



It is disappointing to note that, despite the fact that approximately ten thousand operations have now been done in the United States, anatomical studies have been published in but four cases by Freeman and Watts. They examined these brains in detail and found the most conspicuous degenerative changes occurred in the medial dorsal nucleus of thalamus. This was also confirmed by English investigators, and following this lead, an American neuro-surgeon, Spiegel, developed a procedure known as thalamotomy. The investigations of Freeman and Watts showed that the central part of the medial nucleus of the thalamus projected to the tip of the frontal pole. The lateral portions of this nucleus projected over the convexity of the frontal lobes, while the medial portions projected to the orbital surfaces of the frontal lobes. There were very few changes in the smaller thalamic nuclei. British investigators have also described a dropping out of cells in layer three of the frontal cerebral cortex following the procedure. There seemed to be no changes in the long association fibers. Anatomical studies have also shown that the demonstrated extent of the lesion has little correlation with the surgeon's opinion of what he had accomplished. This is especially true of the trans-orbital lobotomy which in one case resulted in only small puncture wound of the orbital surfaces of the frontal lobes, but considerable clinical improvement. There seems to be little relation between the pathology produced by operation and the improvement in mental states, that is, there is no "standard lesion."

An attempt has been made to differentiate frontal lobe functions in various in the Columbia Graystone Project. Gyrectomies were performed in many different locations. Improvement occurred when areas nine, ten and forty-six were removed. It was believed that these could be identified anatomically after the method of Von Economo and Brodmann. However, Bailey and Von Bonin do not believe that this is the case. They have produced a greatly simplified architectonic chart which was obtained through a detailed study of a non-injured brain. Checking on each other's ability to differentiate areas, they have found that only frontal, temporal and parietal areas can be differentiated with any consistency or certainty. They believe that the amount of tissue removed seems more important so far as its effects are concerned than the area from which the tissue has been removed.

The physiological studies have yielded a good deal of data, but much remains to be done. Sensory changes seem very important. Although pain is not eradicated, complaints of pain almost cease after the operation. The change seems to be a qualitative rather than a quantitative one. It has been observed by Freeman and others. Patients with tabes, radiculitis, cancer, and other painful conditions have been operated. Their complaints of pain have diminished and in many instances patients addicted to drugs for relief of pain have been able to discontinue their use. Despite this qualitative change, work at the Boston Psychopathic Hospital showed a more rapid withdrawal from a painful stimulus (heat) after operation than prior to operation. These observations have seemed to confirm what Freud noted about hysterical pain, that is, one must consider not only the perception of the pain itself, but the affective connotation and associations to the painful stimulus. The lobotomy operation seems to separate the painful associations from the perception of the stimulus itself. On the other hand, "painful affects" are not relieved by any surgery on the peripheral nerve or spinal cord. Lobotomy, for example, will relieve phantom limb pain without reducing the sensation of the phantom limb. Conversely, resection of the post-central gyrus will eradicate the phantom limb sensation, but leave the

pain emanating from the phantom limb intact. This would indicate that one's conception of body image is located in the parietal region. Electric shock has also been used with success in cases of intractable pain.

Electroencephalographic changes have proven of great interest. Cohen has done considerable study of the first thirty patients operated by Freeman and Watts. There were followed for periods ranging from four to six years. Immediately after operation slow wave delta activity was noted over the cortex. This disappeared in one to three months. It was seen following the unilateral lobotomy, most marked on the side of the operation, but evident also on the opposite side. Slow waves on hyperventilation persisted many years after the operative procedure. In one patient, who developed convulsions, electroencephalographic changes were only evident after the onset of the seizures. This would indicate that these brain wave changes may come about as a result of the seizures, instead of constituting their cause, as is now supposed. Electroencephalographic changes showed no correlation with clinical improvement.

Many studies of autonomic function have been undertaken. Dr. Magnus C. Petersen has found that there is a tendency toward earlier and greater secretion of gastric hydrochloric acid on histamine stimulation. Also, some patients have shown greater tolerance to glucose. Greenblatt and others have shown altered response after operation to sympathomimetic drugs and to carotid sinus pressure. The latter procedure frequently produced convulsions and electrocardiographic changes in patients. There was also a greater response to cold and a greater response to epinephrine and related substances.

Urinary incontinence often seen may be due to a disregard of the social obligations of the patient or, as suggested by Greenblatt and others, to an increased stretch reflex in the bladder resulting in a hypertonic bladder with frequent emptying. Dr. Kolb believes that both these may be true, although the evidence for hypertonic bladder should be substantiated with cystometric studies. There are also good indications for more careful study of the motility of the gastro-intestinal tract, and the operation might be tried on cases of anorexia nervosa which do not improve with psychotherapy or other forms of treatment.

Halstead has devised many new techniques for testing frontal lobe function. He finds that adaptation to new situations, which he terms "biological intelligence," constitutes a valid measure of frontal lobe function. He has found that lobectomy is much more damaging to these functions than is lobotomy. In many instances, the presence of psychosis vitiates his pre-operative test results. The operation, however, seems to produce signs of frontal lobe damage in that the subjects use fewer objects in grouping tests, have difficulty placing objects in recalling situations, make more errors, and have "catastrophic reactions" in response to test failures.