

# The School of Science and Engineering

## Cell and Molecular Biology

**Office:** 2000 Percival Stern Hall

**Phone:** (504) 865-5546

**Fax:** (504) 865-6785

**Website:** <http://cell.tulane.edu>

### Professors

*Joan W. Bennett*, Ph.D., Chicago

*YiPing Chen*, Ph.D., Iowa

*Ken Muneoka*, Ph.D., California, Irvine

*Jeffrey Tasker*, Ph.D., Bordeaux, France

*Leonard B. Thien*, Ph.D., California, Los Angeles

### Associate Professors

*Andrei B. Belousov*, Ph.D., Moscow State, Russia

*Carol Burdsal*, Ph.D., Duke

*Peter Cserjesi*, Ph.D., McGill, Canada

*David A. Mullin*, Ph.D., Texas, Austin (Chair)

*Bret Smith*, Ph.D., Tennessee Medical Center

### Assistant Professors

*Fiona Inglis*, Ph.D., Glasgow

*Laura Schrader*, Ph.D., Tulane

The curriculum offered by the cell and molecular biology department is designed for students interested in biological principles that operate at the level of cells and molecules and the application of genetic and molecular techniques to solve problems in medicine and biotechnology.

### MAJOR

Students majoring in cell and molecular biology must complete a minimum of ten courses in the biology component, totaling at least 22 credits, 16 credits in chemistry (one year of both general chemistry with laboratories 107/117, 108/118 or H109/H111, H110/H112 and organic chemistry with laboratories 241/243,

242/244, or H245/H247, H246/H248), and eight credits of physics with laboratories (121, 122 or 131, 132). Students intending to pursue graduate studies are advised to include a course in probability and statistics for scientists.

To fulfill the biology component, all students must complete CELL 101 (lecture only). Students with an AP score of 5 will have the choice between receiving credit for CELL 103/106 or receiving credit for CELL 101. (Students with an AP score of 5 who opt to receive credit for CELL 103/106 will be allowed to take CELL 211 concurrently with CELL 101). Students with an AP score of 4 will receive credit for CELL 103/106. In addition to 101, all students must complete 205, 301, 311, and either 401 or Chemical Engineering 445 or Chemistry 302 or 383 and 384. Students must also complete either 302 or 312, and one course from 331, 332, 416, 478.

An additional three elective courses are required, with at least two of the three being laboratory oriented and one must be an approved capstone course. One course involving independent laboratory research, either H491, H492, 495, 496, H499 or H500 may be used as a laboratory oriented course in the electives requirement. Students may use approved courses from other departments to fulfill the elective component. A list of courses which fulfill the elective requirement and the capstone requirement is available from the cell and molecular biology department.

### MINOR

Students wishing to minor in cell and molecular biology must complete CELL 101, 205, 301, and 311; two additional electives in biology; and 16 credits in chemistry (one year of both general and organic chemistry and their respective laboratories). Because of the interdisciplinary nature of the biological chemistry major, students in that program may not minor in cell and molecular biology.

### HONORS COURSES

#### CELL H491, H492 Independent Studies (1-3, 1-3)

Staff. Laboratory or library research under direction of a faculty member.

#### CELL H499-H500 Honors Thesis (3, 4)

Staff. For juniors and seniors with approval of department and the Honors Committee. Students who complete H499 and H500 with

the preparation of a senior thesis may be recommended to the college for the award of degree with departmental honors.

### **INTRODUCTORY LEVEL COURSES**

#### **CELL 101 General Biology (3)**

Prof. Bennett, Prof. Thien. A study of phenomenology and fundamental concepts that apply to all living systems. Major topics include: cell biology, physiology, genetics, and development.

#### **CELL 103 Heredity and Society (3)**

Staff. The nature, scope, and implications of recent accomplishments in genetics, including consideration of human birth defects, hereditary diseases, and the potential of the human species to manipulate its own genes. Satisfies the college non-laboratory science requirement. Satisfies the college laboratory science requirement with completion of CELL 106. Does not count toward the requirements for a major or minor in cell and molecular biology.

