INCUBATOR
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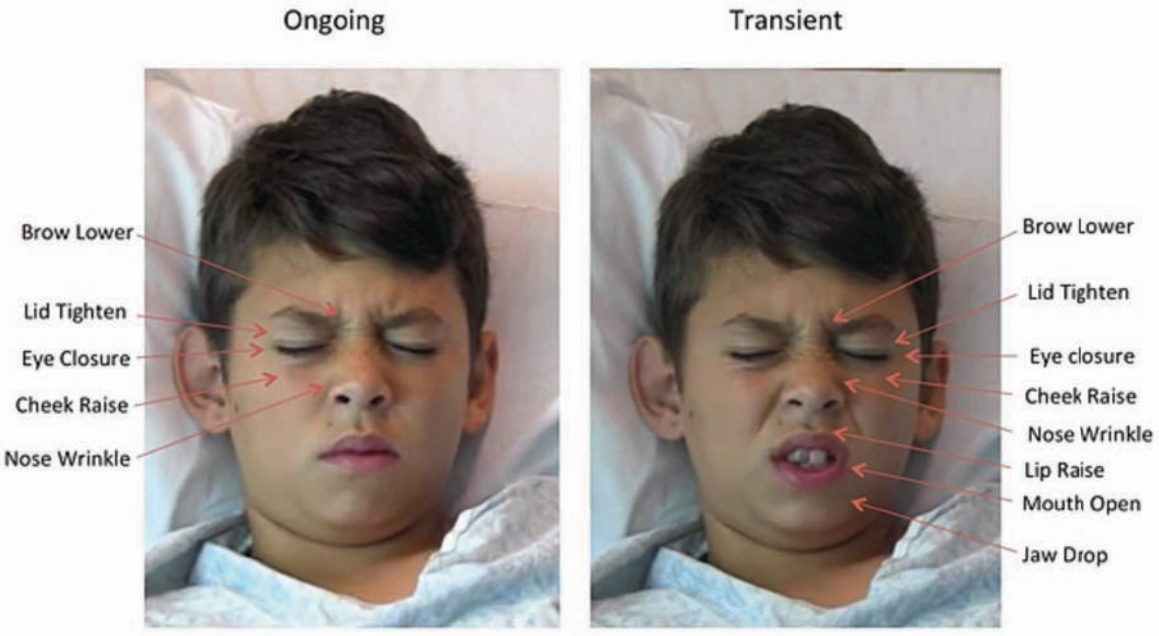
In this Issue:

Staring Pain in the Face – Software "Reads" Kids' Expressions to Measure Pain Level

Accurately assessing pain in children in a clinical setting can be difficult. A study by researchers at the University of California, San Diego School of Medicine has demonstrated the validity of a new method for measuring pediatric pain levels using novel facial pattern recognition software.

The study will publish online June 1 in the journal Pediatrics.

"The current methods by which we analyze pain in kids are suboptimal," said senior author Jeannie Huang, MD, MPH, a professor in the UC San Diego School of Medicine Department of Pediatrics and a gastroenterologist at Rady Children's Hospital-San Diego. "In this study, we developed and tested a new instrument, which allowed us to automatically assess pain in children in a clinical setting. We believe this technology, which enables continuous pain monitoring, can lead to better and more timely pain management."



Examples of a child's facial expressions of pain from the study, illustrating many of the core facial actions observed in pain.

Pain in the Face, cont from page 1

The researchers used the software to analyze pain-related facial expressions from video taken of 50 youths, ages five to 18 years old, who had undergone laparoscopic appendectomies at Rady Children's Hospital-San Diego. Based on the analysis, along with clinical data input by the study team, the software provided pain level scores for each participant.

Huang said controlling pain is important, not only for the child's comfort, but also for recovery. Studies have shown that under-treatment of pain is associated with adverse surgical outcomes. "Accurate assessment of pain is a fundamental tenet of delivery of care," she said.

Several issues, particularly age-related communication difficulties, make existing pediatric pain assessment methods problematic, said Huang. "The current gold standard for measuring pain is self-reporting," she said, noting patients are generally asked to rate their pain on a scale of zero to 10. "But in pediatrics there is a limited population of kids who can answer that question in a meaningful way. Younger children can have difficulty - a two-year-old hasn't developed the cognitive and conceptual abilities to think in those terms."

Clinical pain assessments, aided by nurses or parents, are often used in lieu of patient self-report in children because of these limitations. However, several previous studies have shown nursing staff may have difficulty accurately estimating pain (often underestimating pain), particularly among pediatric patients. Parents are generally more in tune with their children's pain levels, but may not always be available, said Huang.

