brain+cognitive sciences news

Spring 2004 1

MESSAGE FROM THE DEPARTMENT HEAD

Mriganka Sur

In keeping with the change in seasons, the emerging theme this spring is rejuvenation. In both BCS and MIT as a whole, the emphasis is on renewing and rebuilding the resources that are essential to the continued success of the Department and the Institute. Although short-term budget considerations have forced us to scale back our growth somewhat, we continue to look forward, anticipating the changes that are so necessary to our endeavors.

At the Institute level, two committees – one representing the corporation and the other the faculty - have been formed to search for a new president, as Charles Vest announced that it was time to step down after 14 years. For the first time in this process, a student advisory committee has been appointed to provide perspective from this important group. Members of the faculty committee – which includes Susumu Tonegawa – are in the process of visiting all departments, laboratories and centers to keep them informed and to learn their concerns. We are pleased to note that, in their statement of goals, the committees reaffirm the brain and cognitive sciences as one of the Institute's growth areas for the new president. They also seek to identify a candidate who will maintain MIT's standing as a top science/engineering university and increase the financial stability and health of the institution.

Rejuvenation is the order of the day within the Department as well, as we actively search for candidates to fill open slots in the cognitive group. In a strong show of support, the Institute has approved the BCS Visiting Committee's recommendation that we fill these positions speedily and the search committee, headed by Suzanne Corkin, has been working hard to identify and interview applicants. The quality of the applicant pool has been excellent and we expect to fill several positions.

In other BCS-related news, McGovern Institute for Brain Research Director Phil Sharp has announced his desire to devote more of his time

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Massachusetts Institute of Technology

BCS Alumni Please Keep In Touch

Denise Heintze
Academic Administrator
heintze@mit.edu

BCS IN THE NEWS

Professor Suzanne Corkin and Postdoctoral Fellow Elizabeth Kensinger (Ph.D. '03) had their research on emotional memory published in the Mar. 2 issue of the *Proceedings of the National Academy of Sciences*. Using fMRI, they found that, while the hippocampus was active during the learning process for the memories of all tested words, memories that had emotionally charged content activated only the amygdala, while those which were calmer activated only the prefrontal cortex. They believe that stress hormones may enhance affect of the arousing words and detailed cognitive processing may underlie the memory of more neutral words. The two hope that their work will eventually lead to treatments of memory loss and learning impairments.

By discovering one of the mechanisms through which brain synapses are dismantled, MIT neuroscientist, Menicon Professor of Neuroscience Morgan Sheng, and Postdoctoral Fellow Daniel T.S. Pak shed new light on how our brains eliminate connections between neurons. The work was published in the Nov. 21 issue of *Science* magazine. This information may lead to drugs that could prevent or minimize synapse loss associated with neurodegenerative disease such

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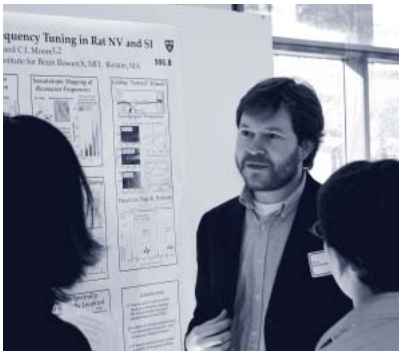
BCS GRADS PARTICIPATE IN EDUCATIONAL OUTREACH PROGRAM

In November, graduate students Emily Hueske and Neville Sanjana with the guidance of Professors Sebastian Seung and Jerry Schneider offered a special neuroanatomy class for area students. The class was part of the MIT Educational Studies Program's SPLASH event, which brings kids from local schools to MIT for 2 days of classes. 36 students in grades 7 through 12 from all over New England joined the course, which included a whirlwind tour of the central nervous system as well as hands-on lab experience. According to Sanjana, the students "really enjoyed the experience" and he looks forward to teaching the class again next year.



Professor Chris Moore discusses his research with prospective students during Interview Weekend.

