School of Natural Sciences and Mathematics

Department of Molecular and Cell Biology

Department Faculty

Professors: Lee A. Bulla, Santosh D'Mello, Rockford K. Draper, Juan E. González, Stephen D. Levene, Lawrence J. Reitzer, Stephen Spiro, Li Zhang, Michael Qiwei Zhang

Professors Emeritus: Hans Bremer, Donald M. Gray, Claud S. Rupert

Associate Professors: Gail A. M. Breen, John G. Burr, Jeff L. DeJong, Ernest M. Hannig, Dennis L. Miller

Assistant Professors: Heng Du, Jung-whan (Jay) Kim, Kelli Palmer, Duane D. Winkler, Zhenyu Xuan, Hyuntae Yoo

Research Assistant Professor: Lan Guo

Senior Lecturers: Irina Borovkov, Mehmet Candas, Vincent P. Cirillo, Monique Duncan, Wen-Ju Lin, Robert C. Marsh, David Murchison, Jing Pan, Elizabeth Pickett, Ruben D. Ramirez, Scott A. Rippel, Elizabeth Rugg, Ilya Sapozhnikov, Uma Srikanth, Michelle Wilson, Wen-Ho Yu

Lecturers: Uyen Henson, John Kolar

Department Objectives

The Graduate Program offers training in those aspects of molecular and cell biology that are the bases of modern biological and biomedical sciences.

The Master of Science degree is designed for students who wish to learn the methodology of research in molecular and cell biology and the fundamentals of problem solving in these areas.

The Master of Science degree without thesis is intended for students who wish to acquire a working knowledge of biotechnology, for other students who seek to gain knowledge of modern biology without the intent to seek positions as technical laboratory personnel, and for those students who are seeking additional preparation for admission to professional schools.

The Master of Arts in Teaching degree in Science Education with a specialization in Biology is designed to strengthen the knowledge of high school teachers in fundamental aspects of biology and to bring them up to date on advances in this rapidly developing field. For further information on this program and for course descriptions, see the Science/Mathematics Education section of this catalog.
The Doctor of Philosophy degree with a major in Molecular and Cell Biology is appropriate for students who show a potential for originality in research and is designed to develop a critical and analytical understanding of current developments, which will enable them to keep abreast of the rapid advances that are likely to occur in the biological and biomedical fields.

The MS and PhD degree plans offer students the opportunity to prepare for academic careers in colleges and universities including medical and dental schools, and for careers in industrial, hospital, public health, and environmental and governmental laboratories and organizations.

Specializations

First-year students will normally complete a body of core courses that emphasize fundamental aspects of biochemistry, biophysics, molecular biology, and cell biology. Students may then proceed to advanced coursework in any of these four general areas. Elective courses are open to all qualified students as recommended by their supervising committees. First-year students are also encouraged to participate in rotations through research laboratories.

In the second year, research is initiated under the supervision of one or more of the Molecular and Cell Biology faculty. The faculty and their research interests are listed below. Prospective students should recognize that it is possible to do research in closely related areas not mentioned in this list, provided a faculty member is prepared to supervise the work.

- **Gail A. M. Breen**: Isolation and characterization of the genes that code for proteins of the mammalian mitochondrion; mitochondrial biogenesis; eukaryotic gene regulation.
- **Lee A. Bulla**: Molecular basis of biopesticides.
- **John G. Burr**: Eukaryotic growth regulation; mechanism of viral oncogenic transformation.
- **Santosh D’Mello**: Molecular control of neuronal apoptosis.
- **Jeff L. DeJong**: Eukaryotic transcription; initiation and activation of RNA polymerase II.
- **Rockford K. Draper**: Membrane traffic; protein toxins; bio-nanotechnology.
- **Heng Du**: Role of mitochondria in synaptic and neural degeneration in Alzheimer’s disease.
- **Juan E. González**: Cell-cell interactions, role of exopolysaccharides in nodulation of legumes by rhizobia; molecular genetics of plant-microbe interactions.
- **Ernest M. Hannig**: Control of protein synthesis; genetic and biochemical analysis of translation initiation factors; protein-protein interactions.
- **Jung-whan (Jay) Kim**: Cancer cell metabolism and the tumor microenvironment.
- **Dennis L. Miller**: Structure and organization of mitochondrial DNA; mitochondrial gene expression; RNA editing; mitochondrial biogenesis.
- **Kelli Palmer**: Genomic, transcriptomic, and biochemical analysis of antibiotic resistance in pathogenic bacteria.
- **Lawrence J. Reitzer**: Regulation of gene expression and metabolism in prokaryotes.
- **Stephen Spiro**: Regulation of bacterial gene expression by environmental signals; genetic and
physiological adaptation to stress.

- **Zhenyu Xuan**: Computational biology and bioinformatics.
- **Hyuntae Yoo**: Systems biology for drug discovery.
- **Li Zhang**: Molecular mechanisms of cell signaling, heme signaling and oxygen sensing, genomics, and systems biology.
- **Michael Qiwei Zhang**: Computational biology; gene regulation and epigenomics.

## Facilities

Major items of equipment used by the faculty and available for graduate student research include a Leica TCS SP2 AOB5 confocal microscope system, complete Spectra-Physics femtosecond laser system, Becton Dickson fluorescence activated cell sorter, Veeco MultiMode SPM atomic force microscope, Molecular Dynamics Phospholmagers, BioRad real-time polymerase chain reaction instruments, Beckman scintillation counters and Optima ultracentrifuges, a Jasco J-715 spectropolarimeter, and an Agilent 5975C series GC/MS with associated software. Individual laboratories are well-equipped with instrumentation needed for research in molecular and cell biology, including thermal cyclers, spectrophotometers, chromatography and electrophoresis systems, chemical hoods, and mammalian cell culture facilities.

