

WELCOME TO THE DEPARTMENT OF BIOLOGY

We have prepared this HANDBOOK to help answer questions you may have about the majors we offer in Biology, Botany, and Zoology. The handbook is not a substitute for regular consultations with a faculty advisor. Rather, it will help you prepare for meetings with your advisor, thus making the best use of your time and of our advising system.

We have tried to address the questions most frequently asked by students about the Department of Biology and about our three majors (Biology, Botany and Zoology) and two degrees (B.A. and B.S.). If you have any questions that are not answered in the handbook, please contact your advisor, or the Lead Departmental Advisor (Dr. Susan Hoffman at bioadvising@MiamiOH.edu).

For additional information about the Department, its degree programs, or the faculty, please visit our web page at <http://MiamiOH.edu/biology>.

*Dr. Paul Harding
Professor and Chair of Biology*

All departments at Miami University are committed to supporting the learning of all students, irrespective of sex, race, age, religion, handicapping condition, or sexual preference. Students should be able to expect that their learning environments are free from sexism, racism, ageism, and other forms of prejudice. Disparaging comments aimed at women or minority group members, any sexist or racist humor, and any questioning of the seriousness of purpose or academic commitment of students based upon gender or minority status may undermine Miami's educational mission. If such behavior occurs in a class in which you are a student, please take steps to improve the environment for yourself as well as for other students. Try talking first to your instructor and identifying for her or him the specific examples of behavior that you found offensive or disparaging. If you are not content with this solution or its outcome, consult with the Department Chair, and seek the Chair's assistance in improving the situation for you and your classmates.

SPECIALIZED ADVISING

Pre-professional careers: For additional information, please contact the following advisors:

Pre-medical:

Ms. Tailyn Walborn	106 PSN	529-3149	walborta@MiamiOH.edu
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Pre-dental:

Ms. Tailyn Walborn	106 PSN	529-3149	walborta@MiamiOH.edu
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Pre-physical/occupational therapy:

Ms. Tailyn Walborn	106 PSN	529-3149	walborta@MiamiOH.edu
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Pre-veterinary:

Dr. Paul Schaeffer	288 PSN	529-3624	schaeopfj@miamioh.edu
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Pre-pharmacy:

Dr. Michael Robinson	256 PSN	529-2353	robinsm5@MiamiOH.edu
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Pre-optometry:

Dr. Katia Del Rio-Tsonis	244 PSN	529-3128	delriok@MiamiOH.edu
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Pre-physician Assistant:

Ms. Tailyn Walborn	106 PSN	529-3149	walborta@MiamiOH.edu
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Clinical (Medical) Lab Science:

Dr. Marcia Lee	58 PSN	529-5425	leemr@MiamiOH.edu
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Graduate School: For additional information, please contact the following advisors:

Dr. Michelle Boone <i>or</i>	178 PSN	529-4901	boonemd@MiamiOH.edu
Dr. Richard Moore	394 PSN	529-4278	moorerc@MiamiOH.edu

Co-majors and/or Minors: For additional information, please contact the following advisors:

Environmental Science Co-Major:

Dr. David Gorchov	336 PSN	529-4205	gorchodl@MiamiOH.edu
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Premedical Studies Co-Major:

Ms. Tailyn Walborn	106 PSN	529-3149	walborta@MiamiOH.edu
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Neuroscience Co-Major:

Dr. Kathleen Killian	258 PSN	529-3310	killiaka@MiamiOH.edu
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Minor in Neuroscience:

Dr. Haifei Shi	318 HUG	529-3162	shih@MiamiOH.edu
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Minor in Molecular Biology:

Dr. Yoshinori Tomoyasu	356 PSN	529-3126	tomoyay@MiamiOH.edu
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Minor in Horticulture:

Dr. Richard Moore	394 PSN	529-4278	moorerc@MiamiOH.edu
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Minor in Plant Biology:

Dr. Richard Moore	394 PSN	529-4278	moorerc@MiamiOH.edu
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Minor in Plant Biotechnology:

Dr. Richard Moore	394 PSN	529-4278	moorerc@MiamiOH.edu
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Minor in Bioinformatics:

Dr. Chun Liang	350 PSN	529-2336	liangc@MiamiOH.edu
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BIOLOGICAL SCIENCES AT MIAMI UNIVERSITY

The Department of Biology at Miami University offers both B.A. and B.S. degrees in Biology, Botany and Zoology, so that any student interested in the biological sciences can find an appropriate degree program. You can major in Biology if you prefer a broader perspective, or major in Botany or Zoology if you prefer to specialize in plants or animals, respectively. The degree programs have similar core requirements, so it is fairly easy for students to switch between the different majors if their interests change over time. Since there are so many facets to the biological sciences, a student usually begins with a broad area of interest. Some students may start out as general biology majors, then later switch to Botany or Zoology as they become more interested specifically in plants or animals. Others will choose to major in Biology because they wish to maintain a broader outlook.

