

A Paranoid's Guide to History
INRECO doc #2
Section 818.08pg
Psychology Division

Schizophrenia and its Neurological Connections

Schizophrenia is a multi-symptom, neural-psychological disease with an elusive pathology. There have been increasing discussions as to the accuracy and functionality of the term schizophrenia applied to such a wide range of symptoms (Andreasen, 1999; Walters). One reason for this is that the behaviors that characterize schizophrenia can be significantly divergent, as evidenced by the categories and types listed in the DSM-IV. On one hand, wildly inappropriate aggressive behavior coupled with other positive symptoms can garner the classification, as can catatonic behavior coupled with negative symptoms (Braff, 1999; Andreasen, 1999). Faced with this dilemma, psychologists have a daunting scientific task: to locate the neurological origins for schizophrenia. It is possible that the increased sophistication of the tools available for examining brain functions will produce more nuanced diagnoses, classifications and treatments.

The history of schizophrenia and mental illness in general, sheds some light on the debates surrounding schizophrenia. The mentally ill have always been with us.

Evidence of the symptoms goes as far back as Pharaonic Egypt. The ancient Greeks referred to similar conditions as "divine madness," granting a supernatural origin. The significant issue in this case is what constitutes a disease. Unlike people with heart or kidney dysfunction, schizophrenia is not physically life threatening. This is not to discount the untold suffering of the 1% of the population afflicted with this condition.(Walters) To make matters worse, in industrialized countries a large percentage of the homeless are schizophrenic, thus pushing the condition even further out toward the fringes of society.

The term schizophrenia was originally coined in 1911 by a Swiss psychologist Eugen Bleuler and was meant to describe the mental disconnection of the patient from reality. Since Bleuer's categorization psychologists have sought to uncover the relationship between schizophrenia and the brain. (Walters) While there is little doubt as to the origin of schizophrenia somewhere in the brain, it is unsettled as to what prepares the brain for the onset of the disease. Various causes have been suggested: genetics, in- and ex-utero viral infections, stress, abnormal development and environmental conditions. Regardless of the initial causal factors, schizophrenics share a common

dysfunction in the cognitive and emotional brain functions. Several different chemicals have been indicated in the condition: dopamine, glutamate, serotonin, acetylcholine, GABA and norepinephrine. These connections have been discovered over the years through the administration of drugs with known effects. In the case of dopamine, the use of Thorazine lead to the belief that schizophrenia might be located in the pre-frontal cortex (PFC). Scientists came to this conclusion because of the effect on patients and the high concentration of dopamine receptors in that part of the brain. Additionally, the symptomatic disorganization of thought in schizophrenics is credited to a deficit in working memory, a primary function of the PFC.(Walters)

Newer models of schizophrenic pathopsychology posit forms of systemic neural circuit failure. Two possibilities seem to offer meaningful theoretical advances. Both approach the problem of schizophrenia by characterizing the problem as an emergent system. One hypothesis, which has been developing since the late 1970s, focuses on the corollary discharge, feed forward systems of thought (CD-FF) (Feinberg, 1998). The other approach centers on the cortico-cerebellar-thalamic-cortical circuit (CCTCC) as the genesis of schizophrenia (Andreasen, 1999).

These systems have the advantage of searching not for a single anatomical factor in schizophrenia, but rather examining the multiple processing systems of the brain. This approach fits with the latest studies that show deeply interconnected, broad regions of the brain are active during psychotic or hallucinatory episodes (Silbersweig, 1995). This is significant because it reveals that schizophrenic delusions are real in as much as there is corollary brain activity. Both visual and auditory hallucinations were associated with activity in visual and auditory association cortices (Silbersweig, 1995).

