

DEPARTMENT OF BIOLOGY

No one really knows what the world will be like 50 years from now, but it is certain that biologists will be at the forefront of science attempting to find solutions to many of the world's problems and to find answers to intriguing questions about animals, plants and microbes at the molecular, cellular, organismal and ecosystem levels. Biologists will be concerned with pollution of the environment, cause and cure of disease, population control, recurring food shortages, preservation of species and many other aspects resulting from the impact of technological changes on life forms. Those who are astounded by the array of living things on the earth and who seek challenging, creative work should consider a career in biology or in a biology-related field. The Department of Biology offers six distinct four-year curricula which lead to the baccalaureate degree. These are the Bachelor of Arts in Biology, Bachelor of Science in Biology, Bachelor of Science in Molecular and Cell Biology, Bachelor of Science in Microbiology, Bachelor of Science in Neuroscience (Molecular and Cellular Neuroscience Track), and Bachelor of Science in Zoology. The curricula are designed to maximize postbaccalaureate opportunities in:

1. professional schools of medicine, veterinary medicine and dentistry;
2. allied health schools of physical and occupational therapy, physician assistant programs, optometry, pharmacy, and nursing;
3. graduate education leading to teaching and research careers in universities, in industry or in state or national agencies;
4. teaching at junior high or high school levels and
5. jobs in biotechnology, research laboratories, pharmaceutical companies and field biology.

The Department of Biology degree plans will enable students to complete all entrance requirements for graduate and professional schools as well as medical technology, pharmacy, optometry, nursing, physical therapy, and other paramedical and health support fields.

Advising

Because some careers in biology require advanced and/or specialized training, it is essential to take advantage of advising opportunities. In the Department of Biology, there are professional advisors in the Biology Undergraduate Programs Office. The advisor may be consulted prior to each registration period and as the student needs. Questions regarding registration, degree checks, transfer of courses, advanced placements and other academic matters are handled in the Office of Undergraduate Programs. Students with special interests in graduate study should consult the graduate advisor. Information concerning entrance to professional schools of medicine, dentistry and other health related fields is available from the Office of Professional School Advising.

Requirements for all Baccalaureate Degrees in the Department of Biology

Each student seeking a baccalaureate degree in the Department of Biology is required to master a common body of knowledge in science. In addition, the student must take courses essential to a liberal education. Students will note that the first two years of all curricula offered by the Department of Biology are similar. Electives must include a 3 hour international and cultural diversity elective and a 3 hour cultural discourse elective required for graduation. Students must also take at least two writing-intensive courses in biology. Other requirements for

graduation are listed in the Texas A&M University Student Rules and this catalog.

Students in the Department of Biology must make a grade of C or better in BIOL 111 and BIOL 112. Additionally, students may have only one D in courses within the major used to satisfy required or directed electives for a given degree plan. It is required that the freshman and sophomore level biology, chemistry and math courses be completed before the start of the 5th full semester and before enrollment in any junior or senior level science.

Common Body of Knowledge

To assure that students have sufficient prerequisite training for advanced courses, Biology majors must complete a series of courses comprising a Common Body of Knowledge (CBK) prior to their junior year (5th full semester) and enrollment in upper level BIOL courses. A Biology student will be admitted into upper level Biology classes when he or she has met the following criteria:

Completion of a set of CBK courses (37-38 hours) before the student's 5th full semester to include:

Code	Title	Semester Credit Hours
BIOL 111	Introductory Biology I	4
BIOL 112	Introductory Biology II	4
BIOL 213	Molecular Cell Biology	3
BIOL 214	Genes, Ecology and Evolution	3
CHEM 119	Fundamentals of Chemistry I	4
CHEM 120	Fundamentals of Chemistry II	4
CHEM 227 & CHEM 237	Organic Chemistry I and Organic Chemistry Laboratory	4
CHEM 228 & CHEM 238	Organic Chemistry II and Organic Chemistry Laboratory	4
Select one of the following:		4
MATH 147	Calculus I for Biological Sciences	3-4
MATH 151	Engineering Mathematics I	
MATH 171	Calculus I	
Select one of the following:		3-4
MATH 148	Calculus II for Biological Sciences	37-38
MATH 152	Engineering Mathematics II	
MATH 172	Calculus II	
STAT 201	Elementary Statistical Inference	
Total Semester Credit Hours		37-38

A student must be in good academic standing with an overall grade point average of a 2.0 or better overall and in the major.

Process

Students will be audited by the department to monitor progress of the CBK. Students failing to complete the CBK within the first four full semesters (two full semesters for Transfer Students) at Texas A&M University may be blocked and forced to change majors or be required to meet with an academic advisor to see if they can be successful in the major. Students registering for upper-level Biology classes without completing the CBK, or without approval of the Undergraduate Advising Office, will be dropped from the roster.

Transfer Students

1. Transfer from within Texas A&M University: The Biology Department will accept changes of major from other departments at Texas A&M upon completion of AT LEAST one semester of an applicable BIOL course taken at Texas A&M and AT LEAST one semester of an applicable CHEM course taken at Texas A&M, with a minimum 2.5 grade point average overall for courses taken at Texas A&M, a 2.5 or better grade point average in BIOL courses taken at Texas A&M, and a 2.5 or better grade point average in CHEM courses taken at Texas A&M. Students still must complete the CBK before being admitted to upper level BIOL courses.
2. Transfer students from other institutions to Biology must have completed the following:
 - a. A minimum of 24 accredited college hours including prescribed coursework
 - b. Prescribed coursework:
 - i. Eight hours of General Biology (TAMU BIOL 111 and BIOL 112 or Texas Common Course Numbers BIOL 1406 and 1407) with B's or better in each course, and
 - ii. Eight hours of General Chemistry (TAMU CHEM 119 and CHEM 120 or Texas Common Course Numbers CHEM 1411 and CHEM 1412) with B's or better in each course, and
 - iii. Four hours of Calculus (TAMU MATH 147 or MATH 151 or MATH 171 and four hours of Calculus II (TAMU MATH 148 or MATH 152 or MATH 172 or three hours of Statistics STAT 201 or Texas Common Courses Numbers MATH 2413 and MATH 2414 or MATH1342) with C's or better
 - c. A minimum cumulative grade point average of a 3.0
 - d. A minimum Biology and Chemistry grade point average of a 3.0 in each
 - e. Please refer to admissions.tamu.edu (http://admissions.tamu.edu/transfer/apply/?_ga=2.156153723.1190088441.1615999771-1217340481.1615999771)

Biology Honors Program

The Biology Department Honors Program is open to highly talented and motivated students pursuing a major in any of our degree plans. Honors students will be part of a vibrant community within the department with enriched learning experiences in both the classroom and biology research laboratories.

