Biophysics & Biomedical Engineering at
The University of Melbourne:

David Dewhurst's Seminal Role

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For most of this year, John McKenzie and I have been working on the history of electro—physiology at The University of Melbourne as part of John's history of the Physiology Department. We have access to departmental and university archives and we have unearthed some interesting material.

As part of this, it seemed important to us to make some systematic documentation of David Dewhurst's work in physiology and biomedical engineering in Australia because it is important to attempt to gather all the pieces together while many of the relevant people are still around. There is now half a generation of biomedical engineers who have heard of David only indirectly so I shall try to tell the story of the man, his group and his achievements and to put some of the highlights in perspective.

The story really starts in 1853 when the young city of Melbourne, awash with money from the gold rush and capital of a state only two years separated from New South Wales, decided to found a university, partly because Sydney had done so the year before and partly because of the enlightened vision of a few educated men.

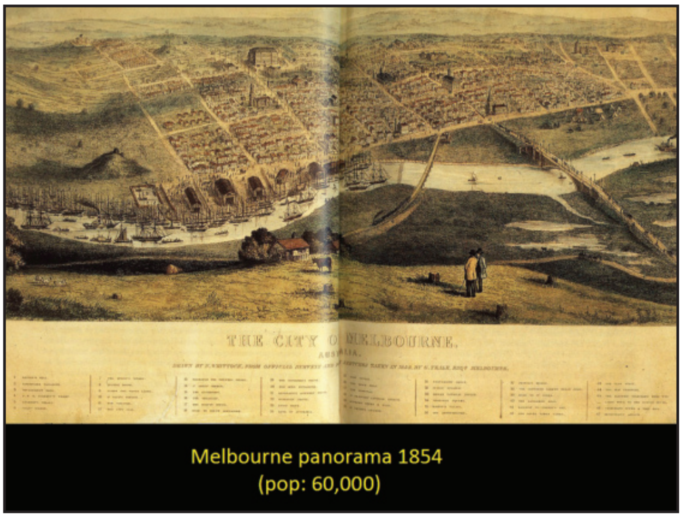


Figure 1

The university was initially to be built on 20 acres of land near the site of what is now the Treasury Gardens (labelled 'O' in **Figure 2**) but even then the space was regarded as inadequate and finally Governor La Trobe granted the University 100 acres of degraded land north of the town, from which most of the topsoil and all of the timber had been removed. The Victorian Government provided £20,000 to set it up.

Figure 2

The University of Melbourne was officially opened in April 9, 1855 and although at first only students in arts were enrolled, the University Act allowed it to confer degrees in arts, medicine, law, and music.

By 1857 plans were afoot for a Faculty of Medicine at the University and the Melbourne Medical School opened in 1862. By 1864 the University had finally built a medical building (well away from the "nice" parts of the campus) as seen in **Figure 3**.

Figure 3

It looks very imposing in the photo but even in 1900 it was described as "a poor paltry brick and stucco thing without dignity, without grace and unpossessed of any architectural beauty". By the time I joined the Physiology Department as a research student in 1964, the tattered and much—modified remains of the medical building, together with a few other down—at—heel buildings, were shared between the Physiology and Pharmacology departments.

We moved to the new medical school in 1968 and the old buildings were pulled down in 1970.

The Physiology Department in particular had a number of eminent professors and produced many distinguished medical graduates over the years, including such people as Nobel laureate Sir John Eccles, but it was largely a teaching department with very little significant research until 1939 when R Douglas Wright was appointed Professor of Physiology. Wright was a Melbourne graduate who had been working under Howard Florey in Oxford and he bought a new vigour to the Department.

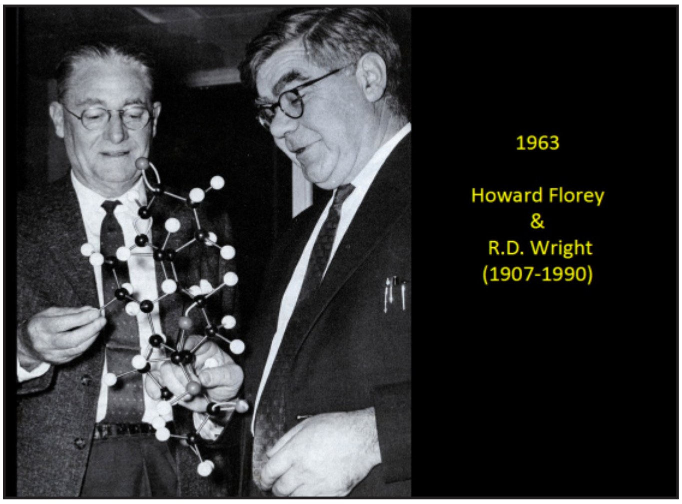
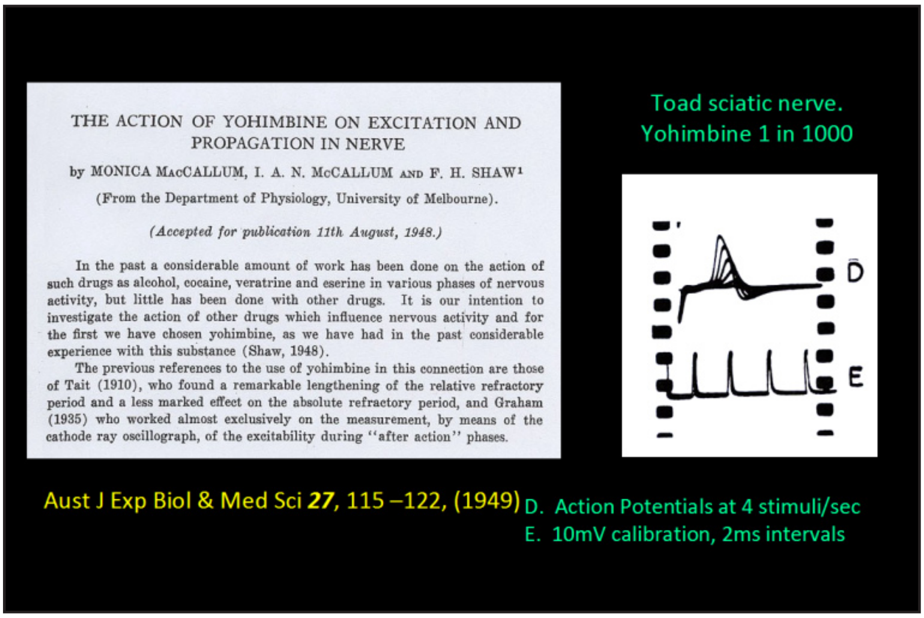


Figure 4

Then of course World War 2 intervened, and the department's resources were largely devoted to the war effort. It did work on drug evaluation and also housed an RAAF unit, leaving little time for pure research.


THE ACTION OF YOHIMBINE ON EXCITATION AND PROPAGATION IN NERVE

by MONICA MacCALLUM, I. A. N. McCALLUM AND F. H. SHAW[1]

(From the Department of Physiology, University of Melbourne).

(Accepted for publication 11th August, 1948.)

In the past a considerable amount of work has been done on the action of such drugs as alcohol, cocaine, veratrine and eserine in various phases of nervous activity, but little has been done with other drugs. It is our intention to investigate the action of other drugs which influence nervous activity and for the first we have chosen yohimbine, as we have had in the past considerable experience with this substance (Shaw, 1948).

The previous references to the use of yohimbine in this connection are those of Tait (1910), who found a remarkable lengthening of the relative refractory period and a less marked effect on the absolute refractory period, and Graham (1935) who worked almost exclusively on the measurement, by means of the cathode ray oscillograph, of the excitability during "after action" phases.