Other shared biology facilities include environmental chambers, a staffed media kitchen with autoclaves and washing machines, a darkroom with an x-ray film developer, and an electronics workshop. There is a modern research animal housing facility on campus, as well as a GE 500 MHz FT multinuclear magnetic resonance spectrometer.

## Admission Requirements

The University's general admission requirements are discussed on the [Graduate Admission page](catalog.utdallas.edu/2013/graduate/admission).

For full participation in the Graduate Program in Molecular and Cell Biology, the student should have a good background in calculus, general physics, organic chemistry, biochemistry, and general biology, including genetics. Entering students not having this background may be required to take some additional coursework in their first year or in the summer immediately preceding entry. A minimum GRE score of 295 (verbal plus quantitative) with a minimum of 147 for the verbal component is advisable based on our experience with student success in the program.

## Degree Requirements

The University's general degree requirements are discussed on the [Graduate Policies and Procedures page](catalog.utdallas.edu/2013/graduate/policies/policy).

Upon satisfactory completion of the core courses (and, for PhD candidates, a favorable evaluation following the spring semester as described below), a Supervising Committee is appointed for each student (except non-thesis MS students) based upon mutual agreement between student and
faculty. The Supervising Committee, with the Supervising Professor as chairperson, will help the student plan an elective course curriculum and will oversee the student’s research and thesis or dissertation.

Master of Science in Molecular and Cell Biology

36 hours minimum

All students seeking the Master of Science degree in Molecular and Cell Biology must satisfactorily complete a total of at least 36 graduate semester hours, which must include the following core courses:

Core Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>BIOL 5410</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>BIOL 5420</td>
<td>Molecular Biology</td>
</tr>
<tr>
<td>BIOL 5430</td>
<td>Mathematical Biology</td>
</tr>
<tr>
<td>BIOL 5440</td>
<td>Cell Biology</td>
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</tbody>
</table>

MS students intending to submit a thesis must, in addition to the core courses specified above, satisfactorily complete a further 20 hours of Biology courses which includes BIOL 6193 Colloquium in Molecular and Cell Biology, BIOL 8V01 Research in Molecular Biology, BIOL 6V98 Thesis, and a minimum of 6 credit hours of general electives for which a letter grade is assigned. The remainder of the credit hours usually reflects experimental research but may also be based on literature research as determined by mutual agreement of the student and Supervising Committee. For MS (thesis) students, the maximum number of Pass/Fail credits allowed within the 36 credit hour minimum is 13 semester credit hours.

MS (non-thesis) students must, in addition to the core courses specified, satisfactorily complete a minimum of four general elective courses in Biology (for which a letter grade is assigned) for a minimum of 9 credit hours, up to 11 semester credit hours of special electives, and/or, with approval of the graduate advisor, other graduate courses. For non-thesis MS students, the maximum number of Pass/Fail credits allowed within the 36 credit hour minimum is 11 semester credit hours.

A Master of Science Degree in Biotechnology is also offered through the Department of Molecular and Cell Biology.

In addition to the above Master of Science Degrees, a Master of Science in Bioinformatics and Computational Biology (BCBM) is offered jointly by the Departments of Mathematics and Molecular and Cell Biology. This program combines coursework from the disciplines of biology, computer science, and mathematics. Faculty from both Mathematics (MMS) and Molecular and Cell Biology (MCB) participate in the Bioinformatics and Computational Biology program, with the Mathematics Department serving as the administrative unit. Both departments participate in advising students.

See the Department of Mathematics for more information on this degree program.
Master of Science in Bioinformatics and Computational Biology

36 hours minimum

The Master of Science in Bioinformatics and Computational Biology (BCBM) is offered jointly by the Departments of Mathematical Sciences and Molecular and Cell Biology. This program will combine coursework from the disciplines of biology, computer science, and mathematics. The BCBM program seeks to answer the demand for a new breed of scientist who has fundamental understanding in the fields of biology, mathematics, statistics, and computer science. With this interdisciplinary training, these scientists will be well prepared to meet the demand and challenges that have arisen and will continue to develop in the biotechnology arena.

Complete information about the Master of Science in Bioinformatics and Computational Biology (BCBM) Program is available at catalog.utdallas.edu/2013/graduate/programs/nsm/bioinformatics-and-computational-biology.

Doctor of Philosophy in Molecular and Cell Biology

75 hours minimum beyond the baccalaureate degree

All PhD students must satisfactorily complete a total of at least 75 credit hours beyond the bachelor's degree. All core courses are mandatory. Students must include a minimum of four general elective courses in Biology (for which a letter grade is assigned) for a minimum of 9 credit hours. After core courses, BIOL 5410 Biochemistry, BIOL 5420 Molecular Biology, BIOL 5430 Mathematical Biology, and BIOL 5440 Cell Biology [and, in addition, two laboratory rotations, BIOL 6V02 The Art of Scientific Presentation, and BIOL 6193 Colloquium in Molecular and Cell Biology] have been completed, students are evaluated following the spring semester. The evaluation is based upon performance in the core classes, laboratory rotations, and performance as teaching assistants (if applicable). Students who pass this evaluation must then pass an oral qualifying examination within three semesters to determine the student's aptitude for continuation of dissertation research. A dissertation defense will be conducted after the dissertation has been written. All students are required to submit a minimum of one manuscript for publication in an internationally recognized, peer-reviewed scientific journal. There is no foreign language requirement.

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