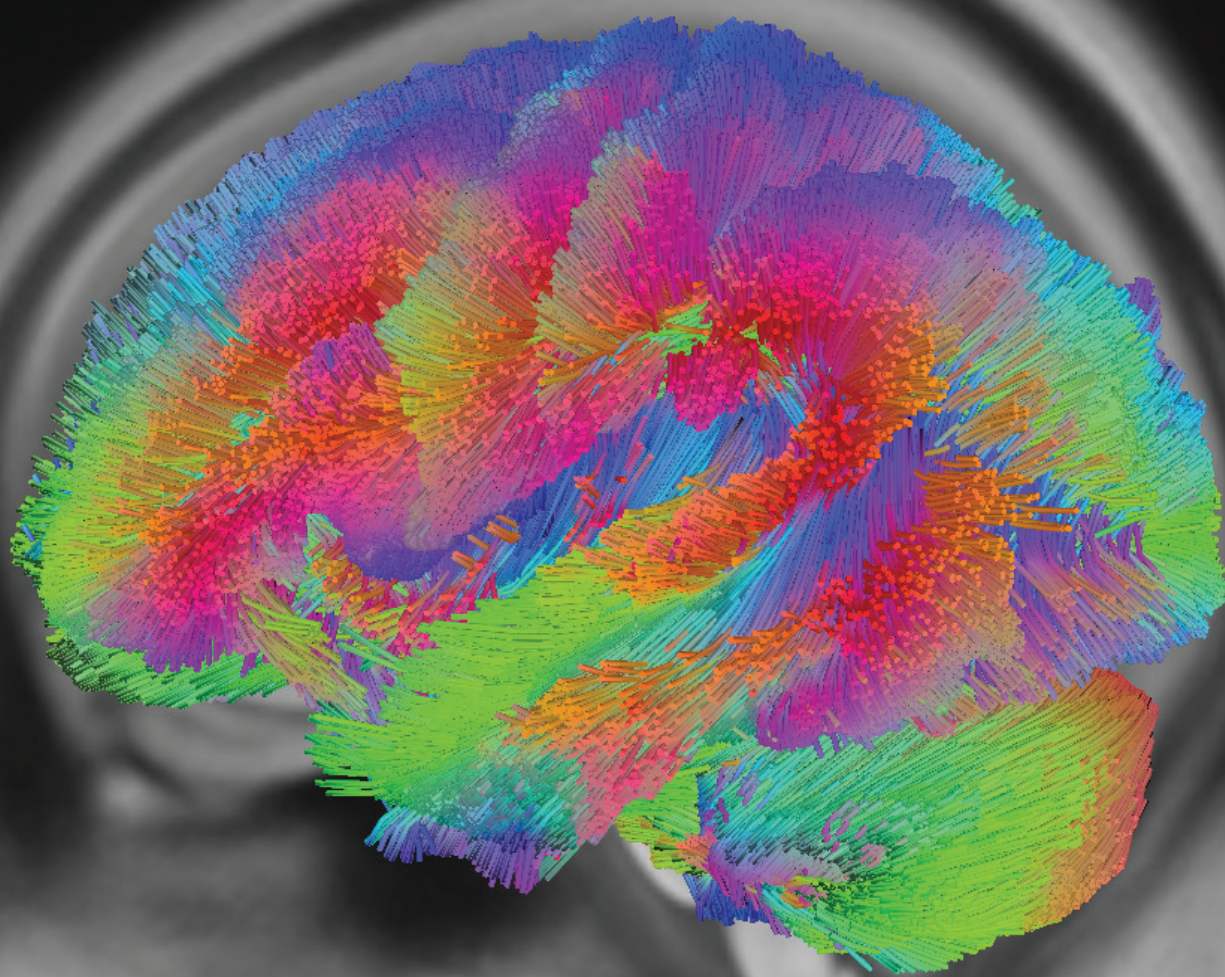


CNBCConnect



Center for the Neural Basis of Cognition

From the co-directors

Welcome to the special 20th Anniversary Celebration issue of the CNBConnect. The last few months have been

productive, and we are happy to report on the successes of members of our community and its continued growth. This issue highlights faculty members and graduate students of the CNBC as well as collaborations between them. We also report on awards received by members of the CNBC and books published by our faculty. In the past year, we have awarded the Andrew Carnegie Prize in Mind and Brain Sciences to Ricardo Dolmetsch (Novartis Institutes for Biomedical Research) and have hired Mac Hooks to the Department of Neurobiology at Pitt. We look forward to welcoming new members too. There are several new departmental searches, including one for the Zdrojkowski Career Development Chair, newly endowed in the area of human developmental neuroscience at CMU.

One notable change will be apparent in the photograph of the co-directors. Mike Tarr is now the chair of the Department of Psychology at CMU, and Marlene Behrmann has taken his place as CMU co-director. We are grateful to Mike for his efforts on behalf of the CNBC and in promoting neuroscience in Pittsburgh and beyond.