The faculty in the Department of Biology teach more specialized courses and conduct research with their students in specific areas such as: animal behavior; aquatic ecology; botany; cell and developmental biology; conservation and environmental biology; evolutionary biology; genetics and molecular biology; neurobiology; physiology; physiological ecology; and plant ecology, physiology and evolution. The faculty and staff in Biology are proud that our majors compete very well with those from other departments and universities for jobs and for admission to professional and graduate schools.

1. What is Botany?

Botany is the study of plants, including a wide range of organisms from microscopic algae to the tallest trees. Plant scientists approach the study of plants from several different levels of organization. Molecular plant biologists study the structure and function of biological molecules in plants, including biochemical and molecular aspects of genetics. Plant physiologists study the functions and vital processes of plants, including photosynthesis and mineral nutrition. Plant systematists study the evolutionary history and relationships among plants. Plant ecologists study the relationships between plants and the environments in which they live, both individually and in communities.

The Botany major is chosen by many students seeking a career in environmental assessment, agriculture, or horticulture. It is also selected by those who wish to teach in the biological sciences or to conduct research in environmental science.

2. What is Zoology?

Zoology is the area of biology that focuses on animals, from the level of DNA to whole ecosystems. Zoology contains many specific subdisciplines, and zoologists approach their study from different levels of organization. For example, physiologists are interested in the functioning of cells, tissues and organ systems; ecologists are interested in the interactions of animals with one another and with their environment; developmental biologists are concerned with how a multicellular organism forms from a zygote; and molecular biologists study how specific molecules, such as nucleic acids, function in animals. Some scientists study a particular group of animals, such as birds (ornithologists), mammals (mammalogists), amphibians and reptiles (herpetologists), insects (entomologists), and so on. These people are concerned with all aspects of the group under study, including their taxonomic status, life history, physiology, ecology, genetics, etc.

The Zoology major is chosen by many students seeking a career in one of the health care professions. It is also selected by those who wish to study animals as teachers and/or researchers, or who plan a career in one of the many areas within the environmental sciences.

3. **What are the Career Opportunities with a Degree in the Biological Sciences?**

A. *Employment that may require only an B.A. or B.S. degree in the biological sciences:*

1. Research assistant in a university or institutional lab
2. Lab technician at a pharmaceutical or chemical company, hospital, or research lab
3. Salesperson or trainer for a pharmaceutical, chemical, or medical equipment company
4. Research associate for clinical research organizations
5. Environmental analyst/planner for public or private agencies
6. Worker for government agencies like the EPA, Health Department, USDA, etc.
7. Animal keeper, administrator, or educator at a zoo, wildlife park, or botanical garden
8. High school biology teacher (Teach for America or private school)
9. Salesperson, representative, or editor for publications in the life sciences
10. Peace Corps worker
11. Administrator for health care delivery firm
12. Park naturalist
13. US or state forest service plant biologist
14. Horticultural or agricultural technician
15. Veterinary assistant
16. Pharmacy technician
17. Any business career that requires a strong background in both the sciences and liberal arts

B. *Career positions that usually require additional graduate or professional training:*

Health Sciences

1. Medical doctor (MD or DO)
2. Dentist
3. Veterinarian
4. Pharmacist
5. Physician assistant
6. Advanced nurse (nurse practitioner, midwife, nurse anesthetist, etc.)
7. Optometrist
8. Physical or occupational therapist
9. Genetic counselor
10. Clinical research technician
11. Radiology or medical imaging technician
12. Dental assistant
13. Anesthesiology assistant
14. Veterinary technician/nurse
15. Health care administrator for hospitals, nursing homes, etc.
16. Epidemiologist
17. Podiatrist

Other

18. Research biologist for university, institute, or biotechnology company
19. Staff biologist for wildlife society, wildlife park, botanical garden, etc.
20. Environmental scientist: public health analyst, park manager, toxicologist, etc.
21. Environmental consultant
22. Biology teacher at advanced high school or college level
23. Forensic scientist
24. Specialist in medical or environmental law
25. Salesperson or trainer for advanced medical or research equipment
26. Plant breeder/geneticist
27. Farm advisor or extension agent
28. Master's degree program for the undecided: the Master's degree program serves to strengthen a student's understanding of science, and it has helped many undecided students to select a career

4. **How Do I Decide on a Career Within the Biological Sciences?**

Do not be overly concerned if at the outset you do not know your exact interests and goals. The courses that you take, the instructors that you encounter, and the laboratory and fieldwork that you experience will help to shape your ultimate plans. It is important that you obtain a solid foundation for any career in the biological sciences, not only in the core biology courses, but also in basic chemistry, physics, and mathematics.

