

# ACPSEM NZ Branch Newsletter

August 2007



*Summertime at Raglan*

---

<i>From the Chair</i> .....	3
<i>NZEPM 2007 &amp; TEAP Workshop</i> .....	3
<i>The College CPD Scheme</i> .....	5
<i>News from Auckland</i> .....	5
<i>News from Waikato</i> .....	7
<i>News from Dunedin</i> .....	10
<i>News from Christchurch</i> .....	11
<i>Review of the HPCA Act and its impact on Clinical Medical Physicists</i> .....	13
<i>How to Decommission a Linac the Auckland Way</i> .....	14
<i>Christchurch Neurotechnology research Programme – Annual Overview 2007</i> .....	16
<i>The History of Medical Physics and Biomedical Engineering in New Zealand – Part 2</i> .....	23

---



The Newsletter of the Australasian College of Physical Scientists and Engineers in Medicine, New Zealand Branch is published 3 times per year and distributed electronically to NZ members of the College and other interested parties. Contributions for consideration of publication are welcomed from all members; for information please contact the Newsletter Editor.

**The 2007 ACPSEM New Zealand Branch Committee members are:**

- Chairperson** ..... **Matthew Paris** Oncology & Haematology CPG, Dunedin Hospital, 201 Gt King Street, Dunedin. Tel: (03) 474 7947 x8375 email: [Mparis@healthotago.co.nz](mailto:Mparis@healthotago.co.nz)
- Vice Chairperson** ..... (Vacant)
- Secretary** ..... **Mark Holmes** Oncology & Haematology CPG, Dunedin Hospital, 201 Gt King Street, Dunedin. Tel: (03) 474 7007 x5135 email: [mark.holmes@healthotago.co.nz](mailto:mark.holmes@healthotago.co.nz)
- Treasurer** ..... **Mark Dirksen** NRL, PO Box 100166, NSMC, North Shore City, Auckland. Tel: 09 441 3687 email: [mark\\_dirksen@nrl.moh.govt.nz](mailto:mark_dirksen@nrl.moh.govt.nz)
- Committee** ..... **Keith Croft** Palmerston North Oncology, Ruahine St, Palmerston North Hospital. Tel : (06) 356 9169 x8147 email: [keithc@midcentral.co.nz](mailto:keithc@midcentral.co.nz)
- Brian Lunt** Cardiac Physiology, Auckland Hospital, Private Bag 92024, Auckland 1. Tel: (09) 307 4949 x24322 email: [brianl@adhb.govt.nz](mailto:brianl@adhb.govt.nz)
- Isla Nixon** Oncology Centre, Auckland Hospital, Private Bag 92024, Auckland 1. Tel: (09) 307 4949 x6205 email: [islan@adhb.govt.nz](mailto:islan@adhb.govt.nz)
- John Turner** Medical Physics and Bio-Engineering, Christchurch Hospital, Christchurch. Tel: (03) 3640853 email: [John.R.Turner@cdhb.govt.nz](mailto:John.R.Turner@cdhb.govt.nz)
- Giles Wynn-Williams** Medical Physics Dept, Dunedin Hospital, 201 Gt King Street, Dunedin. Tel: (03) 474 0999 email: [giles.wynn-williams@stonebow.otago.ac.nz](mailto:giles.wynn-williams@stonebow.otago.ac.nz)
- Newsletter Editor** ..... **Mark Holmes** Oncology & Haematology CPG, Dunedin Hospital, 201 Gt King Street, Dunedin. Tel: (03) 474 7007 x5135 email: [mark.holmes@healthotago.co.nz](mailto:mark.holmes@healthotago.co.nz)



Sunrise over Lake Taupo  
Pic: Fiona Bignell

## *From the Chair*

---



The annual conference is rapidly approaching and the college has a number of important issues to consider. I would like to encourage members to read George Coulter's comments on the Health practitioners Assurance (HCPA) Act 2003 (page 13). The current national review of this act is an opportunity for our NZ Branch to review the implications on our profession. Thanks George for stimulating this debate.

The branch will become incorporated within the next month and arrangements are underway to indemnify the Directors.

There are a number of valued retired members who wish to maintain professional links with the college without

the financial burden. A suggestion for consideration at the next NZ Branch AGM is to form an Alumni member class in which members forgo the college journal.

A travel grant to the EPSM-ABEC 2007 conference has been awarded to Christchurch's Medical Physics registrar, Jonathan Griffin. Jonathan will be presenting his paper on "Monte Carlo Simulation And Experimental Verification Of Radiotherapy Electron Beams".

Other points of interest:

- The ACPSEM administration has moved to new premises at 247 Coward Street, Mascot, near Sydney airport.
- The college is currently considering tenders for development of our Website.

*Matthew Paris*  
*Chair NZ Branch, Dunedin Hospital*

## *NZEPM 2007 and TEAP Workshop*

---

NZEPM 2007 and associated events will be held at the Wellington School of Medicine and Health Sciences during the week of Monday 5th November: The timetable will be as follows:

- Monday 5th November - TEAP REGISTRAR EXTERNAL REVIEWS
- Tuesday 6th November - NZEPM 2007
- Wednesday 7th November - NZEPM 2007
- Thursday 8th November - IMRT WORKSHOP for TEAP registrars and other interested people
- Friday 9th November - IMRT WORKSHOP for TEAP registrars

The second 2007 TEAP workshop will be at Wellington Hospital and the topic will be IMRT. Speakers have been arranged for Thursday 8th November with a special visit

to Palmerston North on Friday 9th November to witness a treatment. Non-registrars are welcome to attend the Thursday IMRT teaching sessions but will have to pay an additional fee towards costs. The Friday visit is for registrars only.

This TEAP workshop immediately follows the NZ Branch meeting on 6-7th November.

All registrars in clinical training will be required to attend the External Review interviews on the Monday 5th November.

For further information about NZEPM and the TEAP Workshop please contact Ekta Jhala and John Turner respectively.



*Future World?*

---



Look closely and guess what these might be  
*Pens with hidden cameras. Right?*



**Wrong!**  
Any more guesses??



**You might be seeing a  
type of future portable  
computer**

## *The College CPD Scheme*

---

I encourage you to participate in the ACPSEM Continuing Professional Development Program. ACPSEM recommends that members should accrue 50 CPD points per year, averaged over a five year period. Points should be accrued in at least three of the following categories: attendance at approved scientific meetings, attendance at informal meetings, participation in educational activities, publication, professional involvement and structured self study. Participation in the CPD program is currently voluntary, and there is no cost to college members.

The CPD web site allows you to record your CPD activities on line, via a simple user-friendly interface. This provides a valuable personal record of your professional development activities. The site also allows you to compare your CPD points with the average points recorded by other participants in the scheme.

Maybe you've already logged some CPD points, but haven't done so recently? Maybe you've never looked at the CPD web site? So far 87 members of the college have used the system, but I'd like everyone in college to be active participants. Why not try it out today?

It's easy! Just go to [www.acpsem.org.au/members/CPD](http://www.acpsem.org.au/members/CPD). On the left hand menu, click on Add Activity. You will be prompted for your username and password, then you will be able to enter the details of your CPD activity. Click on the "info" links for further information about each activity. A summary of your CPD points can be seen by selecting Other Activity, Display Activity, and you can also edit or delete previous entries from this screen.