Peter Strick and Marlene Behrmann

On the Cover:

Cover art of a high resolution map of the normal anatomical connections in the human brain courtesy of Dr. Timothy Verstynen.

If you have news you would like to share please email us at: cnbc-newsletter@cnbc.cmu.edu.

Layout: Kristen McConnell

We devote several pages to our 20th Anniversary Celebration (October 17th-18th), with profiles of the alumni speakers whom we are pleased to welcome back. An exciting art show, curated by Patricia Maurides, entitled “NEURONS AND OTHER MEMORIES-Work in and Around the Brain,” featuring works by artists and neuroscientists, will run at the same time (Miller Gallery, CMU).

Colleagues and friends are warmly invited to join us at the 20th Anniversary Celebration to recognize our unique cross-university training and research institute. We will reflect on its past and its successes and begin to pave the way for the next two decades of achievements in understanding the neural basis of cognition.

Collaboration Spotlight: How Plastic is the Brain?



(Left to Right) Patrick Sadtler, Byron Yu, and Aaron Batista

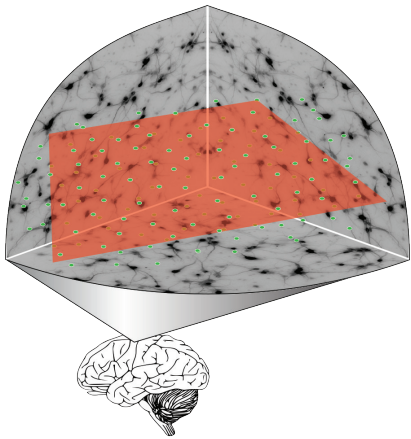
Are there limits to what the brain can learn? The answer to this is obviously yes (we can't learn to fly or do telepathy after all), but an interesting question is whether any constraints on learning arise from the way neurons in the brain are interconnected. Might this help explain why we can more readily learn new skills when they are related to skills that we already possess?

In a recent article published in *Nature*, "Neural constraints on learning," Aaron Batista, Byron Yu, Patrick Sadtler, currently a fifth year graduate student in Bioengineering and the CNBC (Pitt), and their co-workers have demonstrated such constraints using brain computer interfaces (BCI). This work illustrates many familiar properties of research in the CNBC: high-level collaborations across departments and universities and the use of new technologies to address fundamental questions in cognition. Batista, Yu, Sadtler et al. trained animals to move a cursor by generating specific patterns of neural population activity to control the BCI and examined what the limits on learning were.

"Brain-computer interfaces allowed us to go beyond passively observing neural activity," Yu notes. "We can ask animals to generate particular patterns of neural population activity that have properties we care about and observe whether the animals can learn to do so." Patterns of neural activity can be represented as points within a high-dimensional space that defines a manifold. The prediction is that patterns that can easily be learned lie within the manifold while patterns that are more difficult to learn lie off of the manifold.

The study confirmed this. The researchers found that the ability of the animals to generate new patterns of neural population activity was in fact constrained. Sadtler states, "We were able to predict beforehand which patterns of neural activity would be more learnable. We found that the animals were able to more readily recombine familiar activity patterns in new ways relative to creating entirely novel patterns."

In addition to Sadtler, Batista and Yu, the research team included Pitt's Kristin Quick (CNBC) and Elizabeth Tyler-Kabara; CMU's Matthew Golub and Steven Chase (both CNBC); and Stephen Ryu of Stanford University and the Palo Alto Medical Foundation. As Batista notes, "The feedback loop from theory to experiment, which normally can take years or decades, became weeks and months, by virtue of the fact we were working together so closely. The CNBC was absolutely essential in allowing this to happen."



Red plane depicts the manifold of patterns of neural activity for a region of motor cortex. Patterns within the manifold are more easily learned; patterns outside less easily.

20th Anniversary Celebration October 17-18, 2014

Join us in celebrating CNBC successes over the past 20 years and hear our plans for the next 20 years.

- Internationally renowned speakers: Emery Brown, John T. Bruer, Rafael Malach, and Helen Mayberg
- CNBC alumni speakers
- Poster presentations
- Art show

www.cnbc.cmu.edu/20/

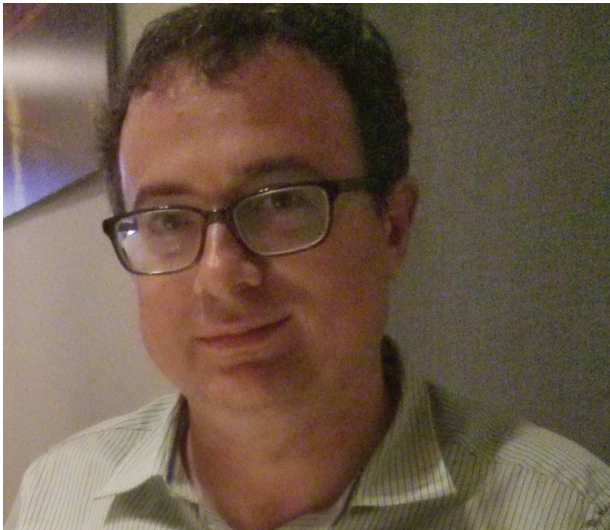
20th Anniversary Celebration:
Distinguished Alumni Speakers



