Summary of workshop #1
"Oscillations in Cortical Systems"

Ernst Niebur

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Computation and Neural Systems Program, California Institute of Technology
Pasadena CA 91125, USA
`ernst@descartes.cns.caltech.edu`

It has generally been assumed that oscillations in the $30 - 80\ Hz$ range play a prominent role in cortical information processing. The existence of such oscillations in evoked EEG potentials is an established fact. $40 - 60\ Hz$ oscillations have also been found in electrophysiological experiments in the olfactory bulb and cortex. More recently, stimulus specific oscillations in this frequency range were observed in several visual cortical areas of cat. Strikingly, neurons with similar orientation tuning up to $10\ mm$ apart showed phase-locked oscillations with a phase difference close to zero. The function and significance of these oscillations were the topic of the workshop.

After a brief introduction by Ernst Niebur (Caltech), Jim Bower (Caltech) presented an overview over the experimental data. He also reported results from a computer model of olfactory and visual cortex that he developed with Matt Wilson. Bard Ermentrout (U. Pittsburgh) then gave an introduction to the mathematics of systems of coupled oscillators. Dierk Schwender (U. Munich, Germany) showed clinical evidence that $40 Hz$ oscillations in the auditorily evoked EEG of patients under anesthesia are closely related to dreams, hallucinations or later conscious recall of events during the surgery. Bill Baird (UC Berkeley) talked about his model of associative memory based on dynamical systems theory. Zhaoping-Li (Inst. Adv. Study, Princeton) presented a model for information processing in the olfactory bulb, which she developed together with John Hopfield. Christian Kurrer (U. Illinois, Urbana-Champaign) showed that interesting phenomena emerge in a system of coupled Fitzhugh-Nagumo neurons. Leonid Kruglyak (UC Berkeley) presented his physics-inspired model.

Two points all participants agreed upon were that the oscillations do exist (*i.e* that they are not an experimental artifact) and that they are important for some task. Differences persisted concerning what this task might be.

Some people tend to believe that the 40 Hz oscillations somehow serve as a fundamental mechanism during information processing, like a synchronizing signal. An experiment that clearly shows that phase coherence over long distances *only* occurs on average would support this view, but this experiment has yet to be done.

Other people believe that 40 Hz cortical oscillations do have something to do with attention or awareness or "higher order tasks". There is some experimental support which shows that oscillations might be *necessary* for this kind of task; in fact, it is known that 40 Hz oscillations in the EEG are related to different "higher order tasks". Obviously, this does not prove that the presence of oscillations is *sufficient* for "higher order tasks," but it makes this an attractive hypothesis that awaits detailed studies.