David Dewhurst – Biomedical Engineer and IFMBE Pioneer

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Abstract—**David Dewhurst was an idiosyncratic, warm-hearted and cheerful man who played a major part in establishing bio-medical engineering in Australia. He had a long association with the IFMBE, was President from 1968-1971 and chaired the 9th ICMBE held in Melbourne. Initially a Classicist destined for the church, he studied physiology and electronics after his return from World War 2 and ran an innovative medical instrumentation group in the Department of Physiology at The University of Melbourne. With the purchase of a minicomputer in 1965, the first in Melbourne, David and his group developed hardware and software for biological signal analysis and carried out a number of studies of human arm reflexes. His strong interest in electrical safety and electrocution led him to play a prominent role in the development of electrical safety standards, with Australia leading the world in this. He was proud to be a member of a government panel evaluating medical technology and advising the Australian Government on the introduction of new medical techniques such as MRI. David also co-supervised the development and construction of the first cochlear ear implant. A gifted teacher and excellent communicator, he wrote widely on technical and non-technical topics including his "On the Real Axis" series produced for the IFMBE.**

David John Dewhurst was born in 1919 in country Victoria, the son of an Anglican minister. As a boy, he was interested in electronics and amateur radio, and from his little workshop under the stairs, he was the fixer of the family wireless set. But his aim was to enter the church, like his father and grandfather, and to this end he studied Classics at The University of Melbourne, graduating with an Honours Arts degree.

DJD in 1940

Then came the Second World War, and from June 1940 David served with the Australian Imperial Forces, first in the Middle East. He was in the Corps of Signals, often attached to anti-aircraft artillery, and he picked up some useful skills. For example, when Australian troops occupied Beirut in 1941 after battling Vichy forces, his unit had to learn quickly to use the mechanical predictors of French 75 mm AA cannons, al-though the manuals had been destroyed by the previous owners. David used such events in later life to illustrate points of principle about good biomedical engineering, such as the ability to adapt to a lack of "suitable tools" - an army term for standard repair-kits, which often went missing.

He was evacuated in early 1942 with hepatitis A, and back in Australia, he was redirected to Air Support Control Signals, and was attached to an anti-aircraft brigade. In March 1945 he was seconded to an army trade school in the former Marconi School of Wireless in Sydney, where he trained as an Instructor.

This wartime experience brought about a change of career. In 1946, after demobilisation, he began a science degree, majoring in physiology and electronics.

In the same year, a young medical graduate, Dr Ian McCallum, was employed in the Department of Physiology. He remained only three years, but he set up its first electrophysiology unit, complete with workshop and an electrically-shielded room for electrophysiological recording. His unit produced various pieces of electronics mainly for research purposes, as well as spending a lot of time recording clinical ECGs and EEGs using a fairly primitive 6 channel EEG machine.

As a student, David spent a long vacation working in McCallum's unit. His surviving reports are investigations of pieces of equipment bought by the department that had never worked properly; in several cases he emphasized that "this design can never work and the department should require the manufacturers either to replace it or to give the department's money back". In at least one of these cases the attached document suggests that his advice was followed.

David graduated at the end of 1948 and, following McCallum's resignation early in 1949, he took over the electrophysiology unit while working on his MSc and demonstrating in the Physiology Department. His 1952 MSc thesis was in two parts, one entitled "A Critique of Electric Modellism in Tissue", the other "The Design of an Oscilloscope for Clinical Research". He was starting to apply his electronic knowledge to biological measurement.

In 1952 he was appointed to a recently vacated lectureship in Physiology and, along with his teaching load, he quickly transformed the small electrophysiology laboratory

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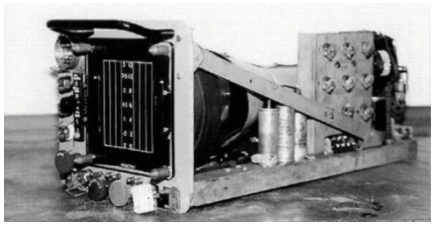
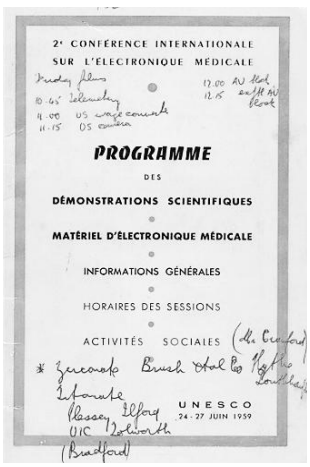
into a renowned centre of medical instrumentation. This was located mainly in two aged preparation rooms behind the Medical School lecture theatres. Together they were known as “the Shielded Room”, a name that became legendary.