SPRING 2004 CALENDAR OF EVENTS

Mondays *Brain Lunch*
Tuesdays *Cog Lunch*
Wednesdays *Brains & Machines Lecture Series*
www.ai.mit.edu/events
Alternate Thursdays *Plastic Lunch*
web.mit.edu/picowercenter/events
Fridays *BCS Colloquium followed by Reception*

SPECIAL EVENTS

Friday, April 2, Hans Lukas Teuber Memorial Lecture, 4:00 PM, E25-111
Mu Ming Poo, Ph.D., Professor and Head, Division of Neurobiology, Department of Molecular and Cell Biology, University of California, Berkeley
"Spike Timing Dependent Plasticity of Neural Circuits"

Friday, April 16, Bidwell Lecture, 4:00 PM, E25-111
Susan Lindquist, Ph.D., Director, Whitehead Institute for Biomedical Research and Professor of Biology, MIT
"Protein Conformational Switches: A Matter of Life and Death"

BCS BUILDING UPDATE

by Arne Abramson, bcsp Project Manager

Ed. Note: Arne has been sending periodic updates on construction progress for the new building. The following are excerpts from those notes.

January 30, 2004 Concrete has now been poured on floors 2 through 6. Masons are setting concrete block on floors 3 and 4, tin knockers are hanging ductwork on the third floor, and electricians and pipe fitters are setting risers in the building (large supply pipes that will feed the branch services on each floor). There are now over 250 workers on the site each day and that figure will be growing quickly.

February 13, 2004 For all intents and purposes, steel erection is done. As you may have noticed, the second layer of canvas has started to go up outside of the staging. At this point, most of the Albany St. side has been "double-bagged." Inside this outer layer, the masons will be laying concrete block in areas that they couldn't reach from the inside. Then in March, an air/vapor barrier will be applied to the outside of the concrete block work, upon which insulation will be affixed. Over the insulation we will be setting the limestone panels. It won't be long before we start to install windows. That's the work that you can't see behind the scaffolding.

Inside the building, work is filtering upwards. The second floor is a beehive of activity with ductwork almost done, pipe fitters running mains and laterals for various lab services, and electricians installing conduit. The scaffold, which will reach almost 75 feet above the atrium floor, will be in place for much of the remaining time before the complex opens.

The new brain and cognitive sciences project construction site as seen from the corner of Vassar and Main streets. The recently-opened Stata Center is at the left.

February 27, 2004 I was in the building on Wednesday when a freight train passed by. Were it not for the noise (we still don't have walls up along the tracks), we never would have known. Standing on the 2nd floor of the complex midway between the tracks and Albany St., we were both pleasantly unsurprised that we couldn't feel the train's movement.

March 28, 2004 Window/wall transitions were tested and all of the east-west trusses for the skylight had been set into place. Based on what I saw, I can tell you two things about the skylight: it will be enormous and it will be spectacular. Inside, it's all duct and pipe and wire.

JOINT BCS/CHILDREN'S HOSPITAL PROJECT GATHERS SPEED

As part of the Brain Development & Disorders Project (BDDP) the Bizzi and Sinha laboratories will soon begin to recruit children with autism spectrum disorders (ASD) directly from the new Genotyping Center headed by Dr. Ellen Hanson, and Dr. Leonard Rapapport at Children's Hospital. The Bizzi lab will be seeking to test the children for motor memory, while the Sinha group will be testing visual perception, particularly face recognition.

Since October, the Project has also held three colloquia: Professor Emilio Bizzi and his postdoctoral fellow, Dr. Robert Ajemian, described their project on motor control in autism; Professor Pawan Sinha discussed his project involving visual perception in ASD, and; Professor Ken Wexler and his postdoctoral fellow, Dr. Alex Perovic, spoke about their upcoming project involving aspects of computational language impairment in children with autism and William's syndrome.

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NEW BEGINNINGS

Financial and Operations Officer Sheila Hegarty married James McCabe on October 25, 2003.

Research Scientist Ed Tehovnik and his new wife Arlete celebrated their marriage on June 26, 2003.

Assistant Professor Elly Nedivi and her husband Jeff Hoch were pleased to announce the birth of their daughter Ness (Hebrew for Miracle) on January 14, 2004.

Graduate Student Gail O'Kane and her husband Dan welcomed their first child Jack to the world on February 26, 2004.

BCS welcomed Project Machinist Konstantinos Tomadakis to the Department in March, 2004.

Sylvester Szczepanowski and new Project Machinist Kostas Tomadakis in the shop

MARK BEAR

Photo courtesy of Fran Salderberg

Mark Bear with his Laser.

One of the first things Mark Bear will tell you is that he has had a lifelong interest in both the brain and sailing. Having grown up in Alexandria, VA on the Potomac, his interest in sailing was self-initiated, not a family activity, and the same might be said about his scientific bent. Neither parent was an academic – his father worked for the government – but Mark's Christmas list at age 11 included a request for a human brain modeling kit (which he never got). Perhaps his interest in science can be traced to the examples of his grandfather, a famous soil chemist and professor at Rutgers, or to his father's cousin, Richard Bear, an X-ray crystallographer (a structural biologist) at MIT. Richard's last paper on the structural biology of muscle and myelin was published in 1980, coincidentally the year of Mark's first publication.

