Synapse

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What's inside

Georgia State University Honors CBN Director

Center for Behavioral Neuroscience Director, Elliott Albers, Ph.D., recently received Georgia State University's prestigious Exceptional Service Award. The award recognizes a faculty member's extraordinary accomplishments in discipline-related service to the community, and excellence in scholarship and teaching.

When accepting the award, Dr. Albers, who is also a Georgia State Regents Professor of Neuroscience, and Director of the University's Special Research Initiative, noted that the honor reflects the hard work of CBN members in each of the Center's seven partner institutions who donate their time to bring an appreciation of science to K-12 teachers and students, higher education students, and to the general public.

"Our partnerships with local organizations like GeorgiaBio, the Georgia Research Alliance, Zoo Atlanta, and the Fernbank Museum of Natural History have also played an important role in garnering national and international exposure of our education and research programs," Dr. Albers said.

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Editor: Martha Barker Koontz

You Can Teach an "Old Brain" New Tricks

Evidence for Learning-Dependent Changes in the Adult Brain

Until the 1980s, scientists believed that the majority of changes related to learning and plasticity in the human brain occurred mainly during development. Since then, researchers have discovered that large sensory changes can occur in adult brains, although the mechanisms for these changes remain unknown. Moreover, it is assumed that long-term memories are associated with structural changes in the brain, but evidence for this has not been easy to demonstrate in the complex human brain.

CBN scientists confirm the olfactory sensory pathway in adult mice is capable of learning-dependent structural plasticity.

A recent study by Center for Behavioral Neuroscience (CBN) scientists demonstrated that emotional learning of odor cues alters the primary sensory representation within the nose and brain of adult mice. These data indicate that the primary sensory neuron population and its projections may remain plastic in adults, providing a structural mechanism for learning-enhanced olfactory sensitivity and discrimination.

"These findings are particularly exciting to us in that we have found a robust

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Georgia State/GA Tech Imaging Center Opens

The Center for Advanced Brain Imaging (CABI), a joint venture of Georgia State University and the Georgia Institute of Technology, provides CBN members and other scientists in metro Atlanta with around-the-clock access to a dedicated magnetic resonance imaging scanner.

Georgia State University and the Georgia Institute of Technology have opened a new center that will provide researchers around Atlanta with a dedicated magnetic resonance imaging scanner to further study the mysteries of the brain and mind.

The Center for Advanced Brain Imaging, a joint venture of Georgia State and Georgia Tech, opened this spring for researchers exploring topics from autism and learning disabilities, to applied physiology, brain signals and brain-computer interfaces.

"We are excited to open a facility which will provide researchers exploring the mind with a dedicated, around-the-clock center to advance research in some of the most fascinating and challenging areas of neuroscience," said Robin Morris, vice president of research at Georgia State. "This is yet another example of how

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Celebrating a Decade of the CBN

Since its inception in 1999, CBN's collaborations have led to startling new discoveries on how the brain controls social behavior; its venture grants have helped bring more than $94 million in external funding to CBN member institutions; and its education programs have introduced more than 20,000 students and teachers to neuroscience.

It is these accomplishments and more that we celebrate during the 10th year of our existence. I would like to take this opportunity to assure our members and community partners that even though NSF funding will end on Oct. 31, 2009, the CBN will not.

During the last decade, the Center has made substantial progress in understanding how the brain works and has made tremendous contributions to neuroscience through innovative research, education, and community programs. Due to the diligence of our members, we've become known within the scientific community as *"a model for conducting nationally recognized scientific research through a broad consortium of colleges and universities,"* and our accomplishments referred to as *"remarkable."*

Our education and community programs, led by Drs. Laura Carruth, Kyle Frantz, and Karen Falkenberg, have become highly sought after by many students and teachers. A metro Atlanta science teacher recently made this remark about the annual Brains Rule! Brain Expo for middle schools students - *"This is the piece de resistance for our school…and we look forward to continuing this relationship."*

We aim to use this foundation of progress and support to build upon the achievements we have made to this point and create new opportunities for our members. For example, the CBN was recently awarded a Templeton Foundation Grant that will support development of research into the fundamental neuroscience of positive emotions and social traits such as social bonding, tolerance, empathy, and hope.

