

DIVISION OF BIOLOGY

Web Site: <http://www.twu.edu/biology>

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The Division of Biology offers many exciting options for students to select a curriculum that fits their choice of professions. These include a major in Biology, which provides excellent training and preparation for a variety of jobs in research, government, and industry, or for graduate school; and a major in Medical Laboratory Sciences, which prepares students for careers in clinical and diagnostic laboratories.

For students who plan to pursue admission to medical, dental, or veterinary school after they graduate, we offer a specific Biology Pre-Med track that includes all the required prerequisites and provides excellent preparation for the Medical College Admission Test (MCAT) or Dental Admission Test (DAT). Another career that is growing in popularity is the physician assistant or physician associate (PA), and we offer a Biology Pre-Physician Assistant track that includes all the prerequisites and serves as outstanding preparation for PA school.

An additional option is a major in Biology with preparation for a career in education, and we offer degree plans tailored for three different levels of teacher certification. Students with an emphasis in any of these areas are advised by a special advisor and should follow the specific recommendations outlined in the respective plan of study.

Finally, the Division of Biology is pleased to offer a degree in Medical Laboratory Sciences, which includes three years of Biology coursework followed by a year of specialized clinical training at an approved affiliate site. Please see more details in the next section on the Medical Laboratory Sciences program.

The Division of Biology offers a minor in Biology, a minor in Neuroscience, and a Certificate in Biological Research. In cooperation with the Division of Chemistry and Biochemistry, we offer a minor in General Science, a minor in Pre-Medicine, and a minor in Pre-PA (for majors other than Biology or Chemistry/Biochemistry). In collaboration with the Division of Visual Arts, we offer a minor in Scientific Illustration.

Academically advanced students seeking higher levels of training can apply to the accelerated B.S./P.S.M. program, a 5 year program that enables students to earn the Bachelor of Science in Biology and a Professional Science Master's Degree in Biotechnology. We also have outstanding graduate programs that include a Master of Science in Biology (with Thesis or Professional Paper options), a Professional Science Master's degree in Biotechnology, and a Ph.D. in Molecular

Biology. For more information on graduate offerings, please refer to the graduate catalog.

Undergraduate Degrees Offered

All bachelor's degrees in Biology require a minimum of 120 semester credit hours (SCH); and a minor of at least 18 SCH, of which a minimum of 6 SCH must be upper-division. Consult the minor department for any additional requirements.

- Minors (<http://catalog.twu.edu/undergraduate/arts-sciences/biology/minors/>)
- Certificates (<http://catalog.twu.edu/undergraduate/arts-sciences/biology/certificates/>)
- B.S. in Biology (<http://catalog.twu.edu/undergraduate/arts-sciences/biology/biology-bs/>)
- B.S. in Biology (Pre-Med) (<http://catalog.twu.edu/undergraduate/arts-sciences/biology/biology-bs-pre-med/>)
- B.S. in Biology (Pre-Physician Assistant) (<http://catalog.twu.edu/undergraduate/arts-sciences/biology/biology-bs-pre-physician-assistant/>)
- B.S. in Biology (4-8 Science Certification) (<http://catalog.twu.edu/undergraduate/arts-sciences/biology/biology-bs-teacher-certification-4-8-science/>)
- B.S. in Biology (7-12 Composite Science Certification) (<http://catalog.twu.edu/undergraduate/arts-sciences/biology/biology-bs-teacher-certification-7-12-composite-science/>)
- B.S. in Biology (7-12 Life Science Certification) (<http://catalog.twu.edu/undergraduate/arts-sciences/biology/biology-bs-teacher-certification-7-12-life-science/>)
- B.S. Environmental Science (<http://catalog.twu.edu/undergraduate/arts-sciences/biology/environmental-science-bs/>)
- B.S. in Medical Laboratory Sciences (<http://catalog.twu.edu/undergraduate/arts-sciences/biology/medical-technology-bs/>)
- Accelerated B.S. in Biology/P.S.M. in Biotechnology (<http://catalog.twu.edu/undergraduate/arts-sciences/biology/accelerated-biology-bs-professional-science-master-biotechnology/>)

For more information about the department, please visit the Division of Biology (<http://www.twu.edu/biology/>) webpage. For information about the teacher education program, please visit the Teacher Education (<https://twu.edu/teacher-education/>) webpage. For information about pre-health professions advising, please visit the Pre-Health Resources (<https://twu.edu/arts-sciences/pre-health-resources/>) webpage.

