Components of the theta rhythm studied in vitro

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The majority of evidence from in vivo studies indicates that theta rhythms are imposed upon cortical structures by projections from the medial septum/diagonal band. Anatomical studies have indicated highly specific target neuronal classes for one branch of this projection (that using GABA as a transmitter) but less specific target specificity for the other branch (that using acetylcholine). In vitro models of various components of the theta-generating architecture in the brain, studied in isolation, have provided mechanistic data useful in the interpretation of the role of theta rhythms in controlling neuronal activity in the temporal domain. The following will be discussed: 1) The pattern of theta generation in the medial septum in isolation - local circuit generators and putative roles for external modulatory influences. 2) Local circuits in cortical target regions - identifying components involved in local network theta resonance. 3) Specific spatiotemporal characteristics of theta rhythms in relation to other co-expressed frequencies. A general hypothesis will be proposed involving medial septal projections behaving not as a 'clock' imposing the septal rhythm on target areas, but as an enabling stimulus activating local theta generating circuits in cortex.