Most biology majors take the same basic courses their first year, then start to select more specific courses as their career goals become more clear. Use the basic courses to your advantage--ask yourself which topics you found the most interesting, then select more advanced courses in that area. It is wise to have several career options available--successful admission to a specific career is never guaranteed--so pursue a program that leaves more than one career option open for you. Discuss career possibilities and requirements with members of the Biology faculty and with area professionals. Your faculty advisor can be an invaluable resource for career planning and can help you to identify other opportunities. Information on many internships and testing services available through the Center for Career Exploration and Success, 45 Armstrong Center, can also help you clarify your vocational goals.

Involvement in one or more of the student biology clubs serves to broaden your understanding of a particular profession. Members of these clubs often bring in practicing professionals to present lectures, and they often make visits to neighboring facilities where related work is ongoing.

5. **Should I Major in Biology, Botany or Zoology?**

The Biology major is the most general, and it incorporates advanced classes that focus on a wide variety of organisms. It can provide a strong background for students interested in everything from the health sciences to ecology or the environmental sciences. The Botany major is suitable for students who are particularly interested in plant biology or who are planning to pursue careers that are centered on plants. The Zoology major is suitable for students who wish to focus on the biology of animals or who are planning careers in any of the health professions. The requirements for all three programs are similar, so students can change between the majors with ease.

Note that some majors offered by the regional campuses, such as Applied Biology or Forensic Science, have required biology courses that are in common with the degrees offered on the Oxford campus. However, those degrees have substantially different upper level and related requirements, and they must be completed at the regional campuses.

6. Should I Pursue a B.A. or B.S. Degree Program?

The Department of Biology offers two different degrees, the Bachelor of Arts (B.A.) and the Bachelor of Science (B.S.), in each of the three majors. The degree requirements for the B.A. and B.S. are described in the next sections of this Handbook. Students should select the degree program that best fits their academic and career objectives. Faculty advisors can provide advice based on your individual interests.

In general, the B.A. degree is designed for students who desire more flexibility or wish to take more courses outside of the natural sciences. All Miami Plan Foundation (MPF) and College of Arts and Science (CAS) requirements apply to this degree. The Departmental requirements are more flexible for the B.A. than for the B.S. degree and leave more room for customizing your program; you can use that flexibility to focus more on certain subdisciplines within biology, to take more courses in other branches of science, or to take a variety of non-science electives. This flexibility is also helpful if students have transferred to Miami from other colleges or from non-science majors.

The B.S. degree has more specific science requirements and fewer CAS requirements than the B.A. It is more appropriate for students who are interested in going on to graduate school. Students who plan to go on to the health science professions, such as medicine, may also find that the B.S. is a better fit with the requirements of the profession schools.

7. What are the Requirements for an B.A. Degree in Biology, Botany, or Zoology?

A. *The Miami Plan for Liberal Education:*

Minimum Credit Hours

Foundation Courses (MPF I-V): 27 hrs.

Focus Courses (Thematic sequence (until Fall 2023)-9 hrs; Capstone-3 hrs): 12 hrs.

B. *College of Arts and Science Requirements:*

CAS A-E: 45 hrs.

Most of the CAS requirements, except for the foreign language, can be met simultaneously by the same courses used to fulfill the MPF and major requirements. All A & S students must complete at least 56 hours of advanced (200-level and higher) course work. For a detailed outline of the University and College Liberal Education requirements, see the *Miami Bulletin*.

C. *Courses in the Major:*

To earn an B.A. degree at Miami University, at least 16 of the credit hours required in the major must be earned at Miami. Credit for one term of Introductory Biology may be earned through Advanced Placement Programs (see the *Miami Bulletin* for details), but check with your faculty

advisor as to whether you should take the entire introductory sequence at the college level even if you have AP credit. The Department of Biology does not offer Departmental Proficiency Exams.

1. 100-Level Courses

Biology and Zoology majors must take BIO 115 and BIO 116. BIO 121, 131, 155, 161, 171, and 172 cannot be applied toward a major in Biology or Zoology.

Botany majors may take BIO 115 and BIO 116; or they may take BIO 191 plus any course from this list: BIO 101, 115, 116, 121, 126, 131, 155, 161, 171, 172, or 176.

2. Advanced Hours

There are a few differences between the majors for the Advanced Hours requirement. A minimum of 22 (Botany) or 24 (Biology, Zoology) semester hours of advanced Biology courses are required (from the BIO 200-499 class list; specific selections from the list are required for the different majors). Handouts with details on the requirements for specific majors are available outside Rm. 212 Pearson Hall.

Biology: Majors must take three of the following four courses: BIO 203, 209, 342 and either 204 or 206. At least one advanced course must have a laboratory component (three credits of independent study lab work can be used instead). At least one 400-level course of three or more credits must be included. The other 24 advanced hours can come from any qualified BIO class.