Graduate Courses

Refer to the Graduate Catalog (<http://catalog.twu.edu/graduate/>) for information regarding graduate courses.

Admissions

All applicants must meet the general undergraduate admission requirements (<http://catalog.twu.edu/undergraduate/admission-information/>). The following degrees have additional secondary admission criteria:

- B.S. in Biology (4-8 Science Certification) (<http://catalog.twu.edu/undergraduate/arts-sciences/biology/biology-bs-teacher-certification-4-8-science/>)

- B.S. in Biology (7-12 Composite Science Certification) (<http://catalog.twu.edu/undergraduate/arts-sciences/biology/biology-bs-teacher-certification-7-12-composite-science/>)
- B.S. in Biology (7-12 Life Science Certification) (<http://catalog.twu.edu/undergraduate/arts-sciences/biology/biology-bs-certification-7-12-life-science/>)
- Accelerated B.S. in Biology/P.S.M. in Biotechnology (<http://catalog.twu.edu/undergraduate/arts-sciences/biology/accelerated-biology-bs-professional-science-master-biotechnology/>)

Policies

The following policies apply to all students in the Division of Biology:

1. A minimum grade of C is mandatory in all required courses for Biology and Medical Laboratory Sciences majors. If a student earns a grade of D, F, or W in a required course, the student must repeat the course and earn at least a C.
2. Students receiving a grade of D, F, or W in a required course in the Biology or Medical Laboratory Sciences major may not progress to courses for which that course is a prerequisite.
3. The Division of Biology will allow students to drop a lecture course but not the co-requisite lab OR lab but not the co-requisite lecture. However, this is possible only after the sixth week of the semester.

These policies are in addition to the state of Texas and university academic policies listed in the TWU Catalog. Exceptions will be considered on a case-by-case basis.

Faculty

*AHMED, SHAZIA A., Clinical Professor of Biology, B.S., University of Karachi; M.S., University of Karachi; Ph.D., Texas Woman's University

*AVERITT, DAYNA L., Associate Professor of Biology, B.A., University of Texas at Austin; M.S., Georgia State University; Ph.D., Georgia State University

*BERGEL, MICHAEL, Associate Professor of Biology, B.Sc., The Hebrew University of Jerusalem; M.Sc., The Hebrew University of Jerusalem; Ph.D., The Hebrew University of Jerusalem

*BERGER, MARY, Assistant Clinical Professor of Biology, B.S., University of Texas Health Science Center, San Antonio; Ph.D., University of Texas Health Science Center

*BIGGERS, AMANDA, Senior Lecturer of Biology, B.S., Texas Tech University; M.Ed., Texas A&M University-College Station; Ph.D., Iowa State University

*BROWER, CHRISTOPHER, Associate Professor of Biology, B.S., Northeastern Oklahoma State University; M.S., University of Oklahoma Health Sciences Center; Ph.D., University of Oklahoma Health Sciences Center

*CONRAD-WEBB, HEATHER M., Associate Professor of Biology, B.S., Baylor University; Ph.D., Ohio State University, Columbus

*DAVIS, ANN M., Lecturer II of Biology; Division Lead of Biology, B.A., Rice University; Ph.D., Southwestern Medical Center

*ELROD, DIANA, Senior Lecturer of Biology, B.S., University of Arkansas for Medical Sciences; M.S., University of Memphis; Ph.D., University of North Texas

*FAURE, LIONEL, Assistant Clinical Professor of Biology, B.S., University of Victor Segalen Bordeaux, France; M.S., University of Victor Segalen Bordeaux, France; Ph.D., University of Victor Segalen Bordeaux, France

FITZGERALD, YOULONDA, Assistant Clinical Professor of Biology, B.S., Baylor University; M.S., Baylor University

*GUMIENNY, TINA, Associate Professor of Biology, B.S., Texas A&M University; Ph.D., State University of New York-Stony Brook

