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Windows to the Young Brain

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Windows to the young brain

by Julie O'Connor and Philip Van Hulle

There have been incredible strides in imaging technology over the past 40 years. Where scientists were once blind to the structure, chemistry and function of the living brain, they are now able to extract detailed information using structural, chemical and functional magnetic resonance imaging.

From these methods, new understanding of the precursors and the bases of psychiatric disorders in the brain have emerged that one day may lead to more effective therapies for numerous disorders.

Using these methods effectively is a challenge facing a team of psychiatrists from Wayne State's divisions of Child and Adolescent Psychiatry and Brain Research and Imaging Neuroscience. Drs. David Rosenberg, Jeffrey Stanley and Vaibhav Diwadkar have joined forces to try to understand the vulnerability for, and the bases of, psychiatric diseases such as attention deficit hyperactivity disorder, obsessive compulsive disorder and more in children and adolescents.

Brain tracking

According to the National Institutes of Mental Health (NIMH), attention deficit hyperactivity disorder (ADHD) is one of the most common childhood illnesses, affecting 3 percent to 9 percent of children, and accounting for 30 percent to 40 percent of child referrals to mental health services. In addition, the condition can persist into adulthood in nearly 60 percent of cases, affecting 4 percent of adults.

One study at WSU using brain imaging technologies and other forms of testing will track

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— Dr. David Rosenberg

the development of ADHD in the brains of children and teens.

"The primary aim is to track at what age and where in the brain developmental differences start to occur in ADHD compared to the developmental course of healthy individuals," said Jeffrey Stanley, Ph.D., associate professor of psychiatry and

behavioral neurosciences, co-director of the Division of Brain Research and Imaging Neuroscience, and program director and graduate officer of the Translational Neuroscience Program in the School of Medicine.

"The cause and progression of this illness is poorly understood biochemically, anatomically and functionally," Stanley said. "The goal of this study, funded by the NIMH, is to map out the developmental course of ADHD using neuroimaging biomarkers and to identify at what age and where in the brain changes are occurring in ADHD that deviate from the normal development course of healthy children. Certain brain areas or networks mature earlier than others, and we anticipate seeing neuroimaging alterations occurring in later maturing areas, such as the prefrontal cortex, that were potentially influenced by maldeveloped earlier brain areas."

"By conducting functional imaging studies in parallel to studies of structure and chemistry, we will also be able to assess the impact of altered neurodevelopment on the functions of developing networks in the brain - networks that are important for basic and lifelong behaviors such as attention, memory and emotion," said Vaibhav Diwadkar, Ph.D., assistant professor of psychiatry and behavioral neurosciences and co-director of the Division of Brain Research and Imaging Neuroscience.

The age that brain networks change in children with ADHD or how those early impaired networks influence other networks within the brain is unknown. Early identification of affected networks





Dr. Vaibhav Diwadkar

Dr. David Rosenberg

Dr. Jeffrey Stanley

Windows to the young brain continued

and charting changes, Stanley said, is critical for researchers to gain a greater understanding of the development and progression of the condition, and in developing more-effective therapies.

"The early identification of impaired networks and charting temporally impaired networks in ADHD is critical in gaining a greater understanding of the development and progression of ADHD," Stanley said. "This will result in developing better targeted and age-appropriate cognitive and behavioral therapy for ADHD."

Combining imaging and genetics

Wayne State is leading the first-ever combined imaging and genetics research study on obsessive-compulsive disorder (OCD) in child psychiatry, funded by the National Institute of Mental Health at the National Institutes of Health.

The project, *Brain Chemistry and Genetics in Pediatric OCD*, led by WSU, with collaborative partners at the University of Michigan and the University of Toronto/The Hospital for Sick Children (SickKids), is focused on OCD, a severe, prevalent and chronically disabling disease. OCD affects approximately 1 percent to 3 percent of the population nationwide and about 50 percent of all OCD cases begin in childhood and adolescence.

"Initial findings at Wayne State University have shown that glutamate plays a key role in OCD," said David Rosenberg, M.D., the Miriam L. Hamburger Endowed Chair of Child Psychiatry and professor of psychiatry in the School of Medicine at Wayne State University and the principal investigator of the project. "Glutamate is the brain's

light switch that helps turn serotonin and other chemicals off and on. Our research has shown that glutamate abnormalities in OCD have significant treatment implications. This new study will further our research by combining imaging and genetics, something never assessed in OCD patients."

By performing critical imaging and genetic tests of glutamate genes in 200 OCD and 200 healthy control patients, this group of scientists aims to examine glutamate changes in brain regions implicated in OCD, and to combine this information with a detailed exploration of variants within genes influencing glutamate transmission.

Brain processes visualized using magnetic resonance imaging are thought to be closer to the action of genes compared with complex behavioral phenomena like OCD. By combining the two powerful techniques of neuroimaging and genetics, Rosenberg and his collaborators hope to speed the discovery of risk genes.

Results will have significant scientific implications as well as key "translational" importance in bringing research from the bench to the bedside with clinical ramifications. By combining unique clinical assessment, magnetic resonance imaging and genetics expertise, the team of researchers will investigate biological, genetic and behavioral variables that may one day lead to a better understanding of pediatric OCD, and in turn, the development of new diagnostic and treatment approaches.

For more information visit: <http://brain.wayne.edu>

About Dr. Vaibhav Diwadkar:

Dr. Diwadkar received a B.S. in psychology and Computer Science from Coe College, Iowa. He received a Ph.D. in cognitive science and psychology from Vanderbilt University. He joined Wayne State University in 2005.

About Dr. David Rosenberg:

Dr. Rosenberg received a B.S. in biomedical science and a M.D. in general psychiatry from the University of Michigan. He completed his general and child psychiatry residency at the University of Pittsburgh and post-doctoral research fellowship at the National Institute of Mental Health. He joined Wayne State University in 1996.

About Dr. Jeffrey Stanley:

Dr. Stanley received a B.S. and M.S. in physics from the University of Waterloo, and a Ph.D. in medical biophysics from the University of Western Ontario. He joined Wayne State University in 2004.

