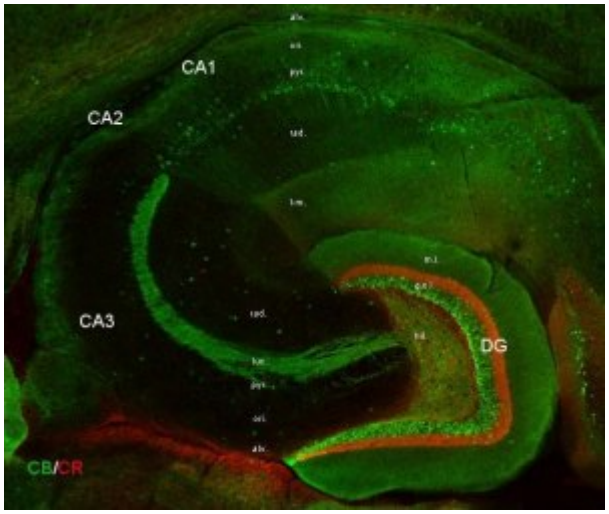
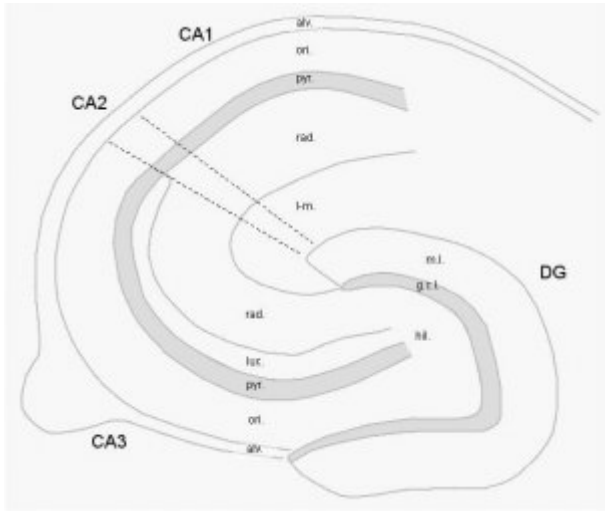


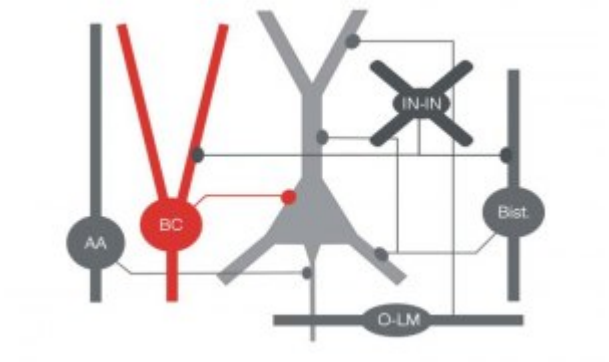
Hippocampus: immunostained for calcium-binding proteins

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)



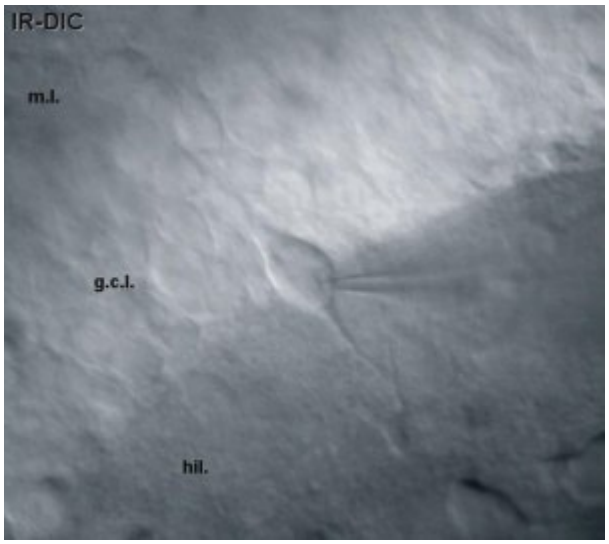
Hippocampus: areas and layers

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.



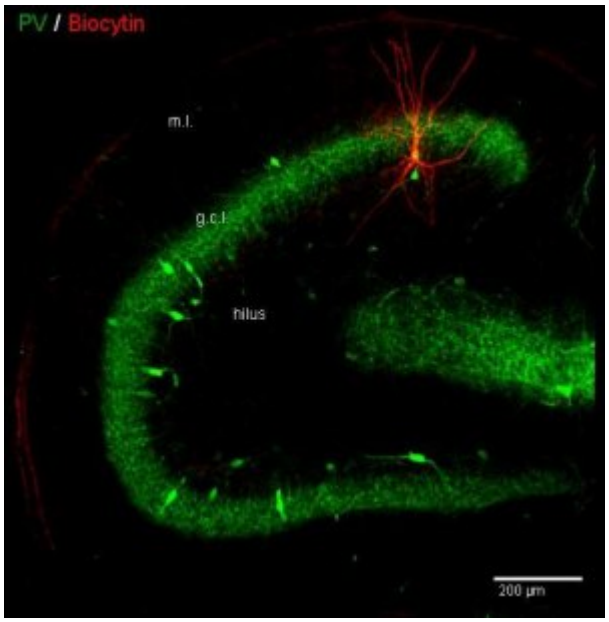
Diversity of hippocampal inhibitory interneurons

