THE LIMBIC LOBE IN MAN*

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In opening this discussion,‡ I wish to extend congratulations to Drs. Pool and MacLean for the meticulous and painstaking collection and presentation of data. Their work begins to be monumental. Dr. Pool and his associates are embarked in collecting from known cortical areas a vast accumulation of physiologic and behavioral data similar to that impressive work already accomplished on animals by Dr. Fulton's associates, especially Dr. MacLean. Their respective works will sow seeds for future as well as present knowledge.

For the past four years in Hartford, we have been embarked on a study of the limbic area in man, which, as you know, includes the rhinencephalon, the anterior cingulate, and posterior orbital cortices. We have isolated, by the "undercutting" technique, the anterior cingulate gyrus and the posterior orbital cortex in a series of fractional lobotomies performed on schizophrenic and neurotic patients. More recently, we have both stimulated and resected bilaterally various portions of the rhinencephalon in carrying out medial temporal lobectomies on schizophrenic patients and certain epileptic patients. I speak with all humility of the small bits of passing data we have accumulated in carrying out these operations on some 230 patients.4,5

Cingulate and Orbital Areas. Stimulation of the anterior cingulate and posterior orbital regions has given meager results.2 Cortical isolation of the rostral cingulate gyrus and the orbital cortex, respectively, has resulted in appreciable improvement in some 50 per cent of schizophrenic psychoses, roughly approximating the results obtained in standard lobotomies. Orbital isolation has given a most gratifying improvement in depressions, psycho-neuroses, and tension states without any gross blunting of personality.5 Following these undercuttings, there were no other changes in personality except for some lightening of mood and a distinct increase in libido in certain cases of orbital undercutting.

Medial Temporal Areas (Rhinencephalon). Uncal stimulation gave marked results with respiratory arrest, loss of consciousness, and clinical or electric seizure formation. Bilateral resection of the uncus and amygdalum alone,2,4 or in conjunction with the entire pyriform amygdaloid hippocampal complex, has resulted in no marked physiologic or behavioral changes with

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the one exception of a very grave, recent memory loss,* so severe as to prevent the patient from remembering the locations of the rooms in which he lives, the names of his close associates, or even the way to toilet and urinal. There has been no apparent increase in libido or sexual activity, no remission of auditory hallucinations, and no gross rage reaction. A temporary calming reaction, similar to that found after other fractional lobotomies, occurred. Hallucinations of smell were not apparent following uncalotomies. Vomiting and temporary loss of consciousness occurred commonly during manipulation of the uncal region, but following resection they disappeared.

_Electro corticography._ ECGs of the cingulate and posterior orbital gyri were not remarkable. The resting uncus exhibited an ECG quite different from all other frontotemporal cortical areas studied. Following stimulation of the uncus, focal seizure patterns with afterdischarge resulted, spreading to the orbital and contralateral uncus but not to the superior frontal convexity.

_Mental Changes._ Psychiatric changes were meager and largely quantitative after medial temporal resections, being exceptional only in a schizophrenic patient in whom 9 cm. of the medial surface cortex of the temporal lobes had been removed bilaterally. Of considerable interest has been the psychiatric result obtained by inadvertent damage to midline structures in the region of the hypothalamus and midbrain in three patients.

* This loss was apparent in the 2 patients undergoing bilateral resection of the entire complex including the hippocampal gyrus extending posteriorly for a length of 8-9 cm. from the tips of the temporal lobes.

Addendum. An additional 2 patients with sphenoid ridge meningioma and aneurysmal temporal lobe clot were subjected to unilateral nondominant inferior temporal lobectomy with deliberate resection of the hippocampal complex because of incisural hippocampal herniation from malignant edema. These 2 patients continue to show grave loss of memory at 2 1/2 years and 6 weeks postoperatively, respectively, without any impairment of deductive reasoning, suggesting a relationship between these areas and recent memory, although both patients obviously had diffuse damage from edema.