

## Biology of Memory

- Library analogy
  - Where «Introduction to Psychology» book is located in the library
  - There is no address and place for our memories
- Memories of different types of experiences are stored in different brain regions
- **Long-term potentiation** is the gradual strengthening of the connections among neurons from repetitive stimulation

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## Biology of Memory

- Search for «engram»:
  - Physical trace of each memory in the brain
- Lashley (1929)
  - He taught rats to run mazes
  - He lesioned different parts of their brains to see if they forgot how to find their way
  - The more brain he removed, the worse the rat performed on the maze
  - No matter which tissue is removed, the rats retained at least some memory of the maze

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## Biology of Memory

- Search for «engram»:
  - There is no engram
- Memory is not located in a single place
  - Memories of different features of experiences (their sound, sight, and smell etc.) are stored in different brain regions
- This remind you what?
  - The binding problem
- Hippocampus plays a key role in forming memories

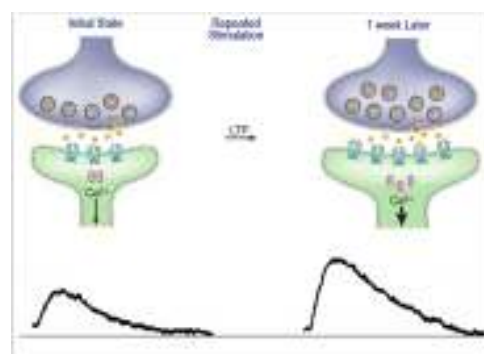
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## Biology of Memory

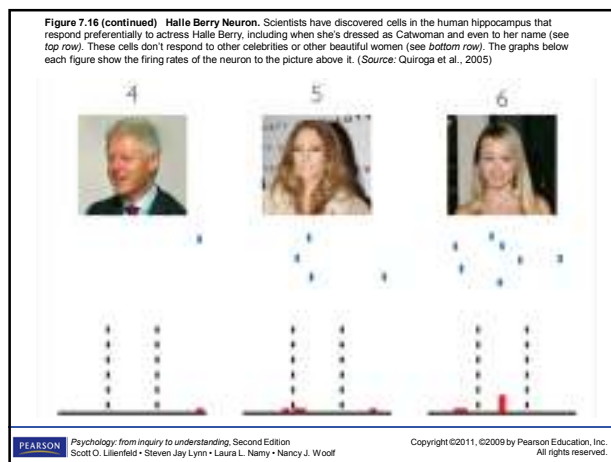
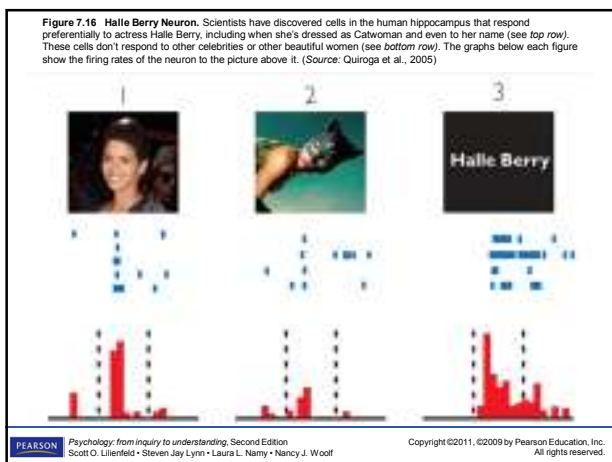
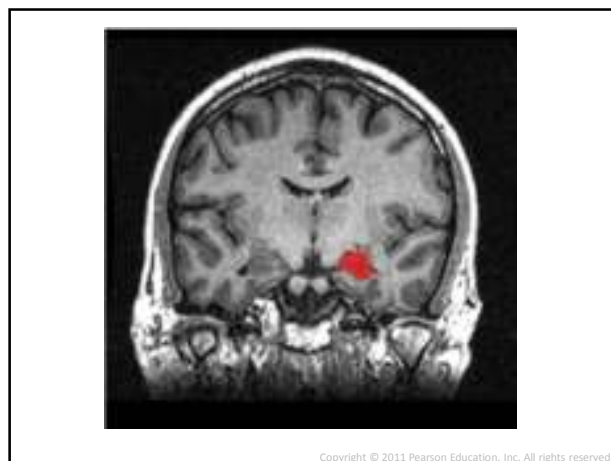
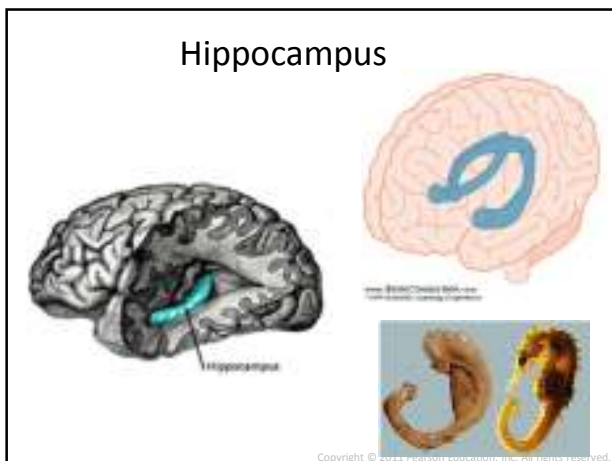
- **Long-term potentiation** is the gradual strengthening of the connections among neurons from repetitive stimulation
  - “Neurons that fire together, wire together”
- LTP plays a key role in learning