*Anne Perkins*

**Editor's note** : Anne has now handed over the role of College CPD Co-Ordinator to Graham Sorrell. Graham writes:

*"I intend to start where Anne left off, and I see my job as "encouraging all members to take advantage of the College's facilities to record your CPD efforts.*

*A true professional takes every opportunity to keep up with the new ideas in his profession, be they technical, scientific, and to an appropriately limited degree, political. Appropriate activities are wide ranging, and include taking formal and informal courses of study, reading the appropriate literature, contributing the new ideas in the literature by publishing your findings, etc. A more exhaustive list will be found on the College Web site.*

*Your CV can only be enhanced by a college certification of your efforts to keep up to date. Make the most of it".*

The College CPD Co-Ordinator can be contacted at [cpd@acpsem.org.au](mailto:cpd@acpsem.org.au).

## *News from Auckland*

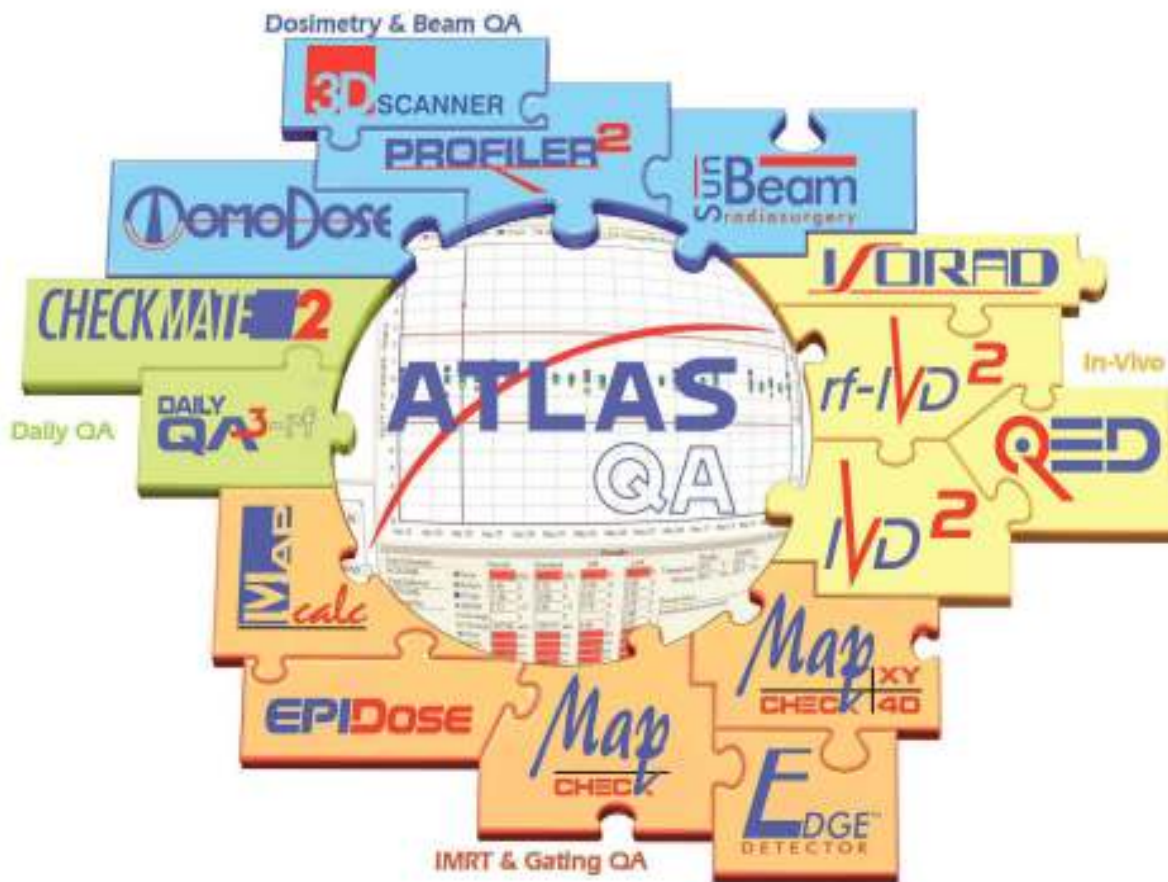
---

Well apart from the obvious hard work that went into de-commissioning our 2100CD linac (see other article in this issue), what else has been happening at Auckland? Well we have had another staff member leave us. We were very sad to see

Christine Thompson leave us at the beginning of July and we made sure that she had a good kiwi send off at her leaving party (see photos below)! Christine and her family have returned back to the UK after



# Your Most Valuable QA Tools



**Independent QA solutions solve the QA puzzle**



AUS (02) 9209 4501 · NZ (09) 486 1195

[www.CMSalphatech.com](http://www.CMSalphatech.com)



being with us for nearly 3 years, but who knows, they may return again one day!

Having had someone leave us with the initials C.M. Thompson we had a very suitable replacement to take over...someone with the initials C.M. Thompson!! So we now have Christopher Thompson as a permanent member of staff in the department.

Modifications are being made to the bunker that the 2100CD was pulled out of, and the hole has been cut in the roof ready for the new 21iX to be craned in on 1st September. Then we will be full steam ahead with acceptance and commissioning tests – perhaps Varian might not be so impressed

if we apply the same procedure as described in my de-commissioning article?? Therefore until Christmas we are running a double late shift to accommodate the patients that would normally be on the linac that is currently absent. This can lead to some interesting rearrangements of scheduled QA if any of the other machines decide to play up! I feel our organisation and adaptation skills will be well honed by the time Christmas comes around!

Finally congratulations go to Siva, one of our physics registrars who has just become a dad again! A little girl called Aashika was born on 28 July.

*Fiona Bignell*

### *News from Waikato*

---

Life in the Waikato has certainly taken off with the arrival of new staff over the past few months which sees us almost fully staffed for the first time in a very long time. We now have a good mix of staff with a wide range of experience. Many of our old projects that have been in the cupboard due to staff shortages have been dusted off, been revisited and either completed or are close to completion. Our CT scanner which was due for replacement next year decided to 'die' and we were able to get a successful case together and get approval to replace that immediately. After a lightening field trip both in New Zealand and Australia to look at the options we decided on a Toshiba Aquilion LB. This was not an easy choice as there are many good features on all the

competing machines but we are certainly happy with our decision. Our new CT arrives in mid-September and hopefully will be installed and operational before the installation of the 4th accelerator at the end of September or early October. The refit of the 4th bunker is due for completion as the CT arrives. Our HDR prostate programme has settled in quite nicely, especially with the introduction of our own procedures room within the department ... saves us negotiating for space in the main theatres, and with over 50 cases now completed we are looking forward to increasing our numbers to four per week instead of the current two.

*George Coalter*



I attended the 49th Annual Meeting of AAPM held at Minneapolis, 'the city of lakes', in United States in July. It was a great meet of a number of physicists from all over the world. The conference mainly dealt with new technologies in the field of Medical physics both in imaging and treatment. Sessions on specific topics were going on in different halls at the same time. Presentations based on proton

therapy, cyber knife and tomotherapy showed the faster developments in the field of radiotherapy. The conference helped me learn a lot in detail about commissioning of IMRT in a radiotherapy facility. Another important aspect of the meeting was the exhibits of new products in the field of radiotherapy by different vendors which gave the participants an opportunity to feel the new products.

