Clearly a breakthrough for better understanding how brain works

By Andrew Myers

Combining neuroscience and chemical engineering, researchers at Stanford have developed a process that renders a mouse brain transparent.

The postmortem brain remains whole — not sliced or sectioned in any way — with its three-dimensional complexity of fine wiring and molecular structures completely intact and able to be measured and probed at will with visible light and chemicals.

Researchers have developed a process that renders a mouse brain transparent. The “invisible” brain (right) remains whole — not sliced or sectioned in any way — with its three-dimensional complexity of fine wiring and molecular structures intact and able to be measured and probed with visible light and chemicals.

Different brains respond similarly to music, study says

By Bruce Goldman

Do the brains of different people listening to the same piece of music actually respond in the same way? An imaging study by scientists at the School of Medicine says the answer is yes, which may in part explain why music plays such a big role in our social existence.

The investigators used functional magnetic resonance imaging to identify a distributed network of brain structures whose activity levels waxed and waned in a strikingly similar pattern among study participants as they listened to classical music they’d never experienced before. The process, called CLARITY, ushered in an entirely new era of whole-organ imaging that stands to fundamentally change our scientific understanding of the most important but least understood organs, the brain, and potentially other organs, as well.

The process

COurtesy Of the Deisseroth lab

In a single day working as a medical volunteer in the second-poorest county in the United States — where life expectancy for men is 47, lower than it is in Haiti, and an overburdened staff and underfunded hospital daily face epidemic levels of alcoholism, diabetes and suicide — Chattopadhyay had experienced firsthand the thrill of making a difference.

“It was awesome. It was incredible. I was standing at the head of the operating table, having a conversation with the mother, who had received an epidural. I could see the obstetrician moving aside her uterus,” she said, glowing with excitement when she returned to the emergency room staff office at the 36-bed Rosebud Indian Health Service Hospital, where she and several Stanford students were stationed for the day. “I got to do so much. The doctors really loved teaching us.”

Chattopadhyay was

A study led by Nigam Shah finds that mining clinical notes could yield signs of harmful drug reactions.

By Krista Conger

Researchers at the School of Medicine have devised an entirely novel way to block biological signaling pathways that, when overactive, lead to many types of cancers.

They’ve done so by disrupting the function of a mediator, or scaffold, protein that brings together key members of the pathway and promotes their interaction to stimulate cell growth and division.

Blocking the function of the scaffold protein, or even removing it entirely, impeded the development of chemically induced skin cancers in laboratory mice and extended the life span of mice with established pancreatic tumors, the researchers say. It also significantly slowed the growth in laboratory culture of human melanoma cells that had become resistant to a new, targeted cancer treatment called vemurafenib (marketed as Zelboraf).

The versatility of the technique, as well as its apparent ability to tackle drug-resistant cancers, indicates that targeting scaffold proteins may lead to a new class of cancer therapies in humans.

Blocking scaffold protein inhibits cancer growth, new study finds

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The Rosebud Sioux Reservation, on the plains of South Dakota, is not your typical destination for spring break, but it’s where 14 Stanford students, including seven medical students, spent theirs last month.

The Rosebud Sioux Reservation.
Scientists transform skin cells into cells that insulate neurons

By Christopher Vaughan

Researchers at the School of Medicine have succeeded in transforming skin cells directly into oligodendrocyte precursor cells, which wrap nerve cells in the insulating myelin sheaths that help nerve signals propagate.

The current research was done in mice and rats. If the approach also works with human cells, it could eventually lead to cell therapies for diseases like inherited leukodystrophies — disorders of the brain's white matter — and multiple sclerosis, as well as spinal cord injuries.

The study was published online April 14 in Nature Biotechnology.

Without myelin to insulate neurons, damaged nerve cells can't conduct electrical signals and quickly lose power. Diseases that attack myelin, such as multiple sclerosis, result in nerve signals that are not as efficient and cannot travel as far. The condition is generally fatal.

Myelin disorders can affect nerve signal transmission in the brain and spinal cord leading to cognitive, motor and sensory problems. Previous research in rodent disease models has shown that transplanted oligodendrocyte precursor cells derived from embryonic stem cells and from human fetal brain tissue can successfully create myelin sheaths around nerve cells, sometimes leading to dramatic improvements in symptoms.

Unfortunately, the availability of human fetal tissue is extremely limited, and the creation of OCPs from embryonic cells has faced significant hurdles. The study’s senior author, Marius Wernig, MD, assistant professor of pathology and a member of Stanford's Institute for Stem Cell Biology and Regenerative Medicine, and Paul Costello, PhD, director of the Office of Communications and Public Affairs, authored an editorial to accompany the study.

