Synapse

SPRING 2008 A quarterly publication of the CENTER FOR BEHAVIORAL NEUROSCIENCE

What's inside

CBN Plays Key Role in Development of GSU's Neuroscience Institute

Since its inception in 1999, the Center for Behavioral Neuroscience (CBN) has played a key role in supporting neuroscience initiatives at all its member institutions including Georgia State University with the development of the Brains and Behavior Program in 2004 and most recently with the creation of the Neuroscience Institute.

The Institute, which emerged from the Brains and Behavior Program, will be a new part of Georgia State University designed to gather GSU neuroscience faculty into a single administrative home to support their research and provide new degree programs to GSU students.

"I don't think the Institute would have ever been formed if CBN had not helped neuroscience at GSU develop into such a strong component of the University," said Walt Wilczynski, Ph.D., Neuroscience Institute director, CBN co-director for research, and a GSU psychology professor. "The Center did this by supporting GSU's efforts to hire more neuroscience faculty, providing neuroscience fellowships for graduate

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Vol. 9, No. 2

News? Story Ideas?
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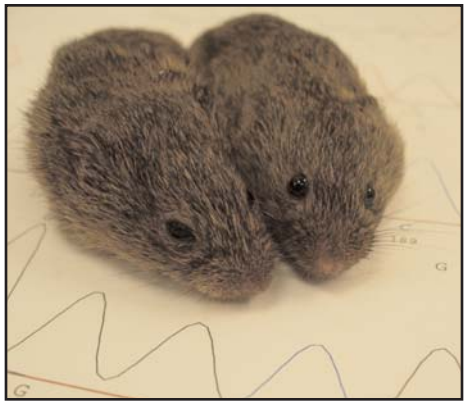
Editor: Martha Barker Koontz

Research May Enhance Social Cognition for People with Autism

The Centers for Disease Control estimates that 1-in-150 children nationwide are diagnosed with autism spectrum disorder (ASD), making it more common than pediatric cancer, diabetes, and AIDS combined.



CBN graduate student Meera Modi is working to develop social bondng in prairie voles as a predictive model for the development of drugs that may be useful in enhancing social cognition in individuals with autism. *Photo courtesy of Larry Young, Ph.D., and Meera Modi of Emory University.*

These statistics have led some to refer to the behavioral disorder as an "urgent public health concern."

ASD is a developmental disorder characterized by aberrant social interactions, impairments in communication and repetitive stereotyped patterns of behavior. CBN student Meera Modi is conducting research that may lead to a potential treatment that could enhance social cognition and ameliorate some of the social deficits in ASD.

Modi is a rising fourth-year Emory University Neuroscience Graduate Program student who works in the lab of Larry Young, Ph.D., Professor in the Department of Psychiatry and Behavioral Sciences at Emory University's School of Medicine and the Yerkes National Primate Research Center.

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Expo Puts Visitors in Touch with the Brain

More people than expected braved the rain on Saturday, April 4, and headed out to Zoo Atlanta for the CBN's annual Brains Rule! Brain Expo held in conjunction with Brain Awareness Month as part of a national effort to increase brain awareness.

The Expo, conducted by more than 200 Atlanta area neuroscience faculty and students, featured more than 30 interactive booths with short neuroscience lessons to engage visitors in interesting topics ranging from brain cells and neuroanatomy to learning, memory, and neurological disorders.

The CBN wishes to thank all its Expo volunteers and the many Atlanta area community organizations who helped to make this year a success.

The Expo's Build-A-Brain station teaches visitors anatomy of the brain and encourages them to create an imaginary brain using Play-doh.

See more photos on page 6

State and National Support for CBN

Georgia is home to a burgeoning life sciences industry and with that growth comes the need for researchers with the skills to meet an increasing demand for a scientifically educated workforce. To help build and maintain this specialized workforce, we've been seeking funding to support programs that reach a broad spectrum of people, from teaching elementary school students about the brain to providing neuroscience researchers with funding and space.

