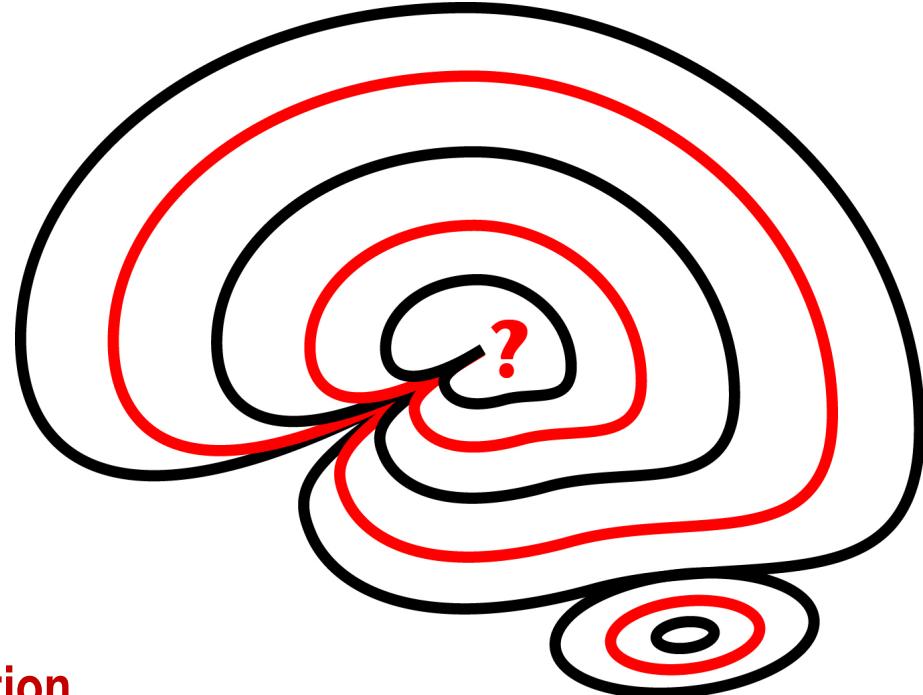


## 1.1 Introduction

**Cellular Mechanisms of Brain Function**

Prof. Carl Petersen



# **Cellular mechanisms of brain function**



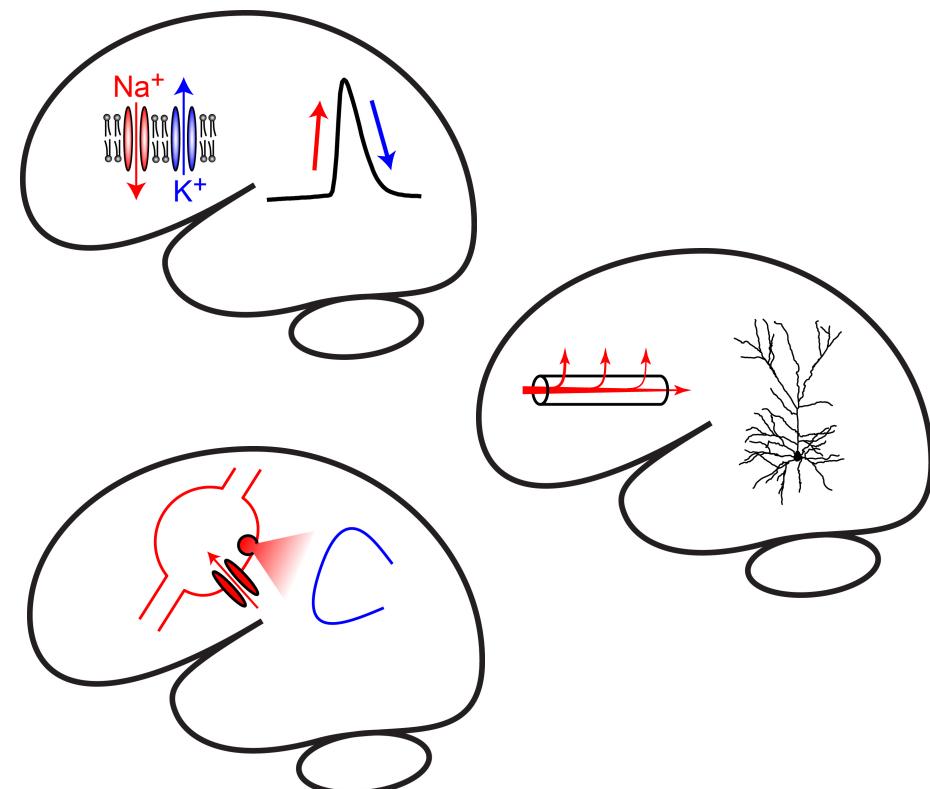
Cellular Mechanisms of Brain Function