Mark spent his undergraduate years undecided about his life plans until he worked in the lab of Irving Diamond, a well-known neuroanatomist. While in Diamond's lab, Mark discovered a new connection in the brain and was amazed that there were still such fundamental discoveries to be made. He realized there was still a lot to learn and he could contribute. He majored in psychology and then went to Brown for graduate studies where he worked with Ford Ebner, also a comparative neuroanatomist. Because of his work with Diamond, Mark had a broad background in the visual system and volunteered for a new lab project on visual cortex plasticity. He was awarded his Ph.D. in 1984 and went to the Max Planck Institute in Germany to work with Wolf Singer on a project to investigate the modulation of visual cortical plasticity by cholinergic and noradrenergic inputs. At that time, modulation seemed like a target for establishing a molecular mechanism for cortical plasticity. He remained for only a year because Brown created a position for him so he could work with Leon Cooper, a theoretical physicist. Cooper had been interested in the nervous system since he won the Nobel prize in physics in 1973 and was one of the first theoretical neuroscientists.

What began as a soft money Research Assistant Professor position morphed into a tenure track position and eventual tenure. Mark was then given a Howard Hughes Medical Institute award and his life changed. What had been a small "mom and pop shop" with many more ideas than people to work on them suddenly expanded.

Mark's lab explores the question of how experience modifies the brain. Previously, LTP (long-term potentiation, which increases the strength of synapses) had received most attention as a synaptic memory mechanism. Mark demonstrated that its counterpart, LTD (long-term depression, in which experience decreases the strength of synapses), and the regulation of LTP induction by the recent history of neural activity (a phenomenon he and Cliff Abraham have designated metaplasticity, the plasticity of synaptic plasticity), have equally important roles to play in information storage.

Leon Cooper had proposed that depression occurs at presynaptically active synapses when postsynaptic activity falls below a modification threshold, but remains above a lower threshold, defined as zero. Thus, the proposal was that presynaptic activity triggers synaptic depression or potentiation depending on the concurrent level of postsynaptic activity (i.e. the degree of correlation). To explain competition and provide stability, Bienstock, Cooper, and Munro made the additional proposal that the value of the modification threshold varies as a function of the history of integrated postsynaptic activity. As average activity falls or rises, so does the value of the modification threshold. This theory is now referred to as the BCM theory. Experiments in Mark's lab validated the key assumptions of the BCM theory: that presynaptic activity triggers LTD or LTP depending on the level of postsynaptic response, and that the LTD-LTP threshold varies depending on the history of cortical activity. Mark's lab has gone on to identify the molecular basis of LTD and metaplasticity, and they are now attempting to show that these mechanisms are utilized during naturally occurring plasticity in the visual cortex. Recently, experiments in Mark's lab showed that a period of monocular deprivation, which depresses synaptic transmission from the deprived eye in visual cortex, engages the mechanisms of LTD.

Outside the lab, Mark shares his life with his wife and daughters. He met and married his wife, Terry, at Duke, though he didn't (and still doesn't) share her enthusiasm for horses. At the time, she had one, but these days, she has 6 show horses, which they keep at home in Bristol, R.I., and which explains why he commutes to MIT. The rest of the family consists of 2 dogs, a cat, a bird, and 2 daughters, one a junior at Brown and the other a high school sophomore. The older one is a neuroscience major. Terry, a former kindergarten teacher, now devotes her time to training horses – or rather, training children to compete in horse shows, and their younger daughter is a Rhode Island champion rider. Mark, however, chooses not to ride, preferring to spend time sailing competitively, which doesn't interest his family, but gives him "the opportunity to reboot my brain." His boat is a Laser, a popular single-handed Olympic class sailboat that is 14 feet long. Mark bought one when he was 16 and now, at 46, is still sailing the same type of boat but, in his words, has yet to master it. Despite such pronouncements, Mark came in second in the 2002 Laser Master World Championship in Hyannis. He races weekly all winter long, and competes internationally in his age group.

Between research and sailing, Mark rarely has time to enjoy his other interest, live music. He describes the move to MIT as great; the lab is thriving and the scientific energy is remarkable.

