

Professors: Ralf Schneggenburger and Olexiy Kochubey

TAs: Jinyun Wu, Runzhong (Yvonne) Zhang#

## **Week 8 – Internal body states and associated behaviors: hunger and feeding**

1) Describe the fate and the role of glucose in bodily energy homeostasis. What are the two major physiological regulators of glucose metabolism controlling the anabolic and catabolic cycles?

2) Back-of-the-envelope fun calculation exercise: assuming exclusively oxidative pathway of glucose metabolism and 100% efficiency of any intermediate conversion of chemical ATP energy to electricity, estimate the capacity of a lithium battery (in mAh) that could be fully charged to 4.2 V using 1 kg of white sugar. To which height from the ground could a load of 1 kg be lifted using the stored energy?

3) Name several hormonal signals by which the body can communicate its energy state to the brain. Where do these signals originate from and what do they signal?

4) Explain directions of typical responses of NPY/AgRP and POMC neurons of the arcuate hypothalamic nucleus (ARC) to the bodily energy state signals (see q. 3). Describe the antagonistic roles of these neurons in control of feeding behavior giving examples of corresponding experimental findings which supported these roles.

5) Describe the inter-ARC and outside-ARC network connections of the NPY/AgRP and POMC neurons and discuss how these connections functionally contribute to the roles of these neurons in appetite control and feeding.

6) Do the neurons responding to hunger or satiety states signal emotional valence? Which valence per neuron type is signaled and how could/was this tested? What is the significance of assigning emotional valence to the body energy states?

7) Read and discuss the following paper:

Carter, M.E., Soden, M.E., Zweifel, L.S., and Palmiter, R.D. (2013). Genetic identification of a neural circuit that suppresses appetite. *Nature* 503, 111–114. 10.1038/nature12596. <https://www.nature.com/articles/nature12596>