COLLOQUIUM

Paradoxical oscillations in feedforward nets and damaged nerves

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This talk concerns the analysis of novel oscillatory phenomena in models of healthy and diseased excitable systems. Neural tissue injuries can render voltage-gated channels leaky, thereby altering excitability, disrupting propagation and causing neuropathic pain. This pain is thought to arise in part from the emergence of pathological ectopic activity, i.e. of enhanced neural activity as well as oscillatory activity in places where it is not supposed to occur. The diverse modes of spontaneous rhythmic activity are studied using bistability and bifurcation analyses. For mild injury, a prominent feature is slow ionic pump-mediated phenomena that underlie slow oscillations and dynamic firing thresholds causing bursting behavior. We further consider the distorsions in spatial propagation that arise from these phenomena. We also present a novel mechanism that leads to oscillatory phenomena in healthy (and perhaps pathological) neural nets. It is based on the superposition of direct neural input and a delayed (feedforward) version of that input. These cross-correlation-induced oscillations can be analyzed mathematically for such stochastic dynamics with delays; they are contrasted with the usual ones expected in the more intuitive delayed feedback context of control engineering.

The lecture will take place in Thackeray 704 at 3:30pm.
Refreshments will start at 3:00pm.