

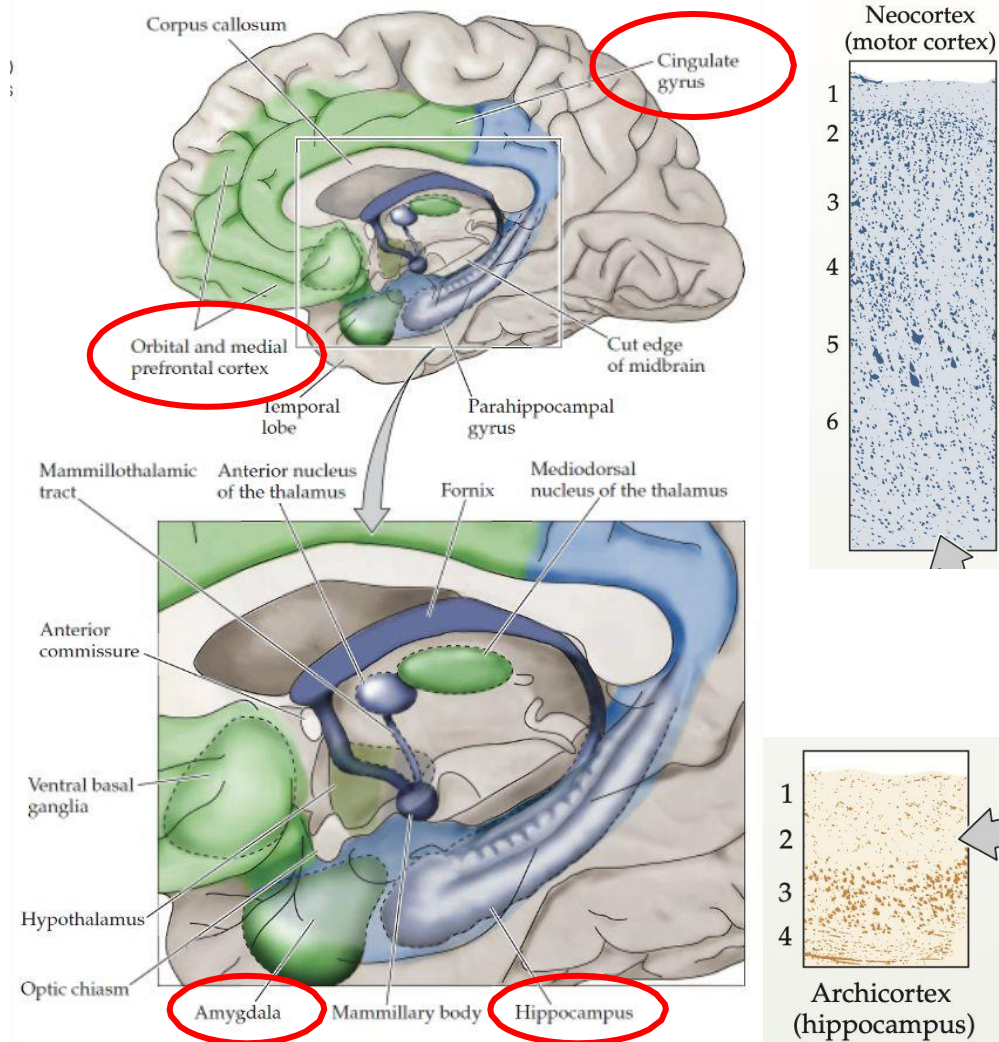
BIO-311 Neuroscience

Unit 11: Learning and Memory

Purves Chapter 27 pp. 627 – 631 & 635 - 640;
Chapter 30 pp. 681 – 698; Chapter 8 pp. 169 - 183

