**Julijana Gjorgjieva – CNeuro Lectures 2021**

**Lecture 1 (Basic):**

*Plasticity and Homeostasis in Neural Circuits*

I will cover models of Hebbian plasticity and explain how to model change in synaptic weights in different types of neural networks. We will start with feedforward networks and go to recurrent networks. I will explain rate-based and spike-based plasticity. For rate-based plasticity, I will explain correlation and covariance based rules and different normalization schemes, and consequences on network organization. For spike-based plasticity, I will explain different models of spike-timing-dependent plasticity (STDP). I will finally discuss the implications of these rules on the generation of tuning and assembly organization.

**Lecture 2 (Advanced):**

*Models of Developing Neural Circuits at Different Scales*

I will discuss how the models of synaptic plasticity explained in the first lecture pertain to the organization of connectivity during neural circuit development. Specifically, I will discuss models for how this emerges at the smallest spatial scale of single synaptic inputs on dendrites, at the network level between neurons and at the largest scale of interacting brain regions. I will demonstrate that the timescales of activity need to match the timescales of synaptic plasticity to yield meaningful organization of. connectivity. I will mostly use examples of the sensory cortex in rodents.

**Lecture Abstracts**