

brain and cognitive sciences

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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MESSAGE FROM THE DEPARTMENT HEAD

Mriganka Sur



Sometimes Mriganka has a strong need to get away from it all. Here he is shown paragliding in the Himalayas.

We begin this Fall with expansion and change as the dominant themes - thanks, in part, to MIT's serious commitment to neuroscience and cognitive science and our willingness to respond to new opportunities.

First, September brought many new faces to our halls and labs with the arrival of the largest class of graduate students our program has ever had. This increase may be attributed to changes we implemented in both our recruiting and selection procedures, as well as in the graduate program itself. We showcased the department's unique combination of molecular and cellular neuroscience, computation, systems neuroscience and cognitive science. New Students Day was successfully restructured to emphasize student-faculty and student-student interaction, and included faculty spokespersons from each of our four areas who described ongoing research and the unifying elements of our work. In addition,

current graduate students presented posters describing their latest findings. We have also made an important change to the first graduate year: students in the entering

class now have the opportunity to do up to three 4-week rotations through labs during the first semester before they are required to select an advisor. We anticipate that these rotations will significantly assist students who are still uncertain of their research interests. Of course, students who are clear about their objectives may make their choice of lab right away and bypass the rotation.

Second, MIT is preparing to announce the construction of four new buildings as part of a Neuroscience Complex. These will house the McGovern Institute for Brain Research, the Center for Learning and Memory, the Department of Brain and Cognitive Sciences, and the Martinos Center for Biomedical Imaging. In all likelihood,

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FALL CALENDAR OF EVENTS

Friday, October 13 at 4:00 HANS-LUKAS TEUBER MEMORIAL LECTURE

This year's featured speaker will be Professor Noam Chomsky

Tuesday, November 7, BCS Social at Society for Neuroscience, New Orleans

Friday, December 22 from 3:00 to 6:00 Holiday Party at the MIT Faculty Club

WEEKLY EVENTS

Mondays – Brain Lunch

Tuesdays – Cog Lunch

Wednesdays – Brains & Machines Lecture Series (<http://www.ai.mit.edu/events/brainsMachines.html>)

Alternate Thursdays – Plastic Lunch (<http://monster.mit.edu/nedivi-lab/plasticlunch.html>)

Alternate Fridays - Perceptual Science Seminar Series (<http://www.bcs.mit.edu/persci/>)

Fridays at 4:00 Departmental Colloquia Followed by tea (<http://web.mit.edu/afs/athena.mit.edu/org/b/bcs/calendar.html>)

Chance or coincidence might aptly describe Nancy Kanwisher's strong ties to MIT. Nancy's undergraduate work was in the Dept. of Biology, and Salvador Luria was her advisor. The summer before coming to MIT, she was walking down the street in her home town of Woods Hole reading his textbook when he passed by, said "Hey, that's my book!". He then told her who he was, and offered to be her advisor at MIT, which led to her working with him. However, toward the end of her undergraduate time at MIT she became more interested in cognitive science, and responded to Prof. Potter's ad for a UROP. After a long conversation, Prof. Potter realized that she had just purchased the Woods Hole home where Nancy had grown up. This second twist of fate led to her Ph.D. and postdoctoral fellowship in Cognitive Science.

However, following her postdoctoral work, and courtesy of a MacArthur Foundation Fellowship, she was off to Columbia University to study international security. Her time there was spent looking at cognitive biases in reasoning about foreign and military policy. However, this is not where her true interests were.

Thanks to a grant, she then headed for Anne Treisman's lab at Berkeley where she was accorded the peculiar title of Assistant Researcher in Psychology without pay (though her grant paid her salary). It was an exciting place to be and she was able to continue the work on repetition blindness that she began in her doctoral thesis.

This led to a faculty position at UCLA for 4 years. While at UCLA, Nancy ran her first brain imaging study. Fearing that tenure would be granted and that she'd feel obligated to stay in LA for life she went to Harvard to do fMRI research at MGH and participate in the Harvard Vision Lab run by Nakayama and Cavanagh. But her heart evidently had remained at MIT, and she was persuaded to



Professor Nancy Kanwisher with her favorite companion

return as a faculty member a few years ago. Nancy considers this department to be the most fun place she knows to do cognitive neuroscience.

