2010 Research Report

The Mind
RESEARCH NETWORK
FOR NEURODIAGNOSTIC DISCOVERY

Welcome

As you read through this Research Report, a theme should emerge—a theme common to most of the research conducted by The Mind Research Network: early diagnosis and intervention is critical to a positive outcome for the patient. Whether it's mental illness, a developmental disorder or an injury to the brain, the sooner effective treatment can begin, the better that outcome should be.

Currently there are no definitive and specific laboratory tests for diseases such as schizophrenia, bipolar disorder, addiction and Alzheimer's, to name just a few. Although experienced clinicians—with the help of currently available medical testing—can diagnose these disorders in most cases, they cannot do so with 100% accuracy. In combination with the most recent findings in genetic research, newer scanning technologies are showing great promise in discovering biological indicators unique to a particular disorder, which may eventually lead to quicker, more accurate diagnoses and interventions tailored to each patient.

With respect to grant funding, 106 proposals, totaling over $156 million were submitted in 2009. Of the submitted proposals, 15 were funded for a total of $21M, with another $64M pending review or under resubmission. Combined with our existing grant portfolio, MRN will have 53 active awards for a total of $77M by the end of 2010. MRN also continues to excel in publishing scientific reports, producing 169 peer-reviewed publications and many additional book chapters and conference abstracts.

This increase in extramural funding and related scientific activity resulted in overall organizational expansion. At the end of 2009, MRN employed 153 staff and 107 volunteers, a 15% increase over the previous year. As a result of this success, MRN has established itself as a national leader in neuroscience research and has made a significant positive economic impact in the Albuquerque, New Mexico region.

Because summaries of each of our research areas are limited to one page, they cannot fully describe the entire scope of research taking place at MRN. If you would like to read about our investigators' work in more detail, please refer to the 'Additional Reading' section at the end of this report where you will find a list of recent publications. Additionally, a glossary of terms has been included on the inside back cover. You may also visit www.mrn.org for additional information about The Mind Research Network's mission to discover and advance clinical solutions for the prevention, diagnosis and treatment of mental illness and other brain disorders.

The Mind Research Network
www.mrn.org
505-272-5028

PRINCIPAL INVESTIGATORS


Kent Hutchison, PhD


Vince Clark, PhD


Sarah Feldstein Ewing, PhD


Francesca Filbey, PhD

ADDITIONAL RESEARCHERS

Eric Claus, PhD
Andy Mayer, PhD
Pilar Sanjuan, PhD

Addiction

Last year was particularly good for the growth of our addiction research area. Collaborative efforts among MRN and other scientists combine neuroimaging and genetic approaches to identify genes that influence the progression of addiction that could eventually guide treatment and prevention efforts. Dr. Kent Hutchison leads the addiction research team and recently received a five-year grant to examine the neurobiological effects of the medication varenicline on smoking cessation. Also, Dr. Sarah Feldstein Ewing received a five-year grant to study risky behaviors in adolescents along with two exploratory grants to develop new treatment approaches using fMRI.

Dr. Vince Clark's study of recovering cocaine and methamphetamine addicts has led to the discovery of possible differences in brain structure between those who relapse and those who do not. When comparing MRI scans of abstainers and relapsed users, abstainers showed greater activity in an area of the brain associated with emotion and attention. "One function this area of the brain handles is interpreting the world around you in terms of how it affects your health and safety," Dr. Clark explains. These scans, when combined with psychological histories of recovering stimulant addicts, have so far been 90% accurate in predicting relapses—hopefully leading to new rehabilitation techniques.

Another notable area of MRN addiction research is being conducted by Dr. Francesca Filbey, who is studying the neurobiological correlates of marijuana craving. Dr. Filbey published a recent paper in the Proceedings of the National Academy that examined cue-elicited craving for marijuana, a drug whose effects have not been explored to the same extent as alcohol and other drugs of abuse. Regular marijuana users were presented with both marijuana-related stimuli and neutral stimuli while undergoing fMRI scans. The results showed that several structures in the reward pathway demonstrated greater blood oxygen level dependent (BOLD) activation in response to marijuana-related stimuli as compared with neutral cues. BOLD activation of the orbitofrontal cortex and nucleus accumbens was also positively correlated with self-reported problems related to marijuana use. "What the results are indicating, is the cue-elicited craving for marijuana activates the brain's reward circuitry, and the magnitude of activation is associated with the severity of cannabis-related problems for the user," explains Dr. Filbey. "The hope is these findings may help in developing treatment strategies for cannabis dependence."

Going forward, MRN addiction researchers will be investigating new methods to predict, diagnose and treat addictions using combined genetic and neuroimaging analyses. Specifically, proposals have been submitted to study positive and negative reinforcement processes involved in pain, cocaine addiction and relapse, smoking, eating, and cannabis use.

