



DEADLINE FOR APPLICATIONS: Monday, April 3, 2017

TRAINING PROGRAM IN COGNITIVE NEUROSCIENCE

**Institute for Neural Computation
University of California, San Diego**

**PREDOCTORAL FELLOWSHIP OPPORTUNITIES
2017-2018**

Applications are invited for predoctoral fellowships from the Training Program in Cognitive Neuroscience through the Institute for Neural Computation at the University of California, San Diego. Please note, fellowships are subject to the NIMH Notice of Award process (pending). Applications will be accepted from UCSD graduate students who have completed their first two years of graduate training and have begun their doctoral research. Preference will be given for applicants whose research is consonant with the mission of the NIMH to transform the understanding and treatment of mental illnesses through basic and clinical research, paving the way for prevention, recovery, and cure.

The program provides interdisciplinary training in cognitive neuroscience to create a new generation of cognitive neuroscientists studying normal and abnormal brain function. San Diego has a highly interactive research community in cognitive neuroscience. Twenty-three faculty members from the Salk Institute for Biological Studies and at UCSD participate in this training program. Training will be provided in a wide range of techniques including electrophysiology, magnetoencephalography, functional magnetic resonance imaging and computational modeling. Candidates must be citizens or permanent residents of the U.S. The fellowships are for a twelve-month period.

The fellowships are supported by the National Institutes of Mental Health (NIMH) and provide an annual stipend of \$23,376 plus partial payment of in-state fees and registration starting July 1 (or up to six months thereafter, if contiguous to another fellowship). NIMH will award the Institute for Neural Computation funds to *partially support* in-state fees and registration (amount later to be determined). We ask that the graduate departments be responsible for the difference. Therefore, a brief letter (Letter of Commitment) from the faculty sponsor must accompany the application packet acknowledging supplemental support will be required of their department as part of the application process.

PRIMARY TRAINING FOCI

1. Sensory Processing and Perception. Investigators working on a broad range of topics that include psychophysics, electrophysiology, brain imaging and modeling studies include T. Albright, V. de Sa, D. Kleinfeld, D. MacLeod and T. Sharpee.

2. Selective Attention. The study of attention is broadly based and includes research on the neural mechanisms and the perceptual consequences of space-based, feature-based, and object-based selective attention. These include, T. Gentner, J. Reynolds and J. Serences.

3. Learning and Memory. San Diego has an especially active research community studying mechanisms of memory at multiple levels ranging from synaptic plasticity to the cognitive neuropsychology of amnesia. The faculty studying different aspects of memory on this training grant includes J. Brewer, E. Halgren, M. Kutas, R. Malinow, T. Sejnowski, and L. Squire.

4. Cognitive Control. Executive control functions include brain processes that guide thoughts and behaviors through internally generated goals and plans. The investigators in this area include A. Aron, A. Saygin and B. Voytek.

5. Translational Research. Several laboratories are pursuing cognitive neuroscience research that translates directly into better understanding of the neural bases of mental disorders, including autism, schizophrenia, Williams syndrome and dementing disease. Training faculty who carry out substantial translational research include T. Sejnowski, J. Brewer, E. Halgren, G. Light, R. Malinow, J. Sebat and N. Swerdlow.

ELIGIBILITY

Candidates must be citizens or permanent residents of the U.S. They must be enrolled in a graduate program at UCSD in good standing. The applicant's home department must agree to offset the fee difference between what this program offers and the actual fees for the year enrolled.

Note that successful candidates need to work on projects that are currently funded by NIMH or conceivably could be funded by NIMH. Please write one or two sentences describing how your proposed research fits within the mission of NIMH, as found on these sites:

<https://www.nimh.nih.gov/about/index.shtml>

<https://www.nimh.nih.gov/research-priorities/index.shtml>

<http://www.nimh.nih.gov/about/strategic-planning-reports/strategic-research-priorities/index.shtml>

Additionally, please note that the mission of NIMH is broad, but that you need to conceptualize and express your research in a manner that makes clear how it contributes to that mission. Please bear that in mind as you write your proposal.

