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Review Article

Neurosciences and Nobel Prizes in Medicine and Physiology, A Brief Historical Sketch

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Abstract

In order to stimulate and promote the development of humanity, Alfred Bernhard Nobel, in his will, established with his fortune a fund with which the best exponents in Literature, Physiology or Medicine, Physics, Chemistry and Peace would be rewarded. Over the years, awardees have come from various fields related to physiology and medicine. This review was motivated by the large number of Nobel Prize winners in Medicine and Physiology in the neuroscientific field. Despite there being numerous publications about this award, there are few that specifically deal with neuroscience, so it was decided to briefly describe it. the Nobel Prizes that were awarded to this branch of medicine, highlighting those that were considered most important by the authors and mentioning the others.

***Keywords:** Neurosciences, Nobel Prize of Medicine and Physiology.*

Introduction

The history of knowledge, like the history of humanity, is marked by an uninterrupted series of discoveries that begins with the very origin of man and reaches the present day. Neurosciences refer to those disciplines or specialties that address the study and knowledge of the anatomy and function of the nervous system (NS). The study of this system can be approached from various branches of medical knowledge. All these multiple disciplines contribute to the comprehensive knowledge of the SN and, therefore, that of living beings with a neural communication system. One of the components of neuroscience is, and has been over time, neuroanatomy, which has enriched this knowledge since very remote times, to understand its form, function and alterations. Modern neuroscience represents a fusion of molecular biology, neurophysiology, anatomy, embryology, cell biology and psychology. All this work together, tenacious and tireless, associated with the clinic, seems to reinforce an idea expressed by Hippocrates two thousand years ago, regarding that "the study of the mind begins with the study of the brain."[1]

In order to stimulate and encourage the development of humanity Alfred Bernhard Nobel born in Stockholm, October 21, 1833, Swedish chemist, engineer, inventor and weapons manufacturer, famous mainly for the invention of dynamite, in his signed will On November 27, 1895 at the Swedish-Norwegian Club in Paris, he established with his fortune a fund with which the best exponents in Literature, Physiology or Medicine, Physics, Chemistry and Peace would be rewarded. A heart attack caused his death when he was at his home in San Remo, Italy, on December 10, 1896 at the age of 63. It is estimated that his fortune at the time of his death was 33,000,000 crowns, of which he bequeathed to his family only 100,000 crowns. The rest was destined for the Nobel Prizes. In honor of such a noble action they named an asteroid (6032) Nobel, a lunar crater is named after him, as well as a chemical element, Nobelium, and the Nobel Prizes.[2]

As dictated by Nobel's will, this recognition is administered directly by the Nobel Foundation and awarded by a committee consisting of five members and an executive secretary who are elected by the Karolinska Institute. Despite being popularly known as the Nobel Prize in Medicine, Alfred Nobel clearly specified that it would be awarded for physiology or medicine, so laureates can come from a wide range of fields of study.[2]

Over the years, awardees have come from various fields related to physiology and medicine. Until 2023, it has been awarded eleven times for research in the field of signal transduction by G proteins and second messengers, nineteen for work in the field of neuroscience and fourteen for contributions in the study of metabolism.

The large number of Nobel Prizes in Medicine and Physiology in the neuroscientific field motivated the realization of this historical review. Despite there being numerous publications of this award, there are few that specifically deal with neuroscience, so it was decided to briefly describe them. the Nobel Prizes that were awarded to this branch, highlighting those that were considered most important by the authors and mentioning the others.

Material and Method

A systematic review was carried out of the main updated articles published in English and Spanish about the contribution of Neurosciences to the Nobel Prizes in Medicine and Physiology. References of articles retrieved by the electronic search were searched for other potentially eligible articles.

Development

The story goes back to 1906 when only 5 Nobel Prizes in medicine and physiology had been awarded thanks to the magnificent idea of those who decided to reward researchers who, with their talent and sacrifice, moved the world with their brilliant discoveries. It was then that Santiago Ramón y Cajal (1852-1934), Spanish doctor, and Camilo Golgi (1843-1926), Italian doctor, were awarded for their contributions in the field of Histology, investigating comparative histology and the structure of epithelial cells in numerous organs. and fabrics. But what earned them the Nobel Prize were their discoveries about the morphology and connections of nerve cells in the gray matter. Complementing his discoveries with brain studies, such as growth, neuronal polarization and nerve cell staining methods. His contributions were such that today there are still several eponyms such as Golgi cells, Golgi corpuscles or Golgi staining, as well as horizontal cells of Cajal or interstitial mesencephalic nucleus of Cajal. These two eminent neuroscientists began a close and successful relationship between neuroscience and Nobel Prize winners.[3]