Schizophrenia

Schizophrenia and other psychotic disorders remain a primary research focus for MRN researchers and collaborators. Great progress has already been made towards the goal of finding earlier and better methods to diagnose these diseases and bring more personalized treatment to the individuals suffering with these disorders.

For example, MRN researchers moved one step closer towards the development of a new diagnostic tool to accurately classify patients with schizophrenia and bipolar disorder, a historically difficult diagnosis. Using fMRI scans (which essentially gives a picture of changes in blood flow over time), Dr. Vince Calhoun and his team have been able to differentiate between the two disorders with better than 90% accuracy. Networks in the brain can be identified using fMRI, thus allowing researchers to see locations and patterns of brain activation while participants are doing a task as opposed to when they are at rest. Dr. Calhoun explains, "When looking at schizophrenia and bipolar disorder, we found two regions that showed profound differences in schizophrenia. Once we identified these networks, we were able to look at whether the changes in these areas could help us better differentiate schizophrenia from bipolar disorder, and also from healthy individuals." This discovery may eventually provide clinicians with more objective methods to accurately differentiate and diagnose these disorders earlier in the disease progression, which could result in the application of more effective treatments and better long-term prognoses.

Our investigators have developed additional mechanisms for identifying linked changes in large-scale genetic and functional brain imaging data. Using these tools, the relationship between multiple genetic markers and brain activation patterns in schizophrenia were identified. Ongoing research indicates this relationship is different for schizophrenia patients than for healthy controls, which suggests a fundamental difference in the brain organization between these two groups.

Another major accomplishment was MRN researchers receiving an $11M COBRE center grant. The grant will support four projects designed to identify key neurobiological mechanisms related to schizophrenia. The hope is that the results of these studies will eventually be used to facilitate the early diagnosis of schizophrenia and the reliable prediction of treatment outcomes.

One of MRN's initial projects was the MIND Clinical Imaging Consortium (MCIC), a multi-institutional study of first-episode and chronic schizophrenia patients. MCIC has created one of the world's largest and most comprehensive collections of anatomical and functional MRI, MEG, and biogenetic data related to schizophrenia. MCIC data have been reported in numerous publications each year, and MRN researchers are expanding the consortium with new collaborations and innovative research methods.

Goals for the MRN schizophrenia research team include developing new methods for predicting cognitive function in schizophrenia, leveraging existing studies on young people facing psychosis into a new imaging and multi-site grant proposal, and developing improved methods to differentiate between schizophrenia and bipolar disorders.

PRINCIPAL INVESTIGATORS


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Julia Stephen, PhD


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Neurodevelopment

A neurodevelopmental disorder is one that impairs a child's ability to develop along a typical trajectory. While the symptoms and causes of these disorders can vary widely, targeted interventions generally lead to better outcomes for these children. Since the brain is most malleable in children less than five years of age, the earlier interventions begin, the more likely these children will follow a closer to normal developmental path. This will hopefully lead to improved quality of life for these children and their families by increasing the child's independence as well as reducing long-term medical costs. One of the barriers to early identification is that many disorders are diagnosed behaviorally, which is limiting due to the natural variability in behavior among healthy children. Behavioral data often fail to indicate which interventions will be most appropriate for a given child, so understanding the atypical brain responses may help to develop and guide the use of a specific treatment.

Using noninvasive imaging, MRN investigators are studying brain development from birth through childhood with the goal of using brain structure and function to identify markers of disorders for the purpose of guiding therapies. Beginning with specific disorders, progress has been made on several fronts, including mapping epileptic activity in young children, and identifying structural and functional differences in children born prematurely. Using the world's first pediatric MEG system (the babySQUID®), Dr. Julia Stephen and her team have identified a measure of atypical brain connectivity in children as young as 20 months who have been diagnosed with an autism spectrum disorder (ASD). Identification of specific markers in children already diagnosed with an ASD may help identify markers of atypical brain development in young children who may be at risk for developing this disorder. Dr. Stephen is also focusing on identifying markers in children aged three to five years with fetal alcohol spectrum disorders (FASD). Due to the stigma associated with drinking alcohol during pregnancy, many children are not diagnosed with FASD until as late as five years of age. Like ASD, early intervention is key to improving the quality of life of children with an FASD, who are known to be at higher risk for developing other mental disorders.

With funding from the Delle Foundation, Drs. Arvind Caprihan and John Phillips are collaborating on a large scale project to investigate how MRI can be used to better understand normal brain development in children from birth to five years of age. In addition to performing a normative longitudinal study on children in the first year of life, Drs. Caprihan and Phillips are collaborating with University of New Mexico researchers on a new and important NIH study to better understand the structural and functional changes associated with providing erythropoietin to premature children in neonatal intensive care.

