INTERNATIONAL MULTIDISCIPLINARY JOURNAL FOR RESEARCH & DEVELOPMENT
SJIF 2019: 5.222 2020: 5.552 2021: 5.637 2022:5.479 2023:6.563
eISSN 2394-6334 https://www.ijmrd.in/index.php/imjrd Volume 11, issue 02 (2024)

ANOTOMIC ARRANGEMENT OF THE HIPPOCAMPUS, WHICH IS ANOTOMICALLY COMPLEX LOCATED IN THE CRANIAL BRAIN

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Annotation: In this article, you will receive the necessary information about the hippocampus, which is anotomically complex located in the brain. Hippocampa is a very important member of the cranium, and is the main memory center. This article was written from internet sources,and as a result of research conducted by scientists, and quotes from them without copyright infringement.

Key words: Hippocamp, neural structure, brain.

Hippocampus anatomy describes the physical aspects and properties of the **hippocampus**, a neural structure in the medial **temporal lobe** of the **brain**. It has a distinctive, curved shape that has been likened to the **sea-horse** monster of **Greek mythology** and the ram's horns of **Amun** in **Egyptian mythology**. This general layout holds across the full range of **mammalian** species, from hedgehog to human, although the details vary. For example, in the **rat**, the two hippocampi look similar to a pair of bananas, joined at the stems. In **primate** brains, including humans, the portion of the hippocampus near the base of the temporal lobe is much broader than the part at the top. Due to the three-dimensional curvature of this structure, two-dimensional sections such as shown are commonly seen. **Neuro- imaging** pictures can show a number of different shapes, depending on the angle and location of the cut.

The hippocampus is the "flash drive" of the human brain and is often associated with memory consolidation and decision-making, but it is far more complex in structure and function than a flash drive. The hippocampus is a convex elevation of gray matter tissue within the parahippocampal gyrus inside the inferior temporal horn of the lateral ventricle. One can describe it more holistically as a curved and recurved sheet of the cortex that folds into the temporal lobe's medial surface. The hippocampus has three distinct zones: the dentate gyrus, the hippocampus proper, and the subiculum. The subiculum is positioned between the hippocampus proper and entorhinal and other cortices. The parahippocampal gyrus and cingulate sulci are located on the medial surface of the hemisphere, forming a C-shaped ring. The medial temporal lobe cortex includes major subdivisions, such as the hippocampus and the entorhinal cortex. This five-centimeter-long hippocampus (from the anterior end at the amygdala to the posterior end near the splenium of the corpus callosum) divides into a head, body, and tail. the head is expanded and bears two or three shallow grooves called pes hippocampi. The head of the hippocampus is part of the posterior half of the triangular uncus and is separated inferiorly from the parahippocampal gyrus by the uncal sulcus. The alveus, which is the surface of the hippocampus, is covered by the ependymal inside the ventricular cavity.

The fornix, which is the main outflow bundle out of the hippocampus, wraps around the thalamus, where it then becomes separated by the choroidal fissure and the choroid plexus. The hippocampus contains parts like the fimbria, crus, body, and column—the fimbria forms where alveus fibers converge along the medial portion of the lateral ventricle's inferior horn. The white matter of the fimbria separates to form a crux of the ipsilateral fornix at a point beyond the splenium of the corpus callosum. The Cornu Ammonis (CA) is a seahorse-like or ram's horn-like structure that describes the different layers of the hippocampus. There are four hippocampal subfields CA1, CA2, CA3, and CA4. CA3 and CA2 border the hilus of the dentate gyrus on either side.

CA3 is the largest in the hippocampus and receives fibers from the dentate granule cells on their proximal dendrites[2] . The pyramidal cell layer is about ten cells thick.