With this in mind, I am proud to share a few recent developments that show leaders on a local, state, and national level are putting science education high on their priority lists:

- The Neuroscience Institute was formally inaugurated at Georgia State University. The Institute, to be led by CBN Co-Director for Research, Walt Wilczynski, Ph.D., will bring GSU neuroscience faculty under one roof, encourage and support their research, and for the first time in the University's history offer a graduate degree in neuroscience.
- GSU and the CBN received an $80,567 Congressionally-directed grant which will create a dynamic partnership among colleges and universities, school systems, community educational organizations, and the life sciences industry. The partnership aims to enhance how science is taught at the middle and high school levels so that students become more aware of and interested in education choices in the sciences and exploring scientific career pathways.
- In April, U.S. Senator Johnny Isakson took time to sit down with me; Charlie Craig, president of Georgia Bio; and Bill Kitchens, chair of Georgia Bio's Governmental Affairs Committee to discuss science education in Georgia and the life sciences industry's benefits to the state's economy and residents.


H. Elliott Albers, Ph.D.

We at the CBN are grateful for the time and support of our local, state, and national leaders.

H. Elliott Albers

Neuroscience Institute

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Walt Wilczynski, Ph.D.

students in several departments, and supplying research funds to faculty and students which allowed their research to become nationally recognized."

In turn, the Institute will help the CBN advance its mission of developing strong collaborative and cross-institutional neuroscience research and education components at each of its member institutions, Wilczynski said.

"Creation of the Institute will be especially beneficial to CBN student members at GSU as it enhances neuroscience graduate training at the University with the formation of a new neuroscience Ph.D. program," he said. "The Institute's long range plan is to develop an undergraduate neuroscience major as well, but it will be a few years before undergraduates will be able to declare a major in neuroscience."

Wilczynski stressed that the Institute is not replacing the CBN at Georgia State, but that the two programs will pool their resources and continue to address the growing demand for information on the brain and research of possible treatments for behavioral disorders.

"Like the CBN as a whole, GSU's Neuroscience Institute is keenly aware of the importance of a relationship with Georgia's biotech industry. We're helping to train the next generation of neuroscience researchers and plan to join with the CBN in new initiatives that will connect research in academic labs with industry interests, and neuroscience students with the needs of the private sector."

For more information on the Institute email: wwilczynski@gsu.edu.

Be on the lookout for...

Sarah Brosnan, Ph.D., assistant professor of psychology at Georgia State University (GSU), studies the evolution of economic behaviors such as cooperation, reciprocity, and reactions to inequity, primarily in nonhuman primates. She is also interested in decision making, and hopes to gain a better understanding the evolution of "irrational" behaviors, in which individuals make decisions which initially appear counter to their interests. She is a member of the memory and cognition, and affiliation collaboratories.

Mukesh Duhamala, Ph.D., assistant professor of physics at GSU, studies various aspects of human cognition, perception and emotion using functional neuroimaging techniques (simultaneous fMRI/EEG and fMRI). He is interested in examining brain networks and dynamics underlying human decision-making processes, complex rhythmic movements, and multisensory perceptions. He is a member of the memory and cognition collaboratory.

Audrey Duerte, Ph.D., assistant professor of psychology at the Georgia Tech, investigates the organization of episodic memory processes in the brain and how these processes are affected by aging in humans. To address these and other issues she uses multiple experimental techniques, such as behavioral testing, electrophysiology (EEG), functional neuroimaging (fMRI) and neuropsychological studies of people with brain injury. She is a member of the memory and cognition collaboratory.

Dario Maestripieri, Ph.D., professor of comparative human development, evolutionary biology, and neurobiology at the University of Chicago studies the neuroendocrine and neurobiological regulation of social behavior in animals and humans. He is generally interested in brain-behavior and hormone-behavior relationships in the context of variation in behavior among individuals, during development, and in relation to changes in reproductive state. His research focuses on motivated behaviors such as aggression, affiliation, mating, and parenting. His current animal research involves nonhuman primates, especially rhesus macaques.

Seth Norrholm, Ph.D., faculty associate, Department of Psychiatry and Behavioral Sciences, Emory University School of Medicine, focuses his research on conditioned fear extinction and stimulus generalization as it relates to the symptomatology of post-traumatic stress disorder (PTSD). Dr. Norrholm has procured grant funding to examine potential genetic influences on one's susceptibility to develop PTSD following exposure to a traumatic event, as well as individual response to

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treatment. A member of the fear collaboratory, Dr. Norrholm's studies include combat veterans returning from the theaters of war in Iraq and Afghanistan. His research methodologies include acoustic startle testing, galvanic skin response measures, contingency awareness assessment, and virtual reality as both a research tool and clinical treatment option.

