocation, metabolism, signal transduction and gene expression, photosynthesis and respiration, hormonal controls during vegetative and reproductive growth, and responses to environmental signals and stresses. Note: Students who do not wish to take the laboratory portion of this course should register for Bio 323. Prerequisites: Bio 210 and 252; Chem 115-118; Math 130 3 Lect Hrs, 3 Lab Hrs, 4 Credits Mr. Colón-Carmona

Biol 323  
Plant Physiology (Lecture)  The description of this course is the same as Bio 321; this course consists of lecture section only; there is no laboratory. Prerequisites: same as for Bio 321 3 Lect Hrs, 3 Credits Mr. Colón-Carmona

Biol 328  
Plant Life  An advanced survey of plant diversity, the major groups, their organization and reproduction, the elements of taxonomy and economic botany of vascular plants, and the major issues of conservation Biology. Note: Students who do not wish to take Biol 330

Biology of Fishes  The evolution, ecology, genetics, taxonomy, and structure of fish. Biological problems of general interest are emphasized, such as breeding systems, genetics of sex determination, evolution by means of chromosome duplication, environmental physiology, and migration. Prerequisites: Bio 252 and 290 3 Lect Hrs, 3 Credits Staff

Biol 332  
Biology of Marine Invertebrates (Lab)  The lab covers life histories, ecological roles, adaptations, morphologies, evolution and
classification of marine invertebrate animals. Laboratory includes field trips to local marine communities. **Prerequisite:** Bio 252 and 290 **Co-requisite:** Bio 333 3 Lab

**Biol 318**
**Neurobiology (Lecture)** The description of this course is the same as Bio 316; this course consists of lecture section only; there is no laboratory. **Prerequisite:** Bio 210 and 252 3 Lect Hrs, 3 Credits Ms Pollack

**Biol 319**
**Endocrinology (Lecture)** The lab portion of this course should register for the lab. The description of this course is the same as Bio 317; this course consists of lecture section only; there is no laboratory. **Prerequisite:** Bio 210 and 252 3 Lect Hrs, 3 Credits Ms Polack

**Biol 335**
**Genomics**
This course surveys the field of genomics using microorganisms as examples. An overview of bacterial and yeast genomes; genome-wide approaches to fundamental problems in microbial physiology and disease. Specific topics include bacterial, yeast, and viral genome structure, genome evolution, genomic variation, and other issues in comparative and functional genomics. **Prerequisites:** Bio 210 and 252; Chem 115-118; Math 130 3 Lect Hrs, 1 Credit Mr Rex

**Biol 333**
**Biology of Marine Invertebrates (Lecture)** The description of this course is the same as Bio 331; this course consists of lecture section only; there is no laboratory. **Prerequisites:** Bio 210, 252, & 290 3 Lect Hrs, 3 Lab Hrs, 4 Credits Staff

**Biol 329**
**Plant Life (Lecture)** The description of this course is the same as Bio 328; this course consists of lecture section only; Study of viruses, bacteria, algae, fungi, and protozoa, to include their study. 3 Lect Hrs, 3 Credits Mr Shiaris

**Biol 336L**
**Ecosystems Ecology** This course will focus on the foundational principles of ecosystems ecology. We will focus on the flow of energy and materials through both the biosphere (plants, animals, and microbes) and the geosphere (soils, atmospheres, and oceans) and the role that humans are playing in altering these key fluxes. We will draw on examples from both terrestrial and marine systems to understand the underlying principles of ecosystem structure and function. **Prerequisites:** Bio 252 and 290 3 Lect Hrs, 3 Credits Ms Bowen

**Biol 338**
**Insect Life** Physiological and other adaptations that account for the survival and success of insect life are considered. The laboratory will deal primarily with the diversity of insects. Brief consideration is also given to the relationship of insects to humankind. **Prerequisites:** Bio 252 and 290 3 Lect Hrs, 3 Lab Hrs, 4 Credits Mr Stevenson

**Biol 339**
**Comparative Animal Physiology (Lecture)** The description of this course is the same as Bio 337; this course consists of lecture section only; there is no laboratory. **Prerequisite:** Bio 252 and 290 3 Lect Hrs, 3 Credits Mr Stevenson
Biol 340  
**Marine Mammal Biology**  
This upper level course will cover mammals (Pinnipeds, Cetaceans, Sirenians) with emphasis on applied population ecology, and conservation issues. Topics include adaptations to marine environments, effects of human exploitation, case studies of population recovery, and multi-species interactions. Many topics make use of mathematical equations.  
**Prerequisites:** Bio 252 and 290; Math 130  
3 Lect Hrs, 3 Credits  
Mr Stevenson

Biol 341  
**Marine Mammal Biology Lab**  
The description of this course is the same as Bio 340; this course is the laboratory section that compliments the lecture portion.  
**Prerequisites:** Same as Bio 340  
Co-requisite: Bio 340  
3 Lab Hrs, 1 Credit  
Ms Brault

Biol 342  
**Ecology**  
A course in population and community ecology. Topics include theory and case studies of population dynamics, competition, predation, niche concepts, life history strategies, behavioral interactions, energetics and productivity, community structure and organization, and Biogeography.  
**Prerequisites:** Bio 252 and 290  
3 Lect Hrs, 3 Credits  
Mr Ebersole

Biol 343  
**Ecology Laboratory**  
Field trips to local terrestrial and marine communities, laboratory studies of population dynamics and interactions between species, and analytical approaches to ecological data. Some field trips may be scheduled on Saturdays. Offered in even-numbered years, fall term.  
**Co-requisite:** Bio 342  
1 Lect Hr, 3 Lab Hrs, 2 Credits  
Mr Ebersole

Biol 348  
**Animal Behavior**  
The course deals with some topics in the physiology and development of behavior and more extensively with social organization, communication, and ecological aspects of behavior. Emphasis on the function and evolution of behavior.  
**Prerequisites:** Bio 252 and 290  
3 Lect Hrs, 3 Credits  
Mr Ebersole

Biol 349  
**Methods in Ethology**  
Observational and experimental analyses of the behavior of a variety of species. Laboratory studies, films, and field trips.  
**Co-requisite:** Bio 348  
5 Lab Hrs, 1 Disc Hr, 3 Credits  
Staff

Biol 352  
**Evolution**  
Evolution as the unifying concept of Biology. Topics include population genetics, adaptive strategies, sex and breeding systems, speciation and population differentiation, fossil histories, evolution of man.  
**Prerequisites:** Bio 252 and 290  
3 Lect Hrs, 3 Credits  
Mr Etter

Biol 353  
**Evolution Laboratory**  
Laboratory investigations of evolutionary processes, including simulations of population genetics, biometric analyses of adaptive morphological features in natural populations, experiments on mimicry, field trips to systematic museum collections and local natural habitats, and phylogenetic analysis of land snails. Concepts of experimental design and statistical analysis are emphasized. (Course offered in the spring semester of even-numbered years.)  
**Co-requisite:** Bio 352  
3 Lab Hrs, 1 Disc Hr, 2 Credits  
Mr Ebersole

Biol 359  
**Tropical Ecology**  
This course serves to introduce students to the basics of tropical ecology, evolution & conservation biology through a mix of lectures, field excursions and independent projects. The course is conducted (in its entirety) in the United States territory of Puerto Rico, at multiple sites. Major topics include a survey of tropical ecosystems, evolution and endemism in the Caribbean, the history of ecological disturbance and conservation biology in the tropics. Offered in Winter Session Term Only.  
**Prerequisite:** Bio 290  
3 Lect Hrs, 3 Lab Hrs, 4 Credits  
Mr Revell

Biol 360  
**Bioinformatics**  
This course will provide a fundamental overview of Bioinformatics, which is the collection, organization, and analysis of biological information. Topics include data searches and sequence alignments, substitution patterns, phylogenetics, genomics, protein and RNA structure prediction, and proteomics. Designed as a required course for biotechnology track students and other students interested in biotechnology careers or graduate study in Biological sciences.  
**Prerequisites:** Bio 210, 252 & 290  
3 Hrs Lec, 3 Credits  
Staff
Biol 365
Genomics Laboratory
This laboratory course, to be taken concurrently with BIOL 335, Genomics, provides a hands-on, inquiry-based laboratory experience for undergraduate science majors. A bacterial model, Enterococcus, will be used to explore the diversity of the bacterium and some of its genes and to test hypotheses about disease virulence and horizontal gene transfer in bacteria. Students will isolate metagenomic DNA and bacteria from the environment and learn basic microbiological methods (bacterial culture, aseptic technique, gram staining) and molecular biology methods (DNA purification/quantitation, PCR, gel electrophoresis, DNA sequencing). In the final portion of the course, students will use bioinformatics tools to analyze their data and submit a final research paper. Prerequisites: Bio 210 and 252; Chem 115-118; Math 130 Co-requisite: Bio 335 3 Lab Hrs, 1 Credit Mr Shiaris

Biol 370
Molecular Biology The molecular biology and biochemistry of gene expression in prokaryotes and eukaryotes. Topics include DNA structure/physical biochemistry, recombinant DNA technology, techniques in research, DNA synthesis, RNA synthesis, protein synthesis, operons, chromatin structure and gene regulation, oncogenes, hormones and growth factors and signal transduction, transposons, mutagenesis and repair, boogies, flowering, photosynthesis, development, circadian rhythms, etc. Laboratories emphasize basic research techniques. Prerequisites: Bio 210/212, 252/254; Biochem 383 and 385 or permission of instructor 3 Lect Hrs, 3 Lab Hrs, 4 Credits Mr Ackerman

Biol 372
Molecular Biology Lecture The description of this course is the same as Bio 370; this course consists of lecture section only; there is no laboratory. Prerequisites: Biochem 383 3 Lect Hrs, 3 Credits Mr Ackerman

Biol 378
Introduction to Immunology An introduction to the principles of immunology including definition of antigens and antibodies, specificity of the immune response, immunoglobin structure, the genetics of immunoglobin synthesis, cellular cooperation in the immune response, and mechanisms of inflammation, transplantation, and diseases associated with responsiveness of the immune system. Prerequisites: Bio 210, 252; Chem 115-118 3 Lect Hrs, 3 Lab Hrs, 4 Credits Mr Beck

Biol 380
Introduction to Immunology (Lecture) The description of this course is the same as Bio 378; this course consists of lecture section only; there is no laboratory. Prerequisites: Same as Bio 378 3 Lect Hrs, 3 Credits Mr Beck

Biol 381
Special Topics Detailed study of a specialized field of biology. Several topics may be offered each semester. Prerequisite: Permission of instructor. Hrs by arrangement, 1-4 Credits Staff

Biochem 383
Biochemistry I In the first of a two semester sequence, the chemistry of life processes is discussed in terms of structure and biological function of proteins, nucleic acids, carbohydrates, lipids, and other cellular components. Special emphasis is given to protein structure and function, enzymology, carbohydrate metabolism, transport mechanisms, energy transformations, and photosynthesis. Prerequisites: Bio 111; Chem 252, 256; Co-req: Biochem 385 3 Lect Hrs, 3 Credits Mr Hagar, Ms Torok, Mr Sugumaran

Biochem 384L
Game Theory, Evolution and Ecology Fundamental concepts of applications of nuclear resonance and biochemical evolution. Prerequisites: Biochem 383 or permission of instructor. 3 Lecture Hrs, 3 Credits Mr Hagar, Ms Torok, Mr Sugumaran

Biochem 385
Biochemistry Lab I Laboratory course to complement Biochem 383. Experiments involving titration, purification and analysis of biological molecules. Provides
training in such techniques as chromatography, electrophoresis, and enzyme kinetics. 
Prequisites: Chem 252, 256 Co-requisites: Biochem 383 or permission of the instructor. 1 Lect Hr, 5 Lab Hrs, 3 Credits Mr Hagar, Mr Sugumaran

