Edited by JOHN R. GREEN, M. D.
and HARRY F. STEELMAN, M. D.

Epileptic Seizures

A Correlative Study of Historical, Diagnostic, Therapeutic, Educational and Employment Aspects of Epilepsy

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EPILEPTIC SEIZURES

A correlative study of historical, diagnostic, therapeutic, educational and employment aspects of epilepsy

Based on proceedings of joint meetings of The Seventh Western Institute on Epilepsy, the Western Society of Electroencephalography, and the American Academy of General Practice (Arizona chapter) on November 10, 11, 12, 1955 in Phoenix, Arizona.

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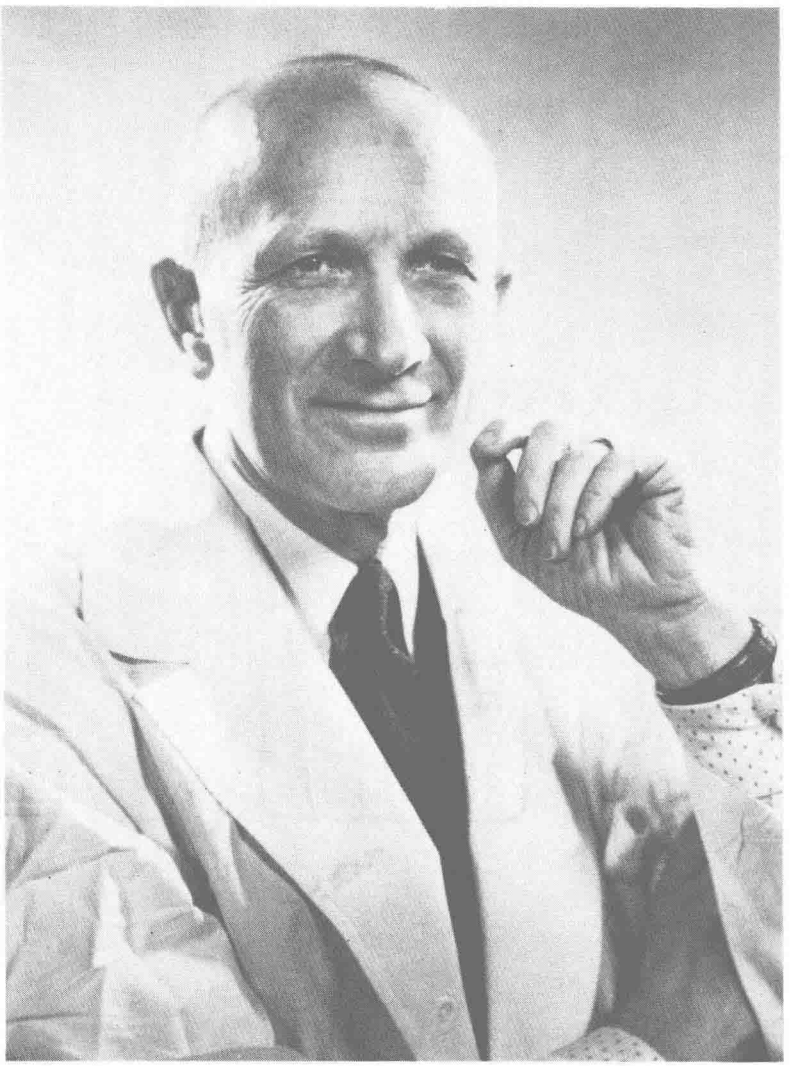
EPILEPTIC SEIZURES

DEDICATION

The Western Institute on Epilepsy
takes pleasure in dedicating this volume to
Doctor Wilder Penfield, Director of the Montreal Neurological Institute.
Dr. Penfield has made invaluable contributions to Neurology,
to the epilepsies, and to these proceedings.



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1955

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Introductory Remarks

Since the patient with epileptic seizures represents one of the commonest problems in medicine, each of the organizations meeting here together for the first time has much to contribute to his welfare. This may be research, clinical care, or social rehabilitation, and certainly all are important.