#### **CELL 106 Heredity and Society Laboratory (1)**

Staff. Corequisite or prerequisite: CELL 103. Laboratory and computer exercises to reinforce concepts discussed in CELL 103. Students will learn basic laboratory skills, including microscopy and molecular biological techniques. Satisfies the college laboratory science course requirement with completion of CELL 103. Does not count toward the requirements for the major or minor in cell and molecular biology.

#### **CELL 210 Biology of Human Reproduction (3)**

Prof. Bennett. The anatomy and physiology of male and female reproductive systems, and the diseases relating to each. A consideration of relevant aspects of gynecology, obstetrics and urology. Meets the college non laboratory science requirement. Does not count toward the requirements for a major or minor in cell and molecular biology.

#### **CELL 222 Exploring Careers in Medicine (1)**

Staff. Prerequisites: CELL 101 and approval of instructor. This course will examine different careers in medicine, the distribution of hours spent in practice each week, and some of the disease processes and treatments seen by physicians. It will be taught from a practical, clinical point of view and is intended to help students identify their areas of interest in medicine or medical research. Must be taken S/U.

### **COURSES FOR INTERMEDIATE AND ADVANCED UNDERGRADUATES**

#### **CELL 205 Genetics (3)**

Prof. Bennett. Prerequisite: CELL 101. The principles of genetic analysis and the nature of genes. Discussion of DNA, chromosomes, and molecular mechanism of replication, mutation, expression, and transmission of heritable characteristics.

#### **CELL 211 General Biology Laboratory (1)**

Staff. Prerequisite: CELL 101. Laboratory exercises emphasizing concepts in cell, molecular, and developmental biology. Designed for majors in the biological sciences.

#### **CELL 301 Cell Biology (3)**

Prof. Burdsal. An examination of the structure and function of eukaryotic cells. Emphasis is placed on mechanisms of intracellular and transmembrane transport, cellular control, and intercellular and intracellular signaling. Experimental methods and applications will be discussed.

#### **CELL 302 Cell Biology Laboratory (1)**

Staff. Corequisite or prerequisite: CELL 301. Laboratory experience in in vitro methodologies. Students will learn to maintain and manipulate mammalian cell cultures.

#### **CELL 311 Molecular Biology (3)**

Prof. Mullin, Prof. Thien. Prerequisite: CELL 205, corequisite or prerequisite CHEM 241 or equivalent. Introduction to theory and applications of molecular biology.

#### **CELL 312 Molecular Biology Laboratory (1)**

Staff. Corequisite or prerequisite: CELL 311. Laboratory experience in molecular biology techniques.

#### **CELL 321 Cellular Physiology (3)**

Prof. Belousov. Prerequisite: CELL 101. A survey of vertebrate anatomy and physiology emphasizing the cellular and molecular basis of organ function. This course emphasizes modern experimental approaches for exploring physiological functions of a variety of organ systems. See CELL 621.

#### **CELL 331 Cellular Neuroscience (3)**

Prof. Tasker. Prerequisite: CELL 101. In-depth coverage of the basic principles of cellular neuroscience, including the biophysical basis of the membrane potential, action potential generation and propagation, and synaptic signaling. Students will be introduced to

the synaptic organization of higher neural systems, such as the visual system and somatic sensory system. See CELL 631. Same as NSCI 331.

**CELL 332 Systems Neuroscience (3)**

Prof. Smith. Prerequisite: CELL 101 or approval of instructor. The subject of this course is the human nervous system, its anatomy, connectivity and function. Discusses the normal structure of the nervous system and the relationship of that structure to physiological function. The course is taught from a practical, clinical point of view and is intended to prepare students for further study in the neurosciences. See CELL 632. Same as NSCI 332.

**CELL 334 Neuroanatomy Laboratory (1)**

Prof. Smith. Corequisite or prerequisite: CELL 332. The subject of this course is the anatomy of the human nervous system. Students will learn to identify and map the structure and position of nuclei, pathways, and anatomical divisions of the brain and spinal cord. The course is a practical correlate to Systems Neuroscience, and is intended to prepare students for further study in the neurosciences. Same as NSCI 334.