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“It appeared we wouldn’t be able to create enough human OCPs for widespread therapeutic use, so we began to think if we could create them directly from skin cells,” Nan Yang, PhD, a postdoctoral scholar in the Wernig laboratory and lead author of the study, said. "This allows us to avoid the problem of immune rejection which is a major complication in transplantation medicine.”

Nan Yang, Wernig’s team successfully created human nerve cells out of skin cells. Other researchers had successfully used a similar process to turn skin cells into embryonic-like pluripotent stem cells, and then grow those IPS cells into nerve cells, but Wernig’s lab has finally converted skin cells directly into nerve cells without the intermediate IPS cell step.

Nan Yang’s current research project also involved directly converting skin cells into OCPs without having to create IPS cells. The researchers showed that mouse and rat skin cells could be directly converted but defining curves and angles were retained, and the foreign-number symbols — the same sound or a similar one (“won” and “tree,” respectively). The larger pool of generic neurons, the “visual numeral area” preferred real numerals to the false fonts and to same-meaning or similar-sounding words.

It seems, Parvizi said, that “evolution has designed this brain region to detect visual stimuli such as lines intersecting at various angles. The visual system of a monkey has to make sense of quickly when swinging from branch to branch in a dense jungle.” The adaptation of one part of this region into a part of the brain’s visual area represents a beautiful intersection of culture and neurobiology, he said.

Having nailed down a specifically numeral-oriented spot in the brain, Parvizi’s lab is looking to use it in tracing the pathways described by the brain’s number-processing circuitry. “Neurons that fire together wire together,” he said. Shum and other researchers are looking to see how particular areas connect with and communicate with other parts of the brain.

The study was funded by the National Institutes of Health, the Stanford NeuroVentures Program and the School of Medicine’s Medical Scholars Research Program. Other co-authors include Dora Hermes, PhD, Brett Foster, PhD, Mohammad Dasteredi, PhD, and Jonathan Winawer, PhD; research assistant Vinitha Rangarajan; and neurosurgery resident Keerti, MD.

The Department of Neurobiology and Neurological Sciences also supported this work.

Researchers transform skin cells into cells that insulate neurons

By Bruce Goldman

Scientists at the School of Medicine have determined the precise anatomical coordinates of a brain “hot spot,” meaning only about one-fifth of an inch across, that is preferentially activated when people view the ordinary numerals we learn early on in elementary school, like “6” or “8.”

Activity in this spot relative to neighboring sites drops off substantially when people are presented with numbers that are spelled out (“one” instead of “1”), homophones such as “won” instead of “1”) or “false fonts,” in which a numeral or letter has been altered.

“This is the first-ever study to show the existence of a hot spot for numeral cells in the human brain that specializes in processing numerals,” said Joseph Parvizi, MD, PhD, associate professor of neurology and neuropsychology and director of Stanford’s Human Intracranial Cognitive Electrophysiology Program. “In this small nerve-cell population, we saw a much bigger response to numerals than to similar-meaning, similar-sounding and similar-meaning symbols.

‘It’s a dramatic demonstration of our brain circuitry’s capacity to change in response to education,” he added. “No one is born with the innate ability to recognize a numeral. Finding fires a door to further discoveries delineating the flow of math-focused information processing in the brain. It also could have direct clinical ramifications for patients with dyslexia for numbers and with dyscalculia: the inability to process numbers and with dyscalculia: the inability to process

Intracranial Cognitive Electrophysiology Program. “In our experience, this behavior is not limited to people with dyslexia. It also could have diagnostic implications for patients with autism: the syndrome that disrupts the brain’s function, had been undertaken so that the patients could be monitored for several days to determine exactly where the seizure’s origination points. While these patients are bedridden in the hospital for as much as a week of such monitoring, they are fully conscious, in no pain and, frankly, a bit bored.

Over time, Parvizi identified seven epi-lepsy patients with electrode coverage in or near the inferior temporal gyrus and got these patients’ consent to undergo about an hour’s worth of tests. The data were captured on a laptop computer screen, while activity in the brain regions responsible by electrodes was recorded. Each electrode picked up activity from an area corresponding to about a half-mil-lion nerve cells (a drop in the bucket in comparison to the brain’s roughly 100 billion cells).

To make sure that any numeral-responsive brain areas identified were really responding to numerals — and not just responses to similar symbols and curves — the tests were carefully calibrated to distinguish brain re-sponses to visual presentations of the classic numerals taught in Western schools, such as 0 or 50, as opposed to spaguetti letters, lines of the alphabet, number-denot-ing words such as “three” or “fifty,” and symbols that in English are also numerals but that are not related to the Thai, Tibetan and Devanagari languages — were extremely unlikely to be recognized as such by this particular group of volunteers.