Another problem with pain assessment protocols, Huang added, is that pain checks tend to be scheduled and consequently may not coincide with times when pain occurs and when intervention is needed. "Pain assessments are typically scheduled along with vital signs, the frequency of which can vary from every 4 to 8 hours depending on patient severity."

In the study, researchers filmed the participants at three different visits post-surgery: within 24 hours after an appendectomy; one calendar day after the first visit and at a follow-up visit 2 to 4 weeks after surgery. Facial video recordings and self-reported pain ratings by the participant and pain ratings by parents and nurses were collected.

The research team sought to determine the software's accuracy at pain measurement as compared to self-reporting by the child and as compared to by proxy estimations by parents and nurses. The software prototype utilized data collected via prior software (Computer Expression Recognition Toolbox) by study co-author Marian Bartlett, PhD, at UC San Diego's Institute for Neural Computation, which utilizes computer vision techniques to analyze facial expressions based on the Facial Action Coding System (FACS). FACS measures facial expressions using 46 anatomically based component movements and has been used in many studies by Kenneth Craig, PhD, a professor of psychology at the University of British Columbia, a world renowned pain expert, and one of the study's co-authors.

The use of FACS in the past has allowed for identification of pain-related facial movements, but this project took facial movement and pain analysis one step further. In the software prototype, the study's authors translated the facial movement data into a pain score and then

Computer Expression Recognition Toolbox (CERT) is an end-to-end system for fully automated facial expression recognition that operates in real-time.

Pain in the Face, cont from page 2

compared that with the information collected from the child's self-reporting and the parent and nurse by proxy pain estimations.

"The software demonstrated good-to-excellent accuracy in assessing pain conditions," said Huang. "Overall, this technology performed equivalent to parents and better than nurses. It also showed strong correlations with patient self-reported pain ratings." The software also did not demonstrate bias in pain assessment by ethnicity, race, gender, or age in the patient cohort studied.

Since the instrument is capable of "operating in real-time and continuously," using this approach to alert clinicians to instances of pain at the time they occur instead of during scheduled assessments might enhance efficient, timely allocation of pain interventions, noted Huang. Furthermore, such technology could potentially advocate for youth in pain when their parents are unavailable to notify medical staff regarding their child's pain level.

Huang said the approach requires further investigation with other forms of clinical pain and across the broad age range of children. "It still needs to be determined whether such a tool can be easily integrated into clinical workflow and thus add benefit to current clinical pain assessment methods and ultimately treatment paradigms," she said.

Coauthors include Karan Sikka, Alex Ahmed, and Damaris Diaz, UCSD; and Matthew Goodwin, Northeastern University.

The above story is reprinted from materials provided by UCSD News Center.

The original article was written by Bonnie Ward.

Hooked On Learning

Popular online class offers practical tips based on brain-based research on how to improve learning skills

"Learning How to Learn," the most popular massive open online course (or MOOC) offered by UC San Diego to date, is starting again July. 13. Based on research in neuroscience and cognitive psychology, the four-week class drew nearly 200,000 people from around the world in August and appears to be the only university MOOC of its kind: It focuses on learning itself. And it presents practical tips that can be put to use by learners of all stripes.

UC San Diego students – undergraduate and graduate – and faculty members, too, are urged to register for the class. Taking and completing the course is free. Coursera, the online provider, charges $49 for a "Verified Certificate" but that's voluntary and optional. The only requirements are an internet connection and a weekly time commitment of three to four hours.

Register for "Hooked on Learning" here.

"Learning How to Learn" was launched in the summer of 2014. At a time when the campus appears quieter than normal – as many students and faculty pursue their work in communities away from La Jolla – 197,000 people from more

Hooked On Learning, cont from page 3

than 200 countries came to UC San Diego virtually. The class proved not only hugely popular but also, in the words of one of its two co-instructors, seemed to "strike a chord."

Jeff Elman, dean emeritus of the UC San Diego Division of Social Sciences who is a campus lead on online and technology-enhanced education, monitored the forums of "Learning How to Learn." He was impressed, he said, by the levels of student engagement with the material and the instructors. And he also came to appreciate keenly just how many people, even those who are apparently successful and have advanced degrees, feel they have difficulties learning.

"The ability to learn requires skills that are rarely taught in a systematic or deep way," said Elman, distinguished professor of cognitive science at UC San Diego. "The closest we get is advice on study habits, the sort of stuff you might hear in your high-school homeroom. But that barely scratches the surface, and it is usually superficial and often wrong. Learning to learn involves a whole lot more than good study habits."