# Cellular mechanisms of brain function



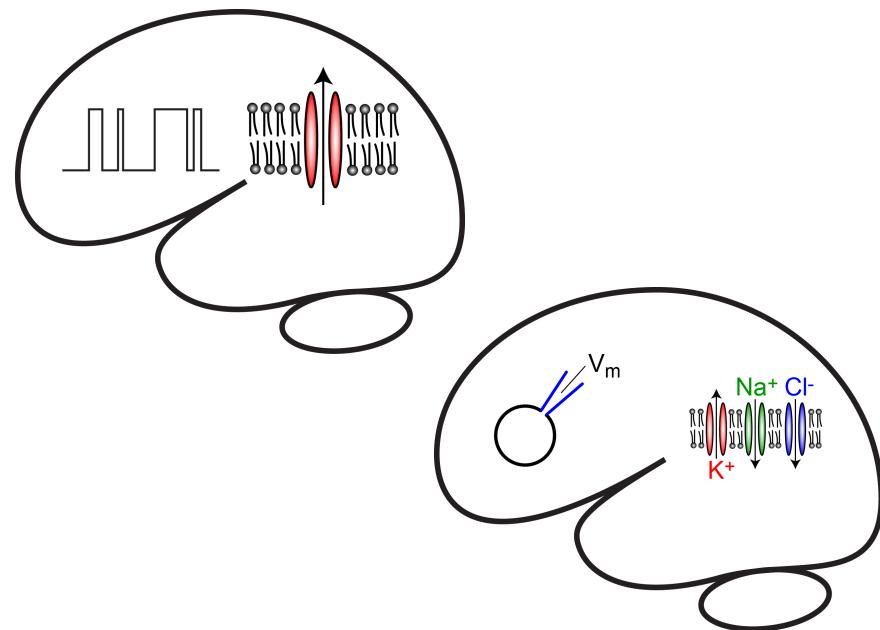
- Week 1 – Membrane potential
- Week 2 – Action potentials
- Week 3 – Synaptic transmission
- Week 4 – Glutamatergic excitation
- Week 5 – GABAergic inhibition
- Week 6 – *In vivo* techniques
- Week 7 – Brain function and behavior