MRN recently recruited senior investigator Dr. Jeffrey Lewine to the neurodevelopment research team. His autism research focuses on identifying markers that will help identify optimal intervention techniques for individual children. Through these combined efforts, MRN neurodevelopment researchers are working toward improving the identification of developmental disorders and optimizing interventions based on known anatomical and/or functional deficits

Forensics and Social Cognition

MRN's forensic program continues to expand in both size and scope as investigators try to shed light on the underlying causes of anti-social behaviors. Crime is estimated to cost society more than $2.3 trillion a year, and MRN researchers are hoping to discover some of the neurobiological correlates of the behaviors that cause this huge economic and societal burden.

MRN's forensic research team now involves more than 40 investigators and staff. Through the use of a unique mobile MRI system, over 2000 brain scans have been collected on location at adult and adolescent correctional facilities, representing the largest set of neuroimaging data ever collected from forensic populations.

Dr. Kent Kiehl is the lead scientist of MRN's forensic program and the Director of MRN's mobile imaging core. "Our studies lead us to believe psychopathic behavior results from disruptions to the parts of the brain that regulate emotion, attention, decision making and other cognitive functions," Dr. Kiehl said. When presented with a series of words intended to invoke an emotional response, psychopaths show deficits in the paralimbic regions when processing 'emotional' words but show greater activity in lateral frontal areas, which are considered classic language areas. "Putting it simply, they use emotional regions less, and tend to employ non-emotional areas to do the processing," Kiehl explains. "Once we understand what causes abnormal behaviors, we can then work to more effectively diagnose and treat these disorders." Dr. Kiehl is also a member of The MacArthur Foundation Law and Neuroscience Project, which is studying how neuroscience is changing the legal system.

Another member of the team, Dr. Carla Harenski, is expanding on Kiehl's research by studying social cognition and moral judgment in psychopaths. "The psychopath's emotional deficits interfere with the development of normal moral socialization, beginning in childhood. As a result, they are incapable of appreciating the consequences of committing harmful, immoral actions." While the brain systems underlying moral judgment in non-antisocial populations have been established, how these systems function in psychopaths is still unknown. "With the mobile scanner, we can now explore these questions by studying incarcerated psychopaths." In Dr. Harenski's recent work, she has found that psychopaths, relative to non-psychopaths, show abnormal activity in paralimbic brain regions when they view pictures depicting moral violations (e.g. one person intentionally causing harm to another).

Harenski plans to extend her research by combining fMRI with functional genomic analyses, by including other forensic populations, such as female psychopaths and sex offenders, and by examining the effects of psychopathy and substance abuse on moral decision making. To fund this ambitious agenda, a center grant focused on the neurobiology and genomics of psychopathy and substance abuse is in preparation.

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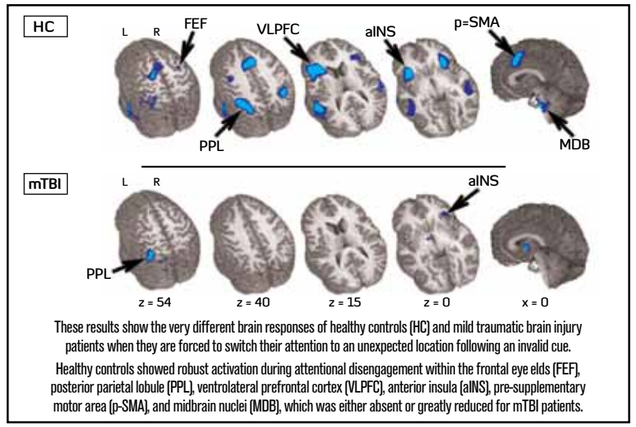
Traumatic Brain Injury

There are approximately 1.4 million documented mild TBI (mTBI) cases every year in the United States. Two-thirds of our returning combat veterans suffer from brain injury or mental health problems, and TBI is the most common diagnosis. The symptoms can range from severe disability to subtle problems with attention, concentration or emotional control that show up long after the original injury. However, TBI is still a very poorly understood problem and traditional neurological tools have not been effective for predicting recovery.

MRN researchers hope to establish documented biomarkers of mTBI through advanced imaging techniques. These markers do not currently exist and make diagnosis and treatment difficult. MRN researchers received two National Institutes of Health awards in 2009 to extend the TBI discovery progress. "Newer neuroimaging techniques such as fMRI, magnetic resonance spectroscopy (MRS), magnetoencephalography (MEG) and diffusion tensor imaging (DTI), provide great promise for elucidating potential biological mechanisms following mild traumatic brain injury," said Dr. Andrew Mayer who leads MRN's brain injury research team. "Diffusion tensor imaging, in particular, may have utility for objectively classifying mTBI and may serve as an indicator for the behavioral deficits that characterize the initial recovery phase of the injury."

MRN researchers use these various neuroimaging techniques to examine mTBI patients both in the semi-acute stage of injury (within 21 days) and longitudinally (three to five months post-injury) to track recovery. Preliminary results published in 2009 indicate subtle differences in white and gray matter functioning between mTBI patients and matched healthy controls. Based on these differences alone, researchers were able to tell who had experienced mTBI and who did not. Importantly, some of the differences that characterized patients from healthy controls appeared to "normalize" as a function of recovery.