The class, which is subtitled "Powerful Mental Tools to Help You Master Tough Subjects," is taught by Barbara Oakley, a professor of engineering at Oakland University in Rochester, Michigan, and Terry Sejnowski, Francis Crick Professor at the Salk Institute and distinguished professor of neurobiology and co-director of UC San Diego's Institute for Neural Computation and of the Temporal Dynamics of Learning Center.

Both instructors emphasize that the class applies to learning in any discipline. The course covers what we know about the brain – from its different learning modes to how it "chunks" information or falls into procrastination habits – and draws on techniques practiced by experts in art, music, literature, math, science, sports and many other fields.

The UC San Diego course grew out of a visit Oakley made to UC San Diego's Temporal Dynamics of Learning Center (TDLC) in March 2013. Sponsored by the Educator Network of the TDLC as part of "Brain Awareness Week," Oakley gave a lecture on learning that was attended by faculty and students and broadcast to local high schools through webinar. The talk was well received, Sejnowski said, and "we thought that a wider audience would benefit from knowing what we have learned about learning in the brain."

The TDLC itself, Elman notes, is a testament to the growing realization that learning is a subject worthy of serious study. One of six Science of Learning centers funded by the National Science Foundation, the TDLC is, among other things, he said, showing us that "we shouldn't be thinking of learners as sponges into which we drip knowledge. The learner has to play an active role that goes well beyond absorption."

Elman considers the MOOC a form of public service. No university resources were used in its creation, he said, but many learners, both off-campus and on, stand to gain.

"What's important about 'Learning How to Learn'," Elman said, "and what differentiates it from other courses is that it serves as a foundation for learning anything, whether a new language, a science skill or how to read history critically." Students of all kinds will benefit from enrolling, as will faculty and other educators, both for their own ongoing learning and because it models effective teaching, he said.

The course is also fun. Guest lecturers make frequent appearances – and zombies, too.

The above story is reprinted from materials provided by UCSD News Center.

The original article was written by Inga Kiderra.

Staff Spotlight - Carmela Arstill

Making TDLC Accessible to Everyone

We sat down with Carmela Arstill, who joined TDLC in 2014 in order to provide a variety of opportunities for students both inside and outside of TDLC. We asked her about her background and current responsibilities.

- Can you tell us a bit about where you came from, and why you decided to work for the TDLC?

I grew up in Arizona, but I did my undergrad here at UCSD. I was a pre-med major, but somewhere along the way, I decided to switch to biology/ psychology. I went on to attend USC to do my graduate work, where I completed my Master's degrees in Computers and in Education. I stayed in L.A. and taught middle school for seven years, then moved back to San Diego, and I have been here for eighteen years. I worked in science outreach for UCSD's School of Medicine for almost eleven years., working with seventh through twelfth graders on science fair projects and internships. When our grant finished, I ended up as Event Sales Director at a country club for two years, selling weddings and events. Totally different field, but valuable nonetheless. I acquired valuable business and financial skill sets and made a ton of money, but I hated the high-pressure sales. I enjoyed educating clients, though, because sales is a form of educating customers about products, and I have always been an educator.

When this position opened up, I happily took a pay cut because I love UCSD and really wanted to come back into academia. I love working with students, and it's really fun to see them transition from students to scientists. That's probably the biggest reason why I decided to come back.

- What are your current roles at TDLC?

One of my responsibilities is to increase diversity within TDLC. I attend diversity forums and other recruiting events at universities and community

colleges to offer opportunities for the students, as well as inform the school administrators about them. I recruit students for our Research Experience for Undergraduate (REU) program, for instance. It's been successful so far: we've had two diversity forums in a year, and I've already recruited twelve students to apply to the REU program, with two currently in the 2014–15 cohort.

Another part of my work is the translational aspect of outreach. We are currently evaluating opportunities for us to work with schools and bring our science to the classrooms.

- For your outreach work, what kind of students are you trying to reach to?

The goal of our diversity and outreach efforts are to include everyone for all of our TDLC programs. We want to make them accessible to everyone,. For example, when we participate in the Southern

The Research Experience for Undergraduates (REU) program is funded by a grant from the National Science Foundation for the purpose of training undergraduate students in the specific research areas of TDLC.

California Forum for Diversity in Graduate Education, we reach out to everyone. I take e-mails from any potential student, and inform them of opportunities and information that would help them get into UCSD and into one of our programs. I reach out to the schools and former students that I used to work with, and they tell their students about these opportunities. That way, our programs are more open to all schools and students.

