Neural Plasticity and Learning and Memory
7.97J/9.301J
Spring 2003

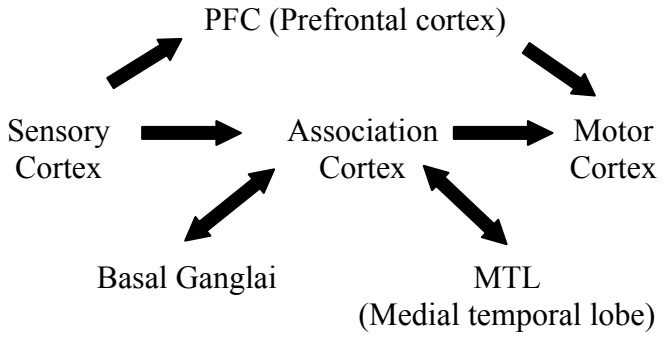
Synopsis of Lecture #1, INTRODUCTION

1. Basic Issues in Learning and Memory Research

2. Memory Classification
   - Associative/Nonassociative
   - Declarative (Explicit)/Nondeclarative (Implicit)
     Episodic (Event) "Remembering"
     Semantic (Fact) "Knowing"

3. Learning and Memory Phases
   - Acquisition (Encoding)
   - Consolidation
   - Recall
   - Reconsolidation
   - Extinction and forgetting

4. Brain Systems for Learning and Memory and Associated Cognitive Functions



5. Memory Traces
   - Hebbian synapses
   - Encoding, NMDA receptors (coincidence detector, Ca^{2+} channels)
   - Synaptic plasticity (LTP and LTD)
   - Place cells (memory traces at the network level)
   - Consolidation:
     Transcription and translation dependency
     Synaptic tagging
     Structural plasticity (size and number of synapses)
     HP → CX "transfer" (system level consolidation)
     Rhythmic oscillation in sleep

- Recall, reactivation of memory traces:
  "Pattern completion"
  Reconsolidation

6. Multilayer Organization of Brain and Multilevel Analysis
   - Molecular and cellular
   - Synaptic physiology
   - In vivo physiology and imaging
   - Behavioral studies and noninvasive imaging
   - Computational and modeling