Dr. Mayer and his staff are exploring how the development of research-based imaging procedures can facilitate the prognosis of mTBI patients. The ultimate goal is to use state-of-the-art neuroimaging technology to provide more accurate and rapid diagnoses and to develop individualized therapies to optimize treatment outcomes. Future goals include expanding this line of research to adolescent populations.



These results show the very different brain responses of healthy controls (HC) and mild traumatic brain injury patients when they are forced to switch their attention to an unexpected location following an invalid cue.

Healthy controls showed robust activation during attentional disengagement within the frontal eye elds (FEF), posterior parietal lobule (PPL), ventrolateral prefrontal cortex (VLPFC), anterior insula (aINS), pre-supplementary motor area (p-SMA), and midbrain nuclei (MDB), which was either absent or greatly reduced for mTBI patients.

Neuroinformatics

When asked for a basic definition of neuroinformatics, Dr. Vince Calhoun breaks it down to its simplest parts: "Neuroinformatics is how we store data, analyze data and share what we learn." What's more difficult to explain is how neuroscience, computer technology and software development are combined to make it easier for MRN researchers and their partners to manage their data so they can focus on research and discovery. "What I can tell you is MRN's Neuroinformatics Core (NIC) is located where our MRI, MEG, EEG and biogenetics analysis occurs, and that, along with a first-class IT infrastructure, facilitates communication and coordination of data entry and research."

MRN continues to develop and enhance its neuroinformatics software tools. This enables investigators to efficiently collect and analyze their data and selectively share the data with others. Automated, centralized analysis procedures now exist for data across all MRN studies, allowing for large-sample meta-analysis across programs and investigators. This provides a powerful tool for our scientists to augment existing research, serve as pilot data for novel data analyses or generate ideas for new projects. NIC analysis methods are currently being applied to schizophrenia, addiction, neurodevelopment and psychopathy studies.

MRN has extensive experience in designing, conducting and analyzing single as well as multi-centered clinical trials, for which the NIC provides the organized network to connect and collaborate with the Biomedical Informatics Research Network (BIRN) as well as the National Alliance for Medical Imaging Computing. This also includes the MIND Clinical Imaging Consortium, which generates data from more than 400 research volunteers across four sites (Harvard University, University of Minnesota, The University of Iowa, and The University of New Mexico), making it one of the world's largest and most comprehensive sources of data collected for brain disorder research.

The NIC had another productive year, with the publishing of more than 45 papers, the submission of eight new grants and over $2 million in NIH and NSF funding. Additionally, a $3 million NIH grant was also just funded, and our work has been enhanced with the recruitment of Dr. Jessica Turner, former project manager of BIRN. Another positive was the publishing of an overview of the MRN neuroinformatics framework in the "Frontiers in Neuroinformatics Journal". The NIC's goals for the coming months include developing and extending tools for multimodal data and classification; implementing automated MEG analysis; developing new methods for integrating imaging, behavioral and large-scale genetic data; and developing a world-class neuroinformatics center.

The combination of our advanced neuroimaging and genetics technologies with rapidly progressing neuroinformatics support and world class data collection, makes MRN uniquely qualified to identify mental disorders at an early stage and find better ways to diagnose, treat and intervene.

PRINCIPAL INVESTIGATORS

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Neurosystems for National Security

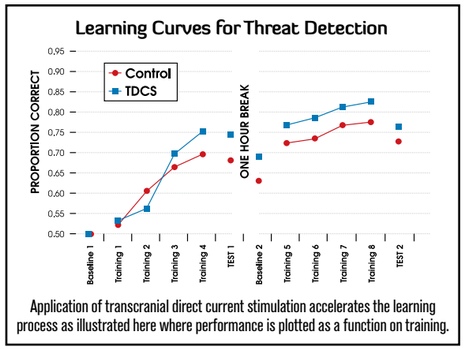
Military and intelligence communities are involved in high impact, complex and rapidly changing situations that often require life and death decisions. These decisions and their consequences can alter the rest of their lives.

Neurosystems for National Security (NS2) explores how neuroscience tools can help these professionals deal with combat stress and perform with optimal decision making. Dr. Gerold Yonas joined MRN in 2009 after retiring from Sandia National Laboratories. His goal as Director of Neurosystems Engineering is to develop and expand this new area of research at MRN. "Our work began with threat detection, and we are building on ways to use neuroimaging and other tools to train soldiers to better identify threat indicators in simulated insurgency operations," said Dr. Yonas.

