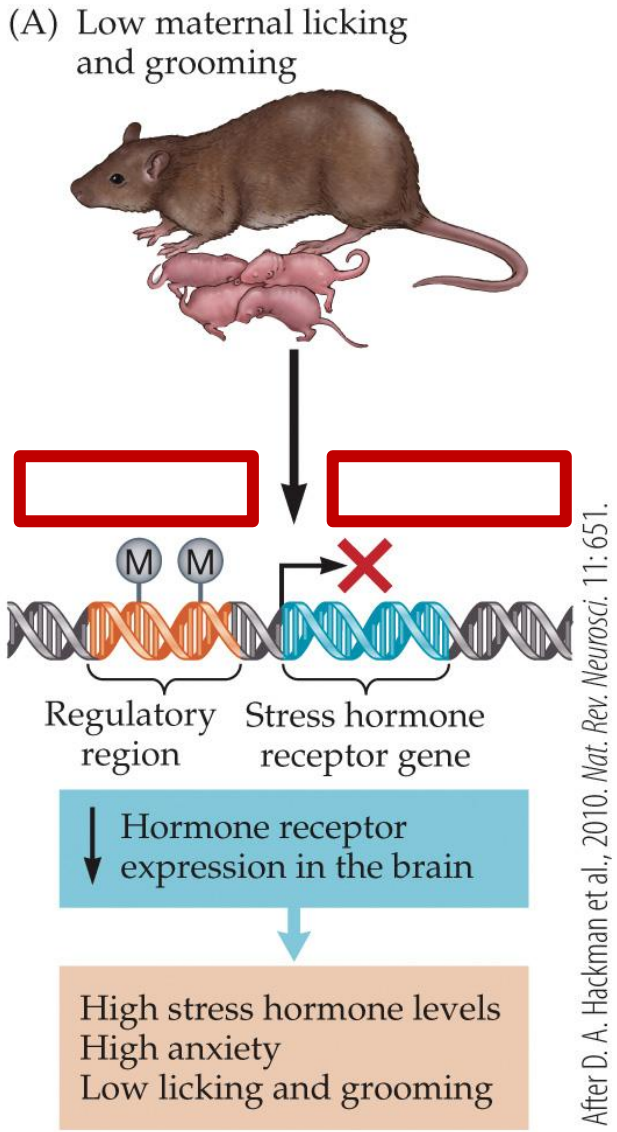
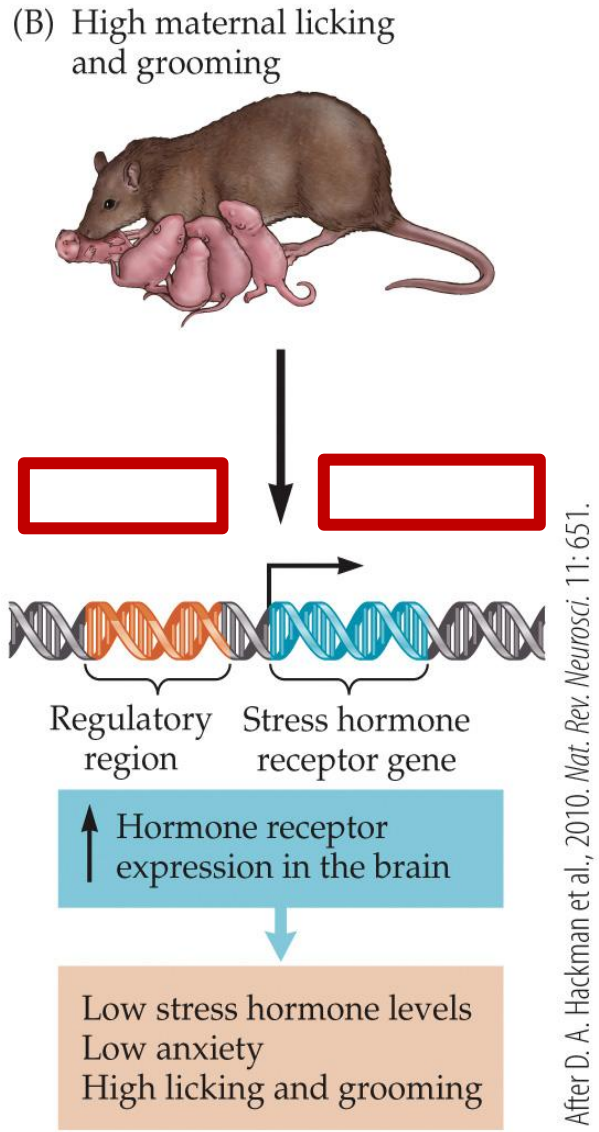
Lecture 16

