Topic Summary:
Neuroscientists have come to view the nervous system as a highly organized computation and communication system, controlling sensorimotor function and physiologic homeostasis. Humans as hunter gatherers evolved to use vision to do remote sensing and do complex planning, and then execute complex sensorimotor control to run and throw, all the while maintaining internal homeostasis. Humans are unique not only in conscious planning capability and teamwork, but also fine motor control of tools, distance running, and projectile throwing, which involve largely unconscious automatic process. But until now there has been no rigorous theory to connect the extremely diverse human behavior capabilities with the equally extreme heterogeneity of nervous system physiology. In this lecture, Ms. Nakahira describe a new theory that integrates computing, communication, and control and connects metabolic tradeoffs in nerve physiology to organism level performance tradeoffs. Particularly important is the tradeoffs at the nerve level in size, bandwidth, and delay and at the behavioral level between speed and accuracy.

About the Speaker:
Ms. Nakahira is a graduate student of Dr. John Doyle, Jean-Lou Chameau Professor of Control and Dynamical Systems, Electrical Engineering and BioEngineering Division of Engineering and Applied Science at California Institute of Technology, where she studies the fundamental limits of optimal control subject to realistic communication constraints, with a look towards applications in neuroscience.

Target Audience: Scientists, clinicians, and students interested in neurosciences, systems biology, physiology, and mathematical biology.

Learning Objectives:
1. To understand the current view of the nervous system as a computation/communication/control system.
2. To understand the relationship between sensorimotor performance and neuronal physiology and mechanics.
3. To understand the advantages of heterogeneous neuron sizes and composition for sensorimotor functions.
4. To understand the robustness vs. efficiency tradeoff in an optimized control system, and the speed vs. accuracy tradeoff in the sensorimotor system.