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## **Foreword**

The advancement of medical knowledge depends on the training of intellectually stimulated, innovative scientists who will serve as leaders of biomedical research in the future. The goal of UT Southwestern Graduate School of Biomedical Sciences is to give outstanding students the opportunity and the encouragement to investigate rigorously and to solve significant problems creatively in the biological, physical, and behavioral sciences.

To attain excellence in science, today's graduate students also must master the art of communication; therefore, students in the Graduate School of Biomedical Sciences have many opportunities to express their ideas orally and in writing to others within the scientific community.

The Graduate School has two Divisions: Basic Science and Clinical Science. These Divisions include the following specific areas of graduate studies: Biological Chemistry; Biomedical Engineering; Cancer Biology; Cell and Molecular Biology; Clinical Psychology; Clinical Sciences; Genetics, Development and Disease; Immunology; Integrative Molecular and Biomedical Sciences; Molecular Biophysics; Molecular Microbiology; Neuroscience; and Organic Chemistry. The Graduate School is continually developing new Programs, described on the website at [www.utsouthwestern.edu/graduateschool/index.html](http://www.utsouthwestern.edu/graduateschool/index.html).

Although enrolled in a specific Program area, a graduate student is not restricted to courses in that area. Exposure to a wide variety of academic disciplines is necessary to prepare the student for rapidly changing emphases in biomedical sciences. Graduate students at the medical center gain a wide perspective of contemporary biomedical science through interdisciplinary courses, seminars, and informal discussions involving students and faculty from all three component schools – UT Southwestern Graduate School of Biomedical Sciences, UT Southwestern Medical School, and UT Southwestern School of Health Professions.

The opportunity for graduate students and postdoctoral scholars to obtain advanced training in the laboratories of faculty members doing cutting-edge research fosters an ability to make significant contributions to the advancement of our understanding of the basis of disease processes that are the targets of contemporary medical research.

## **UT SOUTHWESTERN GRADUATE SCHOOL OF BIOMEDICAL SCIENCES**

The members of the Graduate School faculty are also members of the faculty of either UT Southwestern Medical School or UT Southwestern School of Health Professions. The major portion of research for graduate degrees is performed in the laboratories of these faculty members.

As it has matured into a separate entity of academic distinction, the Graduate School of Biomedical Sciences has benefited from the talents of the basic-science faculty of the Medical School, noted for its innovative contributions to research and teaching methods. Twenty-two faculty members have been elected to membership in the National Academy of Sciences, and six have won the Nobel Prize. These and their fellow faculty members, while internationally recognized leaders in their fields of study, foster a uniquely close-knit research environment on a campus noted for its congeniality and collaborations. As UT Southwestern continues to grow, talented new faculty members are recruited to keep the Medical Center at the forefront of biomedical research.

Many faculty members are serving currently or have served recently as heads of national professional societies, as editorial board members of major scientific publications, and as members of study sections and scientific review panels under the auspices of the National Institutes of Health, the National Science Foundation, and other disease-focused nonprofit organizations.

Throughout their course of advanced instruction, students and postdoctoral scholars in the Graduate School remain in close contact with faculty members and enjoy the highly interactive atmosphere promoted by faculty at all ranks. Courses of study are designed to develop individual abilities in an atmosphere encouraging maximal intellectual interchange between students and mentors.

Graduates of UT Southwestern have obtained postdoctoral fellowships at institutions such as Harvard University, Rockefeller University, Johns Hopkins University, Yale University, University of California San Francisco, Washington University, and the Salk Institute and have gone on to faculty positions at Harvard University, Duke University, University of Pittsburgh, University of Pennsylvania, University of North Carolina at Chapel Hill, and UT Southwestern. Others play key roles in scientific administration and/or research at pharmaceutical corporations and private industry leaders. Two UT Southwestern alumni have been awarded a Nobel Prize (Joseph Goldstein, M.D., Medical School, 1966; and Linda Buck, Ph.D., Graduate School, 1980).

### **ACCREDITATION**

Institutional accreditation for The University of Texas Southwestern Medical Center is contained within the “General” section of the catalog. Graduate School Programs with specific accreditations also may be cited within the Program sections.

## **SCHOOL LEADERSHIP**

- Academic Administration

Charles M. Ginsburg, M.D.  
Vice Provost and Senior Associate Dean for Education

Andrew Zinn, M.D., Ph.D.  
Graduate School Dean

Stuart E. Ravnik, Ph.D.  
Associate Dean

Nancy E. Street, Ph.D.  
Associate Dean

Deirdre Brekken, Ph.D.  
Assistant Dean

Lisa Gardner, Ph.D.  
Assistant Dean

Natalie Lundsteen, Ph.D.  
Assistant Dean

Christine Weirich, Ph.D.  
Fellowship Coordinator

## **GRADUATE DEGREE PROGRAMS**

### **DIVISION OF BASIC SCIENCE**

#### **Objectives**

The scope of basic biomedical science encompasses areas as diverse as molecular biology on the one hand and physical chemistry on the other. The Division of Basic Science at UT Southwestern covers this broad range with specialized studies in biological chemistry, cancer biology, cell biology, cell regulation, chemistry, computational and systems biology, genetics and development, immunology, integrative molecular and biomedical sciences, mechanisms of disease, molecular biophysics, molecular microbiology, neuroscience, organic

chemistry, and pharmacological sciences. The Programs are interdisciplinary by design, and each reflects an area of research strength of the Graduate School faculty.

The most important element shared by the Programs is an intense and exciting research experience in an active, productive, and critical scientific environment. This is the essence of graduate education at UT Southwestern. The goal of the Division is to provide both a broad, integrated understanding of contemporary biomedical science and in-depth training in a specific area that the student chooses as his or her field of research.

## **Curriculum**

During the first semester, students enrolled in the Division participate in the Core Curriculum, which offers an integrated approach to the study of biochemistry, biophysics, molecular biology, genetics, biological regulation, cell biology, and organismal biology appropriate for students with interests in any area of study. Coursework is supplemented by a rich schedule of seminars offered on wide-ranging topics. A substantial benefit of this approach is to prepare students for the increasingly interdisciplinary nature of biomedical science.

The standard first-year curriculum also includes completion of at least two laboratory rotations, each lasting approximately eight to 10 weeks. A student may select any member of the Division's faculty as a preceptor for each research rotation. The topics of research rotations can be as similar or wide-ranging as the student wishes. The rotations provide students opportunities to experience different research questions, approaches, and experimental techniques. Overall, the design of the curriculum also fosters exposure to many of our basic-science faculty who participate in one or more of the components of the first-year curriculum. Advice is available to students who desire guidance in choosing faculty mentors with whom to conduct their research.

In order to foster flexibility and allow an informed choice of the most appropriate Program for advanced study, a specific program and a dissertation research adviser are not selected until the end of rotations.

During the second half of the first semester and subsequent years of study, students immerse themselves in advanced didactic training organized by the faculty of individual Programs and focus on developing a research project. A coordinated design of advanced, specialized course work is another characteristic of the Division's integrative approach to graduate education. Advanced courses include those with pan-Program appeal, as well as a variety of more specialized courses. Curriculum Committees from all of the Programs work together to ensure the existence of an appropriate range of advanced courses, which are scheduled in a manner to facilitate accessibility. Although the Programs of the Division share a common administrative organization, each is distinct in terms of advanced course work and other degree requirements. Specific information is located in the individual Program descriptions.

## **Facilities**

The laboratories of the faculty members of the Division of Basic Science, along with the support laboratories available for their use, provide access for students to the equipment and facilities required for contemporary biomedical research. A central computing facility, animal facilities, an electronic shop, and a comprehensive library are available. There are core research facilities and services for DNA microarray analysis, molecular and cellular imaging, transgenic animals, flow cytometry, structural biology, protein chemistry, mass spectrometry, rapid biochemical kinetics, analytical ultracentrifugation, DNA sequencing, and antibody production.

First-year students are accommodated in a suite of rooms containing a lounge area with kitchen, a conference room, and administrative offices.

## **Financial Assistance**

All students in the Division of Basic Science are supported during their Ph.D. studies. A competitive stipend adequate to cover living costs, tuition, and health insurance coverage is provided.

## **Requirements for Admission**

Students wishing to enroll in any of the component Programs should apply to the Division of Basic Science. Applicants must submit a formal application, including a statement of educational and professional goals; a brief description of research experience; transcripts of undergraduate and prior graduate work; and a minimum of three letters of recommendation which must be from professors capable of assessing the applicant's scientific aptitude.

Foreign students whose native language is not English must submit TOEFL scores. Application information, including direct online application, is available on the UT Southwestern Web site, [www.utsouthwestern.edu/graduateschool/index.html](http://www.utsouthwestern.edu/graduateschool/index.html).

Students matriculate in the fall. Successful applicants generally have a GPA above 3.0 on a 4.0 scale. Most entering foreign students have had TOEFL scores higher than 100.

Under special circumstances, appropriately qualified students may be admitted to advanced standing in one of the Division's Programs without taking the first-year core curriculum; for example, a student with equivalent coursework and research experience gained at another institution.

Students enrolled in the Medical Scientist Training Program at UT Southwestern typically are admitted to advanced standing in one of the Programs based on satisfactory completion of the first two years of the Medical School curriculum and completion of the MSTP research rotations.

## **General Requirements for the Ph.D. Degree**

It is a requirement of the Division that students satisfactorily complete a minimum of 21 credit hours of didactic coursework. The Core Curriculum and Ethics modules are to be supplemented by advanced didactic coursework compatible with the student's Graduate Program of choice. The advanced courses are usually completed by the end of the second year of study and must be completed by the end of the third year. In addition, satisfactory completion of two laboratory-rotations projects is a Division requirement. Graduate Programs specify participation in Journal Clubs and seminars.

Each student must pass a qualifying examination conducted by the relevant Graduate Program. Satisfactory completion of the required coursework, the research rotations and a qualifying examination advances the student to candidacy for the degree. Completion of the dissertation research, its successful defense at an oral examination, and submission to UT Southwestern Graduate School of Biomedical Sciences of an approved electronic dissertation complete the requirements for the degree.

## **Course Descriptions**

### **5284, 5285, & 5287 CORE CURRICULUM**

The dissolution of many boundaries between the classical disciplines of the biological sciences prompted the faculty of the Division of Basic Science to develop a flexible and modern Core Curriculum that offers the broad education now necessary as a foundation for more specialized studies in biomedical research. The Core Curriculum presents first-year students with an integrated view of contemporary biology that begins at the level of individual molecules and progresses through an analysis of the complex structures and functions of differentiated cells.

The Core Curriculum focuses on basic genetics, macromolecular structure and function, and cellular organization. The curriculum places a major emphasis on developing the student's ability to understand and evaluate scientific papers and seminars. To this end, didactic teaching is augmented by frequent literature reviews and experimental design sessions. These activities encourage students to solve problems and make connections between and among diverse topics and experimental approaches. Significant time is spent analyzing the design, execution, and interpretation of experiments.

The course is 16 weeks long (August through December) and is letter-graded.

### **5197 & 5198 ETHICS**

All graduate students are required to receive training in ethics and responsible conduct of research. The goal is to effect a culture change by incorporating ethics, survival skills, and professional development using several strategies. Courses offered in the fall and spring

semesters of the first year and the fall semester of the second year include topics such as institutional policies and expectations, plagiarism, animal and human research, everyday scientific practice, authorship, data management, conflict of interest, technology transfer, and peer review.

### **5080 RESEARCH ROTATION**

Students participate in two to three research experiences in different laboratory settings. Choice of laboratories is determined by the student, although advice from faculty is available. The goals of these laboratory rotations are to broaden exposure to experimental biology, to sharpen laboratory skills, and to facilitate the choice of an area for dissertation research. The student is expected to maintain a proper laboratory notebook; to participate actively in the design, conduct, and interpretation of experiments; and to provide a written or oral summary of the rotation experience. Each rotation is evaluated in writing by the faculty preceptor, and the course is graded pass or fail.

### **SPECIALIZED AND SUPPLEMENTAL CURRICULA**

Courses in mathematical methods and advanced biostatistics are offered to all students whose research requires specialized curriculum. Information about these courses may be found at:

<http://www.utsouthwestern.edu/education/graduate-school/programs/phd-degrees/specialized--supplemental-phd/computational-and-systems-biology/course-descriptions.html>

Students wishing to gain competencies to prepare them to participate in translational research may apply to the Mechanisms of Disease and Translational Research special emphasis curriculum with their application for admission to the Division of Basic Science. Information about this curriculum may be found at:

<http://www.utsouthwestern.edu/education/graduate-school/programs/phd-degrees/specialized--supplemental-phd/mechanisms-of-disease/>

## **Courses Offered by all Division Programs**

### **5094 RESEARCH**

Students enroll in this course while conducting dissertation research prior to being admitted to candidacy. May be repeated for credit.

### **5095 CONTEMPORARY TOPICS**

One or more courses are offered in the format of a journal club on topics related to the individual Program. These courses offer students an opportunity to keep abreast of recent



research results, to sharpen critical appraisal skills, and to develop public-speaking skills. May be repeated for credit.

### **5096 DIRECTED STUDY**

Selected faculty members of each Program provide tutorials for advanced analysis of a chosen topic. The format is determined by each Program but may incorporate any of the following: directed readings and discussions, lectures, laboratory work, and attendance at seminars and conferences. May be repeated for credit.

### **5097 SEMINAR**

In this course each student presents discussions of a selected topic or of an aspect of his or her ongoing research. The interpretation of results and critical analysis of experimental data are emphasized. May be repeated for credit.

### **5098 THESIS RESEARCH**

Students enroll in this course while conducting thesis research leading to a master's degree.

### **5099 DISSERTATION RESEARCH**

Students enroll in this course while conducting research leading to a Ph.D. degree.

## **Advanced Didactic Course Descriptions**

Although enrolled in a specific Program area, the graduate student is not restricted to courses in that area. Course requirements and descriptions are listed in the degree plans of each Graduate Program.

## **BIOLOGICAL CHEMISTRY**

### **Chair, Graduate Program**

Benjamin P. Tu, Ph.D.

### **Degree Offered**

**Doctor of Philosophy**

## **FACULTY**

## **Professors**

Chuo Chen, Ph.D., Harvard University, 2001  
David Chuang, Ph.D., Utah State University, 1970  
David R. Corey, Ph.D., University of California, Berkeley, 1990  
Russell DeBose-Boyd, Ph.D., University of Oklahoma Health Science Center, 1988  
George N. DeMartino, Ph.D., University of Rochester, 1976  
J. Russell Falck, Ph.D., Imperial College, London, 1974  
Mark A. Lehrman, Ph.D., Duke University, 1982  
Steven L. McKnight, Ph.D., University of Virginia, 1977  
Carole R. Mendelson, Ph.D., Rutgers University, 1970  
Kim Orth, Ph.D., UT Southwestern Medical Center, 1993  
Margaret A. Phillips, Ph.D., University of California, San Francisco, 1988  
Vanessa Sperandio, Ph.D., State University of Campinas, Brazil, 1995  
Diana Tomchick, Ph.D., University of Wisconsin, Madison, 1990  
Kosaku Uyeda, Ph.D., University of California, Berkeley, 1962  
Noelle Williams, Ph.D., University of Virginia Health Sciences Center, 1996

## **Associate Professors**

Igor Butovich, Ph.D., Institute of Physical Chemistry, Ukraine, 1985  
Nicholas K. Conrad, Ph.D., Johns Hopkins University, 2001  
Ivan D'Orso, Ph.D., Universidad Nacional De San Ma, 2003  
Marie-Alda Gilles-Gonzalez, Ph.D., Massachusetts Institute of Technology, 1988  
Wen-Hong Li, Ph.D., University of California, San Diego, 1996  
Qinghua Liu, Ph.D., Baylor College of Medicine, 2000  
Jeffrey McDonald, Ph.D., Indiana University, 2002  
Anthony Michael, Ph.D., University of East Anglia (John Innes Institute), 1988  
Uttam Tambar, Ph.D., California Institute of Technology, 2006  
Benjamin P. Tu, Ph.D., University of California, San Francisco, 2003  
Jin Ye, Ph.D., UT Southwestern Medical Center, 2000  
Yonghau Yu, Ph.D., University of California, Berkley, 2006  
Qing Zhong, Ph.D., UT Health Science Center, 2001

## **Assistant Professors**

John Hulleman, Ph.D., Purdue University, 2008  
Jennifer J. Kohler, Ph.D., Yale University, 2000  
Weibo Luo, Ph.D., University of Magdeburg, Germany, 2007  
David McFadden, M.D., Ph.D., UT Southwestern Medical Center, 2004  
Peter Michaely, Ph.D., Duke University, 1995  
Hamid Mirzaei, Ph.D., Purdue University, 2005  
Yunsun Nam, Ph.D., Harvard University, 2006

Deepak Nijhawan, M.D./Ph.D., UT Southwestern Medical Center, 2005

Arun Radhakrishnan, Ph.D., Stanford University, 2002

Fei Wang, Ph.D., University of Massachusetts-Amherst, 2011

Kenneth Westover, M.D./Ph.D., Stanford University, 2007

## **Objectives**

The Biological Chemistry Graduate Program at UT Southwestern offers state-of-the-art training in biochemistry and molecular biology with the goal of preparing students to make significant research contributions at the interface of chemistry and biology. Faculty within the Program are actively engaged in researching a wide range of topics, including enzymology, RNA-mediated cellular processes, hormone receptors, metabolism, small-molecule control of cellular function, and drug discovery.

A characteristic of UTSW's scientific environment is the close proximity of basic science and clinical departments. The extensive collaborations of the Program faculty with faculty of clinical departments provide additional opportunities for students to contribute significantly to research with direct patient and medical relevance. Faculty members of the Program are also well recognized in their fields and maintain a lively communication with colleagues around the world. Numerous seminars by outstanding visiting scientists also are offered and are a vital component of the educational experience.

## **Special Requirements for Admission**

Students wishing to join the Biological Chemistry Graduate Program must be enrolled in the Division of Basic Science and be in good standing academically. It is not necessary for a student within the Program to choose a mentor who is a faculty member of the Program, provided that the student has sound reasons for this choice. Students ordinarily will apply for formal admission to the Program after completing the first-year curriculum but may participate in the Program informally at any time after successful admission into the Division of Basic Science.

