Resources for Graduate Study
The Department of Biology offers graduate programs designed to prepare students for careers in academic institutions, government agencies and industry. The Biological Sciences Complex is centrally located on the campus of Texas A&M University. Graduate research is emphasized in over 50 laboratories that contain modern and sophisticated instrumentation for cellular, molecular, organismal and ecological studies. These laboratories provide opportunities for a broad spectrum of research specializations. The Microscopy Imaging Center, animal care facilities and a state-of-the-art DNA sequencing laboratory are among the many facilities housed in the Biological Sciences Complex.

The Department of Biology faculty has research interests that interface with those of faculty in the Colleges of Agriculture and Life Sciences, Geosciences, Medicine and Veterinary Medicine. Biology faculty participate in interdisciplinary programs in biological clocks, filamentous fungi, genetics, genomics, neuroscience and plant sciences. Cooperation is encouraged to broaden the research experience of graduate students.

Areas of Specialization in Graduate Research
PhD and MS degrees are offered in Biology and Microbiology. General areas of research interests within these degrees include:

**Cellular and Developmental Biology**
- Plant protoplast and tissue culture, transformation and regeneration;
- molecular biology and genetics of development and differentiation;
- nuclear organization; developmental neurobiology; cell surface interactions; physiology of photosynthesis.

**Evolutionary Biology**
- Modern and classical approaches to plant and animal systematics and evolution; genomic and biochemical evolution; cytogenetics.

**Molecular Biology**
- DNA and RNA isolation, cloning and sequencing; gene isolation, characterization, transfer and expression; bacterial and phage genetics;
- molecular processes of differentiation and embryogenesis; molecular microbiology and virology; genomics and informatics.

**Organismal Biology**
- Comparative endocrinology and physiology; neurobiology; invertebrate ecology and ethology; marine biology; biological clocks.

**Entrance Requirements**
Coursework taken at the baccalaureate level normally must include mathematics through calculus, statistics, chemistry including organic chemistry, biochemistry, physics, genetics and adequate preparation in a biological science. Any remedial work will be in addition to the semester hours required for the degree. Graduate admissions decisions are based on students’ academic record, research experience, letters of recommendation, GRE scores (verbal, quantitative and analytical) and suitability of students’ research interests for programs in the department. For information about admissions, contact the Graduate Advisor, Department of Biology or visit us on the website at http://www.bio.tamu.edu.
Erickson, James W, Associate Professor
Biology
PHD, University of Wisconsin - madison, 1989

Garcia, Luis R, Professor
Biology
DDS, Texas A&M University Baylor College of Dentistry, 1999

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

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

Greenbaum, Ira F, Professor
Biology
PHD, Texas Tech University, 1978

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

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

Harlow, Mark L, Assistant Professor
Biology
PHD, Stanford University, 2001

Jones, Adam G, Professor
Biology
PHD, University of Georgia, 1998

Jung, Jae Hoon, Research Assistant Professor
Biology
PHD, Stanford University, 2009

Kemp, Walter M, Professor
Biology
PHD, The Tulane University of Louisiana, 1969

Leboeuf, Brigitte L, Lecturer
Biology
PHD, Texas A&M University, 2009

Lekven, Arne C, Professor
Biology
PHD, University of California- Los Angeles, 1996

Lockless, Steve W, Associate Professor
Biology
PHD, University of Texas at Dallas, 2002

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

Manson, Michael D, Professor
Biology
PHD, Stanford University, 1976

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

McMahan, Uel J, Professor
Biology
PHD, University of Tennessee, 1964

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

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

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

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

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

Pepper, Alan E, Associate Professor
Biology
PHD, University of California, 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, Senior Lecturer
Biology
PHD, Texas A&M University, 2002

Riley, Bruce B, Professor
Biology
PHD, University of Wisconsin - madison, 1990

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

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

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

Schartl, Manfred, Visiting Professor
Biology
PHD, University of Gießen, 1980
Zoran, Mark J, Professor
Biology
PHD, Iowa State University, 1987

Masters
- Master of Science in Biology (http://catalog.tamu.edu/graduate/colleges-schools-interdisciplinary/science/biology/ms)
- Master of Science in Microbiology (http://catalog.tamu.edu/graduate/colleges-schools-interdisciplinary/science/biology/microbiology-ms)