Rebecca Berman (Advisor: Carol Colby; CNBC 1996) is currently staff scientist in the Laboratory of Neuropsychology, the National Institute of Mental Health. After college, Berman moved to Pittsburgh where she worked with John Sweeney on schizophrenia. She then applied to Pitt Neuroscience and the CNBC and worked with Carol Colby on cortical circuits for the integration of vision and eye movements. “We found that a seemingly tricky inter-hemispheric handoff of visual information—a phenomenon we thought surely had its home up in cortex—could take place even in the complete absence of direct cortical commissures.” This led to her current work on subcortical circuits and their contribution to perception. Berman fondly recalls her experience as a CNBC student: “Student-led initiatives were encouraged... we felt very much a part of the community. There was a big emphasis on bringing people together in both formal and informal settings.” Currently, Berman focuses on how actions influence perception, using the eye movement system as a model to understand how movement and vision are intertwined. Her experience at the CNBC is reflected in her approach: “I throw different techniques at the problem of understanding circuits in the primate brain: neurons, behavior, electrical stimulation, and manipulation using either chemical or optogenetic methods.” This has also involved a more unconventional path to her current position. “I was able to spend a year in the Child Psychiatry Branch at NIH to get my feet wet again in schizophrenia research and human neuroimaging. The experience gives me a new perspective as I return to neurophysiology. I continue to study visual perception and cortical-subcortical circuits broadly, but with an eye toward development and plasticity. I can’t imagine doing this without my CNBC background.”

Randy Bruno (Advisor: Daniel Simons; CNBC 1997) is currently an associate professor in the Department of Neuroscience, Columbia University. He was recently awarded the Society for Neuroscience’s 2013 Young Investigator Award. Bruno was associated with the CNBC both at CMU and at Pitt as an undergraduate, post-graduate, and then graduate student. “After a total of 11 years in Pittsburgh, I found myself asking why I never bought a house in Pittsburgh. I’d still like a house in Pittsburgh,” he notes. Bruno earned a B.S. in cognitive science at CMU and then worked with Larry Wasserman and Jay McClelland for two years on new statistical methods for model fitting. As a graduate student, Bruno found the support at the CNBC to be unequalled: “The CNBC puts strong emphasis on graduate training. I’ve visited some institutions that similarly support their students, but never a place that provided more support than the CNBC.” His own lab “is a real mix now of systems/circuits questions attacked by electrophysiology, behavior, anatomy, imaging, and molecular biology for the goal of understanding neural computation. It doesn’t take much effort to trace this back to the CNBC.” Recent work has focused on functional structure in cortex. Using multiple levels of analysis, Bruno’s lab discovered that the upper and deep layers of cortex are two distinct though connected systems with the question now being: what are the computational/behavioral roles of these two strata? To tackle this, Bruno continues a “CNBC style” of approach, including optogenetics, systems and cellular methods to reach computational conclusions.





Nathaniel Daw (Advisor: David Touretzky; CNBC 1997) is an associate professor in the Center for Neural Science and Department of Psychology, at New York University. A graduate student in computer science at CMU and the CNBC, Daw recalls that “the CNBC provided a home away from home for many of the computer science students interested in neuroscience, a place where people from various different home departments could come together toward a shared vision and direction.” At the CNBC, Daw worked with David Touretzky on how the brain learns from reward and punishment and the neural mechanisms for trial and error decision making. He also did a substantial rotation with Bill Skaggs, then in neuroscience at Pitt, doing recording experiments in rats. “That I was able to do both of these things (and be trained in neuroanatomy and rub elbows with fMRI statisticians and so on) – and receive a computer science degree for it – is a real credit to the CNBC. It’s hard to imagine quite that experience anywhere else.” In his current work, Daw continues to focus on computational models of brain learning but coupled with trial-by-trial experimental data: “I work with humans using fMRI and also, increasingly, patients with neurological damage or degeneration and, in collaboration with others, I work on similar experiments using more invasive animal tools. A major focus recently has been developing a crisp computational and experimental understanding of an idea which is ubiquitous but, on reflection, entirely bizarre and puzzling—that the brain has multiple routes to making decisions, such as more automatic and more deliberative.”