The Brain Continues to Change as We Grow Older

Epigenetics Review: Fill in the boxes





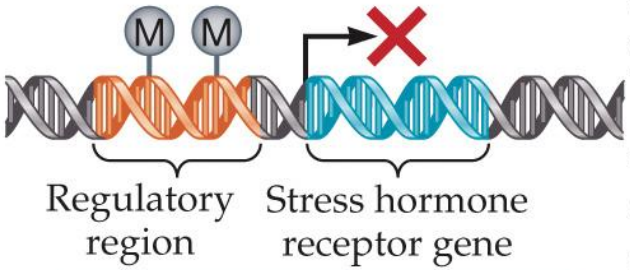
Epigenetics Review: Fill in the boxes

(A) Low maternal licking and grooming



Methyl groups are added

Gene expression is reduced



Hormone receptor expression in the brain

High stress hormone levels
High anxiety
Low licking and grooming

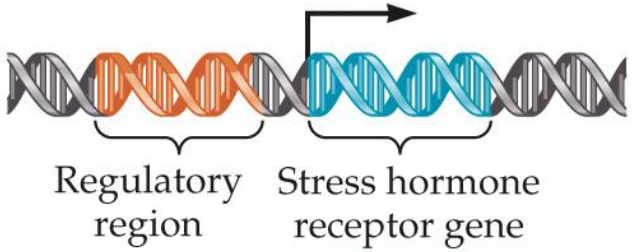
After D. A. Hackman et al., 2010. *Nat. Rev. Neurosci.* 11: 65

(B) High maternal licking and grooming



No Methyl groups are added

High Gene expression



Hormone receptor expression in the brain

Low stress hormone levels
Low anxiety
High licking and grooming

After D. A. Hackman et al., 2010. *Nat. Rev. Neurosci.* 11: 65

The Brain Continues to Change as We Grow Older

The Road Ahead:

- Describe the current model of processes underlying the degeneration seen in Alzheimer's disease.
- Critique the amyloid hypothesis of Alzheimer's.
- Discuss how brain imaging may help us understand the mechanism(s) of Alzheimer's.