Figure 5

It is however interesting to find Wright referring in 1945 to electrophysiology as "this important work being done in the Department".

At the end of the war Professor Wright obtained money from a Commonwealth Department of Reconstruction to set up a workshop and extend research facilities, and he also employed a young medical graduate, Doctor Ian McCallum, on an NHMRC grant.

McCallum worked in the department from 1946 to 1949 and set up an electrophysiology unit, complete with workshop, in a disused prep—room. This included an electrically—shielded room for electrophysiological recording.

McCallum had graduated from the University of Melbourne in medicine in 1940 and in 1941 was a resident at the Alfred Hospital. I had some difficulty finding out what he had done between 1941 and 1946 when he came to the Department but eventually discovered that he had been in the army's Z2 Special Force. This was the secret unit training commandos to work behind Japanese lines. Its members were sworn to secrecy and the Special Force's existence wasn't acknowledged publicly until the 1970s.

McCallum did some medical teaching while he was there, and did a tour of duty in Sarawak, but I've not yet been able to find out much more. The Army may of course be where McCallum picked up some electronics knowledge, but, in any event his unit produced various pieces of electronics mainly for research purposes, as well as spending a lot of his time doing clinical ECGs and EEGs. He had a fairly primitive 6 channel EEG machine, which was probably as good as anything available in Melbourne at that time.

He also did quite a lot of research with pharmacologists over that period. **Figure 5** shows data recorded using equipment built in the department. In 1949 McCallum left the department to become a general practitioner in Bairnsdale.

The other part of our story starts in 1919 when, on the 8th of January, David John Dewhurst was born in Inglewood, a town in country Victoria.

His early years were spent in Canterbury, a suburb of Melbourne, where his father was vicar of St Paul's church. They moved to East Malvern when David was nine and his father became vicar at St John's church. As a boy David was interested in electronics and amateur radio, with a little workshop under the stairs where he was the fixer of the family wireless set.

He was dux of his final school year, combining Physics with humanities subjects. Intending to become an Anglican priest like his father, he took an Honours BA in classics at Melbourne University. But the war changed everything, and in June 1940 he joined the AIF in the Corps of Signals.

David's unit left Melbourne in February 1941 for the Middle East, where he served in Palestine, Syria and North Africa, often attached to anti—aircraft artillery. Some of his experiences left lasting traces. 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, although 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.

Evacuated by hospital ship from Tobruk in early 1942, with hepatitis A, David arrived back in Australia in March, among the first AIF to return following the contention between Churchill and Curtin concerning their disposition against Japan. In September 1942, about to be sent to New Guinea, he was redirected to Air Support Control Signals, and was commissioned as lieutenant in December.

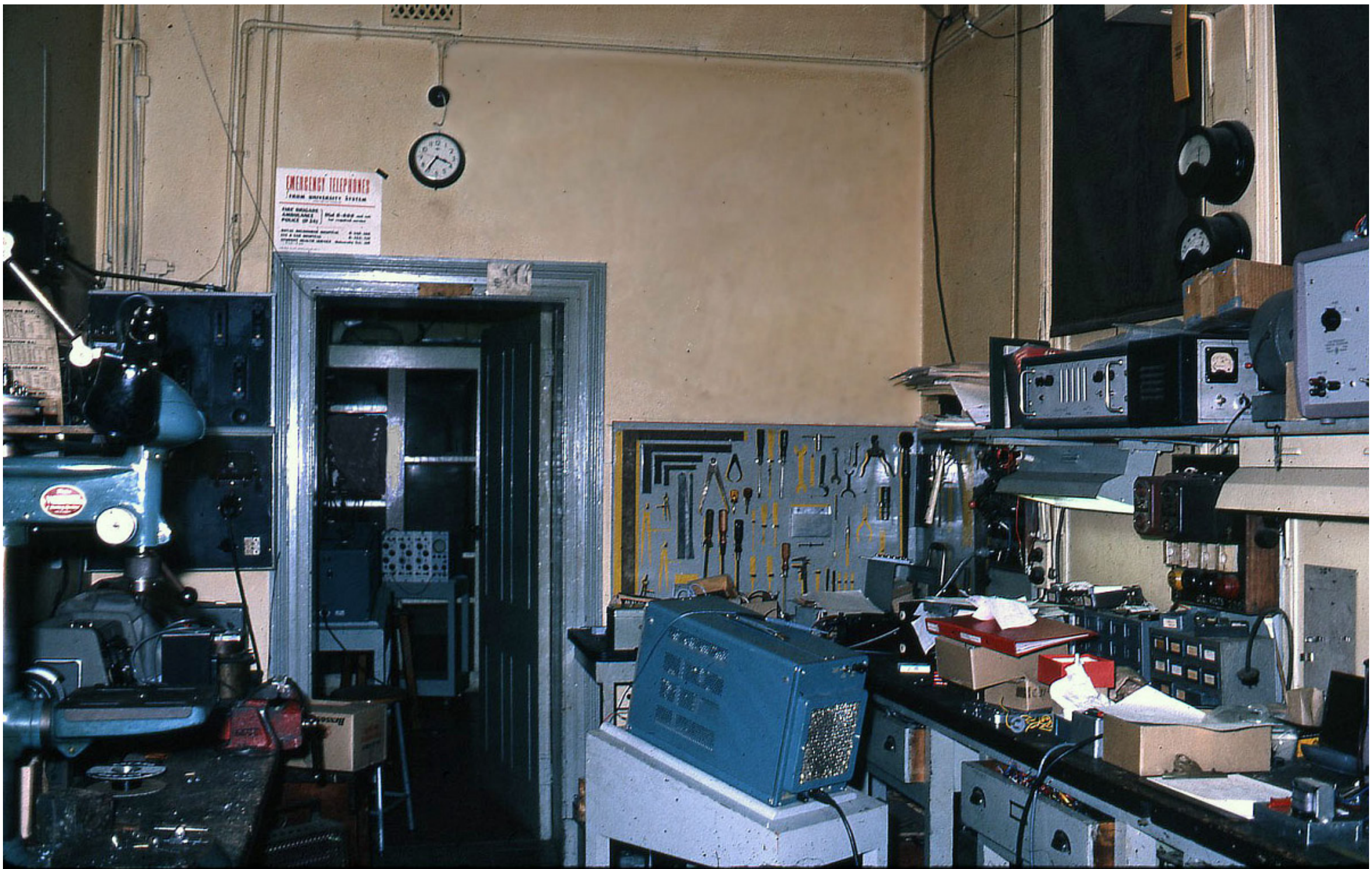
Attached to an anti—aircraft brigade, he served in units in Sydney, Brisbane and Townsville. He was later to describe the unfortunate consequences of battery gunners on Sydney Harbour firing at the Japanese midget submarines over open sights — low trajectory projectiles bounce off water, as nearly every schoolboy knows.

In March 1945 he was seconded to an army trade school in the former Marconi School of Wireless in Sydney, that was then preparing instructors. He met his wife Marjorie, an army Cipher Officer, when she was sent for further training at the Land HQ School of Signals in Bonegilla, where David had been appointed as an Instructor. This was the start of his career as a lecturer.

His experience in signals brought about a change of career. In 1946, after demobilisation, he began a BSc in physiology and electronics on the advice of Dr Arthur Turner of the CSIR Animal Health Laboratory.

Figure 6

Figure 7



The "Shielded Room" and workshop

The switchboard & controls for the 80v, 2kHz power supply required for the Rebecca displays can be seen above the bench

Figure 8

And now the two parts of our story converge.

