**Computational Neuroscience**

**Faculty:** Larry Abbott, Ken Miller, Ashok Litwin Kumar, Stefano Fusi, Lea Dunker, Kim Stachenfeld
**TAs:**

**Meetings:** Tuesdays & Thursdays 2:00-3:30
**Location:** Green Science Center, Fifth Floor, Rm L5.084

**Text:** Theoretical Neuroscience by P. Dayan and L.F. Abbott (MIT Press)
**Webpage:** https://ctn.zuckermaninstitute.columbia.edu/courses

**September**
3 (Larry) Electrical Properties of Neurons, Integrate-and-Fire Model
5 (Larry) Adaptation, Synapses, Synaptic Plasticity
10 (Larry) Numerical Methods, Filtering, Receptive Fields (Assignment 1)
12 (Larry) The Hodgkin-Huxley Model
17 (Larry) Probability, Encoding, Decoding (Assignment 2)
18 Assignment 1 Due
19 ZI SciFest
24 (Lea) Generalized Linear Models

25 Assignment 2 Due
26 NB&B Retreat

**October**

1 (Ken) Linear Algebra I

3 (Ken) Linear Algebra II

8 (Ken) PCA (Assignment 3)
10 (Lea) Dimensionality Reduction, Population Analysis

15 (Lea) Latent Variables,Estimation-Maximization (Assignment 4)

16 Assignment 3 Due

17 (Ashok) Feedforward Networks and Dimensionality
22 (Ken) Rate Networks, Fixed-Point and Chaotic Attractors (Assignment 5)

23 Assignment 4 Due

24 (Ken) E-I Networks
29 (Ashok) Continuous Attractor and Low Rank Networks (Assignment 6)

30 Assignment 5 Due

31 (Lea) Dynamic Systems Approaches to Cognition

**November**5 Holiday

6 Assignment 6 Due

7 (Ashok) Spiking Networks

12 (Ashok) Connectomics (Assignment 7)

14 (Stefano) Perceptrons

19 (Ashok) Convex Optimization and Support Vector Machines (Assignment 8)

20 Assignment 7 Due
21 (Stefano) Multilayer Perceptrons and Mixed Selectivity

26 (Stefano) Deep Learning

28 Holiday

**December**
3 (Stefano) Learning in Recurrent Networks (Assignment 9)
4 Assignment 8 Due
5 (Stefano) Continual Learning and Catastrophic Forgetting

10 (Kim) Reinforcement Learning

11 Assignment 9 Due