American College of Neuropsychopharmacology

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Sensory Deficits May Hold Key to Understanding and Treating Schizophrenia

Researchers Use Biomarkers to Identify Emerging Illness at Early Stage

NASHVILLE, TN (December 9, 2009) – Identifying visual and auditory sensory deficits in adolescents who are just beginning to develop schizophrenia might help restore sensory function and prevent illness development altogether, according to research presented at the annual meeting of the American College of Neuropsychopharmacology (ACNP). Researchers found that impairment in basic sensory processing abilities cause many of the more complicated cognitive deficits seen in people with schizophrenia. Scientists also were able to identify two biomarkers – biological signatures of illness – in the brain that will help identify individuals who can benefit from early intervention.

Sensory systems are the part of the nervous system responsible for processing hearing, vision, smell and touch. "In people with schizophrenia, we know that visual and auditory sensory systems that functioned well in early childhood begin to break down during adolescence, years earlier than the onset of the more complex cognitive symptoms of schizophrenia," said Daniel C. Javitt, MD, PhD, Nathan Kline Institute, New York University School of Medicine and ACNP fellow. Javitt and his team sought to identify biomarkers for low level functioning in both auditory and visual processing systems and to understand how this affects cognitive impairments in people with schizophrenia.

Schizophrenia is a complex thought disorder that includes distortions of sensations and perceptions and is now treated when symptoms are at their most devastating. Currently, there is no diagnostic test for schizophrenia and treatments do not address the functioning of sensory networks in people with schizophrenia.

Investigators measured brain electrical responses from the scalp surface as biomarkers to study how the brain functions in people with schizophrenia. "We already know a lot about what people with this disorder can and cannot do," said Javitt. "Our research focuses on understanding how the brain works and identifying specific biomarkers for cognitive impairment that will distinguish schizophrenia from Alzheimer's and other diseases."

The brain has separate systems for analyzing visual and auditory information. Researchers found that communication between these two systems often breaks down for people with schizophrenia. In fact, Javitt's work disproves several previously held theories on schizophrenia.

Attentional Issues
Javitt and his team discovered that low level functioning of the visual and auditory sensory systems impairs how people with schizophrenia pay attention, understand social cues and read. They used two biomarkers that they recorded from the scalp measurements, termed Mismatch Negativity (MMN) and Visual P1, as outcome measures to track processing defects in the visual and auditory systems.

Early researchers believed that people with schizophrenia had an attention deficit, and that treating this symptom would be therapeutic. However, Javitt found that teaching people how to pay attention better does not address the underlying problem. People with schizophrenia have to overcompensate to pay attention, expending more effort than people without the disorder.

Javitt found while people with schizophrenia clearly hear and understand words, they are unable to integrate voice pitch and intensity that conveys emotion and are vitally important for communicating in a social environment. "To use an analogy, people with schizophrenia hear the individual notes, but not the pattern of the music," said Javitt.

Visual Deficits
In the visual system, people with schizophrenia are more sensitive to very detailed information but they don't see the big picture. Javitt uses the example of seeing a cat behind a venetian blind. Most people can figure out it is a cat even though they only see isolated pieces. The brain puts together the picture. However, people with schizophrenia only see the isolated parts. This inability to see the big picture helps explain why people with schizophrenia have difficulty reading, which requires seeing the paragraph as a whole and not as individual letters. Javitt and his team identified a biomarker – termed "closure negativity" – that maps to the area of the brain that is responsible for putting together the big picture and showed reduced activation of this brain area in functional imaging studies of schizophrenia as well.

"The big hope is that these biomarkers could be a method for early detection and intervention," said Javitt. With early intervention, scientists hope to lessen the disability associated with the disease, but he cautioned that researchers cannot say that fixing the sensory deficit will reverse cognitive impairment. There is still work to be done in understanding why and how these sensory processes are breaking down in these patients.

Javitt's hope is that his team is developing the next generation of biomarkers that can be tested at the Consortium on the Genetics of Schizophrenia, an ongoing, National Institute of Mental Health funded, 7-site collaboration investigating the occurrence of traits (called endophenotypes) that seem inextricably tied to schizophrenia. The COGS consortium is headed by Dr. David Braff of University of California, San Diego and current ACNP president. Results of current COGS investigations are being presented at ACNP by Dr. Gregory Light of UCSD alongside Dr. Javitt's results.

“Using these measures of cognition we can increase the predictability of who is at risk for schizophrenia, and that can be extremely important in guiding treatment for those who are affected,” said Javitt.

Javitt also noted that recent research shows that practicing differentiating between tones can help improve these low level deficits, especially if caught in early adolescence.

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ACNP, founded in 1961, is a professional organization of more than 700 leading scientists, including four Nobel Laureates. The mission of ACNP is to further research and education in neuropsychopharmacology and related fields in the following ways: promoting the interaction of a broad range of scientific disciplines of brain and behavior in order to advance the understanding of prevention and treatment of disease of the nervous system including psychiatric, neurological, behavioral and addictive disorders; encouraging scientists to enter research careers in fields related to these disorders and their treatment; and ensuring the dissemination of relevant scientific advances.