In the first test, subjects were shown simple single numerals and letters — along with false fonts, in which the component parts of numerals or letters had been scrambled but defining curves and angles were retained, and the foreign-number symbols — the same sound or a similar one (“won” and “tree,” respectively). All four brains are shaped slightly differently. But in almost the identical spot within each study subject’s brain, the investigators observed a significantly larger response to numerals than to similar-styled stimuli, such as letters or scribbles or words that either meant the same as the numerals or sounded like them.

Interestingly, said Parvizi, that numeral-processing nerve-cell cluster is parked within a larger group of neu-rons that is activated by visual symbols that have lines with angles or curves, such as “1” and “3.” In a study he showed a preference for numerals compared with words that denoted or sound like those numerals,” he said. “But in many cases, these sites actually responded strongly to scrambled letters or scrambled numerals. Still, within this larger pool of generic neurons, the ‘visual numeral area’ preferred real numerals to the false fonts and to same-meaning or similar-sounding words.

Not, that is, until fourth-year medical student Jen-ni Shum, who also is working in Parvizi’s lab, noticed that, among some of the subjects in the first study, a spot in the inferior temporal gyrus seemed to be sub-stantially activated by math symbols. Charged with verifying that observation was consistent from one patient to the next, Shum, the study’s lead author, re-ported that this was indeed the case. So, Parvizi’s team designed a new study to look into it further.

The new study relied on epileptic volunteers who, as a first step toward possible surgery to relieve unre-tarded seizures that were triggered by their own drugs, had a small section of their skulls removed and electrodes applied directly to the brain’s surface. The procedure, which doesn’t involve any brain tissue that disrupt the brain’s function, had been undertaken so that the patients could be monitored for several days to determine exactly where the seizure’s origination points. While these patients are bedridden in the hospital for as much as a week of such monitoring, they are fully conscious, in no pain and, frankly, a bit bored.

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Anesthesia increases success rates of turning breech babies, reduces delivery costs, study finds

By Tina Shaikh-Lesko

Most people know that the way to stay in shape is to exercise and eat right, but millions of Americans struggle to meet those goals, or even decide which to change first.

Now, researchers at the School of Medicine have discovered that focusing on changing the diet at the same time gives a bigger boost than tackling them sequentially. They also found that focusing on changing diet first — an approach that many weight-loss programs advocate — may actually interfere with establishing a consistent exercise routine.

Their findings were published online April 21 in the Annals of Behavioral Medicine.

“How could it be particularly useful to start both at the same time,” said Abby King, PhD, lead author of the study and a professor of health research and policy and of medicine. “If you start with one, consider starting with physical activity first.”

The team published studies on how to introduce more of one shift in healthy habits report conflicting findings — and few have looked at exercise and dietary changes together. In examining the issue, the researchers also wanted to study people trying to lose weight, and the demands of their schedules didn’t give them enough time to make healthy dietary and exercise choices. The reasoning was that if successful programs could be developed for these time-strapped individuals, they would likely work for others as well.

Researchers split 200 initially inactive participants, ages 45 and older, with suboptimal diets, into four different groups. Each group received a different kind of telephone coaching. The first group learned to make changes to diet and exercise at the same time. The second group learned to make dietary changes first and didn’t try changing their exercise habits until a few months later. The third group reversed order and learned to change exercise habits before adding dietary advice. The fourth group, for comparison, did not make any dietary or exercise changes, but was taught stress-management techniques. Researchers tracked participants’ progress in all four groups for a year.

Despite the challenge of making multiple changes to their lifestyles, participants who began changing diet and exercise habits at the same time were most likely to meet national guidelines for exercise — 150 minutes per week — and nutrition — five to nine servings of fruit and vegetables, and keeping calories from saturated fats at 10 percent or less of their total intake.

Those who started with exercise first did a good job of meeting both the exercise and diet goals, not only as good as those who focused on diet and exercise simultaneously.

The participants who started with diet first did a good job meeting the dietary goals but didn’t meet their exercise goals. King, who also is a senior researcher at the Stanford Prevention Research Center, speculates this is because changing diet and introducing exercise both have unique challenges. “With dietary habits, you have no choice; you have to eat,” she said, “You don’t have that luxury for exercise.”

But, she said, finding time for exercise can be a challenge. Patients who have a busy schedule can be challenging. She pointed out that even the most successful group, those receiving the two behavioral health programs simultaneously, lagged behind in meeting the physical activity goal at first, though over the course of a year, eventually caught up to the other groups.

King credits the way health educators explained the dietary and exercise advice to participants for their overall success and the study’s high retention rate. They met with participants in person just once at the beginning of the one-year period. After that, they called once a month, spending as little as 10 to 15 minutes and no more than 40 minutes — providing advice and support for diet and exercise.