Vivienne Ming (Advisor: Mike Lewicki; CNBC 2001) is a theoretical neuroscientist, technologist and entrepreneur. She is currently a founder and managing partner at Socos, vice president of Research and Insight at Gild, and a visiting scholar at UC Berkeley’s Redwood Center for Theoretical Neuroscience. Having moved to Pittsburgh from San Diego, Ming noted immediately a few differences from California such as the possibility of home ownership by graduate students and the (briefly) enjoyable winters. “Most of the best things in my life came alive during those years at the CNBC,” Ming recalls. “I met my wife, Norma [Ming], there. We shared our first kiss after following all of the digits of Pi written out across CMU’s campus on Pi Day in 2002!” As a graduate student with Mike Lewicki, Ming worked on theoretical models of mammalian audition using information theory to create a computer system that learned how to hear. “The system learned how to hear by listening to summer sounds in Frick Park,” Ming notes. “Mike and I then compared our system’s “solution” to hearing to the mammalian cochlea and found they had an almost identical mathematical language for hearing.” Later, through an IGERT fellowship, Ming worked with Lori Holt to use that model to develop more effective cochlear implants by focusing not on the structure of the ear, but on the computations the auditory system needs to solve. Ming has advised various research projects including work with Emozia to build a platform for continuous emotional state estimation in order to develop an early warning system for manic/depressive episodes for bipolar sufferers. She also developed a predictive model for blood sugar highs and lows after her son was diagnosed with Type 1 Diabetes. In addition, Ming sits on the boards of Credit Suisse, StartOut, and Our Family Coalition, and has been an advocate on issues of LGBT inclusion and gender in technology.





Yuko Munakata (Advisor: Jay McClelland; CNBC 1994) is currently professor in the Department of Psychology and Neuroscience, University of Colorado Boulder. After earning an undergraduate degree at Stanford working with David Rumelhart, Munakata came to Pittsburgh to work with Jay McClelland on cognitive development. "I focused on infants' understanding of object permanence, and used neural network models to show how such understanding could gradually emerge through learning, and lead to dissociations commonly observed in development where kids can seem very smart when tested in one way, but clueless when tested on this same knowledge in a different way." The transition to Pittsburgh from the Bay Area was a shock to the system, but she warmed to Pittsburgh, aided in part by a close cohort of graduate students at the time. "We refer to our Pittsburgh time as the Camelot years. Now I feel quite nostalgic about Pittsburgh, and happily manage to visit fairly regularly." Munakata's current research focuses on the mechanisms that support executive functions, such as working memory and inhibitory control, and their development. "My recent work on inhibitory control is illustrative of a CNBC-levels-of-analysis approach. We've used neural network models, fMRI, ERP, and pupillometric and pharmacological methods to develop and test an alternative framework for understanding how people stop themselves from engaging in inappropriate behaviors, and what role inhibitory interneurons play in executive functioning."

David Redish (Advisor: David Touretzky; CNBC 1994) is currently a Distinguished McKnight University Professor in the Department of Neuroscience at the University of Minnesota. Redish was a member of the first CNBC graduate class and worked with Touretzky on computational models of hippocampal function. He remembers the first brain bags. "We graduate students made it our goal to find the best food at really good prices...we ate really well that year!" he recalls. "The defining thing about the CNBC was that you couldn't tell what department a student was from. The students from the math department were presenting experimental data and the experimental neuroscience students were presenting computational models." The collegial relationships forged during that time continue to this day as Redish maintains collaborations with several of his former classmates. Among current and recent topics of interest, Redish has focused on the mechanisms and representations underlying decision making, drawing on careful conceptual definitions, computational approaches from computer science, methods from behavioral neuroscience to record from large scale neural ensembles, and mathematical approaches to decode neural activity. Thus, his own work continues to reflect the multi-level approach fostered by the CNBC: "We do theoretical, computational, and experimental neuroscience in a single laboratory. We apply complex neural analyses (based on ensemble decoding operations) to neural signals to determine how cognitive representations change over time. By following the neural representations, we can identify mechanisms underlying cognitive processes. By understanding those cognitive mechanisms, we can identify where they can break down and go wrong, which has important clinical implications."





Matthew Roesch (Advisor: Carl Olson; CNBC 1998) is currently professor in the Department of Psychology, Neuroscience and Cognitive Science at the University of Maryland, College Park. Roesch continues to have strong ties to Pittsburgh. “I did my undergrad at Pitt, and my family still lives just outside Pittsburgh. Pittsburgh is home.” At the CNBC, Roesch found graduate student life “outstanding, terrific. There were a lot of interesting people from many different backgrounds doing a variety of intriguing work.” He did his dissertation work with Carl Olson on reward-guided decision making in monkeys performing saccade tasks, a topic he explored in work with rats as a post-doc and which remains a main focus of his current research. “The knowledge I obtained from Carl and the CNBC made the transition into being a post-doc extremely easy. I was well equipped to design experiments, conduct them, analyze data, write papers and think critically about the field both in a highly specialized manner, as well as from a broad perspective.” Current work mainly focuses on neural mechanisms underlying reward-guided decision-making and reinforcement learning and their disturbance in psychiatric illness. To study this, Roesch uses single unit recordings of activity from various brain regions as rats perform a variety of cognitive tasks and evaluates loss of function after pharmacological or optogenetic manipulation. “My work continues to exhibit the qualities captured by the CNBC. I have been involved in writing several articles and grants with researchers outside my discipline, including researchers whose primary focus is in brain imaging, primate electrophysiology, and computational modeling.”