CBN Director Elliott Albers, Ph.D., accepts the Georgia State University Exceptional Service Award. Pictured from left: Georgia State President Mark Becker, Elliott Albers, and Georgia State Provost Ron Henry. ***Photo by: Carolyn Richardson, Georgia State University***

On a larger scale, the state of Georgia received a biotech boost when the world's foremost biotech researchers and industry leaders made their way to Atlanta for the 2009 BIO International Convention, May 18-21. Bioscience is quickly becoming the fastest growing industry in the state and lawmakers are beginning to take notice and realize the importance of connecting Georgia's industry with top institutional researchers. Creating and maintaining interdisciplinary programs such as the CBN will also play a critical role in bringing not only science, but other disciplines such as business and law to the table.

With these new opportunities on the horizon, both on the university and state level, we have much to look forward to in the next 10 years. ■

Service Award

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Under his leadership, the Center reaches out to thousands of Georgians each year with its innovative education programs which include: Brain Camp for Kids, a week-long neuroscience camp for middle school students; Institute On Neuroscience (ION), an eight-week summer research program for high schools students; BRAIN (Behavioral Research Advancements In Neuroscience) a 10-week research program for undergraduate students; and a Teacher Professional Development Workshop at Zoo Atlanta for Georgia science teachers. Community programs include the Brain Expo, which draws thousands of Atlantans to Zoo Atlanta each spring, and the annual Georgia Regional Brain Bee neuroscience trivia competition for high school students, now sponsored by the Atlanta Chapter of the Society for Neuroscience with CBN as co-sponsor.

In addition to his work with the CBN, Dr. Albers has authored more than 125 scholarly papers on the neural basis of behavior and served as a consultant for 29 scientific journals. He has been a member of numerous academic and scientific advisory boards. He also has been an advisor to the National Institutes of Health, National Science Foundation, NASA and the Air Force Office of Scientific Research. ■

Olfactory Sensory Pathway

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adaptation of the olfactory sensory system in a adult mammalian nervous system," said Dennis C. Choi, Ph.D., a CBN postdoc at Emory University. "This is a rare model considering very few areas of the brain continue to have dividing cells throughout adulthood."

In their research, published in the December 2008 issue of the *Journal of Neuroscience*, Choi and his CBN colleagues, Drs. Kerry Ressler and Mike Davis, and former CBN graduate student, Seth Jones, of Emory University, examined fear-conditioning to discrete odor stimuli in adult mice to test the hypothesis that odor-specific changes in the representation of the primary sensory pathway occur in a learning-dependent manner in adult animals. These mice were compared to mice exposed to the same odor without conditioning, a different odor with conditioning, and to mice with no exposure to the experimental protocols.

The results demonstrated that an odor paired with fear conditioning increased the size and number of odorant-specific neurons in the olfactory epithelium indicating that the primary olfactory sensory pathway in adult mice is capable of learning-dependent structural plasticity that is not due to non-specific odor learning.

"Overall, these changes in the olfactory system demonstrate the importance of associative learning and that it is very likely that regions of the brain involved with learning and associations are influencing the recruitment of primary sensory neurons into adulthood," Dr. Choi said.

This study is the first to show glomerular plasticity, not just following olfactory stimulation, but after olfactory-dependent associative learning, in the adult mammalian olfactory system. This phenomenon can be used as a powerful model of adult learning-dependent plasticity, where different stimuli within the same modality can produce different changes in structural representation.

According to Choi, future experiments aim to elucidate the mechanisms involved within the olfactory system, as well as the specific regions of the brain that may have direct influence on the adaptation in odorant-specific population of adult olfactory sensory neurons during olfactory-dependent learning. ■

Imaging Center

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the University System of Georgia has encouraged partnerships between institutions, which yield great gains in scientific advancement."

The center, a facility that has been more than a decade in the making, will provide a huge boost to the study of neuroscience on both campuses, said Randall Engle, professor of psychology at Georgia Tech and interim director of the Center for Advanced Brain Imaging.

"It will bring people together from a broad range of disciplines to study how the brain works, how the brain creates the mind, and to better understand disorders and disabilities emanating from the brain," he said.

