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This Week's Citation Classic

Petsche H, Stumpi C & Gogolak G. The significance of the rabbit's septum as a relay station between the midbrain and the hippocampus. I. The control of hippocampus arousal activity by the septum cells. *Electroencephalogr. Clin. Neuro.* **14**:202-11, 1962. [Insts. Neurology and Pharmacology, Univ. Vienna, Vienna, Austria]

Hippocampus theta waves of unanesthetized, curarized rabbits are triggered by cells in Broca's diagonal band: these bursting cells are phaselocked with the theta waves. Phase angles are different for different cells. The burst activity keeps going on when the theta rhythm is temporarily replaced by another activity. [The *SCI*® indicates that this paper has been cited over 165 times since 1962.]

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"When we wrote this paper, hardly anything was known about the nature of the hippocampus EEG. For us, the hippocampus was no more than a useful model to study a regular electrical activity. One of us (Petsche) was interested in studying the phase angles between different, recording electrodes by a toposcopic display system.[1] In these studies, theta activity turned out to consist of travelling waves diverging from a place in the midline and a few millimeter rostral the hippocampus. Since we hoped to find a sort of pacemaker in this region we stimulated this part electrically and indeed came across a zone in the diagonal band by the stimulation of which theta activity was either 'driven' (at low frequencies) or abolished (at higher frequencies).[2] This was the reason for studying this nucleus with microelectrodes; what we found were cells bursting at the theta frequency. The position of these cells coincided with the position of the lowest threshold for theta suppression by electrical stimulation. These findings suggested the idea that a pacemaker for the theta is in the septum.

"In recent years a sort of renaissance of theta research set in. This seems to us one main reason why our paper has been cited frequently.

"As far as the present level of theta research is concerned, there remains one essential unsolved question: in our original paper we assumed the existence of only one type of theta rhythm originating in CA_1 and being triggered by one pacemaker, whereas several authors postulate two different theta rhythms and also two generators (a second in the dentate gyrus).[3] Personally we cannot contribute to the solution of this question as we have since turned to other topics (Petsche to the neocortex and Petsche and Gogolak to the cerebellum and spinal cord). We only would like to make use of this opportunity to recall another old paper of our group[4] in which we found surprising similarities between the histograms of septum cell discharges and the shape of the CA_1 theta. Unfortunately, this paper seems to be forgotten. In our opinion, it may give essential hints to an understanding of the formation of theta waves."

1. **Marko A & Petscbe H.** The munivibrator-toposcope, an electronic multiple recorder. *Electroencephalogr. Clin. Neuro.* **12**:209-11, I960.
2. **Brückc** F, **Petsche H, Pillat B & Deisenhammer E**. Ein Schrittmacher in der medialen Septumregion des Kaninchengehirnes. *Pflügers Arch.* **269**:135-40, 1959.
3. **Robinson T E.** Hippocampal rhythmic slow activity (RSA; theta): a critical analysis of selected studies and discussion of possible species-differences. *Brain Res. Rev.* **2**:69-101, 1980.
4. **Gogoiak G, Stumpf C, Petsche H & Sterc J.** The firing pattern of septal neurons and the form of the hippocampal theta wave. *Brain Res.* **7**:201-7, 1968.
[The ***SCI*** indicates that this paper has been cited over 55 times since 1968.]