Gretchen Neigh, Ph.D., assistant professor of psychiatry & behavioral sciences at Emory University, uses rodent models to study the neurobiology of affective disorders at the two ends of the life span. One branch of Dr. Neigh's work examines the effects of stress exposure during development (peri-natal and peri-adolescent) on affective behavior and HPA axis function in adulthood. The second branch of her work examines the effects of mild vascular insults, roughly akin to pin strokes, on affective behavior and memory. Neigh is a member of the affiliation and fear collaboratories.

Shani Harris Peterson, Ph.D., assistant professor in the Psychology Department at Spelman College, is interested in sexual health promotion, specifically as it relates to preventing HIV and other sexually transmitted infections. Her research examines the influence of cultural context, popular media, and biology on sexual behaviors in adolescents and young adults. She is interested in determining whether exposure to stereotypical sexual imagery is associated with differential brain activation and image recall in men and women; and whether these factors influence subsequent sexual attitudes and behaviors. She is a member of the reproduction collaboratory.

Irwin Waldman, Ph.D., professor of psychology, Emory University is a clinical psychologist with developmental and statistical interests who examines the classification and genetic and environmental etiology of disruptive behavior disorders (e.g., ADHD, conduct disorder) and related traits (e.g., reactive and proactive aggression, antisocial behavior) in childhood and adolescence. His current research explores the role of candidate genes in the development of externalizing behavior problems, as well as genetic and environmental influences on comorbidity and on the links between normal variation in symptoms and in personality in the general population and extreme variants in clinical samples. He is a member of the aggression and affiliation collaboratories.

Enhancing Social Cognition

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Previous CBN-supported research in Dr. Young's lab found that mice lacking oxytocin fail to process social cues normally and that oxytocin receptors in the brains of monogamous prairie voles promote social bonding. Based on these results, it has been suggested that inadequate levels of oxytocin, possibly in the amygdala might explain the inability of autistic people to recognize social cues and to create normal social relationships.

"I am working to develop social bonding in the prairie vole as a predictive model for the development of drugs that may be useful in enhancing social cognition in individuals with autism," Modi said. "Prairie voles have a much more complex repertoire of social behavior than either rats or mice, and social bonding in voles relies on a series of social cognitive processes. By studying an animal with complex social behavior we are better able to characterize specific phenotypes, look at the neurobiological mechanisms underlying them and determine how different pharmacological agents may affect them."

Meera Modi

As a part of an Autism Speaks Fellowship she received in December 2007, Modi will conduct a series of experiments designed to understand the interaction between oxytocin and glutamate, which includes testing whether clinically available glutamatergic compounds can enhance social cognition in the prairie vole.

"Both oxytocin and drugs that target the glutamate system are currently under investigation as possible therapeutic agents in autism so our studies are important to clarify how they may be operating in the brain," she said.

Modi's interest in the effects of glutamate receptor agonists led her to D-cycloserine (DCS), a drug formerly used to treat tuberculosis. CBN-supported research led by Mike Davis, Ph.D., and Kerry Ressler, Ph.D., of Emory University's School of Medicine found that DCS, an NMDA receptor mixed agonist that enhances synaptic transmission in the amygdala and other parts of the brain, enhances the extinction of conditioned fear in rats and some social phobias in humans.

Inspired by the work of Drs. Davis and Ressler, Modi and Dr. Young found that giving DCS to female prairie voles promotes partner preference formation in female prairie voles under conditions in which social bonds do not typically form, suggesting that it enhances some aspects of social cognition.

"This is the first study to show that modulation of the glutamate system can enhance social bonding," Modi said. "We hypothesize that by enhancing glutatergic transmission in the nucleus accumbens, we are expediating the process of social learning, such that the application of DCS promotes the long term encoding of the rewards associated with social interaction. The drug has already been approved for use in humans, allowing our tests in voles to have direct implications for humans."

