Susumu Tonegawa Biography

Susumu Tonegawa

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Biography

Susumu Tonegawa made a major contribution to the understanding of the immune system by showing how gene fragments are rearranged in somatic cells to make functional immune system genes. For his work, he received the 1987 Nobel Prize in physiology or medicine.

Tonegawa was born in Nagoya, Japan, where his father was an engineer. Developing an interest in chemistry while in high school, Tonegawa took his undergraduate degree in that subject at the University of Kyoto in 1963. However, in his senior year he read papers on the operon theory by the French biochemists François Jacob and Jacques Monod, and subsequently switched to molecular biology for graduate studies, earning his Ph.D. in 1978 at the University of California, San Diego.

He began specializing in immunology while working at the Basel (Switzerland) Institute for Immunology, and in 1981 he joined the faculty of the Massachusetts Institute of Technology's Center for Cancer Research.

In the 1970s, some scientists believed that an individual inherited a separate gene for each of the millions of individual antibody molecules. Other scientists thought that the individual inherits a small number of genes that somehow diversify in specialized somatic (body) cells. Tonegawa made major contributions to resolving the debate.

Using purified messenger RNA (mRNA) for producing antibodies and observing the genes it hybridized with, Tonegawa was able to count the number of genes and show that there were far fewer of them than the number of antibodies that were produced. He next used the then-new restriction enzymes and genetic engineering techniques to demonstrate a theory by other scientists that the somatic cell uses a flexible, multi-step process to rearrange fragments from different genes in different ways, producing many different antibodies. Tonegawa's findings overcame older beliefs that one gene codes one polypeptide chain and that genes are unchanged during development and cell differentiation.

Other scientists have shown that mutations further increase the genetic diversity of the immune system.

Tonegawa's work included investigating the genetic origins of antigen receptors of immune system T cells and, most recently, gene recombination in the central nervous system.