# Biophysics of neurons and synapses



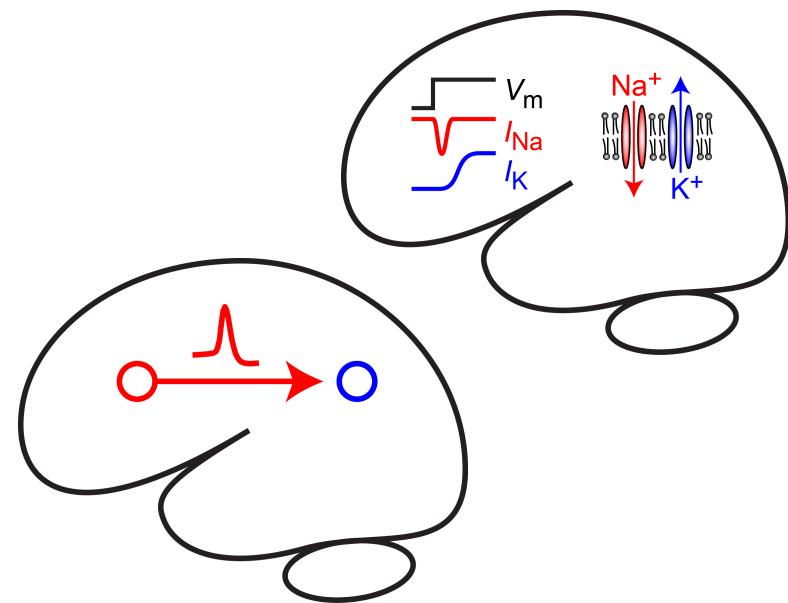
# Week 1

- 1.1 Introduction
- 1.2 The cell membrane
- 1.3 Ion channels
- 1.4 Membrane potential
- 1.5 Cable properties



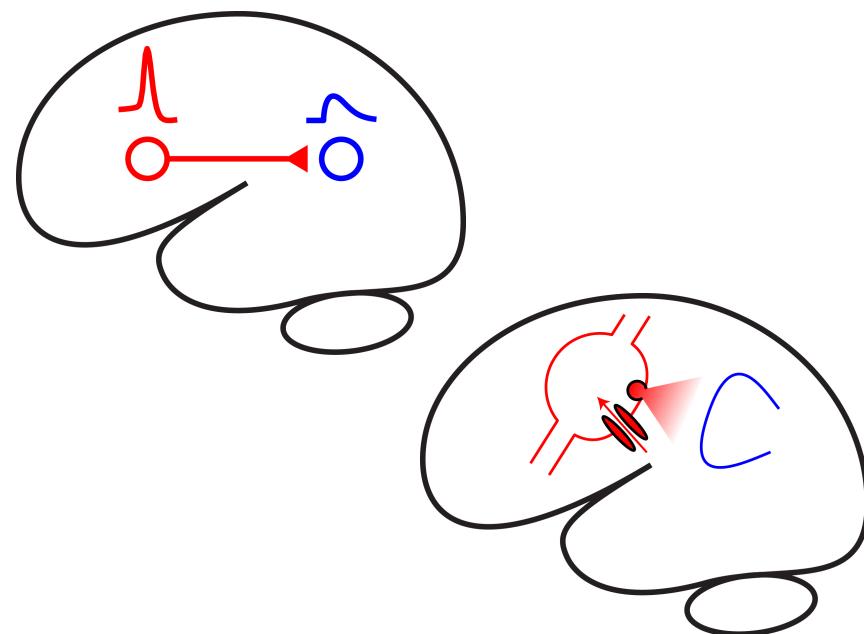
# Week 2

- 2.1 Voltage-gated channels
- 2.2 Voltage-gating kinetics
- 2.3 The action potential
- 2.4 Action potential propagation
- 2.5 Whole-cell recordings