Rebecca Radar Display

The post-war years were lean years for the university and he liked to quote Rutherford, "We had no money so we had to think". What was available and cheap was army surplus equipment, and one of David’s early large-scale successes was the modification of 30 Rebecca [REcognition of BEacons] Radar displays – the airborne end of a system of direction-finding equipment designed to assist the air-drop delivery of supplies to army or resistance units in occupied territory. He transformed these into was 30 physiological monitors for undergraduate classes. And to drive them, he built preamplifiers using ex-army valves. Many of the valves either didn’t work at all or were unreliable, so he bought several hundred to ensure that he had enough good ones to keep 30 preamplifiers working. As a result of this work, every undergraduate student-pair recorded sciatic nerve action potentials, as well as muscle responses, with their own set-up.

David also designed and built apparatus for his (and his colleagues') research using cheap army disposals components together with sound design. A 1957 University publication reports on his design for a cardiac defibrillator and his electronic equipment for recording physiological variables during surgery.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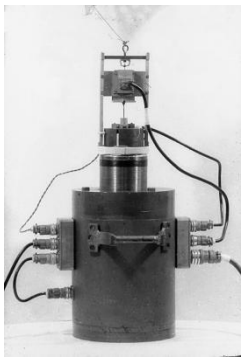
Late in 1958, he completed his PhD thesis on “The Significance of Electrical Parameters in Tissue” and he was awarded the degree in 1959. The year was a seminal one for him, marking a significant development in his career. He and his family spent a sabbatical year in Cambridge, where he worked in Sir Bryan Matthews’ laboratory in the Department of Physiology, and the year had two lasting outcomes.

First, Matthews and his colleagues were studying the relationship between the firing rate of single motor units of a muscle and the force applied to the muscle. David became very involved in this work and after his return to Australia he designed the famous "muscle puller" which, in ever-improved versions, applied an increment or decrement of force to a subject’s elbow.

Secondly David attended the 2nd conference of the then fledgling International Society for Medical Electronics, in Paris. This led to a lasting involvement with the society, later to become the IFMBE.

He also joined the UK Biological Engineering Society, where he made a number of long-lasting friendships with luminaries in the area such as Jack Perkins, Heinz Wolff, Dennis Hill and Keith Copeland.

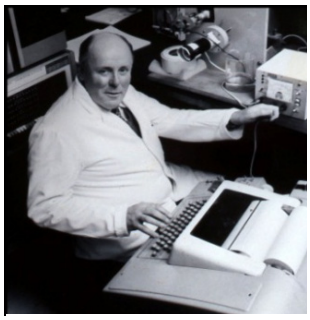
Back in Australia in 1960, David was made Senior Lecturer in Biophysics and was promoted to Reader in Biophysics in 1964.



The Muscle Puller

As already mentioned, David built the "muscle puller" that applied an increment or decrement of force to a subject’s elbow and measured the resulting movement and EMG in one or more of the relevant muscles. David and his group used it extensively to analyse rapid skilled movements by a human subject.

Then in 1965, David organized the purchase of one of the first minicomputers in Australia, a PDP8. With it, his group could to acquire and process electrical and mechanical physiological data in real time. Together they developed considerable in-house software and hardware expertise, which made possible on-line signal processing and coherent averaging. For the muscle puller experiments, this meant that they could produce histograms of motor unit activity and study consistency of responses and the effects of nerve blocks.



DJD & the PDP8, 1967

David was an expert PDP8 programmer well ahead of the field in Australia, and he passed his skills onto many others. Ever the teacher, he produced a programming manual that went through a number of editions.

In 1961 David started an extension course on medical electronics for biological researchers. It covered both theory and practical construction, and by the end of the course, the students had a thorough grounding in basic electronics and