Botany: Majors must take BIO 204 and one course from each of the following sets: (a) BIO 425 or 490; (b) BIO 221, 244, 255, 306, or 331; (c) BIO 205, 302 or 314; (d) BIO 203, 342, 402, 403, or 425. The rest of the 22 advanced hours can come from any qualified BIO class that is not specifically animal-based.

Zoology: No specific courses are required--the 24 advanced hours requirement can come from any 200, 300, or 400-level Biology classes except these plant-based or nursing classes: 203L, 204, 205, 221, 232, 241, 244, 302, 306, 314, 401, 402, 403, 425, 431, 432, 490.

3. Independent Study No more than three total hours of credit in Research in Biology (BIO 320), Independent Study (BIO 277, 377, 477), Internship (BIO 340), and/or Independent Research Capstone (BIO 419.R) may be used to fulfill the Advanced Hours requirement.

D. Related Hours:

Biology: 17 semester hours required, including one year of chemistry with lab and one semester of statistics. The remaining hours may be chosen from ATH, CHM, CIT, CSE, GLG, GEO, IES, MTH, MBI, PCE, PHY or STA.

Botany: 12 semester hours required, including one semester of chemistry. The remaining hours may be chosen from CHM, CIT, CSE, GLG, GEO, IES, MTH, MBI, PCE, PHY or STA.

Zoology: 18 semester hours required, including one year of chemistry with lab. The remaining hours may be chosen from ATH, CHM, CIT, CSE, GLG, GEO, IES, MTH, MBI, PCE, PHY, PSY or STA.

E. *Grade Point Average:*

All courses taken in the major and in related areas for the purpose of fulfilling the requirements for a degree must, with the exception of BIO 277, 340, 377, and 477, be taken for a grade. All majors must attain a cumulative GPA of at least 2.00 in the major. Only courses designed for majors will be included in the computation of this average--Bio 100-199 and Bio 232 are NOT included.

F. *College of Arts and Sciences Writing Competency Requirement:*

This requirement is specifically for students earning the B.A. degree in their major.

- You must complete two of the following courses with a 'W' designation:
BIO 203W, 204W/206W, 209W, 305W
- You must also complete one 400-level course that has a 'W' designation *or* an alternative technical writing assignment connected to an independent study project.

(Note: in any one semester, not all sections of the above courses will necessarily have a 'W' designation)

8. What are the Requirements for a B.S. Degree in Biology, Botany, or Zoology?

A. *The Miami Plan for Liberal Education:*

Minimum Credit Hours

Foundation Courses (MPF I-V): 27 hrs.

Focus Courses (Thematic sequence (until Fall 2023)-9 hrs; Capstone-3 hrs): 12 hrs.

Advanced Writing

Option 1) Complete Bio 115 and 116, plus two of the following courses with a 'W' designation:
BIO 203W, 204W, 206W, 209W, 305W

Option 2) Complete an approved GMP writing course

B. *College of Arts and Science Requirements:*

CAS A (only): 14 hrs.

All A & S students must complete at least 56 hours of advanced (200-level and higher) course work. For a detailed outline of the University Liberal Education and College Language requirements, see the *Miami Bulletin*.

C. *Courses in the Major:*

To earn a B.S. degree at Miami University, at least 18 of the 36 credit hours required in the major must be earned at Miami. Credit for 1-2 terms of Introductory Biology may be earned through Advanced Placement or International Baccalaureate Programs (see the *Miami Bulletin* for details). The Department of Biology does not offer Departmental Proficiency Exams.

1. 100-Level Courses

Biology and Zoology majors must take BIO 115 and BIO 116. BIO 121, 131, 155, 161, 171, 172, and 232 cannot be applied toward any major in Biology or Zoology.

Botany majors must take BIO 115 and BIO 116; or they may take BIO 191 plus any course from this list: BIO 101, 115, 116, 121, 126, 131, 155, 161, 171, 172, and 176.

2. Advanced Hours There are a few differences between the majors for the Advanced Hours requirement. See specific handouts (available outside of 212 Pearson) for details.

Biology: 32 *Advanced Hours*. Majors must take all of the following four courses: BIO 203, 204 or 206, 209, 342. At least two advanced courses must have a laboratory component (three credits of BIO 200-499 Independent Study can be used instead of one lab class). At least one advanced microbiology course is required. At least one 400-level course of three or more credits must be included. The rest of the 32 advanced hours can come from any qualified BIO class.

Botany: 28 *Advanced Hours*. Majors must take BIO 204 and one course from each of the following sets: (a) BIO 425 or 490; (b) BIO 221, 244, 255, 306, or 331; (c) BIO 205, 302 or 314; (d) BIO 203, 342, 402, 403, or 425; (e) BIO 209, 351, 431, 432, 467. The rest of the advanced hours can come from any qualified BIO class that is not specifically animal-based.