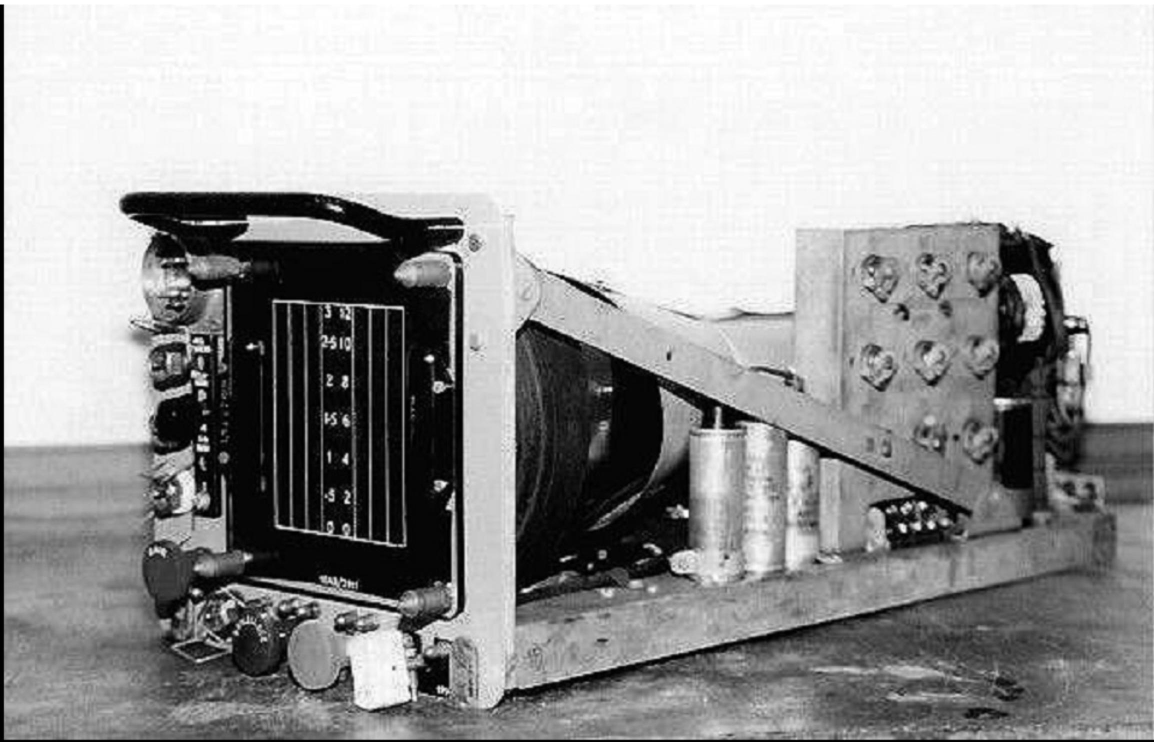
At the end of 1947 David spent his long vacation working in McCallum's unit in the Department of Physiology. Reports survive written in his very characteristic handwriting, that give a fair idea of how he spent his time.

Several of these reports are investigations of pieces of equipment bought by the department that had never worked properly; in several cases he emphasises 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 Ian McCallum's resignation early in 1949, he took over the biophysics unit while working on his MSc from 1949 to 1952 under Professor Wright and demonstrating in the Physiology Department.

His 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, as an MSc graduate, he was appointed to a recently vacated lectureship in Physiology. Along with his teaching load in physiology, he quickly transformed the small electrophysiology laboratory into a renowned centre of medical instrumentation. This was located mainly in two aged preparation rooms behind the demonstration benches of the old Medical North and South lecture theatres in the north—east corner of the University, on Swanston Street – part of the collection of old medical buildings mentioned earlier. Many older colleagues remember his office (and workshop) and his electrophysiological laboratory (and workshop), on either side of the foyer leading to the theatres and central staircase (see **Figure 8**). Together they were called '"The Shielded Room" — soon a legendary name.



“Rebecca” Mk II airborne radar display

The graticule was removed and the circuit modified for conversion to an electrophysiology oscilloscope for use in undergraduate laboratories. The display was driven by a pre-amplifier designed and constructed in the Department.

Figure 9

The room glimpsed through the doorway in **Figure 8** is the Shielded (metal—lined) recording room shown in **Figure 10**. One of David’s early large—scale successes was the modification of 30 Rebecca [REcognition of BEacons] Radar displays into physiological monitors for undergraduate classes.

These displays were 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, and they became available cheaply through Army—disposals. David would have been familiar with them and realised their potential. He took over the lecture theatre benches in vacation time, with technicians as the factory workers. The calibrated escutcheons and some controls were removed, and the conversion also involved some re—wiring. It was run like an assembly line, with each worker moving only specific wires or controls, and moving from monitor to monitor.

He used the same process to build the pre—amplifiers used to drive the monitors. These used ex—army valves, many of which either didn’t work at all or were unreliable, so David bought several hundred valves to ensure that he had enough good ones to keep 30 preamplifiers working.

There was another catch. The monitors were designed to run from the 80 volt AC, 2kHz power supplies used in aircraft, so David and his technicians installed a large motor—generator set outside the lab to provide the necessary power.

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

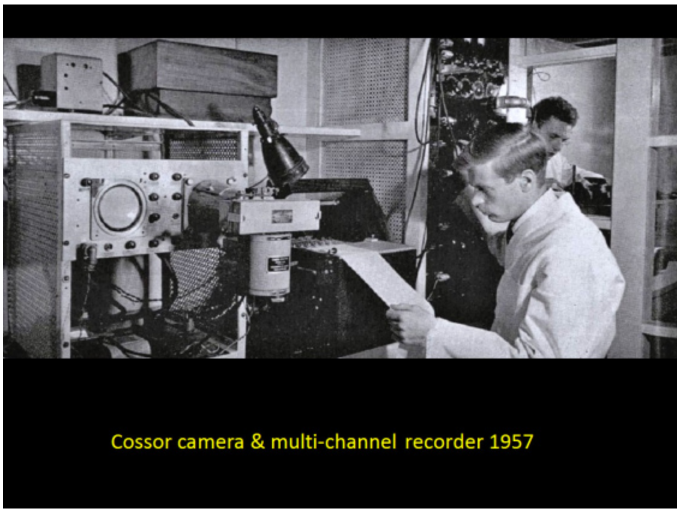


Figure 10

and his electronic equipment for recording physiological variables during surgery.

Of the early years, David would quote Rutherford's statement, "We had no money so we had to think". Late in 1958, he completed his PhD thesis on "The Significance of Electrical Parameters in Tissue" and he was awarded the degree in 1959.

1959 was a seminal year for him and marked a significant development in his career. He and his family spent a sabbatical year in Cambridge, where he worked in Sir Bryan Mathews' laboratory in the Department of Physiology and it had two lasting outcomes.

Figure 11

Firstly 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" in ever—improved versions to apply 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 International Federation for Medical and Biological Engineering (IFMBE). **Figures 12 & 13** show details of the scientific program.


