Intrinsic and associative synaptic circuit in the temporal neocortex, perirhinal and entorhinal cortex: an intra- and extracellular electrophysiological study.

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Unimodal and polimodal information are transmitted during retrieval mnemonic processes from temporal neocortex to the hippocampus via the perirhinal and entorhinal cortices. The associative and intrinsic functional synaptic circuits formed by the temporal neocortex, areas 36 and 35 of the perirhinal cortex and entorhinal cortex are described here in the *in vitro* isolated guinea pig brain by performing simultaneous intracellular and extracellular recordings. Current source density analysis was implemented on field potential profiles. Electrical surface stimulation of the temporal neocortex induced i) monosynaptic activation of layer II-III principal neurons and interneurons in area 36, ii) polisynaptic potentials in area 35 and iii) no responses in the ERC. Superficial stimulation of area 36 evoked i) monosynaptic responses of excitatory principal neurons and interneurons within short distance in areas 36 and 35 ii) polysinaptic EPSP mediated by intrinsic long distance projections are in area 36 itself. These projections run in the superficial layer and contact exclusively the apical dendrites of principal layer II-III neurons iii) nor local field responses neither monosynaptic and polysinaptic intracellular EPSP were observed in the lateral band of the ERC iv) no local field response but only scattered polysynaptic EPSPs were recorded in the medial subregion of the ERC. superficial stimulation of area 35 activate i) either local synaptic circuitry or long projection intrinsic pathways inside the area 35 itself ii) monosynaptic EPSP or no response in the lateral band of th ERC iii) no response or delayed EPSP in the medial subregion of the ERC. These data confirm that, according to the anatomical studies, the flow of the information from the temporal neocortex to the hippocampus i) follows a sequential, steps-like pattern ii) is under a pronounced inhibitory control and iii) the parahippocampal regions are not a merely relay station but behave as integrative structures