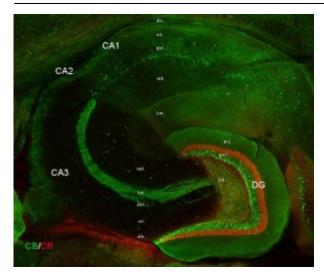
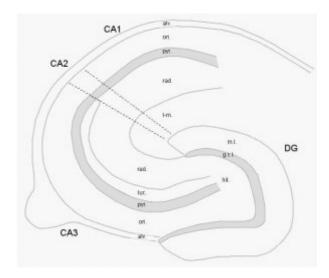
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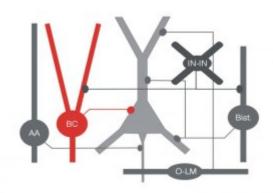
Hippocampus: immunostained for calcium-binding proteins

A transverse section from the rodent hippocampus immunostained for the calcium-binding proteins calbindin (CB) and calretinin (CR). CB and CR are expressed in some principal cells and interneurons. (see Vida, 2010)



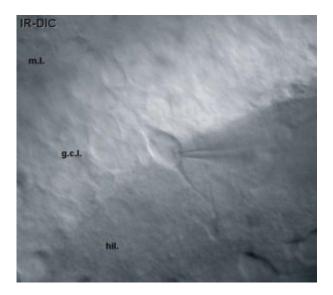
Hippocampus: areas and layers

Schematic drawing of a hippocampal slice. Abbr.: alv. alveus; ori. stratum oriens; pyr. pyramidale; rad. radiatum; l-m. lacunosum-moleculare; g.c.l. granule cell layer.



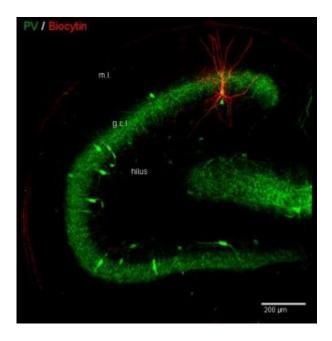
Diversity of hippocampal inhibitory interneurons

Interneurons comprise three major classes: (1) perisomatic-inhibitory cells [left], (2) dendritic-inhibitory cells [right] and (3) interneuron-specific interneurons [IN-IN, not depicted]. (see Vida, 2010)



An interneuron in an acute hippocampal slice

IR-DIC image of an interneuron in the cell body layer of the dentate gyrus in an acute hippocampal slice.

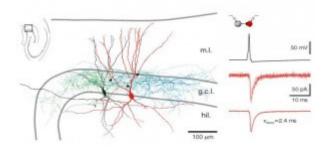


A PV-expressing basket cell in the dentate gyrus

An intracellularly-labeled basket cell (red) immunostained for the calcium binding protein parvalbumin (PV, green) recorded in the dentate gyrus. (Booker and Vida, unpublished)

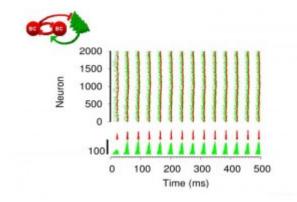
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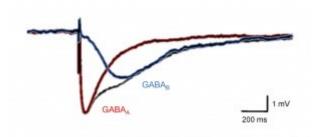
Mutual inhibitory coupling between basket cells

Reconstruction of the synaptically connected BC-BC pair. Right: Action potentials in one BC (top, black) elicited fast and large IPSCs in the other BC (bottom, red). (see Bartos et al. 2001 J. Neurosci.)



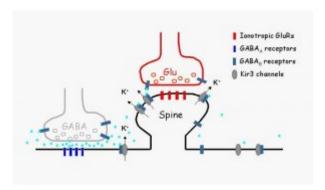
Oscillatory activity in a mixed network model

Raster plot of a mixed basket cell-principal cell network shows coherent gamma frequency oscillations.



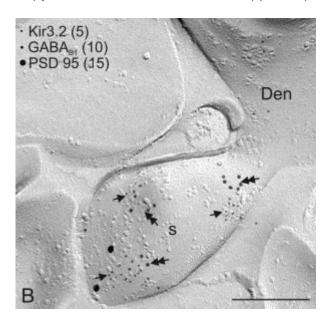
Fast and slow inhibition in hippocampal neurons

Fast ionotropic GABA-A and slow metabotropic GABA-B receptor-mediate inhibition in a hippocampal pyramidal cell (see Solis and Nicoll, 1992 J Neurosci).



Subcellular localization of GABA-B receptors

Schematic drawing illustrates the extrasynaptic distribution of GABA-B receptors on shafts and spines of pyramidal cell dendrites in the hippocampus. (see Kulik et al., 2003 J Neurosci.)



Coclustering of GABA-B and Kir3 protein on spines

Colocalization of GABAB1 receptor and Kir3.2 channels using SDS-digested freeze-fracture replica labeling technique. The two molecules were found to be coclustered on dendritic spines (s) of CA3 pyramidal cells around glutamatergic synapses. Scale bar: 0.2 um. (See Kulik et al., 2006)

The primary interest of our lab is the relationship between the **anatomical and physiological characteristics** of interneurons and their **functions** in cortical networks.

Our working hypothesis is that inhibitory interneurons play a central role in **coordinating neuronal activity** in circuits of the brain. The diversity of interneurons serves a complex **division of labour**; the various types provide inhibition at different times and locations and determine when and where information can flow in the circuit.

We focus on the **hippocampus**, a brain area essential for **learning and memory** and often affected in neurological and psychiatric disorders of the brain (e.g. epilepsy, Alzheimer disease). Furthermore, with its relatively simple structure, the hippocampus is considered as a model (**blueprint**) for more complex neocortical circuits.

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Our experimental approach involve *in vitro* electrophysiological recording techniques, morphological and immunocytochemical analysis, and computational modeling.

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