Elizabeth Tricomi (Advisor: Julie Fiez; CNBC 2000) is currently assistant professor in the Department of Psychology, Rutgers University, Newark. Pittsburgh at first seemed much larger than Ithaca, where Tricomi went to college at Cornell, but the city quickly came to feel quite comfortable. As a graduate in the CNBC, Tricomi enjoyed the CNBC brain bags. “I was impressed that students and faculty from across the different CNBC departments truly interacted; I think this high level of formal and informal cross-disciplinary interaction makes the CNBC special.” Tricomi did her dissertation work with Julie Fiez and used fMRI to study the involvement of the brain’s reward system in feedback-based learning. Her current work remains interdisciplinary, drawing from social psychology research on achievement motivation as well as cognitive neuroscience work on reinforcement learning to investigate how the motivational significance of performance-related feedback influences neural processing and consequent learning. She has found, for example, that individual differences in normative goals (the desire to outperform others) predict feedback-related responses in the striatum when a task is perceived as difficult.



CNBC cross-university research training award

The CNBC appreciates the generous gift from Drs. Heidi Feldman and James L. McClelland to be used in support of cross-university collaboration between Pitt and CMU in the training of Ph.D. students. The first recipient of this award is Adrienne Taren, an M.D./Ph.D. student, who is working with Dr. David Creswell at CMU.

Faculty Spotlight: **Charles Bradberry**

Charles (“Charlie”) Bradberry has been a member of the CNBC community and of the Department of Psychiatry at the University of Pittsburgh since 2004.

A child of a military family, Bradberry moved around quite a bit as a child but ultimately settled in Wichita, Kansas where he attended middle and high school. Having had success as a jewelry designer before college, Bradberry initially enrolled in the School of Fine Arts at the University of Kansas, but later switched to science with the intention of going to Pharmacy School. “I had a series of outstanding professors in chemistry, and it became an easy switch because it was such a fun thing to study,” he recalls. As an undergraduate, his introduction to neuroscience began with research in the lab of Ralph Adams (Chemistry, Kansas) and continued when Bradberry pursued a Ph.D. in Biochemistry, which he completed in 1986.

Bradberry’s doctoral work focused on the regulation of norepinephrine release and this gave him a taste of the multimodal approaches that would come to define his later work. “I grew up in a multimodal training environment focused on neurochemical approaches, and the value of and comfort in collaborating across disciplines was a given.” A post-doctoral position in neuropharmacology in Robert Roth’s lab in the Department of Psychiatry at Yale coincided with the peak of the crack epidemic in the United States, and Bradberry began to study the effects of cocaine.

Starting his own lab in 1991 at Yale’s Department of Psychiatry, Bradberry continued to focus on psychostimulants and addiction in general. Work during this time was driven in part by his technical background in electrochemical methods, but Bradberry continued to be interested in how drugs affect the brain and consciousness. When he was recruited to the University of Pittsburgh and the CNBC in 2004, he took advantage of the opportunity to shift the focus of his work towards more cognitive aspects of addiction.

“An overarching theme of my lab has been to focus on prefrontal cortex during cocaine self-administration,” Bradberry emphasizes. “This contrasts with what I see as too much of a focus on dopamine in ventral striatum in most animal studies of addiction.” In his work, Bradberry and co-workers have focused on primate models of cognition and addiction using a host of different approaches. One approach has been to examine the cognitive consequences of chronic cocaine self-administration in a relatively well-powered primate study, using high throughput automated neurocognitive assessments (Porter et al., 2011). Bradberry and co-workers demonstrated that the impairments often seen in human drug-using populations are due, at least in part, to drug use itself (a potential confound in cross-sectional clinical studies is that observed differences might be due to preexisting traits that explain increase risk of use



rather than the effects of the drugs themselves). Cognitive capacities such as visual working memory and reversal performance where well-learned associations have to be inhibited were significantly impaired in the drug population, and both capacities are served by prefrontal cortical areas.