Her current research continues to be high-level vision, including object recognition and visual attention, though she is of the opinion that it's good to make a fairly radical change in your research every few years just to keep a fresh perspective on things.

When she can tear herself away from her research, Nancy manages to take interesting vacations. Last winter she was in Panama, and the year before in Tasmania. This winter, she is planning to go hiking in

New Zealand and, whenever possible, she makes time for sea kayaking.

Given all of this, it's difficult to understand why Nancy sees herself as somewhat of a nerd. Perhaps it's because she no longer has time to read the NY Times in its entirety on a daily basis, or to be the political activist she once was. However, she admits she is having the time of her life. Nothing is as exciting as the research she is doing now. But she says that it may not last forever; that this is a special and rare moment when very exciting things are happening in research in cognitive neuroscience, and she feels very lucky to be participating in this process.

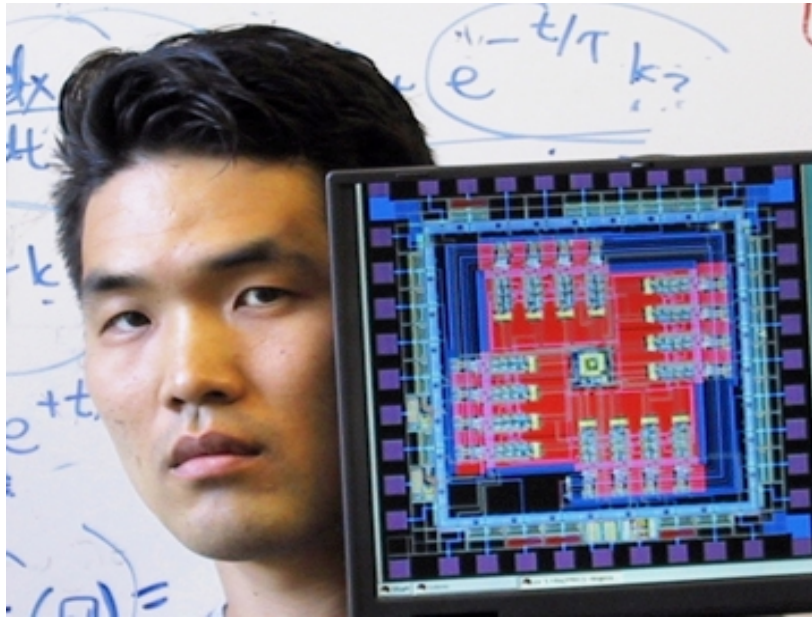
(continued from page 1 Dept. Head)

the buildings will be located at the intersection of Main and Albany streets, across Vassar from the Stata Center and close to the Whitehead Institute. The architect is expected to be chosen by the middle of this term, and vigorous fundraising for this project is in process. Should this site be selected, it will unite all four areas of our department within a single structure, thus greatly facilitating interaction and collaboration between areas.

Third, the undergraduate program is being overhauled and requirements streamlined. We would

like to allow our majors to seamlessly cross traditional boundaries between neuroscience and cognitive science in their choice of courses. Professor Molly Potter, our Academic Officer for the Undergraduate Program, is leading the curriculum development.

These changes are exciting and challenging and will influence our department's mission of education and research for a long time to come. I wish all of you a happy and productive semester, and invite you to bring your ideas to my attention at any time.



Sebastian Seung

Sebastian received his Ph.D. in theoretical physics from Harvard, but by the time he began his postdoctoral work at the Hebrew University of Jerusalem, he had changed his focus to neural computation. Near the end of his graduate studies, he lost interest in his thesis topic and began to feel depressed, an experience with which many graduate students can probably sympathize.

However, he had spent a summer at Bell Labs and met physicists who were studying the brain. Intrigued by their work, he decided to switch fields for his postgraduate project. Following his sojourn in Jerusalem, he spent six years in the Theoretical Physics department at Bell Labs conducting research on computational learning theory and neural networks. He came to MIT because he felt he needed a change; he wanted a new challenge.

His focus here is understanding learning and memory through the mathematical modeling of neural systems.