Honors Requirements: Students wishing to graduate with honors distinctions in either Biology (BIOL), Microbiology (MBIO), Zoology (ZOOL), or Molecular and Cellular Biology (BMCB) must earn 21 credits in Honors courses and meet the following minimum honors requirements in addition to those listed in the degree plan:

- 4 credits BIOL 111H or BIOL 112H*
- 3 credits BIOL 213H or BIOL 214H
- 3 credits at 300/400 BIOL honors or honors contract; any 600 BIOL; not to include BIOL 485H, BIOL 491H, or BIOL 495H
- 6 credits BIOL 491H
- 2 credits BIOL 495H
- 3 credits any honors course outside the College of Arts and Sciences

* This requirement may be waived with a score of 5 on the Biology AP exam, a score of 6 on the IB exam, or by taking an additional honors biology course at the 300 or 400 level.

Grade requirements at time of graduation:

- cumulative Texas A&M University GPA of 3.5 or higher
- cumulative honors GPA of 3.25 or higher
- no grade lower than a B in courses counting toward honors. If a student earns less than a B in an honors course, they will still receive University credit. However, they will need to take a different course to fulfill the honors requirement.
- no F*, given in cases of academic dishonesty, on the transcript

Honors recognition: All honors courses will be denoted as honors on students' official transcripts. Furthermore, students completing the honors program will have the departmental Biology honors distinction as well as any earned university or college distinction noted on the official transcript.

Admission to the Honors Program in Biology

Incoming Freshmen: Incoming freshmen applicants should indicate their interest in the departmental honors program through the ApplyTexas site and by choosing the "Apply to any Honors Program" after August 1. Qualified applicants will be contacted by the department with further information on joining Biology Honors. Current qualifications for freshman admission are detailed on the Biology Honors website (<https://www.bio.tamu.edu/wordpress/index.php/biology-honors-program/>).

Students who have already completed their application and now wish to apply to the Biology Honors program can use the "Apply to any Honors Program" link at the Texas A&M Honors program site (<http://honorsprograms.tamu.edu/Home/>) or contact biohonors@bio.tamu.edu.

Current or transfer students: Current or transfer students with a cumulative GPA of 3.5 or better can apply for admission to the Biology Honors Program by writing a short (less than 300 word) email to the department's Honors Director. When applying students should keep in mind that they will need to fulfill all honors requirements. Please send email to: biohonors@bio.tamu.edu.

Remaining in the program

In order to remain in the Biology Honors program, students must maintain a cumulative GPA at Texas A&M of 3.5 and honors GPA of 3.25. Students falling below these standards will be placed on probation for the next semester. Students unable to meet these standards for a second semester may be dismissed from the Biology Honors Program.

Please direct any questions to biohonors@bio.tamu.edu or the Biology Undergraduate Advising office.

Course Recommendations

The following suggestions are to assist the student in course selections to support their career choice.

Human Biology

These are recommended courses for students interested in pursuing professional schools including medical, dental and allied health programs (e.g., nursing, occupational therapy, optometry, pharmacy, physical therapy and physician assistant). The focus of the science courses on human biology will better prepare these students for their chosen fields. Suggested courses include:

Code	Title	Semester Credit Hours
Social and Behavioral Science		
PBSI 107	Introduction to Psychology	3
	or SOCI 205 or Introduction to Sociology	
Biology Electives		
BIOL 319	Integrated Human Anatomy and Physiology I	4
BIOL 320	Integrated Human Anatomy and Physiology II	4
BIOL 351	Fundamentals of Microbiology	4
BIOL 388	Principles of Animal Physiology	4
BIOL 445	Biology of Viruses	3
BIOL 454	Immunology	3
BIOL 456	Medical Microbiology	3
Free Electives		
HLTH 335	Human Diseases	3
HLTH 354	Medical Terminology for the Health Professions	3
PBSI 107	Introduction to Psychology	3
	or SOCI 205 or Introduction to Sociology	
URPN 370	Health Systems Planning	3
International and Cultural Diversity		
HLTH 236	Introduction to Health Disparities and Diversity	3
HLTH 334	Women's Health	3
Total Semester Credit Hours		46

Students should consult their academic advisor about the courses that best fit their career interests.