*Joby Mathew*

### **Budapest Conference Report**

Of all the ESTRO teaching courses there is just one that is aimed at physicists only: Dose Calculation and Verification for External Beam Radiotherapy. As one could surmise from the course title and the composition of the audience, it was a thrill a minute affair with a host of exciting and interesting characters. The course covered the whole gamut of radiotherapy beam simulation, from the unrepentant simplicity of factorial calculations to the interminable bean-counting of the Monte-Carlo techniques.

Our host city was Budapest, and she provided us with beautiful spring sunshine, quaint yellow trams and unintelligible shop clerks for the duration. The Hungarian language is unrelated to any other in Europe bar Finnish and it is thus impossible to guess the meanings of words. For example: try saying "egg" whilst sounding very unsure of yourself. You have just said "one" in Hungarian. Other useful terms are "Nem ertem" for "I don't understand" and "Beszel Angolul" for "Do you speak English?"

Budapest sits upon the Danube. Originally, it consisted of two settlements: Buda and Pest - one on either side of the river. The conference hotel was a short walk from, and in sight of, the Castle Hill district. In addition to castle walls the district is blessed with a funicular railway, cafe terraces with splendid views down to the river, many buildings - both

ecclesiastical and profane - with those multi-coloured, patterned tiled roofs so often found in central Europe, and the House of Hungarian Wines.

At the House of Hungarian Wines one may pay some number of forints (warning: Hungarian forints are not readily available at New Zealand bureax d'exchange) for a small glass and leave to wander the cellar for up to two hours drinking as much wine as takes ones fancy. As a result, your author arrived to register at the conference in a most care-free and easily-confused disposition. It was said that there were fifty bottles there to try. I don't think that there were, although I did lose count. I tried at least a sip of everything including the grape must. The reds were markedly superior to anything I have tasted in New Zealand, but the whites were nothing to write back about.

Back to the conference. Special mention must be made of the Polish (perhaps) physicist who gave two talks on IAEA dosimetry codes (one and a half hours in total) without stressing a single syllable. However, the winner in the 'Most Interesting Physicist' category must go to A. Ahnesjo who sat at my table during the start of the social dinner as if hewn from granite, staring forward into space as one imagines the Viking god of the sea might stare down the waves or killer whales, and all the while knocking back shots of palinka (fruit flavoured brandy) as others



would sip plain water. He also gave some very interesting talks on pencil beam models and presided over a tutorial on creating a head scatter model based on the lines of sight from the calculation point to the flattening filter.

The highlight of the conference was undoubtedly Sunderland's 2-1 victory over Burnley which effectively cemented our promotion back to the Premiership. Your author was fortunate enough to catch this

in one of Budapest's Irish pubs. He watched this, sipping Hungarian lager, along with one indifferent local and a barman, both of whom seemed confused by his continual muttering and raging at the television screen. Another man, who had been watching some pointless run-around after an egg-shaped ball, left five minutes after kick-off. Some people will never understand.

*Andrew Dunleavy*

### **ICCR 2007 in Toronto**

In June, I attended the ICCR (International Conference on Computers in Radiotherapy) in Toronto, Canada. This is a conference that occurs every few years, and switches between Europe and America (next is The Netherlands, 2010). The ICCR originally began in the 1940s to 1960s as an invitation only group formed to produce isodose atlases and other data for use by centres with less resources or expertise, and moved on from there to other issues such as planning algorithms.

The topics at this years conference covered all areas of radiotherapy where computers are used, from gating, 4DCT and IMRT to Monte Carlo experiments and networking issues. The quality of

presentations was superb, and included all the usual big names in RT, which appeared to get a bit nerve wracking for some presenters in the discussions afterward. As always it was interesting to compare NZ to the rest of the world and, more importantly, to come back with new ideas and a fresh outlook.

The social trip to Centre Island had the coldest weather of the entire week, which deterred many people but meant that there was an open bar to enjoy. The afternoon was thoroughly enjoyable, even though the beach towels with ICCR emblazoned on them, whilst meant for sunbathing on the beach, were used mostly as scarves and coats.

*Carey Marshall*

The last few months have seen us introduce total skin electron therapy (TSET) for the treatment of mycosis fungoides and other cutaneous lymphomas. Patients are treated in a standing position with 6 dual fields at an SSD of 450cm in a nominal 6MeV high dose rate beam. The beam energy at the treatment SSD is reduced to ~3MeV by means of an acrylic degrader/scatterer mounted on the patient positioning frame that also incorporates patient supports for the upper limbs. The special dosimetry and physical conditions used are based on recommendations by the AAPM TG 30. In vivo dosimetry is done largely using TLDS

but we have, on occasions, used MOSFETs which work just as well. Treatment times are 20-25mins per fraction, including set-up.

We are also in the process of modifying our total body irradiation TBI technique from the current 'rice box' technique to a semi-standing technique in the same frame as the TSET and same SSD. Most of the required data has already been acquired but there are a couple of dosimetric issues to resolve before we go clinical. The semi-standing position will greatly improve patient comfort during treatment and cut treatment times from the current 1hr to approximately 20mins per fraction.



Work has started on H/N IMRT but a lot still needs to be done. Our attentions will be diverted to the new linac and CT which we are expecting soon so it may not be

until early next year that we get to treat our first patient.

Its going to be an exciting next few months here in Hamilton.

*Koki Mugabe*

### *News from Dunedin*

---

The Department's manpower is set to seriously diminish in October since Peggy Edmonds and Roy Otway have both announced their retirements. Roy has been the Department's Mechanical Engineering Technician for the last 12 years and Peggy has been a member of the Department for longer than she will care to admit! Both Peggy and Roy will be greatly missed - both personally and professionally - and we wish them both health and happiness for their retirements.

The installation and acceptance testing of our new iX linear accelerator has now been completed. Commissioning measurements have begun in earnest and we are all looking forward to the commencement of clinical treatments in the coming weeks.

Matthew Paris and Fergus Churchman attended the Philips CT Respiratory Gating Workshop, 19-20 May 2007, at the Peter MacCallum Cancer Centre, Melbourne.

Peggy Edmonds attended the XVth International Conference on the Use of Computers in Radiation Therapy, 4-7 June 2007, in Toronto and wrote the following summary.

#### **XVth International Conference on the Use of Computers in Radiation Therapy** Toronto, Canada.

As the title suggests, this was a fairly wide ranging topic broadly covering treatment design, treatment guidance and treatment outcomes. There was considerable focus on tumour movement with related topics of motion modelling and image registration and segmentation. There were also sessions on dose response, radio resistance, patient selection and assessing treatment outcomes. Some interesting projections for the future were also presented including computing with biomolecules! All in all a most interesting conference.

*Danny Warren*



*Grouting in the baseframe and the new Varian iX linac gets delivered*

## *News from Christchurch*

---

It's great to have Jenny Lydon on board now as the Principal Physicist, Oncology. This leaves just one vacancy yet to fill in that group.

Kate Packer formally resigned recently and her locum, Ian Honey, has accepted the permanent position of Radiation Advisory Officer. This is despite his having worked here for several months and experienced some of the fouler aspects of our winter and under-insulated homes.

