



**Arvid Carlsson, Paul Greengard e Eric Kandel,
ganhadores do Prêmio Nobel de Medicina de 2000**

The Nobel Prize of Medicine for 2000 was awarded to Arvid Carlsson, Paul Greengard, and Eric Kandel because of their works on signal transmission in the nervous system.

The three researchers have made essential discoveries about an important way of transmission signal among the different nervous cells, the slow synaptic transmission, decisive to the understanding of the brain normal functions and of the conditions of disturbs on the signal transmission that can induce physical and neurological diseases.

Arvid Carlsson, Paul Greengard, and Eric Kandel won the Nobel Prize for their findings on how messages are transmitted within the central nervous system, what nowadays directly influences the treatment of Parkinson's disease. The three laureates contributed to science for their pioneer discoveries on how a cell sends a message to another, crucial piece of information to understand the brain function. Besides being the basis to treat Parkinson's disease such findings also contributed to the development of antidepressants, like Prozac.

THE DISCOVERIES

The human brain has more than 100 billion nervous cells, connected to one another by a complex network. A message is sent from a cell to another by means of different chemical transmitters. The signal transduction, or transport, takes place in special contact points called synapses, and a lone nervous cell can have thousands of these contacts with other cells.

The three researchers' discoveries related to a kind of signal transduction among nervous cells called slow synaptic transmission. This enabled the understanding of the brain normal function and the way disturbances in that signal transduction may cause neurological and psychiatric diseases, and allowed the development of new drugs.

Arvid Carlsson discovered that dopamine is a brain transmitter and that it is of great importance to our skill in the movement control. His research brought

light on the cause of Parkinson's disease (a lack of dopamine in certain parts of the brain) and an effective drug against it (L-dopa) could be developed. Carlsson next findings all clarified the role of dopamine in the brain, thus demonstrating how drugs used in the treatment of schizophrenia acted.

Paul Greengard discovered how dopamine and other transmitters operate in the nervous system. The transmitter first works on a receptor on the cell surface. Chain reactions triggered by this receptor affect certain key proteins that rule several nervous cells functions. Proteins are modified as sulphate groups are added (phosphorylation) or removed (dephosphorylation), what changes the form and the function of the protein. By this mechanism transmitters can take their messages from one cell to another.

Eric Kandel discovered how synapses efficacy can be modified and which molecular mechanisms take part in that process. Using a snail (sea slug) as an experimental model he showed how synaptic function changes are essential to learning and memory. The protein phosphorylation in synapses plays an important role in generating a kind of short-term memory. In order to develop the long-term memory a change in the protein synthesis is necessary, what may lead to synapses alterations in form and function.

The basic mechanisms Kandel revealed also apply to humans. In a sense our memory is located in the synapses. Because of Kandel's discoveries now it is possible to study how the complex memory images are stored in the nervous system and how we can re-create old events memory. By knowing these mechanisms we can develop new kinds of drugs to improve memory functions.

Arvid Carlsson, 77, was born in Uppsala, Sweden, and directs the Department of Pharmacology, Gothenburg University. Paul Greengard, 74, was born in New York and works in the Laboratory of Molecular and Cellular Science, Rockefeller University, in New York. Eric Kandel, 70, born in Vienna, Austria, and naturalized North-American, works at the Center for Neurobiology, Columbia University, New York.