Prior to the time of Hughlings Jackson, less than a century ago, there was very little specific information about the nature of seizures. It was Jackson who first postulated that epileptic attacks originate in nerve cells of the gray matter of the brain and that the pattern of the seizure which follows depends on the anatomic location of these cells. Such a concept did much to lay the foundation for modern neurology and neurological surgery.

Epileptic seizures occur in as many people as do active tuberculosis and diabetes, and four times more frequently than does poliomyelitis. They are most commonly a symptom of some disturbance of neurochemistry due to a pathologic change. Hereditary factors are uncommon. In discussing epileptic seizures one must, therefore, speak not in terms of "epilepsy," but of "the epilepsies."

The program has been planned along practical lines for the general practitioner, internist, pediatrician, medical student, educator, employer and parent.

JOHN R. GREEN, M.D.

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PART I

DIAGNOSIS OF EPILEPTIC SEIZURES

CHAPTER 1

The Clinical Diagnosis of Epileptic Seizures

WILDER PENFIELD

It is necessary in doing clinical work in epilepsy to classify the cases as you come to them. For that, we need a very simple working classification. The anatomical classification of *epilepsy* or *cerebral seizures* provides the simplest basis of the type of fit that we are talking about. One can divide patients very easily, according to the pattern of fits, into: (1) *focal cerebral seizures*, the anatomical localization of the origin being in the cerebral cortex, (2) *centrencephalic seizures*—the word centrencephalic refers to structures in the higher brain stem. The origin of these seizures is in those areas of gray matter which are connected symmetrically with the cerebral cortex on both sides; there is only one place where such gray matter could exist and that is in the higher brain stem, (3) *cerebral seizures unlocalized*. A clinician must have such a category. His efforts will be to take the patient out of the group of "*cerebral seizures—unlocalized*" and put him into an anatomical classification.

We have all been taught a great deal about the cerebral cortex and its parcelation according to cytological structure into different areas, such as those of Brodmann, but I think from a clinical point of view we should forget that. Some of it is important, but some of the work on architectonics is absolutely misleading and unimportant.

In general I like to picture the formation of the cortex as the result of projections outward from the brain stem. The higher brain stem including the thalamus is the old brain, and with the evolution of man, from lower forms upward, there appear the

frontal and temporal lobes, the development of which marks the real change from animal to man. Each of the areas of cortex attains integration into the function of the brain as a whole by means of its connections with the old brain. Particularly in regard to epilepsy, but also in regard to function within the brain, this interconnection makes understanding possible.

Let us consider the visual system for example. Sensory impulses from the eyes come into the optic tract and pass to the lateral geniculate bodies. The pathway there goes on to the visual cortex but it does not stop there. Animal physiologists are apt to stop at the cortex, but human physiologists must go one step further. From the visual cortex the pathway must go back into this centrencephalic system,* or call it the central area of integration. Somatic sensory impulses come up the spinal cord to the postcentral gyrus and then inward into the area of central integration.

On the other hand, for voluntary activity, a stream of neuronal impulses takes origin not in the pre-central gyrus but in the only place it could arise, namely, in those areas which have received all of the sensory pathways. It arises then in the centrencephalic system; a stream of impulses passes out to the motor area in the cortex and then downward through the brain stem and cord to the muscles.

Let us look at the frontal section of the brain (fig. 1/1). We can see that there is only one area that could be connected symmetrically with the cortex from both sides. That is the upper brain stem including the thalamus. Here originate the voluntary streams of impulses, "supra-cortical motor," passing upward to the cortex and then downward through the pyramidal tract.

On the other hand the psychical areas of the brain, the regions of cortex that have to do with memory and with intelligence, certainly function by means of a back and forth relationship with this integrating area. The centrencephalic system is a hypotheti-

* The original argument for the position and action of the centrencephalic system is to be found in Penfield: Arch. Neurol. & Psychiat. **40:** 417, 1938; also 1952 Association for Research of Nervous and Mental Diseases, 30, 513. Also Penfield and Jasper: Epilepsy and Functional Anatomy of the Human Brain. Little, Brown, Boston, 1954.