After briefly returning from Wellington John Turner is disappearing off to the UK for a month's holiday. Richard Dove will be in Europe for a couple of weeks to pursue NHS Innovations and the IEEE EMBS meeting in Lyon. In May Richard

Jones attended a Neural Engineering conference in Hawaii. Kathryn Greenfield had a great time in June with a rehab meeting in Toronto and Medicon in Ljubljana. Richard Tremewan has recently returned from a couple of conferences: UKRC (in Manchester) and HTAi (in Barcelona). The latter is a Health Technology Assessment meeting. This was just the right time to escape the winter blues.

Seven staff will be attending the Perth meeting in October.

And work continues preparing for the College meeting in Christchurch next year:



# epsm abec 2008

## Innovations in Patient Care

16-20 November 2008  
Christchurch Convention Centre  
Christchurch, New Zealand

*Richard Tremewan*

**Remote planning is Child's Play...  
with CMS Direct Access**



Dr Kym Rykers from Austin Health can now complete IMRT Physics QA at home using CMS Direct Access.  
Daughter Isabella signs off on a job well done!!



**CMS** DIRECT ACCESS  
Broadband for radiotherapy planning

**CMS alphatech**  
AUS (02) 9209 4501 · NZ (09) 486 1195  
[www.CMSalphatech.com](http://www.CMSalphatech.com)

I would like to encourage all NZ Medical Physicists to consider their options under the Health Practitioners Competence Assurance Act.

I am sure most of you know that I hold a position on the MRTB, although my tenure there now is as a lay person and not as a Medical Physicist. This has given me the opportunity to observe the implications of the 'Act' on this profession and caused me some thought as to the future impact for our own 'group'. The reason for raising this at this time is because the HPCAA is up for review starting in September and there will be changes which could/will have far reaching consequences for Medical Physicists.

**Should medical physicists and/or biomedical engineers be registered as health professionals under the HPCAA?**

*- Vere Smyth ACPSEM (New Zealand Branch)*

A submission by Vere on the above topic (in 2004?) makes compelling arguments of why we should not register under the Act. The Act is now three years old and we are in a better position to judge its impact on registered professions. The more important question which now needs explored is: What are the long term consequences of Medical Physicists not getting registered?

The short answer is we may not be able to practise our profession with the scope of involvement as we have now. There are fairly significant parts of our job that we share with other professionals which are already registered. There is a possibility that tasks with clinical components (such as treatment planning, administration of therapeutic radionuclides, involvement in special techniques such as TBI, TSET, IMRT etc) may/will be defined within a particular 'scope of practice' of a registered profession and become the preserve of that profession only.

Be assured that the marginalisation of Medical Physicists in a clinical role is alive

and well ... this 'tool' provides the perfect mechanism to achieve this end.

Physicists have a great role to play in radiotherapy clinics and it will be a sad day to see that role diminished because the profession as a group can not get organised and be registered.

The logistics of setting up and running a registration board is huge and the ongoing costs prohibitive. Data would suggest that a minimum number required to financially support an independent registration board is not less than 400. This is why 'smaller groups' seek to combine with like minded professionals. An example of this can be seen in a very comprehensive discussion document by the Anaesthetic Technicians on the Ministry of Health web site ... well worth a read. This quest for registration has some parallels with our own group and raises the questions as to whom we would attempt to 'plight our troth'. The range of professional groups that would want to accept us may be a lot smaller than you would think and the groups who may accept Medical Physicists may not in themselves be acceptable to the (MP) profession.

Any discussion on the establishment of a separate Medical Physicists Board is now irrelevant as the government has declared a moratorium on the formation of any new Boards. The question of registration under the umbrella of another Board may also be resolved for us in that I believe that there is active discussion on the formation of an 'Allied Health Professionals Board' which could see an amalgamation of many existing Boards. I believe this could be along the lines of what currently happens in the UK and I am grateful to Koki for the download shown below.

This is not an individual's problem; it is a 'College' problem and as such requires active discussion and input by the College at the highest level. You need to lobby the College to ensure that the profession of Medical Physics maintains a clinical future.



## Health Professions Council (HPC) UK

**Remit:** to set standards for professional training, performance and conduct for 13 professions

### List of professions covered

Arts therapists, Biomedical scientists, Chiropractors / Podiatrists, Clinical Scientists, Dieticians, Occupational therapists, Operating Department practitioners, Orthoptists, Paramedics, Physiotherapists, Prosthetics & Orthotists, Radiographers, Speech & Language therapists

### Structure of Council

Council comprises of 13 members from each profession, 13 lay members plus a president. It has 4 statutory committees (ones in blue on the flow chart)



Source: [www.hpc-uk.org](http://www.hpc-uk.org)

**George Coalter**  
Charge Medical Physicist  
Waikato Hospital

### Technical Advice – well, sort of...

---

## How to de-commission a linac... the Auckland way!...

**Step 1:** *Assemble an expert multidisciplinary team*



**Step 2:** *Make sure transportation is booked and operational*



**Step 3:** *Carry out up-to date QA procedures and ensure calibration is within spec for a range of angles*



**Step 4:** *Make sure all documentation and written instructions are complete*



**Step 5:** Ask the de-commissioning experts to execute the final operational procedure



*(Err... please direct expressions of sympathy to Isla Nixon! -Ed)*

## *The Christchurch Neurotechnology Research Programme*

### **Annual Overview – July 2007**

#### **Introduction**

The *Christchurch Neurotechnology Research Programme* (*NeuroTech* & *NeuroTechNZ™*) was formally established in February 2001 (although it had a long informal history) as a formal joint venture between Canterbury District Health Board (CDHB – Medical Physics & Bioengineering [MPBE], Neurology), University of Otago, Christchurch (UOC – Medicine), and University of Canterbury (UC – Electrical & Computer Engineering [ECE], Psychology). *NeuroTech* was initially based in MPBE at Christchurch Hospital but moved into the new *Van der Veer Institute for Parkinson's and Brain Research* at 66 Stewart Street in May 2004.

It remains administratively under, but autonomous from, MPBE.

Neurotechnology can be broadly defined as 'Technology for investigation, quantification, monitoring, and treatment of the nervous system and its disorders'. Within this, *NeuroTech's* vision is to focus on neurotechnology concerning the brain via three broad long-term objectives:

- Undertake cutting-edge research leading to the development and validation of innovative neurotechnology, particularly techniques and devices aimed at accident prevention and improved rehabilitation which can 'make a

difference' to humankind by preventing loss of life and injury and by maximizing quality of life.

- Maximize the health and financial benefits of the innovative neurotechnology through commercialisation – IP protection, pre-market prototype development and validation, and product manufacture and sales on the global market.
- Maintain an awareness of other research projects in the Van der Veer Institute and, where appropriate, foster collaborations with researchers so as to identify and stimulate basic and applied brain research which might lead to potential products suitable for channelling through *NeuroTech* for commercialisation.

