Frontal Lobes, Basal Ganglia, Temporal Lobes—Three Sites for Schizophrenia?

by Monte S. Buchsbaum

Abstract

This special issue of the Schizophrenia Bulletin focuses on three brain areas hypothesized to play a role in the etiology of schizophrenia—the frontal lobes, the basal ganglia, and the temporal lobes. Contributors to the issue review evidence from brain-imaging, post-mortem, and psychopharmacological studies that support the involvement of each of these important brain areas in schizophrenia. It is concluded that theories emphasizing cortical/subcortical interconnections rather than a single brain area provide the greatest challenge, and also the greatest promise, to schizophrenia researchers.

Frontal lobes, basal ganglia, or temporal lobes? Three candidates for the site of schizophrenia are debated in this issue of the Schizophrenia Bulletin. The frontal lobes, site of executive function, abstract thinking, and perhaps attention, are the choice of those who see the integrative and evaluative functions as a primary deficit. The basal ganglia, richest in the neurotransmitter dopamine, are the choice of psychopharmacologists who begin with the undoubted clinical response to neuroleptics as the major clue. The left temporal lobe, crucial in linguistic function, is the choice of those who hear the disordered words of the schizophrenic patient and note the asymmetries in cerebral function. With the new technologies of brain imaging, assessment of these regions can now be made in living patients, and all regions of the brain can be assessed at once. This tricameral division of theories of schizophrenia seemed to provide an easy division of labor among the invited contributors. But this division was only partly accepted, and theories involving the interaction of cortex and basal ganglia figure importantly in these reviews.

The frontal lobes are the focus of three articles. I developed a tabular review—et posifron emission tomographic measurements of metabolism in the frontal lobes and a contrast with the basal ganglia and temporal lobes. Trevor Robbins (1990, this issue) reviews frontal-striatal connections and suggests that it is an altered balance in the flow of information in cortico-striatal loops under control of the frontal lobes that is responsible for the fragmented behavior of schizophrenia.

The basal ganglia and their role in basal ganglia-thalamus-cortex loops are proposed as a system with dopamine and glutamate imbalance by Maria and Arvid Carlsson (1990, this issue). Here, the disturbance in sensory arousal, perhaps related to the role of the thalamus as a filter, is emphasized. This concept brings together neuropharmacology and the extensive literature on sensory and perceptual abnormalities in

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schizophrenia. While not reviewed by the Carlssons, cortical evoked potential researchers have often interpreted their data as indicating some failure in sensory modulation but have not had such an explicit neurotransmitter model to test.

The left temporal lobe is the focus of Timothy Crow (1990, this issue), who reviews the extensive morphological evidence for temporal brain dysfunction in schizophrenia, and notes the relationships between brain asymmetry and gender. Frank Wood and D. Lynn Flowers (1990, this issue) present blood flow data with reductions in both frontal and temporal regions, arguing for a peri-Sylvian deficit. Raquel Gur and co-workers (1990, this issue) present a neuropsychological approach to the three target brain regions. Lastly, Adolf Pfefferbaum and co-workers (1990, this issue) review methodological issues in magnetic resonance imaging and compare findings in the frontal lobes, basal ganglia, and temporal lobes.

Could the evidence for these three brain areas be inconclusive because of common afferents from a single small but greatly dysfunctional brain area? The prevalence of loop connections in the diagrams do not seem consistent with this view.

Are we 15 blind biological psychologists feeling a schizophrenic? Brain imaging makes visible the previously invisible, and its technology forces us to image the entire brain. The theories of Robbins and the Carlssons emphasize cortical/subcortical interconnection rather than the single elephant appendage. The challenge to imaging is to move from considering single voxels to capturing brain systems in statistical and dynamic experimental designs and analyses.

References

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