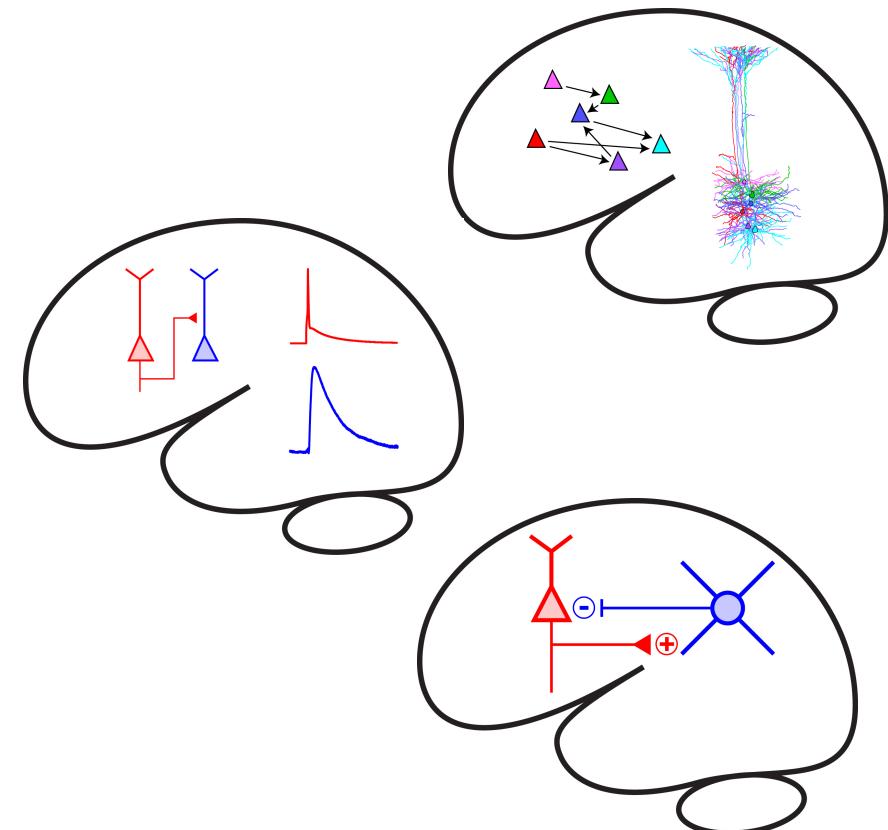


# Week 3

- 3.1 Synaptic transmission
- 3.2 Neurotransmitter release
- 3.3 Presynaptic dynamics
- 3.4 Presynaptic modulation
- 3.5 Electron microscopy



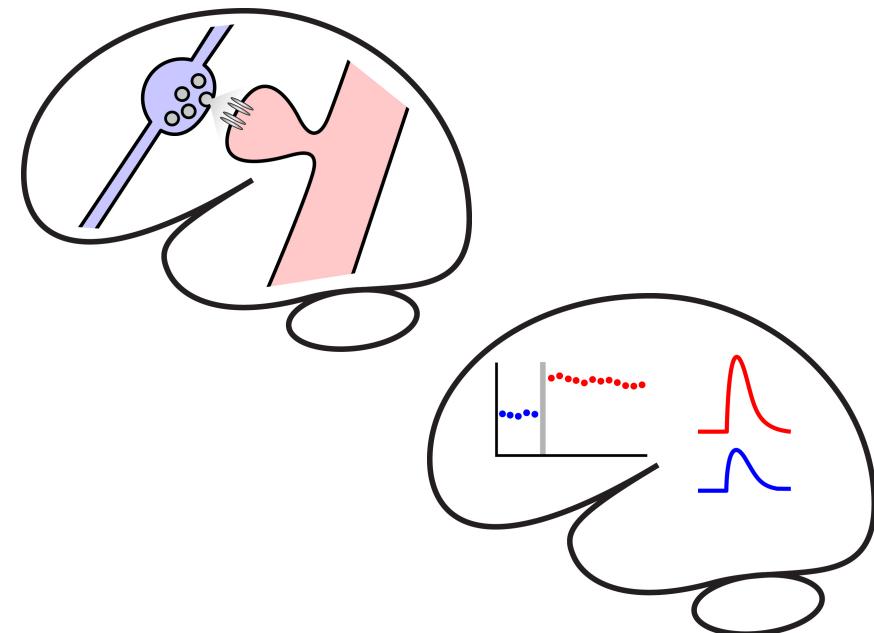
# Synaptically-connected neuronal networks