Program Requirements for Predoctoral Fellows:

1. Trainees will be in their third year or beyond and have their thesis proposal accepted by their thesis committee.
2. Trainees will be chosen for the training grant whose thesis research is interdisciplinary and who have, in addition to a primary adviser, a secondary adviser to coordinate the interdisciplinary research. The student should do a 3 to 6-month research rotation in the laboratory of the secondary advisor.
3. Trainees will meet once each month with all other predoctoral and postdoctoral fellows to discuss their research. Each month one of the trainees will be responsible for presenting the research being performed in that student's laboratory. This has been a highly successful feature of the existing training program.
4. Trainees will attend a weekly lunch-time Cognitive and Neural Systems seminar presented by members of the training grant faculty and other researchers from the San Diego community as well as by visiting cognitive neuroscientists from other institutions.
5. Trainees will be required to register for the course, NEU270B, Neurobiology of Disease. This course focuses on Developmental Disorders, specifically addressing the neurobiology of neuropsychiatric disorders.
6. Trainees will attend the Fall Welcome Meeting (October), and the Annual Spring Retreat (May). The retreat is a day-long event that is co-hosted by the Kavli Institute for Brain and Mind which brings together the entire cognitive neuroscience community. At the retreat each Fellow will give a brief 5-minute PowerPoint presentation on their ongoing research project (additional information will follow).
7. The trainee's doctoral committee will include at least one member of the Executive Committee and the student's advisor or Thesis Committee chair must be a participating member of this training program.
8. In consultation with their doctoral committees, trainees will be urged to take courses outside of their home department, with an emphasis on methods that are typically not available within that department.
9. A course on responsible conduct of research is required.

Application Deadline: 12 noon – April 3, 2017

Application Checklist:

1. Cover (1 Page):

- Name:
- Department:
- Year of matriculation into your Ph.D. program:
- Citizenship Status:
- Ethnicity (self-reported):
- Racial: (self-reported)
- UCSD or Salk E-mail address:
- Gmail or other alternate home email address:
- Primary thesis advisor:
- Secondary thesis advisor:
- Thesis committee:
- Title of thesis project:
- Currently funded on NIH fellowship?
 - If yes, end date of current fellowship:
 - eRA Commons User Name:
- Abstract:

2. Background and Research Interests (1 page)

- Academic background
- Research training
- Research goals

3. Thesis Proposal Summary (3 pages)

- Specific Aims
- Methods
- Proposed research
- Facilities and special equipment available

4. Two Letters of recommendation

- Your research sponsors should each submit a letter of recommendation with the subject line to read: Predoc_reference_Candidate Name
- Email letters to: incfellowships@inc.ucsd.edu

5. Letter of Commitment

- Your home department grad coordinator should submit the commitment letter referencing the fee difference (amount to be determined) with the subject line to read: Predoc_fee difference_candidate name
- Email commitment letter to: incfellowships@inc.ucsd.edu

6. Completed Application:

- Submit your completed application in **PDF format** with the subject line to read: Predoc_app_candidate name
- Email application to: incfellowships@inc.ucsd.edu

Please use NIH formatting instructions; References do not count against the page limit.

Accepted applicants will be required to complete an Individual Development Plan

UC San Diego IDP form: [IDP Form](#)

Comprehensive Skills Analysis Worksheet: [Worksheet](#)

Optional Fellowship Opportunity: The Office of Graduate Studies has offered one **San Diego Matching Fellowship** for diversity to this program. If you would also like to apply for this Fellowship, please contact incfellowships@inc.ucsd.edu for instructions and application. Note: matching fellowships are only open to graduate students past their first year.