Doctoral
- Doctor of Philosophy in Biology (http://catalog.tamu.edu/graduate/colleges-schools-interdisciplinary/science/biology/phd)
- Doctor of Philosophy in Microbiology (http://catalog.tamu.edu/graduate/colleges-schools-interdisciplinary/science/biology/microbiology-phd)

Courses
BIOL 601/NRSC 635 Biological Clocks
Credits 3. 3 Lecture Hours.
Introduction to the formal properties of biological rhythms; cellular and molecular bases for rhythmicity; temporal adaptations of organisms using clocks.
Prerequisite: Graduate classification or approval of instructor.
Cross Listing: NRSC 635/BIOL 601.

BIOL 602/MSEN 612 Fundamentals of Transmission Electron Microscopy
Credits 3. 2 Lecture Hours. 6 Lab Hours.
State-of-the-art fundamentals in transmission electron microscopy (TEM); theoretical background supporting a strong hands-on course component comprising specimen preparation and image acquisition/interpretation; practical experience to attain a proficiency level permitting independent operation of transmission electron microscopes in the Microscopy and Imaging Center.
Prerequisite: Students are required to write a half-page summary describing the specific problem they wish to resolve using transmission electron microscopy.
Cross Listing: MSEN 612/BIOL 602.

BIOL 603/MSEN 613 Advanced TEM Methodologies in Life and Material Sciences (TEM II)
Credits 3. 1 Lecture Hour. 6 Lab Hours.
Advanced TEM methodologies including specimen preparation and TEM imaging/analysis techniques as applicable to both biological and material samples; theory designed to support a strong hands-on component comprising specimen preparation, different imaging/diffraction/spectroscopic techniques and data interpretation.
Prerequisites: BIOL 602/MSEN 612; graduate classification.
Cross Listing: MSEN 613/BIOL 603.
BIOL 604/MSEN 614 Fundamentals of Scanning Electron Microscopy and Environmental Scanning Electron Microscopy
Credits 2. 1 Lecture Hour. 3 Lab Hours.
Fundamentals of Scanning Electron Microscopy (SEM) and Environmental Scanning Electron Microscopy (ESEM). Provides biologists, material scientists, and students from other disciplines with the techniques of operation of the scanning electron microscope (SEM) and the environmental SEM (ESEM) coupled with the appropriate theoretical background knowledge; individual instruction in support of their research endeavors involving SEM/ESEM.
Prerequisite: Graduate classification.
Cross Listing: MSEN 614/BIOL 604.

BIOL 606 Microbial Genetics
Credits 3. 3 Lecture Hours.
Basic understanding of microbial genetic systems and how genetic analyses can be used to investigate fundamental biological processes in bacteria.
Prerequisite: Approval of instructor.

BIOL 608 Theory and Applications of Light Microscopy
Credits 3. 2 Lecture Hours. 3 Lab Hours.
Provides biologists, material scientists and students from other disciplines with the theoretical background and practical techniques of sample preparation, operation of light microscopes as well as image acquisition and processing; individual instruction which facilitates the completion of their research projects involving light microscopic techniques.
Prerequisite: half-page write-up describing how their graduate work will benefit.

BIOL 609 Molecular Tools in Biology
Credits 3. 3 Lecture Hours.
Interactive lecture course in molecular biology for beginning graduate students; introduction to tools and methodologies used in prokaryotic and eukaryotic molecular labs; choosing the appropriate experimental technique for a given scientific question; virtual experiments will reinforce the applications and introduce useful bioinformatics tools.
Prerequisite: Graduate classification.

BIOL 610 Evolution
Credits 3. 3 Lecture Hours. 0 Lab Hours.
Fundamentals of evolutionary biology with an emphasis on evolutionary theory.
Prerequisite: Graduate classification or approval of instructor.

BIOL 611 Developmental Genetics
Credits 3. 3 Lecture Hours.
Major paradigms of eukaryotic gene regulation in terms of the role of gene expression during ontogeny and the effect of dysfunction in these processes on the neoplastic state.

BIOL 612 Fundamental Molecular Cell Biology
Credits 3. 3 Lecture Hours.
Foundation in current molecular and cellular biology and genetics; basis for many interdisciplinary studies including biostatistics, cancer biology, and biomedical materials and devices.
Prerequisites: Graduate classification; non-biology majors.