Biochem 386
Biochemistry Lab II
Biochem 398

evolutionary game theory and their application in biology. Topics include: the strategy and payoff matrix, the game tree, strategic and extensive form games, symmetric games, Nash equilibria. Evolutionary game theory concepts are discussed for two-strategy games (Prisoner’s Dilemma, Hawk-Dove) and three-strategy games (Rock-Scissors-Paper). Biological examples are studied, such as blood sharing in vampire bats, competition in bacteria, or the evolution of altruistic punishment. BIOL 384L and MATH 384L are Laboratory course to complement Biochem the same course. Prequisites: Bio 210, 252, 290 Ms Brault, Mr Killingback

Biochem 384
Biochemistry II In the second of a two semester sequence, discussion of cellular function is continued. The topics are biochemistry and synthesis of nucleic acids and proteins, structural motifs in protein folding, metabolism of lipids and amino acids, nitrogen fixation, molecular immunology, hormones, ion channels, neurochemistry, biological
This course is designed to introduce students to methodologies and approaches in the biotechnology industry. The course focuses on the

Special Topics in Biochemistry A course designed to examine a specialized topic of Biochemical sciences that is not part of the curriculum of Biochemistry, Biology, or chemistry, or to examine in detail a topic that constitutes only a minor portion of the curriculum in a Biochemistry, Biology, or chemistry course. Prequisite: Permission of the instructor Hrs by arrangement, 1-3 credits Mr Ackerman, Mr Hagar, 384. Experiments involving high performance liquid chromatography, circular dichroism, optical rotary dispersion, nuclear magnetic resonance, photosynthesis and analysis of proteins, lipids, and carbohydrates. Prequisites: Biochem 385 Co-requisites: Biochem 384 or permission of the instructor. 1 Lect Hrs, 5 Lab Hrs, 3 Credits Staff

Biol 395
Biotechnology biology course. The department appoints one or more faculty to serve as co-sponsors. All placements are for six months. Full-time: six credits. Half-time: three credits. Prequisites: Junior standing, Bio 210 and 252, cumulative grade point average of 2.5 or higher in all courses, and grade point average of 2.5 or higher in science and mathematics courses. Hrs by arrangement, 3-6 Credits Staff

Biochem 471-472
Readings in Biochemistry I

advanced students to work on a specialized topic or research project in biology under the guidance of a faculty advisor. The course is normally taken for 3 credits per semester. Enrollment may be for one semester but students are strongly urged to enroll for a full year. Bio 478 and 479 do not count toward Biology major requirements. Laboratory and field work. Prequisites: Second semester junior standing and permission of a research director. Hrs by arrangement, 1-3 Credits Staff

Biol 479
Independent Study II
See Bio 478
Staff

Biochem 491-492
Directed Research in Biochemistry
An opportunity for qualified, advanced students to work on a specialized research project under the guidance of a faculty advisor. Prerequisite: Second semester junior standing and permission of the instructor.

STAFF
Hrs by arrangement, 1-6 Credits

GRADUATE COURSES
All 600 level courses with the exception of Bio 698 and 699 are open to advanced undergraduates who meet prerequisites and have permission of the instructor.

PERMISSION OF THE INSTRUCTOR IS REQUIRED FOR ALL GRADUATE LEVEL COURSES.

Biol 601
Marine Ecosystems The structure and function of coastal marine habitats including rocky intertidal areas, sandy beaches, tidal and mud flats, estuaries, salt marshes, soft bottom areas and plankton. The course will review the physical regime, flora and fauna of these environments and case histories of community organization. Prerequisites: Undergraduate course in ecology 3 Lect-Disc Hrs, 3 Credits Staff

Biol 603
Theories of Community Structure Theoretical aspects of community development and organization including demography, competition, predation, life history strategies, trophic structure, community stability, and equilibrium and non-equilibrium models of species diversity. The course emphasizes rigorous mathematical and graphical approaches. Prerequisite: Bio 342 3 Lect Hrs, 3 Credits Staff

Biol 605
Field Sampling Methods and Data Analysis
Statistical principles of research design, integrated with field techniques, to measure parameters of community structure. Field exercises involve application of the principles learned in lectures and the use of typical sampling equipment to solve environmental questions. Laboratory and field work. Prerequisites: Bio 342 & 343 3 Lect Hrs, 6 Lab Hrs, 5 Credits Staff

Biol 606
Freshwater Ecology This course investigates freshwater ecosystems from a physical, chemical, biological, and ecological prospective. Students will be exposed to concepts and environmental applications of freshwaters such as properties of water, movement of light, heat, and chemicals, physiography of flowing and non-flowing freshwater, redox and oxygen, hydrologic, carbon, iron, nitrogen, phosphorus, and sulfur cycling, biodiversity, behavior, predation, competition, food webs, nutrient use and mineralization, disturbance, succession, production, and trophic state and eutrophication. In the laboratory students will learn techniques to collect, analyze, interpret, and report on physical chemical, biological, and ecological parameters of freshwater ecosystems. Some laboratory exercises will require outside classroom activities such as collecting or measuring parameters in local streams, lakes, and ponds. 4 Lect/Lab Hrs, 4 Credits Mr Christian

Biol 608 (Physics 608)
Biophysical Instrumentation
A lecture and laboratory course on the application of microcomputers and microprocessor-based electronics to laboratory experiments in the Biological and physical sciences. Emphasis is on techniques for interfacing the microcomputer with laboratory experiments for automated data acquisition, data reduction and analysis, information display and real-time control of experiments. Prerequisites: Senior or graduate status, advanced laboratory work in major, familiarity with a programming language. 2 Lect Hrs, 4 Lab Hrs, 4 Credits Mr Stevenson

Biol 612
Advanced Cell Biology
Lecture/discussion course studying eukaryotic subcellular organization. Primary literature is used to explore Biochemical, genetic and molecular
approaches toward understanding organelle function, the cytoskeleton and intracellular transport.

3 Lect Hrs, 3 Credits Ms Huang

**Biol 614**
**Advanced Cell Chemistry**
The methodology of cell analysis with emphasis on macromolecules and intermediary metabolites. Hrs by arrangement, 3-5 Credits Staff

**Biol 615**
**Immunology**
Selected topics in immunology are studied in depth, using the current literature. Topics are chosen for relevance and current interest or for their challenging, even controversial, nature. Prerequisite: Bio 378 or 380

3 Lect Hrs, 3 Credits Mr Beck

**Biol 625**
**Genomics and Biotechnology**
This course provides an overview of genomics and covers topics such as mapping genomes, acquiring genomes and annotating genomes. Students will critically assess the genome projects from various organisms. Special emphasis will be given to technologies that contribute to and stem from the advances in genome sciences, including principles of sequencing, computational tools for gene annotation, functional genomic tools for systems genetics, and technologies for massively parallel analyses of gene function. The applications of these techniques to various areas of biology will also be presented.

3 Lect Hrs, 3 Credits Ms Huang

**Molecular Genetics of Bacteria**
In-depth examination of genetic and molecular processes in bacteria and their associated viruses. Coverage of classical bacterial genetics as well as modern molecular genetic analysis. Topics include genetic transfer processes, gene regulation, mutagenesis and repair, plasmids, transposons, gene fusion methodologies, and protein secretion. Emphasis is given to current experimental approaches and research design. Prerequisite: Bio 252

3 Lect Hrs, 3 Credits Ms Skvirsky

**Biol 627**
**Bacterial Physiology**
A rigorous biochemical examination of the bacterial cell. Lectures focus on bacterial cytology, physiology, and genetics. Areas of current research are emphasized. Students are expected to read primary literature and prepare an in-depth review paper on a special topic. Prerequisites: Bio 334 and Biochem 383, or equivalent.

3 Lect Hrs, 3 Credits Mr Shiaris

**Biol 628**
**Microbial Ecology**
The functions, roles, and ecology of microorganisms in the environment, emphasizing biogeochemical cycling of elements. Topics for special concentration are chosen from the following: microbial diversity, evolution, interactions, aquatic or soil microbiology, and sewage microbiology. The course focuses on relating molecular and biochemical mechanisms to ecological principles. Readings are assigned from classical and current scientific literature for class discussion. An in-depth review paper on a special topic is required. Prerequisites: Bio 334 or 342

3 Lect Hrs, 3 Credits Ms Gibson

**Biol 629**
**Host-Microbe Interactions**
This course that will introduce students to the field of host-microbe interactions. Topics will include the molecular genetics of model symbioses and the impact of evolution and ecology in shaping these interactions. Students will read primary literature and current review articles, and these readings will serve as discussion topics during the class period. Prerequisites: Bio 334 and 372

3 Lect Hrs, 3 Credits Ms Gibson

**Biol 631**
**Genetics of Microbial Evolution**
This course examines the genetic and molecular processes that underlie microbial genome evolution. Topics will include processes involved in generating genetic diversity: for example, spontaneous mutagenesis, horizontal gene transfer, and transposition. These molecular events will be discussed within the context of ecological and lifestyle pressure that help shape genome content and architecture. Students will read one primary literature article with a current book chapter or review article and these readings will serve as the discussion focus during the class period. Prerequisites: Bio 334 and 372

3 Lect Hrs, 3 Credits Ms Gibson

**Biol 632**
**Advanced Evolution**
An inquiry into the modern synthetic theory of evolution with emphasis on population genetics, ecological genetics, evolution of dominance, genetic homeostasis, canalization and genetic theory of polymorphism.
Biol 635
Population Genetics and Diversity A quantitative approach to the concept of populations and the evolutionary forces affecting them. The course analyzes the interactions among forces and the resulting dynamics of population structure. Toward the end of the semester, the course shifts is primary emphasis from lecture to discussion in order to cover current topics in population genetics. Topics include, among others, the theory and application of tools necessary for assaying genetic variation in natural populations, DNA fingerprinting in forensics, the evolution of sex, and the genetics of rare and endangered species. Prerequisites: Bio 252 and 352 or equivalent. 3 Lect Hrs, 3 Credits Mr Bawa

Biol 640
Principles of Qualitative Modeling in Biology A mathematical analysis of biological systems, with emphasis on qualitative rather than quantitative approaches. Signed digraphs (Loop Analysis), matrices, and computer programming will be used. In addition, notions of feedback, stability and other global properties of systems will be presented. During work sessions, students will be grouped to solve problems. At the completion of the course students will be competent to distinguish various methods, assess their strengths and limitations, and apply them to biological systems of interest. 3 Lect-Disc Hrs, 3 Credits Staff

Biol 638
Advanced Ecology Concepts of population and community ecology. Topics covered may include population dynamics, life history strategies, theory of r- and K-selection, competition, predation, community organization, and species diversity. Particular emphasis is placed on the relationship between theoretical and empirical ecology. A weekly tutorial provides the opportunity for greater discussion of material covered in lecture. Emphasis changes from year to year. Prerequisite: Bio 342 2 Lect Hrs, 1 Disc Hr, 3 Credits Mr Etter

Biol 639
Conservation Biology The principles of conservation Biology are drawn from such various subdisciplines of Biology as ecology, genetics, evolution, and biogeography. The course begins with an analysis of the distribution of biodiversity, proceeds to examine the patterns of biodiversity loss at all levels, from genes to ecosystems and finishes with a discussion of the causes, consequences and solutions of the crisis. Topics include assessment and monitoring of species diversity, conservation genetics, the theory of island biogeography, habitat loss and forest fragmentation, human impacts on biodiversity, the design of nature reserves, economic valuation of biodiversity, and sustainable use of biodiversity. Prerequisites: Bio 342 and 352 3 Lect-disc Hrs, 3 Credits Mr Kesseli