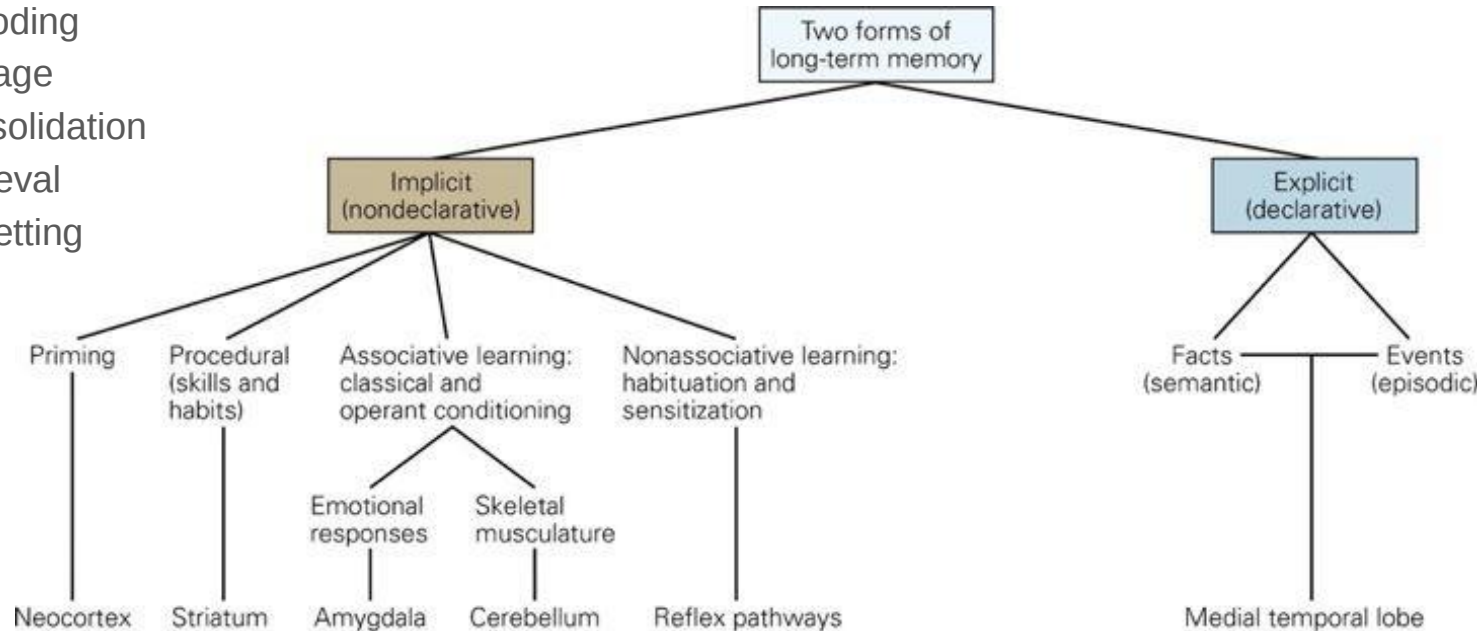
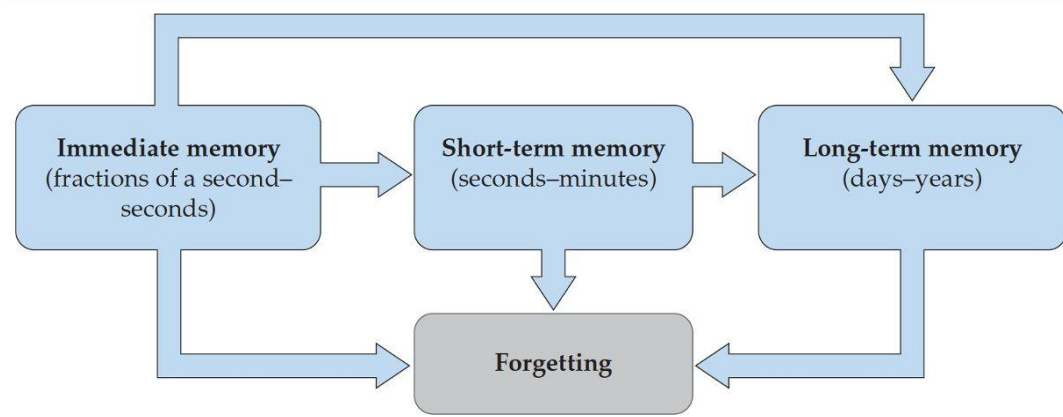
Association cortices