Three phases of memory include (1) registration, (2) storage, and (3) retrieval of information. The hippocampus, parahippocampal region of the medial temporal lobe, and the neocortical association have been shown through autopsy and imaging studies to be essential for memory processing. Impairment of short-term memory leading up to an inability to form new memories occurs when there is bilateral damage to the above mention regions**[3]**. The hippocampus is closely associated with the amygdala, hypothalamus, septum, and mammillary bodies such that any stimulation of the nearby parts also marginally stimulates the hippocampus. There are also high outgoing signals from the hippocampus, especially through the fornix into the anterior thalamus, hypothalamus, and greater limbic system. The hippocampus is also very hyperexcitable, meaning it can sustain weak electrical stimulation into a long, sustained stimulation that helps in encoding memory from olfaction, visual, auditory, and tactile senses.

In lower animals, the hippocampus helps them determine if they will eat certain foods based on olfactory discernment, avoid danger, respond to sexual invites through pheromones, or react to life-and-death decisions. The hippocampus is a site for decision-making and committing information to memory for future safety uses. Thus it has a mechanism to convert short-term memory into long-term memory, consolidating verbal and symbolic thinking into information that can be accessed when needed for decision-making.

The hippocampus originates in the isocortex as part of the fifth limbic lobe of the brain in the cerebral hemisphere's medial surface. It is also considered part of the olfactory cortex.[4] It is drawn to the temporal lobe by a strand of fibers called the fornix. Choroid fissure helps the choroid plexus invaginate into the lateral ventricle. The hippocampus itself is a mammalian innovation, while the isocortex as a whole is part of the phylogenetical ancient brain. The hippocampus is a deep structure hidden between the mesencephalon and the medial aspect of the temporal lobe. Three important changes are necessary for the complex shape and location of the hippocampus

1. Rotation of the lateral parts of the developing telencephalon dorsocaudally, then ventrally and rostrally, forming the parietal, occipital, and temporal lobes.
2. The hippocampal sulcus then invaginates into the medial wall of the temporal lobe
3. Finally, the hippocampal sulcus rotates along a longitudinal axis of the hippocampus, forming a complex structure that is present in the medial aspect of the temporal lobe.

Topologically, the surface of a cerebral hemisphere can be regarded as a sphere with an indentation where it attaches to the midbrain. The structures that line the edge of the hole collectively make up the so-called **limbic system** (Latin *limbus* = *border*), with the hippocampus lining the posterior edge of this hole. These limbic structures include the hippocampus, **cingulate cortex**, **olfactory cortex**, and **amygdala**. **Paul MacLean** once suggested, as part of his **triune brain** theory, that the limbic structures constitute the neural basis of **emotion**. While most neuroscientists no longer believe in the concept of a unified "limbic system", these regions are highly interconnected and do interact with one another.

The internal hippocampus consists of archicortex. Note that archicortex has fewer cortical layers than both the neocortex (which has six layers), and the paleocortex (which has either four or five).

The archicortex of hippocampus is comprised primarily of pyramidal cells. Like all cells, pyramidal cells have afferent processes (dendrites) and efferent processes (axons). It should be noted that the dendrites of a pyramidal cell extend from both the apex and base. The basal dendrites extend toward the surface of the lateral ventricles; while the apical dendrites extend away from the lateral ventricles and toward the dentate gyrus.

The axons of pyramidal cells take information received by the hippocampus and send it to other structures in the brain; these efferent processes extend from the pyramidal cell body, travel through a structure called the alveus fiber layer next to the inferior horn of the lateral ventricle and then enter into either the entorhinal cortex or the fimbria-fornix.

The archicortex of hippocampus has four main layers:

- The lacunar-molecular layer is the deepest layer of the hippocampal archicortex. This layer is mainly composed of interneurons.
- The radiate layer is mainly composed of the dendrites of the pyramidal cells and stellate cells.
- The pyramidal layer is the thickest and the most important layer of the hippocampus. It is composed of densly packed pyramidal neurons. The pyramidal layer merges with the internal pyramidal layer of the neocortex.
- The oriens layer is the most superficial layer of the hippocampus, situated just inferior to the alveus. It is composed mainly of basket-cell interneurons and shares many structural characteristics with the deepest layer of the neocortex.

