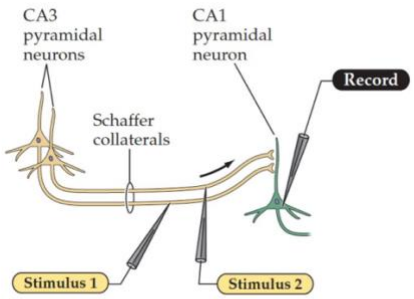
Neuroscience BIO-311

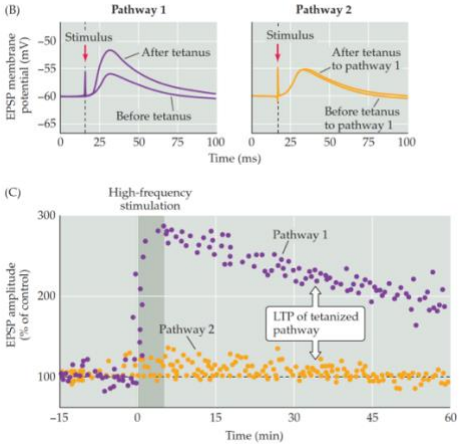
Exercise: Memory & Cognitive Maps of space

1) **i) At what timescale does the “short-term” memory operate? ii) Which brain regions are involved? iii) Explain how this has been shown in monkeys using food cache experiments.**

2) **(i) Explain the difference between "implicit" (also called "non-declarative") and explicit (or"declarative") long-term memories. (ii) Name 3 examples of non-declarative long-term memories.**

3) **i) Which phenomenon is illustrated in Figure 8.7 of Purves? ii) What is meant by ‘tetanus’ and what does it represent in physiological conditions? iii) What is the difference between pathways 1 and 2? iv) Remember from the first modules, we described aneuron as a unit performing a weighted sum of its synaptic inputs. How does this sum change between time t=0 and time t=15 min in this scenario?**





4) **i) Under which conditions do we observe long-term potentiation (plasticity that reinforces a synapse)? ii) What is the underlying molecular mechanism (channels and signaling pathway)?**

5) (i) Describe the concept of a "place cell" in the hippocampus of a freely moving rat/mouse. (ii) In consequence, explain why the performance of rats/mice with a lesion in the hippocampus drops in the "Morris water maze" test.

6) Explain the basic concept of classical conditioning, giving one example for an "appetitive" and another example for an "aversive" conditioning experiment. Which are the unconditioned and conditioned stimuli, and what is the conditioned response? (ii) Do you think this is a long-term memory, and if yes, to what category of long-term memory does it belong? iii) In the example of fear conditioning, which brain region is involved?

7) What is a “concept cell”?