



Biological Psychiatry: 14 (Principles of Medical Biology)

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It is now widely recognised that biological psychiatry is rapidly coming into its own. For over the last three decades dramatic advances in this young discipline have been made, all of which attest to the staying power of the experimental method. Those who made this revolution in knowledge happen are a breed of investigators availing themselves of the tools of molecular biology, pharmacology, genetics, and perhaps, above all, the technology of neuroimaging. The introduction of the interdisciplinary method of approach to the study of psychopathology had made it very clear that neuroimaging, as a set of techniques, is unique in that it is gradually providing us with evidence supporting Kraepelin's original view that mental illness is closely associated with abnormal changes in the brain.

Broadly speaking, there are presently two structural techniques in neuroimaging - computed tomography and magnetic resonance imaging (MRI) - and three functional techniques - single photon emission tomography (SPECT), positron emission tomography and magnetic resonance imaging (fMRI). Through PET technology, for example, we have learned that, in early brain development, the primitive areas, mostly the brain stem and thalamus, are the first to show high activity in an infant. This is followed by the development of cortical areas by year one. Between the ages of four to 10, the cortex is almost twice as active in the child as in the adult. This information alerts us to what might happen in the way of trauma in abused children, especially those under the age of three. Child abuse increases the risk of physical changes, not only in the stress systems, but also in brain development (Glaser and Weissman). In addition to the difficult problem of post-traumatic stress disorder (PTSD), we have to take into account the possibility of other types of mental illness as the consequences of child abuse. These include depression, eating disorders, and drug and alcohol problems.

The combination of PET and fMRI represents a more remarkable example of the power of neuroimaging since the two have made it feasible to map accurately in vitro identifiable cortical fields, or networks. In a landmark NIH investigation of human cortical reorganization (plasticity), persuasive evidence was brought forward showing that the process of learning as a motor task involves a specific network of neurons. These neurons occur in the cortical field that is responsible for that particular task. Such findings are important partly because they provide evidence supporting the current notion that labor in the cortex is divided among ensembles of specialized neurons that cooperate in the performance of complex tasks. Cooperation, then, in this, sense implies crosstalk among ensembles and that signals are both processed and retransmitted to neighbouring ensembles. To understand the workings of these ensembles, much better spatial and temporal resolution in functional brain mapping is required. This can be achieved with an NMR instrument whose magnet is 4.1 Tesla or more.

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