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A combined Golgi-electron microscopic analysis of pyramidal basket cells in the dentate gyrus of the hippocampus.

Pyramidal basket cells have been identified in previous light microscopic studies of the hippocampal dentate gyrus. These cells were shown to have large somata (20-30 μm in diameter) located on the hilar border of the granule cell layer, ascending apical dendrites which arborize in the molecular layer, a group of basal dendrites that branch into the hilus, and an axonal plexus which distributes in the granule cell layer. The location of these axons in Golgi preparations suggested that they were the ones which gave rise to axosomatic synapses with granule cells as observed in electron microscopic preparations. Since this relationship between pyramidal basket cells and granule cells has never been demonstrated, an analysis of the morphology of these cells was undertaken using a combined Golgi-electron microscopic method which utilized gold toning of silver impregnated neurons so that a direct correlation can be made for the same cell between the light and electron microscopes.

Sections containing Golgi-stained pyramidal basket cells were drawn and then gold-toned, embedded for electron microscopy and serially thin sectioned. Electron microscopic preparations showed that the somata of Golgi-stained pyramidal basket cells contained infolded nuclei with intranuclear rods, Nissl bodies, and an abundance of organelles including mitochondria and cisternae of the Golgi apparatus. The dendrites of these cells were aspinous and had adjacent to them terminals which formed both symmetric and asymmetric synapses. The axons of pyramidal basket cells arose from apical dendrites in the molecular layer and arborized in the granule cell layer. Terminals from these axons formed exclusively symmetric synaptic junctions with both the somata and proximal dendrites of granule cells. However, not all of the terminals that formed axosomatic synapses with an individual granule cell soma were observed to arise from a single pyramidal basket cell axon. These data suggest that more than one basket cell may give rise to this pericellular plexus for granule cells. The results of this study indicate that pyramidal basket cells form extensive axosomatic and axodendritic synapses with granule cells in the dentate gyrus.

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