<http://www.dnatube.com/video/216/LongTerm-Potentiation-LTP>

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### Amnesia

- Most common types are **retrograde** (loss of past memories) and **anterograde** (loss of ability to make new memories)
- Myths about amnesia,
  - *generalized amnesia* is very rare,
  - sudden recovery of memory is very rare
  - Anterograde amnesia is more common than retrograde amnesia

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### H.M.

- Had radical surgery to treat severe epilepsy
  - Surgeons didn't anticipate the disastrous impact of this surgery
- Chunks of temporal lobes, including both hippocampi, were removed
- Experienced mild retrograde and severe anterograde amnesia, but implicit memory improvements

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### H.M.

- He was oblivious to the fact that he had undergone surgery
- He didn't remember what he eat at lunch 30 min ago
- Even when he repeatedly informed about the death of his uncle, he showed dramatic grief reaction each time
- «Everyday is alone by itself, whatever enjoyment I had, whatever sorrow I have had»
- He passed at the age of 82 in 2008

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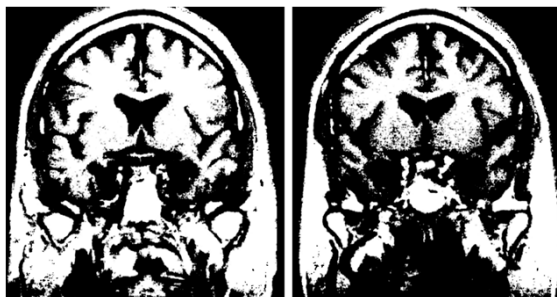
Figure 7.17 A Mirror Tracing Task Similar to That Administered to H.M. How well can you draw while looking in a mirror? On this task, used to assess implicit memory, subjects must trace a star while looking only at a mirror.



PEARSON Psychology: from inquiry to understanding, Second Edition  
Scott O. Lilienfeld • Steven Jay Lynn • Laura L. Namy • Nancy J. Woolf

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H.M.'s brain damage as imaged in 1997. The scan shows severe damage to his hippocampi and nearby regions. (Source: Corkin et al., 1997)



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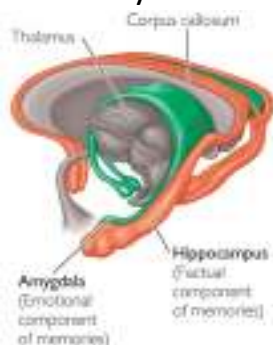
### Clive Wearing

- Hippocampi were destroyed by a virus (herpes virus), resulting in complete anterograde amnesia
- Still shows priming effects, thought
- Bottom line: destroying hippocampus leaves implicit memory intact

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### Emotional Memory

- The amygdala and hippocampus interact to give us emotional memories



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### Emotional Memory

- Patient amygdala damage (S.M.) recalls fear-producing experience but not the fear itself
- Patient hippocampal damage (W.S.) recalls fear but not the fear-producing event
- Amygdala helps recall emotions associated with fearful events
- Hippocampus helps us recall the events themselves

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## Erasing Painful Memories

- Some ethical considerations
- What if it is possible to erase traumatic or painful memories?
- Is erasing all traces of pain in life always a good thing? Or emotional suffering is an essential part of being human.
- If we choose to forget every negative experience, would we learn from our mistakes?