The goal of NS2 is to translate high spatial and temporal resolution brain imaging, fMRI, MEG, and noninvasive brain stimulation into viable solutions for training soldiers and intelligence professionals to help them with real-time decision making and actions that avert injury and trauma. Noninvasive brain stimulation, specifically transcranial direct current stimulation (TDCS), is being used to attempt to influence the learning process, perhaps increasing the speed of learning or improving retention. TDCS utilizes scalp electrodes to deliver low amplitude direct currents to localized areas of the cerebral cortex (the superficial part of the brain), thereby modulating the level of excitability, or, put another way, increasing or decreasing the probability that neurons will talk to each other. "Even though TDCS has been applied to humans safely for decades, we are just beginning to learn how it helps to accelerate the learning process. Within the next couple of years, I expect great progress toward this goal," says researcher Dr. Michael Weisend.

MRN is also exploring the use of noninvasive brain stimulation to modify the sleep cycle. This is aimed at alleviating military sleep deprivation problems, as well as facilitating stress management in combat and after return to civilian life. While the long-term goal is to improve performance in realistic military applications, the research has broader implications. A number of studies suggest that noninvasive brain stimulation could be used therapeutically to treat a range of motor, cognitive and affective disorders including depression, schizophrenia, chronic pain, stroke, epilepsy and Parkinson's disease.

2009 was a start-up year for the NS2 team, and among its successes has been the submission of a provisional patent application for brain stimulation as a treatment for neurological and psychiatric disorders. Additional goals for NS2 include developing ways to measure the biomarkers of trust and trustworthiness in several high-impact stressful environments.



Application of transcranial direct current stimulation accelerates the learning process as illustrated here where performance is plotted as a function on training.

Positive Neuroscience

As a practicing clinical neuropsychologist, Associate Professor of Translational Research Dr. Rex Jung studies both brain disease and what the brain does well—a field known as Positive Neuroscience. His interests focus upon the structural and biochemical correlates of intelligence, creativity and positive affect, particularly white matter contributions to higher cognitive functioning in the normal human brain.

Over the first decade of his career, Dr. Jung conducted research on human intelligence, with a specific focus on understanding the biochemical, structural and functional underpinnings of how "reasoning ability" is manifested in the brain. In collaboration with UC Irvine Psychology Professor Dr. Richard Haier, this work culminated in a theoretical model aimed at helping researchers study intelligence in a more systematic way. Their theory, called the Parieto-Frontal Integration Theory, or P-FIT, ascribes human intelligence to networks of brain regions linking the frontal lobes (the regions responsible for planning, organization and other highly developed human abilities), with the parietal region, which integrates information from the eyes, ears and other senses. P-FIT has since become the model by which other scientists have tested their intelligence theories and research experiments. Dr. Jung elaborates, "The emerging consensus is that intelligence depends not just on the efficiency and strength of one brain region, but the strength and efficiency of the connections between frontal and more posterior brain regions working in harmony with one another."

It was during this time that Dr. Jung came to the realization that intelligence was "not enough" to explain the broad diversity represented in human abilities and began exploring other cognitive factors including creativity and personality. Creativity, defined as the ability to produce something both novel and useful within a given social context, appeared to be particularly promising.

With funding from the Templeton Foundation, Dr. Jung and his team produced the first published paper relating creativity to brain chemistry. Specifically, a chemical found almost exclusively in neurons within a brain region known as the anterior cingulate gyrus (ACG), predicted performance on various measures of divergent thinking—proxy measures of one type of creativity. While low levels correlated with high creativity in people of average intelligence, in people with IQs of above 120, the opposite was true. "This is the first time we've seen real biological evidence that creativity works differently at different levels of intelligence," Jung explained. Subsequent studies resulted in the first paper relating cortical thickness measures to creative cognition and achievement, as well as the first paper linking white matter fidelity to creative cognition and personality variables relevant to creativity.

This year, Dr. Jung aims to renew his Templeton Foundation grant focusing on gifted and talented adolescents, with studies across three creative domains—science/technology/engineering/mathematics, writing and music. Because Dr. Jung believes a better understanding of "what the brain does well' will also shed light on what causes neurological disorders, he hopes to extend his studies into relevant clinical populations to determine overlap between divergent thinking and psychopathology.

PRINCIPAL INVESTIGATORS

Rex Jung, PhD

ADDITIONAL RESEARCHER

Richard Haier, PhD

Financial Data

Revenues and Expenditures

	2007	2008	2009
REVENUES			
Government grant funding	$ 10,277,699	$ 16,892,448	$ 16,135,613
Private grants and gifts	166,732	1,564,055	1,286,012
Other	17,539	9,465	5,676
Total Revenues	**$ 10,461,970**	**$ 18,465,968**	**$ 17,427,301**
EXPENDITURES			
Research	$ 8,918,867	$ 12,966,543	$ 14,451,946
Management and general	1,902,684	2,407,463	3,007,822
Fundraising	85,939	94,763	211,195
Total Expenditures	**$ 10,907,490**	**$ 15,468,769**	**$ 17,670,963**
Change in Net Assets	**$ (445,520)**	**$ 2,997,199**	**$ (243,662)**