SECOND INTERNATIONAL CONFERENCE ON MEDICAL ELECTRONICS
DEUXIÈME CONFÉRENCE INTERNATIONALE SUR L'ÉCTRONIQUE MÉDICALE
PARIS - 24-27 JUNE 1959
PARIS - 24-27 JUIN 1959

ADVANCE ABSTRACTS
RÉSUMÉS PROVISOIRES

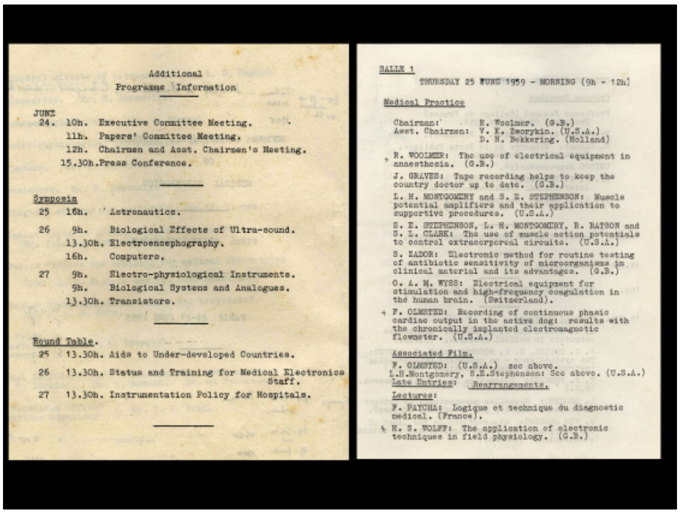
Confidential to members of the conference
Réservé aux membres de la conférence

2e CONFÉRENCE INTERNATIONALE
SUR L'ÉLECTRONIQUE MÉDICALE

PROGRAMME
DES
DÉMONSTRATIONS SCIENTIFIQUES
MATÉRIEL D'ÉLECTRONIQUE MÉDICALE
INFORMATIONS GÉNÉRALES
HORAIRES DES SESSIONS
ACTIVITÉS SOCIALES

UNESCO
24 - 27 JUIN 1959

Figure 12


Additional
Programme Information

JUNE
24. 10h. Executive Committee Meeting.
11h. Papers' Committee Meeting.
12h. Chairmen and Asst. Chairmen's Meeting.
15.30h. Press Conference.

Symposia
25 16h. Astronautics.
26 9h. Biological Effects of Ultra-sound.
13.30h. Electroencephography.
16h. Computers.
27 9h. Electro-physiological Instruments.
9h. Biological Systems and Analogues.
13.30h. Transistors.

Round Table.
25 13.30h. Aids to Under-developed Countries.
26 13.30h. Status and Training for Medical Electronics Staff.
27 13.30h. Instrumentation Policy for Hospitals.

SALLE 1
THURSDAY 25 JUNE 1959 - MORNING (9h - 12h)

Medical Practice

Chairman: R. Woolmer. (G.B.)
Asst. Chairmen: V. K. Zworykin. (U.S.A.)
D. H. Bekkering. (Holland)

R. WOOLMER: The use of electrical equipment in anaesthesia. (G.B.)

J. GRAVES: Tape recording helps to keep the country doctor up to date. (G.B.)

L. H. MONTGOMERY and S. E. STEPHENSON: Muscle potential amplifiers and their application to supportive procedures. (U.S.A.)

S. E. STEPHENSON, L. H. MONTGOMERY, R. BATSON and S. L. CLARK: The use of muscle action potentials to control extracorporeal circuits. (U.S.A.)

S. ZADOR: Electronic method for routine testing of antibiotic sensitivity of microorganisms in clinical material and its advantages. (G.B.)

O. A. M. WYSS: Electrical equipment for stimulation and high-frequency coagulation in the human brain. (Switzerland).

F. OLMSTED: Recording of continuous phasic cardiac output in the active dog: results with the chronically implanted electromagnetic flowmeter. (U.S.A.)

Associated Film.
F. OLMSTED: (U.S.A.) see above.
L.H.Montgomery, S.E.Stephenson: See above. (U.S.A.)
Late Entries: Rearrangements.
Lectures:
F. PAYCHA: Logique et technique du diagnostic medical. (France).
H. S. WOLFF: The application of electronic techniques in field physiology. (G.B.)

Figure 13

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

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. The unit facilitated the analysis of rapid skilled movements executed by a human subject.

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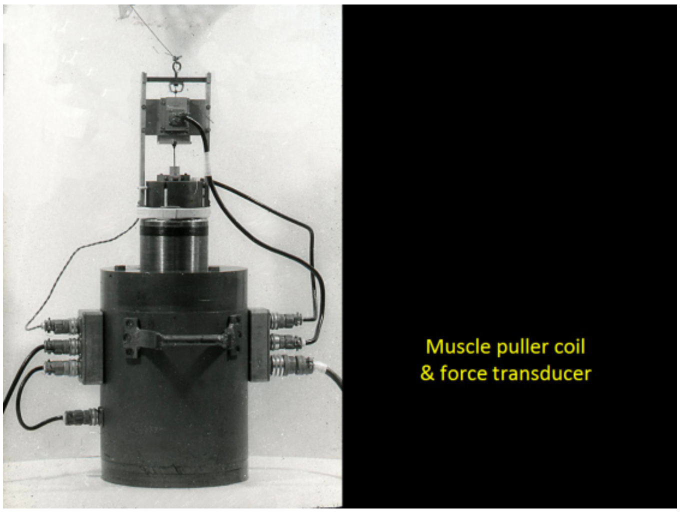