Education

This is for students wishing to acquire state certification to teach at the secondary level upon graduation. Students should seek advice from the advisors within their department and from the School of Education and Human Development, as well as from the advisor in charge of their teaching option. The intention is to make the best possible use of social science, humanity, free and directed electives in the Bachelor of Arts in Biology, thereby condensing as many of the certification requirements as possible into the degree plan and allowing the student to obtain a minor in Secondary Education (SEED). Courses should include:

Code	Title	Semester Credit Hours
Social and Behavioral Science		
INST 210	Understanding Special Populations	3
INST 222	Foundations of Education in a Multicultural Society	3
Biology Electives		
Upper-level BIOL courses, including two writing intensive courses (http://catalog.tamu.edu/undergraduate/course-descriptions/biol/)		14
Free Electives		
RDNG 372	Reading and Writing across the Middle Grades Curriculum	3

or RDNG 465 or Reading in the Middle and Secondary Grades

TEFB 322	Teaching and Schooling in Modern Society	3
TEFB 324	Teaching Skills II	3
TEFB 406	Science in the Middle and Secondary School	3
Student teaching		
Total Semester Credit Hours		32

Marine Biology

These are recommended courses for students desiring a more rigorous and in-depth foundation in biological courses that apply to marine environments and ecosystems. This suggested plan is ideal for students who intend to pursue graduate studies in marine biology or serve as field biologists at national seashores or sanctuaries. Suggested courses include:

Code	Title	Semester Credit Hours
Biology Electives		
BIOL 335	Invertebrate Zoology	4
BIOL 440	Marine Biology	4
Related ZOOL research or field experience (http://catalog.tamu.edu/undergraduate/course-descriptions/zool/)		3
Free Electives		
ECCB 311	Ichthyology	3
OCNG 251	The Blue Planet - Our Oceans	3
WFSC 425	Marine Fisheries	3
Total Semester Credit Hours		20

Students should consult their academic advisor about the courses that best fit their career interests.

Ecology/Environmental Biology

This is for students who are interested in environmental consulting, environmental protection and ecosystem evaluation. This suggested plan can be adapted to focus on particular areas or populations within an ecosystem. Suggested courses include:

Code	Title	Semester Credit Hours
Communication		
ENGL 210	Technical and Professional Writing	3
Biology Electives		
Select one of the following:		3-4
BIOL 335	Invertebrate Zoology	
BIOL 357	Ecology	
BIOL 358	Ecology Laboratory	
BIOL 440	Marine Biology	
BIOL 467	Integrative Animal Behavior	
ECCB 462	Amazon River Tropical Biology	
Free Electives		

CHEM 315 & CHEM 318	Fundamentals of Quantitative Analysis and Quantitative Analysis Laboratory	4
ENTO 201	General Entomology	3
Select one of the following:		3-4
ECCB 311	Ichthyology	
ECCB 401	General Mammalogy	
ECCB 402	General Ornithology	
PLPA 301 & PLPA 303	Plant Pathology and Plant Pathology Laboratory	
Total Semester Credit Hours		17-18

Students should consult their academic advisor about the courses that best fit their career interests.

Liberal Education Requirements of the University, College or State

Code	Title	Semester Credit Hours
	American history (http://catalog.tamu.edu/undergraduate/general-information/university-core-curriculum/#american-history)	6
	Communication (http://catalog.tamu.edu/undergraduate/general-information/university-core-curriculum/#communication)	6
	Language, philosophy and culture (http://catalog.tamu.edu/undergraduate/general-information/university-core-curriculum/#language-philosophy-culture)	3
	Government/Political science (http://catalog.tamu.edu/undergraduate/general-information/university-core-curriculum/#government-political-science)	6
	Social and behavioral sciences (http://catalog.tamu.edu/undergraduate/general-information/university-core-curriculum/#social-behavioral-sciences)	3
	Creative arts (http://catalog.tamu.edu/undergraduate/general-information/university-core-curriculum/#creative-arts)	3
	International and cultural diversity (http://catalog.tamu.edu/undergraduate/general-information/degree-information/international-cultural-diversity-requirements/)	0-3
	Cultural Discourse (http://catalog.tamu.edu/undergraduate/general-information/degree-information/cultural-discourse-requirements/)	0-3
Total Semester Credit Hours		27-33

Faculty

Alexander, Michael B, Lab Instructor
Biology
PHD, Texas A&M University, 2014

Aramayo, Rodolfo A, Associate Professor
Biology
PHD, University of Georgia, 1992

Arzan Zarin, Aref, Assistant Professor
Biology
PHD, The University of Dublin, 2013

Bell-Pedersen, Deborah, University Distinguished Professor
Biology
PHD, State University of New York at Albany, 1991

Blackmon, Heath L, Associate Professor
Biology
PHD, University of Texas at Arlington, 2015

Cohn, William B, Instructional Associate Professor
Biology
PHD, Texas A&M University, 2000

Criscione, Charles D, Professor
Biology
PHD, Oregon State University, 2005

Delmore, Kira, Assistant Professor
Biology
PHD, University of British Columbia, 2015

Dulin, Jennifer N, Assistant Professor
Biology
PHD, University of Texas Health Science Center, 2012

Erickson, James W, Associate Professor
Biology
PHD, University of Wisconsin, Madison, 1989

Farhy, Isabella, Assistant Professor
Biology
PHD, Tel Aviv University, 2013

Fletcher, Samantha, Senior Lecturer
Biology
PHD, Texas A&M University, 2019

Garcia, Luis R, Professor
Biology
PHD, University of Texas, 1996

Gomer, Richard H, University Distinguished Professor
Biology
PHD, California Institute of Technology, 1983

Griffing, Lawrence R, Associate Professor
Biology
PHD, Stanford University, 1981

Hardin, Paul E, Distinguished Professor
Biology
PHD, Indiana University, 1987

Hawkins, Angela K, Senior Lecturer
Biology
PHD, Texas A&M University, 2018

Janes, Donna, Instructional Associate Professor
Biology
PHD, University of Illinois, 2004

Leboeuf, Brigitte L, Instructional Associate Professor
Biology
PHD, Texas A&M University, 2009

Lee, Christopher P, Instructional Associate Professor
Biology
PHD, Texas A&M University, 2014

Lockless, Steve W, Research Assistant Professor
Biology
PHD, University of Texas at Dallas, 2002
PHD, University of Texas Southwestern Medical Center, 2002

Lyons, Jacob I, Lab Instructor
Biology
MS, Texas State University, 2010

Mackenzie, Duncan S, Associate Professor Emeritus
Biology
PHD, University of California at Berkeley, 1980