Assets and Liabilities

	2007	2008	2009
ASSETS			
Cash and equivalents	$ 580,025	$ 412,939	$ 507,256
Grants receivable, pledges receivable and other	2,097,829	2,621,498	1,965,518
Prepaid rent and other expenses	3,823,892	3,544,885	3,223,093
Property	2,762,304	6,358,151	6,376,814
Total Assets	**$ 9,264,050**	**$ 12,937,473**	**$ 12,072,681**
LIABILITIES			
Accounts payable and accrued expenses	$ 1,284,873	$ 3,053,047	$ 1,857,088
Advances and deferred obligations	1,252,378	160,428	735,260
Total Liabilities	**$ 2,537,251**	**$ 3,213,475**	**$ 2,592,348**
NET ASSETS			
Unrestricted	$ 2,475,061	$ 5,968,071	$ 6,084,035
Temporarily restricted	4,251,738	3,755,927	3,396,298
Total Net Assets	**$ 6,726,799**	**$ 9,723,998**	**$ 9,480,333**
Total Liabilities and Net Assets	**$ 9,264,050**	**$ 12,937,473**	**$12,072,681**

Fiscal Year Ended December 31, 2007

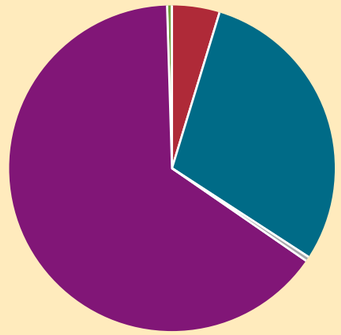
Fiscal Year Ended December 31, 2008

Fiscal Year Ended December 31, 2009

Funding by Research Area

	$M	%
Infrastructure	25.40	32.9
Addiction	16.00	20.7
Psychosis	13.70	17.9
Forensics & Social Cognition	8.84	11.5
Neuroinformatics	7.00	9.1
NS2	3.63	4.7
TBI	0.94	1.2
Other	0.81	1.0
Neurodevelopment	0.80	1.0
Total	**$77.12M**	

Funding by Source



	%
DoD	4.7
DoE	29.5
Foundation	0.3
NIH	65.3
NSF	0.2

Administration / Operations

John Rasure, PhD
President and CEO

Peggy Baca
Operations Manager

Lisa Breeden
Director, Development

Vince Calhoun, PhD
Chief Technology Officer

Judy Cartmell
Director, Finance

Michael Dougher, PhD
Chief Research Officer

Dolores González
Director, External Affairs

Greg Hallstrom
Security Officer

Melissa Hilleary
Chief Operations Officer

Barbara Hughes
Chief Financial Officer

Kent Hutchison, PhD
Chief Science Officer

Juliette Lagassé-Martínez
Executive Associate

Jeremy Lawrence
Chief Information Officer

Mary Maldonado-Hamilton
Director, Contracts & Grants

Gretchen Mullen
Director, Human Resources

Linda Petree
Privacy Officer

John Phillips, MD
Medical Director

Steve Richter
Art Director

Jody Roberts
Director, Research Operations

Additional Reading

Representative Addiction Publications

1 Filbey F.M., Schacht J.P., Myers U.S., Chavez R.S., Hutchison K.E. (2009). "Marijuana craving in the brain" Proceedings of the National Academy of Sciences, 106(31), 13016-13021.
2 Schacht J.P., Selling R.E., Hutchison K.E. (2009). "Intermediate cannabis dependence phenotypes and the FAAH C385A variant: an exploratory analysis" Psychopharmacology, 203, 511-517.
3 Feldstein-Ewing S.W., Lachance H.A., Bryan A., Hutchison K.E. (2009). "Do genetic and individual risk factors moderate the efficacy of motivational enhancement therapy? Drinking outcomes with an emerging adult sample" Addiction Biology, 14(3), 356-365.

Representative Schizophrenia Publications

1 Roffman J.L., Gollub R.L., Calhoun V.D., Wassink T.H., Weiss A.P., Ho B.C., White T., Clark V.P., Fries J, Andreasen N.C., Goff D.C., Manoach D.S. (2008). MTHFR 677C "T genotype disrupts prefrontal function in schizophrenia through an interaction with COMT 158Val" Met. Proc Natl Acad Sci. 105(45): 17573-8.
2 Calhoun V.D., Maciejewski P.K., Pearlson G.P., Kiehl K.A. (2008). "Temporal lobe and 'default' hemodynamic brain modes discriminate between schizophrenia and bipolar disorder" Human Brain Mapping. 29(11):1265-75.
3 Filbey F.M., Toulopoulou T., Morris R.G., McDonald C., Bramon E., Walshe M., Murray R.M. (2008). "Selective attention deficits reflect increased genetic vulnerability to schizophrenia" Schizophr Res. 101(1-3):169-75.
4 Thoma R.J., Hanlon F.M., Petropoulos H., Miller G.A., Moses S.N., Smith A., Parks L., Lundy S.L., Sanchez N.M., Jones A., Huang M.X., Weisend M.P., Cañive J.M. (2008). "Schizophrenia diagnosis and anterior hippocampal volume make separate contributions to sensory gating" Psychophysiology, 45, 926-935.
5 Demirci O., Clark V.P., Magnotta V., Andreasen N.C., Lauriello J., Kiehl K.A., Pearlson G.D., Calhoun V.D. (2008). "A review of challenges in the use of fMRI for disease classification/characterization and a projection pursuit application from multi-site fMRI schizophrenia study" Brain Imaging and Behavior, vol. 2, pp. 207-226.
6 Thoma R.J., Monnig M., Hanlon F.M., Miller G.A., Petropoulos H., Mayer A.R., Yeo R., Euler M., Lysne P., Moses S.N., Cañive J.M. (2009). "Hippocampus volume and episodic memory in schizophrenia". Journal of the International Neuropsychological Society, 15, 182-195.