Years later, scientists from other medical branches were awarded; also in 1915, 1916, 1917, 1918 and 1925 it was not awarded as the research was considered not worthy of such an award.[4]

It was not then until 1932 that C.S. Sherrington and E.D. Adrian were awarded for their exact description of the biomolecular events that occur in the synapse process, a term they introduced to refer to the neuronal joint that constitutes the basis for the transmission of nervous information. He developed what is called Sherrington's law. This states that when a muscle contracts as a result of a nervous action, its antagonist muscles receive a simultaneous signal that inhibits them.[5]

In 1940, 1941, 1942 it was not delivered due to one of the saddest pages in human history, the Second World War and the invasion of Norway by Nazi Germany.[2]

In 1949, one of the most controversial Nobel Prizes in subsequent history was awarded to the Portuguese neurologist Egas Moniz, shared with the Swiss W.R. Hess (due to his contributions to research on the hypothalamus), the first was recognized from the postulation of a neurosurgical technique called lobotomy for the treatment of metastatic cancer pain as well as for the treatment of Psychoses.

Nowadays they are remembered as terrifying operations inappropriately used to control mentally ill patients, but in the 1950s it was not thought that way; lobotomy arose from studies on chimpanzees, carried out at Yale University, which showed that if they were By cutting off part of the frontal lobe, the chimpanzees became calmer and tamer, with fewer signs of alarm and excitement when pain was caused. In the 1950s, prefrontal lobotomy was the gold standard (the procedure considered most appropriate) for metastatic cancer pain. At that time, available opioid medications were avoided because it was feared that the patient would become addicted.[6]

In light of current knowledge, it is known that the technique fell into decline following the development of effective antipsychotic medications, as well as medical alternatives for the treatment of pain. Today, deep brain stimulation, for example, instead of destroying the brain, stimulates it with electrodes to relieve pain, this alternative being much more effective and less aggressive for the patient.[6, 7]

It was not until 1979 that thanks to the contributions of Hounsfield, Godfrey Newbold (Electrical Engineer, English) and Cormack, Allan MacLeod (Physicist, American) the brain could be observed through x-rays at different angles of the body and with their translation into a computer digital language, which has made it possible to have beautiful and useful three -dimensional images, a diagnostic test that was called computed axial tomography. Diagnosis based on images of the inside of the body obtained through X-rays has been used since the beginning of the century. However, classic radiographs do not allow us to observe the relief or clearly distinguish the tissues crossed by the rays. The scanner solves this situation by obtaining a large number of X-ray images (either successively, by rotating the device, or simultaneously, using several emitters and detectors).[8]

Cormack became interested in the problem, working on it intermittently and developing the physical-mathematical theory necessary to carry it out, and Hounsfield was the one who built the first functional tomograph. The awarding of the Prize was curious, neither of the two winners was a doctor or biologist (Cormack was a physicist, Hounsfield an engineer) and, despite being a university professor, the former did not have the title of doctor, while Hounsfield did not have any official title. Cormack was also awarded the United States National Medal of Science in 1990. He was named a Fellow of the Southern African Institute of Physics and the Association of American Physicists. Computed axial tomography is one of the best diagnostic techniques that exist today.[8]

But imaging diagnosis continued to develop, and in 2003 this award was given to the American Paul C. Lauterbur and the British Sir Peter Mansfield for their advances in the field of magnetic resonance imaging. The discovery of the physical properties on which magnetic resonance is based already led to the awarding of the Nobel Prize in Physics in 1952 to Felix Bloch and Edward Mills Purcell.[9]

Until the 1970s, this method was used mainly to analyze the chemical structures of materials. Earlier in the decade, this year's awardees made critical contributions to the development of the system, which led to the application of magnetic resonance imaging to medicine. Images obtained by magnetic resonance are a common method in medical diagnosis. More than 60 million investigations are carried out each year in the world using this system, which is still developing rapidly. This medical method, sometimes more complete than other imaging systems, has significantly improved the diagnoses of many diseases, and has made it possible to avoid invasive diagnostic methods on many occasions, reducing risks and discomfort for the patients involved suppose. The phenomenon of resonance is based on the relationship between the strength of a magnetic field and the frequency of radio waves. For each type of nucleus of an atom, there is a mathematical constant with which the wavelength can be determined as a function of the strength of its magnetic field. Paul Lauterbur discovered the possibility of developing two-dimensional images by introducing magnetic field gradients, a technique that consists of superimposing the spatially uniform static magnetic field with a second, weaker magnetic field that varies position in a controlled manner. In this way, by analyzing the characteristics of the emitted waves, he was able to determine their origin, which made it possible to construct two-dimensional images of structures that could not be visualized in any other way (in 1973 he was able to differentiate, with this system, tubes with heavy water from tubes with water normal). Mansfield advanced the development of magnetic field gradients. He showed how the signals could be analyzed mathematically, and demonstrated in theory how to speed up imaging, which could not be put into practice until a decade later, when he could begin to be used in medicine.[9]