Note that some anatomy textbooks use older classification of the hippocampal layers, which divide the hippocampal structure into three following layers: molecular, pyramidal and polymorphic.

The dentate gyrus is a band of cortex situated between the upper aspect of the parahippocampal gyrus and the fimbria hippocampi. The dentate gyrus gets its name from its tooth-like configuration. This configuration is created by numerous blood vessels that pierce the ventricular surface of the hippocampus and dentate gyrus.

Like the hippocampus, the dentate gyrus is also multilayered; but, unlike the hippocampus whose primary cell is the pyramidal cell, the primary cell of the dentate gyrus is the granule cell. Granule cell axons are called mossy fibers, and they synapse with the pyramidal cells in the CA3 field of the hippocampus.

The three layers that comprise the dentate gyrus are (superficial to deep):

- The molecular layer composed mainly of nerve cell bodies and granule cell dendrites;

- The intermediate granular layer composed of granule cells, the main cells of the dentate gyrus;
- The multiform layer is composed mainly of interneurons.

Alzheimer's disease is accompanied by early dysfunction and loss of synapses, prominently affecting excitatory transmission in the hippocampus and cerebral cortex. These changes may contribute to memory loss. The loss of neuronal population, specifically glutamatergic neurons in the entorhinal cortex and pyramidal neurons of the CA1 sector of the hippocampus, is also seen in Alzheimer's disease. These pyramidal neurons of the CA1 sector are also more selectively vulnerable to global cerebral ischemia, with the severity of pathology depending on the ischemic duration. These abnormalities can be seen on the CA1 field on MRI**[8]**. If a coma persists for less than 12 hours (brief ischemia), it might cause reversible bilateral encephalopathies to the thalamus or hippocampus. Patients with brief ischemia will present with transient confusion or amnesia upon awakening. Some patients may show severe anterograde or variable retrograde amnesia with or without confabulations.

References:

1. AbuHasan Q, Reddy V, Siddiqui W. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Jul 17, 2023. Neuroanatomy, Amygdala. [PubMed] [Reference list]
2. [2]Daugherty AM, Bender AR, Raz N, Ofen N. Age differences in hippocampal subfield volumes from childhood to late adulthood. Hippocampus. 2016 Feb;*26*(2):220-8. [PMC free article] [PubMed] [Reference list]
3. Wang EW, Du G, Lewis MM, Lee EY, De Jesus S, Kanekar S, Kong L, Huang X. Multimodal MRI evaluation of parkinsonian limbic pathologies. Neurobiol Aging. 2019 Apr;*76*:194-200. [PMC free article] [PubMed] Reference list.
4. Li N, Li Y, Li LJ, Zhu K, Zheng Y, Wang XM. Glutamate receptor delocalization in postsynaptic membrane and reduced hippocampal synaptic plasticity in the early stage of Alzheimer's disease. Neural Regen Res. 2019 Jun;14(6):1037-1045. [PMC free article] [PubMed]
5. Bhusal A, Rahman MH, Lee IK, Suk K. Role of Hippocampal Lipocalin-2 in Experimental Diabetic Encephalopathy. Front Endocrinol (Lausanne). 2019;10:25. [PMC free article] [PubMed]
6. Tan B, Fox S, Kruger C, Lynch M, Shanagher D, Timmons S. Investigating the healthcare utilisation and other support needs of people with young-onset dementia. Maturitas. 2019 Apr;122:31-34. [PubMed]
7. Mukhtarovna, D. M. (2022). THE ORIGIN OF MIASTHENIA DISEASE AND METHODS USED IN TREATMENT. American Journal of Interdisciplinary Research and Development, 10, 258-261.
8. Nurumbetova, S. (2022). VAIN ASPECTS OF PRACTICAL RELIGIOUS EXAMINATION IN THE INVESTIGATION OF CRIMES RELATED TO PROHIBITED RELIGIOUS MATERIALS. *Science and Innovation*, *1*(6), 108-113.
9. Nurumbetova, S. (2023). MODERN OPPORTUNITIES AND PROSPECTS FOR DEVELOPMENT EXPERT-CRIMINALISTIC ACTIVITY. *Modern Science and Research*, *2*(9), 415-419.
10. Нурумбетова, С. А. (2023). СОВРЕМЕННЫЕ ВОЗМОЖНОСТИ И ПЕРСПЕКТИВЫ РАЗВИТИЯ ЭКСПЕРТНО-КРИМИНАЛИСТИЧЕСКОЙ ДЕЯТЕЛЬНОСТИ.