For the participants, whose schedules and stressful lives had previously interfered with making healthy lifestyle choices, this approach worked, King said. She said that telephoning participants was a convenient and flexible way to provide personalized information. “These health behaviors aren’t things that we change over a six-week period and then our job is done,” she said. “They’re things that people grapple with their whole lives, so we have to design ways of delivering interventions that are efficient ways of becoming more and more important.”

Participants in this study were not actively trying to lose weight, just trying to develop healthy habits. King’s next step is to test the same sequential versus simutaneous approaches among people who are trying to lose weight.

Other Stanford authors of the study include senior research scholar Cynthia Castro, PhD, statistical analyst David Ahn, PhD; and former postdoctoral scholars Matthew Buman, PhD, and Eric Heggstad, PhD (who are both now at Arizona State University) and Guido Urizar, PhD (now at Cal State Long Beach).

The study was supported by the National Institute on Aging and the National Heart, Lung and Blood Institute.
Brain
continued from page 1

is described in a paper published online April 10 in Nature by bioengineer and psychiatrist Karl Deisseroth, MD, PhD, leading a multidisciplinary team, including postdoctoral scholar Chuanhun Chuang, PhD.

“Studying intact systems with this sort of molecular resolution and global scope — to be able to see the fine detail and the big picture at the same time — has been a major unmet goal in biology, and a goal that CLARITY begins to address,” Deisseroth said.

“This feat of chemical engineering promises to transform the way we study the brain’s anatomy and how disease changes it,” said Thomas Paul, MD, director of the National Institute of Mental Health. “No longer will the in-depth study of our most important three-dimen-sional organ be constrained by two-dimensional methods.”

The research in this study was performed primarily on a mouse brain, but the researchers have used CLARITY on zebrafish and on preserved human brain samples with similar results, establishing a path for future studies of human samples and other organisms.

“CLARITY promises to revolutionize our understanding of how local and global changes in brain structure and function — activity trans-late into behavior,” said Paul Frankland, PhD, a senior scientist in neurosciences and mental health at the Hospital for Sick Children Research Institute in Toronto, who was not involved in the research. Frankland’s colleague, senior scientist Sheena Josselyn, PhD, added that the process could turn the brain from “a mysterious black box” into something essentially transparent.

An inscrutable place

The mound of convoluted grey matter and wiring that is the brain is a complex and inscrutable place. Neuroscientists have struggled to fully understand its circuitry in their quest to comprehend how the brain works, and why, sometimes, it doesn’t.

CLARITY is the result of a research effort in Deisseroth’s lab to extract the opaque elements — in particular the lipids — from a brain and yet keep the important features fully intact. Lipids are fatty molecules found throughout the brain and body. In the brain, especially, they help form cell membranes and give the brain much of its structure. Lipids pose a double challenge for biological study, however, because they make the brain largely impermeable both to chemicals and to light.

Neuroscientists would have liked to extract the lipids to reveal the brain’s fine structure without slicing or sectioning, but for one major hitch: removing these structurally important molecules causes the remaining tissue to fall apart.

Prior investigations have focused instead on automating the slicing/sectioning approach, or in treating the brain with organic solvents that facilitate the penetration of light only, but not macro-molecular probes. With CLARITY, Deisseroth’s team has taken a fundamentally different approach.

“We drew upon chemical engineering to transform biological tissue into a new state that is intact but optically transparent and permeable to macromolecules,” said Chung, the paper’s first author.

This new form is created by replacing the brain’s lipids with a hydrogel. The hydrogel is built from within the brain itself in a process conceptually similar to petrification, using what is initially a watery suspension of short, individual molecules known as hydrogel monomers. The intact, postmortem brain is immersed in the hydrogel solution, and the monomers infuse the tissue. Then, when “thermally triggered,” or heated slightly to about body temperature, the monomers begin to congeal into long molecular chains known as polymers, form-ing a mesh throughout the brain. This mesh holds everything together, but importantly, it does not bind to the lipids.

With the tissue shored up in this way, the team is able to visualize and rapidly extract lipids through a process called electrophoresis. What remains is a 3-D, transparent brain with all of its important structural components — neurons, axons, dendrites, synapses, proteins, nucleic acids and so forth — intact and in place.

Going things one better

CLARITY then goes one better. In preserving the full continuity of neuroanatomic structures, CLARITY not only allows tracing of individual neural connections over long distances through the brain, but also provides a way to gather rich, molecular information describing a cell’s function that is not possible with other methods.

“We thought that if we could remove the lipids nondestructively, we might be able to get both light and macromolecules to penetrate deep into tissue, allowing not only 3-D imaging, but also 3-D molecular analysis of the intact brain,” said Deisseroth, who holds the D.H. Chen Professorship.