Like in any job, part of getting into programs is whom you know. But we want to make them accessible to everyone, not just those students lucky enough to have a parent in the field or have friends that work for the university. It's about reaching out to people who don't know who we are and educating them about what we do and letting those students know they have access to our programs. We have programs all the way from the first year undergraduates, to graduates and postdocs. Letting everyone know about these programs is the way we promote the diversity.

- What are some of the programs that you promote?

Presently I am focusing on the REU program. We also work with the UC-HBCU initiative with Howard University. We provide an exchange-type program, where the scholars from the university are hosted by a UC campus to conduct research during the summer. Many of these students return to UC as master's or doctoral candidates.

We also have internships and outreach programs at the high school levels. For example, Dr. Chiba currently has some of her postdocs outreach at High Tech High and the Sweetwater Unified school district, going into the classrooms and discussing their research. Another thing we participate in is sending the winner of the Brain Bee competition to the national championship competition It's the "Spelling Bee" for Neuroscience, held here in San Diego every January.

- What are the challenges and improvements you have seen within TDLC?

The challenge is always having enough money to fully develop and implement programs, and continue training and support of the students, teachers, even scientists. Speaking from experience with outreach and training programs, the money doesn't go as far as one would think.

Improvements… I've been with TDLC a little over a year, so I can't address any 'improvements' as I never experienced any problems. But this year, I feel we have made progress in our outreach by recruiting more community college students to apply and participate in our programs, such as REU. Many people view a university as an Ivory Tower, exclusionary to those in lower financial and test score brackets. Through outreach

"I'm a huge believer in making the programs accessible to all learners. That's why I'm here and love what I do."

programs and events, we make our programs visible and accessible to all. UCSD is not just for FMR (5 mile radius) students, the 4.5-GPA students, or those with extensive research experience already. In fact, for our REU program, we encourage students with little to no research experience to apply. It's everybody that gets to try a piece of the university "pie", and we encourage everyone to apply to our programs even if they might fall just short of the minimum GPA or test scores, because we look at all parts of the student to determine if the student is a good fit. I think that's a big benefit to applicants and of TDLC's programs.

- I imagine the TDLC network really helps the students be exposed to research opportunities as well?

Absolutely! I envision TDLC as an octopus with eighteen arms. We have eighteen partner institutions and everybody's science feeds into the whole. If one student works in one lab, not only do they get to know the people in the lab, but they also build connections with many others in the center, even across country. They may work in one lab but apply to a different lab within TDLC the next year. How great is that? Getting to know principal investigators as their mentors leads to the students desiring to follow a research path, and applying to graduate school.

The neat part of my job is that I have the opportunity to work closely with undergraduates in the program, helping them to navigate the paths to their future; even working through their feelings of being overwhelmed and lost. I get to connect with them, almost as their 'mom away from mom'! Additionally, as I have outreach and diversity background and school and student connections, I have the ability to recruit diverse students interested in science to TDLC-UCSD. I'm a huge believer in making the programs accessible to all learners. That's why I'm here and love what I do.