The Biological Chemistry Program is designed to train students in theory and techniques related to the molecular mechanisms that control cellular activities. Topics encompassed within the Program include gene regulation, RNA-mediated processes, protein interactions, enzyme functions, cellular metabolism, and drug discovery.

## **Curriculum**

Students in the Biological Chemistry Graduate Program must satisfactorily complete the core curriculum offered in the fall term and two laboratory rotations. In the rest of the first year, students are expected to complete 7.5 credit hours of advanced course work, which require a grade average of B or better. Three credit hours consist of two required courses; the additional 4.5 hours may be selected from offerings by other Programs within the Division of

Basic Science. For exceptional reasons, these course requirements may be altered with permission of the Program Chair. In addition, students participate in a student seminar and Journal Club each semester.

Near the end of the second year, students take a qualifying examination that consists of an oral defense of an original written research proposal. Admission to candidacy for the Ph.D. degree requires satisfactory performance in the core and advanced courses, the qualifying examination, and research.

### **ADVANCED COURSES**

Course requirements and descriptions are listed here:

<http://www.utsouthwestern.edu/education/graduate-school/programs/phd-degrees/biological-chemistry/course-descriptions.html>

### **Student Research Seminar**

Weekly Works-In-Progress seminars provide a format in which students are encouraged to think critically about their own research and how it relates to related topics in biochemistry. Students receive critical feedback and suggestions from students and faculty with a range of biochemical expertise as well as gaining experience with formal presentations, a critical skill for a successful scientist. Several faculty mentors attend regularly and assist in facilitating discussion of the research presented. All track students are required to attend the WIP series weekly and to actively participate in the discussions, in addition to presenting their ongoing research once each year.

WIPs are designed to generate feedback and suggestions for students regarding their research from a diverse audience and to provide experience with formal presentations, a critical skill for successful scientists. Faculty mentors attend regularly and facilitate discussion of the research presented.

Journal Club presentations provide a forum for students to learn and describe an area of chemistry not directly related to their thesis topics. This forum aims to broaden students' knowledge and sophistication regarding important areas in synthetic chemistry. Topics are chosen by students in consultation with thesis advisers. Postdoctoral fellows also have an opportunity to present Journal Clubs.

### **Dissertation Committee**

The Dissertation Committee oversees the scientific progress of students toward the completion of their degrees. Faculty members on the Committee are selected for expertise in the thesis area so they can contribute substantial intellectual insight in direction of the project. The Committee must have at least four members, including the thesis advisor, and at least two

must be Program faculty. The Committee meets at least once a year to provide guidance and advice and to ensure a student's satisfactory progression toward a degree.

### **Qualifying Examination**

The qualifying examination evaluates the student's ability to develop a hypothesis-based research proposal that addresses a specific question in modern biochemistry. The proposal must be presented in written and oral forms. To distinguish the student's abilities from those of the dissertation advisor, the student may not prepare a proposal related to his or her dissertation research or to research being carried out by other members of the student's laboratory. The examination tests the student's ability to defend work described in the proposal and to demonstrate an understanding of the underlying concepts, experimental approaches and designs, and their limitations. Advancement to Ph.D. candidacy depends on successful completion of the oral proposal examination. The qualifying examination process takes place during the late spring of the first year in the Program after course work is completed.

## **BIOMEDICAL ENGINEERING**

**(Joint Program with University of Texas at Arlington or University of Texas at Dallas)**

### **Chair, UT Southwestern Graduate Program**

W. Matthew Petroll, Ph.D.

### **Degrees Offered**

#### **Doctor of Philosophy**

### **UTSW Faculty**

#### **Professors**

Jeffrey A. Cadeddu, M.D., Johns Hopkins University, 1993

Changho Choi, Ph.D., Korea University, 1989

Robert C. Eberhart, Ph.D., University of California, Berkeley, 1965

Jinming Gao, Ph.D., Harvard University, 1996

Gerald Greil, M.D., Technical University of Munich, Germany, 1994; Ph.D., University of Tübingen, Germany, 2007

Connie C.W. Hsia, M.D., University of Toronto Faculty of Medicine, 1982

Michael E. Jessen, M.D., University of Manitoba, Canada, 1981

Steve Jiang, Ph.D., Medical College of Ohio, Toledo, 1998

Lawrence Lavery, D.P.M., Rosalind Franklin University of Medicine and Science, 1988

William Lee, M.D., Columbia University College of Physicians and Surgeons, 1967

Robert Lenkinski, Ph.D., University of Houston, 1973  
Craig R. Malloy, M.D., University of California, San Francisco, 1977  
Ralph P. Mason, Ph.D., University of Cambridge, England, 1986  
Robert Mattrey, M.D., State University of New York at Buffalo, 1978  
Paul Medin, Ph.D., University of California, Los Angeles  
Orhan K. Oz, M.D., Ph.D., Stanford University, 1991  
Ivan Pedrosa, M.D., Universidad Complutense de Madrid, 1994  
W. Matthew Petroll, Ph.D., University of Virginia, 1989  
Neil Rofsky, M.D., New York Medical College, 1985  
A. Dean Sherry, Ph.D., Kansas State University, 1971  
Rathan Subramaniam, M.D., Ph.D., University of Melbourne, 1997

### **Associate Professors**

Shawn C. Burgess, Ph.D., UT Dallas, 1997  
Jonathan Cheng, M.D., Baylor College of Medicine, 2000  
Rajiv Chopra, Ph.D., University of Toronto, Canada, 2002  
Xuejun Gu, Ph.D., Columbia University, 2009  
Mohammed Hussain, M.D., University of Cambridge, 1999, Ph.D., King's College, London  
Zoltan Kovacs, Ph.D., Lajos Kossuth University, Debrecen, Hungary, 1992  
Wen-Hong Li, Ph.D., University of California, San Diego, 1996  
Weiguo Lu, Ph.D., University of Wisconsin, Madison, 2001  
Roderick W. McColl, Ph.D., University of Warwick, England, 1992  
Alan Nugent, M.D., University of Melbourne, 1991  
Matthias Peltz, M.D., UT Southwestern Medical Center, 1999  
Debabrata Saha, Ph.D., University of Nebraska, 1997  
Jay Schneider, M.D., Ph.D., Yale University School of Medicine, 1989, 1990  
Baran Sumer, M.D., Case Western Reserve University, 2001  
Xiankai Sun, Ph.D., University of New Hampshire, 2000  
Masaya Takahashi, Ph.D., Hokkaido University, Japan  
Yulong Yan, Ph.D., Nanjing University, China, 1988

### **Assistant Professors**

Asaithamby Aroumougame, Ph.D., Banaras Hindu University, India, 1999  
Ian R. Corbin, Ph.D., M.Sc., University of Manitoba, 2002  
Reto Fiolka, Ph.D., ETH, Zurich, 2009  
Matthew A. Lewis, Ph.D., UT Southwestern Medical Center, 2002  
Jacques Lux, Ph.D., University of Strasbourg, France, 2009  
Ananth Madhuranthakam, Ph.D., Mayo Graduate School, 2005  
Hamid Mirzaei, Ph.D., Purdue University, 2005  
Albert Montillo, Ph.D., University of Pennsylvania, 2004  
Animesh Tandon, M.D., M.S., University of Michigan Medical School, 2008

Elena Vinogradov, Ph.D., Weizmann Institute of Science, Israel, 2003  
Jing Wang, Ph.D., State University of New York at Stony Brook, 2006  
Che Xu, Ph.D., UT Arlington, 2008

## Objectives

Biomedical Engineering (BME) is an interdisciplinary science that employs engineering methods and approaches to define and solve biological problems. The UT Southwestern Medical Center BME Program has an emphasis on the development of advanced procedures and technologies that facilitate both basic biomedical research and the detection, diagnosis, and treatment of disease and disability. Biomedical Engineering is part of a joint graduate program between UT Southwestern, UT Arlington, and UT Dallas. In addition, the Program has close ties with a number of high-tech industries in the Dallas/Fort Worth area, thus offering a robust set of resources for biomedical research and education.

The Biomedical Engineering Program has more than 40 faculty members from both basic science and clinical departments at UT Southwestern, whose research covers a broad range of fundamental and applied bioengineering research. The BME Program promotes a collaborative, multidisciplinary environment, with a focus on providing the highest-quality education and training for our students.

The UT Southwestern BME Program features four research and teaching tracks:

- \* [Biomedical and Molecular Imaging](#)
- \* [Biomaterials, Mechanics, and Tissue Engineering](#)
- \* [Molecular and Translational Nanomedicine](#)
- \* [Medical Physics](#)

## Curriculum

Ph.D. students are required to complete a minimum of 27 hours of advanced coursework, which includes track-specific engineering and life science courses. In addition, students attend the monthly biomedical engineering seminar series (given by faculty), and a weekly Works-In-Progress course in which students have the opportunity to present and discuss their own research. First-year students complete a Core Curriculum that includes track-specific courses, at least two laboratory rotations, and training in the responsible conduct of research.

All doctoral students must pass three examinations. Exam I is a qualifying exam, usually given during their second year. It consists of a written examination, based on a broad problem in the area of the student's research, and an oral examination in which the student critiques

and defends their written response. Successful completion of the qualifying examination is required to advance to candidacy for the PhD. Exam II consists of a detailed written prospectus of the proposed dissertation research and an oral defense of the proposal. Exam III is the final defense of the completed dissertation.

A Supervisory Research Committee is formed for each doctoral candidate. This Committee reviews and evaluates the student's progress and participates in the proposal and dissertation defenses.

## **ADVANCED COURSES**

Course requirements and descriptions are listed here:

<http://www.utsouthwestern.edu/education/graduate-school/programs/phd-degrees/biomedical-engineering/curriculum.html>

Because of the interdisciplinary nature of the Program, students may also take other courses from the Division of Basic Science at UT Southwestern, as well as graduate level classes at \*UT Arlington and \*\*UT Dallas. Thus, the above list represents only a portion of the many courses available to students.

\* <http://catalog.uta.edu/engineering/bio/graduate/#masterstext>)

\*\* <http://catalog.utdallas.edu/now/graduate/courses/bmen>)

## **CANCER BIOLOGY**

### **Chair, Graduate Program**

Rolf A. Brekken, Ph.D.

### **Degree Offered**

### **Doctor of Philosophy**

## **FACULTY**

### **Professors**

John M. Abrams, Ph.D., Stanford University, 1989



Rolf A. Brekken, Ph.D., UT Southwestern Medical Center, 1999  
James Brugarolas, M.D., University of Navarra, Spain, 1993; Ph.D., Massachusetts Institute of Technology, 1998  
Diego Castrillon, M.D., Ph.D., UT Southwestern Medical Center, 1996  
David Chen, Ph.D., University of Missouri, Columbia, 1978  
Cheng-Ming Chiang, Ph.D., University of Rochester, 1991  
Melanie H. Cobb, Ph.D., Washington University, St. Louis, 1976  
David R. Corey, Ph.D., University of California, Berkeley, 1990  
Gaudenz Danuser, Ph.D., Swiss Federal Institute of Technology, 1997  
Ralph DeBerardinis, M.D., Ph.D., University of Pennsylvania, 2000  
Jef K. DeBrabander, Ph.D., University of Ghent, Belgium, 1993  
Beatriz M.A. Fontoura, Ph.D., New York University School of Medicine, 1996  
Jinming Gao, Ph.D., Harvard University, 1996  
Robert E. Hammer, Ph.D., Wayne State University, 1981  
Jer-Tsong "J.T." Hsieh, Ph.D., University of Wisconsin, Madison, 1989  
Jin Jiang, Ph.D., Columbia University, 1992  
Beth Levine, M.D., Cornell University Medical College, 1986  
Guo-Min Li, Ph.D., Wayne State University, 1991  
Ralph P. Mason, Ph.D., University of Cambridge, England, 1986  
Joshua Mendell, M.D., Ph.D., Johns Hopkins University, 2004  
John D. Minna, M.D., Stanford University, 1967  
Sean Morrison, Ph.D., Stanford University, 1996  
Jerry Y. Niederkorn, Ph.D., University of Arkansas, 1977  
Ganesh Raj, M.D., Ph.D., Jefferson Medical School, 1997  
Theodora Ross, M.D., Ph.D., Washington University, St. Louis, 1993  
Michael G. Roth, Ph.D., University of Alabama at Birmingham, 1982  
Jerry W. Shay, Ph.D., University of Colorado at Boulder, 1975  
Stephen Skapek, M.D., Duke University School of Medicine, 1988  
Michael Story, Ph.D., Colorado State University, 1989  
Woodring E. Wright, Ph.D., M.D., Stanford University School of Medicine, 1974, 1975

### **Associate Professors**

James Amatruda, M.D., Ph.D., Washington University, St. Louis, 1993  
Sandeep Burma, Ph.D., National Institute of Immunology, India, 1995  
Benjamin Chen, Ph.D., Ohio State University, 1996  
Amyr Habib, M.D., Dow Medical College, Pakistan, 1986  
Jun-Shen "Lily" Huang, Ph.D., University of California, San Diego, 1997  
Ralf Kittler, Ph.D., Dresden University of Technology & Max Planck Institute for Molecular Cell Biology and Genetics, 2006  
Pier Paolo Scaglioni, M.D., University of Modena, Italy, 1989  
Joachim Seemann, Ph.D., Max-Planck Institute, Germany, 1996  
Yihong Wan, Ph.D., University of Colorado Health Science Center, Denver, 2002

Angelique Whitehurst, Ph.D., UT Southwestern Medical Center, 2004  
Thomas Wilkie, Ph.D., University of Washington, 1986  
Yang Xie, Ph.D., University of Minnesota, 2006  
Qing Zhong, M.D., Peking Union Medical College, 1995; Ph.D., UT Health Science Center, San Antonio, 2001

### **Assistant Professors**

Todd Aguilera, M.D., Ph.D., UC San Diego, 2011  
Ezra Akbay, Ph.D., UT Southwestern Medical Center, 2010  
Asaithamby Aroumougame, Ph.D., Banaras Hindu University, India, 1999  
Maralice Conacci-Sorrell, Ph.D., Weizmann Institute of Science, Israel, 2005  
Ian Corbin, Ph.D., University of Manitoba, Canada, 2002  
Anthony Davis, Ph.D., UT Southwestern Medical Center, 2006  
Jenna Jewell, Ph.D., Indiana University, Indianapolis, 2010  
Daehwan Kim, Ph.D., University of Maryland, 2013  
James Kim, M.D., Ph.D., University of Rochester, NY, 1999  
Weibo Luo, Ph.D., Otto-von-Guericke University of Magdeburg, Germany, 2007  
Srinivas Malladi, Ph.D., UT Austin, 2010  
Ram Mani, Ph.D., Jawaharlal Nehru Center for Advanced Scientific Research, India, 2006  
Elisabeth Martinez, Ph.D., Georgetown University, 2002  
Saikat Mukhopadhyay, M.D., Banaras Hindu University, 2002; Ph.D., Brandeis University, 2008  
Kathryn A. O'Donnell, Ph.D., Johns Hopkins University, 2005  
Daniel Siegwart, Ph.D., Carnegie Mellon University, 2008  
Richard Wang, M.D., Ph.D., Stanford University, 2007  
Zhigao Wang, Ph.D., UT Southwestern Medical Center, 2004  
Kenneth Westover, M.D., Ph.D., UT Southwestern Center, 2007  
Angelique Whitehurst, Ph.D., UT Southwestern Medical Center, 2004  
Jian Xu, Ph.D., University of California, Los Angeles, 2008  
Hasan Zaki, Ph.D., Kumamoto University, Japan, 2007  
Hao Zhu, M.D., Harvard Medical School, 2005

### **Objectives**

The Cancer Biology Graduate Program provides multidisciplinary training for the student interested in pursuing a research career in any aspect of cancer biology. The Program offers students state of the art training and research opportunities in the molecular and cellular aspects of cancer, the use of model organisms, genomics, mammalian biology and organ systems, cancer therapeutics and drug development relevant to cancer biology. The broad range of interests and expertise of faculty members enables students to experience multiple aspects of cancer research while developing deep knowledge and proficiency in areas germane to their dissertation research. Areas of expertise in Program labs include tumor

microenvironment, drug screening and development, apoptosis, tumor immunology, DNA repair, metastasis, metabolism and signal transduction, among others.

A characteristic of the scientific environment at UT Southwestern is the connection and proximity of basic and clinical Departments and faculty. This fosters a collaborative environment where Program trainees are exposed to clinical faculty and have opportunities to contribute to translational research projects. The collaborative environment on campus often extends beyond campus as many of our faculty maintain robust collaboration with laboratories around the globe. In addition to collaborative opportunities, trainees can attend seminars from outstanding visiting scientists through Cancer Center sponsored and Departmental seminars and symposia.

### **Special Requirements for Admission**

Students wishing to join the Cancer Biology Graduate Program must be enrolled in the Division of Basic Science and be in good standing academically. It is not necessary for a student within the Program to choose a mentor who is a faculty member of the Program, provided that the student has sound reasons for this choice. Students generally will apply for admission to the Program after completion of the first-year curriculum, but may participate in the Program informally at any time after successful admission into the Division of Basic Science.

### **Curriculum**

The Cancer Biology Graduate Program provides advanced courses, seminars, and supervised research based upon successful completion of the first-year Core Course in the Division of Basic Science. Each student entering the Program must successfully complete two advanced courses that provide a core of knowledge important to any cancer biologist: Cancer Biology I – Hallmarks of Cancer and Cancer Stem Cells; and Cancer Biology II – Advanced Concepts in Cancer Biology. In addition, students must enroll in 4.5 credit hours of course work offered by any of the graduate Programs in the Division of Basic Science. Finally, Cancer Biology students participate in an independent study course and must complete and pass a Cancer Biology Core Competency exam in the Fall of their second year in Graduate School. Passing the Core Competency exam and completion of Cancer Biology III – Cancer Biology Qualifying Exam and Hypothesis Driven Grant Writing are designed to prepare students for success in their qualifying exam, which will take place at the end of the second year of Graduate School. The qualifying exam consists of a written research proposal that is critiqued by and orally defended before an examination committee of Program faculty.

Successful completion of this examination is a prerequisite for admission to candidacy for the Ph.D. degree.