Alzheimer's Disease Is Associated with a Decline in Cerebral Metabolism

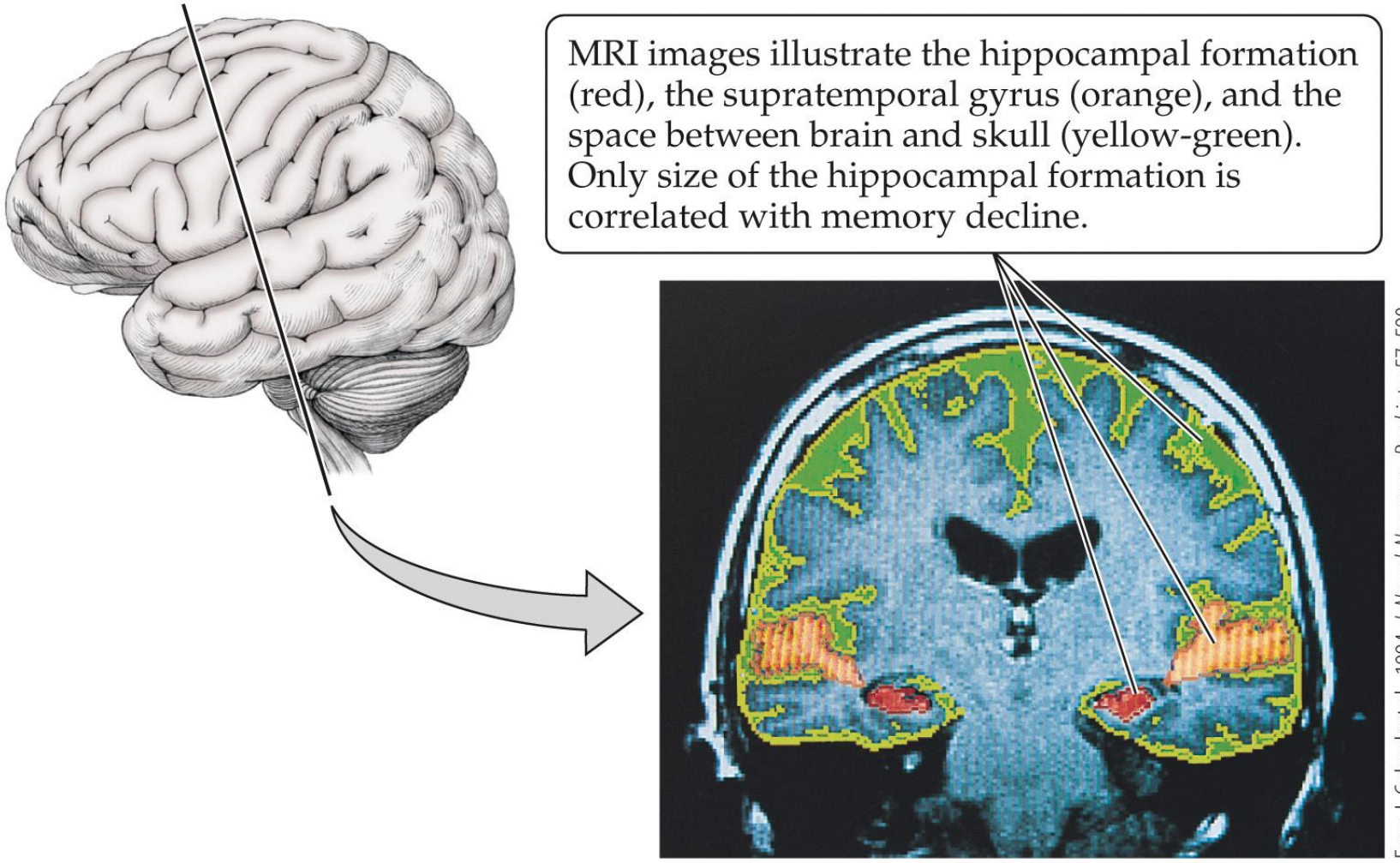
- **Dementia** is a drastic failure of cognitive ability, including memory failure and disorientation.
- **Alzheimer's disease** is a form of dementia. The brain exhibits striking cortical atrophy and reduced metabolism.
  - Begins as memory loss of recent events
  - Memory impairment becomes so extensive that conversation is impossible—both context and prior information are lost

Question: Is mild impairment in memory specifically related to reduction in size of specific brain regions or is better explained by generalized shrinkage of brain tissue?

- Study participants: 55-87 years old.
- Analysis: memory test, MRI imaging.
- Results: Only size of the hippocampal formation is correlated with memory decline.

Memory impairment correlates with hippocampal shrinkage during aging

Figure 4.16 Hippocampal Shrinkage Correlates with Memory Decline in Aging



From J. Golomb et al., 1994. *J. Neurol. Neurosurg. Psychiatry* 57: 590.
MRI courtesy of James Golumb

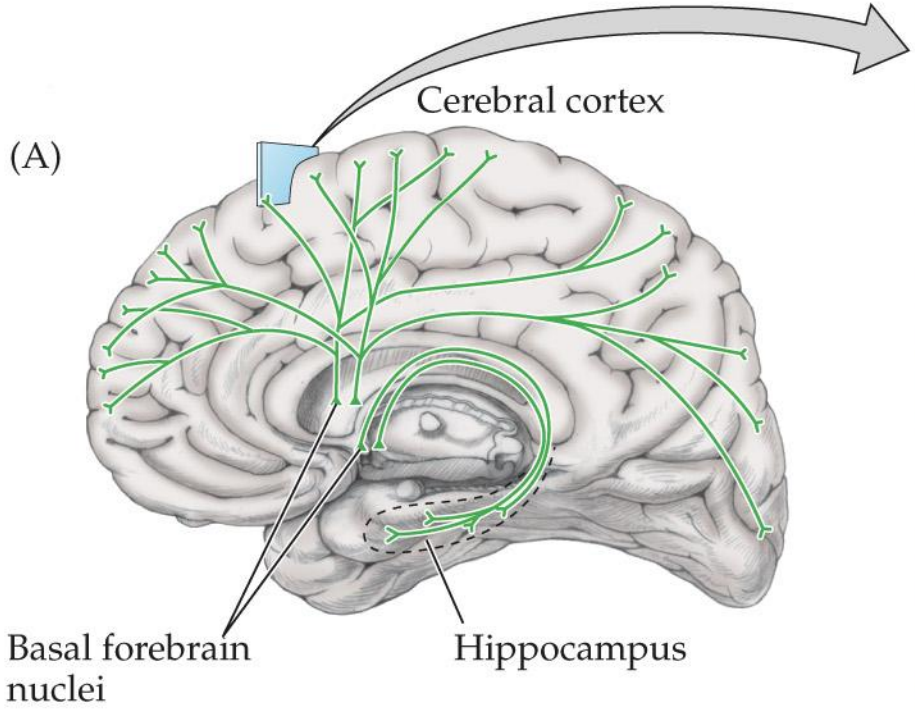
THE MIND'S MACHINE 4e, Figure 4.16
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Alzheimer's Disease Is Associated with a Decline in Cerebral Metabolism

