



What Is Biochemistry and Molecular Biology? Why Study It?

Biochemistry and the closely related discipline of molecular biology involve the study of life processes at the molecular level and provide a chemical and physical basis to understanding all aspects affecting biology from viruses to humans. The recent revolutions in genomics and bioinformatics have dramatically increased interest in understanding the biochemical and molecular biological basis of life and disease processes such as AIDS and cancer. In addition, advances in biochemistry and molecular biology have fueled progress in drug design, forensic medicine, countering bioterrorism and biotechnology. Study of biochemistry and molecular biology provides the necessary background to understand at the molecular level processes that affect life, and it opens doors to the revolutions in the molecular life sciences that will lead science through the 21st century.

The Biochemistry and Molecular Biology Program

The interdisciplinary biochemistry and molecular biology program leads to either a bachelor of arts or bachelor of science degree. The program is based in the biology and chemistry departments and is jointly administered by a coordinating committee consisting of faculty from each department and the program coordinators, Dr. Ellis Bell and Dr. April Hill. The program is designed to offer a flexible route to either the bachelor of science or bachelor of arts degree and actively encourages student participation in research, which may be conducted with faculty in either department. The flexibility of the program lends

itself to combining with study abroad and outreach opportunities. The major is designed to prepare students for future study in biochemistry and molecular biology and related molecular life sciences, for employment in the biotechnology industry, and for those who are fascinated by the revolutions in the molecular life sciences (genomics, proteomics, bioinformatics) that are shaping our future.

The Biochemistry and Molecular Biology Curriculum

Just as biochemistry and molecular biology bring together fundamental principles of both chemistry and biology, the curriculum involves introductory sequences in both the biology and chemistry departments. Included are introductory chemistry (structure, dynamics and synthesis); organic chemistry; introduction to genetics, evolution and diversity of life; cell and molecular biology; and physical chemistry. A series of three courses designed to thoroughly cover key concepts and areas of biochemistry and molecular biology follow: biochemistry, biochemistry and biophysical chemistry of nucleic acids, and protein structure, function and biophysics.

The curriculum focuses on the fundamentals of biochemistry and molecular biology and places these fields in the context of how the information was obtained so that the student is armed with the various laboratory, computational and bioinformatics skills to contribute to this rapidly expanding field. While the bachelor of arts degree does not require a research experience, for the bachelor of science degree two hours of approved research experiences in biology or chemistry and one upper-level elective, from either the biology or the chemistry department, are required.

Undergraduate Research

There is a wide variety of research opportunities available for students in the program. These include fundamental studies of the mechanisms of catalysis; allosteric regulation of enzyme activity; the physical basis of mutagenesis; bioinformatics and the discovery of new classes of enzymes; the effects of drug abuse on the immune response; development of three-dimensional body patterns in vertebrates; molecular genetics of pathogenic bacteria; modeling human neurodegenerative diseases; and the role of enzymes in tumor cell migration.

Because understanding the experimental basis of biochemical and molecular biological phenomena is such a central theme in the program, students in either the bachelor of arts or bachelor of science track are encouraged to engage in research activities, often beginning in the first year. Students regularly present their research on campus and at regional and national professional meetings. These presentations contribute significantly to the overall education provided by the program. Students involved in research activities in the program often publish their research with faculty in scientific literature and help write applications for funding. As a result, a student engaging in research in the program has the opportunity to experience all aspects of the research process, from proposal to presentation.

Research is an ongoing process, and students are encouraged to participate during the academic year and in the summer. Summer students are supported (housing and stipend) by a variety of both intramurally and extramurally funded programs.

In the last several years students have engaged in summer research at a variety of institutions including MIT, Woods Hole Laboratory, the National

Institutes of Health, Johns Hopkins University, the University of North Carolina and Virginia Commonwealth University.

Other Activities and Opportunities of the Program

In addition to the formal academic activities of the program, there is an active undergraduate Biochemistry and Molecular Biology Club (one of the founding members of the American Society for Biochemistry and Molecular Biology Undergraduate Affiliated Programs Network), which provides a variety of opportunities for students to get involved with various service learning and outreach activities. The program also has a visiting scientists series in which leading researchers from around the country (academic, biomedical, industrial and biotechnological) spend time on campus and meet with students to discuss careers and off-campus research opportunities and to give research seminars. Scientists discuss what it's like to be a biochemist or molecular biologist, what training is needed and what alternate career opportunities are available for someone with a degree in biochemistry and molecular biology.

Recent graduates of the program have gone on to graduate school at the University of Texas Southwestern Medical Center, the University of Illinois, the University of North Carolina, the University of Oregon, Cornell University, the University of California at San Diego, Rockefeller University and the University of Washington.

Facilities and Equipment

The biochemistry and molecular biology program is housed in the newly renovated Gottwald Science Center and shares both space and equipment with the biology, chemistry and physics departments. These departments are well equipped for virtually every aspect of modern biochemistry and molecular biology, including fluoroscience, circular dichroism, dynamic light scattering, biological mass spectrometry, electron microscopy, atomic force microscopy and nuclear resonance spectroscopy, automated DNA sequencing, FACS and quantitative PCR facility. Informal partnerships between faculty in the program and various research universities and institutes around the country provide access to techniques such as x-ray crystallography, calorimetry and advanced computational approaches.

Faculty

Chemistry department faculty:

Ellis Bell
D. Phil., Oxford University

Jonathan Dattelbaum
Ph.D., University of Maryland

Lisa Gentile
Ph.D., Brown University

John Gupton
Ph.D., Georgia Institute of Technology

Michelle Hamm
Ph.D., University of Chicago

Michael Leopold
Ph.D., North Carolina State University

Carol Parish
Ph.D., Purdue University

Biology department faculty:

Linda Boland
Ph.D., University of North Carolina at Chapel Hill

Krista J. Fischer-Stenger
Ph.D., Virginia Commonwealth University

Joseph Gindhart
Ph.D., Indiana University

April Hill
Ph.D., University of Houston

Valerie M. Kish
Ph.D., University of Michigan

Scott Knight
Ph.D., University of Montana

Laura Runyen-Janecky
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