*NeuroTech*'s key personnel are:

Staff:

- Associate Professor Richard Jones – Neuroengineer/scientist and Director of Programme, CDHB & UOC & UC
- Dr Paul Davidson – Neuroengineer/scientist and Deputy Director of Programme, CDHB & UOC & UC
- Dr Carrie Innes – Neuroscientist and CMRF Postdoctoral Research Fellow, CDHB
- Stephanie van Bolderen – Personal Assistant, CDHB

Postgraduate students (+ degree sought):

- Malik Peiris – PhD, Electrical & Computer Engineering, UC
- Daniel Myall – PhD, Medicine, UOC
- Amol Malla – ME, Electrical & Computer Engineering, UC
- Govinda Poudel – PhD, Medicine, UOC
- Petra Hoggarth – MA, Psychology, UC
- Stephanie van Bolderen – Graduate Diploma in Management (Marketing), Commerce, UC

Affiliated staff & Research Fellows:

- Associate Professor Philip Bones – UC
- Associate Professor John Dalrymple-Alford – VdVI & UC
- Dr Michael MacAskill – VdVI & UOC
- Dr Marcus Heitger – VdVI & UOC

- Dr Richard Watts – VdVI & UC
- Dr Richard Green – UC
- Grant Carroll – CDHB
- Professor Tim Anderson – VdVI & UOC & CDHB

*NeuroTech* is primarily funded by the Foundation for Research Science and Technology (FRST) from which current funding ends 30 September 2007. Funding beyond then has been sought via a Full Proposal to FRST earlier this year (following acceptance of last year's Concept Proposal), the outcome of which is advised mid-July. *NeuroTech* was successful in gaining funding over the past year from Lottery Health Research and University of Otago. Funding applications have also been made to Marsden Fund, Canterbury Medical Research Foundation, and Neurological Foundation, from which outcomes are awaited. Just being invited to submit a Full Proposal to Marsden, following our Preliminary Proposal in February, is considered quite an achievement (although it doesn't buy the groceries).

### Research Activity

*NeuroTech*'s research largely falls with four Sub-Programmes (of which only the second currently receives funding from FRST), of which the following outlines activity and achievements over the past year.

#### **A. Driving Assessment Research Programme**

Carrie was formally awarded her PhD in 2006 and is currently funded via a prestigious of 3-year Canterbury Medical Research Foundation Postdoctoral Research Fellowship which commenced February 2006. Her Fellowship was to allow her to continue her research in off-road driving assessment & prediction as well as commence research into lapses of responsiveness.

Building on research during her PhD project, Carrie has initiated four further research studies aimed at validation and improvement of our Canterbury Driving Assessment Tool's (*CanDAT*<sup>TM</sup>) ability to predict capability to drive safely on the



road based primarily on performance on a battery of computerized tests of sensory-motor and cognitive function (*SMCTests*<sup>TM</sup>):

**Study 1** – Validation and improvement of the Full Assessment version of *SMCTests* (i.e., for specialist driving assessment therapists) on the full car-rig assessment system (affectionately known as *Chrissy*) at Burwood Hospital’s Driving and Vehicle Assessment Service (DAVAS) in

Christchurch. The study involves independent off-road and on-road assessments of 200 referrals of persons with definite or suspected brain disorders.

**Study 2** – Identical to the DAVAS study except for off-road assessment being on *CanDAT* (*Chrissy*’s portable descendant) and undertaken by O’Leary Driving Assessment Services in Wellington.

**Study 3** – Validation and improvement of the briefer Screening Assessment version of *CanDAT* (i.e., primarily for medical practitioners [GPs and physicians] who have a mandatory responsibility to assess and certify driving abilities for older-aged

drivers and for persons who have some form of neurological or musculoskeletal disorder) at Pegasus Health’s new – and, as far as we aware, the world’s first – driving screening service specifically for GPs (at 24 Hour Surgery, Christchurch). This study involves a pilot of

200 referrals to the new service from the ~240 GPs under Pegasus’s umbrella.

**Study 4** – Validation and improvement of the prediction models in both the Full and Screening Assessment versions of *CanDAT* when applied to a population of 60 healthy older-aged persons. This study is being undertaken by Petra as her ‘part-time’ MA project in Psychology at UC (which we aim to upgrade

to a PhD in August), while also undertaking her Postgraduate Diploma in Clinical Psychology. Petra is supervised by Richard, Carrie, and John and is based at the Institute. In addition to the full set of tests on *CanDAT*<sup>TM</sup> and a blinded on-road assessment, Petra will assess participants on a range of standard tests in the area of cognition/dementia, anxiety, aggression, and mood.

A considerable amount of work has gone into taking the hardware and software of *CanDAT* to a streamlined and robust pre-market prototype for off-road driving assessment (Figure 1). Paul led the technical development of *CanDAT*, based

upon a modified steering wheel and foot pedals from USA, a laptop, separate screen, and, most importantly, *SMCTests*. Under Paul’s guidance, Roger Bellamy made a major contribution to the system software (Roger left us in December 2007).



**Figure 1**  
Paul being ‘assessed’ by Carrie on *CanDAT*



**Figure 2. Carrie and Paul at CDHB’s 2006 Q&I Awards Function**

MPBE's Mechanical Section (Johann Bader, Nevill Turner) and Clinical Engineering Section (Kathryn Greenfield, Richard Dove) provided mechanical and electrical/electronic/safety input to the small-scale manufacture of *CanDATs* for sale (on a cost-recovery basis only) to collaborative-research beta sites for the necessary validation/improvement studies described above. We have also developed a good relationship with Christchurch manufacturer Shape Technology Ltd who are keen to take on the role, if needed, of larger-scale manufacture of *CanDAT* systems for taking to the international market – a necessary step in getting the benefits of our driving assessment research out into the big world. We are also putting considerable energy into finding an international company with distribution and support channels to our end-users (primarily OTs and GPs), necessary for successful global commercialisation (i.e., marketing, sales, and support) of *CanDAT*. So far, we have not found a company with a sufficiently good 'fit' between *CanDAT* and the company's current product lines and channels – this, in itself, supports our view of a largely unmet world-wide need

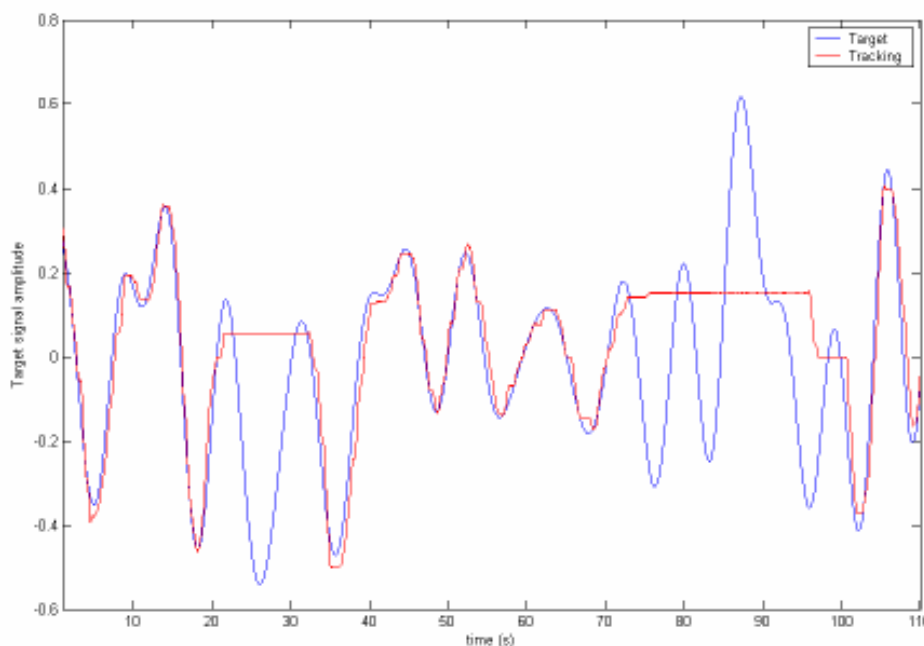
and market for such devices.