Further studies will explore the effect of a combination oxytocin and DCS therapy on the enhancement of social bonding in voles and as a therapeutic strategy to treat the social cognitive deficits in ASD.

Meera Modi's photo courtesy of Larry Young, Ph.D., Emory University

2008 Brain Expo Highlights

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1. *Touch-A-Brain* – Visitors explore neuroanatomy of the brain by touching a real brain specimen.

2. *Incredible Edible Neuron* – Children explore neuroanatomy using yummy cookie creations.

3. *Thank You Expo Volunteers* – It takes the time and talents of more than 200 Atlanta area neuroscience faculty and students to make the Expo a success.

4. *Prize Wheel* – A child spins the prize wheel in hopes of carrying home one of many of the fun brain-related prizes.

5. *Vomit* – New to the Expo this year, the vomit station taught visitors that "when the brain says, 'no' the medulla says, 'go.'" This station was voted a crowd favorite.

6. *Phineas Gage* – During Friday's reverse science fair, a group of Renfroe Middle School, students listen to the story of one of the most famous patients to have ever survived severe brain damage.

7. *Brain Art* – Visitors create and take home wearable brain memorabilia.

8. *Dunking Under the Influence* – Teaches visitors how vision and coordination become distorted when visitors simulate intoxication states using state-of-the-art visual distortion goggles.

9. *BAM Classroom Visits* – This year volunteers from the CBN and the Atlanta Chapter of the Society for Neuroscience visited more than 4,000 students in metro Atlanta classrooms to teach students about the importance of the brain and brain health.

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To view more Expo photos, log on to:
http://www.cbn-atl.org/education/brainsrule.shtml

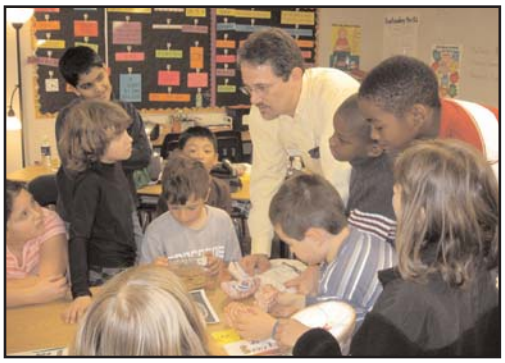

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Photo courtesy of Paul Katz, Ph.D.

Azevedo, C.V., Sousa, I., **Paul, K.N.,** MacLeish, M.Y., Mondéjar, T., Sarabia, J.A., Rol, M.A., Madrid, J.A. (2008) Teaching chronobiology and sleep habits in schools and universities. *J. Mind, Brain, Educ.*, 1: 34-47.

Bachorowski, J.-A., & **Owren, M. J.** (2008). Vocal expressions of emotion. Lewis, M., Haviland-Jones, J. M., & Barrett, L. F. (Eds.), *The handbook of emotion, 3rd Edition*, (pp. 196-210). New York: Guilford.

Bachorowski, J.-A., & **Owren, M. J.** (2007). Emotion-related vocal acoustics: Cue-configuration, dimensional, and affect-induction perspectives. In K. Izdebski (Ed.), *Emotions in the human voice* (pp. 87-99). San Diego: Plural Publishing.

Barr, C.S., M. L. Schwandt, S. G. Lindell, J. D. Higley, **D. Maestripieri,** D. Goldman, S. J. Suomi, M. Heilig. (2008) Variation at the mu-opioid receptor gene (OPRM1) influences attachment behavior in infant primates. *Proceedings of the National Academy of Sciences U.S.A.*, 105: 5277-5281.

Binder EB, Bradley RG, Liu W, Epstein MP, Deveau TC, Mercer KB, Tang Y, Gillespie CF, **Heim CM,** Nemeroff CB, Schwartz AC, Cubells JF, Ressler KJ. (2008) Association of FKBP5 polymorphisms and childhood abuse with risk of posttraumatic stress disorder symptoms in adults. *JAMA* 299(11):1291-1305.

Bordelon-Glausier, J.R., Z.U. Khan, **E.C. Muly** (2008) Quantification of D_1 and D_5 dopamine receptor localization in layers I, III and V of Macaca mulatta prefrontal cortical area 9: co-expression in dendritic spines and axon terminals. *J. Comp. Neurol.* 508:893-905.