Biol 641
Intro to Population Models Fundamentals of mathematical models of population dynamics. The course examines single-species models, including stability analysis, life tables, and analysis of matrix models, as well as competition and predation model forms. More advanced topics include spatial structure, stochasticity, harvesting models, individual-based models, and population viability analysis. The course combines lectures, discussions, and hands-on model development. Prerequisite: Math 135 or 140 2 Lect Hrs, 1 Disc Hr, 3 Credits Ms Brault

Biol 642
Biogeography A study of geographical distribution patterns in plants and animals. Includes historical and descriptive aspects of distributions of organisms, experimental and comparative tests of island biogeography theory, the population genetics and evolutionary strategies of colonizing species. Independent research by students is presented to the class in seminar form. Prerequisites: Bio 342 and 352 or equivalents. Knowledge of statistics & calculus recommended. Hrs by arrangement, 3 Credits Mr Rex

Biol 643
Behavior and Ecology of Seabirds Adaptations of seabirds to the marine environment with particular reference to breeding biology and feeding strategies; other topics of current interest in behavioral ecology. Lectures or lecture and field work. Hrs by arrangement, 2-5 Credits Staff

Biol 644
Marine Mammal Biology The biology and ecology of marine mammals (Pinnipeds, Cetaceans, Sirensians), with emphasis on applied population ecology and conservation issues. Topics include phylogeny, adaptation to marine environments, effects of human exploitation, case studies of population recovery, and multi-species interactions. Prerequisite: Bio 342
3 Lect Hrs, 1 Disc Hr, 3 Credits
Ms Brault

Biol 648
Invasive Species
This course is designed to provide students with an up-to-date perspective on invasive species. The first half of the course will cover characteristics of successful invaders and the ecological processes that occur when a non-native species is introduced into a new habitat. There will also be an extensive review of the pathways that lead to the introduction, evolution and spread of invasives from both past and present. The second half of the course covers invasive species impacts and the issues of invasive species control and management. 3 Lect Hrs, 3 Credits
Mr Kesseli

Biol 650
Scientific Communication
Required of all biology and environmental sciences Biology graduate students; usually taken in the second year. The course covers the storage and retrieval of scientific information (including searching of computerized data bases), the design of tables, figures, and other graphics, the writing of technical reports and papers, and the preparation of posters and publications. Writing, oral presentations and attendance at the weekly departmental seminar are required. Prerequisite: Admission to graduate study in Biology at the master's or the doctoral level. 3 Credits
Staff

Biol 652
Biological Diversity and Evolution
This course is an inquiry into the origin and evolution of patterns of biological diversity. It begins with an overview of biogeochemical history of the Earth, theories of origin of life, diversification of metazoans during the Panerozoic, and the nature and causes of periodic mass extinction events. Biological diversity is considered at molecular, population, and Prerequisites: Bio 210 or 212, and Bio 337 3 Lect Hrs, 3 Credits
Mr Stevenson, Mr Robinson

Biol 660L
Coastal Ecological Processes
Coastal ecosystems form a critical boundary between watersheds and the oceans and as such are influenced by processes in both habitats. From local scale impacts associated with urbanization of near shore watersheds and local fisheries to global scale impacts due to increasing acidification of the oceans and long-range transport of atmospheric pollutants, many coastal waters are under siege from numerous anthropogenic influences. This course will study the basic functioning of coastal ecosystems and the role that human perturbations play in altering these functions. 3 Lect Hrs, 3 Credits
Ms Bowen

Biol 664
Bioinformatics for Molecular Biologists
methods to individual research projects. Prerequisites: Bio 313
2 Sem Hrs, 6 Lab Hrs, 4 Credits
Staff

Biol 670
Tissue Culture
A seminar and laboratory course on the principles and methods of culturing cells, tissues, and organs of animals and plants. Topics include growth factors, differentiation and morphogenesis in vitro, cell cloning, protoplast fusion, and the production of hybridomas for monoclonal antibodies. Students also apply

Biol 653
A series of one credit seminar courses focusing on subfields of biology to help students develop community levels. 3 Lect Hrs, 3 Credits
Mr Etter, Mr Rex

Biol 655
Current Literature in Biology
This course focuses on using computers to predict structure of RNA and protein, search DNA and protein sequence data bases, align protein and DNA sequences, find restriction enzyme sites to tissue culture the habit of keeping up with recent developments through reading scientific journals. The seminars also provide a forum for oral presentations where students can get comment and
critique of their scientific progress. 1 Seminar Hr, 1 Credit Staff

Biol 658 (Env Sci 658)  
Environmental Physiology  
A discussion course exploring in detail the mechanisms by which organisms adapt to their environment and highlighting the interplay among cellular function, physiological function, and the ecology of the organism. Design cloning strategies, and choose oligonucleotide primers for DNA sequencing and PCR. The biological significance, limitations, and interpretation of computer analyses are strongly emphasized. 1 Lect Hr, 3 Lab Hrs, 3 Credits Staff

Biol 666  
Mammalian Toxicology  
This course provides a background of toxicology as they are applied to mammalian systems. Coverage will include: basic concepts in evaluation of poisons and their commonalities with evaluations of drugs and hormones; toxicant exposure. A lecture and laboratory course covering the biosynthesis and regulation of RNA, DNA, and proteins in eukaryotic organisms. The course examines the importance of gene regulation in oncogenesis, levels of gene expression and development; as well as regulation by structure and function (chromosome structure and translational regulation); basic other biomolecules, enzyme kinetics, and the analytical and industrial research techniques; and current recombinant DNA methodology. Please note: Labs meet every other week, for a total of seven hours every two weeks. Prerequisites: Bio 370 or 372

Biol 672-673  
Directed Readings in Biology  
Selected readings in advanced areas of Biology with guidance and regular discussion. Hrs by arrangement, 1-3 Credits Staff

Biol 674  
Cell Signaling  
This course will systematically investigate cell communication mechanisms, with an emphasis on developmental examples of cell signaling. General properties of signaling cascades will be discussed, followed by specific examples of conserved signaling pathways, such as Notch, Wnt, Hedgehog, TGF/BMP, JAK/STAT, nuclear receptors; and receptor tyrosine kinases (RTKs). Normal and aberrant receptor signaling will be examined using experimental evidence obtained in model genetic organisms. Implications of disrupting cell communication pathways in human disease will be discussed. The course will emphasize readings from the current literature. 3 Lect Hrs, 3 Credits Mr Veraksa

Biol 675  
Advanced Molecular Biology  

Biol 678  
Protein Chemistry and Enzymology  
A lecture and laboratory course on various aspects of protein chemistry and enzymology. Emphasis on purification, characterization, structure, function, mechanism of action, kinetics, and regulatory aspects of enzymes. Topics also include the practical and theoretical aspects of affinity chromatography and other separation techniques, immobilization of enzymes and networks. Special emphasis is given to technical advances in collection and analysis of high throughput data and to associated information repositories. 3 Lect Hrs, 3 Credits Mr Veraksa

Biol 679  
Protein Chemistry and (immunoglobins, radioisotopes, lectins, enzymes, chromogen labels, spin labels, heavy isotopes, and particles), instrumentation for their detection, and general methods. The laboratory includes demonstrations and short projects chosen by students and instructor. Prerequisites: Chem 251, 255; Bio 317 or 319; or Biochem 383 2 Lect-Seminar Hrs, 6 Lab Hrs,

Biol 685  
Biomedical Tracers  
A lecture only course covering the same material as Bio 678; no lab work is required. Prerequisites: Same as Bio 678.
Bio 680L
Physical Biochemistry
This course serves as an introduction to analytical methods. 4 Credits
Mr Sugumaran

Bio 690
Advanced Ethology
Examination in depth of topics in the biological protein-protein interaction, and signaling. Emphasis changes each year.
Prerequisites: Graduate student or senior standing, Bio 348 Hrs by arrangement, 3 Credits
Mr Campbell

Biol 677
Advanced Eukaryotic Genetics
A broad spectrum of readings in plant, animal and fungal genetics on such topics as segregation distortion, the control of sex determination, modes of asexual reproduction, inheritance of cytoplasmic genomes, self incompatibility systems, transposable elements, and genetic mapping.
Prerequisites: Bio 252
3 Lect Hrs, 3 Credits
Mr Ackerman

and instrumentation available to the interdisciplinary scientist. While no course can be comprehensive in this field, this course will examine a broad base of analytical methods through introductory theory and will highlight applications and recent developments in these methods through current primary literature. 3 Lect Hrs, 3 Credits
Mr Ackerman, Mr Evans, Mr Sugumaran

Bio 681
Network Biology
The course covers general properties of biological networks, and continues with an in-depth treatment of the properties of the transcriptional, metabolic, and study of behavior with particular reference to communication and the evolution of social behavior. Lecture-discussions, occasional lab exercises and field trips.

Bio 691
Seminar in Developmental Biology
Current problems in developmental Biology. Topics include molecular and cellular differentiation, and pattern determination.
Prerequisites: Bio 313 or 314
3 Sem-Disc Hrs, 3 Credits
Ms Huang

Bio 692
Advanced Physiology
In-depth experimental studies of two or three selected areas of organismal and cellular physiology, focusing on sensory and nervous systems and membrane transport. Provisions will be made for independent projects during the course. One weekly seminar plus one weekly lab meeting. Prerequisites: Bio 337; Biochem 383; Phys 107 or equivalents;
1 Sem Hr; 3-4 Lab Hrs, 3-4 credits
Staff

Bio 693
Seminar in Neurobiology
This seminar will examine the contribution of specific genes to governing such complex traits/disorders as learning and memory, addiction, anxiety and depression. Reading will be taken from the current scientific literature. Students will be responsible for presenting papers and leading class discussions.
Prerequisites: Bio 316 or 318
3 Lect Hrs, 3 Credits
Ms Pollack

Bio 696 Research Experimentation
This independent study provides students with sustained experience in a research laboratory. Each student pursues a specific research project, which may originate in a public or private sector laboratory or at the University. Each student's project should involve the student in ideas and laboratory skills and should permit the student to produce work of publishable quality. Hrs by arrangement, 3 Credits
Staff

Bio 697
Special Topics in Biology
A field of current interest in biology is examined in detail. 
Prerequisite: Permission of instructor. Hrs by arrangement, 1-6 Credits Staff

Biol 698
Projects in Biology
A substantial written report based on library research or an original project such as curriculum design, design of teaching aids and exercises or critique of a book or theory. No more than 6 credits of this course may be applied to the master's degree. The credit may be applied over more than one semester. Bio 698 and Bio 699 are mutually exclusive. Hrs by arrangement, 1-6 Credits Staff

Biol 699
Thesis Research
Substantial laboratory or field research resulting in a master's thesis. This course may not substitute for Biol 698 (these two courses are mutually exclusive). No more than 10 credits of this course may be applied to the master's degree. The credits may be applied over more than one semester. Hrs by arrangement, 1-10 Credits Staff

Appendix C
Department of Biology
University of Massachusetts Boston

Departmental Requirement for the Bachelor’s Degree in Biology

COURSES AND COURSE CREDITS

1. Biology "Core" (19 credits in Biology, 24 credits in Math, Physics and Chemistry) as follows:
   General Biology 111 and 112 (lab required)
   Introductory Chemistry 115 and 116 (lab required 117-118)
   Mathematics through one semester of calculus (usually Math 135 or 140 or 145) Physics 107 and 108 or 113 and 114/Labs 181-182 Cell Biology 210 (lab required)
   Genetics 252 (lab required)
   Population Biology 290

Rev. Fall 2013
2. **20 credits at the 300 level or above in Biology.** These must include at least 4 credits (12 class hours) in the laboratory. (Biochem. 383, 384, 385 and 386 are acceptable)

In two cases, up to 8 of these required 20 credits may be taken in departments other than the Biology Department:

(a) Organic Chemistry (Chem. 251, 252, 255, 256) may be counted toward this 20 credit requirement

(departmental approval is not required)

**NOTE:** no more than 2 of those 4 lab credits can be taken from courses outside the Biology Department, such as Organic Chemistry. In other words, of the required 4 upper level lab credits, a minimum of two must be taken from within the Biology Department – see Residency Requirements on next page - reverse side:

(b) courses taken to complete the requirements of the Bio-behavioral Concentration may be counted toward this requirement, but only with prior approval of the Biology Department Chair.