THANK YOU . . .

We would like to thank the following individuals for their generous contributions in support of teaching and research at BCS

Dr. Anna W. Roe '91
Daniel A. Frankel, M.D. '89
Dr. Donald MacKay '67
Ms. Elizabeth A. Burdash '64
Dr. Janell M. Schweickert '85
Dr. Janine D. Mendola '96
Dr. Judith D. Schaechter '90
Dr. Kyle R. Cave '89
Dr. Martha E. Hardt '73
Dr. Martin S. Chodorow '76
Mr. Neil W. Kowall
Dr. William F. Ganong '77
Dr. William Z. Cohen '77
Dr. Vernon H. Young '91

Does not include contributions made to PCLM or MIBR

SYLVESTER SZCZEPANOWSKI

Sylvester was born in Wejherowo, a small town in northern Poland near the Baltic Sea and Gdansk. His father worked for the railroad company as a machinist and, like Sylvester many years later, earned numerous patents. Sylvester has been fascinated by machinery since childhood. His father collected old clocks and stored them in the attic. Sylvester would take them apart to see how they worked, though generally he was unable to put them back together, which upset his father.

After attending elementary school for the usual 8 years, Sylvester went to a technical trade school in Gdynia that has a program similar to what we would find at Wentworth Institute of Technology. He studied to be a machinist and all around mechanic. While attending school, he would visit his father who was working in railroad machine shops in the same town, and Sylvester became fascinated by how the steam engines worked.

After graduation, he worked at a shipyard in Gdynia as a machinist, and installed big engines on ships until being drafted into the Navy at age nineteen. He was assigned to the Coast Guard (part of the Polish Navy), where he underwent six months of basic training and preparatory school before being assigned to patrol boats as commander of the left engine. He was also assigned to race row boats as part of the competition between various Coast Guard stations.

Even though he would have to go back and forth between the shipyard and the ship to oversee construction, and train for the races, navy life left him with a lot of spare time. As a result, the crew sought ways to pass time and earn extra money. One activity involved going early to train on the Baltic Sea but, instead, the sailors would use the opportunity to swipe fish from the nets left by fishermen the night before and then go through the canals in Gdansk to sell the fish from house to house.

Another popular fundraising activity was to take life preservers made from cork to sell, as the cork, used for making high style shoes, was scarce. To get past the guards at the shipyard, one of Sylvester's friends would put on a fake military police insignia, another would carry a machine gun, and the third had a bag filled with the life preservers. They would use the money they acquired to party. Sylvester characterizes his days in the Navy as lots of fun, which may explain why so many people were able to cross the

Sylvester checks the adjustments on one of the shop's computer-controlled milling machines.

border undetected (according to him).

After three years in the Coast Guard, he returned to the shipyard for a year before getting a job with the Merchant Marines running a machine shop and engine rooms. It was more like building and maintaining parts that were difficult to buy ready-made. Sylvester spent a total of seven years there, returning briefly to the Navy during the fifth year for training updates. The course was supposed to be for three months, but the day before he was due for discharge, the Cuban Missile crisis put everyone on full alert waiting for the command to take off for Cuba.

During this retraining period, Sylvester ran into an old friend who insisted on introducing Sylvester to his wife's friend, Wanda, whom he eventually married. Girls considered Merchant Marines a good catch because they were generally in a good financial position. Sylvester and Wanda corresponded while he was still in the Merchant Marines, but when he returned to Poland after one of his trips, she was no longer there, having left for the U.S. Wanda had been afraid to tell him she was planning to leave because, under communist rule, people were always afraid they would be betrayed. However, she left a letter for him, which contained information about how to contact her in the U.S. – in Jamaica Plain.

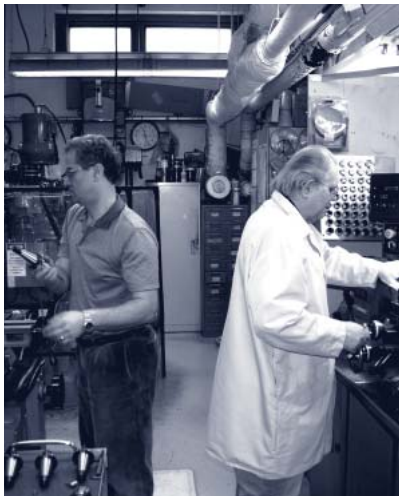
In order to be able to see her, Sylvester signed on with a Polish passenger ship that traveled between Poland and Montreal. While docked in Canada, she came to visit. The next time, he served on ship going to the U.S. When the ship arrived in New York, he travelled to Boston to see her. The next trip, she went to New York to visit him and they got married in City Hall. However, he had to return to Poland (he couldn't just jump ship), while she began the process for him to join her in the U.S. In about a year, he was back.

