Neural Engineering

- *brain-computer interfaces*
- *computational neuroscience*
- *visual/auditory signal processing*
- *neural plasticity*
- *neuroprostheses*

Neural Engineering research involves fundamental and applied studies related to neurons, neural systems, behavior, and neurological disease. This program encompasses a broad spectrum of activities including explicit mathematical modeling; exploring novel approaches to sensory (vision, hearing and touch) and motor processing; exploring fundamentals of neural plasticity; and designing neuroprosthetics. The approaches involve a wide range of physical scales, including information processing at the molecular, cellular, systems, and behavioral levels. Common to all of these efforts is the use of mathematical tools and an engineering perspective to generate novel insights into basic and applied neuroscience.

PROGRAM OF STUDY

Program students are expected to take six courses in the first year in accordance with the regulations of the BME Department. The remaining elective courses are selected from the following list in consultation with their academic advisor:

BIOL 5571 Cellular Neurobiology

BIOL 5651 Neural Systems

BME 533 Biomedical Signal Processing

BME 572 Biological Neural Computation

BME 573 Applied Bioelectricity

BME 575 Molecular Basis of Bioelectrical Excitation

BME 471 Bioelectrical Phenomena

PROGRAM FACULTY

Beau Ances, M.D./Ph.D., Brain imaging of neurocognitive disorders associated with HIV and dementia

Dennis L. Barbour, M.D./Ph.D., *Sensory neurophysiology and cortical circuitry, neurocomputation*

Paul Bridgman, Ph.D., *Basic cellular properties of developing nerve and muscle*

Andreas Burkhalter, Ph.D., *Synaptic mechanisms and organization of forward and feedback circuits in visual cortex*

Jianmin Cui, Ph.D., *Molecular biology and physiology of ion channels*

John Cunningham, Ph.D., Neuroengineering, machine learning, and brain-computer interfaces

Timothy E. Holy, Ph.D., *Neural mechanisms underlying olfaction*

James Huettner, Ph.D., *Physiology of glutamate receptor-mediated signaling in the nervous system*

Vitaly Klyachko, Ph.D., *Synaptic basis for neural plasticity*

Eric Leuthardt, M.D., *Brain-computer interfaces, neuroprostheses*

Daniel Moran, Ph.D., *Motor control, neuroprostheses*

Colin Nichols, Ph.D., *Molecular aspects of potassium channels*

Camillo Padoa-Schioppa, Ph.D., *Cognitive and neuronal mechanisms of decision-making*

Steven Petersen, Ph.D., *Human functional neuro-imaging of vision, attention, memory, and language*

Marcus Raichle, M.D., *Central nervous system function of humans and nonhuman primates*

Barani Raman, Ph.D., *Systems neuroscience of olfaction, biosensors on chips*

Larry Snyder, Ph.D., *Processing of sensory information for goal-directed eye and arm movements in primates*

Kurt Thoroughman, Ph.D., *Psychophysics of motor behavior, neural computation*

David Van Essen, Ph.D., *Information processing in the primate visual system using physiological, anatomical and computational approaches*

Robert Wilkinson, Ph.D. Synaptic structure and function, particularly vesicle processing pathways