NHMRC: IMPACT CASE STUDY

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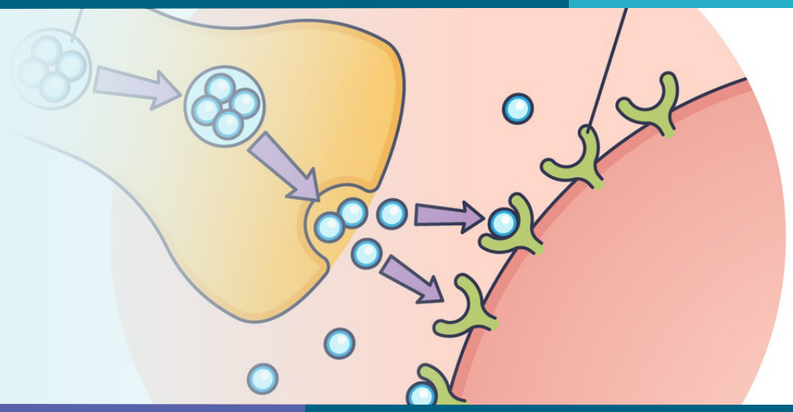
Australian Government
National Health and Medical Research Council

NHMRC

A new neurotransmitter

Neurotransmitters are small molecules that enable communication from nerve cells to other cells, including muscle, glands and other neurons throughout the body. They are essential for processes such as movement, cognition, digestion and cardiovascular control. NHMRC-funded researchers discovered an entirely new type of neurotransmitter, leading to the development of a new area of research. Their work has contributed to the development of new drugs that can prevent heart attacks and stroke, treat chronic cough and relieve dry eye disease.



Origin

Up to the mid-20th century, neuroscience research was focused on only a subset of nervous system behaviours. These were behaviours that were tightly localised in the nervous system, clearly excitatory or inhibitory and involving very short (millisecond) timescales.

This conceptual framework had worked well for reflexes, sensory processing, motor control and rapid information transfer, however it explained bodily state regulation poorly.

Investment

After UK neuroscientist Geoffrey Burnstock arrived at the University of Melbourne in 1959, he began to receive support from NHMRC project grants to undertake further neuroscience research.

Burnstock worked closely with other NHMRC-funded neuroscientists including Mollie Holman, Marcello Costa, John Furness and Max Bennett.

Burnstock's research was also supported by the Wellcome Trust, UK Medical Research Council and US National Institutes of Health.

Research

Following laboratory research, Burnstock proposed the radical concept that adenosince tri-phosphate (ATP), the body's energy molecule, could also act as a neurotransmitter. Burnstock went on to hypothesise that ATP is often released alongside other neurotransmitters from the same neuron. This theory challenged the long-standing assumption that each neuron releases only one chemical messenger. Costa and Furness showed that the gut contains its own network of nerve cells and that gut neurons release multiple signalling molecules.

Translation

From 1972, when it was first proposed, until genetic studies in the 1990s definitively proved it, the idea that ATP could function as a neurotransmitter was received with scepticism. It is now accepted that ATP plays a role across virtually every organ system, including the nervous, cardiovascular, immune, endocrine, and reproductive systems, as well as in core physiological processes.

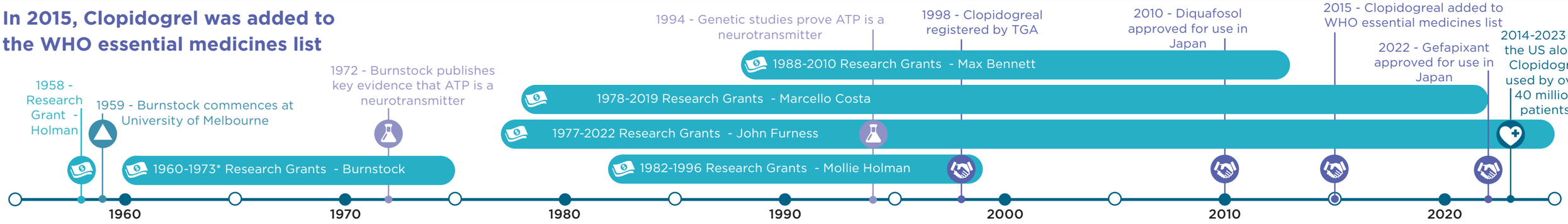
Burnstock's initially marginal hypothesis has now grown into a major field of research, with thousands of journal articles published each year worldwide.

Impact

The discovery that ATP is a neurotransmitter has enabled the development of a range of new pharmaceuticals. These include: clopidogrel, which is now a cornerstone of modern cardiovascular care; gefapixant, which reduces cough frequency; and diquafosol, which increases tear secretion and provides effective relief for dry eye disease.

ATP-based drugs are also in development for chronic pain, inflammatory disorders, cancer, migraine, metabolic disease and immune modulation.

In 2015, Clopidogrel was added to the WHO essential medicines list



*For this and other grants, date range shows start year. colour bar shows indicative funding period

Researchers

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Prof John Furness AO
Prof Max Bennett AO

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

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