- Limbic association cortex
- parietal association cortex
 - objects, self, spatial awareness
- temporal association cortex
 - declarative memory
 - identifying, naming objects
- frontal association cortex
 - planning of purposeful behaviours
 - short-term ('working') memory



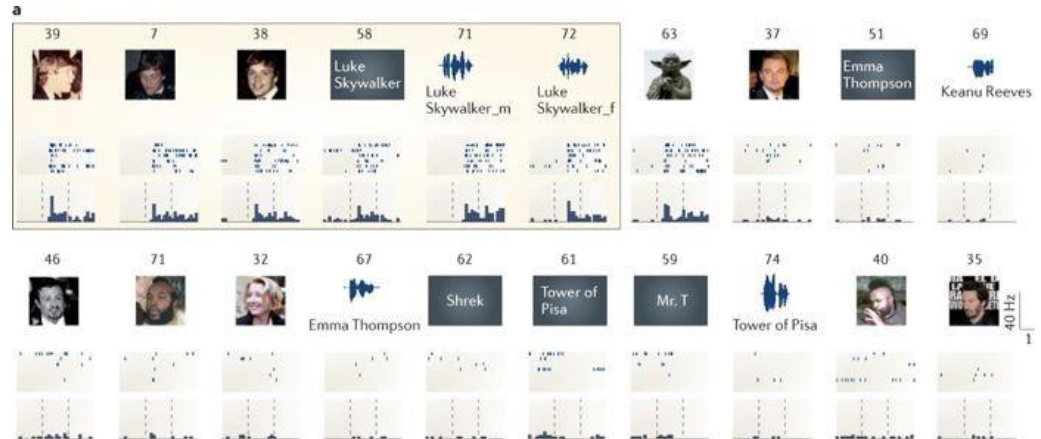
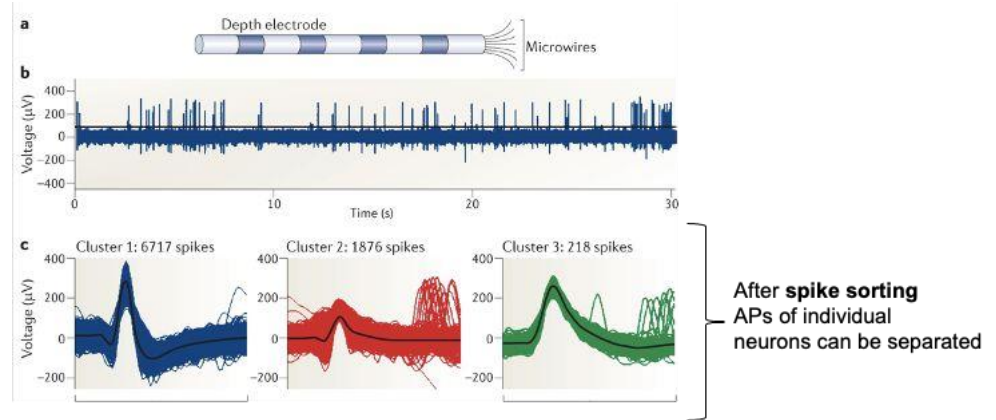
Memory

- long-term
 - implicit
 - encoding
 - storage
 - consolidation
 - retrieval
 - forgetting
 - explicit
- short-term
- immediate