### **ADVANCED COURSES**

Course requirements and descriptions are listed here:

<http://www.utsouthwestern.edu/education/graduate-school/programs/phd-degrees/cancer-biology/course-descriptions.html>

### **Student Works-In-Progress**

Each semester, students participate in a “Works-in-Progress” seminar where they present their own work and listen to presentations from their peers. Students are encouraged to actively participate and engage presenters. The WIPs seminar series is vital to the Program and attendance is mandatory.

## **CELL AND MOLECULAR BIOLOGY**

### **Chair, Graduate Program**

Angelique Whitehurst, Ph.D.

### **Degree Offered**

### **Doctor of Philosophy**

## **FACULTY**

### **Professors**

Joseph P. Albanesi, Ph.D., Duke University, 1980  
Michael S. Brown, M.D., University of Pennsylvania, 1966  
Elizabeth Chen, Ph.D., Stanford University, 1998  
Cheng-Ming Chiang, Ph.D., University of Rochester, 1991  
Melanie H. Cobb, Ph.D., Washington University, St. Louis, 1976  
Gaudenz Danuser, Ph.D., Swiss Federal Institute of Technology, 1997  
Russell DeBose-Boyd, Ph.D., University of Oklahoma Health Science Center, 1998  
Joseph L. Goldstein, M.D., UT Southwestern Medical Center, 1966  
Joel M. Goodman, Ph.D., University of Southern California, 1980  
Carla Green, Ph.D., University of Kansas Medical Center, 1991  
Jer-Tsong “J.T.” Hsieh, Ph.D., University of Wisconsin, Madison, 1989  
Steven Kliewer, Ph.D., University of California, Los Angeles, 1990  
Mark A. Lehrman, Ph.D., Duke University, 1982  
David J. Mangelsdorf, Ph.D., University of Arizona, 1987  
Carole R. Mendelson, Ph.D., Rutgers University, 1970  
John D. Minna, M.D., Stanford University, 1967

Katherine Phelps, Ph.D., University of Colorado, Boulder, 1981  
Elliott M. Ross, Ph.D., Cornell University, 1975  
Michael G. Roth, Ph.D., University of Alabama, Birmingham, 1982  
David W. Russell, Ph.D., University of North Carolina at Chapel Hill, 1980  
Philipp E. Scherer, Ph.D., University of Basel, Switzerland, 1992  
Sandra Schmid, Ph.D., Stanford University, 1985  
Dean P. Smith, M.D., University of Utah, 1986; Ph.D., University of California, San Diego, 1992  
Lance Terada, Ph.D., University of Hawaii, Honolulu, 1983  
Helen L. Yin, Ph.D., Harvard University, 1976  
Hongtao Yu, Ph.D., Harvard University, 1995

### **Associate Professors**

Neal Alto, Ph.D., Oregon Health & Science University, 2003  
Jun-Shen "Lily" Huang, Ph.D., University of California, San Diego, 1997  
Daniela Nicastro, Ph.D., Ludwig-Maximilians-Universität, Munich, 2000  
Daniel Rosenbaum, Ph.D., Harvard University, 2005  
Joachim Seemann, Ph.D., Max-Planck Institute for Biochemistry, Germany, 1996  
Angelique Whitehurst, Ph.D., UT Southwestern Medical Center, 2004  
Gang Yu, Ph.D., University of Calgary, Canada, 1996

### **Assistant Professors**

James Collins, Ph.D., Washington University, St. Louis, 2008  
Maralice Conacci-Sorrell, Ph.D., Weizmann Institute of Science, 2005  
Konstantin Doubrovinski, Ph.D., University of Saarland, Saarbrücken, Germany, 2004  
Mike Henne, Ph.D., University of Cambridge, 2009  
Khuloud Jaqaman, Ph.D., Indiana University, Bloomington, 2003  
Jen Liou, Ph.D., University of California, San Francisco, 2001  
Denise Marciano, Ph.D., Rockefeller University, 1999; M.D., Cornell University Medical College, 2001  
Prashant Mishra, M.D., Ph.D., UT Southwestern Medical, 2007  
Michael Reese, Ph.D., University of California, San Francisco, 2006  
Vincent Tagliabracci, Ph.D., Indiana University, 2010  
Fei Wang, Ph.D., University of Massachusetts, Amherst, 2008  
Dawn Wetzel, M.D., Ph.D., Washington University School of Medicine, 2005

### **Description of the Discipline**

The Graduate Program in Cell and Molecular Biology provides training opportunities for students interested in the study of cellular functions ranging from molecular mechanisms to

functional behavior. The Program emphasizes an interdisciplinary approach to research, which covers a variety of areas, including but not limited to:

- Cell biology
- Molecular biology
- Pharmacology
- Physiology
- Systems biology
- Bioinformatics
- Biomathematics

Advanced courses, Journal Clubs, symposia, Works-In-Progress seminars and intensive training in the development of independent research projects prepare students for completion of the Ph.D. degree and future success in the career of choice. This is facilitated by diverse, active, and collaborative faculty committed to mentoring the next generation of scientists.

### **Special Requirements for Admission**

Students wishing to join the Cell and Molecular Biology Graduate Program must be enrolled in the Division of Basic Science and be in good standing academically. Usually students seek enrollment in their second semester, following completion of a set of research rotations and selection of a mentor who will assist in the development of the research project for the Ph.D. While most students do their doctoral research with a faculty member of the Program, Cell and Molecular Biology students may do their doctoral research with suitable mentors from other Programs. Prior to formal entry, the Graduate Program Chair will occasionally encourage a student to consult with faculty members to ensure that this Graduate Program is the most appropriate for the student's interests.

### **Curriculum**

All students in the Cell and Molecular Biology Graduate Program must satisfactorily complete the core curriculum offered in the fall term including the cell thread and two laboratory rotations. In the remainder of the first year, students are expected to complete 7.5 credit hours of advanced course work, which require a grade-point average of B or better. Three credit hours consist of two required courses; the additional 4.5 hours may be selected from offerings by other programs within the Division of Basic Science. For exceptional reasons, these course requirements may be altered with permission of the Program Chair. In addition, students participate in a student seminar and Journal Club each semester.

Near the end of the second year, students take a qualifying examination that consists of an oral defense of a written research proposal. Admission to candidacy for the Ph.D. degree requires satisfactory performance in the core, advanced courses, the qualifying examination and research.

### **ADVANCED COURSES**

Course requirements and descriptions are listed here:

<http://www.utsouthwestern.edu/education/graduate-school/programs/phd-degrees/cell-molecular/course-descriptions.html>

## **GENETICS, DEVELOPMENT, AND DISEASE**

### **Chair, Graduate Program**

Ondine Cleaver, Ph.D.

### **Degree Offered**

### **Doctor of Philosophy**

## **FACULTY**

### **Professors**

John M. Abrams, Ph.D., Stanford University, 1989

Linda A. Baker, M.D., University of Louisville, 1989

James Brugarolas, M.D., University of Navarra, Spain, 1993; Ph.D., Massachusetts Institute of Technology, 1998

Ezra Burstein, M.D., Cayetano Heredia Peruvian University, 1994

Elizabeth Chen, Ph.D., Stanford University, 1998

Zhijian "James" Chen, Ph.D., State University of New York at Buffalo, 1991

Jonathan Cohen, Ph.D., University of Cape Town, South Africa, 1989

Ralph J. DeBerardinis, Ph.D., M.D., University of Pennsylvania, 1998, 2000

Christine Kim Garcia, M.D., Ph.D., UT Southwestern Medical Center, 1996

Jonathan M. Graff, M.D., Ph.D., Duke University, 1990

Robert E. Hammer, Ph.D., Wayne State University, 1981

Mark J. Henkemeyer, Ph.D., University of Wisconsin, Madison, 1990

Helen H. Hobbs, M.D., Case Western Reserve University School of Medicine, 1979

Jin Jiang, Ph.D., Columbia University, 1992

Jane E. Johnson, Ph.D., University of Washington, 1988

Helmut J. Krämer, Ph.D., University of Cologne, Germany, 1989

W. Lee Kraus, Ph.D., University of Illinois at Urbana-Champaign, 1994

Rueyling Lin, Ph.D., Baylor College of Medicine, 1993

Yi Liu, Ph.D., Vanderbilt University, 1995

Joshua Mendell, M.D., Ph.D., Johns Hopkins University, 2004

Berge Minassian, M.D., McGill University, 1992

Sean Morrison, Ph.D., Stanford University, 1996

Eric N. Olson, Ph.D., Wake Forest University, 1981  
Duoja Pan, Ph.D., University of California Los Angeles, 1993  
Jerry W. Shay, Ph.D., University of Colorado at Boulder, 1975  
Stephen Skapek, M.D., Duke University, 1988  
Carol Wise, Ph.D., UT Southwestern Medical Center, 1991  
Woodring E. Wright, Ph.D., M.D., Stanford University School of Medicine, 1974, 1975

### **Associate Professors**

Sandeep Burma, Ph.D., National Institute of Immunology, India, 1995  
Michael Buszczak, Ph.D., Yale University, 2002  
Thomas Carroll, Ph.D., UT Austin, 1999  
Ondine Cleaver, Ph.D., UT Austin, 1999  
Jenny Hsieh, Ph.D., Johns Hopkins University, 2000  
Taekyung Kim, Ph.D., University of Medicine and Dentistry of New Jersey, 2000  
Zhi-Ping Liu, Ph.D., UT Southwestern Medical Center, 1993  
Hesham Sadek, M.D., Ph.D., Ain Shams University, 1995 and Case Western Reserve 2004  
Jay Schneider, M.D., Ph.D., Yale University School of Medicine, 1989  
Thomas M. Wilkie, Ph.D., University of Washington, Seattle, 1986  
Jiang Wu, Ph.D., UT Austin, 2001  
Chao Xing, Ph.D., Case Western Reserve University, 2006  
Chun-Li Zhang, Ph.D., UT Southwestern Medical Center, 2002

### **Assistant Professors**

Laura Banaszynski, Ph.D., Stanford University, 2007  
Maria Chahrour, Ph.D., Baylor College of Medicine, 2009  
James Collins, Ph.D., Washington University, 2008  
Michael Dellinger, Ph.D., University of Arizona, 2008  
Peter Douglas, Ph.D., University of North Carolina, 2009  
Rene L. Galindo, M.D., Ph.D., UT Southwestern Medical Center, 2000  
Rana Gupta, Ph.D., University of Pennsylvania, 2006  
Dustin Hancks, Ph.D., University of Pennsylvania, 2011  
Gary Hon, Ph.D., University of California-San Diego, 2009  
Jenna Jewell, Ph.D., Indiana University, 2010  
Ning Liu, Ph.D., University of Wisconsin-Madison, 2003  
Denise Marciano, Ph.D., Rockefeller University, 1999; M.D., Cornell University Medical College, 2001  
Saikat Mukhopadhyay, M.D., Banares Hindu University, 2002; Ph.D., Brandeis University, 2008  
Nikhil Munshi, Ph.D., M.D., Columbia University, 2001, 2003  
Kathryn A. O'Donnell, Ph.D., Johns Hopkins University, 2005  
Stuart E. Ravnik, Ph.D., University of Washington, Seattle, 1991  
Vincent Tagliabracci, Ph.D., Indiana University, 2010



Yingfei Wang, Ph.D., University of Magdeburg, Germany, 2007  
Zhigao Wang, Ph.D., UT Southwestern Medical Center, 2004  
Jian Xu, Ph.D., University of California, Los Angeles, 2008  
Hao Zhu, M.D., Harvard Medical School, 2005

## **Objectives**

The Genetics, Development, and Disease Graduate Program provides education in interdisciplinary studies relating to growth, development, and inheritance. Fundamental principles in genetics and their application to the dissection of biological problems are emphasized. Training is focused on high-caliber original research and a discussion-based curriculum. The goal of this Program is to guide students to become outstanding and rigorous scientists, leading to independent careers in academics or industry.

## **Special Requirements for Admission**

Students wishing to join the Genetics, Development, and Disease Graduate Program must be enrolled in the Division of Basic Science and be in good standing academically. Usually students seek enrollment in the Program toward the end of the first year of study, following completion of the set of research rotations and selection of a mentor.

## **ADVANCED COURSES**

Course requirements and descriptions are listed here:

<http://www.utsouthwestern.edu/education/graduate-school/programs/phd-degrees/genetics-and-development/course-descriptions.html>

Students complete advanced course work and qualify for candidacy by the end of the second year. All students participate in Works-In-Progress seminars and Journal Clubs. In the second year of study, each student takes a qualifying exam by preparing an original research proposal and orally defending it before a panel of Program faculty.

## **IMMUNOLOGY**

### **Chair, Graduate Program**

Anne Satterthwaite, Ph.D.

### **Degree Offered**

**Doctor of Philosophy**

## **FACULTY**

### **Professors**

Bruce Beutler, M.D., University of Chicago, 1981  
Ezra Burstein, M.D., Cayetano Heredia Peruvian University, 1994  
Zhijian “James” Chen, Ph.D., State University of New York at Buffalo, 1991  
Yang-Xin Fu, M.D., Ph.D., Shanghai Medical University, 1983; University of Miami, 1990  
Lora Hooper, Ph.D., Washington University, St. Louis, 1996  
Christopher Y.H. Lu, M.D., Harvard Medical School, 1974  
James Malter, M.D., Washington University, St. Louis, 1983  
Jerry Y. Niederkorn, Ph.D., University of Arkansas, 1977  
Roger Rosenberg, M.D., Northwestern University Medical School, 1964  
Edward K. Wakeland, Ph.D., University of Hawaii, 1976

### **Associate Professors**

Lindsay Cowell, Ph.D. North Carolina State University, 2000  
J. David Farrar, Ph.D., UT Southwestern Medical Center, 1996  
Michelle Joubert Gill, Ph.D., M.D., Louisiana State University, 1993, 1995  
Andrew Koh, M.D., Harvard University, 1996  
Nancy L. Monson, Ph.D., University of Wisconsin, Madison, 1996  
Chandrashekar Pasare, Ph.D., National Institute of Immunology, India, 2000  
Anne Satterthwaite, Ph.D., Harvard University, 1993  
Nicolai S. C. van Oers, Ph.D., McGill University, Canada, 1990  
Nan Yan, Ph.D., UT Austin, 2006  
Chengcheng “Alec” Zhang, Ph.D., University of Illinois at Urbana, 1999

### **Assistant Professors**

Dustin Hancks, Ph.D., University of Pennsylvania, 2011  
Tiffany Reese, Ph.D., University of California, San Francisco, 2007  
John Schoggins, Ph.D., Cornell University, 2007  
Michael Shiloh, M.D., Ph.D., Cornell University, 2001  
Nancy E. Street, Ph.D., UT Southwestern Medical Center, 1987  
Ann Stowe, Ph.D., University of Kansas Medical Center  
Sebastian Winter, Ph.D., University of California, 2011  
Hasan Zaki, Ph.D., Kumamoto University, Japan, 2007

### **Description of the Discipline**

Since 1975, the Medical Center has offered a Program through UT Southwestern Graduate School of Biomedical Sciences leading to a Ph.D. in Immunology. This course of study

is interdisciplinary, with a faculty composed of members from the Medical School's Departments of Biochemistry, Dermatology, Immunology, Internal Medicine, Microbiology, Neurology, Ophthalmology, Pathology, and Surgery.

A distinguishing characteristic of this Graduate Program is its multidisciplinary approach. General areas of research include a variety of topics:

- 1) Innate immunity, inflammation, innate control of adaptive immunity, and mucosal immunology;
- 2) Autoimmunity, histocompatibility antigens and disease, immune response to cancer, lymphocyte activation and signaling, cytokines, T- and B-cell interactions, and regulation of immunoglobulin synthesis;
- 3) Transplantation immunology and graft-versus-host reactions

### **Objectives**

The broadly stated objective of the Program is to train each student to function as a professional in the scientific community. The Program specifically endeavors to offer each trainee the opportunity to acquire a firm and substantial understanding of the broad field of immunology as well as the opportunity to develop certain research skills and tools that will allow him or her to advance knowledge in the field of immunology and to develop the teaching capabilities that are essential for a viable academic career.

### **Curriculum**

The field of immunology encompasses many broad areas related to basic science and medicine. A major strength of the Immunology Graduate Program resides in its large faculty of individuals whose research interests include innate immunity, immunology of infection, disease, mucosal immunology, tumor immunology and immunotherapy, genetics of immune response diversity, and clinical immunology. This offers students a broad-based education in all current immunologic concepts and techniques so they can become competitive for future opportunities.

During the first semester, students participate in the Core Curriculum of the Division of Basic Science and the Fundamentals of Immunology course. Students then have the opportunity to gain a broad-based scientific background in areas of modern biology. Students also have an opportunity to attend Journal Clubs, Works-In-Progress seminars, and the Excellence in Immunology seminars during their first semester and are required to attend once they join the Program.

After completing the Core Curriculum and joining the Immunology Graduate Program, a variety of courses are offered.

### **ADVANCED COURSES**

Course requirements and descriptions are listed here:

<http://www.utsouthwestern.edu/education/graduate-school/programs/phd-degrees/immunology/course-descriptions.html>

Each of these courses focuses on integrating material from basic molecular biology, cell physiology, and clinical pathophysiology. The format for these courses involves didactic information and reading of the original literature followed by critical discussion in an informal setting.

The Immunology Program has a weekly seminar series in which all advanced graduate students present their research on an annual basis to the entire Immunology Program. This experience affords students an opportunity to perfect their skills in oral presentation and communication to a sophisticated audience. Teaching opportunities also are available.

During the fall of the second year, students are required to pass a qualifying examination for admission to candidacy for the Ph.D. The qualifying examination consists of a written proposal and its oral defense. Successful completion of the qualifying examination is required to advance to Ph.D. candidacy.

A Supervisory Research Committee is appointed for those candidates. This Committee reviews and evaluates the student's progress and, upon completion of the dissertation based on original research and the student's public presentation of the work, participates in the final oral examination of the student.

## **INTEGRATIVE MOLECULAR AND BIOMEDICAL SCIENCES**

### **Chair, Graduate Program**

Yi Liu, Ph.D.