The following Biology courses do **NOT** fulfill this requirement: 444, 478-479, 672-673.

Majors are advised to complete Biology 111-112, Chemistry 115-118 and Math through Pre-Calculus during their first year and Biology 210, Biology 252, and 290 during their second year. Introductory Physics and all 300+ upper level biology course requirements during their third and fourth years.

**PASS/FAIL**

Students may take **ONLY ONE** course Pass/Fail that counts towards any of the Biology Major course requirements (including all required chemistry, math and physics courses – see 1 and 2 above).

**BIOLOGY TRANSFER COURSE POLICY (LIMITATIONS):**

Fully matriculated students no longer are permitted to take courses elsewhere and transfer them to UMB. Notwithstanding, students who have a particularly pressing reason to take courses at other institutions, may appeal this regulation. That is done through the use of a prior approval form, obtained from the Admissions Office and signed by the Department Chairman or the Departmental Director of Undergraduate Advising or the instructor of UMB’s equivalent course.

**Continued on Reverse**

**REV. FALL 2013**

**BIOLOGY RESIDENCY REQUIREMENTS:**

All students, including transfer students, must take at least **12 credit hours**, including a minimum of **2 credit hours (6 class hours)** in laboratory work, within the Biology Department at UMASS/Boston. These courses will be at the **300 level or above** unless Chair’s approval is obtained for lower level courses. Biology 444, 478-479, and 672-673 **do not** fulfill this requirement. Moreover, **organic chemistry**, (251, 252, 255 and 256) does **NOT count towards the residency requirement**, notwithstanding the fact that **8** of those credits can count towards the fulfillment of the overall minimum of 20 credits upper level bio courses. The Biology residency requirement, therefore, can **only be satisfied** by upper level (**300+ level**) biology courses (**including a minimum of 2 upper level lab credits**).
EXEMPTION FROM GENERAL BIOLOGY:

(a) **CLEP:** The Biology Department accepts the CLEP exam with a score of 50 or above. Students who meet this requirement will be exempt from General Biology 111 and 112 and will **receive six (6) credits** towards graduation.

(b) **ADVANCED PLACEMENT (AP):** Students with a **score of 3** on Advanced Placement Biology are exempt from Biology 111 and 112; those with an **AP score of 4 or higher** are exempt from Biology 111 and 112 and **receive eight (8) credits.** (NOTE: once the CLEP/AP waivers are in force, students **cannot later take** Bio 111-112.)

**BIOLOGY GPA 2.0**

In order to graduate as a Biology major, a **final grade point average of 2.0** is required in Biology courses above Biology 111-112 which are used to meet Biology major requirements.

**HONORS IN BIOLOGY:**

The Biology Faculty may award departmental honors to students who have completed at least 3 credits of Independent Study (Biology 478-479) and who also meet the following requirements:

1. Overall GPA of 3.0 or better
2. Satisfactory grades in advanced Biology courses (usually interpreted as no pass/fail enrollment and GPA of at least 3.0 for all Biology courses 200 level and above)
3. Written thesis and oral presentation of the Independent semester. The thesis is due one week before the presentation.

**ADVISERS**

Every Biology major must have a faculty adviser from the Biology Department. Students should see the departmental assistants in W-3-021 to be assigned an adviser.

**FURTHER INFORMATION**

Additional information can be obtained in the department’s Student Handbook for undergraduates available online and in the University catalog.
Appendix D
BIOLOGY DEGREE REQUIREMENTS TALLY SHEET
(To be used for planning and/or approvals)

STUDENT NAME _______________________________ ID/SS # _______________
ADDRESS ___________________________________ TEL # _______________
EMAIL ______________________________________
DATE OF MATRICULATION _________________________
ADVISER _______________________________________

Check if Completed:  UMB APPROVED
                       credits  transfer

I. CORE: ALL BIO MAJORS
(19 credits in Biology, 24 credits in Math, Physics and Chemistry) General Biology 111-112
Chemistry 115-116; & labs (117-118)
Math through one semester of calculus (135 or 140 or 145)
Physics 107-108 or 113-114 & Labs (181-182) Cell Biology 210
Genetics 252
Population Biology 290

II. UPPER LEVEL BIO/BIOCHEM ELECTIVES (MINIMUM 20 CREDITS):
These upper level Biology offerings are at the 300 or above level, Organic Chemistry (251, 252, 255, and 256) or
(with prior approval) courses taken to complete Bio-behavioral Concentration, including 4 lab credits.
NOTE: no more than 2 of those 4 lab credits can be taken from courses outside the Biology Department, such as
Organic Chemistry. In other words, of the required 4 upper level lab credits, a minimum of two must be taken
within the Biology Department – see Residency Requirements on next page - reverse side:

Requirements to be completed:  total:  total: _______
Course

________________________________________________________
________________________________________________________
________________________________________________________
________________________________________________________

________________________________________________________
This form must be signed by the Department Chairman or the Departmental Director of Undergraduate Advising if it involves transfer credits, substituted courses, or course waivers.

Signature

(Over for important information)

Date

# Formerly Chem. 103-104 (prior to fall 2006)

40

PASS/FAIL

Rev. Fall 2013

Students may take ONLY ONE course Pass/Fail that counts towards any of the Biology Major course requirements (including all required chemistry, math and physics courses).

**BIOLOGY TRANSFER COURSE POLICY (LIMITATIONS):**

Fully matriculated students no longer are permitted to take courses elsewhere and transfer them to UMB. Notwithstanding, students who have a particularly pressing reason to take courses at other institutions, may appeal this regulation. That is done through the use of a prior approval form, obtained from the Admissions Office and signed by the Department Chairman or the Departmental Director of Undergraduate Advising or the instructor of UMB’s equivalent course.

**BIOLOGY RESIDENCY REQUIREMENTS:**

All students, including transfer students, must take at least 12 credit hours, including a minimum of 2 credit hours (6 class hours) in laboratory work, within the Biology Department at UMASS/Boston. These courses will be at the 300 level or above unless Chair’s approval is obtained for lower level courses. Biology 444, 478-479, and 672-673 do not fulfill this requirement. Moreover, organic chemistry, (Chem 251, 252, 255, and 256) does NOT count towards the residency requirement, notwithstanding that it can count towards the fulfillment of the overall minimum of 20 credits upper level bio courses. The Bio major residency requirement, therefore, can only be satisfied by taking upper level (300+) biology courses (including a minimum of 2 upper level lab credits).

**ORGANIC CHEMISTRY FOR EIGHT (8) CREDITS OF UPPER LEVEL BIOLOGY:**

Students may use up to eight (8) organic chemistry credits in partial satisfaction of their upper level (300+) biology courses. However, note that only one (1) credit from each two (2) credit organic chemistry lab can be used to reach that eight credit maximum. That is, only one (1) credit from each of Chem 255 and 256 can be applied toward the upper level biology major requirement.

**EXEMPTION FROM GENERAL BIOLOGY (MINIMUM CLEP/AP SCORES)**

**CLEP:** The Biology Department accepts the CLEP exam with a score of 50 or above. Students meeting these this requirement will be exempt from General Biology 111 and 112 and will receive six (6) credits towards graduation.

**Advanced Placement (AP):** Students with a score of 3 on Advanced Placement Biology are exempt from Biology 111 and 112; those with an AP score of 4 or higher are exempt from Biology 111 and 112 and receive eight (8) credits. (NOTE: once the CLEP/AP waivers are in force, students cannot later take BIO 111-112.)
**BIOLOGY GPA 2.0**
In order to graduate with a Biology Major, students must have a cumulative GPA in all biology courses taken to satisfy the major above the 100 level.

**ADVISERS**
Biology majors must have a faculty adviser from the Biology Department. Students should see the departmental assistants to be assigned an adviser.

**FURTHER INFORMATION**
Additional information can be obtained in the department’s Student Handbook for undergraduates available online and in the University catalog.

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 111 – 4 cr</td>
<td>Biology 112 – 4 cr</td>
<td></td>
</tr>
<tr>
<td>Chemistry 115 &amp; 117 – 5 cr</td>
<td>Chemistry 116 &amp; 118 – 5 cr</td>
<td></td>
</tr>
<tr>
<td>Math 130 – 3 cr</td>
<td>Math 135, 140 or 145 – 4 cr English</td>
<td></td>
</tr>
<tr>
<td>First---Year Seminar – 4 cr</td>
<td>101 – 3 cr</td>
<td></td>
</tr>
<tr>
<td>(16 credits)</td>
<td>(16 credits)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sophomore Year</th>
<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 210 or 252 or 290– 3 or 4 cr</td>
<td>Biology 210 or 252 or 290– 3 or 4 cr</td>
<td></td>
</tr>
<tr>
<td>Gen Ed or Chemistry 251* &amp; 255 – 5 cr</td>
<td>Gen Ed or Chemistry 252* &amp; 256 – 5 cr</td>
<td></td>
</tr>
<tr>
<td>English 102 – 3 cr</td>
<td>Intermediate Seminar – 3 cr General</td>
<td></td>
</tr>
<tr>
<td>General Education – 3 cr</td>
<td>Education – 3 cr</td>
<td></td>
</tr>
<tr>
<td>(14 – 17 credits)</td>
<td>(14 – 17 credits)</td>
<td></td>
</tr>
<tr>
<td>Semester</td>
<td>Courses Offered</td>
<td>Credits Offered</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Junior Year</td>
<td>Biology 210 or 252 or 290 – 3 or 4 cr</td>
<td>(14 – 16 credits)</td>
</tr>
<tr>
<td></td>
<td>Physics 107 or 113 &amp; 181 – 5 or 6 cr</td>
<td>Upper Level Biol Elective** – 3 or 4 cr</td>
</tr>
<tr>
<td></td>
<td>Upper Level Biol Elective** – 3 or 4 cr</td>
<td>General Education – 3 cr</td>
</tr>
<tr>
<td></td>
<td>General Education – 3 cr</td>
<td>(14 – 16 credits)</td>
</tr>
<tr>
<td>Senior Year</td>
<td>Upper Level Biol Elective** – 3 or 4 cr</td>
<td>Upper Level Biol Elective** – 3 or 4 cr</td>
</tr>
<tr>
<td></td>
<td>Elective – 3 cr</td>
<td>Elective – 3 cr</td>
</tr>
<tr>
<td></td>
<td>Elective – 3 cr</td>
<td>Elective – 3 cr</td>
</tr>
<tr>
<td></td>
<td>General Education – 3 cr</td>
<td>General Education – 3 cr</td>
</tr>
<tr>
<td></td>
<td>General Education – 3 cr</td>
<td>(15 – 16 credits)</td>
</tr>
<tr>
<td></td>
<td>Elective – 3 cr</td>
<td>(15 – 16 credits)</td>
</tr>
</tbody>
</table>
Sample Four---Year Plan for a B.S. in Biology

Revised 9.27.2013

* Organic Chem. is **not required for the major**, but is required for most students on the Pre---Medical and Allied health track and serves as a pre---requisite for many upper level courses.

