



Image 2:034

Advances in Cytoarchitectonic Mapping of the Human Amygdala and the Hippocampus

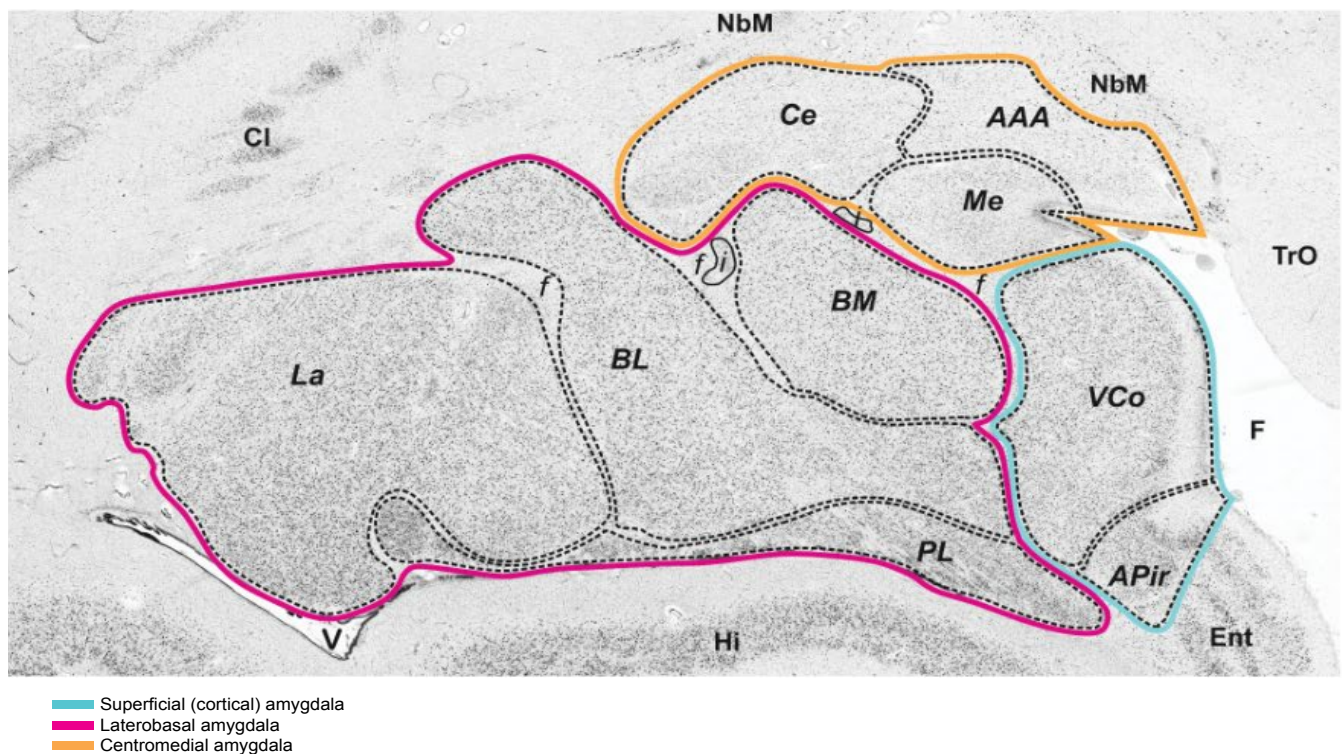


Figure 1: Cytoarchitecture of the amygdala and neighboring cortical and subcortical structures in a coronal section of a human postmortem brain. The centromedial nucleus is labelled by an orange line and the basolateral complex by a red line. The VCo belongs to the superficially located part of the amygdala. AAA anterior amygdaloid area, APir amygdalopiriform transition area, BL basolateral nucleus, BM basomedial nucleus, BV basoventral nucleus, Ce central nucleus, f fiber bundles, i intercalated islands, La lateral nucleus, Me medial nucleus, PL paralaminar nucleus, VCo (ventral) cortical nucleus. Neighbouring structures: Cl Claustrum, Ent entorhinal cortex, F endoneurial sulcus, Hi hippocampus, NbM Nucleus basalis of Meynert, TrO Tractus opticus, V lateral ventricle.

Source: Figure 1 (minimally altered) "Springer Anat Embryol, Cytoarchitectonic mapping of the human amygdala, hippocampal region and entorhinal cortex: Intersubject variability and probability maps, 210, 2005, 343-352, Amunts K, Kedo O, Kindler M, Pieperhoff P, Mohlberg H, Shah NJ, Habel U, Schneider F, Zilles K ©Springer Verlag, "With permission of Springer".

