Spike-time-variability in stochastic Hodgkin-Huxley type neural models PETER ROWAT, University of California San Diego — When the classical Hodgkin-Huxley equations are simulated with Na- and K-channel noise and fixed applied current, the distribution of inter-spike intervals is bi-modal: one part is an exponential tail, as often assumed, while the other is a narrow gaussian peak centered at a short ISI value. The gaussian arises from bursts of spikes in the gamma-frequency range, the tail from the inter-burst-intervals, giving overall a very highcoefficient of variation: upto 2.5 for 180,000 Na-channels. Since neurons with a bimodal inter-spike interval distribution are common, it may be a useful model for any neuron with class 2 firing. The underlying mechanism is due to a sub-critical Hopf bifurcation together with a switching region in phase-space where a fixed point is very close to a system limit cycle. This mechanism may contribute to highly irregular spike times in cortex. Other mechanisms underlying neural variability will also be presented.

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