Representative Neurodevelopment Publications

1 Maclean P., Lowe J., Duvall S., Gasparovic C., Caprihan A., Silva L., Ohls R., Ruhl D., Phillips J.P. (2009). "Neuroanatomic deficits associated with prematurity normalize in early childhood' Developmental Medicine and Child Neurology; 51 (Suppl 5a) 44.
2 Caprihan A., Sakoglu U., Pfeuffer J., Rael J., Stephen J., Lowe J., Duval S., Gasparovic C., Ohls R.K., Phillips J.P. "Differences in blood perfusion between extremely low birth weight (ELBW) pre-tem infants and control term infants" Proceedings of the International Society of Magnetic Resonance in Medicine (ISMRM), Hawaii 2009.
3 Stephen J.M., Braeutigam S., Furlong P.L., Ribary U., Roberts T.P.L., Virji-Babul N. "Pediatric CNS Pathophysiology" IFMBE Proceedings Vol 28, 17th International Conference on Biomagnetism March 28-April 1, 2010, pp 242-245.
4 Pihko E., Nevalainen P., Stephen J., Okada Y., Lauronen L. (2009). "Maturation of somatosensory cortical processing from birth to adulthood revealed by magnetoencephalography" Clin Neurophysiol 120(8): 1552-61.
5 Fey M.E., Finestack L.H., Gajewski B.J., Popescu M., Lewine J.D. (2010). "A preliminary evaluation of Fast ForWord-Language as an adjuvant treatement in language intervention" J Speech Lang Hear Res, Apr;53(2):430-49.

Representative Forensic Publications

1 Harenski C.L., Kiehl K.A. (in press). "Reactive aggression in psychopathy and the role of frustration: Susceptibility, experience, and control" British Journal of Psychology.
2 Harenski C.L., Hare R.D., Kiehl K.A. (in press). "Neuroimaging, genetics, and psychopathy: implications for the legal system" In Responsibility and Psychopathy: Interfacing Law, Psychiatry and Philosophy. L. Malatesti & J McMillan, Ed., Oxford University Press, London, UK.
3 Shane M.S., Stevens, M.C., Harenski, C.L., Kiehl, K.A. (2009). "Double dissociation between perspective-taking and empathic-concern as predictors of hemodynamic response to another's mistakes" Social, Cognitive and Affective Neuroscience, 4, 111-118.
4 Harenski C.L., Kim, S., Hamann, S. (2009). "Neuroticism and psychopathic traits predict brain activity during moral and non-moral emotion regulation" Cognitive, Affective, and Behavioral Neuroscience. 9(1):1-15.

Representative TBI Publications

1 Mayer A.R., Ling J., Mannell M.V., Gasparovic C., Phillips J.P., Doezema D., Reichard R., Yeo R.A. (In Press 2009). "A prospective diffusion tensor mild traumatic brain injury" Neurology.
2 Mayer A.R., Mannell M., Ling J., Elgie R., Gasparovic C., Phillips J.P., Doezema D., Yeo R.A. (In Press 2009). "Auditory orienting and inhibition of return in mild traumatic brain injury: A fMRI study" Hum Brain Mapp.
3 Gasparovic C., Yeo R., Mannell M., Ling J., Elgie R., Phillips J., Doezema D., Mayer A. (In Press 2009). "Neurometabolite concentration in gray and white matter in mild traumatic brain injury: a 1H-magnetic resonance spectroscopy study" J Neurotrauma.: Epub ahead of print.

Representative NS2 Publications

1 Coffman B.A., Garcia C.M., van der Merwe A., Barrow R., Callhoun V.D., Rayboum E.M., Wasserman E.M., Weisend M.P., Clark V.P., "Transcranial direct current stimulation (TDCS) accelerated learning of covert threat detection is influenced by current strength and stimulus novelty" Poster, BioMag 2010.
2 Bullard L.M., Browning E.S., Clark V.P., Coffman B.A., Jung R.E., Kimball E.B., van der Merwe A.J., Wootton C.L., Weisend M.P. "Transcranial direct current stimulation's effect on novice versus experienced learners" Poster, Human Brain Mapping 2010.