Figure 14

Figure 15

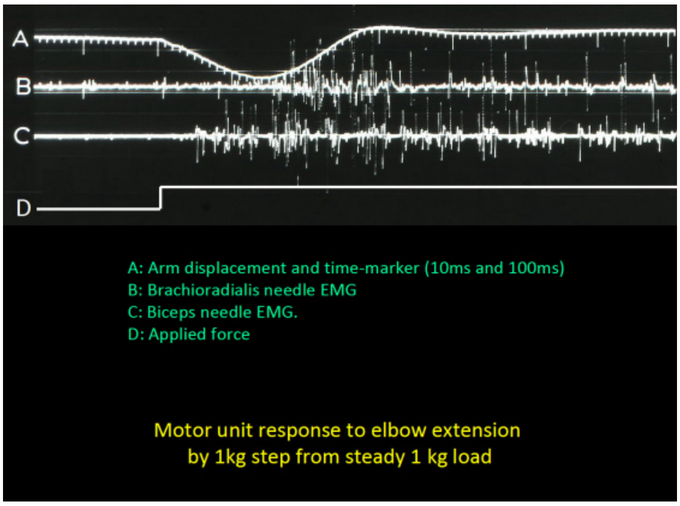


Figure 16

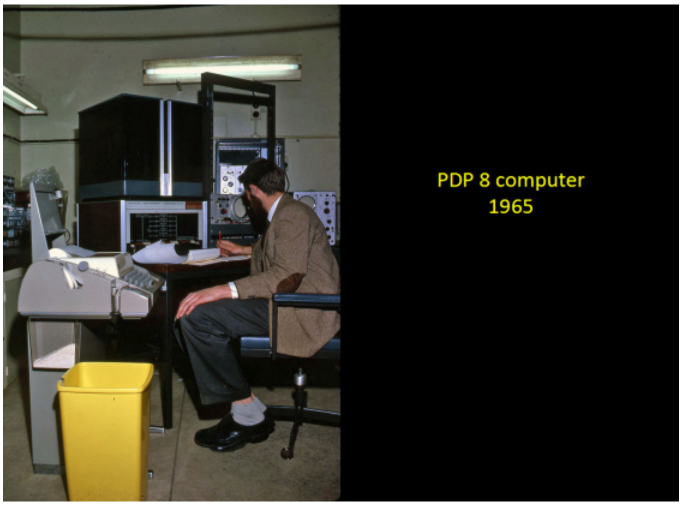


Figure 17

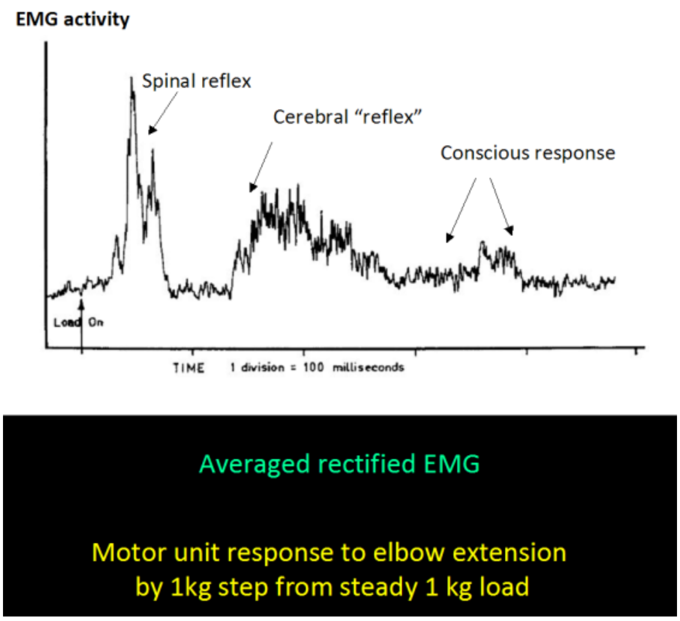


Figure 18

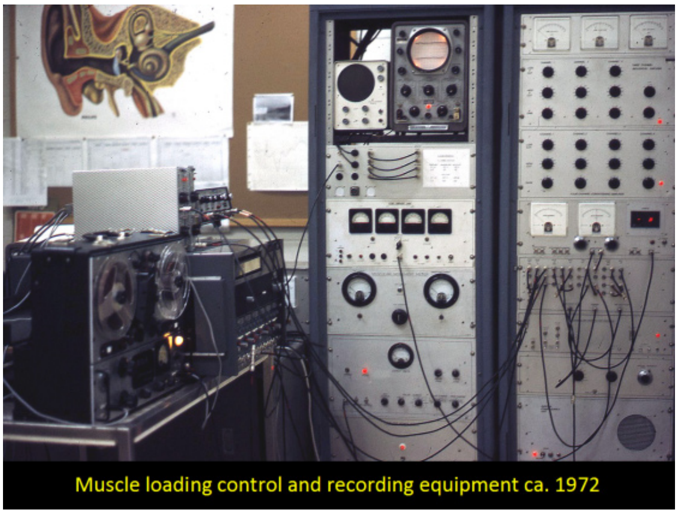


Figure 19

The purchase of the PDP8 minicomputer in 1965 — the first minicomputer in Melbourne [it had a whole 4kB of memory] — enabled the real—time acquisition and processing of electrical and mechanical physiological data.

David's group developed considerable in—house software and hardware expertise enabling on—line signal processing and coherent averaging. For the muscle puller experiments, this enabled us to produce histograms of motor unit activity — the global pattern of firing within a muscle – as a result of force changes, and to study the consistency of responses (**Figure 18**).

This work was subsequently extended to the fine control of finger movements and the computation of visually evoked EEG responses. We also studied the effects of nerve blocks, which were used to block the reflex components of the response.

The mechanical and electronic design of the muscle puller were improved over the years. Later work included the study of accelerometry and the analysis of the properties of visual feedback of arm position given to the subject (**Figure 19**).

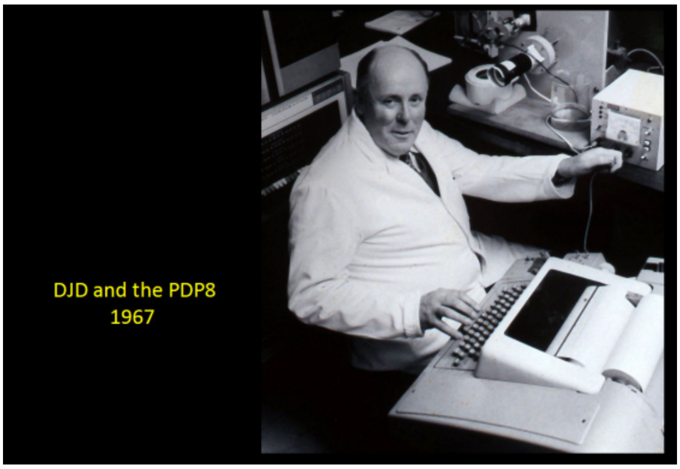


Figure 20

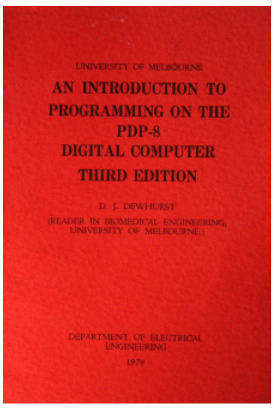


Figure 21

The PDP—8 computer was as much a presence in the biophysics group as any of the research students. As we gradually learnt how to talk to it and drive it, the computer enormously widened our experimental horizons.

David became 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 (**Figure 21**) that went through a number of editions.

In 1961 he started an extension course on medical electronics for biological researchers, with theory and practical construction. The students included cardiologists, neurologists and surgeons from the teaching hospitals, and their influence had a significant impact on the perception and understanding of the role of biomedical engineering departments in hospitals in Melbourne and on the practice of high technology medicine.

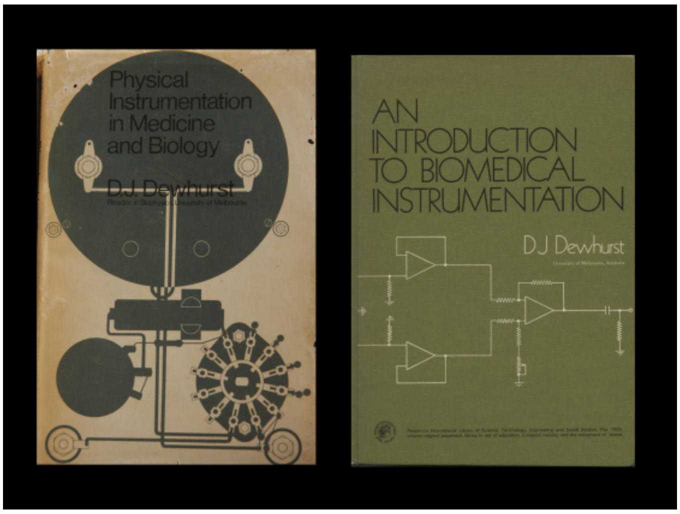
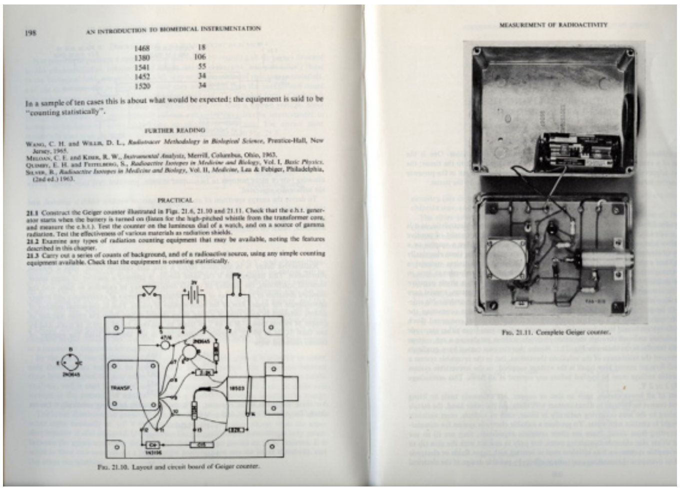


Figure 22



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1468	18
1380	106
1541	55
1452	34
1520	34

In a sample of ten cases this is about what would be expected; the equipment is said to be "counting statistically".

