2008 Fall Colloquium Series

Speaker: Barry Connors, PhD, Professor and Chair, Department of Neuroscience, Brown University

Time: 4pm, Departmental Tea immediately following.

Date: Friday, 10 October 2008

Place: BCS Auditorium, 46-3002

Title: Electrical Synapses in the Thalamocortical System

Host: Chris Moore

Abstract:

The synaptic connectome of the thalamocortical system includes both chemical and electrical synapses. Electrical synapses are neuronal gap junctions that allow rapid, bidirectional flow of ionic current. The rules for their distribution in mature thalamus and neocortex are similar: electrical synapses are mainly restricted to inhibitory neurons and avoid excitatory neurons, they tend to interconnect neurons of similar subclass, and their prevalence and strength are strong functions of cell proximity (i.e. all electrical coupling is local). The functions of electrical synapses in the thalamocortical system follow from their biophysical properties and their spatial patterns; when similar types of neighboring neurons share some of their transmembrane currents, their activity (sub- and suprathreshold) becomes more coherent.

During development, some of the roles and rules of electrical synapses may differ. Inhibitory neurons in the mouse thalamus maintain a constant electrical synaptic strength over the first two postnatal weeks, despite massive changes of the intrinsic properties of neuronal membranes. Excitatory neurons of both thalamus and neocortex are electrically connected early in development, but uncouple by the end of the first postnatal week. Developmental patterns of electrical synapse timing and geometry may play central roles in the maturation of chemical synaptic connections in thalamocortical networks.