*HAMMETT, AMY JO, Associate Clinical Professor of Biology, B.S., Texas Woman's University; Ph.D., Texas A&M University

*HANSON, LAURA K., Associate Professor of Biology, B.S., University of Washington; Ph.D., Cornell University

*HYNDS, DIANNA L., Professor of Biology; Division Lead of Biology, B.S., Hillsdale College; Ph.D., Ohio State University, Columbus

KOTTEGODA, SAMANTHI, Lecturer II of Biology, B.S., University of Kelaniya-Sri Lanka; M.S., University of Illinois at Chicago; Ph.D., North Carolina State University

*LYBRAND, ZANE R., Assistant Professor of Biology, B.S., Texas A&M University-College Station; Ph.D., Texas A&M University-College Station

*MAIER, CAMELIA G., Professor of Biology, B.S., University of Bucharest; M.S., University of North Texas; Ph.D., University of North Texas

*MILLS, NATHANIEL C., Professor of Biology, B.S., Western Kentucky University; Ph.D., Vanderbilt University

*PIERCE, STEPHANIE, Assistant Clinical Professor of Biology, B.S., Texas A&M University-College Station; Ph.D., University of Texas-Southwestern Medical Center at Dallas

*PISLARIU, CATALINA, Associate Professor of Biology, B.S., University of Bucharest, Romania; M.S., Ghent University, Belgium; Ph.D., University of North Texas

SERRANO, MARIA, Lecturer I of Biology, M.S., Texas Woman's University; Ph.D., Texas A&M University-College Station

*SINHA, SUSHMITA, Assistant Professor of Biology, M.S., Ambedkar University, India; Ph.D., Sanjay Gandhi Postgraduate Institute of Medical Sciences, India

*SPENCER, JULIET, Professor of Biology; Chair of the Department of Biology, B.S., Worcester Polytechnic Institute, Ph.D., University of Virginia

*TENNAKON, DEEPANI, Lecturer II of Biology, B.S., Texas A&M University-College Station; Ph.D., Texas A&M University-College Station

Asterisk () denotes Graduate Faculty status.*

Courses

BACT 1001. Microbiology Laboratory. (TCCN BIOL 2120) Practical experiences using the tools of microbiology: culturing, staining, fermentation, and colony studies. Prerequisite: Non-Biology Major. Co-requisite: BACT 1003. Three laboratory hours a week. Credit: One hour.

BACT 1003. Microbiology. (TCCN BIOL 2420) Principles, historic concepts, sterility, chemotherapy and antibiotics, immunology, serology, and diseases caused by microorganisms. Satisfies three hours Life & Physical Sciences Core (30). Prerequisite: Non-Biology Major. Co-requisite: BACT 1001. Three lecture hours a week. Credit: Three hours.

BACT 3111. General Microbiology Laboratory. Principles of classification, anatomy, nutrition, reproduction, growth, metabolism, and control of viruses, bacteria, fungi, and rickettsia. Prerequisites: Junior standing and six hours of biological sciences. Co-requisite: BACT 3113. Four laboratory hours a week. Credit: One hour.

BACT 3113. General Microbiology. Principles, classification, anatomy, reproduction, growth, metabolism, and control of viruses, bacteria, fungi, and rickettsia. Prerequisites: BIOL 1123, and CHEM 1113 or CHEM 1213. Co-requisite: BACT 3111. Three lecture hours a week. Credit: Three hours.

BACT 4111. Immunology Laboratory. Preparation and evaluation of immunizing agents; clearance by the reticuloendothelial system; antigen-antibody reactions as evaluated by agglutination, precipitation, complement-fixation, and ELISA assays; immunochemistry techniques and immunopathology reactions. Prerequisites: BACT 3111, BACT 3113, and CHEM 2213. Prerequisite or Co-requisite: BACT 4113. Three laboratory hours a week. Credit: One hour.

BACT 4113. Immunology. Specific and non-specific immune responses, antigens, antibody structure, genetic bases of antibody structure, cell-mediated immunity, hypersensitivity reactions, and transplantation immunology. Prerequisite: BACT 3111, BACT 3113, and CHEM 2213. Prerequisite or Co-requisite: BACT 4111. Three lecture hours a week. Credit: Three hours.