□

SAN DIEGO brain bee

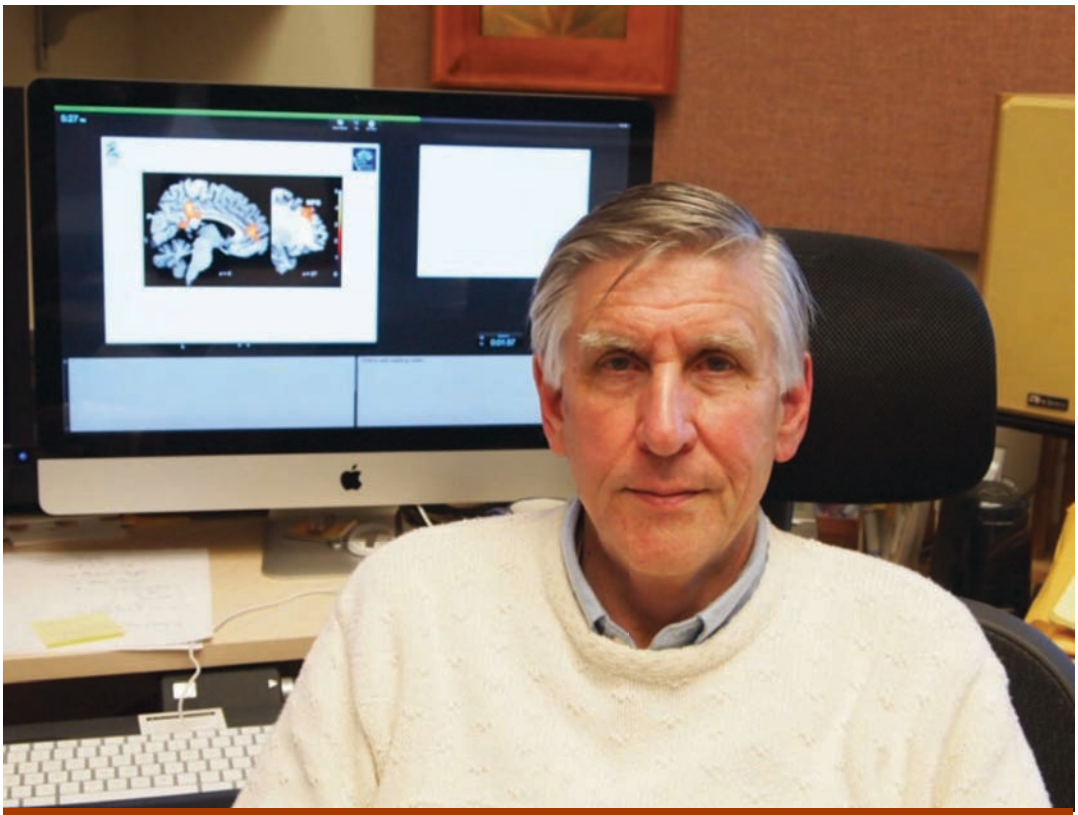
The California Forum for Diversity in Graduate Education

UC-HBCU

The Brain Bee competition, Southern California Forum for Diversity in Graduate Education and the UC-HBCU initiative are some of the outreach programs Carmela partakes in.

Faculty Interview - Scott Makeig

Music and neuroscience



Dr. Scott Makeig in his laboratory.

In December 2014, Dr. Scott Makeig has brought together researchers from five UC campuses to form the UC Music Experience Research Community Initiative (UC MERCI). The initiative won a $300,000 President's Research Catalyst Award, one of five such awards across the UC system announced by President Janet Napolitano (see Incubator Fall 2014). INC editor Tomoki Tsuchida sat down with Dr. Makeig to discuss his background, and how the UC MERCI came about.

- Congratulations on the research catalyst award! To get started, can you tell us a bit about your background?

I went to college at UC Berkeley back in the sixties. I didn't know what I wanted to study — I was studying music composition and mathematics, but I took many courses in different departments. It took me seven years to finish my degree, because I travelled to Europe and India, too. When I came back to finish my degree, I got interested also in psychology. So I called my degree "self," because to study the self, you have to study all topics!

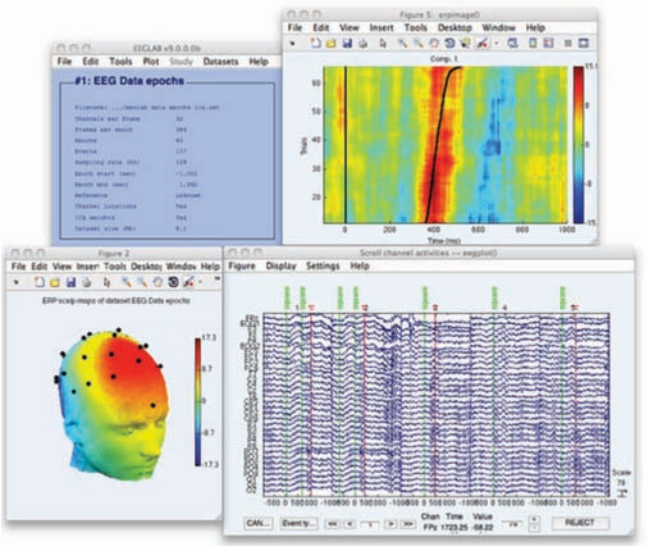
Then, I ended up starting a family and teaching piano lessons. After a few years, I decided that my only hope of supporting my family was to use my only capital, which was my brain. I took an interest in how we experience music, but since I hadn't finished the degree in music, a professor in the music department suggested that I pursue a master's degree in music. So I followed his advice and took a master's degree in music theory. After that, I got accepted at UCSD for the PhD program in what was called the experimental music theory.

When I got here, the person who had accepted me among the music faculty left, and I ended up working with another psychologist in the department. However, our ideas were not fully compatible. As usual, I was interested in many things, so I rode my bicycle around the campus attending courses in many departments instead. They were courses that would now be in the department of cognitive neuroscience, ranging from neuroscience and engineering mathematics to linguistics, psychiatry and, of course, music.