The Marietta Street center provides both institutions with a research-dedicated functional magnetic resonance imaging scanner (fMRI). Scans from fMRIs tell researchers about active areas of the brain while the person is performing certain cognitive or behavioral functions, which shed further light on the brain.

Researchers at both institutions often had to vie for time at clinical MRIs based at hospitals, but the CABI's scanner is solely dedicated to academic research, giving researchers a wider opportunity to perform their experiments.

The $2.3 million fMRI scanner, funded by the Georgia State University Research Foundation, Georgia Tech Research Institute, and the Georgia Research Alliance through the Center for Behavioral Neuroscience, is housed in a 6,000 square-foot facility with a 6-inch thick floor to hold the massive equipment. The machine's magnetic power is rated at 3 Tesla — a unit measuring the strength of a magnetic field — which provides the power to observe details of electrical impulses and pathways in the brain. The MRI scanner is twice as powerful as conventional MRI scanners operating at 1.5 Tesla, and 60,000 times stronger than the earth's magnetic field.

The machine will run 24-hours-a-day, seven-days-a-week to accommodate not only researchers from Georgia State and Georgia Tech, but researchers from other institutions who wish to use it. The CABI also includes facilities for transcranial magnetic stimulation, or TMS, which is a strong magnet that applies bursts to the outside of the head to temporarily disrupt a portion of the brain, giving researchers a way to study the roles of different brain regions. ■

~ Jeremy Craig
Georgia State University

2009 Brains Rule! Brain Expo

"This is the piece de resistance for our school, as we have only one major field trip during the year. So many of our students looked forward to it..."

Michaelangelo Calhoun
Seventh Grade Life Sciences Teacher
Renfroe Middle School, Decatur, GA

Students learn about brain anatomy at the Touch-A-Brain station. ***Photo by: Carolyn Richardson, Georgia State University***

A game of tic-tac-toe helps teach seventh-grade students from Renfroe Middle School how games enrich lives of zoo animals.

Visual distortion goggles simulate the sensory-motor deficits associated with alcohol intoxication.

It takes more than 100 student and faculty volunteers to make the Expo a success. Thank you volunteers!

Inside Sparky, the 35-foot giant neuron, students learn neuron anatomy, action potentials, and neurotransmission.

Sensory games help students learn more about their central nervous system.

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Celebrating CBN Member Achievement

Hang Lu
CBN faculty, Georgia Tech

Sloan Research Fellowship in Neuroscience, Alfred P. Sloan Foundation, 2009

Kerry Ressler
CBN faculty, Emory University

Freedman Award for Outstanding Basic Research, NARSAD, July 2009

Irwin Waldman
CBN faculty, Emory University

President Elect of the Behavior Genetics Association, 2009

John Pulliam
CBN student, Morehouse School of Medicine

First Fellowship in Research and Teaching, Emory University, June 1, 2009

Todd Ahern
CBN student, Emory University

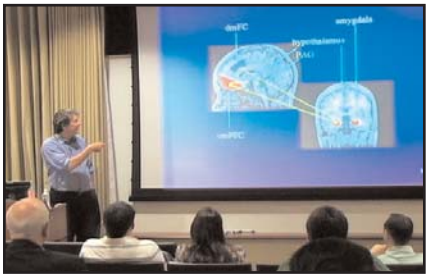
Dean's Teaching Fellowship, Emory University, Graduate School of Arts & Sciences (2009-10)

Zoe Donaldson
CBN student, Emory University

Robert Wood Johnson Foundation Health and Society Scholars Post-doctoral Award, 2009

Celebrating academic achievement: If you or your student has recently been recognized for outstanding academic achievement, we would like to post an announcement in the *Synapse*. To submit an announcement, please send: name, collegiate affiliation, and a brief award/honor description to Martha Barker Koontz at: mbarker@gsu.edu.

CBN Spring Symposium Takes Place at Emory University



James Blair, Ph.D., of the National Institutes of Health, gives a presentation during the CBN's 2009 Spring Symposium. The symposium entitled, *"Social Cognitive Neuroscience: Studies in Humans and Non-Human Primates,"* took place at Emory University, and drew in more than 100 neuroscientists from the metro Atlanta area. *Photo by: Rob Poh, CBN.*

Publications

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