** The Upper Level Biology requirement is 20 credits of Upper Level Biology, including 4 lab credits. Consult with department advisors for details.

†The Writing Proficiency Requirement is recommended to be completed at 60---79 credits. Please consult the WPE website: http://www.umb.edu/academics/vpass/undergraduate_studies/writing_proficiency/

• This document represents a suggested plan for Biology majors. Students must meet with their faculty advisors each semester and follow their degree audit to ensure adequate progress in the major and towards graduation.

Biology BS Course Number Guide

Biology 111 – General Biology I Lecture & Laboratory
Biology 112 – General Biology II Lecture & Laboratory
Biology 210 – Cell Biology
Biology 252 – Genetics Lecture & Laboratory
Biology 290 – Population Biology
Chemistry 115 &117 – Chemical Principles I Lecture & Laboratory
Chemistry 116 & 118 – Chemical Principles II Lecture & Laboratory
Chemistry 251 & 255 – Organic Chemistry I Lecture & Laboratory
Chemistry 252 & 256 – Organic Chemistry II Lecture & Laboratory
Math 130 --- Precalculus
Math 135 – Survey of Calculus
Math 140 – Calculus I
Math 145 – Calculus I for Life and Environmental Sciences
Physics 113 & 181 – Fundamentals of Physics I Lecture & Laboratory
Physics 114 & 182 – Fundamentals of Physics II Lecture & Laboratory
NOTE: This course guide provides the detailed names of courses listed by number on the 4-year plans.
It is not a comprehensive list of courses for your major, or a substitute for an advising appointment! Please consult with your faculty advisor when choosing courses, and check your degree audit regularly.

ADDITIONAL RESOURCES: http://www.umb.edu/academics/course_catalog/search/
http://www.umb.edu/academics/csm/student_success_center/degree_planning/math_placement/
Biotechnology at the University of Massachusetts Boston

The past decade has seen enormous growth in the biotechnology industry. Biotechnology utilizes molecular and cellular biological processes to make commercial products in a wide range of fields, from agriculture, health care, and organic chemistry, to environmental remediation. The Greater Boston area is one of the largest biotechnology centers in the world, with over 150 companies that are predicted to create 20,000 new jobs by the end of the decade.

The Biology Department at the University of Massachusetts Boston is at the forefront of biotechnology education. Since the implementation of the Master’s Program in Biotechnology and Biomedical Science in 1983, virtually all of the graduates of this program have gone on to careers in biotechnology research and development, or to advanced study. Our graduates are employed at Amgen, Amicon, Biogen, Ciba-Corning, Costar, Damon, Genetics Institute, Gene Trak, Genzyme, ImmuLogic, CytoMed, ProCept, T-Cell Sciences, and many other companies. Others work at medical research labs at hospitals and universities, while others have entered Ph.D. and M.D. programs. Undergraduate training has recently been focused as a Biotechnology Track within the biology Major.

Bachelor of Science Biotechnology Track in Biology

The Biotechnology Track in Biology is designed primarily for students who wish to work in research and development at biotechnology companies. However, this track also provides training for work as a laboratory technician in university or medical research labs, or for graduate school in biochemistry, molecular biology or cellular biology.

Students in the biotechnology track must complete the biology major core of basic science courses at the introductory and intermediate levels. In addition, students in the biotechnology track must complete Organic Chemistry I and II. Advanced work focuses on technique and areas of biology that are important in the biotechnology industry. All required biology, chemistry and physics courses must be taken with a laboratory. Elective courses (not required) that would be useful in the biotechnology industry include Animal Physiology, Developmental Biology, Endocrinology, Biopharmaceutical GMP and Licensing, Histology, Biochemistry II, Neurobiology, and Plant Physiology.

Biotechnology companies strongly encourage undergraduates to acquire research experience. The Biology Department offers a variety of opportunities for undergraduate research. Financially qualified students can gain basic research experience through the Work-Study program. Off-campus work experience can be incorporated into a research project for credit as Cooperative Study in Biology. Other students are supported by the National Science Foundation’s Research Experiences for Undergraduates program. Qualified advanced students may undertake Independent Study in a Biology Department or off-campus laboratory, which may lead to graduation with honors.

Required Courses in the Bachelor of Science Biotechnology Track in Biology

<table>
<thead>
<tr>
<th>Basic Science Core Courses</th>
<th>Required Advanced Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Required Introductory and Intermediate Courses)</td>
<td></td>
</tr>
<tr>
<td>Bio 111 and 112 (General Biology I and II with lab)</td>
<td>Bio 334 (Microbiology with lab)</td>
</tr>
<tr>
<td>Chem 115 – 118 (Chem Principles I and II with lab)</td>
<td>Bio 360 (Bioinformatics)</td>
</tr>
<tr>
<td>Mathematics through at least one semester of calculus (Math 135 or 140 or 145)</td>
<td>Bio 370/372 (Molecular Biology with or without lab)</td>
</tr>
<tr>
<td>Physics 107 and 108 (College Physics I and II) or Physics 113 and 114 (Fund. of Physics I and II)</td>
<td>Bio 378/380 (Introduction to Immunology with or without lab)</td>
</tr>
<tr>
<td>Physics 181 &amp; 182 (Introductory Physics Lab I and II)</td>
<td>Bio 395 (Biotechnology)</td>
</tr>
<tr>
<td></td>
<td>Biochem 383 (Biochemistry I)</td>
</tr>
</tbody>
</table>
Advanced Courses

Bio 334 Microbiology
Study of viruses, bacteria, algae, fungi, and protozoa, to include their characterization, classification, and relationship to humans and the environment. Lectures cover microbial biochemistry, cell biology, genetics, taxonomy, pathogenic bacteriology, food and industrial microbiology, and ecology. The laboratory emphasizes aseptic techniques to isolate, culture, observe, and identify bacteria.
Prerequisites: Bio 210, 252 and Chem 115-118
3 Lect. Hrs, 3 Lab Hrs, 4 Credits
Ms Gibson

Bio 360 Bioinformatics
This course will provide a fundamental overview of bioinformatics, which is the collection, organization, and analysis of biological information. Topics include data searches and sequence alignments, substitution patterns, phylogenetics, genomics, protein and RNA structure prediction, and proteomics. Designed as a required course for Biotechnology track students and other students interested in biotechnology careers or graduate study in biological sciences.
Prerequisites: Bio 210, 252 and 290
3 Lect. Hrs, 3 Credits
Staff

Bio 372 Molecular Biology
The molecular biology and biochemistry of gene expression in proaryotes and eucaryotes. Topics include DNA structure/physical biochemistry, recombinant DNA technology, techniques in research, DNA synthesis, RNA synthesis, protein synthesis, operons, chromatin structure, gene regulation, oncogenes, hormones, growth factors, signal transduction, transposons, mutagenesis, flowering, DNA repair, photosynthesis, development, circadian rhythms, etc.
Prerequisites: Bio 210/212, 252/254; Biochem 383 and 385
3 Lect. Hrs, 3 Credits
Mr Ackerman

Bio 378 Introduction to Immunology
An introduction to the principles of immunology including definition of antigens and antibodies, specificity of the immune response, immunoglobulin structure, the genetics of immunoglobulin synthesis, cellular cooperation in the immune response, mechanisms of inflammation, transplantation, and diseases associated with responsiveness of the immune system.
Prerequisites: Bio 210 and 252 and Chem 115-118
3 Lect. Hrs, 3 Lab Hrs., 4 Credits
Mr Beck

Biochem 385 Biochemistry Lab I
Laboratory course to complement Biochem 383. Experiments involving titration, purification, and analysis of biological molecules. Provides training in such techniques as chromatography, electrophoresis, and enzyme kinetics.
Prerequisites: Chem 255, 256; Corequisite: Biochem 383
1 Lect. Hr, 5 Lab Hrs, 3 Credits
Mr Sugumaran, Mr Hagar, Ms Torok

Bio 395 Biotechnology
This course is designed to introduce students to methodologies and approaches in the biotechnology industry. The course focuses on the scientific principles and the applications of microbiology, cell biology, immunology and molecular biology in the medical, pharmaceutical, chemical and agricultural industries.
Prerequisites: Bio 210, 252; Biochem 383
3 Lect Hrs, 3 Credits
Staff

The Biology Department would like to alert students to the course described below, which would be a valuable qualification for an entry level position in the biotechnology industry.

Biopharmaceutical GMP (Good Manufacturing Practice) and Licensing 10.555
Biopharmaceutical GMP examines the regulatory framework in which “drugs,” “biologics,” and “cellular therapies” are evaluated in the United States, including laws, regulations and the state of industrial practice. Students learn about licensing biotechnology products, clinical trials, and license applications and requirements.
3 Credits, 3 Contact Hrs, Senior standing required

The course was listed in the schedule as follows:

Biol 555L PHARMACUT/PRACT/LIC 3CR
Biopharmaceutical GMP is taught by Professor Randall Swartz of the University of Massachusetts Lowell Chemical Engineering Department, who has more than 20 years experience working in the biotechnology industry. Biopharmaceutical GMP provides invaluable preparation for entry level positions in quality assurance and quality control in the biotechnology industry. Biol 555L will not count toward the Biology Major.
Biochem 383 Biochemistry I
In the first of a two semester sequence, the chemistry of life processes is discussed in terms of structure and biological function of proteins, nucleic acids, carbohydrate, lipids, and other cellular components. Special emphasis is given to protein structure and function, enzymology, carbohydrate metabolism, transport mechanisms, energy transformations, and photosynthesis. It is recommended that Biochem 385 be taken concurrently.
Prerequisites: Bio 210 or 212 and Chem 255, 256
3 Lect. Hrs, 3 Credits
Mr Hagar, Mr Sugumaran, Ms Torok

Appendix G
The Biology Minor Requirements Fact Sheet:

a) General Biology BIOL 111 and 112;

b) Four additional biology courses (at least 12 credits), with or without associated lab. Of these courses, two must be at the 200 level and two at the 300 level. (Or you may take three 300 level and one 200 level, or four 300 level courses).

c) At least three of the six required courses (including one course at the 300 level) must be taken at UMass Boston.

d) Only one course for the minor can be taken pass/fail, provided all 6 classes are taken at UMass Boston.

e) The overall GPA for all courses taken to meet the biology minor requirement must be at least 2.0.

f) Students who take a biology minor in a field of study that is closely related to their major may apply or overlap (double count) all courses at the 100 & 200 levels, but only one course at the 300 level may be counted for both the minor and the major.

Appendix H
Environmental Biology Minor

The Biology Department offers an Environmental Biology Minor. Below are the requirements:

The minor consists of taking at least 7 lecture courses (23-26 credits) (some labs are optional) from 5 core areas:
1) Environmental Science
2) 100 level Biology Core
3) 200-Level Biology Core
4) 300 Level Biology Electives
5) Environmental Capstone

100 LEVEL BIOLOGY COURSE REQUIREMENTS (2 COURSES REQUIRED FOR MINOR):
BIOL111 General Biology I (4 Credits)
Pre-req = none
BIOL112 General Biology II (4 Credits) Pre-req = BIOL 111

200 LEVEL BIOLOGY COURSE REQUIREMENTS (2 COURSES REQUIRED FOR MINOR):
BIOL252 or 254 Genetics (4/3 Credits)
Pre-req = BIOL112, CHEM115 and 117
Co-requisite of 130 or placement into Calculus by UMB Placement Exam.
BIOL290 Population Biology (3 Credits)
Pre-req = BIOL112, CHEM115 and 117
Co-requisite of 130 or placement into Calculus by UMB Placement Exam.