McCreedy, Dylan, Assistant Professor
Biology
PHD, Washington University, St. Louis, 2013

McKnight, Thomas D, Professor
Biology
PHD, University of Georgia, 1983

Menet, Jerome, Associate Professor
Biology
PHD, Louis Pasteur University, 2003

Merlin, Christine, Associate Professor
Biology
PHD, University Pierre and Marie Curie, 2006

Mitchell, Angela, Assistant Professor
Biology
PHD, University of North Carolina at Chapel Hill, 2013

Moyes, Rita J, Instructional Associate Professor Emerita
Biology
PHD, Texas A&M University, 1992

Nan, Beiyan, Associate Professor
Biology
PHD, Peking University, 2007

Norton, Jerry D, Lab Instructor
Biology
PHD, University of Texas, 1994

Paredes-Sabja, Daniel, Associate Professor
Biology
PHD, Oregon State University, 2009

Pepper, Alan E, Professor
Biology
PHD, University of California at Davis, 1990

Pilling, Darrell, Research Assistant Professor
Biology
PHD, University of Birmingham, 1995

Qin, Hongmin, Associate Professor
Biology
PHD, Institute of Microbiology, Chinese Academy of Sciences, 1999

Rao, Asha, Instructional Associate Professor
Biology
PHD, Texas A&M University, 2002

Riley, Bruce B, Professor
Biology
PHD, University of Wisconsin, Madison, 1990

Rosenthal, Gil G, Adjunct Professor
Biology
PHD, The University of Texas at Austin, 2000

Roy Sarkar, Tapasree, Assistant Professor
Biology
PHD, Purdue University, 2008
PHD, Purdue University - West Lafayette, 2008

Ryan, Kathryn J, Instructional Associate Professor
Biology
PHD, Baylor College of Medicine, 1998

Sachs, Matthew S, Professor
Biology
PHD, Massachusetts Institute of Technology, 1986

Scott, Timothy P, Professor
Biology
PHD, Texas A&M University, 1996

Siegele, Deborah A, Associate Professor
Biology
PHD, University of Wisconsin, Madison, 1989

Smith, James L, Professor
Biology
PHD, University of Florida, 2002

Smotherman, Michael S, Professor
Biology
PHD, University of California at Los Angeles, 1998

Sorg, Joseph A, Professor
Biology
PHD, University of Chicago, 2006

St. Clair, Allison, Senior Lecturer
Biology
PHD, Texas A&M University, 2017

Tag, Andrew G, Instructional Associate Professor
Biology
PHD, Texas A&M University, 2003

Taylor, Lathrop, Instructional Associate Professor
Biology
PHD, Texas A&M University, 1985

Versaw, Wayne K, Professor
Biology
PHD, University of Wisconsin, Madison, 1995

Wicksten, Mary K, Professor
Biology
PHD, University of Southern California, 1977

Wright, Rachel N, Instructional Assistant Professor
Biology
PHD, Texas A&M University, 2011

Zoran, Mark J, Professor
Biology
PHD, Iowa State University, 1987

Majors

- Bachelor of Arts in Biology (<http://catalog.tamu.edu/undergraduate/arts-and-sciences/biology/ba/>)
- Bachelor of Science in Biology (<http://catalog.tamu.edu/undergraduate/arts-and-sciences/biology/bs/>)
- Bachelor of Science in Microbiology (<http://catalog.tamu.edu/undergraduate/arts-and-sciences/biology/microbiology-bs/>)
- Bachelor of Science in Molecular and Cell Biology (<http://catalog.tamu.edu/undergraduate/arts-and-sciences/biology/molecular-cell-biology-bs/>)
- Bachelor of Science in Zoology (<http://catalog.tamu.edu/undergraduate/arts-and-sciences/biology/zoology-bs/>)

Minors

- Bioinformatics Minor (<http://catalog.tamu.edu/undergraduate/arts-and-sciences/biology/bioinformatics-minor/>)
- Biology Minor (<http://catalog.tamu.edu/undergraduate/arts-and-sciences/biology/minor/>)
- Neuroscience Minor (<http://catalog.tamu.edu/undergraduate/arts-and-sciences/biology/neuroscience-minor/>)
- Pre-Medicine Minor (<http://catalog.tamu.edu/undergraduate/arts-and-sciences/biology/pre-medicine-minor/>)

Courses

- Biology (BIOL) (p. 6)
- Botany (BOTN) (p. 10)
- Microbiology (MICR) (p. 10)
- Zoology (ZOOL) (p. 10)

Biology (BIOL)

BIOL 100 Horizons in Biology

Credits 0-1. 0-1 Lecture Hours. Introduction to the study of biology at Texas A&M University; gain knowledge of departmental and campus resources to assist and enhance the pursuit of a degree in biology, microbiology, molecular and cellular biology or zoology. **Prerequisites:** First-year and first-time-in-college freshman majoring in BIOL, MBIO, BMBB and ZOOL.

BIOL 101 Botany

Credits 4. 3 Lecture Hours. 3 Lab Hours. (BIOL 1311 and 1111, BIOL 1411) Botany. Structure, physiology and development of plants with an emphasis on seed plants. (Not open to students who have taken BIOL 111 and BIOL 112 or BIOL 113.); includes laboratory that reinforces and provides supplemental information related to the lecture topics.

BIOL 102 Neuroscience Overview

Credit 1. 1 Lecture Hour. An introductory survey of neuroscience for freshmen undergraduate students on the basic neuroscience core ideas and neurological disorders. **Cross Listing:** NRSC 101, PBSI 101 and VIBS 101.

BIOL 104 Contemporary Issues in Science - Cosmos, Earth and Humanity

Credits 3. 3 Lecture Hours. Science for citizens; interdisciplinary survey of contemporary issues in the science of our universe or cosmos, Earth and humanity, including the big bang, evolution, genetics, vaccines and drugs; future outlook on humanity, including artificial intelligence, cryptography and cybersecurity; critically analyze science presented in the news, on television and on social media; ethical implications of research. **Cross Listing:** ARSC 104 and PHYS 104.