Information

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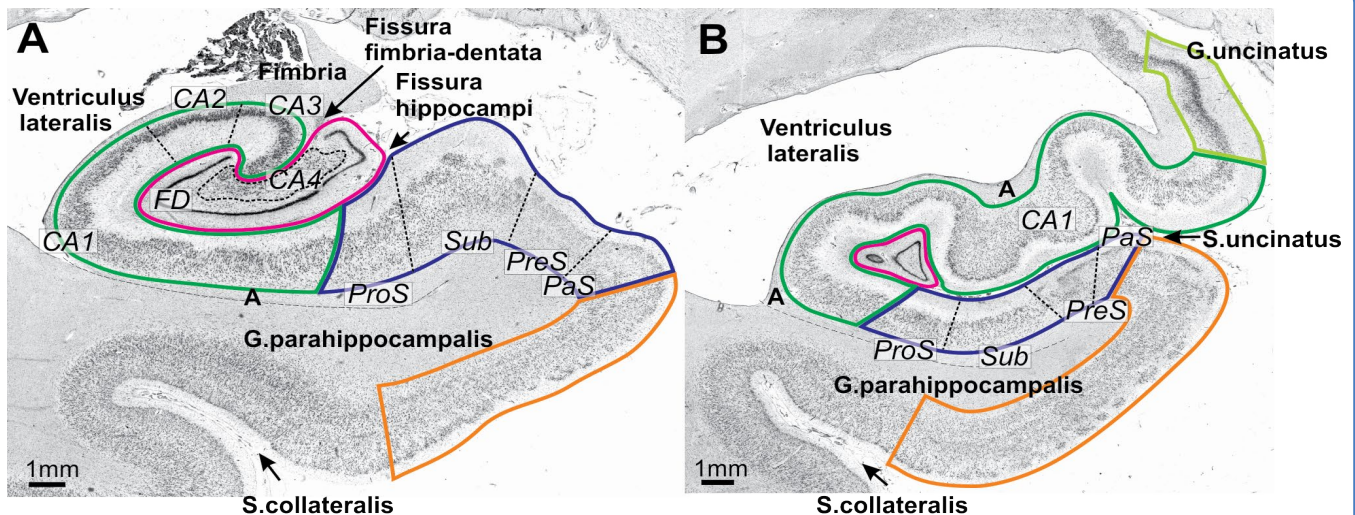
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- Cornu ammonis (CA1 - CA3)
- Dentate gyrus: *FD* Fascia dentata and CA4
- Subicular complex: *ProS* prosubiculum, *Sub* subiculum proper, *PreS* presubiculum, *PaS* parasubiculum
- *HATA* Hippocampal-amygdaloid transition area
- Entorhinal cortex

Figure 2: Cytoarchitecture of the mesial temporal lobe at the level of the body of the hippocampus (a), and its head (b). The hippocampus proper with its subdivisions Cornu ammonis, dentate gyrus, the *HATA*, the subicular complex and the entorhinal cortex are labelled by different colours. Note that cytoarchitectonic borders of the different subdivisions do not coincide with sulci in most cases.

Source: Figure 2 (minimally altered) "Springer Anat Embryol, Cytoarchitectonic mapping of the human amygdala, hippocampal region and entorhinal cortex: Intersubject variability and probability maps, 210, 2005, 343-352, Amunts K, Kedo O, Kindler M, Pieperhoff P, Mohlberg H, Shah NJ, Habel U, Schneider F, Zilles K ©Springer Verlag, "With permission of Springer".

Keywords

Amygdala, Hippocampus, Cytoarchitecture

Discussion

The human amygdala and hippocampus are key structures for emotion and memory processing. They are involved in various neurological and psychiatric disorders. Since each of both brain regions is structurally and functionally extremely segregated [1], their numerous subdivisions are implicated to different degrees in specific pathological processes, e.g. epilepsy [2,3].

Although modern functional imaging techniques can assign dysfunctions to the whole amygdala or hippocampus after specific impairments [4], the disorder- or lesion-specific involvement of the clearly defineable, and functionally as well as structurally diverse cytoarchitectonic subdivisions remains to be elucidated. Therefore, cytoarchitectonic probability maps are a prerequisite for an anatomically sufficiently precise localization of functional imaging data [1]. This was realized by registration of probability maps of the subdivisions of the amygdala and hippocampus to a stereotaxic reference space, which is also used for the localization of functional imaging data. E.g., a prevailing contribution of the basolateral amygdala was revealed by using this combined approach in impaired acquisition of conditioned fear in patients with Urbach-Wiethe disease [5].

Here we present further advanced cytoarchitectonic parcellations of the amygdala (Figure 1) and the hippocampal formation (Figure 2). The cytoarchitectonic identification of the subdivisions of the hippocampus and amygdala in histological sections is the basis of the fine-grained probability maps, as well as of volumetric measurements.

References

- Amunts K, Kedo O, Kindler M, Pieperhoff P, Mohlberg H, et al. (2005) Cytoarchitectonic mapping of the human amygdala, hippocampal region and entorhinal cortex: Intersubject variability and probability maps. *Anat Embryol* 210: 343-352.
- Yilmazer-Hanke DM, Wolf HK, Schramm J, Elger CE, Wiestler OD, et al. (2000) Subregional pathology of the amygdala complex and entorhinal region in surgical specimens from patients with pharmacoresistant temporal lobe epilepsy. *J Neuropathol Exp Neurol* 59: 907-920.
- Graebnitz S, Kedo O, Speckmann EJ, Gorji A, Panneck H, et al. (2011) Interictal-like network activity and receptor expression in the epileptic human lateral amygdala. *Brain* 134: 2929-2947.
- Adolphs R, Tranel D, Buchanan TW (2005) Amygdala damage impairs emotional memory for gist but not details of complex stimuli. *Nat Neurosci* 8: 512-518.
- Klumpers F, Morgan B, Terburg D, Stein DJ, van Honk J (2015) Impaired acquisition of classically conditioned fear-potentiated startle reflexes in humans with focal bilateral basolateral amygdala damage. *Soc Cogn Affect Neurosci* 10: 1161-1168.