300 LEVEL BIOLOGY COURSE ELECTIVES (1 COURSE REQUIRED FOR MINOR):
BIOL 331 or 333 (with or without 332) Biology of Marine Invertebrates (3-5 Credits)
Pre-req = BIOL 252/254 and BIOL 290
BIOL 334 Microbiology (4 Credits)
Pre-req = BIOL 210/212 and BIOL 252/254 and CHEM 104 or 116 & 118
BIOL 336 Ecosystem Ecology (3 Credits)
Pre-req = BIOL 290
BIOL 340 Marine Mammal Biology (3 Credits)
Pre-req = BIOL 252/254 and BIOL 290
*BIOL 342 Ecology (3 Credits) Pre-req = BIOL 252/254 and BIOL 290
*BIOL 343 Ecology Laboratory (2 Credit) Pre/co-req = BIOL 342
*BIOL 352 Evolution (3 Credits) Pre-req = BIOL 252/254 and BIOL 290
*BIOL 353 Evolution Laboratory (2 Credits) Pre/co-req = BIOL 352
BIOL 384L Game Theory, Evolution and Ecology (3 Credits)
Pre-req = BIOL 290; MATH 135 or 140; or permission of the instructor.

*Please note that Bio 342 and 343 or 352 and 353 when taken together count as 1 requirement.

CAPSTONE CORE OPTIONS (1 COURSE REQUIRED FOR MINOR)
ENVSTY 401 Environmental Problem Analysis and Policy Formulation (3 Credits)
Prerequisites: completion of 100 and 200 level courses

Additional Information:
However, it should be noted, that MATH 130, and CHEM 115 and 117 are pre-requisites for the 200 level courses, which would add additional credits if not already fulfilled for the students major. For the Environmental Science Core, there is one course: ENVSTY101: Nature of Environmental Problems. For the 100 Level Biology Core, there are two courses: BIOL 111 and 112. For the 200 Level Biology Core there are two courses: BIOL 252/254 and BIOL 290. For the 300 Level Biology Electives, there are 8 options [2 also have laboratory sections that are recommended but not required: Ecology (BIOL 342) and Ecology Lab (BIOL 343) and Evolution (BIO 352) and
Evolution Lab (BIOL 353): see below for individual course choices and course pre-requisites. Please note BIOL334 Microbiology has additional pre-requisites beyond BIOL252 and BIOL 290. Finally, for the Environmental Capstone, there is 1 course option: ENVSTY401 Environmental Problem Analysis and Policy Formulation. Students are encouraged to pursue independent research opportunities in Biology, but it is not a requirement. The target audience for the minor is students majoring in a different department in the College of Science and Mathematics as they are likely to have the pre-requisites for the minor courses. Students outside of CSM will likely have to take the established pre-requisite courses for the biology courses.

Management of Minor
Management of the Environmental Biology Minor will be through the Biology Department. However, the minor is considered a program under the newly restructured Environmental Studies Program. The goal of that program is to offer individual departments across the university an opportunity to offer an “environmental” minor that incorporates civic engagement and responsibility as part of the offering through having all Environmental minors take ENVSTY101 and ENVSTY401. Both ENVSTY101 and ENVSTY401 incorporate civic engagement and responsibility in their curriculum.

For the most up to date information and course descriptions go to:
http://www.umb.edu/academics/csm/biology/ug/environmental_biology_minor_and_certificate

For more information about the minor, certificate or the Environmental Studies Program in general, please contact the ESP Director, Dr. Alan D. Christian.

Director, Dr. Alan D. Christian
Associate Professor of Biology
Wheatley Hall, 3rd Floor, Room 010
Email: alan.christian@umb.edu
Phone: (617) 287-6639

Appendix I

Environmental Biology Certificate

The Biology Department offers an Environmental Biology Certificate Program. Below are the requirements:

The certificate consists of taking at least 7 lecture courses (23-26 credits) (some labs are optional) from 5 core areas:

1) Environmental Science
2) 100 level Biology Core
3) 200-Level Biology Core
4) 300 Level Biology Electives
5) Environmental Capstone

100 LEVEL BIOLOGY COURSE REQUIREMENTS (2 COURSES REQUIRED FOR CERTIFICATE):
BIOL111 General Biology I (4 Credits)
Pre-req = none
BIOL112 General Biology II (4 Credits)
Pre-req = BIOL 111
200 LEVEL BIOLOGY COURSE REQUIREMENTS (2 COURSES REQUIRED FOR CERTIFICATE):

**BIOL 252 or 254 Genetics (4/3 Credits)**
Pre-req = BIOL112, CHEM115 and 117
Co-requisite of 130 or placement into Calculus by UMB Placement Exam.

**BIOL 290 Population Biology (3 Credits)**
Pre-req = BIOL112, CHEM115 and 117
Co-requisite of 130 or placement into Calculus by UMB Placement Exam.

300 LEVEL BIOLOGY COURSE ELECTIVES (1 COURSE REQUIRED FOR CERTIFICATE):

**BIOL 331 or 333 (with or without 332) Biology of Marine Invertebrates (3-5 Credits)**
Pre-req = BIOL 252/254 and BIOL 290

**BIOL 334 Microbiology (4 Credits)**
Pre-req = BIOL 210/212 and BIOL 252/254 and CHEM 104 or 116 & 118

**BIOL 336 Ecosystem Ecology (3 Credits)**
Pre-req = BIOL 290

**BIOL 340 Marine Mammal Biology (3 Credits)**
Pre-req = BIOL 252/254 and BIOL 290

*BIOL 342 Ecology (3 Credits) Pre-req = BIOL 252/254 and BIOL 290

*BIOL 343 Ecology Laboratory (2 Credit) Pre/co-req = BIOL 342

*BIOL 352 Evolution (3 Credits) Pre-req = BIOL 252/254 and BIOL 290

*BIOL 353 Evolution Laboratory (2 Credits) Pre/co-req = BIOL 352

**BIOL 384L Game Theory, Evolution and Ecology (3 Credits)** Pre-req = BIOL 290; MATH 135 or 140; or permission of the instructor.

*Please note that Bio 342 and 343 or 352 and 353 when taken together count as 1 requirement.

CAPSTONE CORE OPTIONS (1 COURSE REQUIRED FOR CERTIFICATE)

**ENVSTY 401 Environmental Problem Analysis and Policy Formulation (3 Credits)**
Prerequisites: completion of 100 and 200 level courses

Additional Information:
However, it should be noted, that MATH 130, and CHEM 115 and 117 are pre-requisites for the 200 level courses, which would add additional credits if not already fulfilled for the students major. For the Environmental Science Core, there is one course: ENVSTY101: Nature of Environmental Problems. For the 100 Level Biology Core, there are two courses: BIOL 111 and 112. For the 200 Level Biology Core there are two courses: BIOL 252/254 and BIOL290. For the 300 Level Biology Electives, there are 8 options [2 also have laboratory sections that are recommended but not required: Ecology (BIOL 342) and Ecology Lab (BIOL 343) and Evolution (BIOL 352) and Evolution Lab (BIOL 353)]: see below for individual course choices and course pre-requisites. Please note BIOL 334 Microbiology has additional pre-requisites beyond BIOL252 and BIOL 290. Finally, for the Environmental Capstone, there is 1 course option: ENVSTY401 Environmental Problem Analysis and Policy Formulation. Students are encouraged to pursue independent research opportunities in Biology, but it is not a requirement. The target audience for the minor is students majoring in a different department in the College of Science and Mathematics as they are likely to have the pre-requisites for the minor courses. Students outside of CSM will likely have to take the established pre-requisite courses for the biology courses.
For the most up to date information and course descriptions go to:  
http://www.umb.edu/academics/csm/biology/ug/environmental_biology_minor_and_certificate

**Management of Certificate**

Management of the Environmental Biology Certificate Program will be through the Biology Department. However, the minor is considered a program under the newly restructured Environmental Studies Program. The goal of that program is to offer individual departments across the university an opportunity to offer an “environmental” minor that incorporates civic engagement and responsibility as part of the offering through having all Environmental minors take ENVSTY101 and ENVSTY401. Both ENVSTY101 and ENVSTY401 incorporate civic engagement and responsibility in their curriculum.

For more information about the minor, certificate or the Environmental Studies Program in general, please contact the ESP Director, Dr. Alan D. Christian.

Director, Dr. Alan D. Christian  
Associate Professor of Biology  
Wheatley Hall, 3rd Floor, Room 010  
Email: alan.christian@umb.edu  
Phone: (617) 287-6639

---

**Appendix J**

**BIO-BEHAVIORAL STUDIES PROGRAM**

**Program Details:**

Students that are interested in animal behavior and are majoring in psychology, biology or anthropology may choose to participate in the Bio-behavioral Studies Program (BSP) as a specialized addition to their regular major.

The goal of the BSP is to provide students with a broad understanding of the various approaches to the naturalistic study of the behavior of all animals, including humans. Students in the program complete a major in one of the three departments associated with the program and in addition, take a group of appropriate courses in each of the other two departments. Interested students are urged to consult with one of the program’s directors.

**Requirements and Recommendations:**

Students entering the program are advised to take introductory courses in all three departments. In order to ensure that the program is recorded on their transcripts, students should complete the appropriate form, available from either of the program directors, and file a card with the Registrar’s Office.

The program’s requirements are intended to introduce students to the study of animal behavior and to provide both breadth and depth, through courses in both the major field as well as related field.

Students in the program must complete a major in Biology, Psychology or Anthropology. Each of these three departments offers courses which are simultaneously applicable to the department major requirements and to those of the BSP. For matriculated students, successful completion of the program is recorded on official university transcripts when students have met all of the graduation requirements. Non-matriculated students will receive a certificate of completion.

**Approved Courses:**

**A. First Courses in Animal Behavior**  
a. Anthro 210 – Biosocial Bases of Human Behavior  
b. Psych 467 – Evolution and Behavior
B. Associated Fields
   a. Biology 290 – Population Biology
   b. Biology 316/318 – Neurobiology
   c. Biology 317/319 – Endocrinology
   d. Biology 342 – Ecology
   e. Biology 344 – Ornithology
   f. Biology 352 – Evolution
   g. Psych 350 – Learning and Memory
   h. Psych 360 – Behavioral Neuroscience
   i. Psych 460 - The Neuropsychology of Higher Cognitive Processes

C. Advanced Courses in Animal Behavior
   a. Anthro 310 – Primate Behavior
   b. Biology 348 – Animal Behavior
   c. Biology 349 – Ethology
   d. Biology 690 – Advanced Ethology
   e. Psych 465 – Psychobiology of Development

Transfer Credit Policy:
At least three of the five program-approved courses from the departments outside the major department must be taken at U-Mass Boston. Transfer courses must be approved in writing by one of the program’s directors.