FURTHER READING

WANG, C. H. and WILLIS, D. L., *Radiotracer Methodology in Biological Science*, Prentice-Hall, New Jersey, 1965.
MELOAN, C. E. and KISER, R. W., *Instrumental Analysis*, Merrill, Columbus, Ohio, 1963.
QUIMBY, E. H. and FEITELBERG, S., *Radioactive Isotopes in Medicine and Biology*, Vol. I, *Basic Physics*.
SILVER, R., *Radioactive Isotopes in Medicine and Biology*, Vol. II, *Medicine*, Lea & Febiger, Philadelphia, (2nd ed.) 1963.

PRACTICAL

21.1 Construct the Geiger counter illustrated in Figs. 21.6, 21.10 and 21.11. Check that the e.h.t. generator starts when the battery is turned on (listen for the high-pitched whistle from the transformer core, and measure the e.h.t.). Test the counter on the luminous dial of a watch, and on a source of gamma radiation. Test the effectiveness of various materials as radiation shields.
21.2 Examine any types of radiation counting equipment that may be available, noting the features described in this chapter.
21.3 Carry out a series of counts of background, and of a radioactive source, using any simple counting equipment available. Check that the equipment is counting statistically.

FIG. 21.10. Layout and circuit board of Geiger counter.

MEASUREMENT OF RADIOACTIVITY

FIG. 21.11. Complete Geiger counter.

Figure 23

The course evolved to match the rapid advances in electronics into the seventies. The course notes were published as a book by Pergamon in 1966, and a revised and extended version published in 1976 was in demand for many years (**Figure 22**).

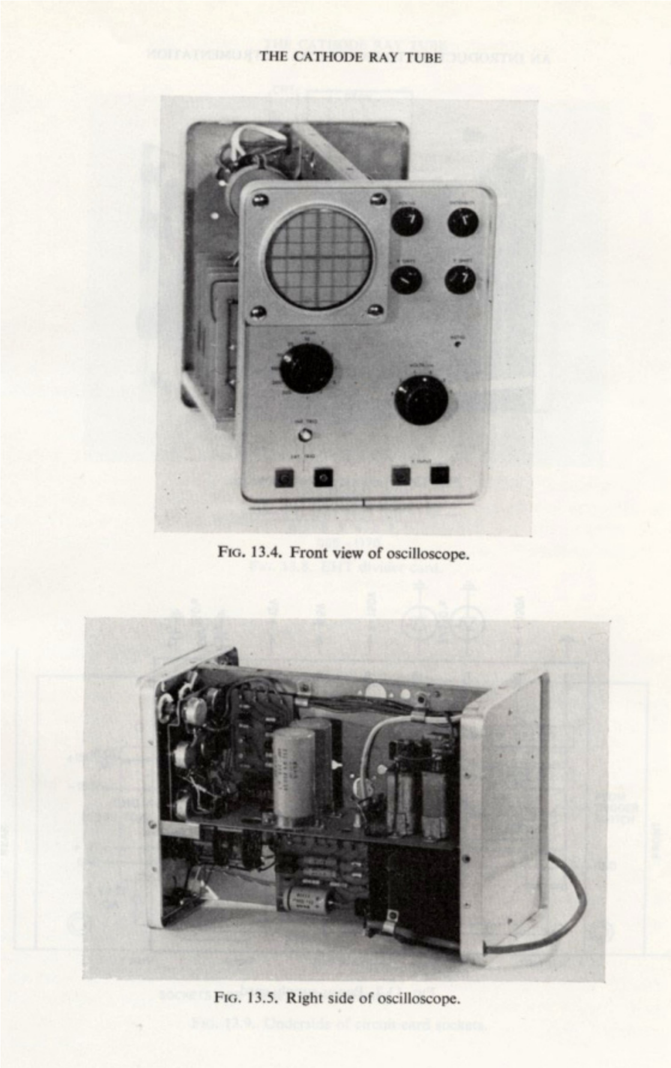


Figure 24

By the time they had completed the course, the students had a thorough grounding in basic electronics and transducers, and had built a small oscilloscope and a Geiger counter (**Figures 23 & 24**). I know various clinicians who still talk about the course and the basic grasp of instrumentation it gave them.

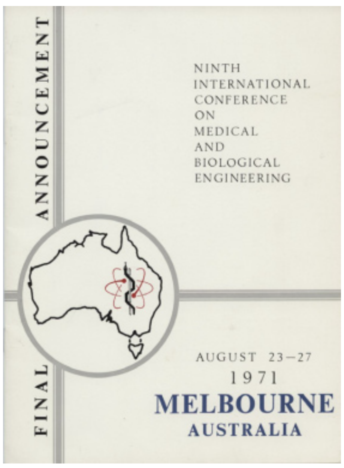


Figure 25

As mentioned, David became interested in international biomedical engineering activities during his time in Cambridge in 1959.

He attended some of the first international meetings on medical and biological engineering in the early 60s and became very involved in activities of the then small International Federation for Medical & Biological Engineering — an international group who knew each other well and became good friends.

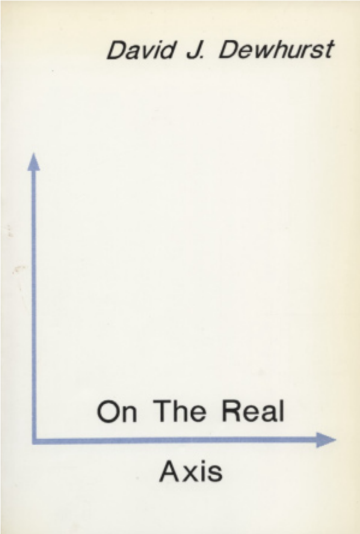
He found himself on the Administrative Council of the Federation, and was President from 1969—1972. During his 3—year term, Melbourne hosted the 9th International Conference on Medical & Biological Engineering, with David firmly at the helm and, once again, the genial host. This was 1971, and the venue was the new medical school.

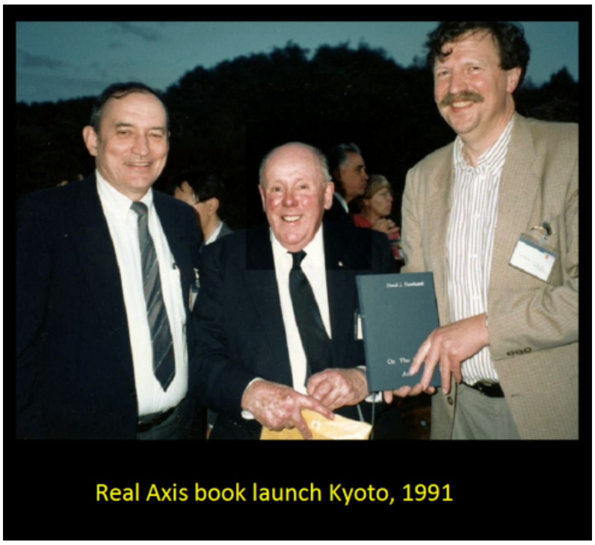
Everyone was roped in, and their spouses if at all possible. David's wife Marjorie was an integral part of the organisation. The meeting was a great success. They came from the UK, Japan, Russia, the US, Czechoslovakia ... For a number of us, it was our introduction to international biomedical activities and lasting friendships. In 1979, David was made an Honorary Life Member of the Federation — a rare honour. His international involvement spread beyond the Federation; he was one of the Foundation Fellows of the Biological Engineering Society in the UK and he was also awarded the IEEE's Centennial Medal.