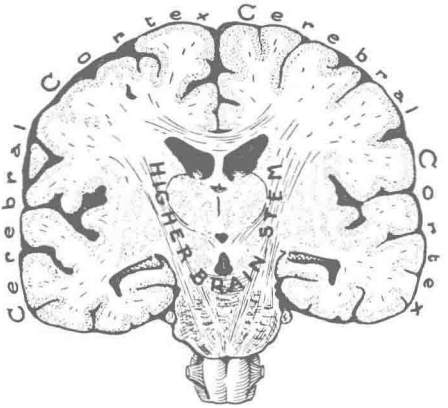

FIGURE 1/1. Frontal section through the brain of man. The brain-stem, as defined by Herrick (1920), includes "all of the brain except the cerebellum and the cerebral cortex and their dependencies." Thus defined, the brain-stem includes the thalami. The centrencephalic integrating system is that neurone system within the brain-stem (diencephalon, mesencephalon and probably rhombencephalon) which has bilateral (symmetrical) functional connections with the cerebral hemispheres. (From Penfield: Mechanisms of voluntary movement. Brain, **77:** 1, 1954.)

cal system, but it is one that must be there and one that is necessary for common sense thinking in epilepsy.

Hughlings Jackson, who found so much evidence in his epileptic patients, concluded that there were levels of integration in the nervous system. The highest level was that in which final integration took place. It was the level in which the discharge took place which produced the type of epilepsy which we are apt to call Petit Mal. In our thinking about epileptics we must come to a similar conclusion. But it is obvious that the highest level is not in the frontal lobes, as Jackson suggested. It is in the higher brain stem. In every epileptic seizure there is a discharge in gray matter, not in white matter. There is a discharge in gray matter which begins locally, as I believe, in every case, although the electrographic tracing may show simultaneous discharge in the convexity of each hemisphere at the beginning.

In order to make a classification that is anatomical we must think anatomically (fig. 1/2). In the central zone of each cortex

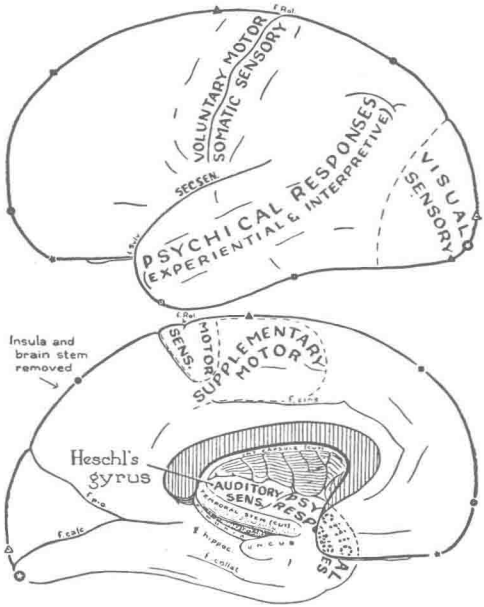

FIGURE 1/2. Area of cortex from which psychical responses are obtained. They may be experiential, recalling the experience of some past interval of time, or they may be interpretive and alter the patient's interpretation of present experience. The major sensory and motor areas are also indicated. (From Penfield: Proc. 14th Internat. Congress Psychologists, June 1954.)

lie the somatic motor and sensory areas, the post and pre-central gyri, respectively. Near the midline there is a supplementary motor area. The visual cortex is located in the occipital lobes and the auditory cortex in the first temporal convolution which runs down into the fissure of Sylvius as Heschl's gyrus. In the insula are located centers for gastro-intestinal sensation and motility.

In approaching a patient you will find at once that he is having either minor seizures or major seizures. Accept the assumption that all major attacks probably begin as minor ones, though you cannot always perceive the transition. Now if the minor attacks occur in the higher brain stem there is a sudden movement on both sides, a twitching of the eyelids (particularly in children), turning of the eyes upward, a lapse of consciousness, perhaps a falling forward of the head, with which every man who has seen