Early in the course of his extensive clinical studies of cortical function and of epilepsy,28,31,32,35,36 Dr. Wilder Penfield made a chance observation that has led to a major contribution to the understanding of cerebral function.

In the nineteenth century, neurosurgeons first began to employ the experimental techniques of Fritsch and Hitzig, Ferrier, Sher- rington, and others, to study the cortical localization of motor functions in man.1,41–43 Frequently these techniques were used to map out the area of the brain to be removed in patients with focal epilepsy.6

"More exciting were the two cases published in 1909 by Harvey Cushing on sensations resulting from stimulations of the post-Rolandic area in man. Operating under local anaesthesia he established the sensory function of the human post-central strip. Penfield, since that day . . . , has greatly extended these observations on both the motor and sensory and other responsive areas of the brain. . . ."

"Ferrier many years ago said that all parts of the cortex would prove to be excitable, but he could not demonstrate excitability himself except from restricted areas of the brain: the greater part was unresponsive. Ferrier's prophecy was long unfulfilled, and only recently has come closer to confirmation. Thus we now know that responses must be looked for not only in movements of the limbs or in sensations or in flashes of light or sounds or odours but in two other directions. The first is in the autonomic or visceral changes that may be the replies to stimulation of some areas. . . . This work has mainly been done on animals. The second and much the more exciting, even dramatic, discovery was made by Penfield—that stimulations of the temporal lobe in human beings may evoke experiences, pictures in the mind. . . ."5

The following is Dr. Penfield's account of his first experiences with this phenomenon:

". . . I was operating upon a woman under local anaesthesia in the Royal Victoria Hospital and was applying to different points on the temporal lobe of her brain a stimulating electrode. She (E.W.) told me suddenly that she seemed to be living over again a previous experience: she seemed to see herself giving birth to her baby girl. That had happened years before, and meanwhile the girl had grown up. The mother was now lying on the operating table in my operating room, hoping that I could cure her attacks of focal epilepsy.

"This, I thought, was a strange moment for her to talk of that previous experience, but then, I reflected, women were unpredictable and it was never intended that men should understand them completely. Nevertheless, I noted the fact that it was while my stimulating electrode was applied to the left temporal lobe that this woman had had this unrelated and vivid recollection, That was in 1931.

"It was more than five years later when a somewhat similar psychological state made its appearance during electrical stimulation. This time, however, it seemed certain that the stimulus had somehow summoned a past experience.

"The Montreal Neurological Institute was opened in 1934, and a patient, J.V., a girl of 14 years, was admitted in June 1936. . . . She was complaining of seizures during which she sometimes fell unconscious to the ground in an epileptic convulsion. But, immediately preceding such an episode, she was aware of what seemed to be a hallucination. It was always the same: an experience came to her from childhood. . . ."

"At operation, under local anaesthesia, I mapped out the somatic sensory and motor areas for purposes of orientation, and I applied the stimulator to the temporal cortex. 'Wait a minute,' she said, 'and I will tell you.' I removed the electrode from the cortex. After a pause, she said: 'I saw someone coming toward me, as though he was going to hit me.' It was obvious also that she was suddenly frightened.

"Stimulation at a point farther forward caused her to say, 'I imagine I hear a lot of people shouting at me.' Three times, at intervals and without her knowledge, this second point was stimulated again. Each time she broke off our conversation, hearing the voices of her brothers and her mother. And on each occasion she was frightened. She did not remember hearing these voices in any of her epileptic attacks.

"Thus the stimulating electrode had recalled the familiar experience that ushered in each of her habitual attacks. But stimulation at other points had recalled to her other experiences of the past, and it had also produced the emotion of fear.
Our astonishment was great, for we had produced phenomena that were neither motor nor sensory, and yet the responses seemed to be physiological, not epileptic. . . ."

Dr. Penfield's subsequent experiences with similar patients has led to two important neurophysiological concepts: the definition of the centrencephalic system and its importance to consciousness, and the role of the temporal lobe in memory and in psychomotor epilepsy. 2-27,29,30,33,34,37-40 Reproduced below is Penfield's initial account of these ideas, as given in the Harvey Lecture delivered October 15, 1936.

References