Zoology: 28 *Advanced Hours*. Majors must take all of the following four courses: BIO 203, 209, 305 and 342. The rest of the 28 advanced hours requirement can come from any 200, 300, or 400-level Biology classes *except* these plant-based or nursing classes: 203L, 204, 205, 221, 232, 241, 244, 302, 306, 314, 401, 402, 403, 425, 431, 432, 490. At least one 400-level course of three or more credits other than BIO 400, 419R or 477 must be included.

3. Independent Study No more than three total hours of credit from Research in Biology (BIO 320), Independent Study (BIO 277, 377, 477), Internship (BIO 340), and/or Independent Research Capstone (BIO 419.R) may be used to fulfill the Advanced Hours requirement.D. *Related Courses (25-48 Hours) for Biology and Zoology Majors:*

1. Chemistry: At least 18 hours to include CHM 141, 142, 144, and 145; either 231 and 332/432, or 241, 242, 244, and 245 or 251, 252, 254, and 255.
2. Physics: At least 4 hours for Biology majors (PHY 161), and 8 hours for Zoology majors (PHY 161 and 162 or 191 and 192).
3. Math and Statistics: At least 8 hours to include a course in statistics (e.g. STA 261) and a course in calculus (e.g. MTH 151).
4. Other Related Hours: The remaining 9-14 hours required to meet the 48-hour Related Course Requirement must be selected from formal courses offered by the following departments: CHM, GEO, GLG, MTH, STA (200-level or higher), MBI, PHY, PSY, CSE, and BIO (200-level or higher).

The remaining hours required to meet the 124-hr graduation requirement are open electives and may be selected according to the educational interests and goals of each student.

E. Related Courses (25-48 Hours) for Botany Majors:

1. Chemistry: A complete thematic sequence in Chemistry.
2. Physical Sciences: Take one of these: GLG 111 or GLG 121 or GLG 141 or GEO 121 or one of these two physics sequences: PHY 161 and 162, or 191 and 192.
3. Math and Statistics: One course in either statistics (e.g., STA 261) or calculus (e.g., MTH 151).
4. Other Related Hours: The remaining 9-14 hours required to meet the 48-hour Related Course Requirement must be selected from formal courses offered by the following departments: CHM, GEO, GLG, MTH, STA (200-level or higher), MBI, PHY, PSY, CSE, and BIO (200-level or higher).

The remaining hours required to meet the 124-hr graduation requirement are open electives and may be selected according to the educational interests and goals of each student.

F. Grade Point Average:

All courses taken in Biology and in related areas for the purpose of fulfilling the requirements for a degree in Biology must, with the exception of BIO 277, 340, 377, and 477, be taken for grade. All majors must attain a cumulative GPA of at least 2.00 in the major. Only courses designed for majors will be included in the computation of this average.

9. **What is a Typical Class Schedule for Biology, Botany, and Zoology Majors?**

FIRST YEAR

FALL SEMESTER

BIO/MBI 116 (lecture + lab)
 CHM 141/141R (lecture)
 CHM 144 (lab)
 Foreign Language / Elective
 ENG 111 or MPF / CAS Course

SPRING SEMESTER

BIO/MBI 115 (LECTURE + LAB)
CHM 142 (LECTURE)
CHM 145 (LAB)
FOREIGN LANGUAGE / ELECTIVE
MPF / CAS COURSE

SECOND YEAR

FALL SEMESTER

BIO 203/204/206/209
 CHM 241 (lecture)
 CHM 244 (lab)
 Foreign Language / Elective
 Elective / MPF / CAS Course

SPRING SEMESTER

BIO 200+
 CHM 242 (lecture)
 CHM 245 (lab)
 Foreign Language / Elective
 Elective / MPF / CAS Course

THIRD YEAR

FALL SEMESTER

BIO 200+ / 300+
 BIO 200+ / 300+
 PHY 161 (lecture + lab) / Elective
 Elective / MPF / CAS course

SPRING SEMESTER

BIO 200+ / 300+
 BIO 200+ / 300+
 PHY 162 (lecture + lab) / Elective
 Elective / MPF / CAS Course

FOURTH YEAR

FALL SEMESTER

BIO 300+ / 400+
 BIO 300+ / 400+
 CHM 432 / Elective
 Electives / Capstone

SPRING SEMESTER

BIO 300+ / 400+
 BIO 300+ / 400+
 Electives / Capstone

10. **Are There Co-Majors and Minors in the Biological Sciences?**

A. *Environmental Science Co-Major:*

The Environmental Science co-major is a second major that is very easily combined with any major in Biology. Because the co-major is a second major, it satisfies the Thematic Sequence requirement. It is called a co-major because it requires that you have another major, which would be termed the “primary” major. Because of the overlapping requirements, students majoring in Biology, Botany, or Zoology can usually add the co-

major by taking only about three additional courses. Contact Dr. David Gorchov (gorchodl@MiamiOH.edu) for additional information.