### **Degree Offered**

### **Doctor of Philosophy**

## **FACULTY**

### **Professors**

Ilya B. Bezprozvanny, Ph.D., Institute of Cytology Russian Academy of Sciences, 1992

Rolf A. Brekken, Ph.D. UT Southwestern Medical Center, 1999

Michael S. Brown, M.D., University of Pennsylvania School of Medicine, 1966

George N. DeMartino, Ph.D., University of Rochester, 1976

Joel K. Elmquist, D.V.M., Ph.D., Iowa State University, 1992, 1993

Christine Kim Garcia, M.D., Ph.D., UT Southwestern Medical Center, 1996

Joseph A. Garcia, M.D., Ph.D., University of California, Los Angeles, 1993

Dwight C. German, Ph.D., University of Oklahoma Health Sciences Center, 1972  
Joseph L. Goldstein, M.D., UT Southwestern Medical Center, 1966  
Frederick Grinnell, Ph.D., Tufts University School of Medicine, 1970  
Joachim Herz, M.D., University of Heidelberg, Germany, 1983  
Joseph A. Hill, M.D., Ph.D., Duke University, 1987  
Jay D. Horton, M.D., University of Iowa College of Medicine, 1988  
W. Lee Kraus, Ph.D., University of Illinois at Urbana-Champaign, 1994  
Yi Liu, Ph.D., Vanderbilt University, 1995  
Mala Mahendroo, Ph.D., UT Southwestern Medical Center, 1992  
David J. Mangelsdorf, Ph.D., University of Arizona, 1987  
Steven L. McKnight, Ph.D., University of Virginia, 1977  
Carole R. Mendelson, Ph.D., Rutgers University, 1970  
Lisa Monteggia, Ph.D., University of Illinois at Urbana-Champaign, 1991  
Eric N. Olson, Ph.D., Wake Forest University, 1981  
Duoja Pan, Ph.D., University of California, Los Angeles, 1993  
Philipp E. Scherer, Ph.D., University of Basel, Switzerland, 1992  
Philip W. Shaul, M.D., University of Cincinnati, 1981  
Philip J. Thomas, Ph.D., University of North Dakota, 1988  
Roger H. Unger, M.D., Columbia University, 1947  
Steven Vernino, M.D., Ph.D., Baylor College of Medicine, 1994  
Helen L. Yin, Ph.D., Harvard University, 1976

### **Associate Professors**

Benjamin Chen, Ph.D., Ohio State University, 1996  
Guosheng Liang, Ph.D., Ohio State University, 1997  
Pradeep Mammen, M.D., University of Wisconsin, Madison, 1995  
Chieko Mineo, Ph.D., University of Tokyo, 1992  
Nancy Monson, Ph.D., University of Wisconsin, Madison, 1996  
Juan M. Pascual, M.D., Universidad de Granada, Spain, 1990; Ph.D., Baylor College of Medicine, 1995  
Beverly A. Rothermel, Ph.D., Yale University, 1991  
Benjamin Tu, Ph.D., University of California, San Francisco, 2003  
Yihong Wan, Ph.D., University of Colorado Health Sciences Center, 2001  
Guanghua Xiao, Ph.D., University of Minnesota, 2006  
Shin Yamazaki, Ph.D., Tamagawa University, Tokyo, 1992  
Jin Ye, Ph.D., UT Southwestern Medical Center, 2000  
Chengcheng "Alec" Zhang, Ph.D., University of Illinois at Urbana-Champaign, 1999

### **Assistant Professors**

Laurent Gautron, Ph.D., University of Bordeaux-France, 2003  
Rana K. Gupta, Ph.D., University of Pennsylvania, 2006

William Holland, Ph.D., University of Utah, 2007  
Ming-Chang Hu, M.D., Ph.D., Nanjing University, 1982, University of Paris, 1999  
James Kim, M.D., Ph.D., University of Rochester, 1999  
Chen Liu, Ph.D., Case Western Reserve University, 2010  
Ram Mani, Ph.D., Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, 2007  
Nikhil Munshi, Ph.D., M.D., Columbia University, 2001, 2003  
Douglas Strand, Ph.D., Baylor College of Medicine, 2007  
Zhao Wang, Ph.D., Albert Einstein College of Medicine, 2008  
Kevin Williams, Ph.D., Tulane University, 2006  
Qun Zang, Ph.D., City University of New York, 1996

### **Associate Members**

These faculty members do not accept graduate students. They participate in teaching, co-mentoring, exam and Dissertation Committees, and all other Program responsibilities.

Shin Yamazaki, Ph.D., Tamagawa University, Tokyo, 1992  
Xiaowei Zhan, Ph.D., University of Michigan, 2014

### **Description of the Discipline**

The Integrative Molecular and Biological Sciences Graduate Program promotes cross-disciplinary research involving faculty in basic science and clinical Departments with the goal of training a student for a career as an independent investigator in biological and biomedical sciences. Students' research focuses on the molecular and cellular basis of integrated biological systems, including cells, tissues and whole animals, under physiological and pathological conditions in world-class laboratories. Major areas of investigation include molecular mechanisms of diseases, metabolism and metabolic diseases, gene expression and regulation, regulation of cardiovascular, renal, liver functions, stem cell biology, cancer, cell cycle and growth control, mechanisms of behavior, carbohydrate and lipid metabolism, cell signaling, neuronal functions and neurological diseases, structural and computational biology, and immunology.

### **Objectives**

The Integrative Molecular and Biological Sciences Graduate Program offers doctoral training in a multidisciplinary, integrative discipline that seeks to understand the molecular basis of biological and physiological processes and thereby discover insights into disease mechanisms and potential therapeutic approaches through molecular medicine. Students in this Program have the opportunity to master scientific principles through classroom, seminar, and discussion experiences and have the opportunity to perform original and innovative research in diverse research areas. The goal of this Program is to prepare students for biomedical and biological research in academia, industry, or government. The dissertation

project can combine studies on cells, tissues, systems, whole animals, and computation with aspects of cell or molecular biology.

### **Special Requirements for Admission**

Students wishing to join the Integrative Molecular and Biological Sciences Graduate Program must be enrolled in the Division of Basic Science and be in good standing academically. Usually, students seek enrollment in the Program toward the end of the first year of study following completion of the set of research rotations and selection of a mentor.

### **Curriculum**

All students in the Molecular and Biological Sciences Graduate Program must have satisfactorily completed the first-year core curriculum and two laboratory rotations. In the second year, students complete at least nine credit hours of advanced course work. The advanced course work must include the program-required courses. Additional courses may be selected from those listed in other Division of Basic Science Graduate Programs.

Students are strongly encouraged to develop – in collaboration with the graduate student advisor and appropriate faculty – special topic courses dealing with the physiological systems related to future dissertation research. These tutorial-type courses may cover fundamental knowledge as well as methodological approaches and recent primary literature. Students will participate in a seminar-Journal Club each term.

At the end of the second year, students take a qualifying examination, which consists of an oral defense of an original, written proposal.

Admission to candidacy for the Ph.D. requires satisfactory performance in the core and advanced courses and on the qualifying exam.

### **ADVANCED COURSES**

Course requirements and descriptions are listed here:

<http://www.utsouthwestern.edu/education/graduate-school/programs/phd-degrees/integrative-biology/course-descriptions.html>

## **MOLECULAR BIOPHYSICS**

### **Chair, Graduate Program**

Luke Rice, Ph.D.

### **Degree Offered**

**Doctor of Philosophy**

## **FACULTY**

### **Professors**

Joseph P. Albanesi, Ph.D., Duke University, 1980  
Paul Blount, Ph.D., Washington University School of Medicine, St. Louis, 1990  
Yuh Min Chook, Ph.D., Harvard University, 1994  
David R. Corey, Ph.D., University of California, Berkeley, 1990  
Elizabeth J. Goldsmith, Ph.D., University of California, Los Angeles, 1972  
Nick V. Grishin, Ph.D., UT Southwestern Medical Center, 1998  
Youxing Jiang, Ph.D., Yale University, 1997  
Ege T. Kavalali, Ph.D., Rutgers University, 1995  
Craig R. Malloy, M.D., University of California, San Francisco, 1977  
Zbyszek Otwinowski, Ph.D., University of Chicago, 1989  
Margaret A. Phillips, Ph.D., University of California, San Francisco, 1988  
José Rizo-Rey, Ph.D., University of Barcelona, Spain, 1988  
Michael Rosen, Ph.D., Harvard University, 1993  
Elliott M. Ross, Ph.D., Cornell University, 1975  
Sandra Schmid, Ph.D., Stanford University, 1985  
Philip J. Thomas, Ph.D., University of South Dakota, 1988  
Hongtao Yu, Ph.D., Harvard University, 1995

### **Associate Professors**

Daniela Nicastro, Ph.D., Ludwig-Maximilians-Universität, Munich, 2000  
Xuelian Luo, Ph.D., Tufts University, 1997  
Luke Rice, Ph.D., Yale University, 2000  
Daniel Rosenbaum, Ph.D., Harvard University, 2005  
Guanghua Xiao, Ph.D., University of Minnesota, 2006  
Yang Xie, Ph.D., University of Minnesota, 2006  
Hong Zhang, Ph.D., University of Illinois at Urbana-Champaign, 1994  
Xuewu Zhang, Ph.D., Albert Einstein College of Medicine, 2003

### **Assistant Professors**

Xiaochen Bai, M.D., Tsinghua University, 2016  
Zhe Chen, Ph.D., UT Southwestern Medical Center, 2002  
Jan Erzberger, Ph.D., University of California, Berkeley, 2005  
Kendra Frederick, Ph.D., University of Pennsylvania, 2006  
William Mike Henne, Ph.D., University of Cambridge, 2009  
Ryan Hibbs, Ph.D., University of California, San Diego, 2006  
Khuloud Jaqaman, Ph.D., Indiana University, 2003  
Lukasz Joachimiak, Ph.D., University of Washington, 2007



Milo Lin, Ph.D., California Institute of Technology, 2012  
Xin Liu, Ph.D., University of Pennsylvania, 2007  
Yunsun Nam, Ph.D., Harvard University, 2006  
Arun Radhakrishnan, Ph.D., Stanford University, 2002  
Michael Reese, Ph.D., University of California, San Francisco, 2006  
Kimberly Reynolds, Ph.D., University of California, Berkeley, 2006  
William Russ, Ph.D., Yale University, 1998  
Erdal Toprak, Ph.D., University of Illinois, 2007

## **Objectives**

The Molecular Biophysics Graduate Program offers a vibrant environment for students interested in studying biology from a quantitative, physical perspective. The Program is highly interdisciplinary, comprising more than 30 faculty members with diverse backgrounds and interests, ranging from mathematics and theoretical physics to neurobiology and genetics. Using a wide range of biophysical techniques, including X-ray crystallography, NMR spectroscopy, electron microscopy, light spectroscopy/microscopy, and computational modeling among others, these laboratories investigate in atomic detail how proteins and other macromolecules function individually or as part of complex biological systems. Neurotransmitter release, cytoskeletal dynamics, cellular signaling, nuclear transport, ion channels, transporters, photosensors, T-cell receptors, and G-proteins are among the many areas of interest.

A highly interactive atmosphere – catalyzed by Journal Clubs, an annual retreat, and the celebrated Molecular Biophysics Discussion Group seminar series – offers all members of the Program the opportunity to learn from each other and to gain expertise in many varied subjects, well beyond their own areas of research. Ultimately, the mission of the Program is to provide students with conceptual tools and research experiences that will prepare them to apply the principles and techniques of the physical sciences to biomedical problems.

## **Special Requirements for Admission**

In general, conditions for admission to the Program are good academic standing within the Division of Basic Science of the Graduate School and an interest in pursuing a research and training program in molecular biophysics. Students with strong backgrounds in the physical sciences and mathematics will be well prepared to join the Program, but such backgrounds are not required.

Students ordinarily apply for formal admission to the Program in the middle or the end of the fall semester, but are encouraged to participate in the Program informally at any time after admission into the Division of Basic Science. It is not necessary that a student within the Program choose a dissertation research mentor who is a member of the faculty of the Program, provided the student has sound reasons for this choice.

## **Curriculum**

Biophysics is a field defined by its application of physical principles and techniques to investigation of key biological problems. Optimal training for a career in molecular biophysics includes exposure to the theoretical basis for physical properties and interactions of biological molecules, the technical approaches that are available to investigate biological systems, and the results of studies in which biophysics has contributed to an understanding of the biological characteristics of system behavior. The Molecular Biophysics Graduate Program includes course work in each of these three areas.

## **Core Curriculum**

The first-year Core Curriculum, required of all students in the Division of Basic Science, offers training in the broad issues faced by contemporary biological science. This course provides four hours of course credit toward the minimum of 30 hours required for the first year. Students are also required to take two courses on Professionalism, Responsible Conduct of Research, and Ethics (2 credit hours).

## **ADVANCED COURSES**

Course requirements and descriptions are listed here:

<http://www.utsouthwestern.edu/education/graduate-school/programs/phd-degrees/molecular-biophysics/course-descriptions.html>

## **Molecular Biophysics Journal Club and Discussion Group**

The Molecular Biophysics Journal Club offers students an opportunity to keep abreast of recent research results in the literature, to sharpen critical acumen, and to develop public-speaking skills. Every student in the Graduate Program is expected to attend the Journal Club and to participate actively. In addition, each student is required to present one journal article or work-in-progress per year.

Students also are strongly encouraged to attend meetings of the Molecular Biophysics Discussion Group and presentations of interest to biophysicists occurring in the numerous seminar series offered by UT Southwestern and its various basic science departments. The

Molecular Biophysics Discussion Group and the annual Molecular Biophysics Research Symposium provide forums for presentation of the students' own research, as well as acquainting them with recent research results from other laboratories on campus and from invited speakers.

### **Qualifying Examination**

Admission to candidacy for the Ph.D. requires that students prepare and defend a written research proposal, modeled on an NIH-R01 grant proposal. A student may choose a topic that is related to his or her own prospective dissertation research or may select an unrelated biophysical topic. The student is expected to write a hypothesis- or question-driven proposal. Students who choose to defend an invention or new method must devise suitable controls to demonstrate feasibility. Proposals based on anticipated dissertation research are expected to address fundamental issues; these may, in some cases, extend beyond those encompassed by the dissertation itself. Both the written proposal and the oral defense will be judged for clarity and originality of thought and for the degree of mastery of experimental design and analysis of data expected for a student at the end of the second year of Graduate School. During the oral examination, the student also is expected to respond to questions of general knowledge in molecular biophysics.

The ad hoc Examination Committee is composed of three faculty members, at least two of whom belong to the Molecular Biophysics Graduate Program. The student's mentor is not eligible to serve on the Committee. Members of the Committee and the Committee Chair will be chosen by the Chair of the Molecular Biophysics Student Evaluation Committee in consultation with the student's mentor. These choices are based primarily upon expertise in the field of study to be examined.

### **Dissertation Committee**

Following successful completion of the qualifying examination, the student proposes a Dissertation Committee comprising at least four members of the faculty, at least two of them members of the Molecular Biophysics Graduate Program. The constitution of the dissertation Committee must be approved by the Program Chair.

Within 30 days after forming the Dissertation Committee, the student presents to the Committee a written summary of his or her proposed topic and preliminary research progress toward the project's goals. This initial meeting generally involves a 30-minute oral presentation by the student, followed by discussion and suggestions from the members of the Committee.

Every student must hold at least one meeting of his or her Dissertation Committee each year. After the third year, meetings are held every six months. Additional meetings may be called at any time by the student or by the Committee. The Dissertation Committee monitors

the student's progress based on research accomplished, course grades, and Journal Club and other presentations.

### **Dissertation Defense**

A complete copy of the dissertation must be approved by the Dissertation Committee before a public dissertation defense can be scheduled. The defense is composed of a public lecture describing the main observations of the research, followed by an oral examination by the Dissertation Committee. Attendance during the oral examination is restricted to faculty of the Graduate School, and participation is restricted to the Examination Committee.

## **MOLECULAR MICROBIOLOGY**

### **Chair, Graduate Program**

David R. Hendrixson, Ph.D.

### **Degree Offered**

### **Doctor of Philosophy**

## **FACULTY**

### **Professors**

Paul Blount, Ph.D., Washington University School of Medicine, St. Louis, 1990

Beatriz M.A. Fontura, Ph.D., New York University School of Medicine, 1996

Eric J. Hansen, Ph.D., University of Michigan, 1977

Lora Hooper, Ph.D., Washington University School of Medicine, St. Louis, 1997

Jeffrey S. Kahn, M.D., Ph.D., State University of New York Health Science Center at Brooklyn, 1991

Beth Levine, M.D., Cornell University Medical College, 1986

Michael V. Norgard, Ph.D., New Jersey Medical School, 1977

Kim Orth, Ph.D., UT Southwestern Medical Center, 1993

Julie K. Pfeiffer, Ph.D., University of Michigan, 2001

Vanessa Sperandio, Ph.D., State University of Campinas, Brazil, 1995

Iwona Stroynowski, Ph.D., Stanford University, 1979

### **Associate Professors**

Neal M. Alto, Ph.D., Oregon Health & Science University, 2003

Nicholas K. Conrad, Ph.D., Johns Hopkins University, 2001  
Ivan D'Orso, Ph.D., National University of San Martin, Argentina, 2003  
David E. Greenberg, M.D., Baylor College of Medicine, 1999  
David R. Hendrixson, Ph.D., Washington University, St. Louis, 1999  
Raksha Jain, M.D., UT Houston Health Science Center, 2001  
Andrew Y. Koh, M.D., Harvard Medical School, 1996  
Tony Michael, Ph.D., University of East Anglia, 1998  
Nicolai S.C. van Oers, Ph.D., McGill University, Canada, 1990  
Nan Yan, Ph.D., UT Austin, 2006

### **Assistant Professors**

Don Gammon, Ph.D., University of Alberta, 2010  
Tiffany Reese, Ph.D., University of California, San Francisco, 2007  
Kim Reynolds, Ph.D., University of California, Berkley, 2006  
John Schoggins, Ph.D., Cornell University Medical College, 2007  
Michael U. Shiloh, M.D., Cornell University Medical College, 2001  
Nancy E. Street, Ph.D., UT Southwestern Medical Center, 1987  
Erdal Toprak, Ph.D., University of Illinois at Urbana-Champaign, 2007  
Dawn Wetzel, M.D., Ph.D., Washington University School of Medicine, 2005  
Sebastian Winter, Ph.D., University of Munich, 2010

### **Objectives**

The Molecular Microbiology Graduate Program emphasizes an integrated approach to the study of prokaryotic and eukaryotic organisms. A universal major focus of the research of many faculty members of the Molecular Microbiology Graduate Program is the study of medically relevant bacteria and viruses and the ways these pathogens interact with respective hosts to cause disease. For many research programs, interdisciplinary approaches are employed to analyze various interesting aspects of the biology of these important pathogens. Overall, this Program is dedicated to providing a superior level of training in biomedical research strategies and technologies related to the major principles of molecular microbiology.