Then one day, an older friend of mine pulled me out of a music class to meet Robert Grembles, a famous neuroscientist who was also one of the founders of the neuroscience department. It turned out he needed a final student, and so I became his apprentice. I programmed his primitive computer and did brain-wave experiments. I learned how to be a scientist while working as an apprentice under him.

I eventually morphed my degree into what I called music psychology. After graduating and going off to India for a post-doc, I found a job back at USCD in psychiatry. When that ended, I took a job as a government scientist at the Naval Health Research Center, where they told me to do something practical with the EEG. So, I began studying alertness monitoring and drowsiness detection. That led me into contact with the Office of Naval Research and Terry Sejnowski.

Next, I recruited Tzzy-Ping Jung, who is now the associate director here. We began studying the application of independent component analysis (ICA) to EEG, and fairly soon our small office at the Salk Institute had five people and sixteen computers. Terry didn't know what to do with us, because there was no space for us. So he talked to Jerry Schwartz the industrialist, and together we pitched the idea of INC at the Schwartz center. We first opened off-campus as there were no campus spaces at the time, but we finally moved into where we are now five years ago.



EEGLAB, an open-source MATLAB toolbox that was originally released by Delorme and Makeig, is one of the most widely-used signal processing environment for processing of EEG data by cognitive neuroscientists.

Through it all, I devoted myself to improving the analysis of human EEG, and I became aware that the methods remained frozen in the past outside of the engineering field: neurologists would still look at the wiggles with their eyes, and psychologists would commonly use event-related averaging and throw away the rest of the data. To convince the power of ICA, I continued to develop source-resolved EEG imaging and high-resolution localization techniques. To make the analysis more readily available, I worked with Arnaud Delorme to create graphical interfaces for the MATLAB functions that I wrote, and that became the basis of the EEGLAB package. In 2004, we received funding from the NIH to continue the development of EEGLAB, and it is now the most-used software environment for the EEG studies by cognitive neuroscientists across the world.

- What other projects are going on in your lab right now?

Besides the EEGLAB project and various investigations of EEG signal processing under the Schwartz foundation funding, we've had a large army project to look at the cognitive response and intent of operators whose EEG

signals were monitored along with their body and eye movements. We received another grant to develop this mobile brain-body imaging (MoBI) technique, and we built the MoBI laboratory with that money. I think the combination of the high-brandwidth brain and behavioral recording in natural environments — recording the naturally motivated actions and social interactions — is really a new frontier in the imaging studies, and there's already a fledging society and workshops around the MoBI paradigm.

More recently, I organized a team of faculty from five UC campuses to submit a proposal under the multi-campus research programs and initiatives (MRPI) program. The program called for UC-wide initiatives to develop new areas of research expertise, so we proposed the study of music, the brain and the mind. As I put in the proposal, the study of music as experience and as communication is only a very small part of any department, and only a small number of researchers are working on the topic at any institution. The idea is that, if we created a network of such researchers, we could do what no other university in the country can. We could develop a UC-wide center of excellence for studying music cognition and neuroscience. Not only did we win the proposal for this idea, but we were also selected as one of five publicized proposals, and the proposal was given the designation of the UC research catalyst award.

We call the initiative UC music experience and research community initiative (UC MERCI). Currently, there are faculty from five campuses in UC MERCI: UCSD, UCLA, UC Merced, UC Davis and UC San Francisco. We'll have our first event here at the UCSD faculty club on March 17th. That will be a colloquium featuring an introductory talk by me, followed by a music performance and a guest lecture by a distinguished music psychologist from Ohio State, David Huron. The lecture will be webcast to the other campuses, followed by a dinner at the faculty club. Under the planning grant we won, we will pilot a series of colloquia at different campuses. We will have two workshops of UC researchers to scheme how to grow the capability and use that in the collaborative efforts and proposals. We will develop a web portal for music and science, and we will also have funds for graduate students to travel among campuses to work with faculties with different expertise within the MERCI network. It's a two-year planning grant, so in the summer of 2016, I expect we will put in a larger proposal for continued support for which these projects are piloted.

The grant is what I would call "a license to dream and propose." I don't know what will become of it, but I do know that music is extremely important economically: in California, film and television industries in Los Angeles and the online music informatics in San Francisco are very interested in understanding musical cognition, for example. Music is part of the economic life of almost everyone, as ninety-nine percent of people respond emotionally to music. For many, music is a soundtrack of their life, so to speak; music is a source of great consolation or inspiration, even if they don't play music. Nevertheless, it's much too little studied.