Bradberry’s multimodal approach motivated an extension of this study across different disciplines to further investigate changes in prefrontal cortex properties. PET studies (collaboration with Raj Narendran) have revealed changes in dopamine vesicular storage mechanisms, and functional PET (fluorodeoxyglucose) studies with Julie Price (Pitt Radiology and CNBC) have probed changes in prefrontal cortex and cerebellum metabolic rate during cognition. Recent work with Seong-Gi Kim (formerly CNBC) yielded magnetic resonance (MR) based functional connectivity data in a subgroup of cocaine and control animals that is currently being analyzed (with Elliot Stein’s group at the NIDA intramural program), and preliminary results again implicate alterations in the prefrontal cortex and cerebellum.

A longitudinal structural MR imaging study on the same animals (with Howard Aizenstein, Pitt Psychiatry and CNBC) compared changes in gray matter from before to after cocaine (or water reinforcers in control animals) in the well-matched experimental and control groups. While there were not very large between group effects, within the cocaine group, the changes in gray matter in the prefrontal cortex and cerebellum were highly correlated with altered cognition. This result raised the question of what might be happening at the cellular level that could drive that relationship exclusively in the cocaine group and only in specific regions. With Clayton Wiley (Pitt Pathology and CNBC) and Aizenstein, Bradberry is embarking on an innovative study in which brains from the control and experimental animals will be sectioned throughout the entire neuraxis. Histological sections will then be stacked into a

volume and manipulated using imaging style approaches. This will enable “voxelwise histopathology,” wherein voxelwise measures of various immunohistochemical stains for synaptic markers and drivers of neuroinflammation such as activated microglia can be related across the entire neuraxis using statistical parametric approaches. The goal is to determine if neuroinflammation, a source of cellular and cognitive damage across a number of neurodegenerative diseases, could be driving cognitive impairments linked to structural alterations in cocaine exposed monkeys.

Bradberry’s laboratory has also been doing electrophysiology. “Andy Schwartz (Pitt Neurobiology and CNBC) and Bitu Moghaddam (Pitt Neuroscience and CNBC) helped my lab get started, and we’ve published the only primate studies of neural encoding in prefrontal cortex during cocaine self-administration (Baeg et al., 2009).” These electrophysiological studies continue to be a major focus of collaboration including additional work with Rob Turner (Pitt Neurobiology and CNBC) and Carl Olson (CMU CNBC). The goal of these studies is to model what is termed “attentional bias” to drug cues in users. Across virtually all classes of abused drugs, this is a very strong predictor of craving and current use, and for those trying to quit, it predicts relapse to use at later times. Bradberry and co-workers want to understand the dynamics of interactions between different cognitive systems at the cellular level, to identify the brain mechanisms creating vulnerabilities, and to use that understanding to better craft behavioral or pharmacological treatment approaches. Bradberry’s long-standing collaborative approach has found a supportive home in the CNBC. “My interactions with the community of scientists in the CNBC has been critical to our ability to do the science we do, and has proven once again that, in addition to individual thought and analysis, science is a social exercise, and a lot of fun!”

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Narendran, R., et al (2014). Imaging dopamine transmission in the frontal cortex: A simultaneous microdialysis and [¹¹C]FLB 457 PET study. *Molecular Psychiatry*, 19(3): 302-10.

Narendran, R., et al (2014). Decreased vesicular monoamine transporter type 2 availability in the striatum following chronic cocaine self-administration in nonhuman primates. *Biological Psychiatry*, Jun 23 [Epub ahead of print].

Graduate Student Spotlight: Leila Wehbe

CNBC graduate student Leila Wehbe grew up in Lebanon, a small but culturally and geographically diverse country, with influences from both Western and Eastern civilizations and a rich landscape of mountains, valleys and sunny coastlines lined with popular beaches. As a young student, Wehbe studied at a French school (French being one of the official languages in Lebanon). For college, she attended the American University of Beirut (AUB), located on a beautiful seaside campus.



Wehbe completed a degree in electrical and computer engineering, taking as many

neuroscience classes as possible despite the lack of a neuroscience major at AUB. In her third year, she did a summer internship in Nancy Kanwisher’s lab at MIT, and worked on a project aimed at studying the brain representation of uncertainty in the location of a target. This experience stoked her excitement about studying human intelligence and how the brain works. For graduate school, Wehbe chose the Machine Learning department in CMU with the dual track in the CNBC. “I came here because I was interested in the combination of computational models and analyzing human brain data, and I was excited to learn how to use machine learning to improve our understanding of the brain, as well as how to use what we know about the brain to build better computational tools.” Currently a graduate student with Tom Mitchell (CMU Machine Learning and CNBC), Wehbe’s dissertation work focuses on how meaning is represented in the brain using fMRI, MEG and computational modeling of language.