The major emphases of studies in the Molecular Microbiology Graduate Program include:

- **Bacterial Pathogenesis:** analysis of virulence and colonization factors, bacterial toxins, interactions of pathogens and their products with eukaryotic host cells, contemporary vaccine strategies, bacterial gene regulation, bacterial export and secretion, and genetic regulation of virulence gene expression
- **Virology:** viral replication and persistence, viral pathogenesis, neurovirology, host resistance to viral infection, viral vaccines, eukaryotic gene regulation, signal transduction pathways, and cellular and molecular mechanisms of human oncogenesis

- ***Cellular and Molecular Immunology:*** mechanisms of immune cell activation by microbes and their products, host responses to pathogen infection, role of commensal bacteria in modulation of immune responses and infection, mechanisms of inflammation, tumor immunology, mechanisms of innate immune responses, and functions of T-cell subsets.

### **Special Requirements for Admission**

Students wishing to join the Molecular Microbiology Graduate Program must be enrolled in the Division of Basic Science and be in good standing academically. Students enter the Program after successfully completing the first-year Core Curriculum and selecting a mentor. Initiation of the student's dissertation research then commences. The faculty offers advanced courses in the areas of medical microbiology and infectious diseases (including immunology), molecular basis of microbial pathogenesis, microbial genetics, virology, viruses in human cancer, cell and molecular immunology, and genetic manipulation of the immune system. Participation in selected Journal Clubs and seminars offered within the Molecular Microbiology Graduate Program provide exposure to additional educational opportunities. The Program is supported in part by an NIH training grant and the S. Edward Sulkin endowment, which awards up to \$1,000 annually to a highly deserving graduate student in the Program.

### **Curriculum**

All Division of Basic Science students take the Core Curriculum beginning in the fall of the first year of graduate study. Upon officially joining the Molecular Microbiology Graduate Program, students take the required courses and attend the Microbiology Seminar course (which includes the student Works-In-Progress series and the Department of Microbiology Seminar Series) and the Journal Club (Contemporary Topics in Microbiology). Preparation for and completion of the qualifying examination should be done during the spring semester of the second year.

### **ADVANCED COURSES**

Course requirements and descriptions are listed here:

<http://www.utsouthwestern.edu/education/graduate-school/programs/phd-degrees/molecular-microbiology/course-descriptions.html>

During the spring of the second year, students are required to pass a two-phase qualifying examination for admission to candidacy for the Ph.D. Phase I of the qualifying exam will consist of a written review of the relevant literature and description of the proposed thesis topic. Phase II consists of a written research proposal and its oral defense. Successful completion of the qualifying examination is required to advance to candidacy for the Ph.D. The goal of the examination is to assess the student's knowledge of fundamental facts in advanced molecular microbiology and his or her ability to synthesize these facts and apply them to

scientific research. It is designed to foster the development of useful skills such as original thinking, critical reading of the literature, logical design of experiments, and focused interpretation of data.

After the student is admitted to candidacy, a Supervisory Committee is appointed with the supervising Professor as Chair. This Committee reviews and evaluates the student's progress according to the Graduate School guidelines and, upon completion of the written dissertation-based original research and the student's public presentation of the work, participates in the final oral examination of the student.

## **NEUROSCIENCE**

### **Chair, Graduate Program**

Kimberly M. Huber, Ph.D.

### **Degree Offered**

### **Doctor of Philosophy**

## **FACULTY**

### **Professors**

Ilya B. Bezprozvanny, Ph.D., Institute of Cytology, Russian Academy of Sciences, 1992  
Marc Diamond, M.D., University of California, San Francisco, 1993  
Jeffrey Elliott, M.D., Washington University, St. Louis, 1988  
Joel Elmquist, D.V.M., Ph.D., Iowa State University, 1992, 1993  
Mark Goldberg, M.D., Columbia University College of Physicians and Surgeons, 1984  
Carla Green, Ph.D., University of Kansas Medical Center, 1991  
Robert Greene, Ph.D., George Washington University, 1982; M.D., University of Maryland, 1983  
Mark J. Henkemeyer, Ph.D., University of Wisconsin, Madison, 1990  
Donald W. Hilgemann, Ph.D., University of Tübingen, Germany, 1980  
Kimberly M. Huber, Ph.D., UT Graduate School of Biomedical Sciences at Houston, 1995  
Jane E. Johnson, Ph.D., University of Washington, 1988  
Helmut J. Krämer, Ph.D., University of Cologne, Germany, 1989  
Berge Minassian, M.D., McGill University, 1992  
Craig Powell, M.D., Ph.D., Baylor College of Medicine, 1994  
José Rizo-Rey, Ph.D., University of Barcelona, Spain, 1988  
Roger Rosenberg, M.D., Northwestern University Medical School, 1964  
David W. Self, Ph.D., University of California, Irvine, 1992  
Dean P. Smith, M.D., University of Utah, 1986; Ph.D., University of California, San Diego, 1992  
Joseph Takahashi, Ph.D., University of Oregon, 1981

Carol A. Tamminga, M.D., Vanderbilt University Medical School, 1971  
Jeffrey Zigman, M.D., Ph.D., University of Chicago, 1994

### **Associate Professors**

Taekyung Kim, Ph.D., University of Medicine and Dentistry of New Jersey, 2000  
Genevieve Konopka, Ph.D., Harvard University, 2004  
Weichun Lin, Ph.D., State University of New York, 1996  
Chen Liu, Ph.D., Case Western Reserve University, 2010  
Ram Madabhushi, Ph.D., Cornell University 2010  
Juan M. Pascual, M.D., Universidad de Granada, Spain, 1990; Ph.D., Baylor College of Medicine, 1995  
Jonathan Terman, Ph.D., Ohio State University, 1997  
Jiang Wu, Ph.D., UT Austin, 2001  
Gang Yu, Ph.D., University of Calgary, Canada, 1996  
Chun-Li Zhang, Ph.D., UT Southwestern Medical Center, 2002

### **Assistant Professors**

Maria Chahrour, Ph.D., Baylor College of Medicine, 2009  
Peter Douglas, Ph.D., University of North Carolina, 2009  
Woo-Ping Ge, Ph.D., Chinese Academy of Sciences, 2005  
Ryan Hibbs, Ph.D., University of California, San Diego, 2006  
Takashi Kitamura, Ph.D., Kyushu University, 2007  
Said Kourrich, Ph.D., University of Provence, France, 2001  
Helen Lai, Ph.D., University of California, San Francisco, 2005  
Bradley Lega, M.D., Baylor College of Medicine, 2006  
Julian Meeks, Ph.D., Washington University, 2006  
Brad Pfeiffer, Ph.D., UT Southwestern Medical Center, 2008  
Todd Roberts, Ph.D., University of Maryland, 2003  
Steven Shabel, Ph.D., University of California San Francisco, 2008  
Ann Stowe, Ph.D., University of Kansas Medical Center, 2006  
Peter Tsai, M.D., Ph.D., University of California, Los Angeles, 2005  
Lenora Volk, Ph.D., UT Southwestern Medical Center, 2007  
Yingfei Wang, Ph.D., University of Magdeburg, Germany, 2007  
Kevin Williams, Ph.D., Tulane University, 2006  
Wei Xu, Ph.D., University of Southern California, 2008

### **Objectives**

The Neuroscience Graduate Program focuses on cellular and molecular as well as systems neurobiology. Topics of particular interest include synaptic physiology and synaptic plasticity; membrane biophysics, especially receptors and ion channels; neuronal organelle



traffic, particularly the biogenesis and exo- and endocytosis of synaptic vesicles; neurogenetics of invertebrates and vertebrates; development of neural systems; and molecular and cellular basis of complex behavior.

### **Special Requirements for Admission**

Students wishing to join the Neuroscience Graduate Program must be enrolled in the Division of Basic Science and be in good standing academically. Usually, students seek enrollment in the Program toward the end of their first year of study following completion of the set of research rotations and selection of a mentor. Prospective students should note that the diverse research topics in the field make neurobiology an appropriate doctoral subject for those with undergraduate degrees in physics, chemistry, engineering, mathematics, and psychology, as well as in biological disciplines.

### **Curriculum**

Neurobiology is a field defined not by a specific intellectual approach or experimental technique, but by its subject matter: the cells of the nervous, sensory, and muscular systems. Because of the variety of methods that must be brought to bear in studies of these systems, the optimal training for a career in neurobiological research includes an in-depth exposure to the principles of biochemistry, biophysics, cell and molecular biology, developmental biology, genetics, immunology, pharmacology, and physiology, as well as behavioral neuroscience.

### **Core Curriculum**

By providing a solid background in the above areas, the first-year Core Curriculum offers appropriate training for first-year students who elect to join the Neuroscience Graduate Program. The first-year course also provides 15 hours of course credit toward the minimum 24 hours required for graduation.

### **Laboratory Rotations**

First-year students participate in a minimum of two laboratory rotations. Insofar as possible, students with an interest in neurobiology should seek rotations that expose them to a wide variety of technical approaches, including anatomy, behavior, biochemistry, biophysics, cell biology, genetics, molecular biology, and physiology. At the end of the first year of study, students choose a mentor for dissertation research.

### **ADVANCED COURSES**

Course requirements and descriptions are listed here:

<http://www.utsouthwestern.edu/education/graduate-school/programs/phd-degrees/neuroscience/course-descriptions.html>

## **Neuroscience Journal Club**

The Neuroscience Journal Club offers students an opportunity to keep abreast of recent research results, to sharpen critical acumen and to develop speaking skills. Every student in the Graduate Program is expected to attend a Journal Club and to participate actively. In addition, each student is required to make at least one Journal Club presentation per year.

## **Neuroscience Seminar**

Weekly neuroscience seminars hosted by the departments of Psychiatry, Neurology, and Neuroscience are held to present current advances in all areas of modern neurobiology. One or two seminars are organized by the students of the Neuroscience Graduate Program. Furthermore, numerous scientific presentations of interest to neurobiologists occur each year in seminar series offered by the Departments of Cell Biology, Molecular Biology, Pharmacology, and Physiology, among others. The University Lecture Series often deals with the nervous system and related topics.

## **Work in Progress**

Students, postdoctoral fellows, faculty, and other interested individuals meet on a biweekly basis to discuss current research carried out by students of the Neuroscience Graduate Program. The student presentations are made in a setting that fosters spontaneity and exchange of ideas.

## **Annual Neuroscience Retreat**

Once a year, students, postdoctoral fellows, and faculty members gather for an all-day meeting to present current work and exchange research ideas. This meeting is held off campus in a setting where participants have the opportunity to present their research in a manner similar to the annual meeting of the Society for Neuroscience. All students in the Neuroscience Graduate Program are expected to attend, and advanced students are required to present their research in a formal setting.

## **Qualifying Examination**

The qualifying examination comprises a written and an oral component, each of which must be passed as part of the qualifications for admission to Ph.D. candidacy. Unless a prior extension is granted by the Steering Committee, each student must complete the qualifying examination by the end of September of his or her second year of graduate enrollment. Those students in the Medical Scientist Training Program who initially take two years of medical training may defer the qualifying examination per approval of the Program Chair.

The written component is a research proposal dealing with a group of related scientific problems in an area of study different from that in which the student expects to conduct his or her dissertation. The oral examination ordinarily is given in a single closed session lasting from one to two hours. The student is expected to answer questions relating to material in courses

that he or she has taken, to the subject matter in the written proposal and to general information in the field of neurobiology.

### **Dissertation Defense**

A complete copy of the dissertation must be approved by the Dissertation Committee before a public dissertation defense can be scheduled. The defense is composed of a public lecture describing the main observations of the research, followed by an oral examination by the Dissertation Committee. Attendance during the oral examination is restricted to faculty members of the Graduate School, and participation is restricted to the Examination Committee.

## **ORGANIC CHEMISTRY**

### **Chair, Graduate Program**

Uttam Tambar, Ph.D.

### **Degree Offered**

### **Doctor of Philosophy**

## **FACULTY**

### **Professors**

Chuo Chen, Ph.D., Harvard University, 2001  
Jef DeBrabander, Ph.D., University Gent, 1993  
Joseph Ready, Ph.D., Harvard University, 2001

### **Associate Professors**

Jeffrey McDonald, Ph.D., Indiana University at Bloomington, 2002  
Uttam Tambar, Ph.D., California Institute of Technology, 2006

### **Assistant Professors**

Jacques Lux, Ph.D., University of Strasbourg, France, 2009  
Daniel Siegwart, Ph.D., Carnegie Mellon University, 2008

### **Objectives**

The Organic Chemistry Graduate Program is designed to prepare students to address emerging research opportunities at the crossroads of modern chemistry, biological chemistry and materials science as it relates to problems of biomedical importance. Students participate in dynamic research led by faculty that are world leaders in the field of chemistry and experience the satisfaction of making original contributions to the advancement of chemistry and related disciplines. Students in the program benefit from working collaboratively across disciplines to solve complex health challenges, a hallmark of an education at UT Southwestern Medical Center.

UT Southwestern has world-class facilities for modern chemistry, including four high-field NMR systems devoted to small molecules.

### **Special Requirements for Admission**

Students within the Program must choose a mentor who is a faculty member of the Program. Students will apply for formal admission to the Organic Chemistry Program at the time of applying to the Division of Basic Science.

Organic Chemistry is designed to prepare students for emerging research opportunities at the crossroads of modern chemistry and discovery biology. Research projects focus on topics at the forefront of synthetic and mechanistic chemistry, chemical biology, and biochemistry. The Program is committed to providing an educational experience that is challenging, broad-based, and rigorous.

### **ADVANCED COURSES**

Course requirements and descriptions are listed here:

<http://www.utsouthwestern.edu/education/graduate-school/programs/phd-degrees/organic-chemistry/courses.html>

### **Student Seminars**

A weekly seminar provides a format in which students are encouraged to think critically about their research and how it relates to topics in chemistry. Each student presents one Works-In-Progress talk and one Journal Club annually.

WIPs are designed to generate feedback and suggestions for students regarding their research from a diverse audience and to provide experience with formal presentations, a critical skill for successful scientists. Faculty mentors attend regularly and facilitate discussion of the research presented.

Journal Club presentations provide a forum for students to learn and describe an area of chemistry not directly related to their thesis topics. This forum aims to broaden students' knowledge and sophistication regarding important areas in synthetic chemistry. Topics are

chosen by students in consultation with thesis advisors. Postdoctoral fellows also have an opportunity to present Journal Clubs.

### **Dissertation Committee**

This Committee oversees the scientific progress of the student toward completion of a degree. Faculty members on the Committee are selected for expertise in the thesis area so they can contribute substantial intellectual insight in direction of the project. The Committee must have at least four members, including the thesis advisor and at least two Program faculty members. The Committee meets at least once a year to provide guidance and advice and to ensure the student's satisfactory progress toward a degree.

### **Qualifying Examination**

The qualifying examination evaluates the student's ability to develop a hypothesis-based research proposal that addresses a specific question in modern chemistry. The proposal must be presented in written and oral forms. To distinguish the student's abilities from those of the dissertation advisor, the student may not prepare a proposal related to dissertation research or to research being carried out by other members of the student's laboratory. The examination tests the student's ability to defend work described in the proposal and to demonstrate an understanding of the underlying concepts, experimental approaches and designs, and their limitations. Advancement to Ph.D. candidacy depends on successful completion of the oral examination. The qualifying examination process takes place during the spring of the second year after course work is completed.

## **DIVISION OF CLINICAL SCIENCE**

The Division of Clinical Science comprises two graduate programs in the areas of Clinical Psychology and Clinical Sciences.

The Clinical Psychology Graduate Program combines training in current methods of counseling and psychological therapy with in-depth exposure to research methods and design to answer important psychological questions. Students undertake didactic course work in addition to internships, clinical practica, and research practica prior to completion of the program. The program leads to the Ph.D. degree.

The Clinical Sciences Graduate Program provides an opportunity for medical fellows, postdoctoral researchers, and junior faculty to receive training in patient-oriented research. Trainees gain an in-depth understanding of the role that rigorous, science-driven research plays in achieving clinical goals. Trainees design and write case reports, case series, cross-sectional studies, case control studies, cohort analytic studies, pathophysiology and human genetic analyses, and clinical trials. The Clinical Sciences Graduate Program leads to the M.S.C.S. degree.

## **CLINICAL PSYCHOLOGY**

**Chair, Graduate Program**

Betsy D. Kennard, Psy.D, ABPP

**Degree Offered**

**Doctor of Philosophy**

**FACULTY****Professors**

C. Munro Cullum, Ph.D., ABPP, UT Austin, 1986  
Graham Emslie, M.D., University of Aberdeen, Scotland, 1974  
Carroll W. Hughes, Ph.D., University of Missouri, 1973  
Mustafa Husain, M.D., Dow Medical College, Pakistan, 1981  
Robin Jarrett, Ph.D., University of North Carolina at Greensboro, 1983  
Betsy D. Kennard, Psy.D, ABPP, Baylor University, 1984  
Laura Lacritz, Ph.D., ABPP, UT Southwestern Medical Center, 1994  
Joan Reisch, Ph.D., Southern Methodist University, 1974  
Celette Skinner, Ph.D., University of North Carolina at Chapel Hill, 1991  
Sunita Stewart, Ph.D., University of Massachusetts, Amherst, 1981  
Alina Suris, Ph.D., ABPP, University of Houston, 1991  
Carol Tamminga, M.D., Vanderbilt University Medical School, 1971  
Madhukar Trivedi, M.D., Baroda Medical College, 1980  
Myron Weiner, M.D., Tulane University School of Medicine, 1957

**Associate Professors**

Julie Germann, Ph.D., University of Toledo, 2000  
Daniel Krawczyk, Ph.D., University of California, Los Angeles, 2003  
Ramona Rhodes, M.D., University of Arkansas College of Medicine, 2000

**Assistant Professors**

Nyaz Didehbani, Ph.D., University of North Texas, 2009  
Kan Ding, M.D., Peking Union Medical College, 1997  
Aleksandra Foxwell, Ph.D., UT Southwestern Medical Center, 2011  
Dailyn Martinez, Ph.D., UT Southwestern Medical Center, 2014  
Wendy Ringe, Ph.D., UT Southwestern Medical Center, 2000  
Mona Robbins, Ph.D., University of Illinois at Urbana-Champaign, 2013  
Rebekah Travis, Psy. D., Florida Institute of Technology, 2013  
Robrina Walker, Ph.D., Virginia Polytechnic Institute, 2007

## Goals and Objectives

The Clinical Psychology Graduate Program is accredited by the American Psychological Association (APA). It offers students the opportunity to work with faculty drawn from many components of UT Southwestern Medical Center; thus, it is an interdepartmental group as well as an interdisciplinary one. Core psychology faculty members are typically members of the Division of Psychology in the Department of Psychiatry. The Program includes an affiliated, separately APA-accredited doctoral internship program.