Sylvester spoke some English that he picked up here and there (Russian, not English, was mandatory in Polish schools). This ability enabled him to get his first job in the U.S. at a butchery through the help of a friend. After three months, he left, taking jobs with firms such as Westinghouse, Ionic, and Carr Fastener (located at the site of MIT's Biology building), before being hired as a machinist in MIT's nuclear reactor lab.

In 1986, Sylvester joined BCS. The department had just been formed from the old Psychology Department and the machine shop moved to E25 from E10. Things were a shambles as his predecessor had not bothered to set it up.

Sylvester's son is a mechanical engineer and works in R&D at Gillette, and his wife works as a technician in MIT's Plasma Fusion Center. Sylvester's great joy however, are the two granddaughters whose photos adorn his office.

Sylvester has little spare time, but does a bit of gardening and holiday cooking, always preparing something new as he doesn't like to repeat himself. Sylvester also fixes things around the house (in Poland he built the house his brother now lives in), and babysits, which is not an easy job. It requires a lot of work and energy just to keep up with the two girls. Though looking forward to retirement, he may be found around the department on an "as needed" basis, and also has some projects lined up at home – things for which there is no time or energy for just now.



A typical busy day in the shop as Sylvester and Kostas Tomadakis double up on a project.

continued from p. 1 Message from the Dept. Head

and energy to research. MIBR has begun the process of looking for a new Director to fill this important and visible position.

Finally, Nancy Kanwisher has chaired a committee that has examined a variety of brain imaging initiatives, with particular emphasis on the research requirements of investigators throughout the Institute. Although a final report is still in the works, it is clear that the committee's recommendations will be influential in shaping the organization of human and nonhuman primate neuroimaging at MIT. With facilities for the next generation of imaging technology already programmed into the new building, the next few years will bring exciting developments for brain imaging research at BCS

In the midst of all this activity, we are navigating through a period of significant budget restrictions at the Institute. As a result, we are being cautious in a number of areas, including admissions for next fall's entering graduate class. Positive signs abound however, and the popularity of the graduate program continues to grow. This year we received a record 304 applications – this in spite of the fact that graduate applications were down nationwide, and a surprising 19% for the year at MIT.

continued from p. 2 Joint BCS/ Children's Hospital Program

Professor Wexler and Alex Perovic are new to the Project. Dr. Wexler's primary research has focused on aspects of language acquisition in children with and without specific language impairment (SLI). In the BDDP collaboration, he will examine computational aspects of language similar to SLI in children with autism and William's syndrome.

The next BDDP Colloquium will be held at MIT on April 7th. Dr. Ellen Hanson from the Developmental Medicine Center (DMC) at Children's Hospital will give a talk on Autism Spectrum Disorders and the new Genomics Project at the DMC. The colloquia include dinner and open discussion. In April, the project will also publish a newsletter entitled "Connections."

AWARDS AND HONORS

FACULTY

Mark Bear was elected Fellow of the American Academy of Arts and Sciences.

Neville Hogan received a silver medal from the Royal Academy of Medicine in Ireland.

Tomaso Poggio was presented the Gabor Award by the International Neural Network Society.

Gerald Schneider was appointed as an honorary professor at the University of Hong Kong.

Pawan Sinha received the Global Indus Technovators Award of the Indian Business Club at MIT.

Mriganka Sur was appointed to the Advisory Council of the National Eye Institute/NIH.

Joshua Tenenbaum was awarded the Newton Career Development Professorship.

Matthew Wilson was promoted to full professor.

STAFF

Rutledge Ellis-Behnke was awarded the first-ever BCS Departmental Service Award in recognition of his many contributions to the Department.

John Armstrong was presented the School of Science Infinite Mile Award.

Administrative Assistants John Canfield and Ellen Goodman received Spot Awards given through the School of Science Rewards and Recognition Program.

GRADUATE STUDENTS

Teresa Feledy won the 2004 Dean's Educational and Student Advising Award for "her superlative achievement in education and student advising and also for her outstanding dedication to her department."

Tom Griffiths of the Tenenbaum lab, won both of the best student paper prizes at the 2003 NIPS (Neural Information Processing Systems) conference, in the "natural systems" and "synthetic systems" categories.