Scott Mckeig (above) and his research group brings together UC experts on music listening, performance, neuroscience, brain imaging, and data science to understand the potential of music for health and cognition.

- Do you foresee commercial applications and funding coming out of this program?

One of my hopes is that the MERCI network will be able to find people who are willing to give money to study something that is so important for our culture. I feel certain that industries such as the music informatics will be interested, because they're trying to develop sophisticated ways of telling what kind of music you would like to listen to. There's also the connection between music and health. This is certainly an important topic: music therapy is known and practiced, but there is not quite yet a rigorous scientific basis. I myself am interested in the connection between music and feeling, the affective experience of music and the way music communicates feelings. I think there's fascinating work that can be done there.

- What kind of research do you plan to conduct under this grant?

I would, of course, like to continue my work with EEG, body motion capture and music. We have already had some projects in that. Other researchers in the network are interested in different topics. The MERCI network really brings together researchers working on very diverse topics and expertise.

UC MERCI initiative brings together researchers from many disciplines, including:

- Petr Janata at UC Davis, who uses fMRI primarily to study music cognition.
- Ramesh Balasubramaniam at UC Merced, who uses behavioral measures, biomechanics and transcranium magnetic stimuluation (TMS).
- Julene Johnson in UCSF, who studies health effects of choral singing on elderly subjects in senior citizen centers in San Francisco.
- Mark Tramo at UCLA is a neurologist who studies the auditory system. He has a long-standing interest in combining music and neuroscience.
- John Iverson at UCSD studies the developmental effects of musical training on children.
- Gert Lanckriet at the electrical engineering department studies music informatics, the mathematical algorithms underlying music search engines like Pandora.

- In current research environment about musical cognition, do you still see separation among different disciplines?

Yes. In particular, we find that musicians and music departments in general have little interest in neuroscience, or even cognitive science, to a surprising degree. For performers, I think it's understandable: they need to work intuitively and

"We're trying to marry the understanding of music theory with neuroscience to see how it produces the cognition and feeling of music."

— Scott Makeig

hone their technical craft of music. Just as one wouldn't assume a novelist would understand the neuroscience of language, I wouldn't expect music performers to necessarily be interested in the neuroscience of music. However, I can't say whether music theory is moving towards more biological approaches. I would hope it is, but my impression when I was studying music theory was that the theorists were only interested in the relationship among the notes on a page, and they had almost no language to describe the experience of music. I was quite struck by that.

What we're trying to do instead is to marry the understanding of music theory — which is real, of course — with neuroscience, and try to see how it produces the cognition and feeling of music. It's difficult to find students or postdocs who have the knowledge of music theory and enough mathematics and understanding of the brain. So I'm looking for such interdisciplinary people and research, and I hope the UC MERCI program will make it easier to fund such approaches.

■

MERCIEVENTS

03/17/15 **UC MERCI Colloquium on Music, Mind, Brain & Body**

Featuring Scott Makeig, MERCI chair, and David Huron, Ohio State University

The UC Music Experience Research Community Initiative (UC MERCI) is "an American center for the scientific study of musical experience, communication, and behavior," that will allow UC researchers to share cutting-edge resources and collaboratively develop methods to understand – and enhance – music's ability to affect and even transform the human mind. Thes first colloquium in the UC MERCI series features speakers, discussion, and an original music performance.

04/24/15 **Second MERCI Colloquium on Music, Mind, Brain & Body**

Featuring Petr Janata, UC Davis, and Mark Butler, Northwestern University

The second MERCI Colloquium features the following speakers:

Petr Janata, UC Davis
Introduction to UC MERCI, and brief presentation titled, "Psychological and Neural Perspectives on Being "In the Groove"

Mark Butler, Northwestern University
I Don't Want to Look Like I'm Checking My Email: Communicative Strategies and Ideologies of Liveness in Laptop Performance

Submit questions for discussion during the live event to questions@merci.ucsd.edu.