Concept cells

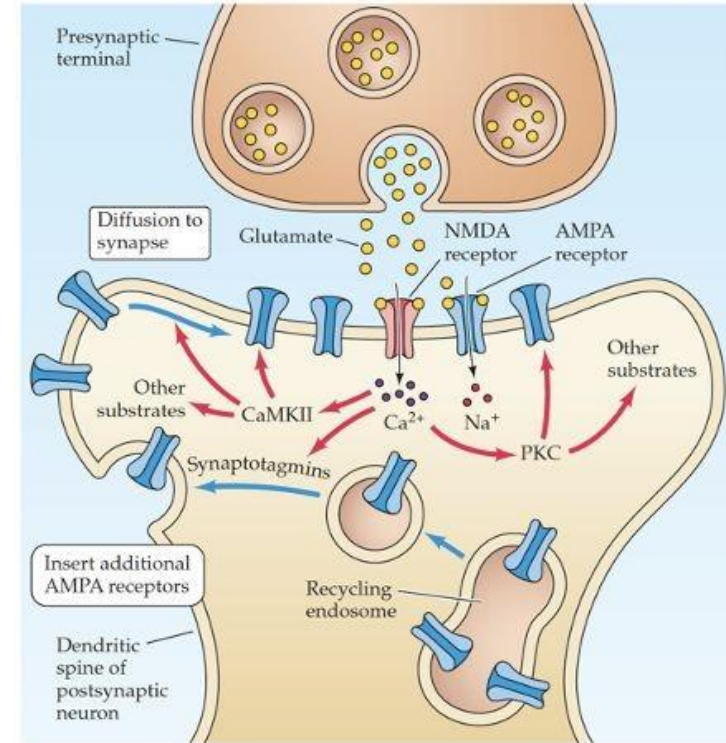
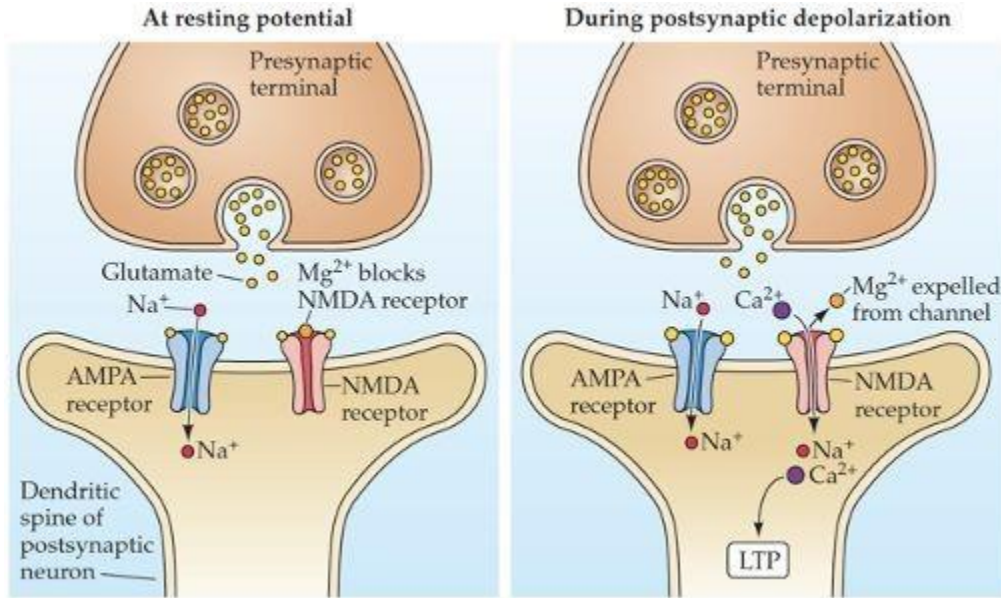
- Multi-sensory cues of the same “concept” trigger a response