BIOL 613 Cell Biology
Credits 3. 3 Lecture Hours.
Consideration of the eukaryotic cell as a functional, integrated unit in living organisms including structure, composition, function and biogenesis of subcellular components; dynamic processes and interactions of cells, including division, communication, and death; experimental approaches in modern cell biology and selected applications of experimental cell biology to problems in medicine.
Prerequisite: BICH 410 or BIOL 213; concurrent enrollment in BIOL 213 or BICH 410 strongly discouraged.

BIOL 615/NRSC 636 Signaling in Behavior and Development
Credits 3. 3 Lecture Hours.
Will focus on signaling pathways used in multicellular animals. In each lecture, major signaling pathways used in behavior, physiology, and development will be introduced at the molecular level, and then be discussed in the context of organismal biology.
Prerequisite: Graduate classification.
Cross Listing: NRSC 636/BIOL 615.

BIOL 622 Microbial Physiology
Credits 3. 3 Lecture Hours.
An area of microbial physiology will be explored at the molecular, cellular, and genetic levels through reading and discussion of classic and current research literature. The area of focus may change from semester to semester. May be taken three times for credit with approval of instructor.
Prerequisite: Graduate classification.

BIOL 625 Structural and Molecular Biology
Credits 3. 3 Lecture Hours.
Successfully integrate structural knowledge into areas of interest; literature examples used to integrate structural information from large macromolecular complexes to single proteins with functional information obtained through other methods.
Prerequisite: Graduate classification or approval of instructor.

BIOL 627/NRSC 601 Principles of Neuroscience I
Credits 3. 3 Lecture Hours.
Detailed introduction to the basic fundamentals of cellular and molecular neuroscience; topics include membrane potentials, action potential generation, and the mechanisms underlying synaptic transmission, as well as their molecular basis.
Prerequisites: Graduate classification or approval of instructor.
Cross Listing: NRSC 601/BIOL 627.

BIOL 628/NRSC 602 Principles of Neuroscience II
Credits 3. 3 Lecture Hours.
Fully integrated overview of nervous system organization and systems-level neurobiology; broad topics include sensory systems and sensory systems function, motor systems and neuromuscular function, central pattern generation and locomotion, homeostatic regulation, motivation, emotions, learning and memory, and circadian rhythms.
Prerequisites: Graduate classification or permission of instructor.
Cross Listing: NRSC 602/BIOL 628.

BIOL 634/NRSC 634 Comparative Neurobiology
Credits 3. 3 Lecture Hours.
Cellular, molecular and systems neurobiology, together with neuroethology. A comparative approach to subject matter is stressed. Topics such as evolution of nervous systems and their diverse structure and complex functions are dealt with.
Cross Listing: NRSC 634/BIOL 634.
BIOL 635 Plant Molecular Biology
Credits 3. 3 Lecture Hours.
Molecular aspects of plant growth, development, reproduction and evolution, emphasizing the structure, function, regulation, interaction and manipulation of plant genes; practical applications of plant molecular biology.
Prerequisite: GENE 431/BICH 431.

BIOL 644/NRSC 644 Neural Development
Credits 3. 3 Lecture Hours.
Classical and current research literature to explore the major events in the development of a nervous system, including topics ranging from neurogenesis to synapse information.
Prerequisite: Graduate classification.
Cross Listing: NRSC 644/BIOL 644.

BIOL 647 Digital Biology
Credits 4. 4 Lecture Hours.
Obtain, organize, process, and analyze genome and genome-related data; learning to ask and answer biologically relevant questions by designing and performing experiments using computers.
Prerequisite: Graduate classification or approval form instructor.

BIOL 650/BICH 650 Genomics
Credits 3. 3 Lecture Hours.
Modern genomics as a tool for understanding biological systems; review of gene structure and organization and the history of sequencing technologies; focus on transcriptional, translational and functional genomics.
Prerequisite: Graduate classification or approval of instructor.
Cross Listing: BICH 650/BIOL 650.