11. Мухамедова, М. Г., Куртиева, Ш. А., & Назарова, Ж. А. (2020). СИНДРОМ ФУНКЦИОНАЛЬНОЙ КАРДИОПАТИИ У СОВРЕМЕННЫХ ПОДРОСТКОВ. In *П84 Профилактическая медицина-2020: сборник научных трудов Все-российской научно-практической конференции с международным участи-ем. 18–19 ноября 2020 года/под ред. АВ Мельцера, ИШ Якубовой. Ч. 2.—СПб.: Изд-во СЗГМУ им. ИИ Мечникова, 2020.—304 с.* (p. 105).
12. Kurtieva, S., Nazarova, J., & Mullajonov, H. (2021). Features of endocrine and immune status in adolescents with vegetative dystonia syndrome. *International Journal of Health Sciences*, *5*(2), 118-127.
13. Kurtieva, S., Nazarova, J., & Mullajonov, H. (2021). Features of Physical and Generative Development of Modern Teenagers Living in Uzbekistan. *NeuroQuantology*, *19*(7), 57.
14. Куртиева, Ш. (2021). CHANGES IN ELECTROENCEPHALOGRAM INDICATORS IN ADOLESCENTS WITH VEGETATIVE DYSFUNCTION. *УЗБЕКСКИЙ МЕДИЦИНСКИЙ ЖУРНАЛ*, (SPECIAL 3).
15. Kurtieva, S. (2022). INDICATORS OF THE EXTERNAL RESPIRATORY SYSTEM AND CARDIAC ACTIVITY IN ADOLESCENTS. *Frontline Medical Sciences and Pharmaceutical Journal*, *2*(01), 17-24.
16. Kurtieva, S. (2021). Physical Performance Assessment in Adolescents with Autonomic Dysfunction. *International Journal Of Medical Science And Clinical Research Studies*, *1*(6), 143-146.
17. Kurtieva, S. (2021). Clinical And Anamnestic Characteristics Of The Health State Of Adolescents With Vegetative Dysfunction Syndrome. *The American Journal of Medical Sciences and Pharmaceutical Research*, *3*(06), 1-12.
18. Negmatov, M. K., & Adashevich, T. A. Water purification of artificial swimming pools. *Novateur Publication India's International Journal of Innovations in Engineering Research and Technology [IJIERT] ISSN*, 2394-3696.
19. Negmatov, M. K., & Adashevich, T. A. WATER PURIFICATION OF ARTIFICIAL SWIMMING POOLS.
20. Negmatov, M. K., Zhuraev, K. A., & Yuldashev, M. A. (2019). Treatment of Sewage Water of Electrical Production on Recycled Filters. *International Journal of Advanced Research in Science, Engineering and Technology*, *6*(10), 11132-11135.
21. Negmatov, M., Kovalenko, V. I., Shumnyj, V. K., & Asrorov, K. A. (1975). Induction of CMS in cottonplants by means of radiation-induced mutagenesis. *Genetika*, *11*(12), 136-138.
22. Negmatov, M., Kovalenko, V. I., Shumnyi, V. K., & Asrorov, K. A. (1975). Induction of CMS in cottonplants by means of radiation-induced mutagenesis. *Genetika;(USSR)*, *11*(12).