Long-term plasticity mechanisms

AMPA: Mg block removal from NMDA

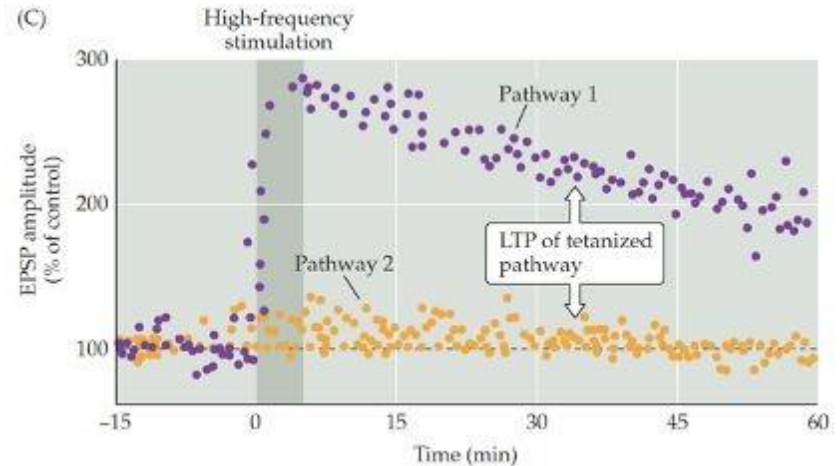
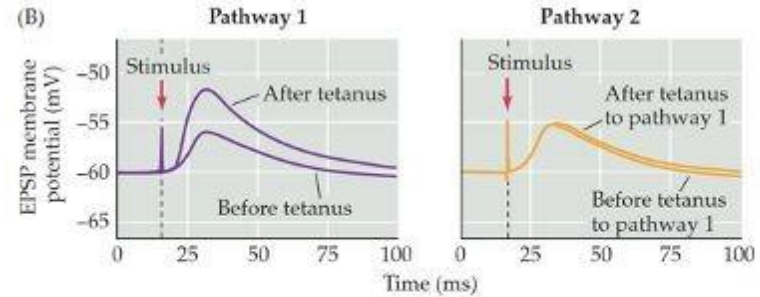
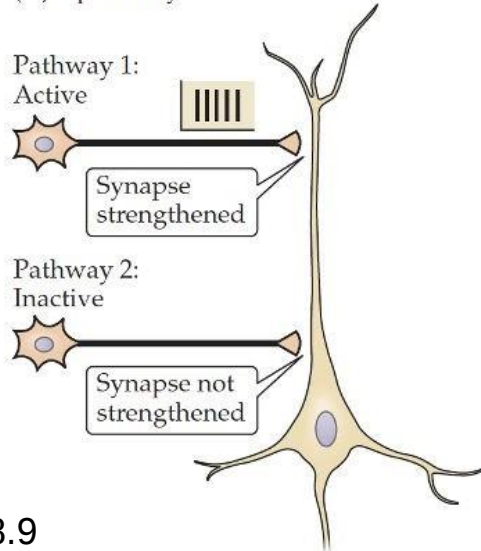
Ca²⁺ influx -> CaMKII -> Increased channel density



