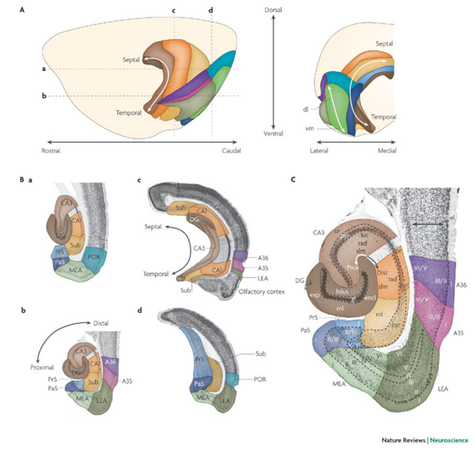

A | Lateral (left panel) and caudal (right panel) views. For orientation in the hippocampal formation (consisting of the dentate gyrus (DG; dark brown), CA3 (medium brown), CA2 (not indicated), CA1 (orange) and the subiculum (Sub; yellow)), three axes are indicated: the long or septotemporal axis (also referred to as the dorsoventral axis); the transverse or proximodistal axis, which runs parallel to the cell layer and starts at the DG; and the radial or superficial-to-deep axis, which is defined as being perpendicular to the transverse axis. In the parahippocampal region (green, blue, pink and purple shaded areas), a similar superficial-to-deep axis is used. Additionally, the presubiculum (PrS; medium blue) and parasubiculum (PaS; dark blue) are described by a septotemporal and proximodistal axis. The entorhinal cortex, which has a lateral (LEA; dark green) and a medial (MEA; light green) aspect, is described by a dorsolateral-to-ventromedial gradient and a rostrocaudal axis. The perirhinal cortex (consisting of Brodmann areas (A) 35 (pink) and 36 (purple)) and the posthrinal cortex (POR; blue-green) share the latter axis with the entorhinal cortex and are additionally defined by a dorsoventral orientation. The dashed lines in the left panel indicate the levels of two horizontal sections (a,b) and two coronal sections (c,d), which are shown in part **B**. All subfields of the parahippocampal–hippocampal region are colour-coded in correspondence with the interactive diagram in Supplementary information S1 (figure). A further description of the anatomical features of each subfield is provided in the legend of this supplementary information. **C |** A Nissl-stained horizontal cross section (enlarged from part **Bb**) in which the cortical layers and three-dimensional axes are marked. The Roman numerals indicate cortical layers. CA, cornu ammonis; dist, distal; dl, dorsolateral part of the entorhinal cortex; encl, enclosed blade of the DG; exp, exposed blade of the DG; gl, granule cell layer; luc, stratum lucidum; ml, molecular layer; or, stratum oriens; prox, proximal; pyr, pyramidal cell layer; rad, stratum radiatum; slm, stratum lacunosum-moleculare; vm, ventromedial part of the entorhinal cortex.

Hippocampal Formation (HF)

The rat HF is a C-shaped structure that is situated in the caudal part of the brain. The cortex that forms the HF has a three-layered appearance. A deep layer, comprising a mixture of afferent and efferent fibers and interneurons. Superficial to this polymorph layer is the cell layer, which is composed of principal cells and interneurons. On top, the most superficial layer is situated - this layer is referred to as the molecular layer (stratum moleculare) in the DG and the Sub. In the CA-region, the molecular layer is subdivided into a number of sub-layers. In the CA3, three sub-layers are distinguished: The stratum lucidum, representing the input from the DG, stratum radiatum, i.e the apical dendrites of the neurons in stratum pyramidale and most superficially, the stratum lacunosum-moleculare comprising the apical tufts of the apical dendrites. The lamination in the CA2 and the CA1 is similar with the exception that the stratum lucidum is missing (see Figure 1 in our NRN Review)

Dentate Gyrus (DG): The DG is a "V" shaped structure situated in the most proximal part of the HF. DG is subdivided into the crest area, the enclosed blade (or ventral, free or outer blade/limb), positioned adjacent to CA1 and the exposed blade (or dorsal, or inner blade/limb) and within each subregion three layers can be distinguished. In the molecular layer (stratum moleculare), an inner, middle and outer one-third is discerned, based on afferent connections impinging on the dendrites of the granule cells. The somas of the granule cells are situated in the granular cell layer (stratum granulare). The hilus or polymorphic layer (stratum multiforme) is enclosed by the granule cell layer and contains a rich variety of cell types including mossy cells.

Cornu Ammonis (CA): The CA subfield forms the area between DG and Sub. The laminar organization of CA3, CA2 and CA1 is rather similar. The principle cell layer (stratum pyramidale) consists of the somas of the pyramidal cells. The stratum oriens is located deep to the stratum pyramidale and contains the basal dendrites of the pyramidal cells. The apical dendrites of the pyramidal cells stretch into the stratum radiatum and the stratum lacunosum moleculare. An additional layer, the stratum lucidum, is located only in CA3 just superficial to the stratum pyramidale. The term CA4, in between the hilus and CA3 is avoided. A separate description of CA2 is not included since this is a small and under-investigated region in the rat.