Using fluorescent antibodies that are known to seek out and attach themselves only to specific proteins, Deisseroth’s team showed that it can target specific structures within the CLARITY-modified — or “clarified” — mouse brain and make those structures and only those structures light up under illumination. The researchers can trace neural circuits through the entire brain or deeply explore the nuances of local circuit wiring. They can see the relationships between cells and investigate subcellular structures. They can even look at chemical relationships of protein complexes, nucleic acids and neurotransmitters.

“Being able to determine the molecular structure of various cells and their contacts through antibody staining is a core capability of CLARITY, separate from the optical transparency, which enables us to visualize relationships among brain components in fundamentally new ways,” said Deisseroth, who is one of 15 experts on the ‘dream team’ that will map our goals for the $100 million brain research initiative announced April 2 by President Obama.

And in yet another significant capability from a research standpoint, researchers are now able to esteem the clarified brain, flushing out the fluorescent antibodies and repeating the staining process anew using different antibodies to explore different molecular targets in the same brain. This staining/destaining process can be repeated multiple times, the authors showed, and the different data sets aligned with one another.

Opening the door

CLARITY has accordingly made it possible to perform highly detailed, fine-structural analysis on intact brains — even human tissues that have been preserved for many years, the team showed. Transforming human brains into transparent-but-stable specimens with accessible wiring and molecular detail may yield improved understanding of the structural underpinnings of brain function and disease.

Beyond the immediate and apparent benefit to neuroscience, Deisseroth cautioned that CLARITY has leapfrogged our ability to deal with the data. “Turning massive amounts of data into useful insight poses immense computational challenges that will have to be addressed. We will have to develop improved computational approaches to image seg-mentation, 3-D image registration, automated tracing and image acquisi-tion,” he said.

Indeed, such pressures will increase as CLARITY could begin to support a deeper understanding of large-scale intact biological systems and organs, perhaps even entire organisms.

“Of particular interest for future study are intrasys-tem relationships, not only in the mammalian brain but also in other tissues or diseases for which full understanding is only possible when thorough analysis of single, intact systems can be conducted,” Deisseroth said. “CLARITY may be applicable to any biological sys-tem, and it will be interesting to see how other branches of biology may put it to use.”

Other co-authors include undergraduate student Jenelle Wallace; graduate students Sung-Yon Kim, Kelly Zalocusky, Joanna Mattis, Aleksandra Denzin and Logan Gronseick; research assistants Sandhiya Kalvanasundaram, Julie Mizrabekov, Sally Pak and Charu Ramakrishnan; postdoctoral scholars Aaron Andelman, PhD, and Tom Davison, PhD; former undergraduate student Hannah Bernstone, and former staff scientist Viviana Gradinaru.

The research was supported by the National Institute of Mental Health; the National Science Foundation; the Simons Foundation; the President and Provost of Stanford University; the Wiegars, Snyder, Reeves, Garthby and Yu foundations; the DARPA REPAIR program; and the Burroughs Wellcome Fund.

Stanford’s Department of Bioengi-neering also supported the work.

Andrew Myers is the associate direc-tor of communications for the School of Engineering.

“A fluorescent protein dye makes visible the connecting neurons in this clarified adult mouse brain. "We drew upon chemical engineering to transform biological tissue into a new state."”

Two types of neurons — eYFP-expressing neurons (green) and parvalbumin-positive neurons (red) — as well as non-neuronal glial cells (blue) can be seen with the help of molecular labeling in this 3-D rendering of the hippocampus in a clarified mouse brain.
Registration now open for fourth annual Stanford Women’s Health Forum set for May 15

The event, which will be held on the Arrillaga Alumni Center, is free, but seating is limited. To register, visit http://tinyurl.com/StanfordWSDM. Videos of the talks will be posted on the center’s website (http://womenhealth.stanford.edu) following the event.

The forum is sponsored by Granter, a Watsonville-based company that supplies concrete and building and road materials.

**Susan Love**

**The students and instructors visit Mount Rushmore, in the western part of South Dakota.**

**Christopher Gardner, PhD, associate professor of surgery and neurological sciences; on behalf of the Dr. Susan Love Research Foundation and What Can We Do.”**

**Renowned breast cancer specialist Susan Love, MD, will be the keynote speaker May 15 at the fourth annual Stanford Women’s Health Forum. Her talk will be titled “A Future Without Breast Cancer: Where Are We and What Can We Do.”**

Love, who served on the National Cancer Advisory Board, is a clinical professor of surgery at UCLA and president of the Dr. Susan Love Research Foundation. She is also author of the best-selling Dr. Susan Love’s Breast Book, now in its fifth edition. After years as a patient advocate, she faced her own illness: a diagnosis last year of acute myelogenous leukemia. She has since received a bone marrow transplant from her sister.