Cellular Mechanisms of Brain Function

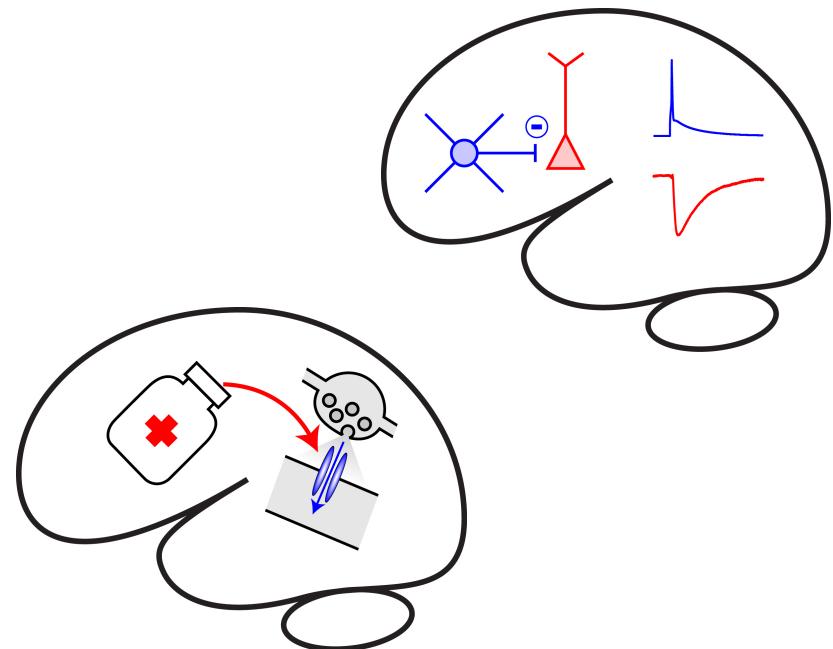
# Week 4

- 4.1 Glutamate receptors
- 4.2 Postsynaptic potentials
- 4.3 Glutamatergic circuits
- 4.4 Synaptic plasticity
- 4.5 Dendritic spines

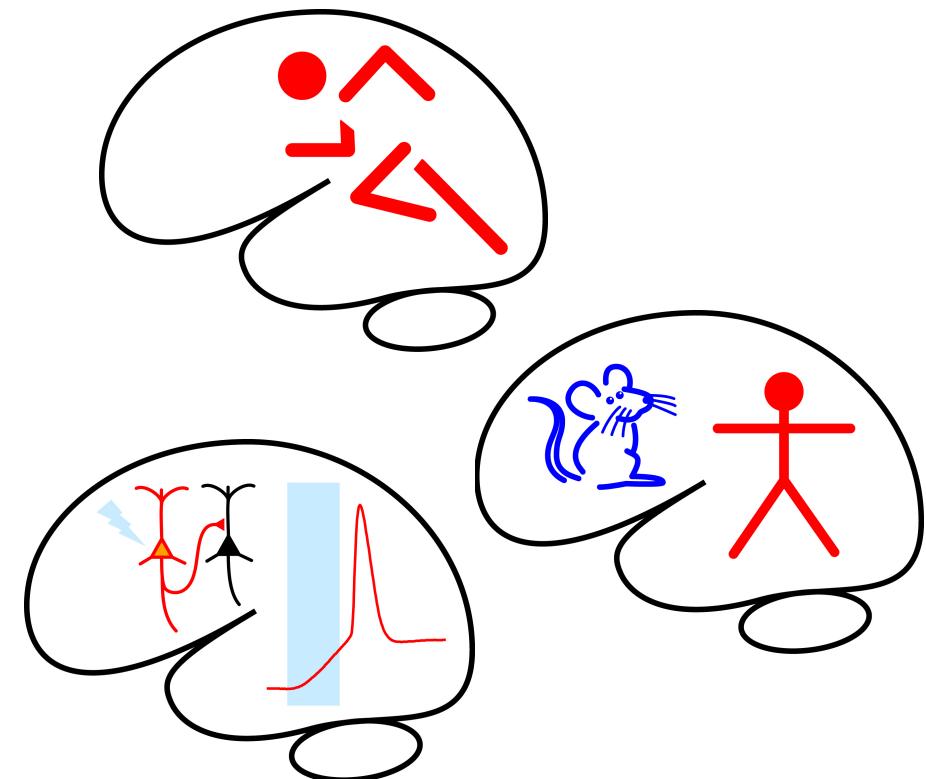


# Week 5

- 5.1 GABAergic inhibition
- 5.2 Inhibitory synaptic conductances
- 5.3 Benzodiazepines
- 5.4 GABAergic projections
- 5.5 Neocortical inhibition