Subiculum (Sub): The Sub stretches between CA1 and the PrS. It consists of a polymorphic layer (not depicted in the diagram), a stratum moleculare and a broad principle cell layer with large pyramidal cells, together with a mixture of smaller interneurons. The stratum moleculare of the subiculum can be subdivided into a deeper portion that is continuous with the stratum radiatum of CA1 and a superficial portion that is continuous with the stratum moleculare of the PrS and stratum lacunosum moleculare of CA1. The stratum pyramidale can be divided into a deep and a superficial part. A transitional area between CA1 and the Sub, termed prosubiculum, has been distinguished by several authors. In this region, the stratum radiatum becomes gradually smaller and the stratum pyramidale broadens. The contemporary view regards the prosubiculum as the area where CA1 and Sub neurons overlap.

Parahippocampal Region (PHR)

The PHR lies adjacent to the HF (bordering with the subiculum) and is characterized by an increase in the number of cell layers as compared with the HF. At the junction with the subiculum, superficially positioned cell layers become apparent and a cell-free zone called lamina dissecans exists in-between the two main neuronal sheets. The PHR is generally described as having six layers. The PHR is divided into five sub-regions: the presubiculum (PrS), parasubiculum (PaS), entorhinal cortex (EC), perirhinal cortex (PER) and postrhinal cortex (POR). The coordinate systems that define the position within the HF and PHR are explained in Figure 1 (NRN Review).

Presubiculum (PrS) and Parasubiculum (PaS): The PrS is located distally from the HF and is positioned in between the Sub and the PaS. The PrS is distinguished from the Sub by a densely packed superficial pyramidal cell layer (II/III). Similar to the EC, the PrS has a plexiform layer, lamina dissecans (IV), and two deep layers with pyramidal cells. The term postsubiculum was introduced by Brodmann to identify the dorsal part of the PrS. Some controversy remains about the existence of this area. In this diagram, the postsubiculum is considered as the septal (dorsal) part of the PrS. The PaS lies distal to the PrS. Layer II and III have densely packed pyramidal cells and the deep layers are continuous with the deep layers of EC.

Entorhinal Cortex (EC): The EC forms the ventroposterior part of the rat cerebral hemisphere and is bordered medially largely by the PaS and dorsolaterally by the POR and PER. The EC consists of six layers, four cell layers (II, III, V and VI) and two plexiform layers (I, IV or lamina dissecans). Two subdivisions are generally recognized; a medial (MEA) and a lateral part (LEA).

Perirhinal (PER) and Postrhinal (POR) cortex: The PER and POR are situated dorsally along the rhinal fissure. Both consist of six cell layers. The PER consist of two subdivisions, the agranular area 35 (A35) and the dysgranular area 36 (A36) or ectorhinal cortex. POR consists of a ventral agranular and dorsal (dys)granular region. The rostral border of POR with PER is difficult to discern. The ventral part of POR is quite similar to A35, but the presence of ectopic layer II cells makes it possible to discriminate the region. In the PER and POR, layer IV is variably developed.

1 2 3 4

dorsal

ventral

unspecified

septal

temporal

unspecified

DL

IM

VM

dorsal

ventral

unspecified

A30

rost int caud unsp

I II III IV V VI

rost int caud unsp

I II III IV V VI

Krieg was the first to delineate the retrosplenial cortex in the rat (Krieg, 1946), based on the anatomical account of Brodmann, who subdivided the retrosplenial cortex in rabbit and named it area (A)29 (Brodmann, 1909). Here, the nomenclature as described by Vogt (2004) is followed. According to this definition, the rat RSC is subdivided into four areas referred to as A29a, A29b, A29c and A30. Most of the connectional papers do not separate A29a and b and the combined region will be referred to as A29ab.

A30

A29c

A29ab unsp **A29b** **A29a**

DG

encl crest exp unsp

oml mml iml gran hilus

CA3

prox int dist unsp

slm rad luc pyr or

CA1

prox int dist unsp

slm rad pyr or

Sub

prox int dist unsp

ml sup / ml deep / pyr

PrS

prox dist unsp

I II III IV V VI

PaS

prox dist unsp

I II III IV V VI

MEA

unsp

I II III IV V VI

dl

im

vm

LEA

unsp

I II III IV V VI

dl

im

vm

A35

rost caud unsp

I II III IV V VI

A36

rost caud unsp

I II III IV V VI

POR

rost caud unsp

I II III IV V VI

Diagram Controls

Open Toolbar

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