Bi152 Syllabus Spring 2019

Instructor: Yuki Oka
Class Time/Place: Tuesday and Friday 9:00 to 10:00 AM 200 Broad

There are two major goals of this course: 1) study neural and molecular basis of appetite and homeostatic regulations, and 2) learn critical reading skill of original publications. On Tuesdays, a lecture will be given about a specific topic. On Fridays (except Apr 7), a paper will be assigned to students for presentation. Everyone taking the course will be asked to actively participate in the discussion by reading the papers before classes. For presentation, students are responsible for both main and supplementary data for the assigned paper.

Recommended textbook: Foundation of Behavioral Neuroscience, Neil R. Carlson
Principles of Neural Science, Eric R. Kandel and others

Week 1: Introduction

April 2 (lecture)

Recommended reading

- Toward a Wiring Diagram Understanding of Appetite Control
https://www.cell.com/neuron/fulltext/S0896-6273(17)30512-3

-Neural circuitry of wakefulness and sleep
http://www.cell.com/neuron/pdf/S0896-6273(17)30038-7.pdf

- Signalling from the periphery to the brain that regulates energy homeostasis
https://www.nature.com/articles/nrn.2018.8

Week 1: Energy balance: neural controls of eating behavior (1)

April 5 (lecture)

Recommended reading

-Three Pillars for the Neural Control of Appetite
http://www.annualreviews.org/doi/abs/10.1146/annurev-physiol-021115-104948

- **AGRP neurons are sufficient to orchestrate feeding behavior rapidly and without training**
http://www.nature.com/neuro/journal/v14/n3/abs/nn.2739.html

- Accumbal D1R Neurons Projecting to Lateral Hypothalamus Authorize Feeding.
http://www.sciencedirect.com/science/article/pii/S0896627315008272

-Genetic identification of a neural circuit that suppresses appetite
http://www.nature.com/nature/journal/v503/n7474/abs/nature12596.html

-Central amygdala PKC-[delta]+ neurons mediate the influence of multiple anorexigenic signals
http://www.nature.com/neuro/journal/v17/n9/abs/nn.3767.html

Week 2: Energy balance: neural controls of eating behavior (1)

April 9 (reading/discussion)

-Visualizing hypothalamic network dynamics for appetitive and consummatory behaviors
http://www.sciencedirect.com/science/article/pii/S0092867414016328

Week 3: Energy balance: neural controls of eating behavior (1)

April 16 (lecture)
Recommended reading

- Deconstruction of a neural circuit for hunger
http://www.nature.com/nature/journal/v488/n7410/abs/nature11270.html

- Parallel, redundant circuit organization for homeostatic control of feeding behavior.
http://www.sciencedirect.com/science/article/pii/S0092867413014141

- A molecular census of arcuate hypothalamus and median eminence cell types
http://www.nature.com/neuro/journal/v20/n3/abs/nn.4495.html

April 19 (reading/discussion)

-A Neural Circuit for the Suppression of Pain by a Competing Need State
https://www.cell.com/cell/pdf/S0092-8674(18)30234-4.pdf

Week 4: Energy balance: neural controls of eating behavior (3)

April 23 (lecture)

Recommended reading

- Sensory detection of food rapidly modulates arcuate feeding circuits
http://www.sciencedirect.com/science/article/pii/S0092867415000768
- Neurons for hunger and thirst transmit a negative-valence teaching signal.
http://www.nature.com/nature/journal/v521/n7551/full/nature14416.html
- A Neural Circuit for the Suppression of Pain by a Competing Need State
https://www.cell.com/cell/pdf/S0092-8674(18)30234-4.pdf

April 26 (reading/discussion)

- Dynamics of Gut-Brain Communication Underlying Hunger
https://www.cell.com/neuron/fulltext/S0896-6273(17)30912-1

Week 5: Fluid balance: central regulation of water and sodium appetite

April 30 (lecture)

Recommended reading

-Coupled Sensing of Hunger and Thirst Signals Balances Sugar and Water Consumption
https://www.ncbi.nlm.nih.gov/pubmed/27477513

-Reciprocal Control of Drinking Behavior by Median Preoptic Neurons in Mice.
https://www.ncbi.nlm.nih.gov/pubmed/27488641

-HSD2 neurons in the hindbrain drive sodium appetite.
https://www.ncbi.nlm.nih.gov/pubmed/27918529

May 3 (reading/discussion)

-Thirst neurons anticipate the homeostatic consequences of eating and drinking.
https://www.ncbi.nlm.nih.gov/pubmed/27487211

Week 6: Sensory detection of external stimuli for homeostasis

May 7 (lecture)

Recommended reading

-The participation of cortical amygdala in innate, odour-driven behavior
http://www.nature.com/nature/journal/v515/n7526/full/nature13897.html

-A Family of non-GPCR Chemosensors Defines an Alternative Logic for Mammalian Olfaction.

https://www.ncbi.nlm.nih.gov/pubmed/?term=27238024

- Peripheral and Central Nutrient Sensing Underlying Appetite Regulation.
https://www.sciencedirect.com/science/article/pii/S0166223618301164?via%3Dihub

May 10 (reading/discussion)

- **The coding of valence and identity in the mammalian taste system.**

https://www.nature.com/articles/s41586-018-0165-4

Week 7: A gut-brain axis for appetite regulation

May 14 (lecture)
Recommended reading

-Role of the gut microbiota in nutrition and health
https://www.bmj.com/content/bmj/361/bmj.k2179.full.pdf

-Hormonal and neural mechanisms of food reward, eating behaviour and obesity.
https://www.ncbi.nlm.nih.gov/pubmed/24958311

-Gut-Brain Cross-Talk in Metabolic Control
https://www.ncbi.nlm.nih.gov/pubmed/28235194

May 17 (reading/discussion)

Food Perception Primes Hepatic ER Homeostasis via Melanocortin-Dependent Control of mTOR Activation
https://www.cell.com/cell/pdf/S0092-8674(18)31323-0.pdf

Week 8: Sleep and circadian rhythms

May 21 (lecture)

-Basal forebrain circuit for sleep-wake control.
https://www.ncbi.nlm.nih.gov/pubmed/26457552

-Melatonin is required for the circadian regulation of sleep.
https://www.ncbi.nlm.nih.gov/pubmed/25754820

-Sleep Drive Is Encoded by Neural Plastic Changes in a Dedicated Circuit.

https://www.ncbi.nlm.nih.gov/pubmed/27212237

May 24 (reading/discussion)

-Control of REM sleep by ventral medulla GABAergic neurons.
https://www.ncbi.nlm.nih.gov/pubmed/26444238

Week 9: TBD

May 28 (lecture)
May 31 (reading/discussion)

Week 10: Final Project

June 3 (Project proposal)
June 6 (Project proposal)

1. prepare 20-25 min presentation with 5-10 min questions/discussion
2. project should be based on (but not limited to) the topics and techniques the course covered
3. clearly present the following items;

   Background: Why it is important to interesting to study
   Hypothesis: What you want to show
   Methods: How you want to show
   Results: Expected outcome and interpretations. Alternative hypothesis.

4. Grades will be based on logic, accurate use of tools, and originality.