SPIKE TIMING RELIABILITY IN THE PREFRONTAL CORTEX DEPENDS ON THE FREQUENCY CONTENT OF ITS SYNAPTIC INPUTS. **J. -M. Fellous*, R.P.N. Rao, A.R. Houweling R.H. Modi and T.J. Sejnowski. The Salk Institute. La Jolla, CA 92037.**

Neurons in the prefrontal cortex of rats were investigated that may be involved with working memory. In particular, the dependence of the reliability of spike timing on the temporal properties of the input was assessed by varying the frequency content of the injected current. In an in vitro slice preparation, prefrontal cortical cells generated spikes that were precisely time locked with fluctuating input currents that mimicked synaptic activity. The reliability of spiking depended on the frequency spectrum of the inputs. Spike timing was most reliable in prefrontal cells when they were injected with sinusoidal current in the theta frequency band (5-10 Hz), and interneurons were more reliable than pyramidal neurons. For randomly fluctuating current stimuli with mixed frequencies or computer simulated EPSCs and IPSCs, the reliability and precision of spiking was highest if the power of the synaptic signal peaked in the theta band. Multi-compartmental modeling studies suggest that Hodgkin Huxley dynamics and synaptic-like background noise can reproduce this phenomenon, and that reliable firing depends on the degree of synchrony of the excitatory and inhibitory synaptic inputs. An information theoretic approach based on a linear stimulus reconstruction paradigm was used to quantify the information contained in synaptic inputs and in the resulting prefrontal cortex neuron's output spiking pattern to assess the degree to which information is conserved by the firing pattern of the neurons. Supported by HHMI and the Sloan Foundation.