BIOL 107 Zoology

Credits 4. 3 Lecture Hours. 3 Lab Hours. (BIOL 1313 and 1113, 1413) Zoology. Survey of animal life with respect to cell organization, genetics, evolution, diversity of invertebrates/vertebrates, anatomy/physiology, and interaction of animals with their environment; includes laboratory that reinforces and provides supplemental information related to lecture topics. (Not open to students who have taken BIOL 111 and BIOL 112 or BIOL 113).

BIOL 111 Introductory Biology I

Credits 4. 3 Lecture Hours. 3 Lab Hours. (BIOL 1306 and 1106, 1406) Introductory Biology I. First half of an introductory two-semester survey of contemporary biology that covers the chemical basis of life, structure and biology of the cell, molecular biology and genetics; includes laboratory that reinforces and provides supplemental information related to the lecture topics; also taught at Galveston campus.

BIOL 112 Introductory Biology II

Credits 4. 3 Lecture Hours. 3 Lab Hours. (BIOL 1307 and 1107, 1407) Introductory Biology II. The second half of an introductory two-semester survey of contemporary biology that covers evolution, history of life, diversity and form and function of organisms; includes laboratory that reinforces and provides supplemental information related to the lecture topics. **Prerequisite:** BIOL 111; also taught at Galveston campus.

BIOL 113 Essentials in Biology

Credits 3. 3 Lecture Hours. (BIOL 1308, BIOL 1408) Essentials in Biology. One-semester biology for non-majors; overview of essential biological concepts and their application to real world and contemporary issues; topics include evolution, biodiversity, cellular, molecular and forensic biology, genetics and heredity to scientific literacy, human impact on the environment, genetically modified organisms and emerging diseases.

BIOL 206 Introductory Microbiology

Credits 4. 3 Lecture Hours. 4 Lab Hours. (BIOL 2320 and 2120, BIOL 2321 and 2121, BIOL 2420, BIOL 2421) Introductory Microbiology. Basic microbiology of prokaryotes and eukaryotes; main topics include morphology, physiology, genetics, taxonomy, ecology, medically important species and immunology; mandatory laboratory designed to give hands-on experience and to reinforce basic principles. **Prerequisites:** BIOL 101, BIOL 107, BIOL 111, or BIOL 113; CHEM 119. May not be used for credit by biology, molecular and cell biology, microbiology, zoology, predentistry or premedicine majors.

BIOL 213 Molecular Cell Biology

Credits 3. 3 Lecture Hours. Exploration of the molecular basis of cell structure, function and evolution; gene regulation, cell division cycle, cancer, immunity, differentiation, multicellularity and photosynthesis.

Prerequisite: BIOL 112 and CHEM 120.

BIOL 214 Genes, Ecology and Evolution

Credits 3. 3 Lecture Hours. A genetically-based introduction to the study of ecology and evolution; emphasis on the interactions of organisms with each other and with their environment. **Prerequisite:** BIOL 112.

BIOL 285 Directed Studies

Credits 1 to 4. 1 to 4 Other Hours. Problems in various phases of plant, animal and microbial science. **Prerequisites:** Freshman or sophomore classification; approval of ranking professor in field chosen and Undergraduate Advising Office.

BIOL 289 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. Selected topics in an identified area of biology. May be repeated for credit. **Prerequisite:** Approval of instructor.

BIOL 291 Research

Credits 0 to 4. 0 to 4 Other Hours. Active research of basic nature under the supervision of a Department of Biology faculty member. May be repeated for credit. **Prerequisites:** Freshman or sophomore classification and approval of faculty member.

BIOL 302 Careers in Biology

Credit 1. 1 Lecture Hour. Development of job search skills; utilization of career resources; self-assessment of career interests and career objectives; strategies for professional correspondence and networking; business etiquette and interviewing techniques; insight into life science career opportunities. **Prerequisites:** Junior or senior classification; department of biology majors only; or approval of instructor.

BIOL 318 Chordate Anatomy

Credits 4. 3 Lecture Hours. 3 Lab Hours. Classification, phylogeny, comparative anatomy, and biology of chordates; diversity, protochordates, vertebrate skeletons, shark and cat anatomy studied in laboratory.

Prerequisite: BIOL 214 or approval of instructor.

BIOL 319 Integrated Human Anatomy and Physiology I

Credits 4. 3 Lecture Hours. 3 Lab Hours. Integrated approach to cellular, neural, skeletal, muscular anatomy and physiology; includes some histology, histopathology, radiology and clinical correlations. **Prerequisite:** BIOL 111 and BIOL 112, or BIOL 107.

BIOL 320 Integrated Human Anatomy and Physiology II

Credits 4. 3 Lecture Hours. 3 Lab Hours. Continuation of BIOL 319. Integrated approach to endocrine, cardiovascular, respiratory, digestive, urinary, reproductive and developmental anatomy and physiology; includes some histology, histopathology, radiology and clinical correlations. **Prerequisite:** BIOL 319 or approval of instructor.

BIOL 335 Invertebrate Zoology

Credits 4. 3 Lecture Hours. 3 Lab Hours. Morphology, taxonomy, natural history and phylogeny of invertebrate animals, with emphasis on biodiversity; class includes both lecture and lab. Labs include study of preserved material and demonstration of living animals in aquaria and terraria. **Prerequisite:** BIOL 214 or approval of instructor.

BIOL 344 Embryology

Credits 4. 3 Lecture Hours. 3 Lab Hours. Introduction to general and comparative embryology; molecular and cellular mechanisms of development; genetics and early development of selected invertebrates (*C. elegans*, *Drosophila* and sea urchin) and emphasis on vertebrates (frog, fish, chick and mouse). **Prerequisite:** BIOL 213 or GENE 302.