BIOL 651 Bioinformatics
Credits 3. 3 Lecture Hours.
Introduction to applications related to information processing in biological research with practical training exercises; includes internet databases, sequence alignment, motif prediction, gene and promoter prediction, phylogenetic analysis, protein structure classification, analysis and prediction, genome annotation, assembly and comparative analysis, and proteomics analysis.
Prerequisite: Graduate classification or approval of instructor.

BIOL 652 Epigenetic Mechanisms
Credits 3. 3 Lecture Hours.
Lectures and discussion of current research in epigenetic inheritance and its mechanisms in a variety of organisms. Structure of the course includes paper discussion and presentation, grant-writing, and grant-review.
Prerequisite: BICH 631/GENE 631.

BIOL 661 Antimicrobial Agents
Credit 1. 1 Lecture Hour.
Understanding of microbial agents, limitations of use, biosynthesis and regulation, and challenges in development as new therapeutics.
Prerequisite: Approval of instructor.

BIOL 663 Biology of the Crustacea
Credits 4. 3 Lecture Hours. 3 Lab Hours.
Classification, life history, morphology, physiology, ecology, diseases, parasites and predators of crustaceans; economic aspects of crustaceans; original literature emphasized.
Prerequisite: BIOL 335 or equivalent, or approval of instructor.

BIOL 665 Biology of Invertebrates
Credits 4. 3 Lecture Hours. 3 Lab Hours.
Morphology, biology and phylogeny of invertebrates. Topics may be either detailed discussions of specific organisms or comparative information on a process.
Prerequisite: BIOL 335 or equivalent.

BIOL 680 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.
Prerequisite: Graduate classification in biology or microbiology.

BIOL 681 Seminar
Credit 1. 1 Lecture Hour.
Detailed reports on specific topics in field chosen. Students may register in up to but no more than three sections of this course in the same semester.

BIOL 682 Research Seminar
Credit 1. 1 Other Hour.
Seminars presented by students based upon their research projects.
Prerequisite: Graduate classification.

BIOL 683 Experimental Design in Biology
Credits 3. 3 Lecture Hours.
Design of scientific research projects in the field of biology; a wide range of biological experiments designed with the appropriate statistical technique for analysis; design biological studies that are statistically tractable and perform basic statistical analyses using the statistical programming language R.
Prerequisites: Graduate classification and STAT651 or approval of instructor.

BIOL 685 Directed Studies
Credits 1 to 8. 1 to 8 Other Hours.
Limited investigations in fields other than those chosen for thesis or dissertation.

BIOL 686 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: Graduate classification or approval of instructor; BIOL 696 or concurrent enrollment.

BIOL 689 Special Topics in...
Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 4 Lab Hours.
Limited investigations in an area of biology.

BIOL 691 Research
Credits 1 to 23. 1 to 23 Other Hours.
Research for thesis or dissertation.

BIOL 694 Graduate Orientation
Credit 1. 1 Lecture Hour.
Instruction on what constitutes fraud in science, how to recognize it and avoid committing fraud; includes basis of ethics and plagiarism; negotiation techniques and conflict management; regulations and ethics covering animal and human experiments; record-keeping; data management; peer review. May be taken on a satisfactory/unsatisfactory basis.
Prerequisite: Graduate classification.
BIOL 696 Ethics and Responsible Conduct of Research  
**Credit 1. 1 Lecture Hour.**
Instruction on what constitutes fraud in science, how to recognize it and avoid committing fraud; includes basis of ethics and plagiarism; negotiation techniques and conflict management; regulations and ethics covering animal and human experiments; record-keeping; data management; peer review. May be taken four times for credit.  
**Prerequisite:** Graduate classification or approval of instructor.

BIOL 697 Methods in Teaching Biology Laboratory  
**Credit 1. 1 Lecture Hour.**
Introduction to teaching methods associated with the teaching of undergraduate biology laboratories; emphasis on effective preparation and delivery of laboratory course content, clear instructions for procedures and laboratory safety.  
**Prerequisite:** Graduate classification in a biological science.

BIOL 698/NRSC 698 Special Topics Behavior, Genes and Evolution  
**Credits 3. 3 Lecture Hours.**
This literature and lecture-based course will introduce an integrative approach to the study of animal behavior, complementing evolutionary and ecological perspectives with molecular and genetic approaches and methodologies.  
**Prerequisite:** Graduate classification.  
**Cross Listing:** NRSC 698/BIOL 698.