

Department of Microbiology, Molecular Genetics and Immunology

The mission of the Department of Microbiology, Molecular Genetics and Immunology at the University of Kansas Medical Center is to conduct high impact research that is relevant to human health and train the next generation of biomedical scientists and physicians who will advance our understanding of infection and immunity in ways that benefit humankind. The Department currently consists of nine tenure-track faculty members, two research-track faculty members, and three faculty with secondary appointments in the department. The faculty members represent seven countries. Offices and laboratories of the primary faculty occupy over 16,000 square feet on four floors of three contiguous buildings.

Currently, the Department is ranked in the top 25 Microbiology departments among U.S. public medical schools. Eight of the nine tenure-track faculty members are principal investigators on significant research grants, all except one of which is derived from the NIH. In total, primary faculty in the Department have been awarded over five million dollars in research grants for the current fiscal year. This includes support from the NIH/NIGMS Center of Biomedical Research Excellence Program (COBRE). The COBRE grant also supports the Flow Cytometry Core Laboratory which houses seven major instruments worth a total of approximately \$1.5 million. The Flow Core serves all basic science departments at KUMC, some clinical departments, and investigators at nearby institutions, including KU-Lawrence, Kansas State University, Children's Mercy Hospital and Clinics, the University of Missouri-Kansas City, and several companies in the area. For outside institutions, we are able to provide a service that facilitates their operations while providing a revenue stream to KUMC by adding a surcharge to the fees equivalent to Facilities and Administration costs. In addition to funding the Flow Core, the COBRE grant provides support for a seminar program, in which nationally and internationally recognized speakers present their research to our faculty and trainees. Further, the COBRE grant also provides support for a writing center, which provides technical writing and editing assistance, as well as seminars on writing techniques open to all.

Graduate students entering the Department of Microbiology, Molecular Genetics, and Immunology, who typically include students seeking PhD or MD/PhD degrees, take a series of three one-hour courses that cover the essence of the three disciplines represented by the faculty of the Department. The three disciplines are Bacteriology, Virology, and Immunology. Students are then required to take an advanced course in the discipline in which their research is based. As scientific research becomes less defined by conventional disciplines, students from departments other than Microbiology often request to participate in our courses. Our courses are offered to all students at KUMC, KU-Lawrence, and KU-Edwards, as well as neighboring institutions. The courses are also offered to medical fellows. For example, fellows in the rheumatology program are required to take Immunology courses and they often use the Advanced Immunology course to fulfill this requirement.

Each course is offered annually. Because our courses are open to all students, the needs of the students can vary widely each time the courses are offered. For this reason, it is essential that the courses are designed with sufficient flexibility to accommodate the student population in any given year. The clearest teaching methodology to build this flexibility is through active learning, in which students design their own learning objectives and fulfill the objectives. For example, during the Advanced Immunology course, students are given a list of topics, but can use those topics to pursue directions that will be of the most benefit to them.

In addition to formal classes, graduate students are required to perform research that will ultimately lead to publications and their dissertation or thesis. The required research involves designing and implementing cutting edge scientific theory and applications. The research opportunities in the department extend beyond PhD and MD/PhD students and include medical students, students from the Master of Science in Biotechnology Program, undergraduate students, the Outreach program, and non-traditional students interested in pursuing research as a career. Some of these students often volunteer for short periods of time while they decide whether to pursue graduate or medical education.

Just as students from many departments register for classes in the Department, faculty in the Department often teach in classes offered by other departments. For example, Microbiology faculty participates in the curriculum offered by the Interdisciplinary Graduate Program in Biological Sciences. In addition, there are grant-writing courses organized by two other departments that are taught, in part, by Microbiology faculty.

Graduates from the Department have been highly successful in representing KUMC and the state of Kansas. Graduate students and post-doctoral fellows trained in the Department include people who are currently faculty at KUMC and other universities around the United States and the world. In addition, there are recent PhD graduates representing KUMC in their work in prestigious institutions, such as Washington University, Harvard University, and La Jolla Institute for Allergy and Immunology, to name a few.