In 2014, another Nobel Prize related to neuroscience was awarded, among the winners, John O'Keefe, neuroscientist, professor at the Institute of Cognitive Neuroscience at University College London, who for years has worked to decipher how the brain controlled behavior. Awarded the Nobel Prize in Medicine and Physiology together with the Norwegian couple composed of May-Britt Moser, the eleventh woman to receive the Nobel Prize in Medicine, she studied psychology at the University of Oslo and received a doctorate in neurophysiology in 1995 and Edvard Moser, neuroscientist and Norwegian psychologist, for discovering that the brain has a positioning system, an internal GPS, that allows orientation in space.

The Karolinska Institute in Stockholm has awarded the three scientists for solving "the mystery of how the cell organizes its internal transport system" and detailing "the molecular principles" that explain why this system is capable of delivering the precise molecules "in the right place, at the right time." [10]

Those who have made such important discoveries available to everyone as detailed explanations of why the ears hear, the eyes see, the brain is capable of distinguishing olfactory sensations, as well as its ability to transmit nervous signals with a specific objective through very complex brain ionic mechanisms.

Not far behind are those who described the capacity for the production of peptides in the brain that play an elemental role in the dynamics of the limbic system and its relationship with emotions, memory, as well as the survival instinct of the human being and its influence on mechanisms. neuroendocrine cells that control pituitary functions.

Others who have made discoveries about neurotransmitters, as well as their storage, release and inactivation, demonstrating that the nervous transmission between the nerve and the muscle, through the intermediation of acetylcholine, could be easily blocked, also the discovery of catechol-methyl- transferase, which neutralizes

Date	Country	Awarded	Contribution
1906	Italy/Spain	Camilo Golgi/ S. Ramón y Cajal	For research into the structure of the nervous system
1932	United Kingdom	C.S. Sherrington/ E.D. Adrian	For research on the function of neurons
1949	Portugal/Switzerland	A. Egas Moniz/ W.R. Hess	For research on leucotomy of certain psychoses and research on the hypothalamus
1961	United States	G. Von Bekesy	For research into the function of the cochlea
1963	United Kingdom/Australia	A.F. Huxley, A.L. Hodgkin y J.C. Eccles	For research into the ionic mechanisms of nerve cell membranes
1967	Sweden/United States	R.A.Granit, H.K. Hart-line y G. Wald	For research into vision mechanisms
1970 -	United Kingdom/Sweden/ United States	B. Katz, U. von Euler y J. Axelrod	For research on humoral transmitters and the release of transmitters in nerve terminals
1977	United States	A. Schally, R. Guillemin y R.S. Yalow	For research on the production of peptides in the brain
1979	United States/United Kingdom.	A.M. Cormack y Sir G. N. Hounsfield	For the invention of Computed Tomography
1981	United States/Sweden	D.H. Hubel, T.N. Wiesel y R.W. Sperry	For research on the information processing of the visual system and the functions of the left and right hemispheres of the brain
1986	United States/Italy	S. Cohen y R.L. Montalcini	For research into the control of nerve cell growth
1991	Germany	E Neher y B. Sakmann	For research into the function of ion channels in cells
1997	United States	Stanley B. Prusiner	For the discovery of prions
2000	Switzerland/United States	A. Carlsson, P. Greengard y E. Kandel	For research into signal translation in the nervous system
2003	United States/United Kingdom	P.C. Lauterbur y Sir P. Mansfield	For discoveries related to magnetic resonance imaging
2004	United States	L.Buck y R. Axel	For the discovery of smell receptors and the organization of the olfactory system
2014	United Kingdom/Norway	John O'Keefe, May-Britt Moser, Edvard Moser	Due to the discovery that the brain has an internal positioning system
2017	United States	Jeffrey C. Hall, Michael Rosbash, Michael W. Young	For his discoveries of the molecular mechanisms that control the circadian rhythm
2021	United States/Lebanon	David Julius, Ardem Patapoutian	For the discovery of touch and temperature receptors

Conclusion

There have been many neuroscientists who have obtained this historic distinction since its establishment in 1901, so their intense scientific activity consistent with their results donated to the well-being of humanity will never be forgotten. Therefore, the stimulus of being awarded the Nobel Prize goes beyond obtaining a medal, a diploma and a considerable sum of money, as its beneficiaries cease to be the heritage of a particular nation, and become personalities. of universal renown.

Conflict of Interest

The authors have no conflicts of interest to declare.

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