BACT 4413. Virology. Morphology, growth, and classification of viruses; pathogenesis, epidemiology, and chemotherapy of major disease-producing viruses. Prerequisites: BIOL 1123 and BACT 3113. Three lecture hours a week. Credit: Three hours.

BIOL 1013. Human Biology. (TCCN BIOL 1308) Structure and function of the human body and its relationship to health and disease; interrelationships between individuals, groups, and environments; development of skills in problem solving and critical thinking; and discussion of recent human-related events impacting physiological functions. Satisfies three hours Life & Physical Sciences Core (30). Three lecture hours a week. Credit: Three hours.

BIOL 1023. Environmental Biology. (TCCN BIOL 2406) Diversity of life; interrelationships between organisms and their environment; environmental interaction problems. Course for non-science majors. Satisfies three hours Life & Physical Sciences Core (30). Three lecture hours a week. Credit: Three hours.

BIOL 1033. General Life Science I. (TCCN BIOL 1408) Life processes as they are based on physical and chemical principles. Manifestation of different life forms in various organisms in adaptation to diverse environments. Satisfies three hours Life & Physical Sciences Core (30). Three lecture hours a week. Credit: Three hours.

BIOL 1111. Principles of Biology I Laboratory. (TCCN BIOL 1106) Experiences with basic fundamentals of biology, including structure and function from cell to organism. Emphasis on plants as organisms. For science majors and minors. Co-requisite: BIOL 1113. Three laboratory hours a week. Credit: One hour.

BIOL 1113. Principles of Biology I. (TCCN BIOL 1406) Development of current concepts in cell structure and functions with introduction to organismal level. For science majors and minors. Satisfies three hours Life & Physical Sciences Core (30). Co-requisite: BIOL 1111. Three lecture hours a week. Credit: Three hours.

BIOL 1121. Principles of Biology II Laboratory. (TCCN BIOL 1107) Experience with basic fundamentals of organismal biology of plants and animals. For science majors and minors. Prerequisite: BIOL 1111. Co-requisite: BIOL 1123. Three laboratory hours a week. Credit: One hour.

BIOL 1123. Principles of Biology II. (TCCN BIOL 1407) Organismal and population biology of plants and animals and introduction to evolutionary biology and ecology. For science majors and minors. Satisfies three hours Life & Physical Science Core (30). Pre-requisite: BIOL 1113. Co-requisite: BIOL 1121. Three lecture hours a week. Credit: Three hours.

BIOL 1223. General Life Science II. (TCCN BIOL 1309) Basics of the scientific process and biology topics surrounding the history and diversity of life, different kingdoms of life with a focus on plants and animals, and ecology. Satisfies three hours Life & Physical Sciences Core (30). Three lecture hours a week. Credit: Three hours.

BIOL 2111. Plant Biology Laboratory. (TCCN BIOL 1111) Laboratory studies of plant morphogenesis, anatomy, physiology, and classification. Prerequisites: BIOL 1111 and BIOL 1113, or permission of instructor. Co-requisite: BIOL 2113. Three laboratory hours a week. Credit: One hour.

BIOL 2113. Plant Biology. (TCCN BIOL 1411) Plant morphogenesis, anatomy, physiology, and classification. Prerequisites: BIOL 1113, BIOL 1111, BIOL 1123, and BIOL 1121, or permission of instructor. Co-requisite: BIOL 2111. Three lecture hours a week. Credit: Three hours.

BIOL 4221. Ecology Laboratory. Laboratory and field experiments designed to illustrate the basic concepts of ecology. Co-requisite: BIOL 4223. Three laboratory hours a week. Credit: One hour.

BIOL 4223. Ecology. Introduction to principles of general ecology in the context of current environmental and social conditions and issues. Relationships between organisms and their environment. Human influences on the global environment. Prerequisite: BIOL 1123. Co-requisite: BIOL 4221. Three lecture hours a week. Credit: Three hours.

BIOL 4293. Scientific Communication. Written and verbal communication skills involved in gathering, analyzing, and distributing scientific and technical information efficiently and accurately for scientific and lay audiences. Prerequisite: 8 hours of BACT, BIOL, BOT, or ZOOL courses. Three lecture hours a week. Credit: Three hours.