This Program offers the student an educational sequence that emphasizes extensive professional preparation and incorporates communitywide clinical and consulting experiences while maintaining those scientific underpinnings that make the psychologist's approach distinctive – an interest in the spirit and techniques of inquiry and responsiveness to behavioral data informed by critically evaluated theory. In keeping with psychology's scientific foundation, students have the opportunity for exposure to a range of clinical research activities, especially during the last two years when they apprentice with a faculty researcher and embark upon formal dissertation research.

We believe that an appreciation of the reciprocal influence of practice and research will help in a student's professional preparation and stand him or her in good stead in the public or private practice of clinical psychology.

The Program requires four semesters of practicum clinical experience (20 hours a week), and a two-year, half-time doctoral internship experience over a four-year period in an academic medical center.-Emphasis is placed on assessment, intervention, and consultative experiences in a variety of medical, psychiatric, and community settings. Examples of these settings include Parkland Hospital, Children's Health/Children's Medical Center Dallas, UT Southwestern Neuropsychology Center, Dallas County Juvenile Department, local University mental health centers, and community-based mental health services.

Notable examples of comprehensive clinical research programs at UT Southwestern in which psychology graduate students have participated include an affective disorders research program with projects such as comparisons of medication and cognitive therapy in the management of depressed patients and response to treatment in children and adolescents with affective illness; a health psychology research program investigating psychological factors in individuals with chronic pain and survivors of cancer; and the Alzheimer's Disease Center, which is involved in clinical research projects such as differential diagnosis of Alzheimer's disease, early detection of dementia, and neuroanatomical and biochemical correlates of Alzheimer's.

In addition, the UT Southwestern Neuropsychology Laboratory has a research component with multiple ongoing projects, including the differentiation of normal and abnormal aging; cognitive and memory function in neuropsychiatric disorders; neuroimaging correlates of neuropsychological function (including fMRI); and cognitive profiles in epilepsy, multiple sclerosis, cortical and subcortical dementias, and recovery from neurosurgery. Children's Health

Pediatric Neuropsychology Service also has numerous research projects focused on cognitive and psychosocial outcomes of complex medical conditions, impact of medical and therapeutic interventions, and tele-neuropsychology.

### **Requirements for Admission**

Potential applicants should communicate directly with the Office of Enrollment Services at UT Southwestern Medical Center. Applicants must apply online at our web address, <http://www.utsouthwestern.edu/education/graduate-school/programs/phd-degrees/clinical-psychology/index.html>. Applicants must submit one original copy of each transcript of record issued by every college or university attended, and provide three letters of recommendation (submitted electronically), as well as Graduate Record Examination scores.

A bachelor's degree or its equivalent from an accredited institution of higher learning in the United States, or proof of equivalent training at a foreign university, is required. Students who have completed or are in the process of completing a bachelor's degree are eligible to apply. Substantial coursework or a major in psychology is encouraged.

The Admissions Committee uses the following criteria in evaluating each application (not in any particular order of priority):

- 1) Scores on the GRE-General test taken within the past five years;
- 2) Academic performance in undergraduate school as reflected in the grade-point average;
- 3) Experiences in clinical and/or scientific research activities that would contribute to successful completion of a doctoral program;
- 4) The applicant's statement of background training experiences and personal motivation for a career in clinical psychology;
- 5) Recommendations from appropriate professors and/or mentors;
- 6) Personal suitability for a career in clinical psychology, as evidenced by ability to relate to others, warmth, empathy, and a deep interest in psychological processes;
- 7) Factors that contribute to individual diversity; and
- 8) Interview.

The Admissions Committee conducts all-day group interviews for the top 35 to 40 applicants who have been screened from the total pool of applicants and deemed to be the best match for the Program. The interview is an interactive process that involves students and faculty and includes Program overview, individual interviews, and group activities. The interview typically is scheduled for the last Saturday in February.



Students are admitted only in the fall term. The submission deadline for completed applications is Dec. 1.

## **Curriculum**

The curriculum is designed as a full-time, four-year program and includes four summers of full-time work. During the academic year, students are involved in classes, seminars, research apprenticeships, and clinical work simultaneously. Clinical assignments begin during the first summer and continue throughout the remaining three years. Research apprenticeships are scheduled for the third and fourth years, two days per week. In the third and fourth year of the Program, the students are concurrently enrolled in an affiliated half-time APA-accredited predoctoral internship program. Clinical experiences are obtained in a wide variety of settings, both on and off campus.

Even though the curriculum is largely set, opportunities for elective courses exist at UT Southwestern in addition to the rich variety of educational offerings in the program's didactic series and also throughout the Medical Center (e.g., Grand Rounds in Psychiatry, Neurology, Neurological Surgery, etc.). The broad-based Program is designed to train well-balanced clinical psychologists. Medical/health psychology, neuropsychology, pediatric psychology, along with adult psychology are the major areas of clinical and research interest in which students can gain expertise.

This program and the affiliated internship are accredited by the American Psychological Association. The APA Office of Program Consultation and Accreditation can be contacted at [www.apa.org/ed/accreditation/index.aspx](http://www.apa.org/ed/accreditation/index.aspx) or the Office of Program Consultation and Accreditation, 750 First Street NE, Washington, DC 20002-4242, phone 202-336-5979, TDD/TTY, 202-336-6123, fax 202-336-5978.

## **First Year**

### **Fall term**

#### **Hours**

Applied Cognitive  
Neuroscience

3

Advanced  
Statistics

3

Personality Theories and Dynamics

3

Clinical Methods I and

Lab

4

Advanced Abnormal Psychology and

Lab

4

### **Spring term**

Developmental Psychology

3

Theories and Techniques of Individual Psychotherapy

3

Clinical Methods II and

Lab

4

Research Design & Multivariate  
Statistics

3

Health

Psychology

3

### **Summer Term**

Evidenced Based Therapies

2

Basics of Neuroanatomy

1

Fundamentals of Clinical Management

1

Cultural Diversity

2

Practicum (2.5 days/week)

2

## **Second Year**

### **Fall term**

#### **Hours**

Clinical  
Neuropsychology

3

Theories and Methods of Cognitive-Behavioral  
Therapy

3

History and Systems of  
Psychology

3

Practicum (2.5  
days/week)

2

### **Spring term**

Psychopharmacology

3

Professional Ethics and  
Issues

3

Elective in intervention or psychological assessment

3

Practicum (2.5 days/week)

2

### **Summer Term**

Psychometric  
Theory

3

Social Psychology

3

Practicum (2.5  
days/week)

2

### **Third Year**

#### **Fall term**

#### **Hours**

Theories and Methods of Consultation, Supervision, and Program  
Development

3

Research in Psychology (2  
days/week)

3

Internship in Clinical Psychology (2.5  
days/week)

3

#### **Spring term**

Elective in intervention or psychological  
assessment

3

Research in Psychology (2  
days/week)  
3

Internship in Clinical Psychology (2.5  
days/week)  
3

### **Summer Term**

Life-Span Developmental Psychology 2

Research in Psychology (2  
days/week)  
2

Internship in Clinical Psychology (2.5  
days/week)  
2

### **Fourth Year**

#### **Fall term**

#### **Hours**

Dissertation  
Research  
3

Internship in Clinical Psychology (2.5  
days/week)  
6

#### **Spring term**

Dissertation  
Research  
3

Internship in Clinical Psychology (2.5  
days/week)  
6

### **Summer Term**

Dissertation  
Research  
3

Internship in Clinical Psychology (2.5  
days/week)  
3

### **Course Descriptions**

#### **5353 Social Psychology**

This course covers research findings and theoretical formulations in social psychology and social cognition.

Prerequisite: consent of the Graduate Studies Committee.

#### **5364 Psychometric Theory**

This course offers students an introduction to test construction. Topics include reliability theory, test validation, and item analysis.

Prerequisite: consent of the Graduate Studies Committee.

#### **5350 Clinical Neuropsychology**

This course is an introduction to neuropsychology and its clinical application. Issues of brain-behavior function are addressed along with clinical assessment of brain-related dysfunction. An introduction to neuropsychological test administration and interpretation is offered.

Prerequisite: consent of the Graduate Studies Committee.

#### **5352 Developmental Psychology**

This course includes consideration of the principles, methods, and findings in selected areas of child development, such as sensory processes, perceptual development, cognitive and social development, intelligence, and language acquisition.

Prerequisite: consent of the Graduate Studies Committee.

### **5354 Applied Cognitive Neuroscience**

Basic concepts and research strategies in the study of the neurocognitive basis of behavior are introduced in this course.

Prerequisite: consent of the Graduate Studies Committee.

### **5355 Personality Theories and Dynamics**

Selected personality theories in relation to research evidence and clinical case material are considered in this course.

Prerequisite: consent of the Graduate Studies Committee.

### **5456 Advanced Abnormal Psychology and Laboratory**

This course includes intensive consideration of psychopathology, emphasizing description, etiology, prognosis, treatment modes, and clinical research findings.

Prerequisite: consent of the Graduate Studies Committee.

### **5357 Psychopharmacology**

This course offers an introduction to psychopharmacology and discussions of the various classes of psychotropic drugs with emphasis on indications for use and behavioral aspects of drug abuse.

Prerequisite: consent of the Graduate Studies Committee.

### **5358 Health Psychology**

This course begins with an overview of the current field. The physiological bases of behavior and health and the interactions of stress and emotions are reviewed. Specific topics are control and helplessness, behavioral factors in illness, psychophysiological disorders, medical settings and patient behavior, psychological assessments in medical settings, behavioral treatment techniques, biofeedback, and pain and pain management.

Prerequisite: consent of the Graduate Studies Committee.

### **5363 Professional Ethics and Issues**

Current professional issues in American psychology, including training, ethics, standards, legislation, and social issues relevant to psychology, are discussed in this course.

Prerequisite: consent of the Graduate Studies Committee.

### **5365 History and Systems of Psychology**

This course attempts to determine whether psychology is a science and, if so, what kind of science. The course includes an overview of the history and philosophy of psychology,

beginning with the pre-Socratic Greeks and proceeds through to current theoretical approaches. The philosophy of science also is explored as the underlying context for considering whether psychology is a science.

### **5266 Life-Span Developmental Psychology**

This course covers the study of individual development spanning youth to old age. The life events and challenges unique to each developmental period are highlighted.

Prerequisite: consent of the Graduate Studies Committee.

### **5372 Theories and Techniques of Individual Psychotherapy**

This course includes a survey of the theories, techniques, and evaluation of individual psychotherapy.

Prerequisite: consent of the Graduate Studies Committee.

### **5373 Theories and Methods of Cognitive-Behavioral Therapy**

This course includes a review of theories and methods of cognitive-behavioral therapy and their applications to clinical problems.

Prerequisite: consent of the Graduate Studies Committee.

### **5381 Theories and Methods of Consultation, Supervision, and Program Development**

This course is an introduction to the theories, methods, and practice of consultation, supervision, and program development as they are applied to organizational, educational, and clinical settings.

Prerequisite: consent of the Graduate Studies Committee.

### **5284 Cultural Diversity**

This course examines the complex relationships among social, cultural, ethnic, and racial factors with regard to mental health service delivery and considers cultural backgrounds and cultural issues in the assessment and treatment of patients.

### **5392 Research Design and Multivariate Statistics**

This course offers a solid foundation and understanding of basic statistical concepts. The student acquires experience with data analysis using applied statistics for the behavioral sciences (including nonparametric tests, correlations, t-tests, ANOVA, and linear regression). Applications of computerized database and data analysis are highlighted. Methodological and ethical issues relevant to applied clinical research problems are emphasized.

Prerequisite: consent of the Graduate Studies Committee.



### **5385 Advanced Statistics**

The course integrates research design and computerized data analysis. The course covers experimental design and analysis of variance models, multiple linear regression, analysis of covariance, and nonlinear inference.

### **5461 Clinical Methods I and Laboratory**

This course includes the consideration and application of diagnostic methods for the assessment of children and adolescents on the constructs of intelligence, achievement, aptitude, interest, personality, and psychological deficits.

Prerequisite: consent of the Graduate Studies Committee.

### **5462 Clinical Methods II and Laboratory**

This course emphasizes assessment of adult populations, with an emphasis on projective techniques and clinical consultation using psychological test materials.

Prerequisites: Clinical Methods I and consent of the Graduate Studies Committee.

### **5090-01 Practicum in Clinical Psychology**

This course includes the application of psychological principles, assessment methods, and other behavior-changing techniques and consultation approaches under supervision in a clinical setting. Practicum may be repeated for credit.

Prerequisites: consent of the Graduate Studies Committee, and full-time graduate student standing in Clinical Psychology.

### **5091-01 Internship in Clinical Psychology**

This course includes the affiliated, APA-accredited doctoral internship, which is a two-year, half-time clinical experience where the application of psychological principles, assessment methods, and other behavior-changing techniques and consultation approaches are taught and performed under supervision by a licensed psychologist in a clinical setting. Internship may be repeated for credit.

Prerequisites: consent of the Graduate Studies Committee, satisfactory completion of practicum, and full-time graduate student standing in Clinical Psychology.

### **5093 Seminar in Psychology**

This seminar course includes reading, reports, and discussion of special areas in psychology. May be repeated for credit.

Prerequisite: consent of the Graduate Studies Committee.

### **5094 Research in Psychology**

Laboratory or field research is carried out under the supervision of a faculty member.

Prerequisite: consent of the Graduate Studies Committee.

### **5099 Dissertation Research**

Prerequisite: admission to candidacy and consent of the Graduate Studies Committee.

### **5285 Evidence-Based Therapies**

This course will offer instruction on evidence-based treatments in clinical psychology which are disorder based. The content rotates each year, and repeats every four years. The following therapies are included: Prolonged Exposure Therapy (first half of the summer) and Cognitive Processing Therapy (second half of the summer); Dialectical Behavior Therapy and Integrative Behavioral Couples Therapy; Interpersonal Therapy and Acceptance and Commitment Therapy; Motivational Interviewing and Seeking Safety.

### **5101 Basics of Neuroanatomy**

This course will introduce the students to basic neuroanatomy as it informs which the neural and physiological underpinnings of behavior.

### **5102 Fundamentals of Clinical Management**

The course is designed to provide students with the basic skills required as they begin to evaluate and treat clients. The course will focus on evidence-based practices for conducting clinical interviews, responding to crisis situations, and evaluating/managing suicide risk with diverse patient populations.

### **5310 Psychodynamic Psychotherapy (Elective)**

Psychodynamic psychotherapy is an evidence based method of treatment that has various goals, depending on the client. These may include relief of symptomatic suffering, as well as decreased levels of character pathology and increased reflective functioning.

### **5360 Developmental Psychopathology (Elective)**

This seminar focuses on typical and atypical life course issues of early attachment and adult attachments. It reviews attachment theory research and the relevance of the discoveries to clinical work, child-care, and education. This course will highlight the importance of developmental psychology to psychotherapy and psychopathology.

The course will center upon case descriptions from diverse backgrounds with an emphasis upon translating theoretical understanding of developmental psychopathology from psychoanalytic and current developmental psychology traditions to clinical care.

Prerequisite: Developmental Psychology

### **5351 Advanced Neuropsychology (Elective)**

Review of various neurological disorders and associated neuropsychological profiles in addition to related neuroimaging and neuropathological markers of disease.

Prerequisite: Introduction to Neuropsychology

### **5256 Forensic Psychology (Elective)**

This is a survey course that provides a broad overview of the major areas of forensic psychology including consideration of evidence-based practices and individual/cultural diversity.

### **5285 Evidence Based Therapies (Elective)**

This course is required for all first-year students, but is an elective for all other class years. The content is rotated every four years to give all students the opportunity for exposure to all evidence-based therapies. Content areas include:

Interpersonal Therapy for Depression/Acceptance and Commitment Therapy  
Motivational Interviewing/Seeking Safety  
Cognitive Processing Therapy/Prolonged Exposure Therapy  
Dialectical Behavior Therapy/Integrative Behavioral Couples Therapy

### **5254 Theories and Techniques of Group Psychotherapy (Elective)**

This course includes a survey of the theories, techniques, and evaluation of group psychotherapy.

## **CLINICAL SCIENCES**

### **Chair, Graduate Program**

Keith E. Argenbright, M.D., M.M.M.

### **Degrees Offered**

#### **Graduate Certificate**

**Master of Science in Clinical Science**

## **FACULTY**

### **Professors**

Keith Argenbright, M.D., Tulane University, 1984; M.M.M., Carnegie Mellon University, 2009  
Robert Haley, M.D., UT Southwestern Medical Center, 1986  
Ethan Halm, M.D., Yale University School of Medicine, 1991; M.P.H., Harvard School of Public Health, 1997  
Elizabeth Heitman, Ph.D., Rice University, 1988  
Linda Hynan, Ph.D., University of Illinois at Urbana-Champaign, 1993  
Joan S. Reisch, Ph.D., Southern Methodist University, 1974  
Robert D. Toto, M.D., University of Illinois at Chicago, 1977  
Andrew Zinn, M.D., Ph.D., UT Southwestern Medical Center, 1988

### **Associate Professors**

Heidi Jacobe, M.D., Baylor College of Medicine, 1996; M.S.C.S., UT Southwestern Medical Center, 2008  
Ronald Taussig, Ph.D., Stanford University, 1988

### **Faculty Associate**

Frank Grassler, J.D., University of Colorado, Boulder, 1983  
Vice President for Technology Development

### **Objectives**

The overall goal of the Center for Translational Medicine's Research Education, Training, and Career Development Program is to generate a diverse biomedical workforce that will drive excellence in clinical and translational research at UT Southwestern and our partner institutions. The master's program is offered through the Graduate School of Biomedical Sciences and operates out of the UT Southwestern Center for Translational Medicine (CTM), which is the integrated home for the NIH Clinical & Translational Science Award (CTSA). We have established a highly successful multidisciplinary program. In an effort to evolve and improve over time, we strive to leverage our strengths in research education, training, and career development in order to expand and enhance our all our training programs, including the master's degree.