BIOL 350 Computational Genomics

Credits 3. 2 Lecture Hours. 2 Lab Hours. Hands-on approach to obtaining, organizing and analyzing genome-related data; emphasis on asking and answering biologically relevant questions by designing and performing experiments using computers; understanding biology from a computational perspective. **Prerequisite:** Junior or senior classification in life sciences, engineering, mathematics, chemistry.

BIOL 351 Fundamentals of Microbiology

Credits 4. 3 Lecture Hours. 4 Lab Hours. Introduction to modern microbiology with emphasis on prokaryotes; includes microbial cell structure, function, and physiology; genetics, evolution, and taxonomy; bacteriophage and viruses; pathogenesis and immunity; and ecology and biotechnology; includes laboratory experience with microbial growth and identification. **Prerequisites:** BIOL 112; CHEM 227, and CHEM 237 or CHEM 231; or approval of instructor; also taught at Galveston campus.

BIOL 352 Diagnostic Bacteriology

Credits 4. 2 Lecture Hours. 6 Lab Hours. Practical experience in handling, isolation and identification of pathogenic microorganisms using biochemical tests and rapid identification techniques. **Prerequisite:** BIOL 351 or approval of instructor.

BIOL 357 Ecology

Credits 3. 3 Lecture Hours. Analysis of ecosystems at organismal, population, interspecific and community levels. **Prerequisite:** BIOL 214 or approval of instructor.

BIOL 358 Ecology Laboratory

Credit 1. 3 Lab Hours. Quantitative analyses of freshwater and terrestrial ecosystems; includes data sampling and presentation of results in written and oral formats; required fieldtrips; analysis of competition and predator-prey interactions using ecological models. **Prerequisite:** BIOL 357 or concurrent enrollment; junior or senior classification.

BIOL 388 Principles of Animal Physiology

Credits 4. 3 Lecture Hours. 3 Lab Hours. Introduction to how animals function, including basics of neurophysiology, endocrinology, muscular, cardiovascular, respiratory, osmoregulatory, and metabolic physiology; broadly comparative in scope and encompassing adaptation of physiological systems to diverse environments; the laboratory stresses techniques used for monitoring and investigating physiological mechanisms and responses to environmental changes. **Prerequisites:** BIOL 214 or CHEM 228 or approval of instructor.

BIOL 401 Critical Writing in Biology

Credit 1. 1 Lecture Hour. Reading scientific papers and writing short synopses of papers with a focus on learning how to think and write like a scientist; fills the current Writing Intensive "W" course requirement for biology. **Prerequisite:** BIOL 213 or CHEM 228; junior or senior classification.

BIOL 402 Communicating Biological Research to the Public

Credit 1. 1 Lecture Hour. Interpretation of scientific papers; analysis of how research findings are communicated to lay audiences; creation of synopses of research findings for the general public. **Prerequisite:** BIOL 213 or CHEM 228; junior or senior classification.

BIOL 403 Medical Narratives

Credit 1. 1 Lecture Hour. Focus on reading and analyzing brief nonfiction stories about medicine; exploration of different perspectives and experiences with illness and medicine. **Prerequisites:** BIOL 213 or CHEM 228; junior or senior classification or approval of instructor.

BIOL 405 Comparative Endocrinology

Credits 3. 3 Lecture Hours. Basic principles of endocrinology including structure and functions of hormones in vertebrates; hormonal control of growth, metabolism, osmoregulation, and reproduction; endocrine techniques and mechanism of hormone action. **Prerequisites:** BIOL 214 and CHEM 227.

BIOL 406/GENE 406 Bacterial Genetics

Credits 3. 3 Lecture Hours. A problem oriented course surveying the manipulation and mechanisms of genetic systems in bacteria; recombination, structure and regulation of bacterial genes, plasmids and phages. **Prerequisites:** BIOL 351; GENE 302. **Cross Listing:** GENE 406/BIOL 406.

BIOL 407 Biological Clocks

Credits 3. 3 Lecture Hours. Examination of the basic mechanisms of biological timing; in depth study of clocks in model organisms and the relationship between clocks and human health and disease. **Prerequisites:** BICH 431/GENE 431, BIOL 213 or GENE 431/BICH 431.

BIOL 413 Cell Biology

Credits 3. 3 Lecture Hours. Structure, function, and biogenesis of cells and their components; interpretation of dynamic processes of cells, including protein trafficking, motility, signaling and proliferation. **Prerequisites:** BIOL 213 or GENE 302; BICH 410 or BICH 440.

BIOL 414 Developmental Biology

Credits 3. 3 Lecture Hours. Concepts of development in systems ranging from bacteriophage to the mammalian embryo; use of recombinant DNA technology and embryo engineering to unravel the relationships between growth and differentiation, morphogenesis and commitment, aging and cancer. **Prerequisite:** BIOL 213 or GENE 302; BICH 410 or BICH 440.

BIOL 423 Cell Biology Laboratory

Credits 2. 1 Lecture Hour. 3 Lab Hours. Modern methods of study of cell structure and cell function. **Prerequisites:** BICH 410 and BIOL 413, or concurrent enrollment or approval of instructor.

BIOL 428 Cellular Neuroscience

Credits 3. 3 Lecture Hours. Cell biology, molecular biology and biophysics of neurons as it pertains to their fundamental role in the physiological basis of behavior; study of how neurons create, maintain and exploit electrical signals for information coding and transmission; principles of electrical and chemical signaling between neurons, and the role of intracellular signaling for signal modulation and synaptic plasticity; exploration of a broad range of state-of-the-art molecular tools currently used to study the nervous system, and the cellular basis for many of the most common neurological disorders affecting humans as well as the strategies and therapies for their treatment. **Prerequisites:** BIOL 213 and PSYC 235, or approval of instructor. **Cross Listing:** NRSC 428/BIOL 428.