Daniel Casasanto received an NSF Dissertation Improvement Award for his thesis, "Spatial Foundations of Abstract Thought" that he is working on under the direction of Lera Boroditsky.

Angus MacDonald Awards for Excellence in Undergraduate Teaching went to Ben Balas, Alex Rivest, Serkan Oray, Itamar Kahn, Corey Harwell, and Richard Russell.

The Walle Nauta Award for Excellence in Graduate Teaching went to Brandon Farley and David Badre.

Walle Nauta Awards for Continuing Dedication to Teaching went to Josh McDermott, Charlene Ellsworth, Amy Pooler, Yuri Ostrovsky, Ned Sahin, and Nathan Witthoft.

UNDERGRADUATE STUDENTS

Twenty-nine sophomores and juniors have been selected as Burchard Scholars in the School of Humanties, Arts, and Social Sciences (SHASS) for 2004. The awards are given to students who demonstrate unusual abilities and academic excellence in SHASS areas. The Burchard Scholars who are Brain & Cognitive Sciences majors are: Nao Gamo '05, Yong-Hwa Lee '05, Farhan Merali '05, Haruka Horiuchi '05, Lara Rogers '05, and Stephan Stiller '06.

SPECIAL THANKS . . .

. . . to Administrative Assistants Carla Ashton-Cohen and Casey Johnson, to Undergraduate Administrator Jason Jacobson, and MIT Mascot Tim the Beaver for spearheading the department drive to collect Toys for Tots. The Marines came to the BCS holiday party to collect the large pile of toys they had collected and/or bought with the donations from the BCS faculty, staff and students.

Graduate Student Theresa Feledy is congratulated by her parents and Professor Ann Graybiel for winning the Dean's Educational and Student Advising Award

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as Alzheimer's. Sheng, a Howard Hughes Medical Institute investigator, studies the structural and functional connections in the brain and how they are altered during development and by experience. Synapses, which is where information is processed and stored in the brain, are eliminated all the time, especially in young developing brains, to balance out new synapses that form in response to experience and learning. The number of synapses in the adult brain stays pretty constant; there is less turnover than in the young brain. But exactly how the brain accomplishes this paring process is not well-understood. Synapse loss also is the hallmark of many neurodegenerative diseases. Serum-inducible kinase (SNK) is involved in cell cycle control in dividing cells. In the brain, cells do not divide, but SNK has taken on the function of degrading the proteins that make up synapses. By inhibiting SNK, Sheng and Pak, now an assistant professor in Georgetown University's pharmacology department, made neurons grow more synapses than normal. "When we used a molecular trick to inhibit function of the SNK protein kinase, neurons sprouted a lot more synapses. It's doable in a culture dish in the laboratory, but whether it's doable in the living brain, I'm not sure," Sheng said.

Professor Neville Hogan's current research includes efforts to create new technology to aid recovery after neurological injury such as stroke. In previous work his lab has shown that a simple form of interactive robotic movement therapy consistently yields twice the benefit of conventional physiotherapy. Recent work with a more sophisticated control system has improved benefits by up to a factor of ten. His work has been featured in the Irish Times and on ABC World News Tonight among others.

The L.A. Weekly had a story about grad student Leila Reddy and her predecessor Gabriel Kreiman at UCLA's Cognitive Neurophysiology Laboratory, who have made some startling discoveries. It turns out that in the medial temporal lobe many neurons respond only to specific categories of images. Fifteen percent seem to respond exclusively to faces or animals. It's as if we are hard-wired to see them. But how specific is our visual machinery? Kreiman, who is now a Whiteman Fellow in the Poggio Lab/BCS and the McGovern Insitute at MIT, discovered that it can be highly specific. One neuron he recorded fired only when the patient was shown pictures of the Three Stooges' Curly. In another patient, Kreiman found a neuron that responded only to images of Bill Clinton. Kreiman showed that many neurons will respond only when we are consciously aware of the image we're looking at. Reddy is now embarking on a series of experiments to determine if there are also neurons that fire when the patient isn't aware.

Twenty years ago, Professor Tomaso Poggio proposed that neurons use an excitatory/inhibitory form to process information. Now, the March 7 issue of *Nature Neuroscience* reports that Professor Guosong Liu's research has provided the first experimental evidence supporting this. Liu demonstrated the existence of tiny excitation/inhibition modules within brain cells, which also addresses the question of what is the brain's fundamental processing unit? By showing that each cell is built from hundreds of modules which compute independently, he is showing that there might be something even smaller than the cell at the core of computation. The modules would then send signals to the cell body which integrates them and passes them on. The modules, which form as the brain develops, can sense and correct defects in the circuitry. Positive excitatory connections and negative inhibitory connections can balance each other out and thus retain the capacity to transmit information.