FACULTY RESEARCH SPONSORS

Co-directors:

Terrence J. Sejnowski and Eric Halgren

Executive Committee:

Thomas Albright

Jeffrey Elman

Marta Kutas

Larry Squire

Neal Swerdlow

Participating Faculty:

Adam Aron
James Brewer
Richard Buxton
Anders Dale
Virginia de Sa
Timothy Gentner
David Kleinfeld
Gregory Light
Don MacLeod
Roberto Malinow
John Reynolds
Ayse Saygin
Jonathon Sebat
Katerina Semendeferi
John Serences
Tatyana Sharpee
Bradley Voytek

FACULTY RESEARCH INTERESTS

Thomas Albright, Vision Center Laboratory, Salk Institute. Dr. Albright's laboratory focuses on the neural structures and events underlying the perception of motion, form and color. Through an integrative approach, which combines neurophysiological and psychophysical techniques, and computational modeling of neural networks, his laboratory is beginning to understand the mechanisms of higher-level vision in the visual cortex and to define their unique contributions to visual perception and visually-guided behavior.

Adam Aron, Department of Psychology, UCSD. Dr. Aron uses functional and structural MRI and Transcranial Magnetic Stimulation (TMS) to study neuropsychological and neurological patients to address a range of questions related to cognitive control. In particular, he is interested in how frontal/basal-ganglia circuits are engaged during cognition and in how pathology of these circuits relates to neuropsychiatric conditions such as impulse control disorders.

James Brewer, Departments of Radiology and Neurosciences, UCSD. Dr. Brewer's laboratory uses functional and structural magnetic resonance imaging (MRI) to study memory processes in volunteers with healthy memory and in patients with memory difficulties, such as in Alzheimer's disease (AD). This research focuses upon the medial temporal lobe (MTL), which shows selective damage early in the course of AD. The laboratory studies the contributions to memory that are made by distinct MTL substructures and the interaction of these structures with other brain regions.

Richard Buxton, Department of Radiology, UCSD. Dr. Buxton is a physicist by training and founding director of the UCSD Center for Functional MRI. His research interests focus on recently developed fMRI techniques for measuring patterns of activation in the brain, including basic studies of the physiological mechanisms that underlie fMRI, novel approaches to the design and analysis of fMRI experiments, and development of new imaging techniques to directly measure tissue blood flow.

Anders Dale, Neurosciences and Radiology Departments, UCSD. Dr. Dale is co-Director of the Multimodal Imaging Laboratory and specializes in the development and utilization of multimodality imaging technologies including functional MRI, DTI, PET, MEG, EEG, and optical imaging. Among his projects are the development of software tools for automated segmentation of the brain and application of these techniques for assessment of anatomical and physiological changes associated with normal brain development and aging, as well as brain related diseases such as schizophrenia, autism and Alzheimer's disease. Another major focus of Dr. Dale's research is on mapping the genetic influences on brain development using brain imaging and genome-wide association studies.

Virginia de Sa, Department of Cognitive Science, UCSD. Dr. de Sa studies unsupervised category learning and has developed an algorithm that makes use of information from other sensory modalities to constrain and help the learning of categories within single modalities. She has also shown that supervised learning can be improved by changing the way inputs interact. She has applied these algorithms to real-world visual and auditory data and compared them to human performance on the same tasks.

Jeffrey Elman, Department of Cognitive Science, UCSD. The major focus of Dr. Elman's has been on connectionist models of language, ranging from acoustic/phonetic processing to syntactic and semantic levels. In particular, he has used simple recurrent networks for predicting time series that occur in natural language. These networks are capable of extracting and representing abstract grammatical structure of considerable complexity. He has focused on modeling neural development in his recent work, applying neural network models to investigate problems of learning and change under different assumptions about the initial state of the organism and its subsequent development. (*Rethinking Innateness: A Connectionist Perspective on Development*, MIT Press, 1996).