BIOL 430 Biological Imaging

Credits 4. 3 Lecture Hours. 3 Lab Hours. Still and video photography and photomicrography, computerbased digital image analysis and processing of biological images; theory and principles of light and electron microscopy including transmission and scanning electron microscopy; optical contrast methods for light microscopy including phase contrast, DIC, polarizing light and confocal laser scanning microscopy. **Prerequisite:** Junior classification or approval of instructor.

BIOL 434/NRSC 434 Regulatory and Behavioral Neuroscience

Credits 3. 3 Lecture Hours. Cell biology and biophysics of neurons; functional organization of the vertebrate nervous system; physiological basis of behavior. **Prerequisites:** BIOL 213; BIOL 319, BIOL 320, BIOL 388, BIOL 413, NRSC 235, or PSYC 235, or approval of instructor. **Cross Listing:** NRSC 434/BIOL 434.

BIOL 435 Laboratory for Regulatory and Behavioral Neuroscience

Credit 1. 3 Lab Hours. Study of modern methods and tools used to investigate nervous system structure and function. **Prerequisite:** BIOL 213; BIOL 319, BIOL 320, BIOL 388, BIOL 413, BIOL 428, BIOL 434/ NRSC 434, NRSC 235, NRSC 335, NRSC 428/BIOL 428, NRSC 434/BIOL 434, or PBSI 235, or approval of instructor.

BIOL 437 Molecular and Human Medical Mycology

Credits 3. 3 Lecture Hours. Principles of fungal pathogenesis, diagnosis and antifungal therapies, and relevant genetic and molecular tools for studying human pathogens and drug delivery. **Prerequisites:** BIOL 351; junior or senior classification; or approval of instructor.

BIOL 438 Bacterial Physiology

Credits 3. 3 Lecture Hours. Structure and function of prokaryotic cells, with emphasis on evolutionary adaptations to different environmental, developmental, and pathogenic selection pressures; formation of teams and preparation of presentations on specific topics in microbiology. **Prerequisites:** BIOL 351; BIOL 406/GENE 406 or concurrent enrollment; BICH 410, BICH 431/GENE 431 and GENE 302 strongly recommended.

BIOL 440 Marine Biology

Credits 4. 3 Lecture Hours. 3 Lab Hours. Introduction to biology of common organisms inhabiting bays, beaches and near-shore oceanic waters with special reference to Gulf of Mexico biota; emphasis on classification, distribution, history, ecology, physiology, mutualism, predation, major community types and economic aspects of marine organisms. **Prerequisite:** BIOL 214 or approval of instructor.

BIOL 443 Early Stages of Animal Evolution

Credits 3. 2 Lecture Hours. 2 Lab Hours. Analysis of the earliest stages of animal evolution by integrating various scientific fields such as genomics, paleontology, metabolism, morphology, environment, development and behavior; includes hands-on exploration of fossils and modern animals to understand how evolution shaped our world. **Prerequisites:** BIOL 214; junior or senior classification.

BIOL 444/NRSC 444 Neural Development

Credits 3. 3 Lecture Hours. Cellular and molecular mechanisms of nervous system development including neural induction and the basis of complex behaviors; use of a wide range of model organisms with a specific emphasis on vertebrate nervous system development. **Prerequisites:** BIOL 213, BIOL 319, BIOL 320, BIOL 413, BIOL 388, NRSC 235 or PSYC 235. **Cross Listing:** NRSC 444.

BIOL 445 Biology of Viruses

Credits 3. 3 Lecture Hours. Structure, composition and life cycles of viruses; methods used to study viruses; their interaction with host cells; mechanisms of pathogenicity and cellular transformation; responses of the host to viral infection, and vaccine applications; in-depth study of the life cycles of the major classes of viruses and discussion of emerging viruses. **Prerequisite:** BIOL 213 or BIOL 351 or approval of instructor.

BIOL 450/BICH 450 Genomics

Credits 4. 3 Lecture Hours. 3 Lab Hours. The study of genomic data includes consideration of the logic behind the most important genomic approaches, as well as their capabilities and limitations in investigating biological processes; the science of accessing and manipulating genomic data; and practical applications, including development of an hypotheses-driven datamining experiment. **Prerequisites:** BIOL 213, GENE 301 or GENE 302, BICH 431/GENE 431 or GENE 431/BICH 431, or BIOL 351; junior or senior classification or approval of instructor. **Cross Listing:** BICH 450/BIOL 450.

BIOL 451 Bioinformatics

Credits 3. 3 Lecture Hours. Bioinformatics tools applicable to eukaryotic organisms; theoretical background of computational algorithms, with an emphasis on application of computational tools related to modern molecular biological research. **Prerequisite:** BIOL 213, GENE 301, or GENE 302, or BIMS 320/GENE 320 or GENE 320/BIMS 320; junior or senior classification, or approval of instructor.

BIOL 454 Immunology

Credits 3. 3 Lecture Hours. Introduction to basic immunological concepts and principles of serology. **Prerequisite:** BIOL 351 or equivalent or approval of instructor.

BIOL 455 Laboratory in Immunology

Credits 2. 6 Lab Hours. Practical application of serological principles which include precipitation, agglutination and blood banking principles; techniques in tissue culture and hybridoma technology also included. **Prerequisite:** BIOL 454 or registration therein.

BIOL 456 Medical Microbiology

Credits 3. 3 Lecture Hours. Microbiology, epidemiology and pathology of human pathogens with an emphasis on bacterial agents. **Prerequisite:** BIOL 351 or approval of instructor.

BIOL 461 Antimicrobial Agents

Credit 1. 1 Lecture Hour. Understanding of antimicrobial agents, limitations of use, biosynthesis and regulation, and challenges in development as new therapeutics. **Prerequisites:** BICH 410 or BICH 440 and BIOL 351 or VTPB 405.