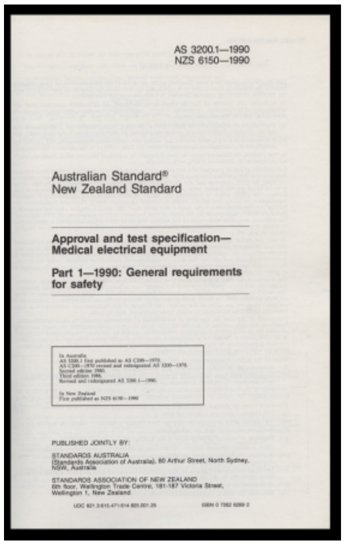
He didn't ignore the local scene. His enthusiasm for all aspects of medical electronics and biomedical engineering was contagious and led to the formation of the Society for Medical & Biological Engineering (Vic) in 1959, and to the Australian Federation for Medical & Biological Engineering in 1967 as a way of enabling Australian biomedical engineering to affiliate with the IFMBE.

In 1967, his interest in improving the organisation and status of professional biomedical engineering in Australia was a major factor in the formation of the Institution for Biomedical Engineering (Australia), subsumed into Engineers Australia's College of Biomedical Engineers in 1994.

From 1977 to 1988 David wrote a column, "On the Real Axis", in the IFMBE newsletter. The articles defy easy categorisation — observations on the practice of biomedical engineering, the human relationships involved, the ethics, with odd interpolations about wombats, bludgers, Omar Khayyam, steam engines, Horace, the plague.... The column had a wide







AS 3200.1—1990
NZS 6150—1990

Australian Standard®
New Zealand Standard

Approval and test specification—Medical electrical equipment

Part 1—1990: General requirements for safety

PUBLISHED JOINTLY BY:

STANDARDS AUSTRALIA

STANDARDS ASSOCIATION OF NEW ZEALAND

Figure 26

Figure 27

Figure 28

following, and in 1991 the International Federation published a selection of the essays as a book (**Figures 26 & 27**). He was delighted that some of the articles were translated and published in a Swedish biomedical journal.

David was a good committee—man inside and outside the University. He was very much involved in Australian Standards. Due to his efforts, Australia had electrical safety standards for electro—medical equipment in the early 1970s, well in advance of international standards. He took an active role in this, as member and chairman of various standards committees.

The initial impetus for this interest in standards was his understanding of the physiology of cardiac fibrillation and electrocution. Throughout his professional life David was intensely concerned about the electrical safety of medical instruments, and had stories to tell of accidental electrocution due to poor design or maintenance, as of the patient who sat down for a rest on an improperly insulated grid supposedly protecting the power source of an early X—ray machine. Together with Dr ER Trethewie, he researched the parameters of fatal current flow affecting the heart, and contributed decisively to the establishment of safety standards on a physiological basis.

He was very involved in the early work of the National Health Technology Advisory Panel and was proud of the part he played in technology evaluation and the introduction of high technology medical techniques such as Magnetic Resonance Imaging.

What was it like in the Shielded Room?

David's old colleagues remember discussions with David in his office, when they sought help in getting some apparatus built, advice about membrane potentials, and so on. There would be repeated interruptions, David singing out to Lindsay or Stuart (his technical officers) for some fact or other, telephone calls for advice from all and sundry in hospitals, institutes, other Departments and our own. Memorable shielded room traditions included monthly lunches of Chinese food — all colleagues welcome to subscribe — with the small tables aligned from desk to door; Friday fish and chips collected by Lab manager Albert Kennedy, in which most of the Department joined to eat amongst the circuit elements, and sherry from 250 ml Erlenmeyer flasks marked with a red 'S". Then there was Professor Basil Verney on sabbatical from Cambridge. Basil had had a total gastrectomy so that he could drink large quantities of alcohol with very little effect, and he drank his sherry from a 500 ml Erhlenmeyer flask. Sherry volume in the Shielded Room was measured in Verneys.

Until the mid—sixties there was an annual Shielded Room ski outing to Mt Baw Baw (on a week—day, of course). All these Shielded Room activities had the effect of building an "esprit de corps" among the participants, and everyone in Physiology was welcome.

These activities largely fell away with the move to the new medical school, where we were all neatly tucked away in our nice clean labs on different floors and didn't trip over one another nearly as much.

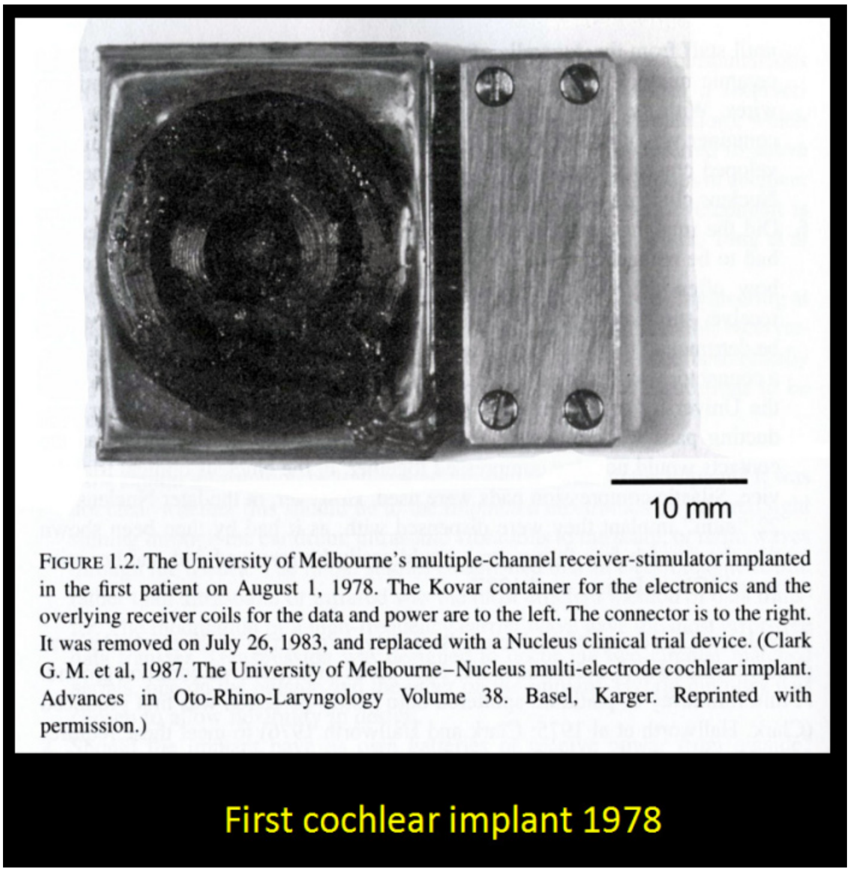


Figure 29

David began to identify more and more with Biomedical Engineering as a profession, especially after moving from the Physiology Department to the Electrical Engineering Department in 1975. It was there that he collaborated in the design of the first cochlear ear implant, which was designed in the Electrical Engineering Department by Ian Forster as his PhD project under David's supervision.

The original implant (**Figure 29**) was really state—of—the art, utilised CMOS technology and lasted almost 5 years. Three significant publications are shown in **Figure 30**.

The bioengineering development of a multi-channel, implantable hearing prosthesis for the profoundly deaf
Forster IC
PhD thesis, Dept. of Elec. Eng Univ of Melb 1978

A multiple electrode cochlear implant
G. M. Clark, Y. C. Tong, R. Black, I. C. Forster, J. F. Patrick and D. J. Dewhurst
J Laryng & Otol (1977), 91: 935-945

A multiple-electrode hearing prosthesis for cochlear implantation in deaf patients.
Clark GM, Black R, Dewhurst DJ, Forster IC, Patrick JF, Tong YC.
Med Prog Technol. 1977 Dec 15;5(3):127-40.