B. Premedical Studies Co-Major:

The Premedical Studies co-major is designed to provide students with a broad-based science background, and it prepares them to pursue advanced degrees in medicine as well as other healthcare-related fields. The co-major integrates formal advising sessions with professional development courses and courses covering the fundamental concepts in the biological, physical, and social sciences that are required for admission into medical school and/or covered on the Medical College Admission Test (MCAT). As a result, the co-major requires only two additional credit hours in addition to a normal premedical curriculum, while allowing students to more efficiently track their progress toward achieving their professional goals.

While they are strongly encouraged to pursue this co-major, pre-health students are not required to complete the co-major for successful application and admittance into medical school or any other health professional school. Premedical Studies courses, as well as access to the advising services provided by the Mallory-Wilson Center for Healthcare Education and the Premedical Advisory Committee, are available to all students.

Lastly, the Premedical Studies co-major is not a stand-alone major and must be taken in conjunction with a primary major that provides the significant depth and breadth of a formal academic discipline. Upon graduation, students receive the degree designation of their primary major. Contact Ms. Tailyn Walborn (walborta@MiamiOH.edu) for more information.

C. Neuroscience Co-Major:

The Neuroscience co-major offers students the opportunity to pursue an in-depth exploration of the nervous system, including the biology of individual nerve cells, the organization of nerve cells into a functional nervous system, and the role of the nervous system in behavior and cognition. The co-major is multidisciplinary, including coursework in biology and psychology. Students in the Neuroscience co-major must also be enrolled in and complete a primary major. Because of the overlapping requirements, the Neuroscience co-major can be easily combined with the Biology major and/or the Pre-medical Studies co-major. Contact Dr. Kathleen Killian (killiaka@MiamiOH.edu) or Dr. Jennifer Quinn (quinnjj@MiamiOH.edu) for additional information, or view the Neuroscience co-major website at <http://miamioh.edu/cas/academics/programs/neuroscience/academics/co-major/index.html>

D. Minor in Neuroscience:

The Neuroscience Minor is offered cooperatively through the Department of Biology and Department of Psychology. This minor enables students to pursue an in-depth multidisciplinary study of the nervous system that can be completed with fewer credit hours than the Neuroscience co-major. It provides a basic framework for students planning advanced work in neuroscience at the graduate level. *A minimum cumulative 2.0 grade point average is required for all courses in the minor.* Contact Dr. Haifei Shi (shih@miamioh.edu) for additional information.

E. Minor in Molecular Biology:

The Minor in Molecular Biology enables students to pursue in depth a multidisciplinary study of biological phenomena at the molecular level. It provides a strong foundation for students planning careers in biotechnology industries or advanced work at the graduate level. *A minimum 2.0 grade point average is required for all courses in the minor.* Contact Dr. Yoshi Tomoyasu (tomoyay@miamioh.edu) for additional information.

F. Minor in Horticulture:

This minor provides a general understanding of horticulture and related fields. Courses used for this minor cannot be used for the minor in Plant Biology or Plant Biotechnology, except for BIO 115, 116, or 191. Only 10 credit hours may count in both the horticulture minor and the B.A. or B.S. in Botany or Biology. Advanced courses must represent at least 10 hours of the total 18. College chemistry and BIO 191 are recommended for this minor. *A minimum 2.00 GPA is required for all courses in the minor; no courses for the minor may be taken credit/no-credit.* Contact Dr. Richard Moore (moorerc@miamioh.edu) for additional information.

H. Minor in Bioinformatics:

Bioinformatics, or the application of computational techniques to biological problems, is a fast growing field of significant importance in both academia and industry. A Bioinformatics minor is offered cooperatively by the Departments of Biology, Computer Science and Software Engineering, Microbiology, and Statistics. Students completing the minor will gain the basic knowledge of biology and programming needed to work in this area, as well as an understanding of how computational techniques can be used to advance our knowledge of biology. *A minimum 2.0 GPA is required for all courses in the minor.* Contact Dr. Chun Liang (liangc@miamioh.edu) for additional information.

I. Minor in Plant Biotechnology:

This minor exposes students to the field of plant biotechnology and related areas, including the tools and methods used to manipulate living organisms, as well as the ethical and social implications of these technologies. Courses used for this minor cannot

be used for the minor in Plant Biology or Horticulture, except for BIO 115, BIO 116, or BIO 191. *A minimum 2.00 GPA is required for all courses in the minor; no courses for the minor may be taken credit/no-credit.* Advanced courses must represent at least 10 hours of the total 18, but only 10 credit hours in this minor can count toward the B.A. or B.S. in Botany or Biology.

