Sir Andrew Huxley, OM PPRS HonFREng HonFRSE
Eminent scientist whose pioneering work earned him a Nobel Prize in 1963

Huxley often designed and built the new specialist equipment that his scientific work necessitated

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Professor Sir Andrew Huxley, widely regarded as one of Britain's most eminent scientists and great university administrators, the former master of Trinity College, Cambridge, shared the Nobel Prize in Physiology or Medicine in 1963 with Sir Alan Hodgkin, a lifelong friend and collaborator, and with Australian scientist Sir John Eccles, who was cited for research on synapses. They received the prize for unravelling the biophysical mechanism of nerve impulses which control muscle action.

Huxley and Hodgkin began collaborating on the nature of nerve impulses in August 1939, when Hodgkin invited him down to the Plymouth Marine Laboratory, following his return from America. While there, he had successfully demonstrated the mechanism by which electrical impulses activate the next segment of a nerve fibre, and had begun to work with the recently discovered nerve fibre of the giant squid. At the time, there was controversy about the way in which neural signals were generated and transmitted along fibres and across synapses – the connecting junctions where there are gaps between the ends of one fibre and the beginning of the next.

The scientists began experiments on the very large nerve fibres (diameter about 0.5mm) possessed by squids. Their first task was to measure the viscosity of the interior of the fibre by suspending it vertically and dropping droplets of mercury down it. This failed because the mercury droplets stopped as they entered the fibre, showing that its interior was a solid, not a viscous liquid as supposed. Instead, they pushed an electrode down inside, in order to measure directly the potential difference between inside and outside – and obtained a direct recording of the voltages across the nerve membrane, the first time that this had been done.

The consensus of the time was that the interior of a fibre at rest was up to one-tenth of a volt negative relative to the external solution, but rose to equality with the external potential at the peak of a nerve impulse. The pair confirmed this as regards the resting state, but the internal potential at the peak of the impulse was substantially positive. They published a short paper in the journal Nature, announcing their achievement of recording action potentials from inside a nerve fibre.

However, their work was suspended with the outbreak of the Second World War, during which time Huxley was involved in a number of projects. Initially a clinical student in London, due to the Blitz teaching was suspended, and Huxley spent the rest of the war on operational research in gunnery, first for Anti-Aircraft Command and later for the Admiralty, working in a team under Patrick (later Lord) Blackett. Hodgkin worked in radar research with the Air Ministry.

In spite of the war and their involvement in widely separated and often secret activities, the two men remained in touch and even swapped advice on particular problems. One such occasion saw Huxley design and produce, using a lathe, a new type of gun sight during the development of airborne radar.

Soon after the war, in 1946, they returned to neurological research at Cambridge. Their work necessitated the development of specialist equipment which in many cases was not only designed by Huxley, but also built by him. They began discussing how the squid membrane becomes specifically permeable to sodium ions. These are about ten times more concentrated in the external solution than inside the fibre, so they diffuse inwards, carrying their positive charge.

Within six years, Huxley and Hodgkin had laid the detailed foundations of the modern understanding of the transmission of nerve impulses. Their model, which was developed well before the advent of electron microscopes or computer simulations, was able to give scientists a basic understanding of how nerve cells work without having a detailed understanding of how the membrane of a nerve cell looked.

They demonstrated that these travel, not along the core of the fibre, but along the outer membrane as a product of successive cascades of two types of ion. The finding and the detailed mathematical theory that accompanied the work, completed in 1952 in a series of five papers, was groundbreaking and resulted in their share of the Nobel Prize.

Born in Hampstead in 1917, Andrew Fielding Huxley came from a celebrated family. His grandfather was Thomas Huxley, the 19th century biologist and staunch supporter of Charles Darwin; his two half-brothers were Julian Huxley, also a biologist, and Aldous Huxley, author of the novel Brave New World.

Surrounded by a plethora of books of all persuasions, Huxley became interested in science and practical engineering, learning how to make microscopes and other scientific instruments. He was encouraged by his mother, who was good with her hands, and at the age of 14 he received a metal-turning lathe. It proved a revelation. With it he produced many items including a 6cc two stroke internal combustion engine. This skill was to prove invaluable in later life, enabling him to design much of the equipment he used in his experiments.

Huxley attended University College School before transferring to Westminster School with a King's Scholarship. In 1935, he won a scholarship to read natural sciences at Trinity College, Cambridge. Initially, aiming to specialise in physics, a friend suggested physiology to Huxley because "it was a most vital subject" and he "would be learning things that were still controversial," which appealed to his sense of curiosity.

During his research with Hodgkin, Huxley also worked with the Swiss physiologist Robert Stämpfli on myelinated nerve fibres. Together, in 1951, they evidenced the existence of saltatory conduction in myelinated nerve fibres. Thereafter, Huxley turned to muscle contraction and its causes, and developed an interference microscope for studying the striation pattern in isolated muscle fibres. He also developed a microtome for electron microscope sections, and a micromanipulator.

In 1984, Huxley succeeded Hodgkin as master of Trinity, Cambridge, breaking the tradition whereby the mastership alternates between a scientist and an arts man. Huxley relished the opportunity and took on the role with his strong yet gentle and peaceful personality. He was carefully but sharply outspoken on issues of scientific structure, the university role and the need for long-term stability in the national research base.

Already a research fellow at Trinity College in the late 1940s, Huxley became director of studies from 1952-60, and was Jodrell Professor of Physiology at University College London (1960-69). As a Fellow of the Royal Society (1955), he served on its Council (1960-62) and held a Royal Society Research Professorship at UCL (1969-83). Huxley was an editor of the Journal of Physiology (1950-57), and also an editor of the Journal of Molecular Biology. He received many national and international honours.

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To my knowledge, writes Tam Dalyell, Andrew Huxley took many initiatives to help scientists at the beginning of their careers and those facing adversity.

Allow me a personal experience. In 1981, I sabotaged in the House of Commons Standing Committee a Private Members Bill by the Wellingborough MP, Peter Fry, which would have had the effect of inhibiting scientific research in Britain on animals. My Party leaders, Jim Callaghan and Michael Foot, were deluged with over 500 seemingly independent, but incandescent letters complaining that "so wicked a man as Dalyell" could be endorsed as a Labour MP. What were they going to do to arrange my deselection as a Labour candidate in the 1983 general election? Callaghan, who was well disposed towards me, summoned me to his office. "What have you been up to? It's not only the anti-vivisectionists that have written, but a number of those who claim to be substantial financial donors to the Labour Party. How am I to reply?" Michael Foot summoned me. "I love cats," he said.

Unprompted, hearing of my plight, Andrew Huxley, as president of the Royal Society, broke precedent and wrote to Callaghan and Foot saying that the Fry bill would injure medical research. My bacon was saved.

Huxley's contribution to the Research Defence Society was extremely significant. For a quarter of a century after 1981, I would phone him from time to time about the content of my weekly column for New Scientist. No man was less conscious of his eminent positions.

Martin Childs, Tam Dalyell

Sir Andrew Huxley OM PPRS HonFREng HonFRSE. Born 22 November 1917. Elected HonFRSE 1983. Died 30 May 2012.