The recently established Stanford Center for Health Research on Women & Sex Differences in Medicine (WCS) is curating the afternoon-long forum.

Previous health forums have “an opportunity for people in the community to learn about important medical issues affecting women and about the groundbreaking research done at Stanford,” said Rachel Westphal, associate professor of obstetrics and gynecology and co-director of the center. “At this year’s forum, anyone who has been touched by cancer, either personally or through a loved one, will benefit from the discussions.”

On the reservation, the students experienced what one week can’t fix things,” said Adrian Begaye, who along with fellow third-year Stanford medical student Keith Glover instructed this year’s course and led the trip. Both men are tribal members of the Navajo Nation. “But we can come to a greater understanding of the needs of underserved populations and influence the course of some students’ careers,” Begaye added.

Staying in the Habitat for Humanity dorms in Mission, a community on the reservation, the 12 students in the class — only one of them, Layton Lamasan, was American Indian — and Begaye and Glover spent their days alternating between helping to build houses for the reservation, where poorly heated trailers are the norm, and volunteering at the hospital. The medical students were able to assist doctors while the under-graduates shadowed hospital staff. In the evenings, the students met with community leaders who taught them about such problems as the inaccessibility of nutri- tional food due to geographic isolation, and poor education due to difficulties recruiting teachers. Youth leader Shane Red Hawk discussed the levels of hope-lessness that have led the community to be ranked among those with the highest suicide rates in the world.

“We're looking for quarters under seat cushions,” said Salom, after hearing that they were short a medical machine would be down, and that there was no night OB doesn't even have an assistant. I can’t even imagine how they do it.”

At times, they don’t have a general surgeon, often the OB doesn’t even have an assistant. I can’t even imagine how they do it,” said Salom. “But they have returned to the hospital after suffering a severe fracture in her arm two months ago. Due to the lack of orthopaedic care, she was back again, her arm still in pain.

“Jade” said Daneshjou. “It’s the worst feeling in the world to sit somewhere and know that the ability exists to fix something, and just not see it get done. The doctors were visibly frustrated.”

Shaking her head in frustration, she listened to Chattopadhyay, the first-year medical student, who was still excited about helping to birth her first baby that day.

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Music continued from page 1

The new study is one in a series of collaborations between Saumendra Menon, the psychology professor at McGill University in Montreal, dating back to when Levitin was a visiting scholar at Stanford several years ago. “We made music, not language, that study participants’ brains would be tracking. Menon’s group used music that had been recorded up to ten years earlier, participants had heard before, in order to eliminate the confounding effects of having some participants who had heard the musical selection before while others were hearing it for the first time. Using obscure pieces of music also avoided tripping off memories, such as where participants were the first time they heard the selection.

The researchers settled on complete classical symphonic musical pieces by 18th-century English composer William Boyce, known for his musical categorization—‘as the English Bach’ because his late-baroque compositions are “the English Bach” because his late-baroque compositions are “the English Bach” because his late-baroque compositions are “the English Bach” because his late-baroque compositions.

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Music continued from page 1

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Music continued from page 1

The new study is one in a series of collaborations between Saumendra Menon, the psychology professor at McGill University in Montreal, dating back to when Levitin was a visiting scholar at Stanford several years ago. “We made music, not language, that study participants’ brains would be tracking. Menon’s group used music that had been recorded up to ten years earlier, participants had heard before, in order to eliminate the confounding effects of having some participants who had heard the musical selection before while others were hearing it for the first time. Using obscure pieces of music also avoided tripping off memories, such as where participants were the first time they heard the selection.

The researchers settled on complete classical symphonic musical pieces by 18th-century English composer William Boyce, known for his musical categorization—‘as the English Bach’ because his late-baroque compositions are “the English Bach” because his late-baroque compositions are “the English Bach” because his late-baroque compositions are “the English Bach” because his late-baroque compositions.

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Khavari continued from page 1

“...This could be a new type of tool for clinicians,” said Paul Khavari, MD, PhD, the Carl J. Herzog Professor and chair of the Department of Dermatology, as well as the director of the Center for Global Enrichment...”

Katherine Jameson, PhD, and postdoctoral scholar Brian Zarnegar, PhD, the Carl J. Herzog Professor and chair of the Department of Genetics and the T ech Museum of Innovation, have been named recipients of Stanford’s 2013 Community Partnership Awards.

The university’s Office of Public Affairs created the awards to honor the valuable partnerships that exist between Stanford and its neighbors, and to celebrate community efforts that successfully tackle real-world problems and advance the public good.