Bradley RG, Binder EB, Epstein MP, Tang Y, Nair HP, Liu W, Gillespie CF, Berg T, Evces M, Newport DJ, Stowe ZN, **Heim CM**, Nemeroff CB, Schwartz A, Cubells JF, Ressler KJ. (2008) Influence of child abuse on adult depression: moderation by the corticotropin-releasing hormone receptor gene. *Arch Gen Psychiatry* 65(2):190-200.

Brosnan, Sarah F. (2008) A different approach to human evolution - a review of "Baboon Metaphysics: The evolution of a social mind" by Dorothy Cheney & Robert Seyfarth. *Evolution and Human Behavior* 29: 221-222.

Caprio, J. and **C.D. Derby.** (2008) Aquatic animal models in the study of chemoreception. In The Senses: A Comprehensive Reference, Six-Volume Set (eds. A.I. Basbaum, A. Maneko, G.M. Shepherd, and G. Westheimer.) Vol. 4, *Olfaction & Taste* (eds. S. Firestein and G.K. Beauchamp). Academic Press, San Diego. Pp. 97-134.

Dailey, M. E. and Bartness, T. J. (2008) Fat pad-specific effects of lipectomy on foraging, food hoarding and food intake. *American Journal of Physiology* 294:R321-328.

Davis RG, **Ressler KJ**, Schwartz AC, Stephens KJ, Bradley RG. (2008) Treatment barriers for low-income, urban African Americans with undiagnosed posttraumatic stress disorder. *J Trauma Stress* 21(2):218-222.

Duncan E, Boshoven W, Harenski K, Fiallos A, Tracy H, Jovanovic T, **Hu X,** Drexler K, Kilts C (2007) fMRI study of the interaction of stress and cocaine cues on craving. *Am J Addictions* 16:174-182.

Festuccia, W. T., Oztezcan, S., Laplante, M., Berthiaume, M., Michel, C., Dohgu, S., Denis, R. G., Brito, M. N., Brito, N. A., Miller, D. S., Banks, W. A., **Bartness, T. J.,** Richard, D. and Deshaies, Y. (2008) Peroxisome Proliferator-Activated Receptor-{gamma}-mediated positive energy balance in the rat is associated with reduced sympathetic drive to adipose tissues and thyroid status. *Endocrinology*, 149:2121-2130.

Gerardi M, **Rothbaum BO, Ressler K**, Heekin M, Rizzo A. (2008) Virtual reality exposure therapy using a virtual Iraq: Case report. *J Trauma Stress* 21(2):209-213.

Glover, E. M. and Davis, M. (2008) Anxiolytic effects of morphine and buprenorphine the fear-potentiated startle: Tolerance, cross tolerance and blockade by naloxone. *Psychopharmacology* (Berl) 198:167-180.

Goodisman MAD. (2007) A theoretical analysis of variation in multiple mating in social insects. *Sociobiolgy* 49:107-119.

Goodisman MAD, Kovacs JL, and Hoffman EA. (2007) Lack of conflict during queen production in the social wasp Vespula maculifrons. *Molecular Ecology* 16:2589-2595.

Goodisman MAD, Kovacs JL, and Hoffman EA. (2007) The significance of multiple mating in the social wasp Vespula maculifrons. *Evolution* 61:2260-2267

Goodisman MAD, Sankovich KA, and Kovacs JL. (2007) Genetic and morphological variation over space and time in the invasive fire ant Solenopsis invicta. *Biological Invasions* 9:571-584.

Hasenkamp W, Kelley M, Egan G, Green A, Lewison B, Boshoven B, Keyes J, **Duncan E** (2007) Prepulse inhibition of startle is reduced in family members of schizophrenia patients. *Schizophr Bull* 33(2):405.

Heldt SA, Ressler KJ. (2007) Training-induced changes in the expression of GABAA-associated genes in the amygdala after the acquisition and extinction of Pavlovian fear. *Eur J Neurosci.* 26(12):3631-3644.

Heldt SA, Ressler KJ. (2007) Forebrain and midbrain distribution of major benzodiazepine-sensitive GABAA receptor subunits in the adult C57 mouse as assessed with in situ hybridization. *Neuroscience* 150(2):370-385.