Long-term plasticity mechanisms

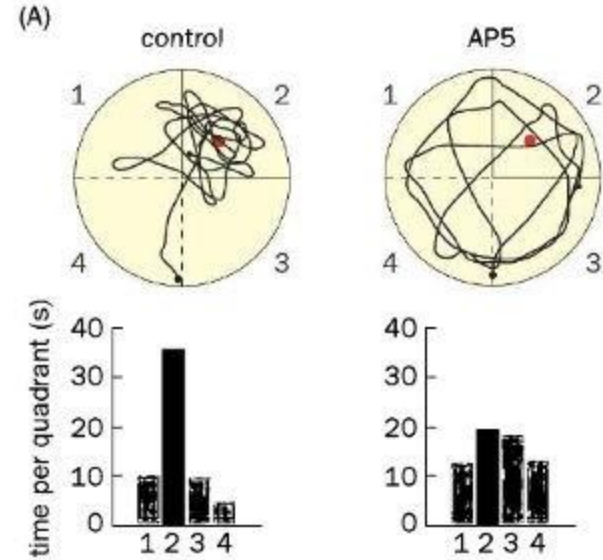
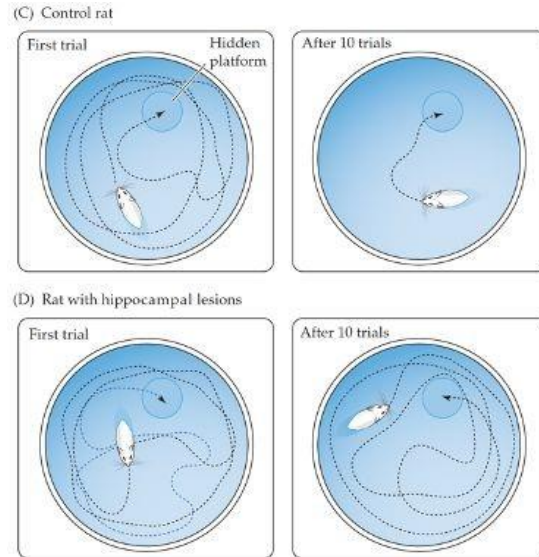
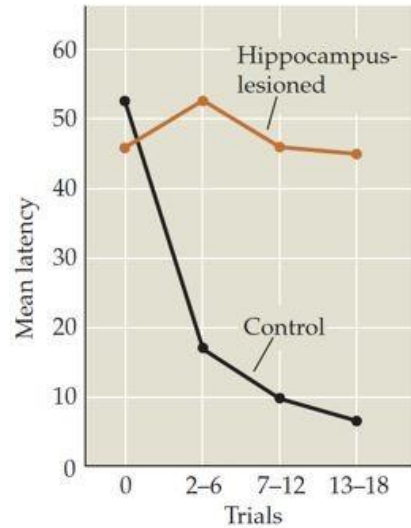
- Reinforcement by tetanic stimulation
- Coordinated firing is crucial
- «Fire together, wire together»

(A) Specificity



Hippocampus: plastic spatial navigation & memory

- “place cells” in mice
- water maze: show the role of the hippocampus in spatial learning



- Importance of NMDA shown by injection of the NMDA antagonist D-AP5

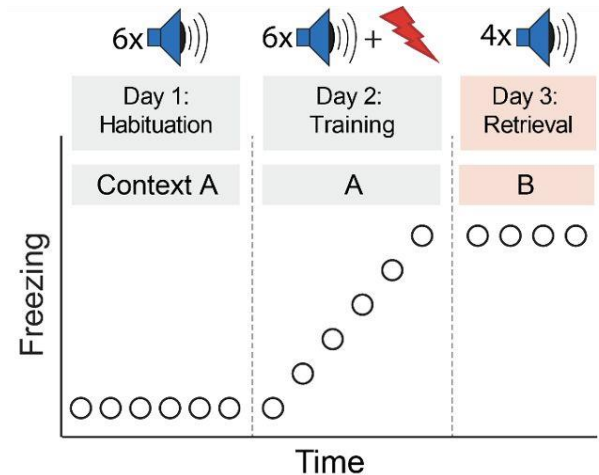
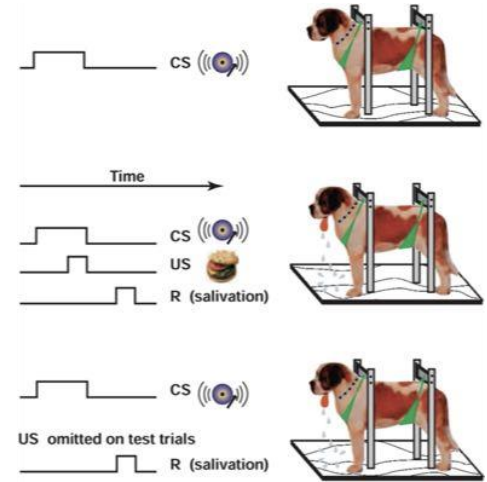
Conditioning: associative learning (implicit)

