Program Description

The Biophysics Graduate Program encourages applications from students with strong backgrounds in chemistry, biology, biochemistry, biomedical engineering, physics, or mathematics and an enthusiasm for carrying out scientific research. The Program consists of two major areas —Molecular Biophysics and Magnetic Resonance Imaging. The faculty in the Molecular Biophysics section utilize biophysical techniques to study structural biology, free radicals in biology, and membrane protein systems . For example, current research includes studies on protein structure, functional dynamics, free radicals in biology, and magnetic resonance technology development . Students wishing to pursue this track should apply directly to the Biophysics Graduate Program or to the

- Investigation of pathophysiological mechanisms enhancing free radical formation from nitric oxide synthase in vascular cells and their relation to the tetrahydrobiopterin pathway.
- Mapping of human brain language systems with magnetic resonance imaging (MRI).
- Development and employment of MRI techniques to diagnose and monitor injuries and diseases of the central nervous system.
- Mapping of activity in human brain visual systems with MRI.
- Characterization of brain cancer tumor cellularity and vascularity through diffusion and perfusion MRI; development of image processing techniques to help clinicians plan surgery and map out brain function for epilepsy.
- Functional MRI study of mechanism of anesthesia with respect to loss and return of consciousness as studied by electrophysiological and brain imaging methods, and of Alzheimer's disease and drugs of abuse.
- Address engineering challenges in diagnostic imaging to

03223 Electron Spin Resonance. *3 credits.*
The aim of the course is to provide an introduction to the theory and practical applications of modern electron spin resonance (ESR) spectroscopy. Basic ESR theory, biological free radical spectroscopy, relaxation and motional phenomena, spin labeling, and transition metal ESR are among the topics covered.

03226 Biophysical Techniques in Biochemistry. *3 credits.*
This course will introduce the basic theory and practical applications of an ar ray of biophysical techniques commonly used in biochemical research. Optical and magnetic spectroscopies, X -ray crystallography, and kinetics techniques are a sampling of the topics covered in this comprehensive course.

03298 Journal Club: EPR. *1 credit.*
EPR Journal Club introduces students to the various aspects of EPR via published studies in the scientific literature. Students present selected papers to the class, along with any introduction to the area of study, and the class critically discusses each paper. Students will encounter aspects of EPR that they may not have previously encountered through either

03295 Reading and Research. *1- 9 credits.*

03251 Free Radicals in Biology. *3 credits.*
Topics to be discussed include the nature of free radicals; radical initiation, propagation, and termination; free radical reactions of biological interest; and the role of free radicals in physiological and pathological processes.

03260 Special Topics in Molecular Biophysics. 3 credits.
This is an advanced course dealing with special topics including free radicals in biology, spin relaxation, metal ions in biology, X -ray crystallography, and photobiology.

Magnetic Resonance Imaging Track

03240 Fourier Transforms. *3 credits.*
This course provides basic knowledge for students who will continue to study EPR or MRI. Material will cover the theory of Fourier transforms, digital transforms, MRI image generation, Fourier image reconstruction, and digital signal processing. An understanding of calculus and matrix algebra is recommended.