11. Can I Double-Major in the Biological Sciences?

It is possible to double-major in Botany and Zoology but NOT in Biology and Botany OR in Biology and Zoology, since botany and zoology are both subsets of biology. If you wish to double major in Botany and Zoology you may combine either B.A. or B.S. degrees, but *only nine credit hours of the Advanced Hours requirements may be used for both degrees.*

12. How Do I Obtain an Advisor?

You will be assigned a Departmental faculty advisor who specializes in first-year students after the first few weeks of the semester. Once you have been notified that your advisor has been assigned, you can find out who that is on your myMiami page. Click on the Student Services and Financial Aid tab at the top of the page to see your advisor(s) in the bottom right hand corner. In the meantime, the Lead Departmental Advisor, Dr. Susan Hoffman, will be listed as your default Departmental advisor until you are assigned a specific advisor. Dr. Hoffman will not be your long-term faculty advisor, but you can talk to her (bioadvising@MiamiOH.edu) or to your BIO 147 instructor when questions or problems arise during your first semester. If you are a transfer student who needs an advisor, go to the Department of Biology office in Rm. 212 PSN to receive an advisor assignment.

Towards the end of your first year you will be assigned a permanent Departmental advisor. That advisor will be either be your original advisor or another advisor to whom you have been reassigned. That faculty member will be the primary person who will give you advice for the rest of your time at Miami. Once advisors have been reassigned, your advisor's name and contact information will appear on your myMiami page under the Student Services and Financial Aid tab.

Students should consult with their advisor on a regular basis. Your advisor is available to help you with questions concerning course selection within your major, major and minor requirements, career planning, etc., and will endeavor to clarify the Miami Plan and College Liberal Education Requirements. You are urged to become familiar with all requirements for your degree. *The ultimate responsibility for satisfying academic requirements rests with you!*

The *Miami Bulletin* is considered to be the official document concerning graduation requirements. You will find all Departmental, College, and University requirements listed therein. Unusual problems concerning requirements may be directed to the Arts and Science Advising Office, 146 Upham Hall. General questions concerning vocational goals and career planning may be directed to the Center for Career Exploration and Success, 45 Armstrong

Center. Summer internship opportunities may also be explored through the Office of Career Services.

13. Where Can I Obtain Advice and Information About the Requirements for Admission to a Particular Professional Postgraduate Degree Program?

There is a list of Biology faculty members who serve as special advisors to students interested in different preprofessional programs on page 2. Also, specific handouts are available from the main office of the Department of Biology (212 Pearson Hall) summarizing the requirements for admission to these professional degree programs. In general, these schools have similar minimum requirements, plus additional requirements specific to the subject area.

A. Graduate Programs in Biology:

Applying to graduate programs is *very different* from applying to undergraduate colleges, and the requirements vary considerably between programs. If you are even *considering* applying to graduate school, you should see your advisor as soon as possible to discuss the process and to make sure you are taking the right prerequisite classes. You should also talk to your advisor about becoming involved in research as an undergraduate in order to prepare for graduate school.

*B. Pre-Health Professional Programs--Typical Basic Requirements:
(Handouts for specific pre-health programs are available outside 212 PSN)*

MINIMUM REQUIREMENTS	MIAMI EQUIVALENTS
1 year of English	ENG 111 plus one more advanced class
1 year of College Chemistry/with lab	CHM 141, 142 and 144, 145
1 year of Organic Chemistry/with lab	CHM 241, 242 and 244, 245
1 year of Physics/with lab	PHY 161 and 162, or 191 and 192
1 year of Introductory Biology/with lab	BIO/MBI 115/116
1 semester Calculus and/or Statistics	MTH 151 or 153; STA 261

Additional class requirements often include:

BIO 201-Human Anatomy	BIO 203-Cell Biology
BIO 305-Human Physiology	BIO 342-Genetics
CHM 432-Biochemistry	MBI 201-Basic Microbiology

14. What are the Opportunities for Independent Study in the Biological Sciences?

Students can earn academic credit for independent study projects done either on or off campus.

A. On Campus:

The Department of Biology offers opportunities for students to pursue independent research studies on a one-to-one basis with a member of the faculty. The independent study may involve fieldwork, laboratory experimentation, or intensive library research. We recommend that students interested in pursuing graduate studies or other research-oriented careers should get some research experience as early as possible in their undergraduate years.

If you are interested, the first step is to choose an area in biology that appeals to you-- look over the faculty research information on the departmental website at (<http://MiamiOH.edu/biology>) and see which labs are doing research you find interesting. Then talk to those faculty members and see what openings are available in their labs. If you and a faculty member reach an agreement, you can join their research team in one of three ways.

