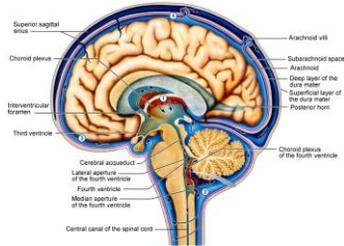


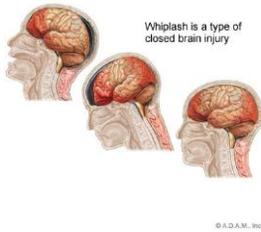
Recall that the brain floats in a layer of cerebrospinal fluid....



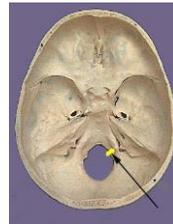
- In instances of sudden stops or the extremes of movement in an accident situation, the brain can be injured by banging against the interior of the skull even if the skull is not fractured ("closed head injury")



Closed Head Injuries to Brain



Floor of Skull



- Prefrontal region & front tips of temporal lobes are particularly at risk (like the front bumper or headlights on your car, the front parts are likely to collide with skull)

Contusions of Closed Head Injury



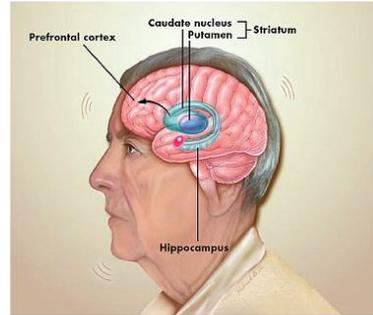
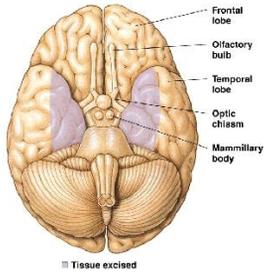
Pattern of frontal and temporal lobe bruising often seen.

Patient H.M. had a bike accident as a kid and damaged the tips of both of his temporal lobes.

The Sad Case of H. M.

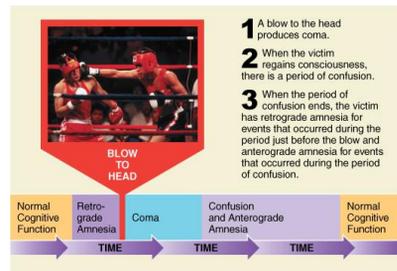
- He developed post-traumatic focal epilepsy in both temporal lobes which could not be controlled by medication.
- Unilateral temporal lobe surgeries had successfully reduced seizures in previous patients with an epileptic focus in that area.
- Bilateral surgeries had been done in animals without serious disruptions of behavior, so.....
- HM had *bilateral* medial temporal lobectomy

► Medial Tempal Lobectomy



H. M.

- Epilepsy greatly improved but memory severely impaired
- Retrograde amnesia- most severe for things within the 2-3 years before surgery, but older memories and IQ intact
- Severe anterograde amnesia for declarative memories. STM fairly normal but once HM is distracted, those memories are lost



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Figure 11.6

Different Aspects of Long Term Memory

- Terms to refer to types of LTM:
 - Declarative memory – memories we can state in words:
 - information (“semantic” memories)
 - life experiences (“episodic” memories)
 - Procedural memories – motor skill memories
- Explicit memory – conscious intentional recollections
- Implicit memories – more “unconscious” memories evidenced by improved/alterd performance, without conscious recollection of what caused that

H.M. Also Shows All Memories Not Stored in Same Way

- H.M. has shown evidence of the formation of new procedural & implicit memories
- Finger maze, mirror tracing & reading, rotary pursuit, playing Tetris, classical conditioning



Mirror-Drawing Task

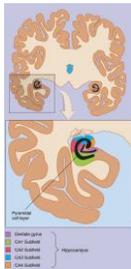


(a)

Clive W.

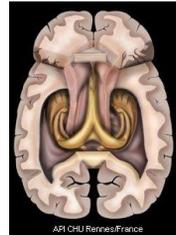
- Suffered damage to hippocampus and frontal cortex during a bout of encephalitis
- Extreme anterograde amnesia similar to H.M.'s; old LTM s are fine – some additional dyscontrol of emotion because of frontal lobe damage.
- http://www.youtube.com/watch?v=OmkiMlvLKto&list=PLjDlFq66T_8hdi7dVXI_D990yDMaGqyv
- go to 1:58

More selective brain damage case: R.B.