The schizophrenic experience is so all-encompassing that, when fully active, it hijacks consciousness. It is perhaps this multi-dimensional aspect of the disease that lead researchers to the CD-FF and CCTCC models. Empirical evidence of brain activity helps understand how the neuro circuitry of schizophrenics gives rise to its symptoms. Schizophrenics have under-functioning mechanisms in a wide range of mental activity: perception, social behavior, language use, motor skills, emotional and cognitive inference in addition to psychosis (Andreasen, 1999). Andreasen points out that there is likely a connection between the motor coordination "feed back loop" created by the thalamus the cerebral cortex and the cerebellum

creating CCTCC and cognition. This system provides for a constant flow of neural activity that synchronizes physical actions. The process is compared to the memory function in computers by the use of the term "on-line." This is an apt analogy; for a computer to work smoothly it must be able to process huge amounts of divergent and multifaceted information in the form of electric digital circuitry and a binary communications system, much like the human brain.

The CCTCC model uses the fact that a disruption of the motor function feed back loop leads to physical "dysmetria" and applies the same principal to the cognitive deficits of schizophrenia (Andreasen, 1999). Schizophrenic cognitive dysmetria could arise from a similar disruption in the "sequencing component of mental activity" (Andreasen, 1999). Earlier, Andreasen made the case that the thalamus was significant to the schizophrenia's neuropathology. The CCTCC includes the thalamus plus the cerebellum and the prefrontal cortex as part of a multiprocessing system responsible for monitoring and coordinating sensory input, perception, cognition, and action (Andreasen, 1999; Braff, 1999).

The CD-FF characterization of schizophrenia hits on some of the same brain regions and processes as the CCTCC. It also links motor functions to the processes of higher

cognition. According to Feinberg, "the pathophysiology of schizophrenia lies in the integrative circuits of basal ganglia, thalamus and frontal cortex." (Feinberg, 1998) Additionally the CD-FF makes connections between the types of hallucinations of schizophrenics and their "cross-cultural" nature. These types of psychic events also call into question the most basic human concepts of self and consciousness: How are thoughts generated and what is the relationship between the brain and thinking? Regardless of the sophistication of the tools of observation, the Cartesian dilemma remains.

Schizophrenics seem to be afflicted by a misfiring or dysymmetry in the processing and coordination of physical, sensory and mental perception. Since these processes themselves do not occur as atomized functions in "healthy" brains, why then should their dysfunction not also be multilateral. The disruptions called for in the CCTCC and CD-FF approaches could also account for many of the more striking features of schizophrenia such as auditory hallucinations. The inability to recognize their own thoughts and actions leads schizophrenics to attribute them to external sources.(Mathalon, 2002) It is this basic disconnection from self and reality that lead to the use of the word schizophrenic in the first place.

The psychological study of schizophrenia and psychotic disorders in general have made momentous strides in the past century. There have also been significant missteps along the way. The asylums and treatment of the nineteenth century were barbaric and inhumane. But how might our continued use of Electro-shock therapy and powerful chemical restraints, not to mention the plight of the undiagnosed or under-treated mentally ill, look to our counterparts in the future. Unless our scientific inquires and experimentation maintain a humanistic and empathetic outlook, and society devotes the resources necessary to treating the most helpless, our own negligence and callousness will not go unnoticed.

Works Cited

Andreasen, Nancy C. MD *A Unitary Model of Schizophrenia*, Archives of General Psychiatry, 1999, Vol. 56 No 9

Braff David L. MD, Commentary, *Connecting the "Dots" of Brain Dysfunction in Schizophrenia: What Does the Picture Look Like?*, Archives of General Psychiatry, 1999 Vol. 56 No 9

Feinberg, Irwin, *Schizophrenia – a disorder of the corollary discharge systems that integrate the motor systems of thought with the sensory system of consciousness*, The British Journal of Psychiatry, 1999, Vol. 174 No. 3

Mathalon, Daniel, *Response Monitoring Dysfunction in Schizophrenia: An Event Related Brain Potential Studies*, Journal of Abnormal Psychology, 2002, Vol. III No.1-22

Silbersweig, D.A., Letter. *A Functional Neuroanatomy of Hallucinations in Schizophrenia*, 1995, Nature Vol. 378 No. 9

Walters, Rhodri, *Schizophrenia: A cyclical and heterogeneous dysfunction of cognitive and sensory processing?* www.cellscience.com/shdss2.html