Since he arrived at MIT two years ago, Sebastian has received a Sloan Research Fellowship, a Packard Fellowship, the McKnight Scholar Award and the Robert A. Swanson Career Development Professorship in the Life Sciences. Last year, he was one of 2 MIT nominees for a nationwide search by the Howard Hughes Medical Institute for investigators in computational biology. Eight months later, Federal Express arrived with news of his selection as an Assistant Investigator.

Sebastian's broad vision for his role at MIT is dual: His educational mission is to create a new generation of researchers who are trained in biology and quantitative skills. His research of neural systems will continue, but he is also constantly rethinking his goals.

Outside of his laboratory, Sebastian plays squash, rollerblades to and from work, and takes some time for yoga. He used to practice the martial arts and prepare Korean dishes, but his workload at MIT has narrowed him to a more one-track life.



Professor Tomaso Poggio's likeness is courtesy of the artistic talent of Professor Pawan Sinha.

The problem of learning is arguably at the very core of the problem of intelligence, both biological and artificial.

Tomaso Poggio and C.R. Shelton

Tommy is extremely proud that this quote by him and his graduate student appears in the collected works of one of the most famous living mathematicians, Steve Smale.

Tommy Poggio, the Uncas and Helen Whitaker Professor of Vision Sciences and Biophysics and Director of the Center for Biological and Computational Learning, received

his Ph.D. in Genoa and then almost immediately was awarded an EMBL fellowship to the Max Planck Institute in Tubingen. His original visit to the group of Werner Reichardt, which was to last a few weeks, turned into ten years as a Research Scientist. This appointment came to an end when he was offered a faculty position at MIT. Tommy's original contact with MIT had been through the AI Lab, where he had collaborated since 1976 with David Mar.

Tommy's major area of interest has always been the problem of intelligence in biological organisms and machines, particularly, how to make intelligent machines and how the brain works. In his first ten years here, his focus was primarily on how to make computers see by investigating how the brain sees and, for instance, recognizes faces and other objects.

During the last ten years, however, his focus has changed to the problem of how the brain learns to do things — such as motor skills or object recognition — as the key to understanding how the brain works. In order to make intelligent machines, we must make computers learn from experience, somewhat like children do. That is unlike how today's computers work. Tommy addresses this problem

at 3 levels: 1) Mathematical. He uses learning theory to define what can be learned and how. The main outcome of this mathematical research consists of practical algorithms for making computers learn from data.

2) Engineering. On this level, mathematical techniques and algorithms are applied to practical problems such as training systems to learn to find objects in images, a very difficult task. Daimler-Chrysler has tested one of the systems developed in Tommy's group in an experimental Mercedes to recognize (and possibly avoid!) pedestrians. A second application is the result of a collaboration with the Lander group at the Whitehead Institute. They are using data from DNA chips to measure the level of expression of 7100 human genes in biological samples. They expect that this will enable them to diagnose specific types of cancer. Eventually, this might lead to knowing which specific blood pressure medication will be most effective for a particular patient, or predicting the best treatment for a cancer patient. Applications have also been developed in the finance area (he is currently collaborating with faculty in finance and marketing at the Sloan School), music, web searches,

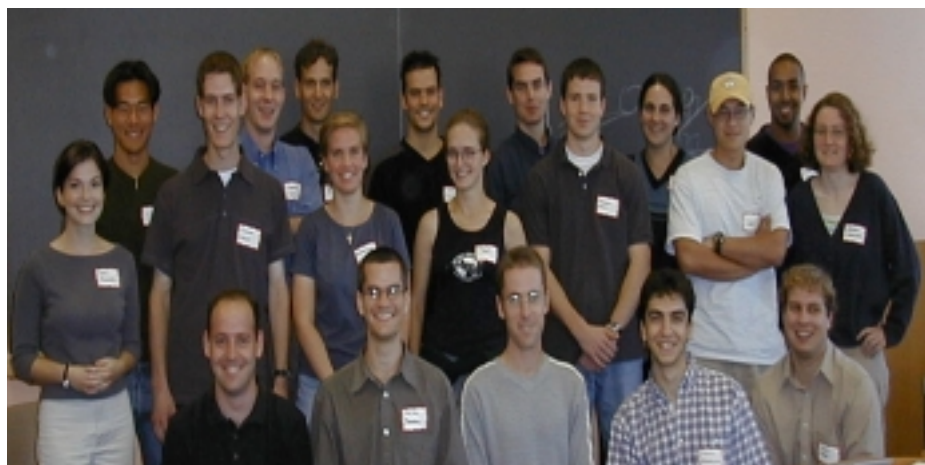
computer vision, etc.

