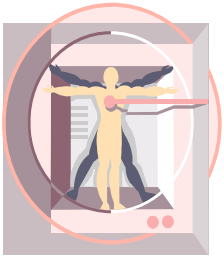

Biomedical Engineering Department Seminar

Friday, April 13, 2007

Location: Cullimore Hall, Lecture Hall 3

Time: 12:00 - 1:00 PM

"Activity in gap-junctionally coupled networks depends on dendrite diameter".

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Electrical signal transmission between passive and electrically compact neurons coupled via gap junctions is well understood. However, signal transmission via gap junctions between realistically shaped neurons, including dendrites and axons, is complex and depends nonlinearly on the diameter of the coupled processes. Specifically, I will show that there is a unique optimal diameter, depending on membrane and gap junction properties, for which signal transfer between two electrically coupled processes is maximal (or attenuation is minimal). These observations predict that in dendritically gap junction coupled model neurons that include an excitable axon, action potential generation should also depend on dendrite diameter. Using model neurons with a passive soma, passive dendrites and an action potential-generating axon that are connected by dendro-dendritic gap junctions to form networks of various architectures, action potentials can propagate through the network and can generate sustained rhythmic network activity. The frequencies of the rhythmic activity generated by these gap junction-coupled networks fall within observed spinal cord (0.3 – 25 Hz) and brain rhythm oscillations (i.e. theta rhythms, 4-12 Hz and beta/gamma rhythm, 15-70 Hz). These gap junction coupled rhythms may explain observed oscillations in the developing mammalian nervous system at times when chemical synapses are not yet present.

Refreshments will be served.