FINAL EXAM STUDY GUIDE

CH. 12 LEARNING AND MEMORY

Learning – Relatively long-lasting change in an organism's behavior (or thought) as a result of experience

Types of Learning

Non-associative learning involves change in the magnitude of response to environmental events

–Habituation
–Sensitization

Associative learning involves a connection between two elements or events

–Classical conditioning
–Instrumental conditioning

Habituation- Decrease in strength or occurrence of behavior after repeated exposure to stimulus

Sensitization- Experience of one (startling) stimulus heightens responding to subsequent stimuli

Learning with Aplysia

Invertebrate learning offers a simpler system in which to isolate neurobiological correlates of learning

-Simple nervous system (~20,000 neurons)
-Neuronal development hard-wired
-Identifiable individual neurons

The gill-withdrawal reflex occurs when touching the siphon produces a retraction of the gill

Sensitization in Aplysia

Shocking the head or tail results in an enhanced gill-withdrawal reflex following siphon touch

-Serotonin (interneuron) release promotes enhanced glutamate (sensory neuron) release

Control *Aplysia* have ~1300 axon terminals on sensory neurons
Aplysia experiencing sensitization have ~2800 terminals
Aplysia experiencing habituation have ~800 terminals

Classical Conditioning

-An unconditioned stimulus (US) is a biologically relevant stimulus
-An unconditioned response (UR) is an unlearned reaction to the US

-A conditioned stimulus (CS) is an initially neutral stimulus that acquires the ability to signal important biological events
-A conditioned response (CR) is a learned reaction to the CS

Interpositus cell activity (PP)

-LTP-dependent increase in neuronal firing across trials
-NMDA receptor activation leads to changes in synaptic efficacy—i.e., AMPA receptors (which gate sodium) are inserted (LTP) or removed (LTD) from the terminal
-LTP-dependent increase in neuronal firing across trials
-Neuronal activity in IP corresponds to generation of eyeblink CR, suggesting IP neurons "drive" the behavioral response

Purkinje cell activity

-Sole output from cerebellar cortex
-Inhibitory: releases GABA onto IP neurons
-Decrease in firing rate due to LTD
-IP excitation generates CR
-Purkinje cell disinhibition enables proper timing of blink CR

Extinction of Eyeblink CR
- Not simple unlearning
- New, opposing response acquired
-Learned response is unexpressed

- Spontaneous Recovery
-CR recovers with passage of time
- Renewal
-CR is context-specific
- Reinstatement
-US reminder reinstates CR

-Autistics show facilitatory learning in this paradigm

Engram- Physical representation of learned information in the brain

-Karl Lashley incorrectly concluded that all parts of the cortex make an equal contribution to memory formation

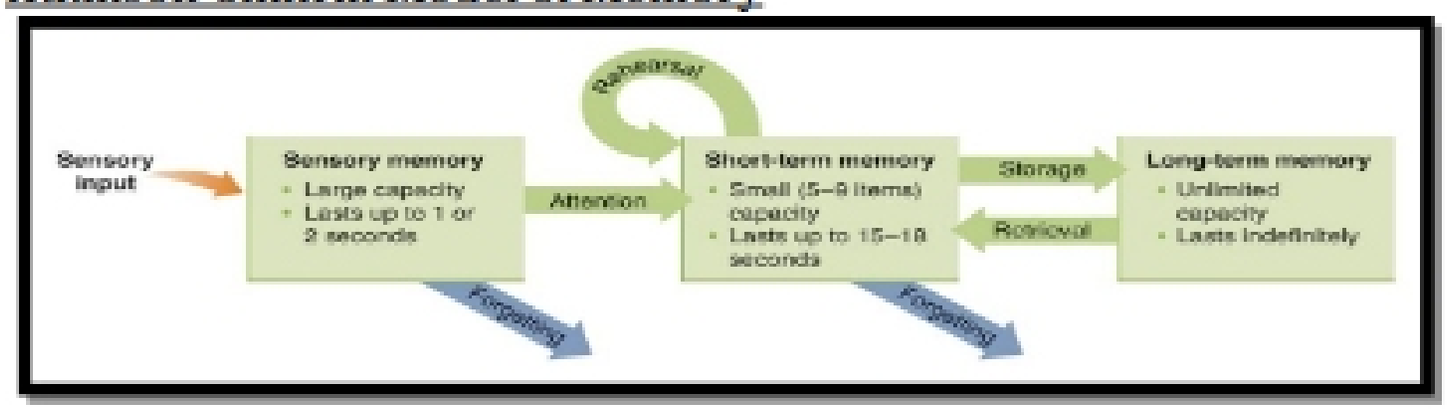
Eyeblink Conditioning & the Engram
-Pons (CS) or inferior olive (US) can be stimulated in place of physical stimulus
-The Interpositus nucleus is the brain structure that is sufficient for the CS US learning

Memory

Learning is a relatively permanent change in behavior that marks an increase in knowledge, skills, or understanding

Memory is the fruit of this learning process, the concrete trace of it that is left in your neural networks

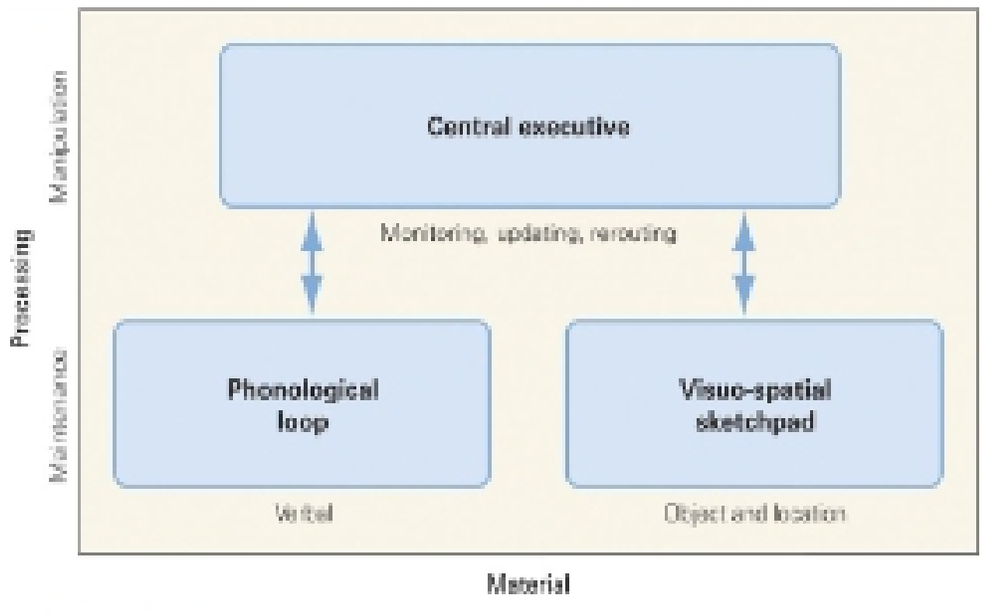
Atkinson-Shiffrin Model of Memory



Short Term/Working Memory

-Active and temporary representation of information that is maintained for short periods of time
-Different systems maintain phonological and spatial-visual information
-Central Executive: Monitors and manipulates WM information

Baddeley's Working Memory Model



Central Executive

Prefrontal Cortex plays key role in WM
- Attention
- Places long-term memories into WM

Damage results in Dysexective Syndrome

Perseveration: persist in using old rule despite repeated feedback indicating it no longer holds

Long Term Memory

Declarative or Explicit Memory: memories for facts or events
Non-Declarative or Implicit Memory: memories for skills, habits, and emotions