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)



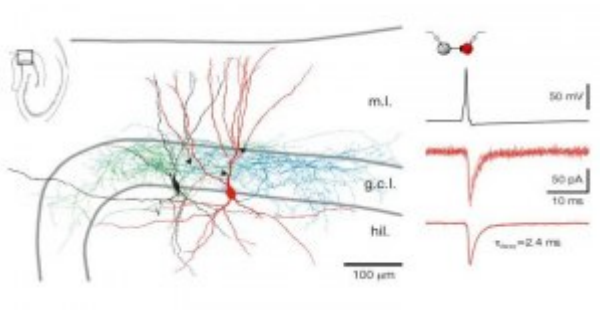
An interneuron in an acute hippocampal slice

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



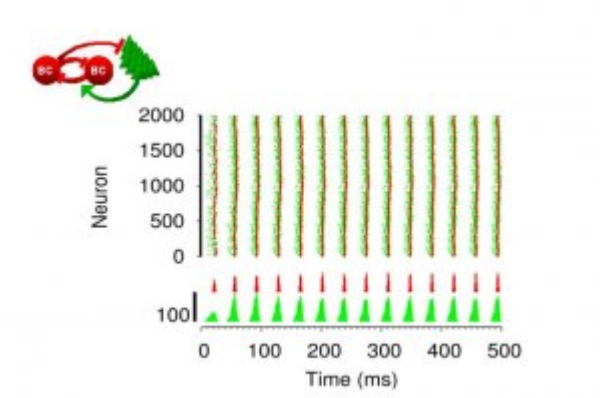
A PV-expressing basket cell in the dentate gyrus

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 (Booker and Vida, unpublished)



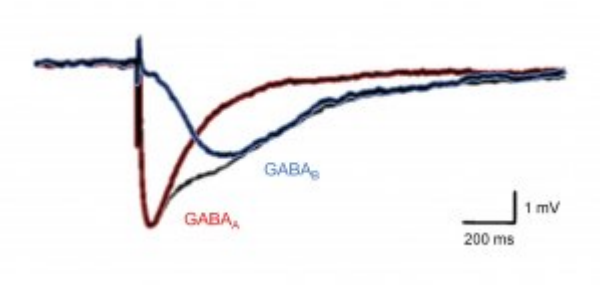
Mutual inhibitory coupling between basket cells

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.)



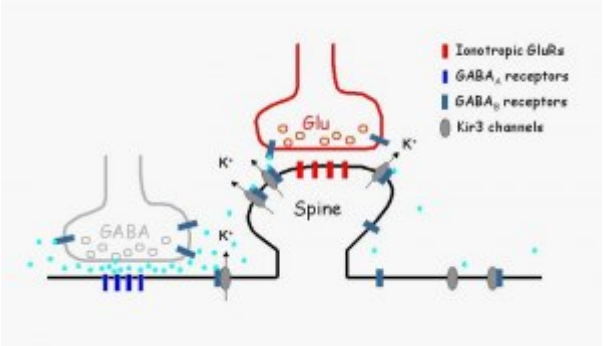
Oscillatory activity in a mixed network model

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



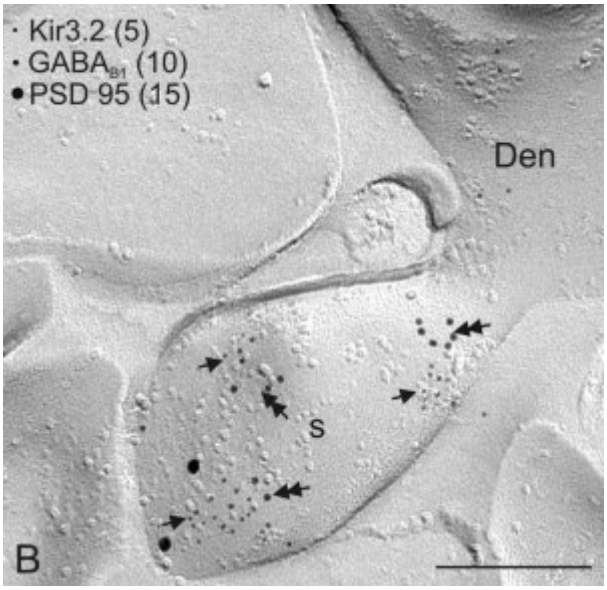
Fast and slow inhibition in hippocampal neurons

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.

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