BIOL 4344. Pathophysiology. Basic study of physiological systems in health and disease. Prerequisites: ZOOL 2013 and ZOOL 2023. Four lecture hours a week. Credit: Four hours.

BIOL 4513. Genome Editing and Medical Ethics. Exploration of emerging technologies at the forefront of biomedical science and public discussion, how DNA within living organisms can be altered to treat human disease and other significant problems facing our society, and the ethics surrounding genome editing and its applications. Prerequisite: Eight hours from subjects BIOL, BOT, ZOOL, or BACT. Three lecture hours a week. Credit: Three hours.

BIOL 4593. Science in the Secondary Classroom. Strategies for teaching high school and middle school science using science inquiry and active learning techniques. Notebooking, portfolio building, 5E lesson plan design, classroom management, cooperative learning, assessment, and technology applications. Three lecture hours a week. Credit: Three hours.

BIOL 4681. Biology Seminar. Student presentations based on library or laboratory research projects. Prerequisite: Minimum of 85 total semester credit hours and minimum of eight hours upper-division Biology, including BIOL, BACT, BOT, or ZOOL courses. One lecture hour a week. Credit: One hour.

BIOL 4811. Molecular and Cellular Biology: Gene Expression Laboratory. Laboratory studies in gene expression. Experience in basic laboratory techniques and their application in answering experimental questions. Prerequisites: BIOL 1123 and CHEM 3223. Co-requisite: BIOL 4813. Three laboratory hours a week. Credit: One hour.

BIOL 4813. Molecular and Cellular Biology: Gene Expression. First in a sequence of two courses. Integrated principles of cellular, molecular, and genetic aspects of cell function. Mechanisms of gene expression including transcription, translation, and their regulation. Prerequisites: BIOL 1123 and CHEM 3223. Co-requisite: BIOL 4811. Three lecture hours a week. Credit: Three hours.

BIOL 4821. Molecular and Cellular Biology: Genetics and Inheritance Laboratory. Laboratory studies in genetics and inheritance. Experience in basic laboratory techniques and their application in answering experimental questions. Prerequisites: BIOL 1123, BIOL 4811, and CHEM 3223. Co-requisite: BIOL 4823. Three laboratory hours a week. Credit: One hour.

BIOL 4823. Molecular and Cellular Biology: Genetics and Inheritance. Second in a sequence of two courses. Integrated principles of cellular, molecular, and genetic aspects of cell function. Mendelian genetics, cell cycle control, and cell signaling. Prerequisites: BIOL 4813 and CHEM 3223. Co-requisite: BIOL 4821. Three lecture hours a week. Credit: Three hours.

BIOL 4901. Special Topics. Advanced studies in biology. Prerequisite: Permission of instructor. May be repeated for additional credit when topic varies. One lecture hour a week. Credit: One hour.

BIOL 4903. Special Topics. Advanced studies in biology. May be repeated for additional credit when topic varies. Prerequisite: Take eight hours from subjects BIOL, BOT, ZOOL, or BACT; or permission of instructor. Three lecture hours a week. Credit: Three hours.

BIOL 4911. Independent Study. Topics in advanced biology. Prerequisite: Permission of instructor. May be repeated. Credit: One hour.

BIOL 4913. Independent Study. Topics in advanced biology. Prerequisite: Permission of instructor. May be repeated. Credit: Three hours.

BIOL 4951. Internship. Students undertake a significant experiential learning opportunity, typically with a company, non-profit, governmental, or community-based organization. Minimum of 150 hours throughout the semester. Departmental approval required.

BIOL 4953. Internship. Students undertake a significant experiential learning opportunity, typically with a company, non-profit, governmental, or community-based organization. Minimum of 450 hours throughout the semester. Departmental approval required.

BIOL 4981. Undergraduate Research. Original research with formal, written report required. May be taken for honors credit and repeated for additional credit. No more than six semester credit hours will count toward the biology degree. Prerequisite: Permission of instructor and department chair and completion of laboratory safety training. Three laboratory hours a week. Credit: One hour.

