

# Neural Bases of Memory

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# History of Memory

- Science of memory began in 1885 when Hermann Ebbinghaus announced the study-test method and experimental results obtained with it
- Reciprocal interactions between clinical observations and experimental research stimulated further advances
- Ex: recent distinction between declarative and nondeclarative kinds of memory arose from research to find what kind(s) of memory is lost and what is spared after certain kinds of brain damage

## History cont'd

- In 1793, the possibility of testing experimentally whether mental exercise can induce growth of brain was discussed
- A man named Michele Vincenzo Malacarne agreed to undertake a test of hypothesis, using an experimental design that anticipated one used 180 years later

# Hypothesis tested

- He chose as subjects 2 dogs and a pair of birds
- In each pair, he gave one animal intensive training with the other received none, over a few years
- He then sacrificed the animals and compared the brains in each pair
- The trained animals were reported to show more folds in the cerebellum than the untrained

# Memory Systems

- Memory is not a single entity, but instead consists of several functions supported by independent brain regions.
- The independence of memory functions is disclosed when damage limited to a particular brain region leads to dissociations between impaired and intact memory abilities



# Memory and Learning

- Can be dissociated into several behavioral components
  - Registration storage (encoding)
  - Retention
  - Retrieval (recall)
    - Recall can be declarative (verbal report of conscious memories); procedural (the learning of a motor skill); or autonomic (the visceral response associated with the experience)

# Cont'd

- Can be classified according to modality
  - Visual
  - Auditory

# Cont'd

- Can be classified according to material
  - Verbal
  - Non-verbal

# Types of Memory

- Declarative memory and Nondeclarative
  - Declarative encompasses the acquisition, retention, and retrieval of knowledge that can be consciously and intentionally recollected
    - Examples: memory for events (episodic) or facts (semantic memory)

## Cont'd

- Nondeclarative is known as procedural kinds of memory which encompass the acquisition, retention, and retrieval of knowledge expressed through experience-induced changes in performance

# Working Memory

- Characterized as the ability to keep a limited amount of information “on line” for immediate use during short intervals
- Refers to a system involved in the temporary storage and processing of information
- It supports higher cognitive brain function such as language comprehension, learning and reasoning

# Memory Systems

- An issue of fundamental importance in memory research has to do with the classification of memories.
- 4 major systems examined are episodic, semantic, perceptual representation (PRS), and procedural

# Episodic Memory System

- Enables people to recollect personally experienced events
- Ex. Free recall, cued recall and recognition



# Semantic Memory System

- Involved in the acquisition and retention of general knowledge of the world
- Ex. Word fluency, vocabulary and primed and unprimed category associations

# Perceptual Representation System

- Facilitates identification of perceptual objects
- Ex. Primed stem completion, primed fragment completion and primed identification of degraded words

# Procedural Memory System

- Concerned with the acquisition and the expression of motor, perceptual and cognitive skills, and simple conditioning
- Ex: mirror reading, serial reaction time and rotor pursuit