Another boost for our Driving Assessment Research Programme and *CanDAT* came in August 2006 when we were awarded Runner-up in CDHB's Quality & Innovation Awards (clinical/diagnostic category) for our submission 'Canterbury Driving Assessment Tool (*CanDAT*<sup>TM</sup>) – Increasing the safety and accuracy of driving assessment of people with brain disorders' (Figure 2).

Carrie's research into using computerized sensory-motor and cognitive tests to predict the driving ability of persons with brain disorders has been recognized by acceptance of a paper for publication in *Journal of the Neurological Sciences*.

### **B. Lapse Research Programme**

Several long-term projects are under way looking at various aspects of complete lapses of responsiveness (Figure 3). These lapses can be anywhere from 1 to 20 s duration and due either to *microsleeps*, where the brain turns off for a few seconds due to a brief shut-down in our arousal system, or *lapses of sustained attention*, which can occur even when a person is not



**Figure 3. Some more extreme lapses seen in a non-sleep-deprived healthy subject undertaking a 1-h log tracking task in Malik's study (14 of the 15 subjects lapsed at least once and, on average, at a rate of ~40/hour).**



drowsy. Our Lapse Research Programme is looking at various aspects of lapses and drowsiness, including (1) detection and prediction of lapses from electrophysiological and video data, (2) characteristics of lapses, such as rate, duration, changes over time, and differences between individuals, and (3) underlying mechanisms in the brain.

Malik is close to submitting his PhD on characteristics and EEG-based detection of lapses (he

changed from full- to part-time on taking up a full-time research position at Fisher and Paykel Healthcare in Auckland in July 2006). An important paper on Malik's work was published in *Journal of Sleep Research* in August 2006, which focused on the high incidence and characteristics of lapses in non-sleep-deprived healthy subjects. Also in August, Richard presented a paper at *EMBC 2006* in New York on an aspect of Malik's research looking at ability to detect lapses from spectral changes in the EEG.

Amol is currently writing up his ME thesis on a computer-vision-based system he has developed for automated detection of drowsiness and lapses by measuring eye closure from video images of a person's face (Figure 4).

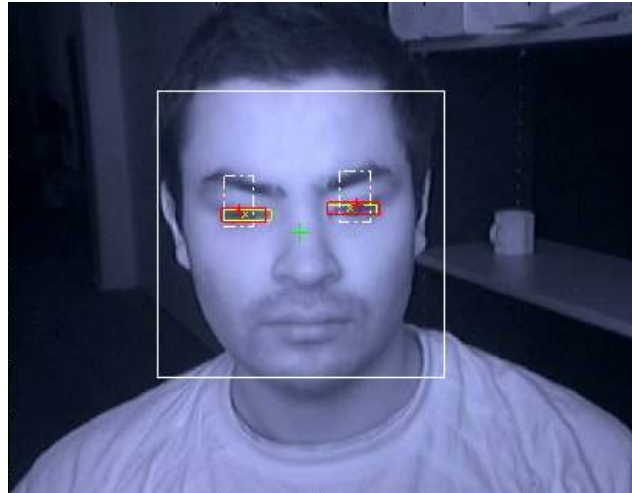
Govinda has made substantial progress towards our aim of finding out just what does happen in the brain during lapses. His PhD project will investigate lapses via fMRI, 64-channel EEG, video of eyes, and visuomotor performance on a continuous 2D tracking task – all being carried out concurrently while in a 3T MRI scanner for up to an hour (Figure 5). This is a very

exciting, – but also very challenging – project and, hence, we've roped in some new and keen co-researchers due to their specialist expertise and experience: Richard Watts (MRI) and Michael Hlavac (sleep disorders) from Christchurch; Leigh Signal

(sleep-wake research) from Wellington; Tzzy-Ping Jung (ICA and drowsiness) from San Diego; Fabio Babiloni and Laura Astolfi (sim-fMRI+EEG and directed transfer function analysis) from Rome. Govinda has completed a major literature review and research proposal and built a mock MR scanner in the Institute so that we can carry out

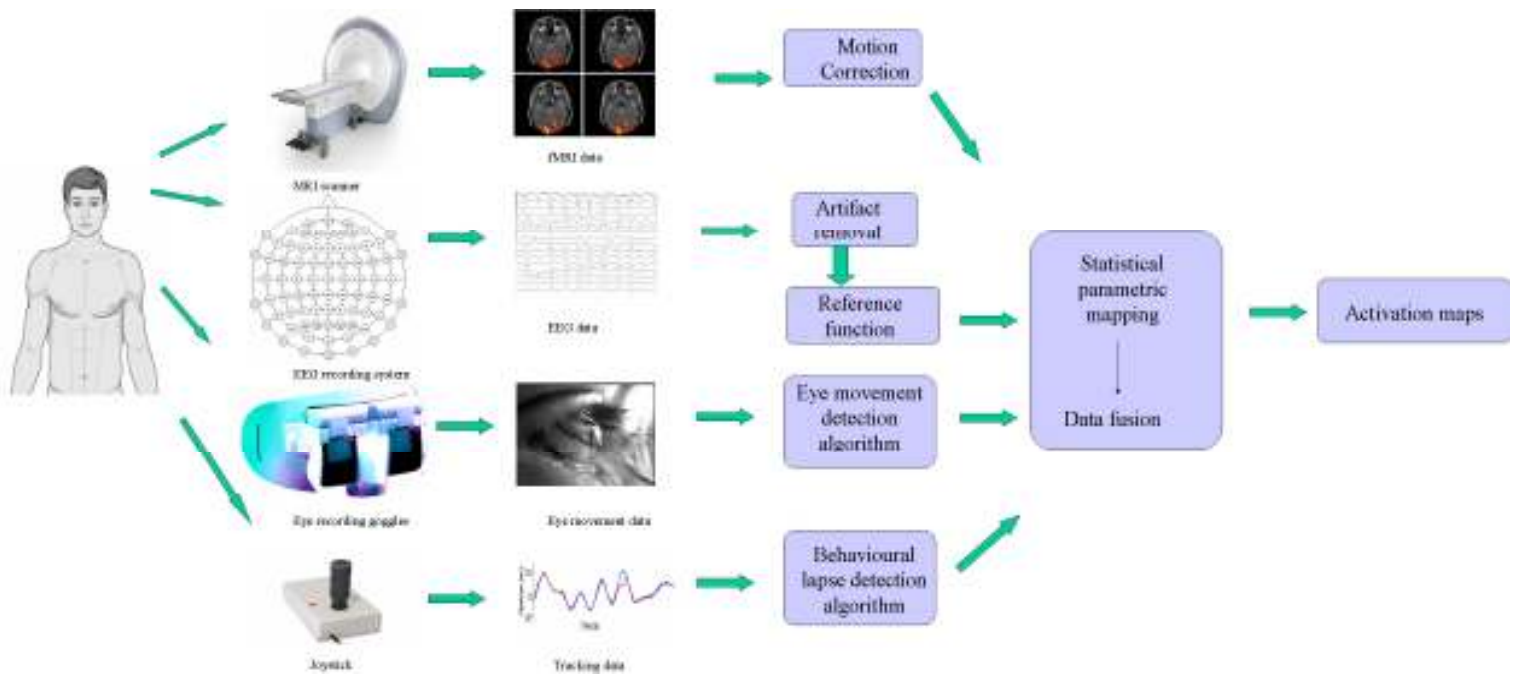
preliminary studies and subject familiarisations with an MR scanner without incurring the high costs needed to do the same in the real scanner. He has also developed a novel 2-D tracking task able to detect behavioural lapses with high temporal accuracy. Understanding just what happens in the brain between arousal, attention, default mode, and other networks in the brain during lapses is of considerable interest in its own right but it also has the potential to provide important information for use in substantially improving the accuracy of detection and, hopefully, prediction of lapses solely from the EEG.