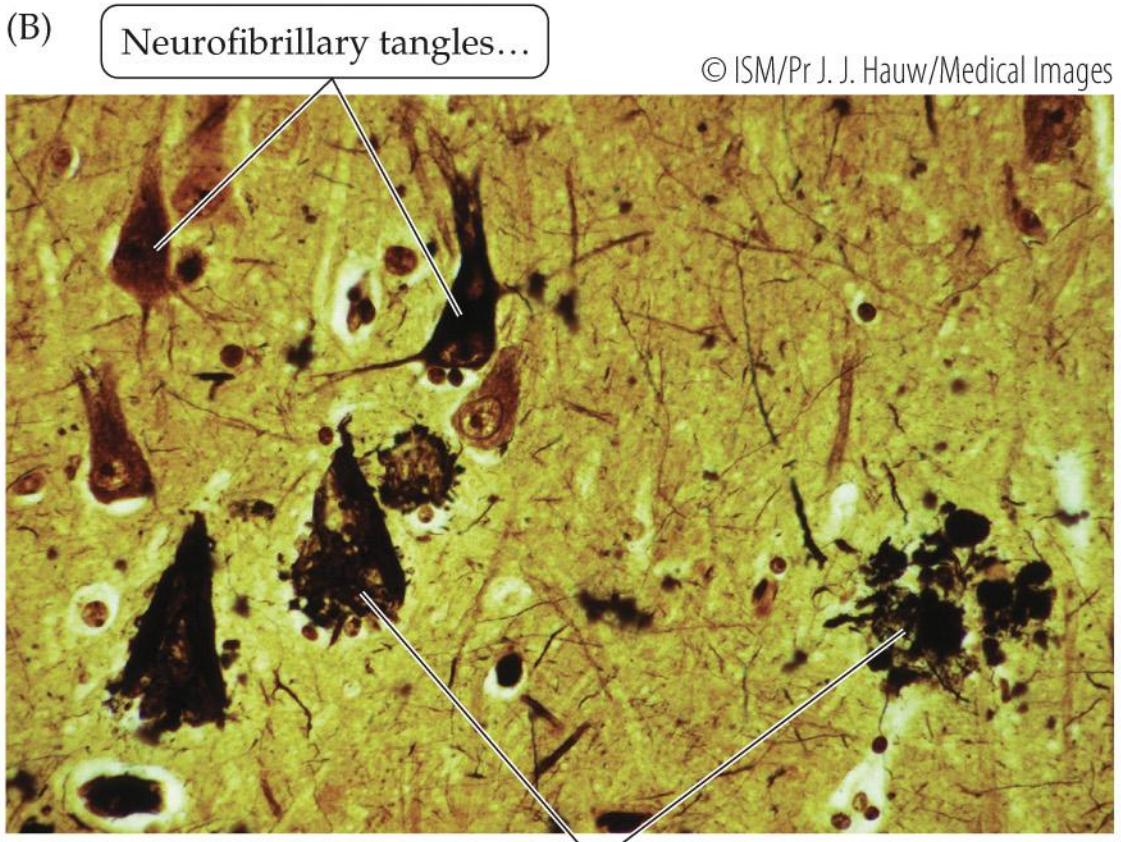
Cellular changes in Alzheimer's:

- Patches of **amyloid plaques** (or *senile plaques*), formed by **beta-amyloid** buildup
- **Neurofibrillary tangles**—abnormal whorls of filaments
- Loss of neurons that make acetylcholine in the basal forebrain

Figure 4.17 People with Alzheimer's Show Structural Changes in the Brain



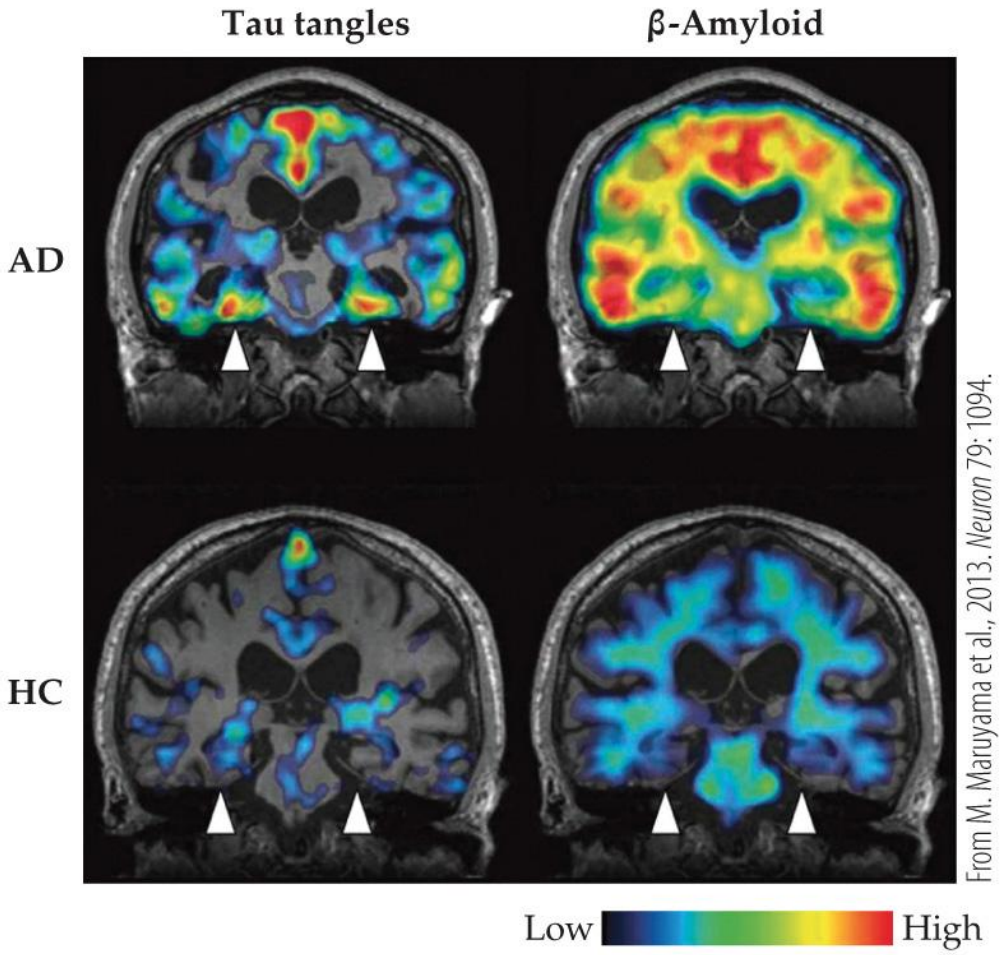
The basal forebrain nuclei project their axons, which use acetylcholine as a neurotransmitter, widely across the brain. These cells seem to disappear in Alzheimer's patients.



…and amyloid plaques are visible in this section of cerebral cortex from a patient with Alzheimer's.

THE MIND'S MACHINE 4e, Figure 4.17
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Figure 4.18 Imaging Tau Tangles and Amyloid Plaques in the Brain



By injecting radiolabeled markers, scientists can image Tau tangles, which are concentrated in the hippocampus (indicated by arrowheads) of a person with Alzheimer's disease (AD) compared with a healthy control (HC). Similarly, Pittsburgh Blue can reveal β-amyloid, which is abundant throughout the brain of a person with AD.

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