In her current work, Wehbe has focused on story processing, specifically how the brain represents the different types of information that underlie a very complex task like reading a story. Wehbe used a text from a Harry Potter novel, and distinguished its syntactic, semantic, and narrative properties. Using fMRI, Wehbe, Mitchell and their colleagues

were able to show that these different properties are processed by different sets of brain regions. “While classical language experiments have identified a set of brain regions to be implicated in language processes, they usually are only able to find regions that increase in activity when a single property of the stimulus is manipulated,” Wehbe notes. “In contrast, we were able to simultaneously find what property of the text is represented by each region, to an unprecedented level of detail and breadth. We are able not only to find where a specific type of information is represented, such as syntax, but how different instances are represented. For example, how a specific phrase structure is represented or what the brain representation of Harry Potter is.” More recently, Wehbe and Mitchell have been using MEG data to shed light on the temporal dynamics of processing in these regions, and to determine the order in which these properties are processed by the brain.

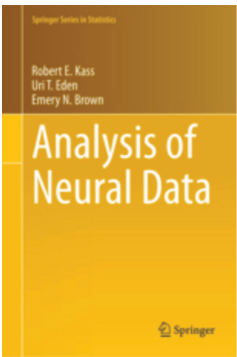
As her work illustrates, Wehbe aims for a multi-level approach to cognition. She appreciates the general structure of the CNBC graduate program. “It might seem for the students at times that taking four classes from the four main areas of neuroscience is not as valuable as taking classes related directly to their research, but the CNBC program guarantees a well-rounded education that is useful both in understanding one’s own work in a more general frame of mind and being able to appreciate other people’s work.” After graduating, she intends to keep working on similar research by modeling complex information processing using computational approaches.

Reference
Wehbe et al. (2014). *Aligning context-based statistical models of language with brain activity during reading*. Proceedings of the 2014 Conference on Empirical Methods in Natural Language Processing.

Faculty Books

Analysis of Neural Data
by Rob Kass (Statistics, CMU) with
Uri Eden and Emery Brown

Publisher, Springer



In 1998, Kass and Emery Brown (Massachusetts General Hospital and MIT) agreed to write a review article on statistical analysis of spike train data. They discovered that many of the techniques they hoped to be reviewing had not yet been developed. This led to many years of research, a broadening of interests to include other investigative modalities, especially neuroimaging, and a realization that a book on statistical methods in neuroscience was desperately needed. “One thing we decided to do,” Kass said, “was illustrate data analysis principles with examples drawn from the literature across the brain sciences.” There are more than 100 such examples in the book. “We also introduced quite a bit of theory, but only when it was needed in order to explain the analytical methods we presented.”

Attention
by Wayne Wu (CNBC, CMU)

Publisher, Routledge Press



Wu’s textbook links attention to philosophical issues, but the initial chapters discuss empirical work on attention and attempt to provide a conceptual synthesis of those results. “It is not uncommon to find scientists wondering whether William James was right, that we all know what attention is,” Wu notes. “People say that ‘attention’ means too many things.” Still, in the book, Wu notes that a common thread in all experimental paradigms on attention is that where subjects select some target to perform the task, the subject is taken to attend to the target. That is, selection for task is sufficient for attention. “This provides a unifying conception of attention drawn from the experimental methodology,” Wu concludes.

Nathan Urban appointed interim Provost at Carnegie Mellon University



Nathan Urban, formerly chair of the Department of Biological Sciences, CMU, was appointed by CMU president Subra Suresh to serve as interim provost. An active member of the CNBC, Urban's laboratory continues to investigate brain function and computation using the olfactory system as a model organism. "One feature of our work has been the question of how "noise" or variability affect brain function," Urban notes. "This has led us to work on questions about the importance of cell-to-cell variability

(both within and between neuron types) in robust coding of stimuli to questions about how shared fluctuations can improve correlations across a variety of time scales." Urban's work in this area has involved collaborations with a number of CMU and Pitt colleagues including Bard Ermentrout (Pitt Math) and Rob Kass (CMU Statistics).

During his tenure as department head, Urban oversaw the hiring of two neuroscientists into Biological Sciences and the CNBC, Aryn Gittis and Sandy Kuhlman (see last issue for profiles): "Their arrival has helped to create real critical mass for cellular and systems neuroscience at CMU, and they both bring important technical and conceptual expertise to the community. They are both off to a great start, and they will be key elements of CMU's efforts in brain science for years to come."

Urban looks forward to working to promote brain science both at CMU and in connection to the CNBC: "In the next year, I hope that we can increase CMU's profile and competitiveness in a number of areas, including brain science. I think that a critical aspect is to increase the degree to which our faculty with expertise in computer science and engineering are engaged with our faculty who are thinking about brain and behavior. This intersection, while already strong at CMU, will be important for moving forward in interpreting and understanding the complex kinds of data that will become increasingly available in the future."

Recent Honors



David Creswell (Associate Professor in Psychology, CMU) has been awarded the American Psychological Association Early Career Award, the top early career award in psychology. Creswell's research focuses on understanding the neurobiological mechanisms

of stress resilience and the award recognizes his research in health psychology.