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## Erasing Painful Memories

- Cahill & McGaugh (1995)
  - They tell participants two stories with 12 slides
  - Half of the participants listened to an emotionally neutral story (boy visits to a hospital where his father works)
  - Second half of the participants listened to an emotionally disturbing story (boy was injured and operated on at a hospital to reattach his leg)
  - Participants who heard emotionally arousing story displayed the best recall for the part of the story about boy's trauma

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## Erasing Painful Memories

- Cahill & McGaugh (1994)
  - Used similar methodology as the previous study
  - Additionally some participants received propranolol (blocks effects of adrenaline, doctors use it to treat high blood pressure)
  - These participants did not show good recall for emotionally arousing part of the story
  - Their performance was similar to those who heard the neutral story

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## Biology of Memory Deterioration

- Usually begin to show some declines after 65, but not always
- Alzheimer's disease is the most frequent cause of *dementia* (50-60% of cases)
- Show memory and language losses, consistent with cortical loss

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## Alzheimer's Disease

- Research shows that those with active lifestyles are less likely to develop AD
- Greater education and intellectual activity are related to lower AD rates
- Use it or lose it!

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## Video

- MultiMedia Library
- Video
  - [Memory Hazards \(p. 268\)](#)
  - [Dementia: Judy \(p. 268\)](#)
  - [What Happens with Alzheimer's \(p. 268\)](#)
  - <http://www.mathxl.com/info/mmlib.aspx?bookcode=Lilienfeld2e>

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## Infantile Amnesia

- Inability of adults to retrieve accurate memories before 2-3 years old
- No one knows sure «Why infantile amnesia is observed»
- Hippocampus is only partially developed in infants (insufficient brain architecture to retain memories)
- Lack of sense of self

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Research suggests that other than humans, gorillas, orangutans, dolphins, and perhaps elephants are among the handful of species that exhibit mirror self-recognition—often regarded as one important indicator of the presence of a self-concept (Plotnik, deWaal, & Reiss, 2006). Here a baby reacts to his mirror image.



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## Our memory for the past

- a. is like a camcorder, recording exact events as they happen; when we recall, we play it back and see the images.
- b. is like a computer storing endless pages of information, when we recall, we can recall individual events like a page of paper.
- c. is neither like a camcorder or computer, rather it stores bits of information that must be reconstructed during recall.

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## Short-term memory

- a. holds about one word.
- b. holds  $7 \pm 2$  pieces of information.
- c. lasts about 40 minutes.
- d. tends to be stable over long periods of time.
- e. does not overlap with working memory.

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## Short-term memory

- a. holds about one word.
- b. **holds  $7 \pm 2$  pieces of information. (pp. 247-249)**
- c. lasts about 40 minutes.
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We tend to remember the first items on a list and the ones we learned a few minutes ago. I am referring to the \_\_\_\_\_ and \_\_\_\_\_ effects

- a. Von Restorff; primary
- b. Recency; primacy
- c. Primacy; recency
- d. Priming; short-term memory

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## Implicit memory

- a. can be stated verbally and is subject to conscious recollection.
- b. depends on one specific part of the brain.
- c. includes many types of memory, excluding explicit memory.
- d. involves motor performance, but never words.

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## Implicit memory

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## Priming

- a. refers to the fact that you remember the first items on a list better.
- b. refers to facilitated recognition of a stimulus after having seen it previously.
- c. refers to unique information being remembered better.
- d. refers to the fact that you can recall memory better in the same room where you first learned it.

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## Priming

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## Long-term potentiation

- a. refers to the fact that you learn fear better if you are already scared.
- b. refers to increases in neural connections due to repetitive stimulation.
- c. refers to a cellular mechanism only for classical conditioning.
- d. is the proven way that memory is stored in the brain.

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## Long-term potentiation

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## The best way to study would be

- a. 10 hours straight a week before the exam.
- b. 10 hours straight right before the test.
- c. 1 hour per day, for 10 days before the test.
- d. 10 hours straight for each of 10 days before the exam.

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