### **Center for Translational Medicine**

The Center for Translational Medicine (CTM) is a member of the national Clinical and Translational Science Award (CTSA) consortium, a group of 64 medical research institutions that work together and share a common vision to improve the way biomedical research is conducted across the country, reduce the time it takes for laboratory discoveries to become treatments for patients, engage communities in clinical research efforts, and train a new generation of clinical and translational researchers.

The Center provides resources and infrastructure to enable investigators to perform cutting-edge clinical research. The staff, facilities, and resources are available to all researchers at UT Southwestern, and many resources are also available to our Council of Partners.

The mission of the Center for Translational Medicine is to provide the crucial infrastructure necessary for medical scientists to discover and apply new diagnostics and therapeutics for the detection, diagnosis, treatment, and prevention of disease and, thereby, to achieve the goal of improving our nation's health in a safe, ethical, and responsible manner that ensures an individual's well-being and the public's trust.

## **Education & Training Program**

The CTM Education and Career Development Program strives to provide trainees with a unique and rigorous multidisciplinary program that will prepare them to become leaders of the next generation of clinical and translational investigators. As part of this initiative, UT Southwestern offers a Master of Science in Clinical Science (MSCS). In addition, it offers a graduate level Mentored Clinical and Translational Research Scholar Program (CTSA KL2; Scholar Program) and a yearlong predoctoral medical student/Ph.D. student training program (CTSA TL1).

Our vision is to enable the training and launch the careers of predoctoral and postdoctoral level trainees across all disciplines and including all partnering institutions of the Center for Translational Medicine. This will be accomplished by providing outstanding education and career development programs that meet the trainees' short-, intermediate-, and long-term clinical and translational science educational needs.

KL2 Mentored Clinical and Translational Research Scholar Program (Scholars Program) is designed to provide intense research training and career development opportunities in a multidisciplinary setting that culminate in the submission of an extramural career development grant application. Scholars include junior faculty and clinical research fellows who have protected time for research. As with the master's degree curriculum, deliverables include a completed research project, a publishable manuscript, and an extramural grant application such as an NIH K award.

The goal of the Scholars Program is to prepare junior investigators for a successful career in clinical and translational research. The CTM aims to transform junior investigators by providing resources and support needed to launch their research careers. In addition, trainees acquire competence in critical thinking, team science, leadership, biomedical statistics and informatics, and other disciplines by taking courses offered in the master's program. All CTM trainees are mentored by faculty across the UT Southwestern campus, focusing on team science that spans the spectrum of translational medicine.

## **Facilities**

The Program holds classes and seminars in Medical School classrooms located on UT Southwestern's South Campus, which is within walking distance of major hospitals and clinics. The Program offers a flexible environment and sets achievable goals and expectations for busy

clinical investigators who need to balance course work, research, patients, and their personal lives.

### **Requirements for Admission**

The Clinical Sciences Graduate Program exists for predoctoral and postdoctoral candidates whose career goals include a significant commitment to conducting high-quality clinical and translational research in an academic medical center.

All candidates must:

- Fulfill all requirements for admission to UT Southwestern Graduate School of Biomedical Sciences;
- Have a doctoral degree in health professions/biomedical science (e.g. M.D., Ph.D., PharmD, DDS, etc.) unless applying to the predoctoral track;
- Have a current, formal affiliation with UT Southwestern or one of its CTSA partnering institutions;
- Have a minimum of 50 percent protected time devoted to the Didactic and Socratic curriculum, research project, and the research practicum;
- Submit the following essays:
  - A career development plan,
  - A personal statement answering the following questions:
    - How did you arrive at this place in your career?
    - A career in clinical/translational research is challenging, with many opportunities and frustrations. Why are you attracted to this career?
  - A description of a potential research project.
- Submit a current CV, using the standardized UT Southwestern Promotion and Tenure format; and
- Submit the four following letters of recommendation:
  - A detailed letter of support from the applicant's Department Chair, guaranteeing 50 percent protected time for a minimum of two years and funding for the candidate's salary and fringes during this time.
  - One letter of professional reference.
  - One letter from the applicant's Scientific Mentor, documenting the applicant's commitment to a career in clinical/translational research.

### **Curriculum**

The curriculum is well suited for candidates who possess both a working knowledge of clinical medicine and excellent scholastic aptitude. Both the certificate and master's degree programs are designed to be completed in two to three years, depending on the amount of time the individual can commit to the didactic curriculum. Program requirements are tailored to meet the individual academic needs of each candidate by the Program. Required course work may include didactic courses in basic biostatistics, epidemiology, clinical advisor research design, translational research, grant-writing skills, and data analysis and management. Also, students may take courses from other institutions that have similar clinical research or public-health programs, with prior permission of the Clinical Sciences Graduate Program Director.

Trainees entering the Program with previous academic work in an equivalent program at any institution of higher education may waive up to 12 credit hours upon entry to the Program with faculty approval.

### **Graduate Certificate**

Didactic Curriculum: 3-11 hours depending on goals established in career development plan

Socratic Curriculum: Active participation and regular attendance at seminars, lectures, workshops, etc.

Research Practicum: 9-15 hours depending on goals established in career development plan

### **Master's Degree**

Didactic Curriculum: 21-27 hours

Socratic Curriculum: Active participation and regular attendance at seminars, lectures, workshops, etc.

Research Practicum: 9-15 hours

## **COURSE DESCRIPTIONS**

### **Didactic Curriculum**

#### **5096 Special Topics**

This course is designated for independent or group study as directed by a faculty instructor and approved by the Program's Steering Committee and faculty directors. [FALL, SPRING, SUMMER] (1-3 credit hours)

#### **5097 Directed Research**

Research and writing efforts guided by the trainee's scientific mentor(s) and Program leadership. Deliverables will be reviewed and approved by Program leadership. (FALL, SPRING, SUMMER) (1-15 credit hours)

### **5105 Ethics in Clinical Science**

Introduction to ethical reasoning and related processes, techniques of settling disagreements among people, treatment versus research, informed consent, clinical research relevant to third parties, dealing with unexpected scientific and clinically important findings, getting what you want from mentors, consent and risk issues with unproven biological markers, conflicts of interest/duty, handling misconduct and fraud, ethics of subject recruitment, compensating for injuries or medical errors in research, talking to media, public policy advising, authorship order and publications, gender and ethnicity in sciences careers. [FALL of odd-numbered years] (1 credit hour)

### **5106 Grant Writing and Funding Strategies**

This course will review the different types of federal grant mechanisms as well as grants or contracts from research foundations, advocacy organizations, and industry. How to write a persuasive, well-reasoned application will be the main focus of the course, including the budget, resources and environment, preliminary data, and the research plan. [FALL] (1 credit hour)

### **5111 Translational Science Forum**

This seminar provides an open community-based opportunity for early-career clinical investigators to improve their skills in clinical research design and analysis and in the presentation of research plans and data. Participants will achieve this goal by mastering key aspects of the thinking process of clinical research in a lighthearted, but critically analytical environment. Expert panel members will ask the presenter general and specific questions about all aspects of the research proposal and provide lively critiques of the substance and style of the research proposals. [FALL, SPRING] (1 credit hour)

### **5114 Preparing a Journal Report**

Included are general writing skills and strategies; preparing an empirical article, including tips on writing the abstract, introduction, aims, methods, results and discussion/conclusion sections of a peer-reviewed journal article. Students are required to submit a journal article and review others' articles. [FALL] (1 credit hour)

### **5115 Clinical Research from Proposal to Implementation**

Basic elements of a research proposal and implementation are covered. Topics include regulatory approvals; continuing regulatory oversight; monitoring patient safety; recruitment; clinical assessments; data treatment, data collection, entry, and auditing; provision of experimental tests/tasks; data analyses; and publication planning. [FALL] (1 credit hour)

### **5118 Successfully Obtaining an R (SOAR) Grant Writing Seminar**



SOAR is designed to increase NIH R-type grant acquisition success rates in basic, translational, and clinical research. SOAR includes topics such as demystifying the grant writing process, grantsmanship, surviving the NIH study section review, writing tips and tricks, navigating NIH requirements, peer-review, etc. [FALL, SPRING] (1 credit hour)

### **5119 K Grant Writing Seminar**

This seminar is intended for trainees who are writing and submitting K grants. Participants attend each session, engaging in a peer review of each other's specific grant section. Faculty experts are brought in to enhance the learning experience. [FALL, SPRING, SUMMER] (1 credit hour)

### **5209 Practical Clinical & Translational Research Protocol Development**

This covers defining and developing a research question; distinguishing between correlative and mechanistic questions; matching methods to questions; understanding bias and confounding, random, and systemic error; quantifying clinical information. Additionally, practical aspects of research protocol conceptualization and development are covered. Enrollees have the opportunity to learn how to translate a research question into a hypothesis; how to identify and describe hypothesis-appropriate study subjects and study measurements; select a specific study design appropriate to the research question and resources available; synthesize the elements into a study plan; and develop a statistical section and analytical plan. Protocols developed by enrollees form the primary basis for group discussions. [SPRING] (2 credit hours)

### **5203 Clinical Pharmacology and Drug Development**

Included are pharmacokinetics; pharmacodynamics; drug absorption, distribution, metabolism, and elimination; drug-drug and drug-disease interactions; preclinical drug development (Phase I, II, III and IV); proof-of-concept and dose-finding studies; post-marketing surveillance. [SPRING of odd-numbered years] (2 credit hours)

### **5207 Introduction to Patient Centered Outcomes & Comparative Effectiveness Research**

This course covers the methods used in outcomes and health services research, which include research design, theory, measurement, methods of analysis, and evaluation of published research. Course objectives are to: 1) Describe basic concepts, definitions, and types of outcomes and health services research; 2) Understand structure, process, outcomes and underuse, misuse, or overuse of conceptual models; 3) Identify common approaches and challenges in measuring cost, quality, access, and equity in health and health care; 4) Describe experimental and observational research designs used to assess the impact of health services (drugs, devices, procedures, strategies, delivery, and financing systems) on patient-oriented, clinical, and resource-use outcomes. [SPRING] (2 credit hours)

### **5208 Essentials of Leadership & Management for Researchers**

This course is a structured review and discussion of the basics of management and leadership theory and practice. Topics include project management and budgeting, information systems, leadership style, effective interviewing and hiring techniques, conflict resolution, and the basics of organizational culture. Predominant theories and research, as well as shared experiences of

the instructor and the group, are discussed in order to enhance each participant's effectiveness as a manager and leader. Several hours are spent throughout the course understanding and analyzing federal and state health policy (current and proposed) and the implications for the independent researcher. The curriculum combines assigned readings, didactic lectures, active group discussion, a mid-term project, and a final examination. [SPRING] (2 credit hours)

### **(TBA) Developing & Commercializing Biomedical Research**

This course reviews basic concepts in developing and commercializing research in biomedical sciences. Students will learn principles of designing experiments for clinical and regulatory relevance, discerning inventions from research data, obtaining intellectual property legal protection, structuring licenses of inventions to existing companies, forming new start-up companies, attracting investment capital, and regulatory approval of products for human therapy.

### **5301 Introduction to Principles & Methods of Clinical & Translational Research**

This class presents basic and intermediate principles in research design; formulation of the research question; identifying primary and secondary hypotheses; use of control groups and pre-specified hypotheses; surrogate measurements; analysis of incomplete data; meaning of P values and confidence intervals; and identification of bias and flaws in study design. [FALL] (3 credit hours)

### **5302 Biostatistics for Clinical Science II**

Topics to be considered are linear and logistic regression models (control of confounding and predictive models); categorical data analysis (binomial and Poisson distributions); analysis of paired categorical data; nonparametric methods for ordinal data; survival analysis (Kaplan-Meier curves, hazard functions, types of censoring, log-rank tests, and generalized Wilcoxon tests, Cox regression model). [SPRING] (3 credit hours)

Prerequisites: CTM 5391 or 5309

### **5307 Epidemiology for the Clinical Investigator**

This course offers considerations such as concepts of multivariate causality; criteria for establishing causality; risk; rates; incidence, prevalence and attack rates; incidence density; crude, specific and adjusted rates; relative risk, odds ratio, case-fatality rate and attributable risk; sampling error, selection bias, information bias, definition bias and confounding; statistical techniques to control for bias; variables; overview of statistical analysis; multiple comparisons correction; study designs to avoid bias; survey and sample selection, cross-sectional, cohort, case-control; prospective versus retrospective; attributes of cohort studies; design principles of case-control studies; types of control groups; strategies of matching in case-control studies; experiential introduction to statistical computing for different types of clinical epidemiology studies. [SPRING] (3 credit hours)

### **5309 Biostatistics I**

This course includes a conceptual approach to statistical analysis of biomedical data; review of fundamental statistical principles, focusing on explanation of the appropriate scientific

interpretation of statistical tests rather than the mathematical calculation of the tests themselves. The course covers all topics typically used in biomedical publications (data description, summary statistics, p values, non-parametric tests, analysis of variance, correlation, regression, statistical power, and sample-size estimation). [FALL] (3 credit hours)

### **Socratic Curriculum**

The highly innovative Socratic curriculum complements the didactic curriculum. The Socratic curriculum consists of a rich selection of seminars and workshops, conducted using an interactive approach to provide continuous opportunities for clinical investigators to exchange ideas, apply knowledge, present and defend their work, critique the work of others, and participate in forums mimicking real-life conditions of peer review.

### **Translational Science Forum**

Weekly presentations of research proposals to a peer group audience by early-career clinical investigators with lively critiques of substance and style by a panel of senior clinical investigators, with the intent of making key points of interest to all investigators.

### **Navigating CT Science Academic Careers**

This workshop focuses on important issues for junior faculty, for example: negotiating for protected time, equipment, resources, promotion, salary, achieving career milestones, surviving in academic medicine, and other career-building topics.

### **Responsible Conduct of Research**

This seminar examines regulatory requirements of clinical research (IRB, GCP, HIPAA, and investigational filings); ensuring patient safety; interactions with government and industry; contract negotiations; successful strategies and tactics. This meets the NIH requirement for training in RCR.

### **Research Practicum**

#### **Research Project**

The Research Project is a hands-on research training experience. Depending on the trainee's prior research experience, it may serve as an introduction to clinical or translational research practices, or as an advanced experience as a PI to oversee a multidisciplinary research team. The study should examine an important clinical and/or translational question, and the goal is to obtain interpretable data that can advance the field and the trainee's academic career. The trainee should be actively involved in the analysis of data, protocol development/gaining IRB approval/accrual of patients as applicable in order to gain a breadth and depth of experience. The trainee should be involved in presenting data at meetings and publish papers when appropriate. The project will lay the foundation for the publishable manuscript and the extramural grant application. Early and frequent consultation with a multidisciplinary team is strongly recommended.

## **Publishable Manuscript**

The trainee will write and submit a manuscript for publication (as first author) describing the findings of the research project. In an effort to establish himself/herself as an expert in the field, the trainee should discuss current knowledge and provide unique insights. The trainee is expected to cite related literature and raise specific questions that need to be addressed in future research. The manuscript must be related to the research project (above) and address primary data. In the event that in spite of excellent research effort, the data are not suitable for publication, then a critical literature review in a manuscript format on the topic of research may be submitted in lieu of a primary research manuscript (with approval).

## **Extramural Research Grant Application**

As the capstone to the program, the trainee writes and turns in a complete and submitted extramural grant application. In the majority of cases, the trainee will submit a NIH career development grant ([NIH K23, K08](#)) or equivalent foundation grant. In some cases, the trainee may submit a R21, R01 or equivalent independent grant. If planning to submit a grant to other agencies, the trainee should seek approval by the Career Development Committee in advance. The research grant proposal will use standard NIH forms (or similar forms for foundation-based awards). The research proposal should be based on the trainee's prior research (project and manuscript(s) must form the background and significance of the proposal). The grant application will be developed with the close advice and guidance of the trainee's mentor(s) and multidisciplinary team.

## **Career Development**

The Center for Translational Medicine's Education and Career Development programs enhance the knowledge and skills required for the performance of high-quality innovative clinical and translational research, advancing the development of trainees planning a career in or interested in contributing meaningfully to clinical or translational research. Specific program activities are closely related to career development and available for trainees formally enrolled in the Program.

## **Mentoring**

The mentoring of early-career medical researchers is critical to their academic and scientific success. Access to one or more senior colleagues who has demonstrated a career of scientific prowess, is willing to facilitate, nurture and transfer the necessary behaviors for personal and professional growth and understands the vicissitudes of academe and its institutions has been recognized as a vital factor for setting the stage for potentiating the career of the mentee. Studies have shown that young researchers and junior faculty members who identified a mentor felt more confident than their peers, were more likely to have a productive research career and reported greater career satisfaction. Furthermore, as an added bonus to the

providing institution, departments that deliberately assist their new members in learning how to thrive in an academic research culture gain the benefit of improved productivity, stability, loyalty and leadership capacity.

UT Southwestern recognizes that a successful mentoring program is dependent on the availability of willing and effective mentors. When a faculty member is identified as being either a scientific or humanistic mentor, a formal communication is sent to the mentor. This communication consists of a) formal notification of their role as a mentor in the UTSW Scholars program; b) the name of their mentee; c) their defined role in the mentee's training – scientific mentor, humanistic mentor, or both; d) a copy of the UTSW Mentor Guidelines; e) how and when to contact program faculty/staff with issues regarding their mentees; and f) formal recognition and gratitude for the critical role these mentors play in the academic success of their mentee. This formalized process of mentor notification has been in place for the last three years with overwhelming success. The mentors frequently contact program leadership to discuss specific issues with their mentees, allowing the program faculty/staff to muster additional resources for the students. The Mentor-Mentee Guidelines/Agreement are the basis for the relationship, and contain explicit expectations for mentors and mentees alike.

