



DAVID KLEINFELD
DEPARTMENT OF PHYSICS
9500 GILMAN DRIVE
LA JOLLA, CA 92093-0374

EMAIL: DK@PHYSICS.UCSD.EDU
VOICE: (858) 822-0342
FAX: (858) 534-7697
[HTTP://WWW-PHYSICS.UCSD.EDU/NEUROPHYSICS/](http://WWW-PHYSICS.UCSD.EDU/NEUROPHYSICS/)

9 January 2005

Biocomplexity Faculty Search
c/o C. Howard
Department of Physics
Indiana University
Swain West 117
727 East 3rd street,
Bloomington, IN 47405-7105.

Dear Members of the Search Committee,

It is my great pleasure to write in support of Dr. Robert S. N. Sachdev's application for a faculty position in the Department of Physics. I have known Robert for nearly 5 years. During that time, I worked directly with Robert as part of a collaborative effort between Prof. Ford Ebner (Vanderbilt), with whom Robert was a post-doctoral fellow, and myself. It was an extremely productive time that yielded two results. The first showed that the rat motor cortex receives a sensory input of vibrissa position and, further, that this input is adaptively filtered at the center frequency of a rhythmic drive (2). This result was a cornerstone in pushing the idea that motor cortex can drive whisking (1). The second showed that there is a positive feedback in the force of whisking upon contact (5). This experiment motivated recent work in our laboratory that identified the brainstem pathway responsible for excitatory feedback (4).

Robert was instrumental in the perfection of a very important technique, that of the head-fixed preparation for electrophysiological recording from awake behaving animals. This technique, first used in physiological studies in Prof. Taketoshi Ono's Laboratory (Toyama) and later in behavioral studies in Prof. Phil Ziegler's (Hunter) lab, was not ready for regular use until Robert systematized the necessary handling, training and surgical procedures. He thus transformed a very time-intensive specialized procedure to a modestly high throughput technique that is becoming a standard in the field. Robert and Ford first reported on this procedure in a paper on direct inhibitory input to S1 vibrissa cortex (7). Robert's variant is now employed in Ahissar's laboratory (Weizmann), Sakmann's laboratory (Hiedelberg), our laboratory at UCSD, and soon Svoboda's laboratory (CSHL), among others.

I am somewhat familiar with Robert's most recent work on the transitions between discrete states of depolarization in cortical neurons (6). This is technically and conceptually beautiful work, carried out in Prof. Charlie Wilson's laboratory, that shows how large blocks of neurons in vibrissa sensory cortex can weakly synchronize their respective subthreshold membrane potentials. This work bears directly on our understanding of multi-columnar response to vibrissae contact and on our understanding of activation of sensory cortex by nucleus basalis magnocellularis during attention (3).

Robert is a very strong experimentalist in systems neuroscience who thinks deeply about his problems. He has a nose for important questions and has pushed himself to learn and advance state-of-the art techniques. He is a very careful scientist. More generally, Robert is a quick study and a thoughtful scholar and I always looked forward to discussing work and science with him. He is also a clear lecturer and this I suspect will make an excellent teacher.

Most sincerely,



David Kleinfeld
Professor

1. Brecht, M. (2004) What Makes Whiskers Shake? Focus on: Current Flow in Vibrissa Motor Cortex Can Phase-Lock With Exploratory Rhythmic Whisking in Rat, *Journal of Neurophysiology*.92:1265-1266.
2. Kleinfeld, D., Sachdev, R. N. S., Merchant, L. M., Jarvis, M. R., and Ebner, F. F. (2002) Adaptive filtering of vibrissa input in motor cortex of rat, *Neuron*.34:1021-1034.
3. Metherate, R. and Ashe, J. H. (1993) Ionic flux contributions to neocortical slow waves and nucleus basalis-mediated activation: Whole-cell recordings in vivo, *Journal of Neuroscience*.12:5312-5323.
4. Nguyen, Q.-T. and Kleinfeld, D. (2004) Positive feedback in a brainstem tactile sensorimotor loop, *Neuron*:in press.
5. Sachdev, R. H. S., Berg, R. W., Chompney, G., Kleinfeld, D., and Ebner, F. F. (2003) Unilateral vibrissa contact: Changes in amplitude but not the timing of vibrissa movement, *Somatosensory and Motor Research*.20:162-169.
6. Sachdev, R. N., Ebner, F. F., and Wilson, C. J. (2004) Effect of subthreshold up and down States on the whisker-evoked response in somatosensory cortex, *Journal of Neurophysiology*.92:3511-3521.
7. Sachdev, R. N., Sellien, H., and Ebner, F. F. (2000) Direct inhibition evoked by whisker stimulation in somatic sensory (S1) barrel field cortex of the awake rat, *Journal of Neurophysiology*.84:1497-1504.