Inspiring visitors at a local science museum

Under Stanford at The Tech, The Tech Museum of Innovation gets up-to-date information for its exhibits and for a popular website, http://genetics.thechtech.org, as well as several scientific writings — graduate students and postdoctoral scholars — who act as docents and role models for K-12 visitors.

Stanford at The Tech was founded in 2003 as an outgrowth of the university’s Office of Public Affairs. The museum is housed in a building that was constructed to serve as the garage for Stanford’s first car. The Tech Museum is the result of a collaboration between Stanford University and the City of Menlo Park.

Stanford at The Tech booth at the Bay Area Science Festival, which is held in AT&T Park in San Francisco. Last year, about 400 people — mostly kids and families — stopped by the booth.

Tackling childhood obesity

Under Stanford GOALS, the Stanford Prevention Research Center has created a partnership between community groups that serve children on the Peninsula, were presented with the awards April 11.

A partnership between Stanford’s Center for Latin American Studies, the East Palo Alto Academy, People of Progress, the East Palo Alto Community Resource Center, also received a Community Partnership Award. The East Palo Alto Academy is a partnership of the East Palo Alto Police Department, the East Palo Alto Academy, People of Progress, and the East Palo Alto Community Resource Center.

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**William Newsome to lead interdisciplinary neuroscience institute**

**By Bjorn Carey**

William Newsome, PhD, a professor of neurobiology, has been appointed to direct Stanford's new interdisciplinary neuroscience institute.

The campus-wide brain research initiative will catalyze new interdisciplinary collaborations at the boundaries of traditional fields and array of disciplines.

"The study of the brain is no longer, if it ever was, just a problem of biology," said Newsome, who recently was appointed the Harman Family Provostial Professor. "In this age of rapid technological advances, we have the tools we need to ask fundamentally new questions about what kind of experiments make sense to do in this age of rapid technological advances."

Stanford University, Newsome said, is particularly well positioned to tackle the challenge. There are more than 100 neuroscientists at Stanford, distributed among 14 departments. The institute has been discussed for more than a year, but a framework for encouraging interdisciplinary brain research has not yet existed; organizations such as Bio-X NeuroVentures and the Stanford Institute for Neuro-Innovation and Translational Neurosciences (iNTN) had been providing support and seed funding for adventurous neuroscience projects for the past several years.

"We are delighted that Bill Newsome has agreed to take on this directorship," said Ann Arvin, MD, the university's vice provost and dean of research. "Bill is an extraordinary researcher and scientist who has contributed many remarkable insights about the fundamental brain processes of decision making — that is, how brain circuits compute risk and reward. We are delighted to add: Bill's understanding and appreciation of neuroscience runs the full spectrum from molecules to behavior."

Lloyd Minor, MD, dean of the School of Medicine, is similarly optimistic about Newsome's knack for fostering exciting cross-discipline research. "Bill is an extraordinary researcher and scholar. He is a creative thinker and wonderful at promoting collaboration and collegiality," said Minor, a professor of otolaryngology. "He excels at bringing people together from all stages of research, from theoretical to experimental to clinical to technology transfer, and creates a vibrant and engaging environment. I am extremely enthusiastic about him leading this new institute."

As vice president for university-level support for the new institute, Newsome said, Stanford's excellent foundation can be leveraged to establish new collaborative research communities and new sources of support. "Where else can you find world-class psychology, clinical research, computer science, biology, physics, neuroscience and engineering departments all within 200 yards of each other?" Newsome said. "The membranes that divide the usual academic structures are porous at Stanford, of a greater density between schools and departments on a regular basis. We want to make that easier and happen more often so we can launch a broad, sustained interdisciplinary attack on solving the problems of the brain."

A committee of faculty leaders has been planning the institute's make-up for more than a year and identified six major research themes that will form the backbone of the effort.

• The Language of the Brain: Cracking the Neural Code
• Enhancing the Brain: Brain-Machine Interfaces and Neuro modulation
• Understanding Human Thought: Decisions, Cognition, and Emotion
• The Brain in Disease: Neurological and Psychiatric Disorders
• The Changing Brain: Development, Learning and Aging
• Neuroscience for Society: Education, Law and Business

"One of Newsome's first efforts will be to meet with faculty from various departments that have a stake in current neuroscience research at Stanford, as well as with faculty and departments who are new to the field, to discuss how they might get involved."

"I think most people will be able to look at these six initiatives and see where they fit in, but we'll need interdisciplinary leadership to determine where the best research opportunities lie," he said. "Which of these areas of study take flight will depend on the scientific opportunities that emerge, and where faculty and students band together to work cooperatively on an important research goal."

