COGS 107B – Systems Neuroscience

Week 9: Study Questions
Memory

Motor Control
Memory
What is implicit memory?

What is explicit memory?

Define the terms and describe their differences.
• **Implicit memory**, sometimes called as procedural knowledge, denotes the knowledge of how to accomplish a task.

• **Declarative memory** generally refers to memory which can be easily articulated by the individual.
• Rats learn, across days, to efficiently reach and grasp a small sugar pellet. This is a model of motor skill learning, or in other words __________ learning.
• Rats learn, across days, to efficiently reach and grasp a small sugar pellet. This is a model of motor skill learning, or in other words procedural/implicit learning.
Cont. from rats reach-to-grasp skill

• As rats get better at reaching and grasping behavior, the area of ________________ taken up by neurons associated with the reaching limb grows.
Cont. from rats reach-to-grasp skill

- As rats get better at reaching and grasping behavior, the area of primary motor cortex taken up by neurons associated with the reaching limb grows.
• The neuromodulator __________ is vital in procedural learning of rats’ reaching to grasp behavior. If its inputs to the primary motor cortex are removed, neither the learning nor the changes in primary motor cortex occur.
• The neuromodulator ACh is vital in procedural learning of rats’ reaching to grasp behavior. If its inputs to the primary motor cortex are removed, neither the learning nor the changes in primary motor cortex occur.
• In a perceptual skill learning experiment, rats are trained to make a nosepoke if they detect a 4 kHz tone. Over the days of training, they show improvements in detection. Over the same period, the primary auditory cortex also shows changes as below:

![Control vs Trained Cortex](image)

Polley et al., JNS, 2006

• What kind of change has happened in the primary auditory cortex?
• The topographic representation of pitch in primary auditory cortex changes such that more neurons respond to 4 kHz tones.
• In training (below), the rat is taught to move to the goal to obtain a reward.

• In test trials (above), the maze is turned upside down. The rat is tested whether it has learned to ‘make a left’ at the ‘T’ (response strategy), or ‘move to that place in the room’ (place strategy).

• Early in training, the rat demonstrates a _____________ strategy, and ACh is high in ______________.

• Later in training, the rat demonstrates a _____________ strategy, and ACh is high in ______________.
• In training (below), the rat is taught to move to the goal to obtain a reward.

• In test trials (above), the maze is turned upside down. The rat is tested whether it has learned to ‘make a left’ at the ‘T’ (response strategy), or ‘move to that place in the room’ (place strategy).

• Early in training, the rat demonstrates a place strategy, and ACh is high in hippocampus.

• Later in training, the rat demonstrates a response strategy, and ACh is high in basal ganglia.
• In the previous experiment, if ____________ is inactivated early in training, one sees a response strategy.

• On the other hand, if ____________ is inactivated later in training, one sees a place strategy.
• In the previous experiment, if hippocampus is inactivated early in training, one sees a response strategy.

• On the other hand, if basal ganglia is inactivated later in training, one sees a place strategy.
• _______________ refers to the memory of events and their ordering, and is generally associated with ____________ (hint: brain region).
• Episodic memory refers to the memory of events and their ordering, and is generally associated with hippocampus.
• ____________ refers to a limited capacity memory in which items are held for a short period of time, and is generally associated with ____________ and ____________ cortices.
• Working memory refers to a limited capacity memory in which items are held for a short period of time, and is generally associated with prefrontal and parietal cortices.
Motor Control
• The primary brain region that controls the motor behavior is ____________.
• The primary brain region that controls the motor behavior is **motor cortex**.
• The activity patterns in motor cortex are controlled by ____________, which is in turn controlled by prefrontal and parietal cortices.
• The activity patterns in motor cortex are controlled by **premotor cortex**, which is in turn controlled by prefrontal and parietal cortices.
• Premotor cortex in navigating rats exhibits more abstract relationships to action such as ____________, ________________, and ______________.
• Premotor cortex in navigating rats exhibits more abstract relationships to action such as mapping of action, sequence dependence of action mapping, and mapping of action plans.
• There are neurons in the monkey brain which fire both during the execution of an action, and the observation of the same action performed by another individual. These neurons are known as ____________, and found in ____________.
• There are neurons in the monkey brain which fire both during the execution of an action, and the observation of the same action performed by another individual. These neurons are known as mirror neurons, and found in premotor cortex.