Co-Directors Information:
Alexia Pollack: Office: W-3-005; phone: 617-287-6618; email: alexia.pollack@umb.edu
Susan Zup: Office: M-4-273; 617-287-6319; email: susan.zup@umb.edu

Appendix K

REQUIREMENTS FOR THE B.S. DEGREE IN THE JOINT MAJOR IN BIOCHEMISTRY*

Note: Biochemistry majors may not double-major with Biology or Chemistry or minor with Biology or Chemistry.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry 383⁠ + 384⁠</td>
<td>Biochemistry Lecture I &amp; II</td>
<td>6</td>
</tr>
<tr>
<td>Biochemistry 385⁠ + 386⁠</td>
<td>Biochemistry Laboratory I &amp; II</td>
<td>6</td>
</tr>
<tr>
<td>Biology 111-112*</td>
<td>General Biology I &amp; II</td>
<td>8</td>
</tr>
<tr>
<td>Biology 212 (or 210)*</td>
<td>Cell Biology (lecture) (or lecture &amp; laboratory)</td>
<td>3 (4)</td>
</tr>
<tr>
<td>Biology 250 (or 252)*</td>
<td>Genetics (lecture) (or lecture &amp; laboratory)</td>
<td>3 (4)</td>
</tr>
<tr>
<td>Biology 372 (or 370)*</td>
<td>Molecular Biology (lecture) (or lecture &amp; laboratory)</td>
<td>3 (4)</td>
</tr>
<tr>
<td>Chemistry 115 &amp; 117 + 116 &amp; 118**</td>
<td>Chemical Principles lecture I &amp; II + lab I &amp; II</td>
<td>10, 252 + 255</td>
</tr>
<tr>
<td>Chemistry 311⁠</td>
<td>Analytical Chemistry</td>
<td>4 &amp;</td>
</tr>
<tr>
<td>Chemistry 313⁠</td>
<td>Analytical Chemistry Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 312⁠</td>
<td>Physical Chemistry (lecture)</td>
<td>4</td>
</tr>
<tr>
<td>Math ▼ [140* or145]<em>)+ [141</em>or146]*)</td>
<td>Calculus I &amp; II</td>
<td>8</td>
</tr>
<tr>
<td>Physics 113-114*</td>
<td>Fundamentals of Physics I &amp; II</td>
<td></td>
</tr>
<tr>
<td>Physics 181-182*</td>
<td>Physics Laboratory I &amp; II</td>
<td></td>
</tr>
<tr>
<td>256*</td>
<td>Organic Chemistry lecture I &amp; II + lab I &amp; II</td>
<td></td>
</tr>
</tbody>
</table>

Total: 77-80

* Biochemistry 383-386 and a minimum of 15 additional credit hours of non-400 level Biochemistry/Biology/Chemistry courses must be completed at UMB. A final GPA of 2.0 or better in select Biochemistry+Biology+Chemistry courses is required for the Biochemistry degree.

* Students may substitute Bio 210 for 212, Bio 252 for 254 and Bio 370 for 372 if they so desire.
These courses were formerly numbered Chemistry 103 and 104.

These courses were formerly numbered Chemistry 253 and 254.

Students must pass a placement exam to enroll in these courses.

Math 140 + 141 are traditional calculus courses; Math 145 + 146 are designed for the life sciences. These courses may be mixed: 140+141, 145+146, 140+146, 145+141.

*Offered every semester and during the summer sessions. ‡Offered in the Fall semester. §Offered in the Spring semester.

Honors
A minimal cumulative GPA of 3.0 and a minimal GPA of 3.3 in allowed Biochemistry, Biology, and Chemistry courses and completion of Biochemistry 491 and/or 492 (an independent research project with a written thesis, and a presentation before an audience).

Biochem 491/492 Directed Research I/II 1-6 credits, repeatable, but only for a lifetime maximum of 6 credits each Students may alternatively/also enroll for research experience in:

 Bio 478-479 Independent Study I & II 1-3 credits, for a maximum of 6 credits total
 Chem 481-482 Advanced Laboratory I & II 1-4 credits each semester, repeatable
 Chem 491 Senior Thesis 4 credits

Possible electives for qualified students (many other Biology and Chemistry courses are also pertinent):

Biochem 471-472 Readings in Biochemistry I & II 1-3 credits each semester, repeatable
Biochem 480 Special Topics in Biochemistry 3 credits Bio L680/Chem L680 Physical Biochemistry 3 credits
Bio 360 Bioinformatics 3 credits
Bio 664 Computer Analysis of DNA & Protein Structure 3 credits
Chem 361 Analytical Instrumentation 4 credits

Pass/Fail Requirements:
One of the Mathematics or Physics courses required for the major may be taken on a pass/fail basis. No required Biochemistry, Biology, or Chemistry course for the major may be taken on a pass/fail basis.

Example Course Sequence

<table>
<thead>
<tr>
<th>Year 1 Fall</th>
<th>Year 2 Fall</th>
<th>Year 3 Fall</th>
<th>Year 4 Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 credits</td>
<td>16 credits</td>
<td>15 credits</td>
<td>16 credits</td>
</tr>
</tbody>
</table>

Biochemistry Certificate

The Biochemistry Certificate requires a minimum of 15 credits (5 courses, 21 credit hours). Students who have not completed the 100 level and 200 level pre-requisites for the required courses at the 300 level, will complete more course work.

By allowing students who have completed Introductory Biology, General Chemistry, Cell Biology, Genetics, and Organic Chemistry to just complete the 300-level requirements, it is possible to complete the Biochemistry Certificate in 1 year. Students needing to complete all the above listed courses could complete the program in two years, although a realistic plan would be three years.

To receive the Biochemistry Certificate a student must complete, at the University of Massachusetts-Boston, the following courses:

- Biochemistry 383 - Biochemistry I lecture 3 credits / 3 hours
- Biochemistry 385 - Biochemistry I lab 3 credits / 7 hours
Biochemistry 384 - Biochemistry II lecture 3 credits / 3 hours
Biochemistry 386 - Biochemistry II lab 3 credits / 5 hours
Biology 372 - Molecular Biology lecture 3 credits / 3 hours

Successful completion of a course requires a minimum grade of C.
The Grade Point Average (GPA) for all completed required courses must be 2.5 or higher.

It is expected that students enrolling to complete this Biochemistry Certificate will have completed the pre-requisites for the above courses. The pre-requisites are listed in the University of Massachusetts Course Description catalog. Evidence of successful completion of these pre-requisites elsewhere should be presented, prior to enrolling in Biochemistry 383 and Biochemistry 385, to the Biochemistry Director, in the form of an official University transcript. A grade of C or better is required, and the decision on whether to accept a course from another institution resides with the Biochemistry Director, in consultation with appropriate colleagues in Biology and Chemistry.

For students lacking the appropriate pre-requisite courses, any or all of the following courses may be completed at the University of Massachusetts-Boston:

Biology 111 - General Biology I (with lab) Chemistry 115 + 117 - Chemical Principles I lec + lab
Biology 112 - General Biology II (with lab) Chemistry 116 + 118 - Chemical Principles II lec + lab
Biology 212 - Cell Biology (lecture) Chemistry 251 + 255 - Organic Chemistry I lec + lab
Biology 254 - Genetics (lecture) Chemistry 252 + 256 - Organic Chemistry II lec + lab

For further information contact the Biochemistry Director, Dr. Steven Ackerman (617-287-6682; W-3-031; steven.ackerman@umb.edu)
<table>
<thead>
<tr>
<th></th>
<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Freshman Year</strong></td>
<td>Chemistry 115 &amp; 117 – 5 cr</td>
<td>Chemistry 116 &amp; 118 – 5 cr</td>
</tr>
<tr>
<td></td>
<td>Biology 111 – 4 cr</td>
<td>Biology 112 – 4 cr</td>
</tr>
<tr>
<td></td>
<td>Math 130 – 3 cr</td>
<td>Math 145 (or 140) – 4 cr</td>
</tr>
<tr>
<td></td>
<td>English 101 – 3 cr</td>
<td>First---Year Seminar – 4 cr</td>
</tr>
<tr>
<td></td>
<td>(15 credits)</td>
<td>(17 credits)</td>
</tr>
<tr>
<td><strong>Sophomore Year</strong></td>
<td>Biology 212 – 3 cr</td>
<td>Biology 254 – 3 cr</td>
</tr>
<tr>
<td></td>
<td>Chemistry 251 &amp; 255 – 5 cr</td>
<td>Chemistry 252 &amp; 256 – 5 cr</td>
</tr>
<tr>
<td></td>
<td>Math 146 (or 141) – 4 cr</td>
<td>Physics 113 &amp; 181 – 6 cr</td>
</tr>
<tr>
<td></td>
<td>English 102 – 3 cr</td>
<td>Intermediate Seminar – 3 cr</td>
</tr>
<tr>
<td></td>
<td>(15 credits)</td>
<td>(17 credits)</td>
</tr>
<tr>
<td><strong>Junior Year</strong></td>
<td>Biochemistry 383 &amp; 385 (*) – 6 cr</td>
<td>Biochemistry 384 &amp; 386 (*) – 6 cr</td>
</tr>
<tr>
<td></td>
<td>Physics 114 &amp; 182 – 6 cr General Education – 3 cr</td>
<td>Elective – 3 cr</td>
</tr>
<tr>
<td></td>
<td>(15 credits)</td>
<td>General Education – 3 cr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>General Education – 3 cr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(15 credits)</td>
</tr>
<tr>
<td><strong>Senior Year</strong></td>
<td>Biochemistry 491 (**) – 3 cr</td>
<td>Biology 372 (*) – 3 cr</td>
</tr>
<tr>
<td></td>
<td>Chemistry 311 &amp; 313 (*) – 6 cr</td>
<td>Biochemistry 492 (**) – 3 cr</td>
</tr>
<tr>
<td></td>
<td>General Education – 3 cr</td>
<td>Chemistry 312 (*) – 4 cr</td>
</tr>
<tr>
<td></td>
<td>Elective – 3 cr</td>
<td>Elective – 3 cr</td>
</tr>
<tr>
<td></td>
<td>(15 credits)</td>
<td>General Education – 3 cr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(16 credits)</td>
</tr>
</tbody>
</table>
Sample Four---Year Plan for a B.S. in Biochemistry

*Classes offered only once a year; **required only for students wishing to graduate with honors; others can take an elective
†The Writing Proficiency Requirement is recommended to be completed at 60---79 credits. Please consult the WPE website: http://www.umb.edu/academics/vpass/undergraduate_studies/writing_proficiency/

• This document represents a suggested plan for Biochemistry majors. Students must meet with their faculty advisors each semester and follow their degree audit to ensure adequate progress in the major and towards graduation.
• Students are strongly advised to select general education courses which fulfill multiple requirements.
• See reverse side for more detailed information.

Biochemistry BS Course Number Guide

Biochemistry 383 &385 – Biochemistry I Lecture & Laboratory
Biochemistry 384 & 386 – Biochemistry II Lecture & Laboratory
Biochemistry 491 – Directed Research in Biochemistry I
Biochemistry 492 – Directed Research in Biochemistry II
Biology 111 – General Biology I Lecture & Laboratory
Biology 112 – General Biology II Lecture & Laboratory
Biology 212 – Cell Biology Lecture
Biology 254 – Genetics Lecture
Biology 372 – Molecular Biology Lecture
Chemistry 115 &117 – Chemical Principles I Lecture & Laboratory
Chemistry 116 & 118 – Chemical Principles II Lecture & Laboratory
Chemistry 251 & 255 – Organic Chemistry I Lecture & Laboratory
Chemistry 252 & 256 – Organic Chemistry II Lecture & Laboratory
Chemistry 311 & 313 – Analytical Chemistry Lecture and Laboratory
Chemistry 312 – Physical Chemistry
Math 130 – PreCalculus
Math 145 – Calculus I for Life and Environmental Sciences
Math 146 – Calculus II for Life and Environmental Sciences
Physics 113 & 181 – Fundamentals of Physics I Lecture & Laboratory
Physics 114 & 182 – Fundamentals of Physics II Lecture & Laboratory
NOTE: This course guide provides the detailed names of courses listed by number on the 4---year plans. It is
FACT SHEET- TEACHER CERTIFICATION (TC) OPTION: Biology Major

Students who seek certification for teaching Biology in Secondary Schools need to complete the following Biology major requirements.