Our ability to carry out simultaneous fMRI+EEG investigations of the brain during lapses is only possible due to (i) the installation in late 2006 of a GE 3T MRI scanner immediately below the Institute in Hagley Radiology and (ii) a successful application to Lottery Health Research (led by Paul) for \$76,000 to purchase a Neuroscan MagLink system to allow us to measure 64 channels of EEG while a person is in the undergoing fMRI. This new tool for investigation of functional



**Figure 4. Automated identification of face and eyes leading to measurement of eye-closure.**





**Figure 5. System for concurrent measurement of fMRI, EEG, video, and 2-D tracking.**

activity in the brain is currently the ultimate tool for non-invasive investigations of the brain.

Carrie's research in the Programme has taken a major shift and is now focused on looking at what happens in the brain just prior to the *end* of a lapse. This will tie in closely with Govinda's study and aims to answer the question 'Once a person has gone into a lapse, why does he/she come out of it rather than continue to meet the brain's presumed need to sleep or, at least, rest?'

Paul provides critical input into all of the above projects and is also forging new directions in his own research in this area focused on the detection of lapses. His detection system based on recurrent neural networks is able to detect lapses from EEG better than any other system in the literature. A paper on this work has appeared in the prestigious *IEEE Transactions on Biomedical Engineering* (May 2007). However, as impressive an achievement as this is, the level of accuracy of detection is still too low to be viable as a device for accurate detection of lapses in, say, various transport sectors. Paul is forging a new direction for lapse detection based on the development of a head-

mounted device and a more multi-modality approach to detection, with sensors for EEG, video-based eye closure, a MEMS gyroscope, an auditory warning output, signal/image processing electronics, and a power supply. This is an exciting new approach but still very much in the proof-of-concept stage.

### ***C. Traumatic Brain Injury Research Programme***

Marcus has not long completed the first two years of his Postdoctoral Fellowship from UOC and has not long been advised of this having been extended for a further two years. His work continues to focus on the subtle deficits which occur following mild TBI. He has demonstrated that sub-clinical motor deficits can be detected in patients who were otherwise considered to have had no long-term adverse effects due to their mild head injury (e.g., concussion and subsequent visit to an Emergency Department). Furthermore, Marcus has shown that some of these deficits will not have completely recovered several months after the accident. He has also shown that the early subtle oculomotor, somatomotor, and visuoperceptual deficits are predictive of outcome, including postconcussion



**Figure 6. Near-field and head-mounted-display virtual environments.**

syndrome. These findings are being further validated through further more extensive studies of acute TBIs and of patients referred to the Burwood Head Injury Clinic several months after their injury due to non-resolving sequelae. Once validated, these techniques have the potential for incorporation into devices which can predict outcome following mild head injury with substantial possibilities for commercialisation. Marcus's research has lead to a further two publications – *Brain Injury* and *Journal of the Neurological Sciences* – over the past year.

Back in 2004, Marcus was successful in gaining funding from the CMRF for a project aimed at using advance MR imaging techniques to study anatomical and physiological changes in persons who had sustained a mild TBI. This project was put on hold pending arrival of the 3T MR scanner. Now that the scanner has arrived and been commissioned (in Hagley Radiology), this imaging study will soon be up and running.

#### ***D. Virtual-Environment Neuro-rehabilitation Research Programme***

Not deterred by a series of substantial technical challenges, Daniel has developed an impressive 3-D multi-sensor/multi-display platform for studies of movements in a virtual environment (Figure 6) – based in our Movement & Virtual Environment (MoVE) Lab at the Institute. Daniel is close to submitting a manuscript on this system, with examples from several pilot

applications, to an international journal in neural engineering.

With this new system, Daniel, Michael, Tim, and Richard have instigated a major research study involving 24 patients with Parkinson's disease and matched controls. The study, nearing completion of its data-collection phase, comprises 4 sessions per subject, several movement and adaptation paradigms (including visual/memory-guided movements and response delays), ballistic and smooth arm movements, and on- and off-medication; this all happens in a virtual environment in which all sorts of manipulations (some obvious to subject, some not) can be made to the target, the visual environment, and to the target-response dynamics. Results from the study will be used to gain a fuller understanding of movement deficits in PD and to test and improve a computational model of the brain and its ability to account for the various deficits seen in PD.

By way of a head-mounted display, the MoVE system also has capabilities for investigating lower-limb dysfunction, such as postural sway and ambulation, in a fully immersive virtual environment. Peter Steenbergen, from University of Twente (Enschede, The Netherlands), made good progress in this area during his 4-month Biomedical Engineering Workshop Training with us. Still early days but we are keen to apply these techniques in the investigation of balance and gait disorders.

***Richard Jones***

Neurology Spokesperson (NZ Branch), 4<sup>th</sup> Aug 2007



## ***The History of Medical Physics and Biomedical Engineering in New Zealand – Part 2***

---

*The Development of Medical Physics and Biomedical Engineering in New Zealand Hospitals 1945-1995* was first published in 1995 and a second edition was produced in 1996. After the efforts of David Goode and Hugh Jamieson it is now available in electronic format.

With copyright permission from Hugh Jamieson we will publish regular extracts in this newsletter. There are some wonderful insights into both how much technology has changed and also how familiar many of the early political issues are in today's environment.

### **EARLY HOSPITAL PHYSICS IN NZ: SOME MEMORY FRAGMENTS (1945-95)**

#### **AROUND THE CENTRES:**

The need for hospital physicists in the main centres from 1950 was becoming recognised, although there are serious recorded discussions about whether there was enough work for a full-time physicist in any centre! Early names in the various centres are given below, to indicate our beginnings:

**DUNEDIN HOSPITAL:** As noted, Warren Sinclair began here on November 29 1945. Within a year, he realised the need for overseas experience, and was able to obtain a position under Prof Mayneord at the Royal Marsden Hospital, London. He left Dunedin Hospital in August 1947, intending to return after 3 years' leave, and asked me to fill in for him for that period. In the event, he never returned (another story there!). I completed my MSc (Hons) course at Otago University (including a thesis using primitive X-ray crystallography equipment, unused but bought the year I was born!) and began at Dunedin Hospital on December 16 1947, with no intention of being there for 37 years!