Pulkit Grover (Assistant Professor in Electrical and Computer Engineering, CMU) has been awarded a five year \$600,000 National Science Foundation Career Award to reduce energy consumption in big data center networks. The award will enable the development of the

science of information for minimum energy communication and computing and applied to the design of energy efficient brain-machine interfaces to aid understanding of brain circuits and of energy efficient computing in brain networks.



Bita Moghaddam (Professor of Neuroscience and Psychiatry, Pitt) has received the Neuroscience Basic Research Award, given every two years by the International College of Neuropsychopharmacology to an established scientist in recognition of outstanding contribution to

psychopharmacology. The award recognizes her important work in shaping schizophrenia and depression research using a systems approach in rodent models to study neuronal mechanisms that maintain cognitive and emotional functions in brain regions implicated in psychiatric illnesses.



Tim Verstynen (Assistant Professor of Psychology, CMU) has received the Faculty Early Career Development (CA-REER) Award from the National Science Foundation. This work supports a set of behavioral, imaging and modeling projects trying to understand at what level

(i.e., conceptual or motoric) skilled sequential actions are learned across several days of training.



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Honors & Awards

Faculty

Kevin Chuen Wing Chan was awarded the 2014 Alcon Research Institute Young Investigator Award.

Kirk Erickson was awarded the Neal Miller Young Investigator Award from the Academy of Behavioral Medicine Research.

David Lewis received the 2013 Edward A. Strecker Award from the University of Pennsylvania and the 2014 American Psychiatric Association Research Award.

Melissa Libertus received the 2014 International Mind Brain and Education Society (IMBES) Early Career Award.

George Loewenstein received an Honorary Doctor of Science degree from the University of Warwick.

Beatriz Luna received the 2014 Society for Adolescent Health and Medicine (SAHM) Gallagher Lecture Award.

Charles Perfetti was awarded the 2014 Distinguished Scientific Research Award from the Society for Text and Discourse.

Mary Phillips became an elected member of the American Society for Clinical Investigation and was also elected Counselor-at-Large of the Society of Biological Psychiatry.

Postdoc

Lauren Bylsma was awarded a K01 to examine neural and daily life behavioral indices of emotional reactivity and regulation in youth at high risk for depression.

Kathleen Salerno was awarded an F32 grant on the contribution of synaptic vesicle proteins to molecular mechanisms of amphetamine.

Adam C. Snyder was awarded an NIH NRSA Individual Postdoctoral Fellowship.

Current Students

Victoria Corbit received Honorable Mention for the 2014 National Science Foundation Graduate Research Fellowship Program.

Ana Beisy Cruz received the CSol Channel Scholarship, with a goal of designing signal processing strategies for precise neuromodulation using ultrasound.

Matt Golub received the Bertucci Graduate Fellowship from the Carnegie Institute of Technology.

Regina Leckie was awarded the Dr. Ruth Myers Memorial Award for Mentoring Excellence from the University of Pittsburgh.

Ran Liu was awarded a grant from the National Science Foundation entitled "Investigating generalization, transfer, and representation resulting from non-native speech category training."

Tina Liu received a Fellowship for the MIT "Brains, Minds and Machines" summer course at MBL, as well as the 2013 Ungerleider Carnegie Prize Graduate Fellowship.

Jared Moreines was named Finalist, 2014 Top Poster Award, Society of Biological Psychiatry.

Cyrus Omar received the 2013 Alan J. Perlis Graduate Student Teaching Award.

Suchitra Ramachandran was runner-up in the Three-Minute Thesis competition conducted by Carnegie Mellon University and also won the People's Choice Award.

Alba Tuninetti received a 2014 Language Learning Doctoral Dissertation Grant from the Language Learning Journal, and the 2014 Provost's Fund Development Award from the University of Pittsburgh.

Andrea Weinstein was awarded the 2014 Walter G. McMillen Memorial Award from the American Psychological Association and a 2014 Ruth L. Kirschstein National Research Service Award (NRSA) from the National Institute of Neurological Disorders and Stroke.

Amanda M. Willard received an NIH Predoctoral Training Grant in Basic Neuroscience and a 2014 Dolmetsch Carnegie Prize Graduate Fellowship.

Recent Doctoral Graduates

Jineta Banerjee, CMU Biological Sciences (Kandler)

Eva Dundas, CMU Psychology (Behrmann)

Jason Godlove, Pitt Bioengineering (Batista)

James Hokanson, Pitt Bioengineering (Weber)

Kubra Komek, CMU Neural Computation (Cho & Ermentrout)

Ashok Kumar, CMU Neural Computation (Doiron)

Sung-joo Lim, CMU Psychology (Holt)

Christopher Paynter, CMU Psychology (Reder)

Maria Tsiarli, Pitt CNUP (DeFranco)

Rachel Vistein, CMU Biological Sciences (Puthenveedu)

Cassandra Weaver, Pitt Bioengineering (Cui)