The new institute, which will be headquartered in Bio-X's Clark Center, will seek to attract new faculty — the "glue people" Newsome describes as having a foot in neuroscience while coming from another discipline — in order to catalyze novel interactions between current faculty and make new and different science possible. Another major focus will involve raising funds to support young researchers, specifically graduate students and postdoctoral fellows who may already have a degree or PhD in a relevant discipline but want to learn neuroscience.

"Our educational initiatives will fundamentally be about giving students and postdocs the freedom to cross disciplines and learn a new field, so their independent research careers will add greater richness to study of the brain," Newsome said. "They'll be the young faculty of tomorrow."

Newsome is also the director of the Bio-X NeuroVentures program, which has co-lead the working group for President Obama's $100 million Brain Initiative, which also will seek interdisciplinary solutions to unraveling the mysteries of the brain.

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**Grants proposals sought for research in immunity, transplantation, infection**

**By Bjorn Carey**

Grant applications are now being accepted for innovative research in the areas of immunity, transplantation and infection.

Several grants of $50,000 will be made to selected faculty projects. Young investigator awards of $25,000 will go to selected projects led by Stanford postdoctoral scholars, clinical fellows, research associates and instructors.

The School of Medicine's Institute for Immunity, Transplantation and Infection, which is overseeing the selection process, will give preference to interdisciplinary projects and those that have a disease focus. Applicants are encouraged to address critical questions in the key areas of pediatrics and obstetrics, sarcoidosis, transplant tolerance, allergies, infectious diseases, autoimmune disease and new methods of analyzing blood and other clinical samples.

Faculty applicants should hold university, research or medical-center-line positions, and an active collaboration between two or more faculty members from different disciplines is required for proposals. Collaborations between basic and physician scientists are especially encouraged.

The submission deadline for grant proposals is 5:30 p.m. April 30. For more information, visit http://med.stanford.edu/rmg/fund- ing/itri_interdisc.html or contact Michele King at mking@stanford.edu or 723-3084.

**Student research symposium set for May 2**

Nearly 50 MD and MD/PhD students will showcase their research projects, ranging in topic from risk factors for autism during pregnancy to immunologically transgenic diabetes, like myself, are geriatric medical justice detainees, at the 30th annual Stanford Medical Student Research Symposium.

The event, which is free and open to the public, kicks off at 3 p.m. May 2 in the Ford Rec Center for Learning and Knowledge. From 3 to 5:30 p.m., students will discuss their research, which will be highlighted with poster displays. Each of the projects involved researching a different contemporary health issue. The research was carried out in laboratories at branching points of the local and abroad. At 5:45 p.m., the alumni association will announce the students with the outstanding poster presentations.

For more information, contact Maria Miranda, director of medical student research and scholarship, at mara@stanford.edu.

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**New clinical trials website honored**

The Stanford Clinical Trials Directory was named "best new website" by communications representatives from the 62 National Institutes of Health institutions that make up the National Institute of Health's Clinical and Translational Science Award consortium.

The "best new website" award is one of several honors bestowed each year on selected consortium members, that recognize communications tools and resources that support the CTSA program's mission to accelerate research that enhances public health.

Stanford's new clinical trials directory makes it easier for patients to locate trials related to their medical conditions using nontechnical searches. It also allows Stanford groups to display a list of condition-specific clinical trials from their home pages. In addition, a pass word-protected, back-end element of this tool enables clinical trial administrators to more efficiently manage study recruitment using it's 'friends' dashboard that allows real-time website analytics.

This project was developed by an Information Resources & Technology team led by Richard Renn, manager of web and mobile development, and Donald Mitchell, director of systems engineering and architecture, Stanford Hospital & Clinics. Lucile Packard Children's Hospital, the Stanford Cancer Institute and Spectrum also participated in its development, which was partially funded through Spectrum's NIH CTSA Award.

Faculty and researchers can try out the new trials directory at http://med.stanford.edu/clinicaltrials.

**April 16 Senate meeting minutes now online**

At its April 16 meeting, the School of Medicine's faculty senate heard a report from Amir Dan Rubin, president and CEO of Stanford Hospital & Clinics, who discussed the hospital’s goals and new projects.

Maurice Druzin, MD, professor of obstetrics and gynecology, gave an update on the Committee on Performance, Professionalism and Promotion, which he chairs.

Medical school faculty can download the complete minutes of the senate meeting by visiting http:// med.stanford.edu/senate.

The next senate meeting is scheduled for May 21. Clarence Bradbrook, MD, will preside and will report on the Committee on Curriculum and Academic Policy, which he chairs.

Dan Herschlag, PhD, professor of biochemistry and senior associate dean of graduate education, will report on postdoctoral affairs, which he chairs.