Horner, A.J., M.J. Weissburg, and **C.D. Derby.** (2008) The olfactory pathway mediates sheltering behavior of Caribbean spiny lobsters, Panulirus argus, to conspecific urine signals. *J. Comp. Physiol.* A 194: 243-253.

Jones SV, Stanek-Rattiner L, Davis M, Ressler KJ. (2007) Differential regional expression of brain-derived neurotrophic factor following olfactory fear learning. *Learning and Memory* 14(12):816-820.

Kamio, M., Reidenbach, M. A., **Derby, C. D.** (2008) To Paddle or Not: Context Dependent ?Courtship Display by Male Blue Crabs, Callinectes sapidus. *J Exp Biol.* 211: 1243-1248.

Kicklighter, C., Germann, M., **Kamio, M., Derby, C. D.** (2007) Molecular identification of alarm cue in defensive ink of the sea hare Aplysia californica. *Animal Behaviour.* 74: 1481-1492.

Kovacs JL, **Goodisman MAD.** (2007) Irregular brood patterns and worker reproduction in social wasps. *Naturwissenschaften.* 94:1011-1014.

Krebs-Kraft, D.L and Parent M.B. (2008) Hippocampal infusions of glucose reverse memory deficits produced by co-infusions of a GABA receptor agonist. *Neurobiology of Learning and Memory* 89(2):142-152.

Krebs-Kraft, D.L, Wheeler, M.G, and **Parent M.B.** (2007) The memory-impairing effects of septal GABA receptor activation involve GABAergic septo-hippocampal projection neurons. *Learning and Memory* 14(12):833-841.

Leitner, C. and **Bartness, T. J.** (2008) Food deprivation-Induced changes in body fat mobilization after neonatal monosodium glutamate treatment, *American Journal of Physiology*, 294:R775-R783..

Loyd D.R., Morgan M.M., **Murphy A.Z.** (2008) Sexually dimorphic activation of the periaqueductal gray-rostral ventromedial medullary circuit during the development of tolerance to morphine in the rat. *Eur J Neurosci.* 27(6):1517-1524.

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Celebrating CBN Student Achievement

Kelli Duncan
CBN graduate student, GSU:

NRSA Pre-doctoral Fellowship from NIH

GSU Dissertation Grant

Jamie LaPrairie
CBN graduate student, GSU:

Georgia State University Biology Department Teaching Award, 2008

Dayna Loyd:
CBN graduate student, GSU

International Association for the Study of Pain Travel Award, 2008

GSU Neurobiology and Behavior Outstanding Graduate Student Fellowship, 2008

GSU Biology Department Graduate Award for Outstanding Instruction, 2008

Deborah Lutterschmidt
CBN postdoc, GSU:

Dorothy M. Skinner Award from the Society for Integrative and Comparative Biology (SICB), 2008

Luis Martinez
CBN graduate student, GSU:

Travel Award for the 2008 Society of Behavioral Neuroendocrinology Annual Meeting

Joe Normandin
CBN graduate student, GSU:

Travel Award for the 2008 Society of Behavioral Neuroendocrinology Annual Meeting

Mahin Shahbazi
CBN graduate student, GSU:

Steven Kudravi Memorial Award for an Outstanding Teaching Assistant, 2008

Bridgett Wynn
CBN undergraduate student, GSU:

Travel Award for the 2008 Society of Behavioral Neuroendocrinology Annual Meeting

Alyson Zeamer
CBN graduate student, Emory:

2008-2009 PRISM Fellowship (Problems and Research to Integrate Science and Mathematics)

Celebrating academic achievement:

If your student has recently been recognized for his or her academic achievement, we would like to post an announcement on the CBN Web site. To submit an announcement, please send the student's name, field of study, and a brief award/honor description to Martha Barker Koontz at: mbarker@gsu.edu.

Publications

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Maestripieri, D. (2007) Macachiavellian Intelligence. How rhesus macaques and humans have conquered the world. *Chicago: The University of Chicago Press.*

Maestripieri, D., S. G. Lindell, J. D. Higley. (2007) Intergenerational transmission of maternal behavior in rhesus monkeys and its underlying mechanisms. *Developmental Psychobiology*, 49: 165-171.