- classical conditioning vs operant conditioning
 - classical: produce a novel response to a previously neutral stimulus
 - operant: reward a specific behaviour

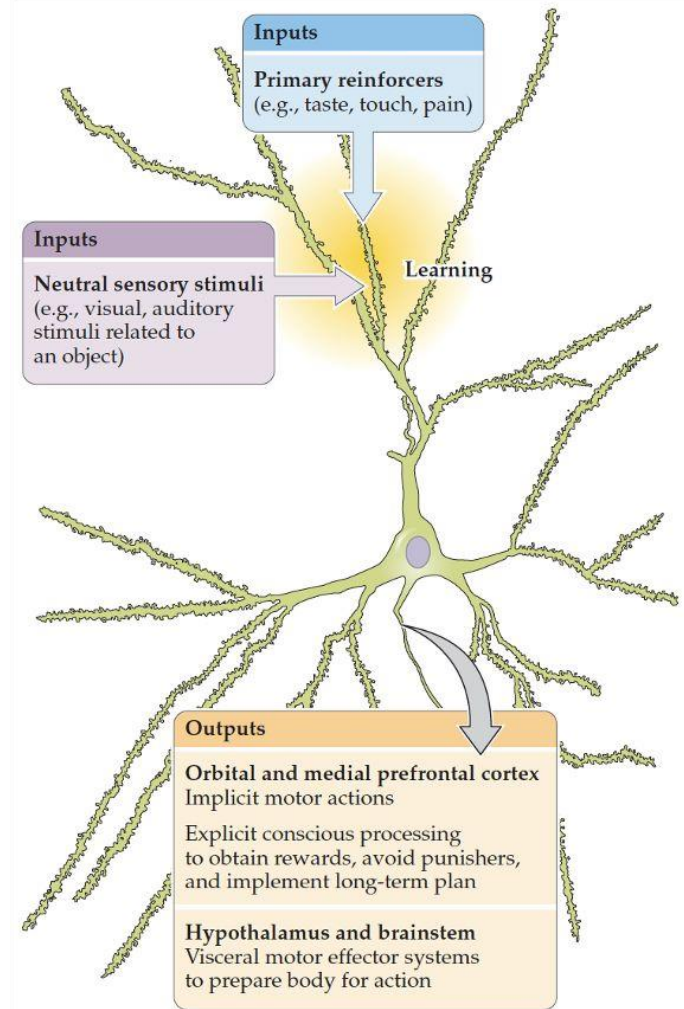
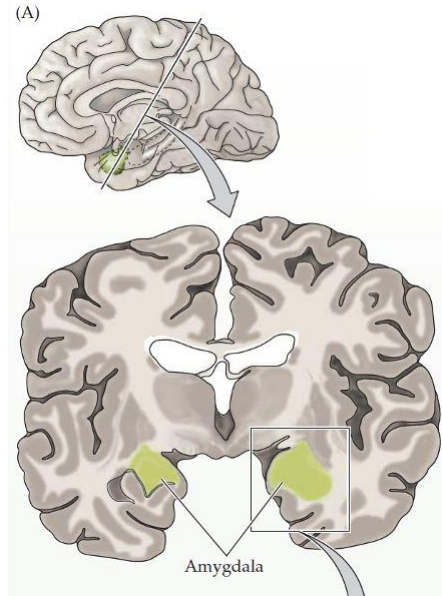
CS: conditioned stimulus

US: unconditioned stimulus

CR: conditioned response



Fear learning: in the Amygdala



Alzheimer's disease

- Clinical signs:
- Most-portem markers
- Insights from familial forms: mutations in the APP genes or in the presenilin 1 or 2 genes
- Hints for potential treatments: target the accumulation of $A\beta$ proteins, but still very early stage

