

*Review Article*

**Serotonergic modulation of Neural activities in the entorhinal cortex**

Saobo Lei

Department of Pharmacology, Physiology and Therapeutics, School of Medicine and Health Sciences, University of North Dakota, Grand Forks, ND 58203, USA

Received November 27, 2012; Accepted December 19, 2012; Epub December 26, 2012; Published December 31, 2012

**Abstract:** The entorhinal cortex (EC) is considered as the gate to control the flow of information into and out of the hippocampus. The EC is important for numerous physiological functions such as emotional control, learning and memory and pathological disorders including Alzheimer's disease, schizophrenia and temporal lobe epilepsy. Serotonin is a classical neurotransmitter which may modify these physiological functions and pathology of neurological diseases. The EC receives profuse serotonergic innervations from the raphe nuclei in the brainstem and expresses high density of serotonergic receptors including 5-HT<sub>1A</sub>, 5-HT<sub>1D</sub>, 5-HT<sub>1E</sub>, 5-HT<sub>2A</sub>, 5-HT<sub>3</sub> and 5-HT<sub>6</sub>. The prominent innervation by serotonergic neurons and the dense expression of serotonergic receptors in the EC suggest that serotonin is a major modulator in this brain region. Serotonin exerts inhibitory effects in the EC. Serotonin hyperpolarizes entorhinal neurons and inhibits the excitatory synaptic transmission via activation of 5-HT<sub>1A</sub> receptors but facilitates GABA release via activation of 5-HT<sub>2A</sub> receptors. Both 5-HT<sub>1A</sub> and 5-HT<sub>2A</sub> receptors are required for serotonin-induced inhibition of epileptiform activity although 5-HT<sub>3</sub> receptors may be involved in serotonin-mediated inhibition of acetylcholine release in the EC. Furthermore, the functions of serotonin in the EC may be implicated in Parkinson's disease, Alzheimer's disease and depression. Thus, understanding the roles of serotonergic modulation in the EC is of major clinical importance. Here, I review recent findings concerning the effects of serotonin on neural circuitry activity in the EC. (IJPPP1211003).

**Keywords:** Glutamate, GABA, synaptic transmission, epilepsy, neurotransmitter, G-protein coupled receptor

**Address all correspondence to:**

Dr. Saobo Lei  
Department of Pharmacology, Physiology and Therapeutics  
School of Medicine and Health Sciences, University of North Dakota  
Grand Forks, ND 58203, USA  
Phone: 701-7774745; Fax 701-7774490  
E-mail: saobo.lei@med.und.edu