Maestripieri, D., C. L. Hoffman, R. Fulks, M. S. Gerald. (2008) Plasma cortisol responses to stress in lactating and nonlactating female rhesus macaques. *Hormones and Behavior*, 53: 170-176.

Markham, C. M.; Huhman, K. L. (2008) Is the medial amygdala part of the neural circuitry modulating conditioned defeat in Syrian hamsters? *Learning and Memory* 15:6-12.

Mittal VA, Hasenkamp W, Sanfilipo M, Wieland S, Angrist B, Rotrosen J, **Duncan EJ** (2007) Relation of neurological soft signs to psychiatric symptoms in schizophrenia. *Schizophr Res* 94:37-44.

Muly, E.C., A.C. Nairn, P. Greengard, **D.G. Rainnie** (2008) Subcellular distribution of the Rho-GEF Lfc in primate prefrontal cortex: Effect of neuronal activation. *J. Comp. Neurol.* 508:927-939.

Normandin, J.J., and A.Z. Murphy (2008). Nucleus paragigantocellularis afferents in male and female rats: organization, gonadal steroid receptor expression, and activation during sexual behavior. *J Comp Neurol.* 508(5):771-794.

Owren, M. J., and Goldstein, M. H. (2008) The babbling-scaffold hypothesis: Subcortical primate-like circuitry helps teach the human cortex how to talk. In D. K. Oller, & U. Griebel (Eds.), Evolution of communicative flexibility: Complexity, creativity, and adaptability in human and animal communication (Vienna Series in *Theoretical Biology*, vol. 5; pp. 169-192). Cambridge, MA: MIT Press.

Rilling, James K., Sarah K. Barks, **Lisa A. Parr, Todd M. Preuss,** Tracy L. Faber, Giuseppe Pagnoni, J. Douglas Bremner, John R. Votaw. (2007) A comparison of resting state brain activity in humans and chimpanzees. *Proceedings of the National Academy of Sciences* 104(43): 17146-17151.

Rilling, James K., Matthew F. Glasser, **Todd M. Preuss,** Xiangyang Ma, Tiejun Zhao, **Xiaoping Hu** and Timothy E.J. Behrens. (2008) The Evolution of the Arcuate Fasciculus Revealed with Comparative DTI. *Nature Neuroscience* 11(4): 426-428.

Rilling, James K., Agnes Lacreuse, Sarah K. Barks, Hanie Elfenbein, Giuseppe Pagnoni, John R. Votaw and James G. Herndon. (2008) Effect of menstrual cycle on resting brain metabolism in female rhesus monkeys. *NeuroReport* 19(5):537-541.

Shipherd JC, Keyes M, Jovanovic T, Ready DJ, Baltzell D, Worley V, Gordon-Brown V, **Duncan E** (2007) Veterans seeking treatment for posttraumatic stress disorder: What about comorbid chronic pain? *J Rehab Res Devel* 44(2):153-166.

Steullet, P., **Edwards, D.H.** and **Derby, C.D.** (2007) An electric sense in crayfish? *Biol. Bull.* 213: 16-20.

Vonk, Jennifer, **Brosnan, Sarah,** Silk, Joan B., Henrich, Joseph, Schapiro, Steven, Richardson, Amanda, Lambeth, Susan P., Povinelli, Daniel J. (2008) Chimpanzees do not take advantage of very low cost opportunities to deliver food to unrelated group members. *Animal Behavior* 75(5): 1757-1770.

Wang, L.M., Schroeder, A., Loh, D., Smith, D., Lin, K., Han, J.H., Michel, S., **Hummer, D.L.**, Ehlen, J.C., **Albers, H.E.**, and Colwell, C.S. (2008). Role for the NR2B subunit of the N-methyl-D-aspartate receptor in mediating light input to the circadian system. *European Journal of Neuroscience* 27:1771-1779.

Whitham, J.C., M. S. Gerald, **D. Maestripieri.** (2007) Intended receivers and functional significance of grunt and girney vocalizations in free-ranging female rhesus macaques. *Ethology*, 113: 862-874.