INCEVENTS (Winter)

INC-IEM Neuroengineering SEMINAR SERIES

01/26/15	**Khaled Nabil Salama**	On-Chip RF Power Harvesting for Biomedical Implantable Wireless Sensors

INC CHALK TALKS

02/05/15	**Ning Lan**	Corticospinal Computation of Sensorimotor Control for Normal and Abnormal Movements
02/12/15	**Massimiliano Di Ventra**	Memcomputing: Computing with and in Memory Using Collective States
02/19/15	**Emre Neftci**	Neuromorphic Cognition
02/26/15	**Zeynep Akalin Acar**	High-Resolution EEG Source Imaging
03/05/15	**Bradley Voytek**	Cognitive Networks and the Noisy Brain
03/12/15	**Douglas A. Nitz**	Cell Assemblies of the Basal Forebrain

Special Events

02/27/15 **TDLC All Hands Meeting**

Theme: "Technology for Learning"

Planned sessions include: Technology Transfer; Learning with Robots; Outreach Technology; and Science, Technology and Math for the Classroom.
We have planned exceptional speakers and ample time for networking with other TDLC researchers.

Submit questions about the event to kshanks@ucsd.edu.

More information: *http://inc.uscd.edu/events.html*

For more information on current events,

INCEVENTS (Spring)

INC-IEM Neuroengineering SEMINAR SERIES

06/01/15	**Paul Tillberg**	Expansion Microscopy

INC CHALK TALKS

04/09/15	**Victor Minces**	Role of Neuromodulators and Neural Correlations in Network Encoding
05/07/15	**Ying Wu**	Insights Into Insight: What EEG Reveals about Problem Solving Across Multiple Domains
05/21/15	**Stephen Robinson**	Estimating Phasic and Sustained Dynamic Information Transfer in the Human Brain
05/28/15	**Frank Fernandez**	Dealing with Uncertainty: DARPA's New Paradigm for the 21st Century
06/04/15	**Ruth Williams**	Slowly Oscillating Periodic Solutions for Stochastic DDEs with Positivity Constraints

Special Events

05/09/15 **2015 Cognitive Neuroscience Spring Retreat and KIBM Symposium on Innovative Research**

Sponsored by the NIMH Cognitive Neuroscience Training Program for the Institute for Neural Computation and the Kavli Institute for Brain and Mind.

Full agenda and more details can also be found here.

06/10/15 - 06/12/15

Brain Connectivity Workshop 2015

The La Jolla edition of the Brain Connectivity Workshop will focus on the role of electrophysiology in understanding the fine temporal scale of brain network dynamics as well as the mechanisms by mean of which emergent dynamics, behavior, and human experience originate from multi-scale interactions. The first day will be dedicated to Educational lectures by, followed by the two-day workshop in which short presentations will stimulate longer general discussions among the faculty and 100 attendees.

Full agenda and more details can also be found here.

More information: *http://inc.uscd.edu/events.html*

INC at a glance

INC Research Groups and staff

Institute for Neural Computation (INC)
http://www.inc.ucsd.edu
Terrence Sejnowski and Gert Cauwenberghs, Co-Directors
Carol Hudson, Management Service Officer

Swartz Center for Computational Neuroscience at INC
http://www.sccn.ucsd.edu
Scott Makeig and Tzyy-Ping Jung, Co-Directors

Machine Perception Laboratory at INC
http://mplab.ucsd.edu/
Javier Movellan, Marian Stewart Bartlett, and Glen Littlewort, Principal Investigators

Temporal Dynamics of Learning Center (TDLC) Motion Capture/Brain Dynamics Facility at INC
http://inc.ucsd.edu/~poizner/motioncapture.html
Howard Poizner and Scott Makeig, Co-Directors

Office of Naval Research (ONR) Multidisciplinary University Initiative (MURI) Center
http://inc.ucsd.edu/~poizner/onr_muri/
Howard Poizner, UCSD (PI); Gary Lynch, UCI (Co-PI); Terrence Sejnowski, Salk Institute/UCSD (Co-PI)

Mobile Brain Imaging Laboratory (MoBI) at INC
Scott Makeig, Principal Investigator

Poizner Laboratry at INC
http://inc2.ucsd.edu/poizner/
Howard Poizner, Principal Investigator

Dynamics of Motor Behavior Laboratory at INC
http://pelican.ucsd.edu/~peter/
Peter Rowat, Principal Investigator

Data-Intensive Cyber Environments (DICE) Group at INC
Wayne Schroeder, Principal Investigator
http://diceresearch.org/DICE_Site/Home/Home.html

International Exchange Scholar Program:
Tzyy-Ping Jung <jung@sccn.ucsd.edu>

Newsletter Editor:
Tomoki Tsuchida<ttsuchida@ucsd.edu>

Webmaster and Information Technology:
Luis Palacios <lpalacio@crl.ucsd.edu>

For general inquiries, contact:
Luisa Flores <m2flores@ucsd.edu>