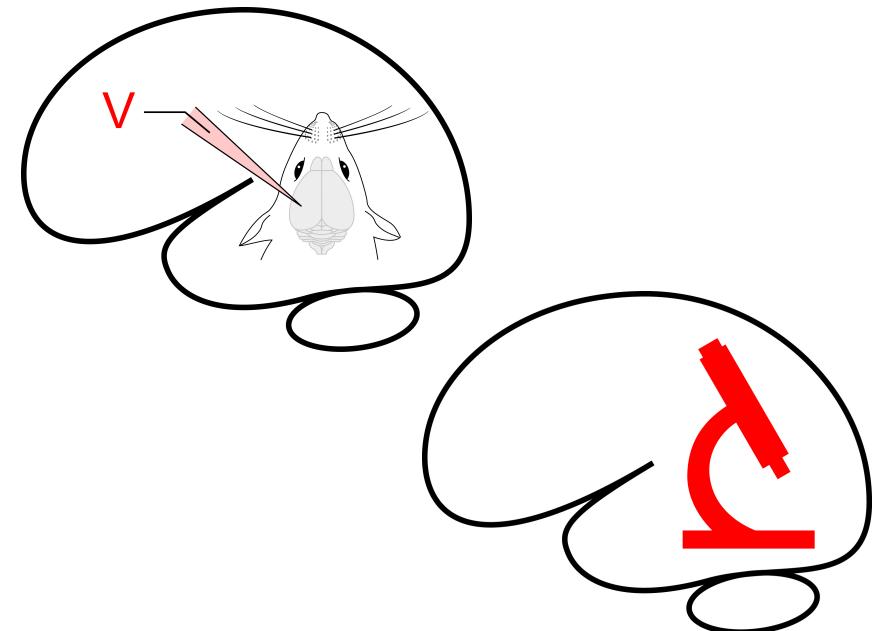


# Brain function and behavior



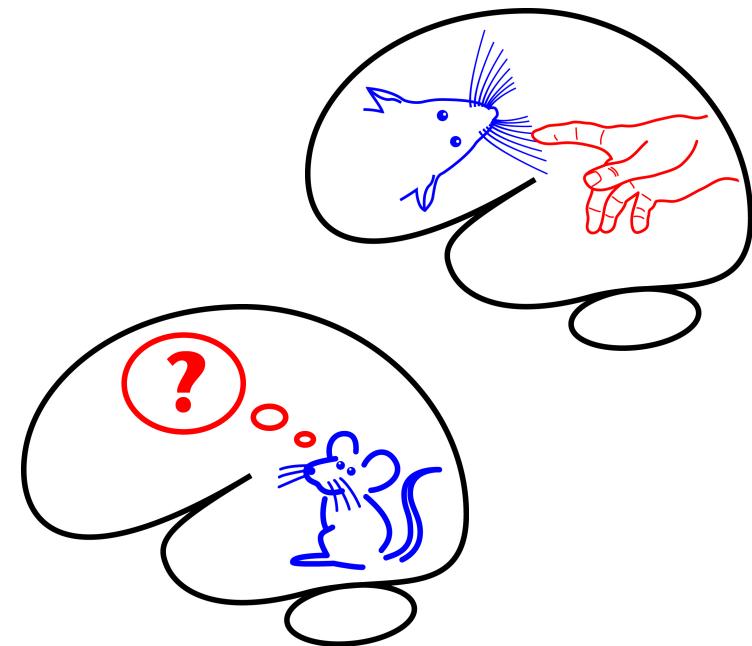
# Week 6

- 6.1 Brain function and behavior
- 6.2 Man and mouse
- 6.3 Imaging the brain in action
- 6.4 *In vivo* electrophysiology
- 6.5 Controlling brain function



# Week 7

- 7.1 Sensorimotor interactions
- 7.2 Sensory perception
- 7.3 Learning
- 7.4 Brain dysfunction
- 7.5 Concluding remarks



# Cellular mechanisms of brain function



- Unitary elements of the brain, neurons and synapses, are beginning to be understood in biophysical detail.
- Neuronal networks involving specific cell-types are being delineated at high resolution.
- The next major challenge for neuroscience is to causally link neuronal function to behavior.