3) Neuroscience. This focus is on how the brain works; specifically, how the visual cortex learns to recognize faces. This work is based on computer models and simulations, and involves at present collaboration with physiologists like Earl Miller.

Tommy also has numerous patents, all of which are based on work with his MIT students, typically funded by government agencies. Adobe incorporated one of his inventions into some of its Photoshop products. A former student of his created a system — and a company — that uses fingerprints instead of passwords for computer and network security.

For Tommy, work is also a hobby, but he occasionally manages to make time for downhill skiing, classical music, and sailing. These days, however, he has abandoned the boat racing he used to do in Europe and just rents a boat for a pleasure sail. He does manage to find time for his two children: his daughter, who is still in high school, and his son who graduated from Harvard and is now studying physics in grad school.

WELCOME NEW GRADUATE STUDENTS



Bottom Row (L to R): Itamar Kahn, Keith Thoresz, Richard Russell, Alexander Rakhlin, David Badre. Middle Row: Amy Pooler, Florian Wolf, Charlene Ellsworth, Rebecca Saxe, Brandon Farley, Wei-Chung Lee, Marnie Phillips. Top Row: Gene Yeo, Nathan Wilson, Boris Krupa, Ned Sahin, Simon Overduin, Jodi Davenport, Cory Harwell (Missing from photo: Daniel Casasanto)

David Badre, a graduate of the University of Michigan in biopsychology and cognitive science, is planning to focus on the cognitive neuroscience of memory and executive function. He's also composes and performs all musical styles from rock to jazz to classical.

Daniel Casasanto graduated from the Conservatory of Music at Oberlin College, and did graduate work in voice and vocal performance at Johns Hopkins. He's a professional opera singer and coffee junkie, and will pursue memory, language and fMRI work here.

Vincent Chi-Kwan Cheung a pharmacology and math major from the University of British Columbia is in the MEMP division of HST, and is interested in mathematical modeling in neuroscience and neuroengineering. He has very strong interests in music and plays the piano and collects rare CDs.

Jodi Davenport attended UCLA where she developed an interest in visual perception, especially optical illusions, object recognition, and scene perception. She enjoys photography, playing the bass and traveling.

Charlene Ellsworth is a Tufts graduate in math and biology, but has since done research in molecular genetics at UCSD. She hopes to focus on systems neuroscience. She enjoys theater – as an observer and a performer.

Brandon Farley graduated from the University of Michigan and is interested in the mechanisms of developmental plasticity and playing and listening to music.

Corey Harwell graduated from Tennessee State University with a degree in chemistry. He is interested in the molecular mechanisms of plasticity. His major concern is tolerating the cold weather here.

Itamar Kahn attended Tel Aviv University and would like to study higher cognitive processes using fMRI, MEG and other imaging techniques.

Boris Krupa, originally from Slovakia, did his undergrad work at the University of Chicago. He's interested in computational/information processing, neural networks, coding, learning, representation and organization of information in the brain. He is another student with interests in music and composition, particularly the piano and guitar.

Wei-Chung Lee born in Taiwan but raised in Minnesota, studied at Bowdoin and Caltech – government, biochemistry, and chemical engineering - but was new to neuroscience when he came to MIT as a Tech Assistant. He is interested in molecular mechanisms behind activity-dependent plasticity. He's also a whitewater raft guide.

Simon Overduin has a degree in biology and psychology (minor in physics) from Wilfrid Laurier University in Waterloo, Ontario. He plans to study systems neuroscience, including the interfacing of neural and electronic architecture. He enjoys science fiction literature, alternative film and sporadic exercise.

Marnie Phillips became a Tech Assistant here after studying biology and anthropology at the University of Michigan. She expects to balance her interest in hiking, climbing and skiing, with her studies of how different patterns of neuronal activity are transduced into specific gene expression.

Amy Pooler comes from Wiscasset, Maine, but studied neuroscience at Brown and plans to do research into possible cures for Alzheimer's Disease. She enjoys hiking and playing the guitar.