**CELL 389 Service Learning (1)**

Staff. Prerequisite: departmental approval. Students complete a service activity in the community in conjunction with the content of a three-credit corequisite course.

**CELL 401 Cellular Biochemistry (3)**

Staff. Prerequisites: CELL 101 and CHEM 242 or H246. Structure and function of biological molecules, energetics, metabolism, synthesis of macromolecules and assembly of structures. See CELL 601.

**CELL 411 Cells and Tissues (4)**

Staff. Prerequisite: CELL 301 or approval of instructor. Descriptive study of mammalian microscopic anatomy in a physiological context. Lectures and laboratory. See CELL 601.

**CELL 413 Embryology (4)**

Prof. Muneoka. Prerequisite: CELL 301 or approval of instructor. Anatomical study of developmental processes in humans. Lectures and online laboratory. See CELL 613.

**CELL 416 Developmental Biology (3)**

Prof. Burdsal, Prof. Chen. Prerequisite: CELL 205 or approval of instructor. The origin and development of form and patterns in

organisms. Recent investigations and research methodology on the processes of growth and differentiation are stressed. See CELL 616.

**CELL 422 Microbiology (3)**

Prof. Mullin. Prerequisite: CELL 301 or approval of instructor. Taxonomy, physiology, genetics and ecology of microorganisms. This course will cover the role of microbes in medicine and industry, and as model systems for research. See CELL 622.

**CELL 423 Microbiology Laboratory (1)**

Staff. Corequisite or prerequisite: CELL 422. Laboratory studies of microbial taxonomy, physiology, biochemistry, and genetics.

**CELL 434 Neurobiology of Disease (3)**

Prof. Belousov. Prerequisite: CELL 331. Advanced course on the higher neural functions of the nervous system and neurological diseases resulting from disruption of these functions. An emphasis is placed on the physiology of the nervous system and neural dysfunction caused by inherited and acquired diseases. Topics range from motor control and neuromuscular diseases to high cognitive function and dementia. See CELL 634. Same as NSCI 434.

**CELL 435 Developmental Neurobiology (3)**

Prof. Inglis. Prerequisite: CELL 331 or CELL 416 or approval of instructor. A broad overview of the different stages of neural development. Examination of the molecular aspects of developmental neurobiology, with reference to some important signaling pathways involved in neural growth and specification. Particular attention will be given to those active research fields, such as growth cone guidance and collapse, activity-dependent development, and applications of these to injury and disease. See CELL 635. Same as NSCI 435

**CELL 437 Molecular Neurobiology (3)**

Prof. Inglis. Prerequisite: CELL 311 or CELL 332, or approval of instructor. Introduction to the molecular biology of neurons and neuronal functions. Topics of study will include: the molecular composition of nerve cells, and how this provides a basis for their functional properties; their synaptic connectivity; how they receive, transmit, and retain information at a molecular level. Studies will focus on current research in the field of molecular neurobiology. See CELL 637. Same as NSCI 437

**CELL 444 Advanced Molecular Biology (3)**

Prof. Thien. Prerequisite: CELL 311 or approval of instructor. Current topics in molecular biology with emphasis on higher-order chromatin structure and transcription, mutability, and DNA repair mechanisms in prokaryotes and eukaryotes. Other topics include: nuclear hormone receptors, HOX gene activation in development, RNAi, and genome organization.

**CELL 456, 457 Internship Studies (3, 3)**

Staff. Prerequisites: approval of instructor and department. An experiential learning process coupled with pertinent academic course work. Open only to juniors and seniors in good standing. Registration is completed in the academic department sponsoring the internship. (Note: A maximum of six credits may be earned in one or two courses.)

**CELL 466 Special Topics in Cell and Molecular Biology (1-3)**

Staff. Courses offered by visiting professors or permanent faculty primarily for undergraduates. For description, consult department.

**CELL 471 The Molecular Biology of Cancer (3)**

Prof. Burdsal. Prerequisite: CELL 301. The complex multistep process which transforms a normal cell into a cancer cell, carcinogenesis, will be examined with emphasis on current molecular insights. See CELL 671.