BIOL 4982. Undergraduate Research. Original research with formal, written report required. May be taken for honors credit and repeated for additional credit. No more than six semester credit hours will count toward the biology degree. Prerequisite: Permission of instructor and department chair and completion of laboratory safety training. Six laboratory hours a week. Credit: two hours.

BIOL 4983. Undergraduate Research. Original research at the undergraduate level. Formal, written report required. May be taken for honors credit and repeated for additional credit. No more than six semester credit hours will count towards the biology degree. Prerequisite: Permission of the department chair. Nine laboratory hours a week. Credit: Three hours.

ZOOL 2011. Human Anatomy and Physiology I Laboratory. (TCCN BIOL 2101) Observations of the structure and function of the human body. Prerequisite: Non-Biology Major. Co-requisite: ZOOL 2013. Three laboratory hours a week. Credit: One hour.

ZOOL 2013. Human Anatomy and Physiology I. (TCCN BIOL 2401) Principles of the structure and functions of the human body. Satisfies three hours Life & Physical Sciences Core (30). Prerequisite: Non-Biology Major. Co-requisite: ZOOL 2011. Three lecture hours a week. Credit: Three hours.

ZOOL 2021. Human Anatomy and Physiology II Laboratory. (TCCN BIOL 2102) Continuation of observations of the structure and function of the human body. Prerequisite: Non-Biology Major. Co-requisite: ZOOL 2023. Three laboratory hours a week. Credit: One hour.

ZOOL 2023. Human Anatomy and Physiology II. (TCCN BIOL 2402) Principles of the structure and functions of the human body. Satisfies three hours Life & Physical Sciences Core (30). Prerequisite: ZOOL 2013 and Non-Biology Major. Co-requisite: ZOOL 2021. Three lecture hours a week. Credit: Three hours.

ZOOL 3121. Neuroanatomy and Neurophysiology Laboratory. Laboratory exposure to the gross and microanatomy of the human brain and spinal cord. Discussion of case studies based on analyses of lesions associated with neurological dysfunction. Prerequisite: BIOL 1121 or ZOOL 2021. Co-requisite: ZOOL 3123. Three laboratory hours a week. Credit: One hour.

ZOOL 3123. Neuroanatomy and Neurophysiology. Basic anatomy and physiology of the human nervous system. Identification of location, structure, and function of major CNS systems and associated pathways. Prerequisite: BIOL 1123 or ZOOL 2023. Co-requisite: ZOOL 3121. Three lecture hours a week. Credit: Three hours.

ZOOL 3241. Systemic Anatomy Laboratory. Examination of the advanced structure of the human body and organ systems through laboratory methods. Prerequisite: BIOL 1121 or ZOOL 2021. Prerequisite or Co-requisite: ZOOL 3243. Three laboratory hours a week. Credit: One hour.

ZOOL 3243. Systemic Anatomy. Advanced structure of the human body and organ systems. Prerequisite: BIOL 1123 or ZOOL 2023. Prerequisite or Co-requisite: ZOOL 3241. Three lecture hours a week. Credit: Three hours.

ZOOL 3313. Biology of Aging. Physiological, anatomical, and immunological changes occurring with the aging process. Three lecture hours a week. Credit: Three hours.

ZOOL 4033. Animal Behavior. Basic examination of animal behavior principles, instinct, learning, communication, and social organization. Presentations compare various animal groups and students practice observational methods. Field trip. Prerequisite: Introductory course in general biology or zoology. Three lecture hours a week. Credit: Three hours.

ZOOL 4241. Medical Physiology Laboratory. Laboratory experiments in mammalian and human physiology. Prerequisites: BIOL 1121 or ZOOL 2021, and CHEM 1121 or CHEM 1221. Co-requisite: ZOOL 4243. Three laboratory hours a week. Credit: One hour.

ZOOL 4243. Medical Physiology. Basic function of the adult human body's tissues, organs, and systems and major principles of operation of the neurological, cardiovascular, pulmonary, gastrointestinal, and renal systems. Emphasis on human physiological function rather than anatomical organization. Normal physiological function in the context of human medical care. Prerequisites: BIOL 1123 or ZOOL 2023, and CHEM 1123 or CHEM 1223. Co-requisite: ZOOL 4241. Three lecture hours a week. Credit: Three hours.