BIOL 466 Principles of Evolution

Credits 3. 3 Lecture Hours. Evolutionary patterns, mechanisms and processes at the organismal, chromosomal and molecular levels; modes of adaptation and the behavior of genes in populations. **Prerequisite:** GENE 302 or approval of instructor.

BIOL 467 Integrative Animal Behavior

Credits 3. 3 Lecture Hours. Examines how behavior contributes to survival and reproduction, and how evolutionary history and ecological circumstance interact to shape the expression of behavior; focus on integrative nature of behavior; how the interaction of evolutionary processes, mechanistic constraints, and ecological demands determine behavioral strategies. **Prerequisite:** BIOL 214, BIOL 357, BIOL 388, BIOL 405, BIOL 434/NRSC 434, or BIOL 466, or approval of instructor.

BIOL 480 Departmental Colloquium

Credit 1. 1 Lecture Hour. Attend presentations given by renowned scientists from various fields of biology; learn about new developments in science; stay abreast of current and trending research topics. **Prerequisites:** Senior classification; majors in BIOL, MICRO, BMCB and ZOO.

BIOL 481 Seminar in Biology

Credit 1. 1 Lecture Hour. Recent advances. **Prerequisite:** Senior undergraduate majors in biology, microbiology, botany or zoology.

BIOL 484 Internship

Credits 0 to 4. 0-1 Other Hours. Directed internship in a private firm or public agency to provide research experience appropriate to the student's degree program and career objectives. May be taken two times. **Prerequisite:** Approval of internship agency and advising office.

BIOL 485 Directed Studies

Credits 1 to 12. 1 to 12 Other Hours. Problems in various phases of plant, animal and bacteriological science. **Prerequisites:** Junior classification; approval of ranking professor in field chosen and Undergraduate Advising Office.

BIOL 487/VTPB 487 Biomedical Parasitology

Credits 4. 3 Lecture Hours. 2 Lab Hours. Helminth and protozoan parasites of medical and veterinary importance; life cycles, morphology, taxonomic classification, economic and public health aspects and current topics in parasitic diseases. **Prerequisites:** BIOL 107 or BIOL 111; junior classification or approval of instructor. **Cross Listing:** VTPB 487/BIOL 487.

BIOL 489 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 10 Lab Hours. Selected topics in an identified area of biology. May be repeated once for credit.

BIOL 491 Research

Credits 0 to 4. 0 to 4 Other Hours. Active research of basic nature under the supervision of a Department of Biology faculty member. May be taken two times. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded. **Prerequisite:** Approval of departmental faculty member.

BIOL 492 Biomedical Therapeutics Development

Credit 1. 1 Lecture Hour. Basic aspects of the biotechnology business; includes key aspects of biotechnology patents, the main steps in preclinical drug development and company structure and funding. **Prerequisites:** BIOL 213 or equivalent; CHEM 227 and CHEM 228.

BIOL 495 Biology Capstone: Research Communication in the Life Sciences

Credits 2. 2 Lecture Hours. Culmination of capstone research experience; formalization of research results in written and oral forms; introduction to primary genres or scientific writing; apply principles of rhetoric and composition to diverse methods of professional communication. **Prerequisite:** BIOL 452, BICH 464/GENE 464, BIOL 400, BIOL 493 or BIOL 491 or approval of instructor.

BIOL 496 Ethics in Biological Research

Credit 1. 1 Lecture Hour. Fraud in science, how to recognize it, and how to avoid committing fraud; includes the basis of ethics and plagiarism, negotiation techniques and conflict management, the regulations and ethics covering animal and human experiments, record-keeping, data management and peer review. **Prerequisite:** BIOL 491, NRSC 491, BICH 491, GENE 491, BIMS 491, CHEM 491, BIOL 351, or BICH 410, or approval of instructor.

Botany (BOTN)

BOTN 289 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. Selected topics in an identified area of botany. May be repeated for credit. **Prerequisite:** Approval of instructor.

BOTN 291 Research

Credits 1 to 4. 1 to 4 Other Hours. Active research of basic nature under the supervision of a Department of Biology faculty member. **Prerequisites:** Freshman or sophomore classification and approval of instructor.

BOTN 485 Directed Studies

Credits 3. 3 Lecture Hours. Problems in various phases of plant, animal and bacteriological science. **Prerequisites:** Junior classification; approval of ranking professor in field chosen and Undergraduate Advising Office.

BOTN 491 Research

Credits 1 to 4. 1 to 4 Other Hours. Active research of basic nature under the supervision of a Department of Biology faculty member. **Prerequisites:** Junior or senior classification and approval of instructor.

Microbiology (MICR)

MICR 289 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. Selected topics in an identified area of microbiology. May be repeated for credit. **Prerequisite:** Approval of instructor.

MICR 291 Research

Credits 1 to 4. 1 to 4 Other Hours. Active research of basic nature under the supervision of a Department of Biology faculty member. **Prerequisites:** Freshman or sophomore classification and approval of instructor.

MICR 489 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. Selected topics in an identified area of microbiology. May be repeated once for credit.

MICR 491 Research

Credits 1 to 4. 1 to 4 Other Hours. Active research of basic nature under the supervision of a Department of Biology faculty member. **Prerequisites:** Junior or senior classification and approval of instructor.

Zoology (ZOOL)

ZOOL 289 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. Selected topics in an identified area of zoology. May be repeated for credit. **Prerequisite:** Approval of instructor.

ZOOL 291 Research

Credits 1 to 4. 1 to 4 Other Hours. Active research of basic nature under the supervision of a Department of Biology faculty member. **Prerequisites:** Freshman or sophomore classification and approval of instructor.

ZOOL 489 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. Selected topics in an identified area of zoology. May be repeated once for credit.

ZOOL 491 Research

Credits 1 to 4. 1 to 4 Other Hours. Active research of basic nature under the supervision of a Department of Biology faculty member. **Prerequisites:** Junior or senior classification and approval of instructor.