Professor Pawan Sinha and his wife, Dr. Pamela Lipson, were recently featured in TIME Magazine (as well as TIME/Europe and TIME/Asia) in connection with Imagen, a company they started to develop technology for computer vision. BCS Professor Tomaso Poggio and Professor Eric Grimson of CSAIL are members of Imagen's scientific advisory board. Imagen's technology is inspired, in part, by research exploring how humans are able to perform challenging recognition tasks with remarkable proficiency.

For the first application of its technology, Imagen partnered with Teradyne to create a machine for automated inspection of printed circuit boards. These boards are extraordinarily complex, with several hundreds to thousands of minute components (some too small to be seen by an unaided eye). In the face of such complexity, quality control becomes critical. Electronic testing is ineffective until the components have been soldered in place, and by that time it is typically too difficult to correct any problems. The testing, therefore, has necessarily to be visual. Given the high rate at which these devices are produced, a human inspector simply cannot do a thorough job of visually scanning the boards for any defects. The automated inspection system Imagen helped create rapidly scans circuit boards loaded with components and conducts visual analyses to determine whether all of the components are present and are in their correct positions.

Other potential applications of Imagen's technology include automated logo search systems for the U.S. Patent and Trademark database (with more than 3 million logos) and image search in large digital repositories, such as the world-wide web.

Studies of human recognition performance provide benchmarks against which to evaluate computational systems. As if to reinforce the linkage between human and machine vision, the TIME photographer decided to incorporate one of Professor Sinha's perceptual illusions in the image that accompanies the article. The TIME photograph (above) shows a hybrid face that has Professor Sinha's inner facial features replaced by his wife's. The result, it turns out, is quite disturbing (according to Professor Sinha).


TECH PIONEERS

Changing the Face of the World

PAMELA LIPSON
PAWAN SINHA
Co-founders, Imagen

By MARK HALPER

Pioneers think big. It wasn't small-mindedness that led Lewis and Clark to conquer the Rocky Mountains. Name a challenge today, and chances are you'll find a company with world-altering answers. Want proof? Meet the 2004 Tech Pioneers—this year's crop of cutting-edge amazers, chosen annually by the World Economic Forum. They're working to combat AIDS, cancer and blindness; feed the hungry; and wean the world from its thirst for oil. Wish them luck.

Photograph for TIME by Jason Grow

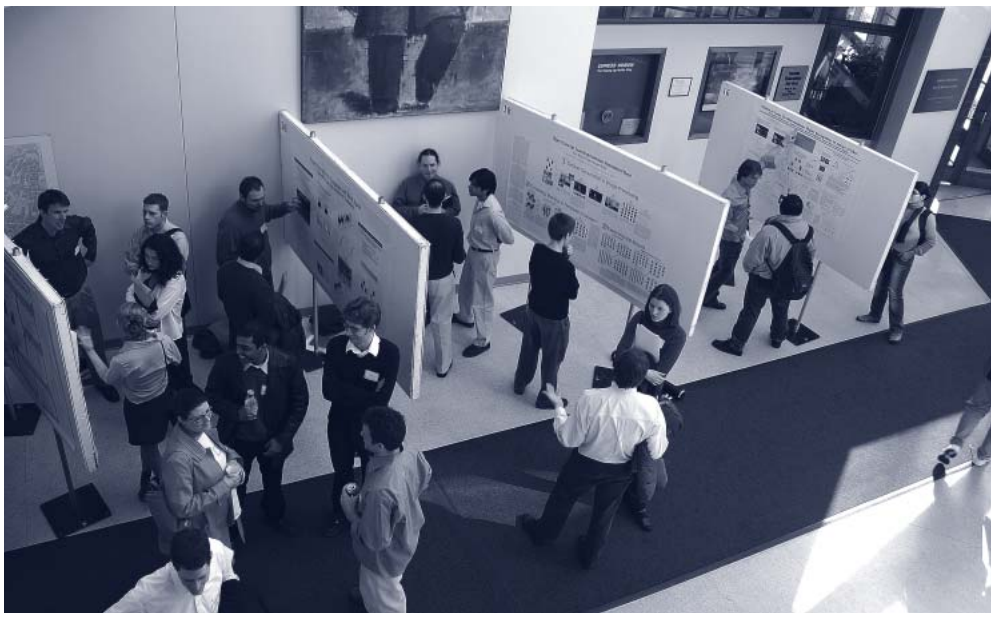
Photo courtesy of Jason Grow. Reprinted by permission of Time Magazine.