Timothy Gentner, Department of Psychology, UCSD. Dr. Gentner's research takes an integrative, systems-level approach to study the neural mechanisms that govern the sensory, perceptual, and cognitive processing of real-world acoustic signals. The goal is to find out how the brain represents behaviorally important, complex, natural stimuli, with a primary focus on the elaborate vocal communication system in songbirds.

Eric Halgren, Neurosciences and Radiology Departments, UCSD. Dr. Halgren is co-Director of the Multimodal Imaging Laboratory and carries out research that combines fMRI, MEG, and EEG for high-resolution spatiotemporal mapping of brain activity during cognition. He validates these measures using intracranial recordings from microelectrode arrays in patients with epilepsy. Dr. Halgren's research aims to identify, locate and characterize the neurocognitive stages used to encode and interpret meaningful stimuli such as words and faces. Currently he is investigating memory replay for consolidation during sleep, and language development. The overall goal is to understand fundamental integrative processes of memory and cognition at the synaptic and system levels.

David Kleinfeld, Department of Physics, UCSD. Dr. Kleinfeld studies how the vibrissa sensorimotor system of rats enables animals to extract a stable picture of the world from the blur of inputs obtained with their actively moving sensors. Ongoing studies address the detailed muscular control of the vibrissae, and the modularity and interaction of brainstem nuclei involved in exploratory whisking. Additional projects include

electrophysiological investigation of correlates of vibrissa contact and the fusion of contact and position signals, as well as exploration of intracellular mechanisms for nonlinear mixing of rhythmic whisking signals in neocortex. Experiments also address the sensory feedback in cortical control of exploratory whisking, and the roles of arousal and cholinergic input in the control of whisking.

Marta Kutas, Department of Cognitive Science, UCSD. Dr. Kutas investigates language and memory processes, primarily using electrophysiological recording techniques with ERPs. Her studies of memory have shown specific patterns of brain activation associated with encoding and recognition processes for both episodic and semantic memory. Other processes under investigation include semantic and repetition priming and amnesic memory disorders. Dr. Kutas' methods reveal the precise timing of memory storage and retrieval operations for both verbal and non-verbal items.

Gregory Light, Psychiatry Department, UCSD. Dr. Light's research focuses on the neurophysiologic, endophenotypic and cognitive abnormalities of schizophrenia patients. A major aim is to study the relationship of measures of pre-attentive sensory information processing with higher order cognitive and functional outcomes in schizophrenia. Dr. Light also participates in the Consortium on the Genetics of Schizophrenia, which is investigating the genetic basis of psychotic symptomatology.

Donald MacLeod, Psychology Department, UCSD. Dr. MacLeod investigates visual perception using a variety of psychophysical and electrophysiological techniques, both in animals and humans. This involves tracing the sequence of neural operations that occur as information flows from retina to brain. His major research interests are in face perception, color vision, motion perception, and visual sensitivity.

Roberto Malinow, Neurosciences Department, UCSD. Dr. Malinow uses electrophysiological, optical, molecular and behavioral techniques to examine synapses and circuits underlying normal and abnormal behavior in rodents. His research established AMPA receptor trafficking as a major component of synaptic potentiation in hippocampal slice LTP, and established the nature and distribution of synaptic change during fear conditioning in the amygdala. He also studies the lateral habenula and depression, and the effect of amyloid on LTD.

John Reynolds, Systems Neurobiology Laboratory, Salk Institute. Dr. Reynolds studies the neural mechanisms of selective visual attention at the level of the individual neuron and the cortical circuit and relates these to perception and conscious awareness. He records from multiple neurons in the visual cortex of monkeys to identify the regions where the representations of objects compete with one another and create a computational bottleneck. He seeks to understand this selection process using a combination of psychophysics, neurophysiology, and computational neural modeling approaches.

Ayse Saygin, Cognitive Science Department, UCSD. Dr. Saygin's research examines mechanisms of sensory-motor coordination, including the temporal dynamics of action perception and unconscious perception of biological motion. Another line of research in her laboratory investigates individual differences in social perception and cognition.