1. Shadow another student for a few hours a week to learn how research is done in that lab--this is a good way to get your foot in the door and to see if you like doing research.
2. Paid work is available in some labs; ask the faculty member if there are funds for this.
3. Academic credit may be earned for on-campus research work by enrolling in one or more of the following independent study courses: BIO 320 (Research in Biology, 1-3 credits per semester, graded); BIO 177, 277, 377, or 477 (Independent Study, 1-5 credits per semester, credit/no credit); and, *for seniors only*, BIO 419.R (Independent Research Capstone, 3 credits, graded). Usually, 3-4 research hours each week during the semester is worth one credit. To enroll for credit, complete an Independent Study Permit (available from the Department of Biology office), have it signed by your faculty sponsor, and return it to the Department of Biology office.

B. Off Campus:

If you wish to receive credit for work-related experiences *outside* of Miami University (e.g. research laboratories, consulting firms, zoos, museums, industrial laboratories, or government agencies), you can arrange with a faculty sponsor to receive BIO 340 (Internship) credit. To receive credit, you MUST:

1. Arrange for a faculty sponsor and develop a letter of agreement with them, specifying what you will do during the internship and what you will submit to your mentor as an academic product, e.g. written reports or papers, a journal of your work, etc. This agreement **MUST** be signed by you, your faculty mentor, and your supervisor at the internship site **BEFORE** you can register for credit.
2. Register for BIO 340 (Internship) using the Independent Study Permit and get approval from the Department Chair and the Dean of the College **BEFORE** you begin the work experience.
3. Submit a written report on the independent research or internship experience to the faculty sponsor at the end of the course and before a final grade is assigned. This report should summarize the important results of the work.

Also, be aware that Miami University WILL charge you tuition for any BIO 340 credit hours you earn off-campus during the summer or winter terms. If you plan to participate in an internship experience over the summer or winter breaks but submit your written report to your faculty mentor the following fall or spring term, you can receive the Bio 340 credit for that fall or spring term. However, you STILL must sign an internship agreement before you begin the internship, regardless of when you receive the class credits.

Restrictions on Independent Study Credits:

An accumulated total of three credits from all independent study or internship courses may be applied to the advanced hour (i.e., 200-level or above) requirements for the B.A. or B.S. The three credits may come from BIO 277, 320, 340, 377, 419.R, or 477.

Students can accumulate a maximum of three credits of BIO 320. They also can take only three credits of BIO 419.R. The grades for those two courses (up to six credits total) will be used in the calculation of the GPA in the major. However, only three credits may be applied to the advanced hour requirement in the major. Additional credits of independent study or internship can be applied to the University minimum of 124 credits for graduation and to the College of Arts and Science minimum of 56 advanced hours, according to guidelines set forth in the Miami Bulletin.

15. Does the Department of Biology Offer Student Awards?

Each year, by vote of the faculty, the Department of Biology may make several monetary awards to majors who have achieved a strong academic record and have been involved in noteworthy service activities and/or independent research. The winners of these scholarships are announced by the Office of Student Financial Aid. Some of the scholarships are limited

to premedical or pre-veterinary students. A list of these scholarships is available from the Department of Biology office in 212 PSN.

16. How Can I Earn Departmental Honors in Biology?

The Department of Biology encourages our majors with high academic ability to participate in our Departmental Honors Program. Successful completion of this program will result in Departmental recognition and the award of Departmental Honors upon graduation. The program consists of seminar courses coupled with independent research, resulting in an Honors thesis.

Students interested in pursuing Departmental Honors should begin by identifying a departmental faculty member willing to supervise the Honors work (i.e. willing to serve as the Departmental Honors Advisor). Our Departmental web page (<http://MiamiOH.edu/biology>) is a good source of information about faculty members and their ongoing research projects. The student and advisor should then complete an application form, available from the Department of Biology office. In order to allow time for completion, the program should be initiated no later than the spring semester of a student's junior year.

Requirements for Departmental Honors in Biology:

1. Attainment of a cumulative GPA of 3.5 or higher in all BIO courses.
2. Identification of a member of the Biology faculty who agrees to oversee the project as the Departmental Honors Advisor for the student.
3. Completion of a total of five credit hours of independent work, including a minimum of one credit hour from BIO 491 and three credit hours from BIO 277, 320, 377, 477, or 419.R.
4. Submission to the Department of Biology of a hard copy of an Honors thesis based upon the research undertaken. The thesis must be reviewed and approved by the Honors Advisor and another faculty member who serves as a Reader.
5. Public presentation of the Honors research at the Undergraduate Research Forum or other suitable venue.

For additional information about this program, contact your Departmental academic advisor or the Lead Departmental Advisor (Dr. Susan Hoffman, bioadvising@MiamiOH.edu).