WINTER EVENTS

MIT Mascot Tim the Beaver pays a surprise visit to the DiCarlo lab

Mriganka Sur shows off his dancing moves at the BCS Holiday Party

Graduate student DJ Josh McDermott spins records at the BCS Holiday Party



Prospective graduate students view research posters in the E-25 lobby during Interview Weekend

ALUMNI NEWS

Eric Newman (SM '72) taught at Hampshire College before returning to MIT to work on a Ph.D. on the physiology of glial cells. After getting his degree, he spent the next 12 years working at the Eye Research Institute in Boston, studying the infrared sensory system of rattlesnakes and then returned to his work on glial cells. Since 1990, he has been at the University of Minnesota, where he holds the Distinguished McKnight University Professorship in the Neuroscience Dept. His wife is also an MIT alum (undergrad and graduate) and they have a son and daughter.

Marshall Devor (Ph.D. '75) studied neuroanatomical plasticity in the olfactory cortex and then went on to Jerusalem to pursue plasticity and affect in the lab of Patrick Wall, a former MIT professor. Their work on neural plasticity associated with nerve injury also contributed to current understanding of chronic neuropathic pain. He became a full professor in 1988 and served two terms as chair of the Dept. of Cell and Animal Biology of the Hebrew University of Jerusalem. His newest project asks how general anesthetic drugs permit painless surgery.

Tom Finger (Ph.D. '75) is a professor at the Rocky Mountain Taste and Smell Center at the University of Colorado Medical School doing research on chemical senses and development. He is happily still researching fish brains amongst other things. He says he loved his years at MIT and "...I appreciate in retrospect my exposure to psychophysics and psycholinguistics even though I was less appreciative when that was occurring." However, we never know how things will work out, and he spent time on a study section at NIH that used to review psycholinguistics grant proposals along with those dealing with smell and taste.

Moshe Leibler (Ph.D. '76) currently lives in the Binyamin region of Israel. He met and married his wife while at MIT and they currently have 12 children and several grandchildren. Since 1983 he has been working as an educational psychologist and family therapist. His special interest is in traumatic responses to terrorist attacks. He made his decision in 1983 to take on a more therapeutic orientation in order to find a suitable job.

The Health and Sciences section of the December 16, 2003 issue of the Boston Globe featured and article on BCS Alumna (Ph.D. '92) and Harvard neurologist Dr. Alice Flaherty's then forthcoming book (published in January 2004), *The Midnight Disease: The Drive to Write, Writer's Block, and the Creative Brain*. Alice explores hypergraphia, the overwhelming desire to write, as well as writer's block. She points out that the drive to create is not the same as talent. She sees the drive as another disease, with a neurological basis, affecting part of the basal ganglia.

David Poeppel (Ph.D. '95) did a postdoc at UCSF working mostly on functional neuroimaging studies of hearing, speech perception, and language processing. In 1998, he moved to the University of Maryland College Park where he is on the faculty of the Departments of Biology and Linguistics. He developed the Cognitive Neuroscience of Language Lab there and they work on a range from neurophysiological studies of basic auditory processing to speech perception and sentence processing to theoretical semantics using timing-sensitive methods (EEG, MEG, eye-tracking) as well as imaging techniques (PET, fMRI) to study the neural basis of speech and language. He and wife Amy now have 3 sons.

Ralph Hyre (SB '85) studied machine vision and worked with software that tested some assumptions of John Rubin's (Ph.D. '86) doctoral thesis regarding the ability of double-opponent cells in the optical cortex to determine whether changes in a scene were due to changes in materials. When Ralph left MIT, he took a full-time position at CMU, but has since turned to consulting work doing human factors and user interface design work.

Susanna Mierau (SB '00) studied systems neuroscience at MIT and then went to the University of Oxford for a D.Phil in neuroscience. From there, she plans to attend Harvard Medical School's "New Pathway" program to get her M.D. Eventually, she would like to combine clinical work, research, and teaching. She particularly enjoyed the classes that mixed grad and undergrad students and the access to participation in research, including connections with labs at Harvard and MGH.

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