Alex Rakhlin came to the US from Russia at age 16. His degree in computer science is from Cornell. At MIT he plans to study artificial intelligence from a computational perspective. Alex plays the guitar, but also finds time for TaeKwonDo, pottery, and woodcarving.

Richard Russell attended Pomona College, and then spent two years as a research assistant at

Cambridge University, where he did functional neuroimaging of various aspects of language. At MIT, his main interest will be vision. His other pursuits include photography and other visual media, poetry, kayaking, rock climbing, and the SETI program.

Nedim Sahin specialized in biology and neuroscience at Williams College, then spent two years working in software in London and Dublin, and traveling in 19 countries and principalities. At MIT, he will be working on language processing. He enjoys rock climbing and snowboarding, and plans to continue the rowing he did at Williams and Oxford.

Rebecca Saxe, of Ontario, studied experimental psychology and philosophy at Oxford University, and will be pursuing cognitive neuroscience here. Danced competitively for the last three years, and is also interested in wildlife conservation and medical anthropology.

Keith Thoresz has a bachelors from Rensselaer and a master's from the University of Wisconsin-Madison. At MIT he will work on object representations and recognition. He enjoys traveling, SCUBA diving, flying, and hacking, and hopes to eventually work in the space industry and/or found a software startup company.

Nathan Wilson, a Cornell graduate in biology and neuroscience, and an M.Eng. in computer science, would like to use modeling to explore the algorithms used in learning and memory as well as the biological structures that implement them. He also enjoys music and hosting dinner parties.

Florian Wolf studied at the University of Munich, and got his MA in linguistics and psycholinguistics at Stellenbosch (South Africa). At MIT, he plans to investigate processes at the discourse-syntax-interface using methods from cognitive neuroscience and computational linguistics. He is also a guitar player.

Eugene Yeo graduated in

chemical engineering and economics from the University of Illinois, Urbana-Champaign, before returning to his native Singapore for two years of military service. He was a weapons officer on a Navy ship. He would like to find computational methods to resolve problems of learning and memory, but also hopes to continue running and swimming and, perhaps, participating in biathlons, as he has in the past.

A History of Neuroscience at MIT

Mary Parlee (MIT 1966) is writing a history of neuroscience at MIT. Among other questions she is attempting to answer is what factors promoted the development of psychology and neuroscience here. If you have information to contribute, please contact her at: mparlee@mit.edu.

If you would like to be put on the newsletter mailing list, or have information you would like to see published in a future issue, please contact:
Judith Rauchwarger
 Editor, BCS Newsletter
 MIT E25-406
 (617) 253-5749
jrauch@mit.edu

HONORS AND AWARDS - FACULTY

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| Ann Graybiel | Named Head of the Board of Neuroscience and Behavioral Health of the Institute of Medicine
Member, Scientific Advisory Board of the Max Planck Institute for Biological Cybernetics
MIT Teaching Prize for Excellence in Graduate Education by the School of Science |
| Earl Miller | Society of Neuroscience Young Investigator Award |
| Elly Nedivi | Fred and Carole Middleton Career Development Chair |
| Steven Pinker | Peter de Florez Professor of Psychology
His book, <i>The Language Instinct</i> , was named one of the 100 best science books of the century by <i>American Scientist</i> magazine. |
| Sebastian Seung | Howard Hughes Medical Institute Assistant Investigator
Robert A. Swanson Career Development Professorship in the Life Sciences
McKnight Scholars Award |
| Pawan Sinha | NEC Award for 2000-01
Award from the Defense Advanced Research Projects Agency for 2000-02. |
| Elizabeth Spelke | American Psychological Association's Distinguished Scientific Contribution Award
American Psychological Society's William James Prize for Scientific Contributions |
| Mriganka Sur | MIT Teaching Prize for Excellence in Graduate Education by the School of Science
Australian Neuroscience Society Distinguished Lecturer for 2000
Sigma Xi Distinguished Lecturer for 2001-2003 |
| Anthony Wagner | Surdna Foundation Research Award, 2000
Ellison Medical Foundation New Scholars Award, 2000
Paul E. Newton Career Development Professorship in Neuroscience |

Dept. of Brain & Cognitive Sciences
 Massachusetts Institute of Technology
 E25-406
 Cambridge MA 02139

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