Jonathan Sebat, Departments of Psychiatry and Cellular & Molecular Medicine, UCSD. Dr. Sebat is Director of the Beyster Center for the Genomics of Psychiatric Disease. His laboratory is interested in how rare and *de novo* mutations in the human

genome contribute to risk for common psychiatric disorders such as autism and schizophrenia. To this end, he is developing novel approaches to gene discovery that are based on advanced technologies for the detection of rare variants, including studies of copy number variation (CNV) and deep whole genome sequencing (WGS). His goal is to identify genes related to psychiatric disorders and determine how genetic variants impact the function of genes and corresponding cellular pathways.

Terrence Sejnowski, Computational Neurobiology Laboratory, Salk Institute and Department of Biology, UCSD. Dr. Sejnowski uses computational models and experimental approaches at several levels of investigation ranging from the biophysical level to the systems level. Realistic models of electrical and chemical signal processing within and between neurons are used as an adjunct to physiological experiments. Network models based on the response properties of neurons are studied to explore how populations of neurons code and process information. Dr. Sejnowski has developed a new research program in his laboratory led by M. Behrens to study a mouse model for schizophrenia, and he collaborates with J. Ecker at Salk to study the methylome of the developing brain and the possible involvement of epigenetics in mental disorders.

Katerina Semendeferi, Department of Anthropology, UCSD. Dr. Semendeferi's research involves the comparative neuroanatomy of the human brain exploring neural systems involved in complex cognitive and emotional processes in humans, apes and other primates, as well as in human mental disorders. More recently Semendeferi's research expanded to the study of selected human mental disorders (Publications), that affect aspects of social cognition including autism and Williams Syndrome (Salk Institute). Semendeferi is the Director of the Laboratory for Human Comparative Neuroanatomy at UCSD.

John Serences, Department of Psychology, UCSD. Dr. Serences' research focuses on understanding how behavioral goals influence perception, decision-making, and memory. To investigate the influence of behavioral goals and previous experiences on perception and cognition, his group employs a combination of psychophysics, computational modeling, and neuroimaging techniques.

Tatyana Sharpee, Computational Neurobiology Laboratory, Salk Institute. Dr. Sharpee works on theoretical principles for information processing in the brain. She is interested in how sensory processing in the brain is shaped by the animal's need to create parsimonious representations of events in the outside world. Her approaches are derived from methods in statistical physics, mathematics, and information theory. She is particularly interested in understanding how neural feature selectivity is influenced by, and to what extent is determined by, the statistics of real-world inputs. One of her long-term goals is to understand how invariant feature selectivity is achieved in cortex.

Larry R. Squire, Department of Psychiatry, UCSD. Dr. Squire studies the neuropsychology of memory in humans and non-human. His research involves studies of identified patients with amnesia. The analysis of such cases provides useful information about the structure and organization of normal memory. He also studies non-human primates in an effort to understand anatomy of memory functions in collaboration with S. Zola. The goal is to identify medial temporal lobe and diencephalic structures important for memory.

Neal Swerdlow, Psychiatry Department, UCSD. Dr. Swerdlow's laboratory conducts studies in both humans and animal models focused on the neural circuits and molecular regulation of information processing and its deficiencies in specific brain disorders including schizophrenia and obsessive-compulsive disorder. One line of research has elucidated the neural regulation of pre-pulse inhibition, a measure of sensorimotor gating that is impaired in schizophrenia and other brain disorders. A broad goal is to elucidate how limbic system and basal ganglia dysfunction contributes to mental illness.

Bradley Voytek, Department of Cognitive Science, UCSD. Dr. Voytek investigates the role of the frontal lobes in executive control and working memory. Using electrophysiological recordings of human brain activity, he studies oscillating network communication, brain-computer interfaces and brain/cognition/societal interactions.