In addition to teaching graduate students, a major focus of the department involves medical education. Faculty members in the Department are module directors for two medical school courses. One course is the Inflammation and Immunity (I2) module, which is taken by students in the first semester of medical school. The other course is the Infectious Disease (ID) module, which is taken by students in the spring semester of their

second year. Just as in the graduate curriculum, these modules employ active learning as critical elements of the teaching modalities. This sharing of teaching techniques between graduate and medical education enhances the overall experience for both sets of students. Not only is this method of teaching highly effective for long-term retention of information, it is essential for Liaison Committee on Medical Education (LCME) accreditation. The directors of I2 and ID have been highly innovative in their education techniques and are examples for the rest of the medical education faculty. In fact, the former director of the I2 module is a member of the Academy of Medical Educators at KUMC, a distinguished position that recognizes excellence in education. The Academy also serves as a resource for novel educational methods. In addition, the director of the ID module also serves as the Chair of the Education Council, the faculty governance committee responsible for the medical education curriculum. The director of the I2 module also serves on the Promotions subcommittee of the Academic and Professional Committee, the faculty governance committee responsible for tracking medical student progress.

The teaching mission of the Department of Microbiology, Molecular Genetics, and Immunology is enhanced by the research mission of the Department. Research in the Department can be divided into three major programmatic themes: Bacteriology, Virology, and Immunology. Bacteriology and Virology are included in the broader subject of Infectious Diseases, which is the second leading cause of death worldwide and has greater than double the death rate than that from malignant diseases. For example, faculty in the Department investigates novel therapeutic approaches to fight the causative agents of Lyme disease, flesh-eating bacteria, HIV, endocarditis, hepatitis, and other common infectious diseases.

Research covered by the immunologists includes aspects of innate and adaptive immunity, the two primary branches of the immune system. This research includes studies that will fill gaps in our understanding of basic immunologic mechanisms. In addition, immunology research in the Department involves clinical applications, including immunotherapy for cancer and transplantation. The Immunologists in the Department nucleate a larger group of scientists whose research involves immunology. These scientists include people from several departments at KUMC as well as people from KU-Lawrence and Children's Mercy Hospital and Clinics. The research represented by this larger community includes topics relevant to cardiovascular health, cancer, reproductive health, allergies, immune deficiencies, autoimmune disease, and transplantation.

Scientists in the Department of Microbiology, Molecular Genetics, and Immunologists are also involved with interdisciplinary centers and institutes at KUMC. For example, there are faculty members in the Department that are also members of the University of Kansas Cancer Center, the Institute for Reproductive Health and Regenerative Medicine, and the Liver Center.

In addition to supporting the research efforts of the Department, faculty in the Department support the larger research mission of KUMC. As described above, the Department includes the Scientific Director of the Flow Cytometry Core Laboratory, which has served more than 60 investigators at KUMC. In addition, faculty members have served as Chair of the School of Medicine Research Committee and were members of the Research Advisory Committee, two committees in the faculty governance structure that advise KUMC administration on matters related to research infrastructure and funding. Members of the Microbiology faculty also serve on regional, national, and international committees related to their research. For example, faculty members serve as reviewers for grant programs sponsored by neighboring states (including Missouri, Oklahoma, and Texas), and serve as reviewers for the National Institutes of Health and the Italian Ministry of Health. Faculty also serves as reviewers for numerous scientific journals.

The research mission of the Department also serves the economic interests of the state of Kansas. The research funding earned by faculty members is used to hire graduates of local universities, including KU-Lawrence and Kansas State University. In addition, the research funding is used to recruit staff from around the world to the Kansas City area, enhancing the diversity of the state.

Faculty in the Department has been honored for their efforts in research and education. Our University Distinguished Professor won the 2013 Louisa Gross Horwitz Prize for Biology or Biochemistry, which is often considered a precursor for the Nobel Prize. Two faculty members are members of the Faculty of 1000, including one who is Section Chief. Educationally, Department faculty members have won numerous Student Voice Awards as well as the Ruth Bohan Teaching Professorship.

In summary, the Department of Microbiology, Molecular Genetics, and Immunology is an excellent resource for the University of Kansas Medical Center and the State of Kansas. We perform life-saving research and, in the process of this work, we provide an important element of the economic resource that is KUMC and at the same time educate the next generation of physicians and scientists.