COURSES REQUIRED FOR BIOLOGY MAJOR:

1. **Biology “CORE”:** (19 Biology credits; 24 in Math, Physics and Chemistry):

   - General Biology 111 – 112 (Lab required)
   - Cell Biology 210 (Lab required)
   - Genetics 252 (Lab required)
   - Population Biology 290
   - Intro Chemistry 115, 116, 117, 118 (Lab required)
   - Intro Physics 107-108 or 113-114 and Labs 181-182
   - Mathematics through one semester of Calculus (Math 135 or 140 or 145)

2. **A minimum of 20 credits at the 300 level or above in Biology:**
   - In two cases, up to 8 of these required 20 credits may be taken in departments other than in the Biology Dept:
     - Organic Chemistry (Chem 251, 252, 255, 256) may be counted toward this requirement (but only 1 credit from each 2 credit lab (255 & 256) can be applied to this upper level option)
     - Course(s) taken to complete requirements of the Bio-Behavioral Program may be counted toward this requirement, but only with prior approval of the Biology Department Chair.

   The following Biology and Biochemistry courses **do not** fulfill this requirement: Bio 444, 478-479 and 672-673; Biochem 471-472, 480, and 491-492.

3. In order to graduate as a Biology major, a final grade point average of **2.0** is required in biology courses above 111-112 which are used to meet Biology major requirements.

4. Not more than **one (1) course** used to satisfy requirements **1 & 2** above can be taken Pass/Fail.
REQUIREMENTS FOR BIOLOGY TEACHER CERTIFICATION (TC):

1. Subject Matter Knowledge for Teacher Certification in Biology – Completion of the requirements for a major in Biology or Biochemistry.

2. In addition to the Biology major coursework, students must also complete two courses in the Psychology department (unless this coursework has been transferred in from another school). Students must take PSYCH 100 or 101 “Introduction to Psychology” and PSYCH 342, “Adolescence”

3. Secondary Education (9-12 in subject area)

<table>
<thead>
<tr>
<th>Semester 1: EDC G 441</th>
<th>Contemporary Issues in Education</th>
<th>3 credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester 2: EDC G 424</td>
<td>Cultures of the High School</td>
<td>3 credits</td>
</tr>
<tr>
<td>EDC G 410</td>
<td>Computers – Technology and Education</td>
<td>3 credits</td>
</tr>
<tr>
<td>EDC G 422</td>
<td>Middle &amp; Secondary Pre-Practicum I</td>
<td>1 credit</td>
</tr>
<tr>
<td>Semester 3: EDC G 460</td>
<td>Designing Secondary Curriculum and Learning Strategies</td>
<td>3 credits</td>
</tr>
<tr>
<td>EDC G 465</td>
<td>Teaching and Learning in Science</td>
<td>3 credits</td>
</tr>
<tr>
<td>EDC G 423</td>
<td>Middle and Secondary Pre-Practicum II</td>
<td>1 credit</td>
</tr>
<tr>
<td>Semester 4: EDC G 499</td>
<td>Practicum &amp; Seminar: Secondary Education</td>
<td>12 credits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(29 Credits)</td>
</tr>
</tbody>
</table>

4. All students MUST pass both the Communication & Literacy Test as well as the Biology Subject Test on the MTEL prior to taking EDC G 499. Students who do not have passing scores on both exams will not be allowed to complete their Practicum. For information and objectives addressed on these exams, please visit the MTEL website at www.mtel.nesinc.com.

Advising:

Every Biology major in the TC Program must apply to the Graduate College of Education. Application and additional information are available in the Office of Student Services located in W-2-119. You can contact them via phone at 617-287-7625 or email: grad.teachered@umb.edu. The Office of Student Services will work with each student throughout the program.

Every Biology major must also have a faculty adviser from the Biology Dept. The Biology Teacher Coordinator (TC) is Dr. Brian White, phone 617-287-5776; email: brian.white@umb.edu.

Prior to the student teaching semester, the TC Coordinator and the Biology TC Committee will review and
evaluate the candidate’s record.

Further information can be obtained from the Biology Department Administrative Assistants in Wheatley 3-021; phone: 617-287-6600.
<table>
<thead>
<tr>
<th>Area</th>
<th>Courses</th>
<th>Course Titles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
<td>Biology 111 and 112</td>
<td>General Biology I and II</td>
</tr>
<tr>
<td></td>
<td>Biology 210 or 212</td>
<td>Cell Biology (with or without lab)</td>
</tr>
<tr>
<td></td>
<td>Biology 252 or 254</td>
<td>Genetics (with or without lab)</td>
</tr>
<tr>
<td>Chemistry</td>
<td>Chemistry 115/117, 116/118</td>
<td>Chemical Principles I and II, lecture and lab</td>
</tr>
<tr>
<td></td>
<td>Chemistry 251/255, 252/256</td>
<td>Organic Chemistry I and II, lecture and lab</td>
</tr>
<tr>
<td>Biochemistry</td>
<td>Biochem 383</td>
<td>Biochemistry I lecture</td>
</tr>
<tr>
<td>Physics</td>
<td>Physics 107 and 108 (or 113 and 114), 181 and 182</td>
<td>College Physics I and II (or Fundamentals of Physics I and II), plus two semesters of physics lab</td>
</tr>
<tr>
<td>Math</td>
<td>Math 140 or 145</td>
<td>Calculus I, or Calculus I for Life Sciences</td>
</tr>
<tr>
<td>Social Science</td>
<td>Psych 100 or 101, or Sociology 101</td>
<td>Introductory Psychology, or Introduction to Sociology</td>
</tr>
</tbody>
</table>
Pre---Med Program of Study

This program offers matriculated students a comprehensive curriculum and advising support as they prepare for careers in medicine and health-related fields. Successful completion of the program is recorded on their official University transcripts when they have met all graduation requirements. Students in the program are required to take a minimum of ten science courses (excluding labs) chosen from the list below. These courses include the basic courses in math, chemistry, physics, and biology as well as selected advanced science courses and introductory coursework in psychology and/or sociology.

Students must have completed at least three semesters of coursework in math and science with at least a 3.2 average in the premedical courses (excluding labs) before declaring the Program of Study, and must maintain a 3.2 average in the Program of Study.

To officially declare the Program of Study, fill out the “Declaration of Major” form (available at The One Stop) and bring it to the Student Success Center.

Requirements
Students must complete at least ten (not including labs) of the following set of courses. No more than four courses may be transferred from other institutions; it is strongly recommended that no courses be taken at two---year institutions.

Note regarding AP credit: currently, medical schools prefer that students do not use AP credit for the required courses. With the new requirements in psychology and sociology that may change; for now, we will accept AP credit in social science towards the Program of Study.
Other Courses Required for Allied Health Studies

Freshman English (English 101 and English 102)

Requirements for Highly Competitive Schools

Calculus (1 year) --- Math 145 & 146 or Math 140 & 141
Calculus Based Physics --- Physics 113/181 and Physics 114/182

Recommended Additional Courses

Molecular Biology (Biology 372 or 370)
Neurobiology (Biology 318 or 316)
Microbiology (Biology 334)
Immunology (Biology 380 or 378)
Appendix P
Research Experiences for Undergraduates (REU)

Summer 2014

Sponsored by the National Science Foundation

Research Experiences for Undergraduates in Integrative and Evolutionary Biology

Biology Department. UMass Boston
June 2 to August 8, 2014: Pending Renewal of Funding

STUDENTS WILL:

☆ Carry out closely guided research projects in biology
☆ Become part of a research group
☆ Develop laboratory skills
☆ Explore issues related to science careers
☆ Exchange ideas at weekly workshops
☆ Participate in field trips, retreat, and social activities

STIPEND: $7600. Includes stipend and housing allowance

RESEARCH AREAS:

Biodiversity  Genetics  Molecular Evolution
Bioinformatics  Evolutionary Biology  Microbial ecology
Cell Biology  Molecular Genetics  Population Biology
Ecology  Plant Biology  Marine Biology

TO LEARN MORE & APPLY: Go to www.reu.umb.edu

Or Contact: Anshika Verma, REU Program Assistant, Biology Dept.
617-287-6600 or anshika.verma@umb.edu

DEADLINE: Completed applications are due Feb 15, 2014
Underrepresented minorities are especially encouraged to apply.
Appendix Q

Initiative for Maximizing Student Development (IMSD)

Initiative for Maximizing Student Development

A Program to Prepare Undergraduate Students for Research Careers in the Biomedical Sciences

The IMSD program at UMass Boston is a research-intensive, skill-building, and mentoring program with the goal of increasing diversity among PhD-level biomedical researchers.

ELIGIBLE STUDENTS:
- U.S. citizens and permanent residents
- Full-time undergraduates who wish to pursue a PhD in science

HOW TO APPLY OR LEARN MORE:
Visit [www.imsd.umb.edu](http://www.imsd.umb.edu)
Contact: Claudia Heske
IMSD Program Coordinator, W. 3 011
517.287.6649
claudia.heske@umb.edu

THE PROGRAM PROVIDES:
- Year-round research opportunities in laboratories at UMass Boston and Dana-Farber/Harvard Cancer Center
- Hourly wages for research
- Tuition waivers
- Research skills training
- Faculty mentoring
- Preparation for graduate school

Individuals who belong to a racial, ethnic, or other group underrepresented in science are encouraged to apply. IMSD aims to increase the participation of such groups in biomedical science research.

Sponsored by the National Institutes of Health
Appendix R

Coastal Research in Environmental Science and Technology (CREST)

The “Coastal Research in Environmental Science and Technology (CREST)” program at the University of Massachusetts Boston (UMass Boston) is a 10-week immersive research experience serving 10 undergraduates per year. CREST exposes students to cutting edge, authentic, coastal environmental research at UMass Boston in an integrative transdisciplinary program across the ecological, environmental, and social sciences. CREST focuses on integrative coastal research crossing disciplinary boundaries that incorporates the ecological, earth, chemical, geographic, and social sciences and leverages the existing research and educational programs within the Environmental, Earth and Ocean Sciences and Biology departments at UMass Boston.

The CREST REU programs offer undergraduate students the opportunity to: 1) carry out independent research project in coastal environmental science (e.g. biology, ecology, geology, chemistry, policy, economics, and management), 2) work closely with a faculty advisor and research group, 3) develop laboratory skills, 4) develop a cohort and networking skills, 5) explore issues of science ethics, 6) exchange ideas with students and faculty at weekly seminars, 7) present summer research at a program wide symposium at the end of the program, 8) participate in field trips/social events in and around Boston Harbor.

- **Program Dates:** June 4 to August 10, 2012 (Arrive in Boston on 6/3; leave Boston on 8/11)
- **Research Topics:** Coastal Ecology, Coastal Environmental Toxicology, Coastal Earth Science, Coastal Environmental Policy, Law, Economics and Management
- **Location:** UMass Boston campus is south of downtown Boston located on the Columbia Point peninsula
- **Financial Package:** Participants will receive 1) a $5000 stipend, 2) 1 round trip airfare to and from Boston, 3) transportation to and from Boston (Logan International) airport, and 3) and housing in a same gender apartment (2-3 bedroom apartment with 2 roommates per room) for the 10 week period.
- **Eligibility:** Applicants must 1) be citizens or permanent residents of the United States, 2) must be enrolled in college for the fall 2012 (i.e. students who will graduate by June 2012 are not eligible to apply), 3) have successfully completed an introductory course/course sequence major (e.g. biology, ecology, geology, chemistry, policy, economics, and management), 4) be willing to live in group (same gender) housing of 4-6 person apartments, and 5) be able to participate in the program full time (e.g. 40 hrs/week, nights, weekends).
- **Students that are minorities underrepresented in the sciences, veterans, disabled, or are early (rising sophomores or juniors) in their undergraduate coursework are especially encouraged to apply.**
- **Application deadline:** February 3rd, 2012 or until positions are filled
- **Information and Online Application:** [http://www.umb.edu/crest-reu](http://www.umb.edu/crest-reu)
- **Contact for Questions:** Dr. Alan D. Christian, CREST-REU Director and Co-Principal Investigator; Phone: 617-287-6639 or email: alan.christian@umb.edu