Figure 30

This was an important and significant project and I believe that neither David nor the Electrical Engineering Department received anywhere near adequate recognition of their major achievement and their contribution to the success of the bionic ear project.

And finally there was FRED. David conceived FRED, or Friendly Electronic Device, as a way of utilising microprocessor technology to make an interactive teaching device for disabled people who are unable to use a computer keyboard.

FRED involved a pursuit task where the player used a lever to move an image of a toy bear on a screen to keep it inside a square that moved periodically. The speed of the game and the type of lever could be changed to suit the abilities of the player – each move could take an hour if necessary. One disabled person said that it was the first time in his life that he had managed to complete something without someone else coming in and finishing it for him.

FRED's genesis was inextricably bound up with David and Marjorie's experience with their son Peter, and the acute understanding of the needs of disabled people that this fostered. Although FRED's hardware changed radically in the 15 years after the first prototype units were tested, the basic design philosophy remained unchanged — the device must always reinforce success and never failure. FRED gave to many severely disabled people a degree of independence, and convinced them that they could indeed achieve something. Unfortunately, David never succeeded in finding the commercial support needed to make the project viable. It was also being designed at a time of enormous advances in computer hardware and software, and it was overtaken by technology.

David Dewhurst's work in this field was widely recognized. When he was made a Member of the Order of Australia in 1990, the citation read "For services to biomedical engineering for people with disabilities".

Figure 31

The story ends with David's death at Portarlington on 4th March 1996 aged 77.

Three characteristics of David's stand out across his lifetime.

Firstly, he was an excellent communicator who could talk to anyone. It was, I suspect, a natural ability possibly reinforced by his wartime experience. He knew everyone. He established a group in the Physiology Department in which ideas flourished.

Secondly, he was a gifted teacher who had the capacity to get to the essence of a complex subject. An example of this, of course, was the way that he taught medical electronics to medical researchers and clinicians.

Thirdly he was an excellent organiser. He could see where a new organization was needed and how to go about putting it in place, as he did with the IBME.

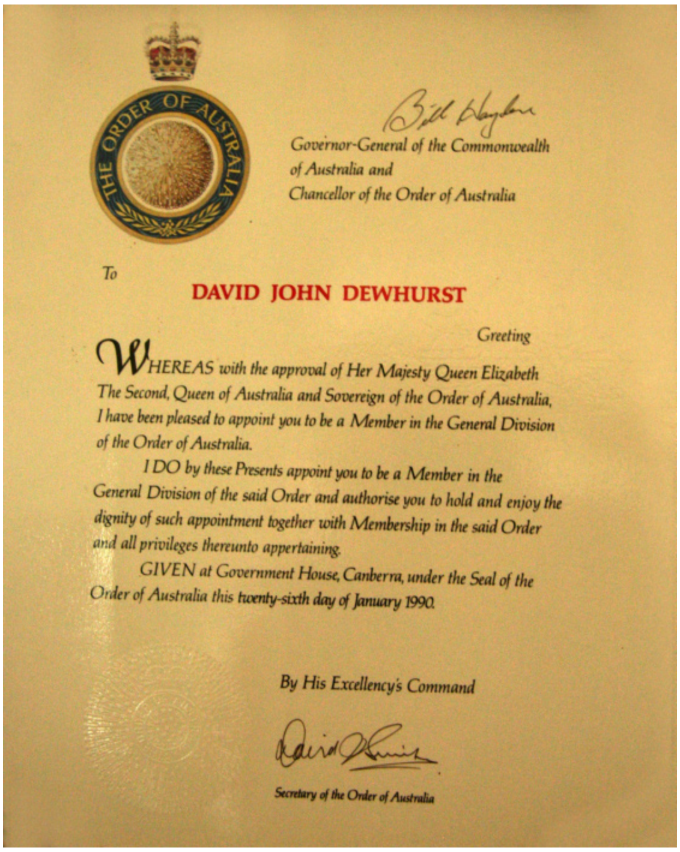
His legacy is the change of perception that he brought about of the role of biomedical engineers in research and in hospitals – at least in the eastern states – and the way he brought Australia into the international biomedical engineering community.

He had friends in many disciplines and was widely known and respected throughout the international biomedical engineering community. From a personal perspective, David kick—started my interest in international biomedical engineering and the IFMBE, and during my involvement with that organization over many years, he was an excellent sounding board for new ideas and constitutional problems.

He was someone I could discuss problems with. He was a good friend and I regard it as a great privilege to have known him.

Richard L G Kirsner

December 2010



THE ORDER OF AUSTRALIA

Governor-General of the Commonwealth of Australia and Chancellor of the Order of Australia

To

DAVID JOHN DEWHURST

Greeting

WHEREAS with the approval of Her Majesty Queen Elizabeth The Second, Queen of Australia and Sovereign of the Order of Australia, I have been pleased to appoint you to be a Member in the General Division of the Order of Australia.

I DO by these Presents appoint you to be a Member in the General Division of the said Order and authorise you to hold and enjoy the dignity of such appointment together with Membership in the said Order and all privileges thereunto appertaining.

GIVEN at Government House, Canberra, under the Seal of the Order of Australia this twenty-sixth day of January 1990.

By His Excellency's Command

Secretary of the Order of Australia

Figure 32

Doctor's work pioneered new medical technologies

Obituary

Dr David John Dewhurst

Former reader in biophysics and biomedical engineering, Melbourne University. Born: Inglewood, Victoria, 8 January 1919. Died: Portarlington, Victoria, 4 March 1996, aged 77.

DR DAVID JOHN DEWHURST was a pioneer in the field of biophysics and medical instrumentation and in using computer technology in physiological and medical research.

With an honors BA (1939) in classics from Melbourne University, and excellent knowledge of Latin and Greek, he intended to follow his father as an Anglican priest, but after war service in the AIF Signals Corps (1940-1946) he took a Bachelor of Science in physiology and electronics.

Appointed lecturer in physiology at Melbourne University in 1949, he soon transformed a small electrophysiology laboratory into a renowned centre of medical instrumentation. He received a PhD in 1959 and in 1964 was appointed reader in biophysics.

By 1960 he was using intracellular recording and human electromyography to study muscle physiology with undergraduate and postgraduate students. The following year, he started a course in medical electronics for biological researchers, which had a big influence on medical technology and research in Melbourne Becoming an expert programmer early on, Dr Dewhurst acquired the first minicomputer in Melbourne in 1966.

After a sabbatical year in Cambridge in 1959 he became involved in the International Federation for Medical & Biological Engineering, serving on its Administrative Council.

His "On the Real Axis" column, for the International Federation newsletter between 1977 and 1988, ranged widely with observations on the practice of biomedical engineering, its human relationships and ethics, with remarks about wombats, steam engines and the plague.

His interest in developing new medical techniques included his involvement in the 1970s in the design of the first cochlear ear implant — the bionic ear.

He contributed to the development of Australian Standards for medical apparatus and was also a member of the National Health Technology Advisory Panel. His interest in improving the organisation and status of biomedical engineering in Australia was an important factor in the formation of the Institution of Biomedical Engineering (Australia).

His strong commitment to the needs of people with disabilities — inspired by his disabled son Peter — found expression in FRED, or Friendly Electronic Device, an interactive teaching device utilising microprocessor technology, for people unable to use a computer keyboard. This work was recognised in 1990 when Dr Dewhurst was made a Member of the Order of Australia. He leaves a wife, Marjorie, and children Penelope and Timothy.

— Richard Kirsner, John McKenzie and other colleagues at the department of physiology, Melbourne University.

Obituaries are edited by Peter Schumpeter. Phone: (03) 9601 2595.

Figure 33

www.engineersaustralia.org.au/biomedical

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