- R.B. suffered damage to just one part of the hippocampus (CA1 pyramidal cell layer) and developed amnesia
- R.B.'s case suggests that hippocampal damage alone can produce amnesia
- H.M.'s & Clive's damage and amnesia were more severe than R.B.'s

Role of Hippocampus Within Medial Temporal Lobe

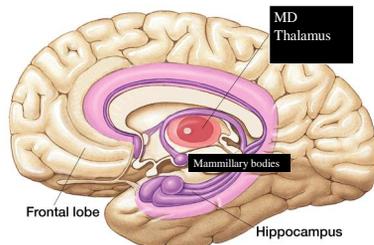


- Seems to be involved in the *process of storing declarative memories ("consolidation")* but is **not** the final "memory bank"
- (we'll come back to the "memory banks" in a minute)

New View of Consolidation and LTM

- LTM files are not permanent, unchanging records. When we recall or "re-open" these files, they can be 'updated' or changed, then "re-consolidated".
- Most of the time this is necessary and adaptive.

How About Other Limbic Areas?



Amnesia Due to Thalamus/Hypothalamus Damage

- Korsakoff's Syndrome - serious anterograde AND increasing retrograde amnesia . Tendency to **confabulate as their episodic memories deteriorate.**
- Like HM, implicit memories are better preserved.
- Due to thiamine deficiency, most often in alcoholics, which impairs the supply of energy (glucose) to the brain
- Widespread loss of neurons; most concentrated damage in MD thalamus & medial hypothalamus/mammillary bodies of hypothalamus, and cortex.

Another Diencephalic Case

- N.A. & his fencing foil
- mild retrograde + more serious anterograde amnesia
- 1970 CAT scan revealed left MD thalamus lesion
- More recent MRI scan showed additional damage to mammillary bodies.

Memory Role of Other Areas

- Amygdala - emotional significance of memory
- Frontal lobe – working memory; memory for temporal order, keeping track of timeline
- Cerebellum & Basal Ganglia- implicit, procedural memories; motor habits
- **Long-term memories** – diffusely stored in the secondary & association **cortex** areas involved in the original stimulus perception/processing
- Severity of amnesia related to extent of brain damage.

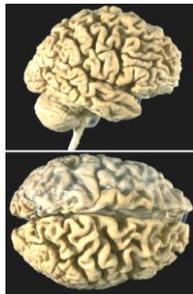
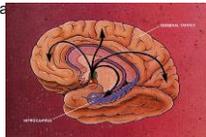
Alzheimer's Disease



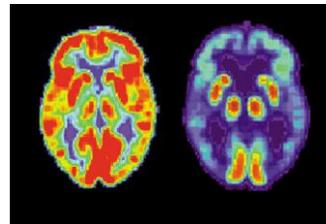
Most common dementia – a terminal progressive degenerative disease Affects ~5.2 million in US.

Alzheimer's Disease

Widespread degeneration in cortex (especially association areas), hippocampus, amygdala, as well as a critical source of ACh -nucleus basalis of the basal forebrain. Cortical & hippocampal changes can be seen on MRI as disease

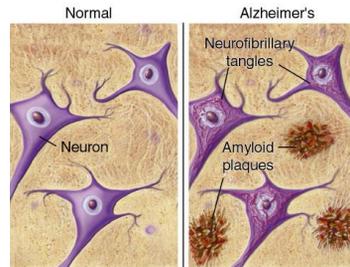


PET Scan of Decreased Brain Activity in Severe AD



Alzheimer's Disease

- Runs in families; genes on at least 4 different chromosomes have been linked to early AD and others are linked (but less strongly) to the more common late-occurring variety
- Several pathological changes in brain
 - Production of **abnormal amyloid protein** which damages neurons, causing distinctive **plaques** of neural debris
 - Production of **abnormal tau protein** which produces abnormal **neurofibrillary tangles** within neurons. Interfere with neuron function & may cause toxic levels of glutamate to be released, causing cell death.



- Currently: drugs to boost ACh by preventing its breakdown (Aricept, Cognex, Exelon, Reminyl) provide some improvement in the early stages.
- One new med to try to block toxic effects of glutamate (Namenda)
- Researchers investigating potential genetic, stem cell, and insulin related treatments as well as a possible amyloid 42 vaccine.
- <http://www.medicalnewstoday.com/articles/287837.php>