### **Education & Mentoring Oversight Committee**

The Education & Mentoring Oversight Committee establishes Program policies and processes, reviews student and mentor feedback and other training program evaluation data, reviews and develops courses, reviews and approves research practicum projects, and makes final decisions on degree completion. It has a fundamental role in the evaluation and continuous development and implementation of the Program.

## **PROGRAMS**

### **POSTDOCTORAL SCHOLARS TRAINING PROGRAM**

Postdoctoral scholars are recognized as crucial participants in keeping UT Southwestern at the forefront of biomedical research. The objectives of the Postdoctoral Scholars Training Program are to extend the traditional best practices of postdoctoral training in basic sciences at UT Southwestern and to make available new initiatives to improve training. The ultimate goal is to provide a structured Program to aid the transition of each scholar to career independence through the development of professional and research skills.

#### **• Qualifications**

A postdoctoral scholar must have earned a Ph.D., M.D., or equivalent doctoral degree and perform research in a specialty area under the supervision of a faculty mentor. Postdoctoral training presupposes that the scholar is capable of independently executing

original research under the guidance of the postdoctoral mentor. Appointment as a postdoctoral scholar is limited to six years, including postdoctoral training received at other institutions, either inside or outside the United States.

- **Organization of the Program**

All postdoctoral scholars are enrolled in a Certificate Program that includes multiple tracks, each of which is intended to be completed in two years. Postdoctoral scholars register for three hours of course work in the fall and spring terms and two hours of course work in the summer term. The Program is organized as continuing professional training and is graded on a pass/fail system. Certificates are offered in a variety of tracks, each of which includes required course work. A certificate is awarded upon completion of 15 credit hours of training. Beginning postdoctoral scholars are enrolled in the research track, which has requirements for course work in ethics, career advancement, supervised research, and their Individual Development Plan. Additional certificate offerings include Advanced Research, Scientific Management, Cancer, and Educational Techniques.

- **Benefits**

In addition to providing postdoctoral scholars with unique experiences in specialized research and advanced course work, the Program affords access to career and professional development resources offered by the Graduate Career Development Office. Additional benefits include health insurance and other employment benefits, support services, and fitness and recreation opportunities at the Bryan Williams, M.D. Student Center, computer and software assistance, and the lowest campus parking rates.

## **MEDICAL SCIENTIST TRAINING PROGRAM**

The Medical Scientist Training Program (MSTP) at UT Southwestern integrates medical and research training for qualified individuals at the graduate level leading to both M.D. and Ph.D. degrees. The goal of the Program is to prepare individuals as physician-scientists. Graduates of this Program typically pursue careers in academic medicine and biomedical research at the nation's leading institutions.

This Program offers students an integrated curriculum in the scholarly setting of UT Southwestern Graduate School of Biomedical Sciences and UT Southwestern Medical School. The MSTP curriculum is flexible and individualized to suit the background and interest of each medical scientist fellow. The program is designed to be completed in approximately seven to eight years. Additional time is allotted if needed to meet requirements for the Ph.D. degree.

- **Prerequisites**

A baccalaureate degree is required, and significant experience in laboratory research is essential for admission. It is desirable, but not mandatory, that the minimum prerequisites for admission to UT Southwestern Medical School be supplemented by one year of college calculus and one year of physical chemistry. Potential applicants who have not had prior experience in a research laboratory should gain such experience before considering a career in academic medicine and medical research. For Medical School students, it is possible to acquire the necessary research experience after entering and to apply to the MSTP during the first or second year of medical school.

- **Medical Scientist Fellowships**

The Medical Scientist Training Program is the recipient of a training grant from the National Institute of General Medical Sciences of the National Institutes of Health. Support for the Program also is provided by other sources. All students accepted into the Program receive stipend support and full funding for tuition and fees.

There is no priority assigned to an applicant's state of residency. MSTP fellows come from all over the United States, and a limited number of positions with full support are available to international applicants.

- **Organization of the Program**

Through the course of the Program, M.D./Ph.D. fellows are enrolled in UT Southwestern Medical School or UT Southwestern Graduate School. Students who complete the MSTP will have met all requirements for the Ph.D. degree in the Graduate School and for the M.D. degree in the Medical School. The Ph.D. may be earned in one of the basic science graduate training programs within the Division of Basic Sciences. Program faculty are derived from both basic science and clinical departments of the Medical School.

The schedule includes the first two years of medical school with summer laboratory rotations prior to and following the first year and again following the second year. The summer laboratory rotations are research apprenticeships to aid the student in selecting a research area and a mentor for research training. These apprenticeships are established by discussion with each student, the MSTP Committee and the potential preceptor. They are intended to expose the student to a variety of excellent laboratories in his or her area of interest.

- **Application Procedure**

The process for admission to the MSTP can be viewed at the website [www.utsouthwestern.edu/mstp](http://www.utsouthwestern.edu/mstp). Application to the MSTP is made via the American Medical College Application Service. Concurrent application to the medical school alone is permissible via the Texas Medical and Dental Schools Application Service.

## **GRADUATE STUDENT INFORMATION**

## ADMISSIONS

Key dates include:

- **August 1:** Application begins
- **December 1:** Application Deadline
- **January – March:** Interviews and offers made
- **April 15:** Applicants must inform graduate school of decision
- **Mid-August:** Courses and rotations begin

Information regarding admissions and online application is available on the UT Southwestern website at [www.utsouthwestern.edu/graduateschool/index.html](http://www.utsouthwestern.edu/graduateschool/index.html). Electronic application is required. Application procedures and deadlines are detailed on the application website.

### Requirements for Admission

There are three minimum requirements that must be met in applying for admission as a regular graduate student:

- 1) A bachelor's degree or its equivalent from an accredited institution in the United States or proof of equivalent training at a university in another country. Each applicant is required to have one official transcript from each institution of higher learning attended (including postgraduate studies) sent to the Office of Enrollment Services.
- 2) Evidence of relevant academic preparation for the graduate training sought. If the bachelor's degree was earned in an unrelated field, evidence of prior formal preparation (usually via postgraduate studies) must be submitted.
- 3) Scores on the Graduate Record Examination General Test. International students from countries where English is not the official language must also submit scores on the Test of English as a Foreign Language.

Applicants must request that the Graduate Record Examination (GRE) and TOEFL scores be sent directly to the Office of Enrollment Services. The code number for UT Southwestern Medical Center is R66860.

### Essential Functions

All individuals who apply for admission to the Graduate School must be able to perform specific essential functions in order to complete a graduate program curriculum, including original research. No applicant who can perform the essential functions – either with or without reasonable accommodations – will be denied consideration for admission. Information regarding how to request reasonable accommodation due to disability and UT Southwestern's Learners with Disabilities Policy is available from Student Academic Support Services. This information is also included in the material sent to all accepted applicants.



The following are essential functions for graduate students at UT Southwestern Medical Center. Each graduate program may require additional essential functions to accommodate unique aspects of that program, and such requirements may be subject to change.

1) Communication: Graduate students must be able to communicate effectively and efficiently orally and in writing. Candidates also must be able to read and comprehend written material.

2) Intellectual and Cognitive Abilities: Graduate students must be able to measure, calculate, reason, analyze, synthesize, integrate, and apply information. Problem solving, the main challenge in research, requires these intellectual abilities.

3) Behavioral and Social Attributes: Graduate students must possess the emotional health required to use their intellectual abilities fully, including good judgment, maintaining an appropriate work schedule, and meeting program expectations on schedule. Graduate students must be able to tolerate challenging workloads and function effectively under stress. They must be able to adapt to changing circumstances and learn to function in the face of uncertainties and ambiguities inherent to the research enterprise. Integrity, concern for others, and interpersonal skills are all needed for success in graduate studies.

4) Ethical Standards: Graduate students must demonstrate professional demeanor and behavior and must perform in an ethical manner in all dealings with peers, faculty, and staff of UT Southwestern Medical Center and with patients, where appropriate.

### **Evaluation of Applicants**

Admissions decisions will be made in accordance with UT Southwestern's institutional admissions policy and the Graduate School of Biomedical Sciences admissions policy, and based on the program-specific requirements and procedures outlined herein.

Admission Committees for individual graduate programs consider all of the following in evaluating each applicant:

- 1) Scores on the Graduate Record Examination General Test if provided (required for Clinical Psychology);
- 2) Academic performance in college as reflected in the grade-point average;
- 3) The rigor of the undergraduate curriculum and its appropriateness as preparation for study in the graduate program sought;
- 4) Recommendations from appropriate professors and/or mentors;
- 5) Experiences in scientific research activities;
- 6) Socioeconomic background;
- 7) Ability to communicate in English;
- 8) Personal integrity;
- 9) The applicant's statement of motivation for a career in scientific research and/or teaching.

A personal interview may be initiated by invitation from the appropriate Admissions Committee. The Committee interviews applicants who are viewed as having the greatest likelihood of succeeding in graduate study based on the listed considerations. The interview provides further evidence of acceptability.

Individual programs may have one or more additional requirements specific to the area of training. Any additional requirements or considerations can be found in descriptions of individual programs.

### **Use of Race or Ethnicity in Admissions**

Programs within the Division of Clinical Science (DCS) do not consider race or ethnicity in the admissions process. All programs within the Division of Basic Science (DBS) (e.g., Biological Chemistry, Biomedical Engineering, Cancer Biology, Cell and Molecular Biology, Genetics, Development and Disease, Immunology, Integrative Integrative ~~Biology~~ Molecular and Biomedical Sciences, Molecular Biophysics, Molecular Microbiology, Neuroscience, and Organic Chemistry) consider race or ethnicity as one factor in an individualized, holistic approach to identify applicants whose qualities, attributes, and accomplishments indicate that they will contribute to the missions of the Graduate School and be successful in their course of study.

### **REGISTRATION**

Before registering, both new and continuing students must consult their graduate advisers regarding specific courses and obtain approved course registrations. Permission must be secured from the appropriate instructor to enroll in classes outside the student's major program. Registration is completed with the Office of Enrollment Services through the Graduate Program office.

Late registration will be allowed only by permission of the instructor(s) responsible for the course or courses the student wishes to take, with concurrence of the Dean, and is subject to a late registration fee.

The typical academic load in credit hours varies with the program and other factors. The minimum full-time registration is nine hours in a fall or spring term and six hours in the summer term. Changes in course load (adding or dropping) during a term require written approval of the student's graduate adviser, the faculty member teaching the course and the Director of Enrollment Services (see also the Expenses section). A course may be added or dropped without record of the student's performance only during the first 12 academic days (nine academic days for the summer term). After that time, if the student withdraws from a course, a grade of WP (Withdrew-Passing), WF (Withdrew-Failing) or W (Withdrew) will be assigned.

A student must be registered currently for the appropriate dissertation or thesis course to receive advice or direction from his or her mentor(s) during the preparation of a thesis or dissertation. A student is required to be registered during the term in which the oral defense examination of the thesis or dissertation is held.

### **Student Responsibility**

Students are responsible for understanding degree requirements and for enrolling in courses necessary for their individual degree Program. Each student also is responsible for knowing University regulations regarding the standard of work and conduct required for continued enrollment in the Graduate School. If a student needs additional information, the

Graduate School office should be consulted. To obtain a complete list of requirements for a particular degree, the student should combine the general requirements detailed in this section with the special requirements listed under his or her Graduate Program of choice.

## **ENROLLMENT**

Students are expected to be enrolled full time for the duration of their studies at UT Southwestern. First-year students in the Division of Basic Science take 12 credit hours in the fall term, 12 credit hours in the spring term and six credit hours in the summer term. In subsequent years they are enrolled in nine credit hours in the fall, nine credit hours in the spring, and six credit hours in the summer.

Typically, didactic course work is completed in the first one to two years, and then students are enrolled for research seminars or Journal Clubs totaling full-time enrollment equivalency. Course requirements for each Graduate Program are listed in the appropriate chapters of this catalog and online at [www.utsouthwestern.edu/graduateschool/index.html](http://www.utsouthwestern.edu/graduateschool/index.html).

## **SPECIAL GRADUATE STUDENTS**

Under exceptional circumstances, individuals wishing to enroll in graduate courses for credit, but who have not been admitted as regular graduate students, may do so provided they:

- 1) Complete the special student application form from the Office of Enrollment Services;
- 2) Present satisfactory evidence of preparation for the course and secure written permission from the instructor of the course involved;
- 3) Secure written approval of the Dean; and
- 4) Pay all appropriate fees and costs.

Such special graduate students may enroll for no more than nine credit hours in one term, 18 credit hours in total. Registration will be permitted only if undue crowding of facilities will not result.

## **AUDITORS**

Permission to audit a graduate course may be granted only under exceptional circumstances. An individual wishing to enroll as an auditor may do so if he or she meets the same four requirements stipulated for special graduate students. Auditors may enroll for no more than six credit hours in one term and nine credit hours in total. Auditors do not receive academic credit for courses in which they have enrolled.

## **CONCURRENT ENROLLMENT**

### **UT System Institutions**

A student concurrently enrolling at more than one of the three UT System components in North Texas (UT Arlington, UT Dallas, and UT Southwestern) may register and pay tuition and fees for all courses through the student's home campus. Detailed procedures may be obtained from the Office of Enrollment Services of the student's home campus. The concurrent enrollment agreement and waiver of specified fees apply only to students following the concurrent enrollment procedures specified by the Office of Enrollment Services at the home campus.

The charges for tuition at an appropriate rate, applicable laboratory fees, and general fees will be assessed and collected at the home institution for the other institution. Student services at the second institution will be made available to concurrently enrolled students paying the appropriate fees at the second institution. The three institutions have a reciprocal agreement for honoring parking permits. Details may be obtained from the Parking Services Office of the home campus.

Concurrently enrolled students should report problems concerning registration, payment of fees, or other matters related to concurrent enrollment procedures to the Registrar of the home institution.

### **Other Public Institutions of Higher Education**

When a student registers at more than one public institution of higher education in Texas, tuition is determined in the following manner:

- 1) The student will pay the full tuition charges to the first institution at which he or she is registered.
- 2) If the minimum tuition at the first institution is the same as or greater than the Medical Center's minimum, the amount charged for tuition will be the hourly rate.
- 3) If the minimum tuition at the first institution is lower than the Medical Center's minimum, the amount charged for tuition will be the difference in the minimum charges, but in no case will the amount charged for tuition be less than the Medical Center's hourly rate.

Other applicable fees will be charged. Students desiring to take advantage of the concurrent enrollment plan should bring a copy of the fee receipt from the other institution when registering at the Medical Center.

### **Courses of Instruction**

Graduate courses offered at UT Southwestern are listed under program descriptions. The unit of measure for credit in graduate work is a credit hour. A four-digit system generally is used for designating courses, with the second digit indicating the number of credit hours. If the second digit is zero, this indicates the course is offered for varying hours of credit. Certain courses, such as research and seminar, may be repeated for credit.

A student who is admitted to a graduate program in UT Southwestern Graduate School of Biomedical Sciences may apply for permission to take one or more courses on the campus of

one of the private universities in Dallas or at any other component of The University of Texas System.

## **REQUIREMENTS FOR GRADUATE DEGREES**

### **General**

- 1) The student must demonstrate a high order of scholarly achievement in his or her chosen field of study, including appropriate research and professional competencies. The Program Steering Committee, through designated graduate advisers and mentors, determines the student's program of study and evaluates whether adequate mastery has been acquired.
- 2) For any graduate degree, a student must be in academic residence for at least two terms of full-time enrollment. In practice, the master's degree usually requires one to two years of graduate study while the doctorate usually requires four or more years. (Some courses used to meet this requirement may be taken at other universities participating in an interinstitutional program.)
- 3) The student must discharge all financial and other obligations to the Medical Center. In the event of nonpayment, one or more actions may be taken by the Dean: 1) readmission may be denied; 2) a student's grades and official transcript may be withheld; and 3) the degree to which the student would otherwise be entitled may be withheld.

In addition to the foregoing general requirements, there are specific requirements in each degree program (refer to Program descriptions for further information).

### **Specific Requirements for the Master's Degree**

Each Program Steering Committee determines the number of hours of course credit required for the master's degree. Additionally, the program specifies whether the student is required to complete a thesis, or its equivalent, that is acceptable to a Supervisory Committee appointed to direct and evaluate the thesis.

Master's degree candidates from a Program requiring a thesis must submit to the Graduate School office an electronic copy of the thesis, as well as a report of the final oral examination signed by the Supervisory Committee members. These documents, as well as research papers, can be made available to interested members of the public

For a master's degree by examination, the Program Chair must submit to the Graduate School office a written report documenting that the degree requirements have been met. Deadline dates for submission of approved theses for each term are published in the annual academic calendar from the Office of Enrollment Services.

### **Specific Requirements for the Degree of Doctor of Philosophy**

Each program specifies a minimum number of credit hours to meet requirements for admission to candidacy in the program. In all programs, students must pass a qualifying

examination, as specified by the program, in order to demonstrate mastery of and the ability to perform scholarly work in a field.

When the student is deemed by the Program Steering Committee to have met all academic requirements and has passed the qualifying examination, he or she is formally admitted to candidacy. The degree is awarded after the candidate has conducted independent research under the guidance of a supervising professor, prepared a dissertation, and successfully defended it in an oral examination before an appointed Committee.

Doctoral degree candidates must submit to the Graduate School office an electronic copy of the dissertation and a report of the final oral examination signed by the Supervisory Committee members. Deadline dates for submission of approved dissertations for each semester are published in the annual academic calendar prepared by the Office of Enrollment Services.

## **Graduation**

Degrees may be conferred at the end of any term, but only one commencement ceremony is held each year – at the end of the spring term. All students on whom degrees have been conferred since the previous graduation will be listed in the commencement program.

## **ORGANIZATIONS**

### **Graduate Student Organization**

Established in 1973, the Graduate Student Organization is directed by an Executive Committee consisting of elected representatives from each of the Graduate Programs. This Committee serves as a formal liaison between the graduate students and administration. It also sponsors social functions and is responsible for supplying information to new and prospective students.

A number of other organizations offer students at UTSW opportunities for association with individuals of shared interests or backgrounds. Information on registered or sponsored student organization can be found in the “General Information” section of the catalog.

A list of organizations is available from the Bryan Williams, M.D. Student Center or on the UT Southwestern website at:

<http://www.utsouthwestern.edu/life-at/campus-academic-life/student-center/student-orgs/index.html#>