**WELLINGTON HOSPITAL:** Bob Borthwick began here in June 1950, but soon became disillusioned at lack of the progress he thought necessary in radiotherapy - perhaps it is significant that he was appointed to the "Radium Department". He resigned in December 1951, and took up a position at NRL in diagnostic X-ray protection. He was followed at Wellington Hospital by Ross Garrett (1952-1956, when he moved to Auckland University), and Wallace Armstrong (1956-1980) who then gave up medical physics and moved into meteorology. Wallace was our 1994 John Strong Memorial Lecturer.

**AUCKLAND HOSPITAL:** Owen Hames began in January 1952, and continued on until his retirement in 1988. John Wright began in 1955 after the introduction of supervoltage radiotherapy but left in 1960 (returned to the UK). Bruce White began in the Auckland Hospital path lab (biochemistry) in Feb 1961, moved into nuclear medicine in Feb 1963; became head of the



new medical physics and biomedical engineering department in Jan 1979; he moved into asset management in Dec 1992; and retired in November 1994. We all know of the ongoing substantial developments in Auckland from early on.

**PALMERSTON NORTH HOSPITAL:** Dr Don Urquhart was a driving force here, firstly as radiologist (including private practice); he then developed radiotherapy; later still, nuclear medicine. When the embryonic Radiotherapy Department began, Campbell Begg was appointed in April 1952 as physicist/radiographer. He worked very hard, qualified as a therapy radiographer as he worked, and finally left to take up a hospital physics appointment in the UK in January 1961. His health was not good, and he died in 1963. Ray Trott then took over, but as radiographer/physicist until he became fully qualified in physics, when he took up the post as physicist until his retirement in July 1986.

**CHRISTCHURCH HOSPITAL:** Initial developments were slower at Christchurch Hospital. Bob Borthwick moved again, in June 1954 (this time from NRL), to start up hospital physics. Jack Tait joined him in 1956, and continued on over many developments until he retired in 1989. Bob Borthwick went overseas on a UN assignment to Pakistan, and never returned but moved on to a variety of UN posts, initially in IAEA and later in UNDP. Christchurch grew and flourished with Jack's hard work and cheerful leadership.

**WAIKATO HOSPITAL:** By the late 1950's, there was provision for 2-3 physicists at each of the main centres, but there was a shortage of applicants which was serious. Hamilton was the last major centre to appoint a hospital physicist, in their new Radiotherapy/Nuclear Medicine Dept. Howard Tripp, who had been assistant physicist in Dunedin from 1955-1965 took up the Hamilton post in June 1965, but tragically died a week later after a traffic accident in the grounds of Waikato Hospital. Gordon Monks then came out from the UK to take up the post in October 1965, returned to the UK for a time in 1967/68, came back to Hamilton in 1968 and worked there until his retirement in May 1985.

#### **SUPERVOLTAGE RADIOTHERAPY:**

It was obvious by 1949 to those working in the field - radiotherapists and physicists alike - that supervoltage X-ray therapy was essential for adequate radiotherapy of deep-seated conditions. Technical developments specifically for radiotherapy equipment had been slowed greatly by WW2, but betatrons had been developed for industrial radiography from 1942. Direct high voltage equipment, with 1-2 MV resonant transformers and 2 MV Van de Graaff generators, were also now available in the USA.

With radar microwave developments in wartime, and of course the availability of artificial radionuclides from nuclear reactors, the post-WW2 possibilities of new equipment had arrived. USA suppliers offered the Allis-Chalmers 24 MeV



betatron or the 2MV Van de Graaff; Canada with high-flux nuclear reactors was busily producing Co-60, and the AECL (Atomic Energy of Canada Ltd) set up production of the Theratron series (Type A - traditional X-ray look alike, in appearance a 44 gallon drum on pivots, and with a mercury shutter(!); Type B - isocentric rotation units with 75 cm source-axis distance (SAD) initially, later increased to 80 cm.

The UK MRC drew up specifications in 1950 for medical linear accelerators, with isocentric design, high dose-rates, precise adjustable diaphragms and localisation accessories, and 5 MeV operation. Philips/Mullard and Metropolitan-Vickers entered the field with competitive designs, which in the event operated at 4 MeV. This MRC isocentric design has basically continued on to the present machines, except that now bending magnets allow horizontal waveguides.



*First supervoltage radiotherapy unit in NZ: AECL Theratron-B Co-60 isocentric unit, 75 cm SAD; installed at Christchurch Hospital in 1956*

Christchurch led the New Zealand charge into supervoltage radiotherapy, with a Theratron B gifted by Sir Arthur Sims on Sept 9 1954. High-cost technology had arrived although the phrase arrived much later! The official view by all "authorities" was that "Two supervoltage units would serve the country for many years to come" (documentary evidence on hand). But no money of course! Auckland and Otago/Southland ran public appeals in 1955, and money poured in! Both



centres raised over 100,000 pounds (\$200,000, which with inflation since, would be about \$2-3M today). Auckland chose a 4 MeV Metrovick linac; Dunedin chose the Allis-Chalmers 24 MeV betatron, both installed in 1958. Not to be outdone, Don Urquhart organised a public appeal in Palmerston North in 1957 to provide a Co-60 unit there; a Barazzetti small isocentric unit (55 cm SAD) was installed in 1958 also. In 1962, the first Government-purchased unit, a TEM (British) isocentric Mobaltron Co-60 (75 cm SAD) unit was installed at Wellington Hospital. Finally, in 1965 Waikato Hospital set up a completely new Department, including a Theratron-80 Co-60 unit, and, uniquely, a Continental Cs-137 unit. So much for the 1955 "official" view, that 2 units were enough! (Note that this official view recurred regularly with new developments, ie that 2 of anything would "Serve NZ for many years to come." See later!)



*Allis-Chalmers 24 MeV Betatron, Wakari Hospital, March 1958  
(Dr Frank Ramsay holding pendant controls; Howard Tripp as  
simulated patient. Note 60 cm dia water window; TV camera.*

It is interesting now to look back at what happened to the original machines. Christchurch "made-over" their Theratron-B as the basic gantry for their 'home-built' X-ray CT scanner. The Dunedin betatron (condemned by various visiting "experts" usually with no personal experience of supervoltage radiotherapy) continued in full operation for 32 years; introduced electron beam therapy into NZ. Its energy range for photons and electrons is now the recognised desirable high-energy range. The Barazzetti Co-60 unit was later moved to New Plymouth, where it bravely survived against all odds for many (too many really) years. The Dunedin small Theratron



C-II Co-60 unit (55 cm SAD; installed 1961; removed 1971)  
was offered to NRL to give them a Co-60 calibration source.  
Other units have come and gone up and down the country....

= = = = =

Hugh Jamieson  
November 1995

*Note: The article above has been extracted from the first chapter of 'The Development of Medical Physics and Biomedical Engineering in NZ Hospitals 1945-1995'. This book, which was edited by Hugh Jamieson in 1995, is available in pdf format on a CD from David Goode ([david.goode@slingshot.co.nz](mailto:david.goode@slingshot.co.nz)). It is intended that it will also be accessible from the ACPSEM NZ Branch website in the not too distant future.*

*David Goode*