**CELL 478 Developmental Genetics (3)**

Prof. Cserjesi. Prerequisite: 416, or approval of instructor. This course examines the genetic pathways regulating development and the underlying molecular mechanisms by which these pathways are regulated. The goal of the course is to expose students to topics and techniques shaping the field of development biology. See CELL 678.

**CELL 488 Writing Practicum (1)**

Staff. Corequisite: three-credit departmental course. Prerequisite: successful completion of the First-Year Writing Requirement. Fulfills the college intensive-writing requirement.

**CELL 495, 496 Special Projects in Cell and Molecular Biology (1-3, 1-3)**

Staff. Individual studies in a selected field. Open to qualified students with approval of instructor and advisor.

**COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES****CELL 600 Biomedical Ethics (3)**

Prof. Bennett. Prerequisite: Cell 101 or approval of instructor. An interdisciplinary course that examines the moral principles that apply to biology and medicine. Ethical principles will be analyzed in relation to such topical issues as informed consent, abortion, death and dying, allocation of scarce resources, personhood, AIDS, risk, human experimentation, and public policy. Case studies and class discussion will complement lectures and video presentations.

**CELL 601 Cellular Biochemistry (3)**

See CELL 401 for course description. In addition, a term paper is required.

**CELL 608 Advanced Developmental and Cell Biology II (3)**

Prof. Burdsal, Prof. Chen, Prof. Inglis, Prof. Muneoka. Prerequisite: approval of instructor. Lectures, readings, and discussion of the literature in the fields of cellular, developmental, and molecular biology.

**CELL 611 Cells and Tissues (4)**

See CELL 411 for course description. In addition, a term paper is required.

**CELL 613 Embryology (4)**

See CELL 413 for course description. In addition, a term paper is required.

**CELL 616 Developmental Biology (3)**

See CELL 416 for course description. In addition, a term paper is required.

**CELL 621 Cellular Physiology (3)**

See CELL 321 for course description. In addition, a term paper is required.

**CELL 622 Microbiology (3)**

See CELL 422 for course description. In addition, a term paper is required.

**CELL 631 Cellular Neuroscience (3)**

See CELL 331 for course description. In addition, a term paper is required. Same as NSCI 631.

**CELL 632 Systems Neuroscience (3)**

See CELL 332 for course description. In addition, a term paper is required. Same as NSCI 632.

**CELL 634 Neurobiology of Disease (3)**

See CELL 434 for course description. In addition, a term paper is required. Same as NSCI 634.

**CELL 635 Developmental Neurobiology (3)**

See CELL 435 for course description. In addition, a term paper is required. Same as NSCI 635.

**CELL 637 Molecular Neurobiology (3)**

See CELL 437 for course description. In addition, a term paper is required. Same as NSCI 637.

**CELL 644 Advanced Molecular Biology (3)**

See CELL 444 for course description. In addition, a term paper is required.

**CELL 655 Synaptic Organization of the Brain (3)**

Prof. Tasker. Prerequisite: 331 or approval of instructor. This course is offered jointly by Tulane and LSU Medical School every other year. It provides an in-depth examination of the physiologic and anatomic organization of the major structures of the brain and spinal cord. It is team taught by members of both faculties, drawing from the research expertise of the faculty of the two schools. Same as NSCI 655.

**CELL 663 Cellular Neurophysiology (3)**

Prof. Smith. Prerequisite: CELL 331 or approval of instructor. Survey of current topics and techniques in the physiology of neurons and neuronal circuits, concentrating primarily on electrophysiological studies. Same as NSCI 663.

**CELL 666 Special Topics in Cell and Molecular Biology (1-3)**

Staff. Courses offered by visiting professors or permanent faculty. For description, consult department.

**CELL 671 The Molecular Biology of Cancer (3)**

See CELL 471 for course description. In addition, a term paper is required.

**CELL 678 Developmental Genetics (3)**

See CELL 478 for course description. In addition, a term paper is required.

**CELL 684 Current Topics in Developmental Biology (2)**

Prof. Burdsal, Prof. Chen, Prof. Inglis, Prof. Muneoka. Prerequisite: approval of instructor. Reports and discussions of current literature on developmental processes.