NHMRC: IMPACT CASE STUDY

OCT 2024

Australian Government
National Health and Medical Research Council

NHMRC

A foundation for neuroscience

The human central nervous system consists of billions of neurons, with each neuron capable of forming thousands of connections. It is these connections that make the nervous system capable of processing information, but up until the mid-20th century some central aspects of their functioning were unknown. NHMRC-funded researchers made key breakthroughs in our understanding of how neurons communicate with each other, and in doing so provided a foundation for modern neuroscience and neurotransmitter-based medicine.

Origin

Signals are transmitted from one neuron to another at connection points called synapses.

During the first half of the 20th century, the nature of synaptic transmission was a source of debate among neuroscientists. Some thought that the process was chemical, others thought it was electrical.

Resolving this question was vital to enable further progress in neuroscience.

Investment

John Eccles, working with Bernard Katz and Stephen Kuffler at the Kanematsu Memorial Institute of Pathology at Sydney Hospital, was supported by a succession of NHMRC grants during the period 1938-1944.

Eccles' research was later supported by the University of Otago and the Medical Research Council (MRC) of New Zealand, and by the Australian Government, through its support for the John Curtin School of Medical Research (JSCMR) at the Australian National University (ANU).

Research 1

Commencing in 1938, at Kanematsu, Eccles' team's research focus was on the physiology of the peripheral nervous system, and on how neurons send signals to muscle cells, across the synapse.

They undertook this research by stimulating the outside of a neuron with electrical impulses and then measuring the resultant electrical signals on the other side of the synapse. Their work demonstrated that acetylcholine was a key neurotransmitter in the peripheral nervous system.

Research 2

Commencing in 1945, at the University of Otago in New Zealand, Eccles' team used very fine glass microelectrodes capable of measuring electrical signals within motor neuron cell bodies that were only 70 thousandths of a millimetre across. In 1951, they also showed that central synaptic transmission was chemical.

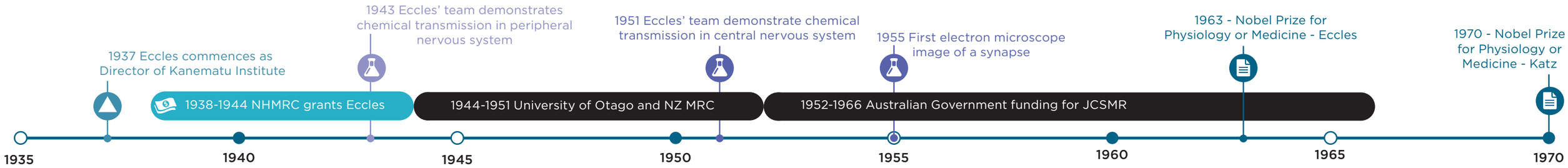
Then at ANU, Eccles' team used this recording technique to demonstrate the biophysical properties of synaptic transmission. Their work established the existing 'text book' conceptual framework for electrical activity in neurons.

Impact

Eccles shared the 1963 Nobel Prize for Physiology or Medicine for this work. Katz shared the 1970 prize for further discoveries related to neurotransmitters. Eccles and Kuffler trained many future leaders in neurophysiology. Kuffler trained two future Nobel Prize winners.

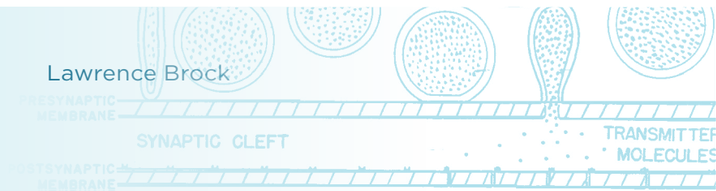
The knowledge they generated is now a standard part of basic neuroscience education. Many classes of medically important substances are now known to exert their effects via neurotransmisssion.

The work of Eccles, Katz and Kuffler revolutionised neuroscience.



Researchers

Prof Sir John Eccles AC
Prof Sir Bernard Katz
Prof Stephen Kuffler
Prof David Curtis AC
Prof Anders Lundberg
Jack Coombs
Lawrence Brock



visit **nhmrc.gov.au** to read the full story

BUILDING A HEALTHY AUSTRALIA