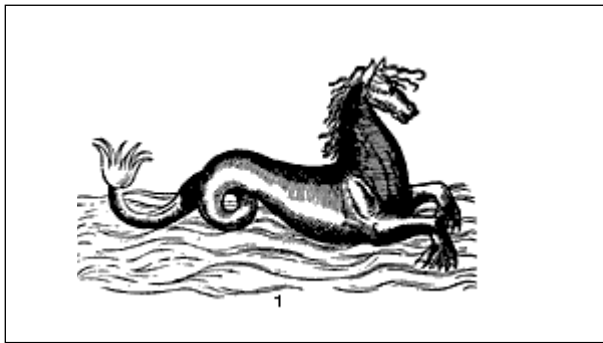


LEARNING AND MEMORY (2)

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One of the first and best case-studies of the effects on memory of bilateral removal of portions of the temporal lobe was the patient called HM. The enormous research about him was done by Brenda Milner. HM was 27 years old and had suffered for over 10 years from untreatable bilateral temporal lobes seizures as a consequence of a head trauma. At the surgery the removal of anterior hippocampus and adjacent structures bilaterally caused an inability to form new memories of events. But he still had normal short-term memory, over seconds or minutes. He also remember the events happened before the surgery. His main problem was the inability to transfer new short-term memory into long-term memory. Thus, Milner introduced herself to HM every time they met as he could not remember her from last visit.

Three distinct zones -the dentate gyrus, the hippocampus, and the subicular complex- constitute the hippocampal formation, which is located in the floor of the temporal horn of the lateral ventricle. Those zones are composed of adjacent strips of cortical tissue that run in a rostral-caudal direction but



Hippocampus: From Greek and Roman mythology. The hippocampus is a creature that is half-horse and half-fish, with the head and forequarters of a horse and the tail and hindquarters of a dolphin. It had forelegs with webbed paws, and may have a fin on the back of its neck. Neptune's chariot was pulled through the ancient seas by several of these creatures, and Neptune was occasionally seen riding one.

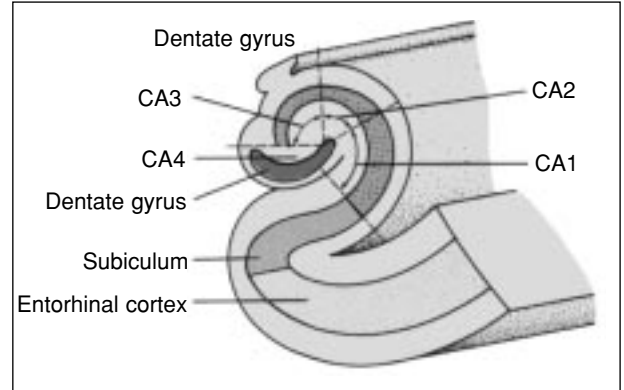


Figure 1. The hippocampus is divisible into four fields designated CA1, CA2, CA3, CA4.

CA is derived from the term *cornu ammonis* after the Egyptian deity Ammon, who was depicted with ram's horns, which some early investigators thought described the shape of the hippocampus

fold over each other mediolaterally in a spiral fashion, resulting in a C-shaped appearance. The hippocampus is also a trilaminar structure composed of molecular and polymorphic layers and a middle layer that contains pyramidal neurons (Figure 1). On the basis of differences in cytoarchitecture and connectivity, the hippocampus can be divided into three distinct fields, which have been labeled CA3, CA2, and CA1.

Explicit memory is first acquired through processing in neocortex that synthesize visual, auditory and somatic information. This information is then conveyed to the parahippocampal and perirhinal cortices. The next station is entorhinal cortex. Individual stored items such as words are presented as patterns of active and inactive neurons in the entorhinal cortex. Activity spreads from here to subregions of hippocampus, including a structure with extensive recurrent connections - region CA3. Within the region CA3, with the mechanism of long-term potentiation (LTP), the different components of each stored pattern is associated to each other. LTP is a prolonged excitatory stimulus delivered to presynaptic hippocampal neurons leading to a long-lasting increased response in postsynaptic neurons. Somehow, the

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postsynaptic neuron senses the coincidence between its own and presynaptic activity and sends a signal back to concurrently active presynaptic inputs to selectively increase their strength (LTP will be the topic of next issue).

Acetylcholine (ACh) is more important in recalling than recognition. During encoding, activity spreads through the dentate gyrus into region CA3 where the connections are strengthened between the neurons. The neurons represent context and words. Encoding depends on strength between neurons where ACh influences on synaptic modification, depolarization and feedback excitation. This is one of the basic mechanism that fails in Alzheimer's Disease.

KAYNAKLAR

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