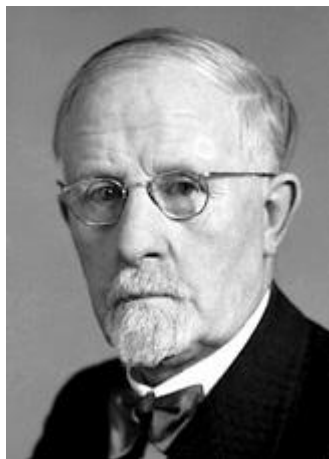


## **Nobel Prize in Medicines 1949**



**Walter Rudolf Hess**



**Antonio Caetano de Abreu Freire Egas Moniz**

**The Nobel Prize in Physiology or Medicine 1949 was divided equally between Walter Rudolf Hess "for his discovery of the functional organization of the interbrain as a coordinator of the activities of the internal organs" and Antonio Caetano de Abreu Freire Egas Moniz "for his discovery of the therapeutic value of leucotomy in certain psychoses"**

The Caroline Institute, through the presentation of this year's Nobel Prize, desires to reward two important discoveries in the fields of neurophysiology and its clinical application, neurology. Both of these discoveries touch upon the connection between function and localization in the brain.

The primary centers of vital functions such as respiration, control of blood circulation, the secretory and motor activity of the digestive organs, and the like, as was already well known, are all located in the medulla oblongata. It has also been understood for some time that the functions of these and several other primary reflex centers are integrated in the mesencephalon, that is, the grey matter, grouped in several nuclei, which is located below the hemispheres of the cerebrum, in immediate proximity to the

hypophysis, which exercises a regulating influence on a great many vegetative functions. It has been found, inter alia, that a surgical operation for the purpose of removing tumours situated in or near this region is accompanied by very great dangers due to the fact that even slight operative traumas in this sensitive area may cause disturbances of vital functions such as temperature regulation, blood pressure, and the like.

Although we have long been aware of the function of the midbrain as a higher center of the autonomous nervous system, we have only now, through the research of Walter Rudolf Hess, had the localization of these functions mapped out in detail. Through the use of a refined and accurate technique he has succeeded in applying stimulation to or causing the destruction of very small areas, and thus he has been able to study the effect of the stimulus, as well as of the disappearance of a function. For his experiments he has used cats into which, under anesthesia, a thin metal wire has been introduced. The wire has been electrically insulated along its entire length except at the very end, which has been placed in the center of the brain area which is being studied. When the animal has regained consciousness and has recovered entirely from the effect of narcosis, it is possible to stimulate the area of the midbrain where the end of the needle is situated by conducting a weak electric current through the metal wire. There were various effects, depending upon the location of the needle-end, each effect always connected to one definite center of stimulation. By electrical stimulation of certain strictly limited parts of the midbrain it was possible to reproduce spontaneous autonomous functions. By stimulating one definite part, the animal was caused to curl up and go into a sleep from which it could be awakened just as easily as from natural sleep. Stimulation of other areas gave rise to defensive reactions which would normally occur if the cat were threatened by a dog: the hairs on the back stood up on end, the tail was ruffled, the cat spat and, if the stimulus was not discontinued, it attacked. Other localizations of the stimulus caused evacuation of the intestines or the bladder, accompanied by the characteristic body postures. From other areas, blood circulation and respiration could be influenced. It was common to all these experiments with stimuli that they released complex functions, not limited to the reactions

characteristic of the autonomic nervous system, such as evacuation of the intestines, secretion of saliva, changes of the pupils, and the like, but were accompanied by reactions of the skeletal muscles necessary and appropriate to the autonomic function, such as characteristic body postures, attempts at escape or attack, and so forth. It was apparent from these facts that in the midbrain we have higher centers of autonomic functions which coordinate these with reactions of the skeletal musculature adapted to the individual functions. An ingenious method made possible the exact determination of the anatomic localization after the discontinuance of the experiment, and thus the anatomic substrata of complex autonomic functions could be mapped out. Through his research Hess has brilliantly answered a number of difficult questions regarding the localization of body functions in the brain.

The lines of thought along which Antonio Egas Moniz has advanced to the discovery of the prefrontal leucotomy refer primarily to the localization of certain psychic functions in the brain. It has long been known that the frontal lobes are of great importance for higher cerebral activity, especially in regard to the emotions, and that the destruction of the frontal lobes, by bullet wounds or brain tumours, lead to certain typical changes of the personality, primarily on the affective plane, but sometimes also affecting the intellect, especially highly integrated intellectual functions such as power of judgement, social adaptability, and the like. The American physiologist, Fulton, and his collaborators have proved by experiments on anthropoid apes that neuroses caused experimentally disappeared if the frontal lobes were removed and that it was impossible to cause experimental neuroses in animals deprived of their frontal lobes.

It occurred to Moniz that psychic morbid states accompanied by affective tension might be relieved by destroying the frontal lobes or their connections to other parts of the brain. On the basis of this idea Moniz gradually worked out an operative method whose purpose was to interrupt the lines of communication of the frontal lobes to the rest of the brain. Since these lines of communication run through the white matter, this operation was called frontal or prefrontal leucotomy. It was soon found that morbid conditions in which

emotional tension was a dominating part of the pathological picture reacted very favorably to such operations. To this group of diseases belong, primarily, states of depression accompanied by fear and anxiety, obsessive neuroses, certain forms of persecution mania, and a considerable part of the most important and common of all mental diseases, schizophrenia: those cases, namely, in which the schizophrenic pattern of behaviour and the emotional condition is affectively charged to a high degree, as for instance in states of anguish or anxiety, refusal to take food, aggressiveness, and the like. Great subjective suffering and invalidism are characteristic of this group of diseases. Many of the diseased, especially within the schizophrenic group, are very difficult patients and are often dangerous to the people around them. When it is remembered that other methods of treatment have failed or have been followed by recurrence of the disease, it is easy to understand the immense importance of Moniz' discovery for the problems of psychiatric treatment. As was expected, the results are best for the non-schizophrenic groups, that is to say, among those suffering from depression, obsessive neurosis, and the like, where the great majority of patients operated upon have recovered and become capable of working. Within the schizophrenic group, where the disintegration of the personality has often advanced very far, the prospects are less favourable, but even in this group quite a few cases can be released from the mental hospitals, some of them after having fully regained the capacity for work. In other less favourable cases, the nursing problem will be much simplified by the fact that the patient, after operation, can be kept in a «quiet» ward.

The interesting observation has also been made that serious, bodily conditioned pain can be successfully treated through frontal leucotomy. As the operation does not touch any pain-communicating tracts, and the capacity of the patient to feel pain is unimpaired, the effect must be due to a change in the psychic experience of pain. Anguish and anxiety due to pain and the affective tension which accompanies pain disappear. When asked, the patient admits that he feels pain, but he does not care about the pain: he has become indifferent to it. These observations of psychically normal persons, on whom leucotomy has been performed in order to remove pain, have contributed in a high degree to the

clarification of the influence of leucotomy on the normal mental functions. Without doubt there are, after double-sided leucotomy, changes of personality of the same type as observed after the destruction of the frontal lobes through other causes. When it becomes a question of persons who are complete invalids because of sickness, this may be of small importance, while in other cases a very strict interpretation of indications is necessary. Frontal leucotomy, despite certain limitations of the operative method, must be considered one of the most important discoveries ever made in psychiatric therapy, because through its use a great number of suffering people and total invalids have recovered and have been socially rehabilitated.

***For more details please visit:***

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