Lab Modules included in Spring 2015

- Sheep brain dissection
  - Identify the major structures visible on the surface
  - Dissect the brain to reveal the 3D anatomy of internal brain structures
  - Emphasize structure/function relations
  - Compare the brains of sheep to the brains of humans
- Magnetic resonance imaging
  - Understand how MRI works and its safety requirements
  - Identify major brain structures in 3D MR images
  - Use neuroanatomical directional terms and interpret functional MRI data
- Multitasking
  - Understand complex multitasking and attention switching
  - Division of work between prefrontal cortex and subcortical motor programs
  - Investigate the efficiency of attention switching
- Rhythmic behavior
  - Determine the wing beat frequency and phase relationship among the wings
  - Compare and contrast three techniques used to measure the wing beat frequency of a flying cockroach
  - Investigate the effect of sensory input on CPG output
  - Interpret EMG recordings of CPG output
  - Determine the phase relationship between elevators and depressors of a single wing
  - Speculate the neural mechanisms underlying wing beat behavior
  - Determine the number and location of flight CPG(s)
- Taste and neural coding
  - Determine the threshold for sweet taste and assess individual variations
  - Differentiate labeled-line model and across-fiber models of neural coding
- Touch and receptive fields
  - Behaviorally define receptive fields of touch receptors
  - Determine the relation between receptive field size and resolution for touch on different parts of the body
- Proprioception
  - Explore the role of muscle spindles in balancing and maintaining postures
  - Collect and analyze angular measurements
- Visuomotor adaptation
  - Determine the speed and duration of visuomotor adaptation
  - Investigate the relationship between vision and proprioception in simple movements
  - Design your own experiment(s) to further understand CNS plasticity
- Salivary cortisol and stress
  - Understand the "stress axis" (the hypothalamic-pituitary-adrenal or HPA axis) and how it controls cortisol secretion
  - Collect and analyze a biochemical measure of human neural activity
  - Investigate the effect of psychosocial perturbations on cortisol levels

Lab Modules included in Fall 2015

- Macroscopic examination of the brain (the same as "sheep brain dissection" in Spring 2015)
- Microscopic examination of the brain
  - Understand why microscopy is an integral part of neuroscience research
  - Explore prominent structures of the mouse brain
  - Examine DAPI-stained brain cells under the microscope
  - Identify fluorescent Nissl-stained brain cells under the microscope
  - Identify different brain structures
  - Examine the laminar structure of the neocortex
  - Understand the technique of immunohistochemistry
  - Finish a NeuN/GFAP double-staining for microscope examination
  - Learn specific labeling of neural cell types and subcellular structures using antibodies
- Intracellular recording simulation
  - Calculate equilibrium potentials by Nernst equation
  - Examine the ionic mechanisms of resting potentials
  - Measure the time constant and length constant of the axon
  - Review the basics of neurophysiology: Aps, EPSPs, and IPSPs
- Neuromodulatory drugs in crickets
  - Understand how neuromodulatory drugs affect neuron responsiveness
  - Explain the effects of agonistic and antagonistic neuromodulators and their pharmacological applications
- CNS control in cockroaches
  - Understand and successfully perform the basic techniques of microsurgery
  - Use hook electrodes to determine that the action potentials you record are in response to wind information from the cerci, i.e., they are ascending signals
  - Determine whether wind information travels in the connectives bilaterally, ipsilaterally, or contralaterally up toward the thorax
  - Learn how to identify "units" from extracellular recording
  - Determine how the neural activity in the connectives changes with different strengths of wind stimuli
- Conduction velocity
  - Analyze the main features of an action potential and the influence of the fiber diameter on the threshold for action potential generation
  - Compute conduction velocity of the median and lateral giant fibers in an earthworm
  - Determine the absolute and relative refractory period of action potentials
  - Compute conduction velocity of the median nerve in the upper limb
  - Compute aggregated conduction velocity of Achilles reflex
  - Compare reaction times between reflex and voluntary movement
- Visuomotor adaptation (the same module as in Spring 2015)

Lab Modules included in Spring 2016

- Somatosensation (a combination of "touch and receptive fields" and "proprioception" in Spring 2015)
- Taste (the same as "taste and neural coding" in Spring 2015)
- Motor system
  - Introduce root mean square as an integrated measure of EMG signals
  - Discriminate afferent signals from efferent activity in EMG recordings
  - Quantify the relation between motor unit recruitment and force
  - Contrast muscle activation between fast and slow movements
- Central pattern generator (the same as "rhythmic behavior" in Spring 2015)
- Salivary cortisol and stress (the same as in Spring 2015)
- Birdsong and sexual dimorphism
  - Understand the sexually dimorphic brain and song system in zebra finches
  - Collect quantified data to address sex differences in the brain
  - Discriminate organizational and activational effects of steroid hormones on sexual differentiation
- Attention (the same as "multitasking" in Spring 2015)
- Cardiovascular activity
  - Measure and interpret the components of an EKG wave
  - Use changes in cardiovascular activity (EKG recordings and peripheral blood volume) to assess patterns of ANS activity in response to external stimuli
- Memory
  - Understand different types of memory, how they are implemented in the brain, and how they interact
  - Measure your own iconic memory and working memory capacity