Representative Neuroinformatics Publications

1 Bockholt H.J., Scully M., Courtney W., Rachakonda S., Scott A., Caprihan A., Fries J., Kalyanam R., Segall J., De la Garza R., Lane S., Calhoun V.D. (In Press 2009). "Mining The Mind Research Network: A Novel framework for exploring large scale, heterogeneous translational neuroscience research data sources" Frontiers in Neuroinformatics, PMC Journal - In Process.
2 Sui J., Adali T., Clark V.P., Pearlson G., Calhoun V.D. (2009). "A method for accurate group difference detection by constraining the mixing coefficients in an ICA framework" Human Brain Mapping, vol. 30, pp. 2953-2970, PMC2733923.
3 Calhoun V.D., Liu J., Adali T., (2009). "A review of group ICA for fMRI data and ICA for joint inference of imaging, genetic, and ERP data" NeuroImage, vol. 45, pp. 163-172, PMC2651152.
4 Li Y., Adali T., Wang W., Calhoun V.D. "Joint blind source separation by multi-set canonical correlation analysis" IEEE Trans. Signal Processing, In Press, PMC pending #110331.

Representative Positive Neuroscience Publications

1 Jung R.E., Haier R.J. (2007). "The parieto-frontal integration theory (P-FIT) of intelligence: converging neuroimaging evidence" Behavioral and Brain Sciences, 30(2): 135-154.
2 Jung R.E., Gasparovic C., Chavez R.S., Flores R.A., Smith S.M., Caprihan A., Yeo R.A. (2009). "Biochemical support for the "Threshold" theory of creativity: A magnetic resonance spectroscopy study" Journal of Neuroscience, 29(16):5319-5325.

Proposals by Year

Proposals Submitted in 2007

	Total #	Total Costs	IDC to Mind
Funded	17	$17,222,560	$5,193,797
Not Funded	24	$14,513,627	$4,640,923
Not Funded/Resubmitted	4	$3,627,587	$1,304,225
	45	**$35,363,774**	**$11,138,945**

Proposals Submitted in 2008

	Total #	Total Costs	IDC to Mind
Funded	27	$29,977,361	$8,812,764
Not Funded	31	$36,863,365	$12,057,060
Not Funded/Resubmitted	25	$49,568,315	$17,685,023
Pending	1	$29,999	$11,597
	84	**$116,439,040**	**$38,566,444**

Proposals Submitted in 2009

	Total #	Total Costs	IDC to Mind
Funded	19	$21,616,468	$6,400,952
Not Funded	51	$85,857,081	$23,423,612
Not Funded/Resubmitted	16	$21,169,208	$7,892,216
Pending	19	$24,236,844	$9,162,554
	105	**$152,879,601**	**$46,879,334**

As of July, 01, 2010

Glossary of Terms

biomarker - a distinctive biological indicator of a process, event, or condition.0

cognition, cognitive function - the scientific term for "the process of thought." Refers to a faculty for the processing of information, applying knowledge and changing preferences.

cue - a stimulus, either consciously or unconsciously perceived, that elicits or signals a type of behavior. A **cue-elicited craving** refers to a craving that is brought on by being exposed to something that reminds you of the original craving, such as the sight of a beer bottle causing an alcoholic to desire a drink.

DTI (diffusion tensor imaging) - provides quantitative information with which to visualize and study connectivity and continuity of neural pathways (white matter) in the brain by measuring the movement of water.

fMRI (functional magnetic resonance imaging) - a form of magnetic resonance imaging that, by tracking blood oxygen levels, registers blood flow to functioning areas of the brain to determine which part is active during a given task.

forensics - the application of science to answer questions of interest to a legal system, specifically the study of criminal acts.

MEG (magnetoencephalography) - a technique for mapping brain activity by recording magnetic fields created between neurons as electrochemical information is passed along.

MRS (magnetic resonance spectroscopy) - used to measure the levels of different metabolites in brain tissue. The MR signal produces a spectrum of resonances that correspond to different molecular arrangements of the isotope being "excited".

multimodal - in reference to neuroscience research, employing multiple types of neuroimaging, such as MEG, MRI, DTI or MRS.

psychosis - a symptom or feature of mental illness typically characterized by radical changes in personality, impaired functioning and/or a distorted or nonexistent sense of reality (including hallucinations or delusional beliefs).

social cognition - relating to members of society, the encoding, storage, retrieval, and processing of information in the brain.

white matter / grey matter - white matter is the tissue through which messages pass between different areas of gray matter within the nervous system. Using a computer network as an analogy, the gray matter can be thought of as the actual computers themselves, whereas the white matter represents the network cables that connect the computers together.

The Mind Research Network
www.mrn.org
505-272-5028