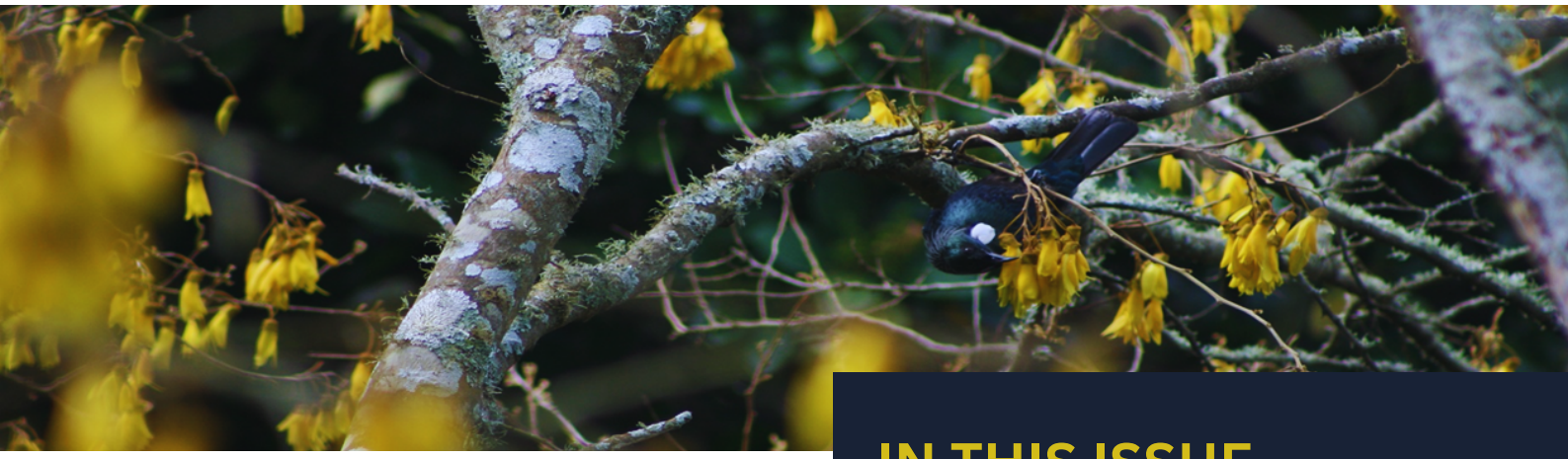
APRIL 2023

NEW ZEALAND BRANCH NEWSLETTER

ACPSEM
Australasian College of Physical Scientists & Engineers in Medicine



ALICIA MOGGRÉ

UPDATE FROM NZ BRANCH CHAIR

Hi Everyone,
Hopefully, you are all enjoying a bit more of a normal start to this year and all the disruptions of the last few years remain a distant memory. I know there are a lot of people impacted by short staffing and heavier-than-usual workloads, so wishing you all the best. I'll try to keep this report short and sweet – and on the sweetness topic, I'm writing this just before Easter, so I hope everyone had the chance to take some time with their family and friends in whatever way you celebrate Easter (there will be quite a lot of sweetness in my household!). We have our very own Easter bunnies who are very cute

IN THIS ISSUE

ABOUT THIS NEWSLETTER

The ACPSEM New Zealand branch newsletter is published twice per year and distributed electronically to NZ members of the College and other interested parties. Views expressed in the Newsletter are the authors' own and do not necessarily reflect the views of the ACPSEM or ACPSEM NZ Branch.

2023 NZ BRANCH COMMITTEE

Chairperson: Alicia Moggré
Vice Chairperson: Christine Thompson
Records member: Nicola Thomas
Finance: Rowen de Vries
Committee Members: Gray Lu, Tania Groudeva, James Dudson
Newsletter Editor: Grace Healy
Past Chairperson: Matthew Paris

BRANCH SPOKESPERSONS

University: Nanette Schleich
Radiology Physics: Brian Lunt
Radiation Oncology Physics: Matthew Paris
Nuclear Medicine Physics: Darin O'Keeffe
Radiation Protection: Annalie Ronaldson

and cuddly, which made me think of this meme that made me chuckle recently.

The latest edition of the NZ Branch committee is off to a great start. We have been joined by a few new faces this year, welcoming Grace Healy (editing this newsletter!), Christine Thompson as Vice Chairperson, as well as Tania Groudeva and James Dudson who are providing some new perspective. They are joining myself, Rowen de Vries (Finance member), Nicola Thomas (Records member), Matthew Paris (past Chair), and Gray Lu.

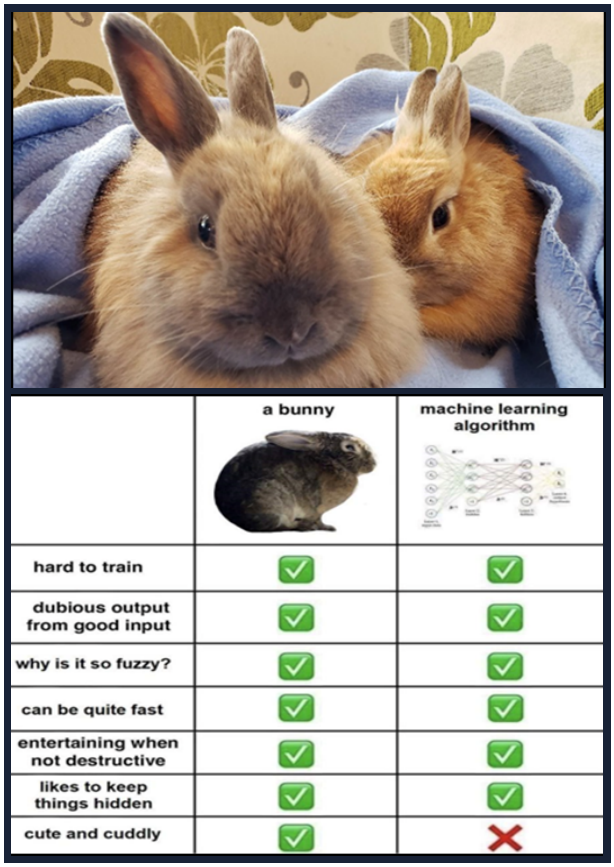
Along with good attendance at meetings from the various spokespeople, it again feels like we have a nice cross-section of people representing our profession, which is great. Since the last newsletter, we've also had several new members join the Branch, so welcome to everyone new here!

As a committee, we have set many goals for the year, which include the following:

1. Showcase New Zealand Medical Physics and Bioengineering members by supporting EPSM in Christchurch 2023. To this end, the committee has agreed to sponsor a prize for the "Best NZ Innovation" talk presented at EPSM, which is only open to NZ Branch members. Additionally, we will be doing our best to promote attending and presenting at the conference within our clinics.

This is a great chance to showcase the work happening around the country. If you have any ideas for people undertaking work that we should highlight, or suggestions for companies that may wish to have the opportunity to be involved in sponsorship for the conference, then please do get in touch with me.

And please consider submitting an abstract and/or encouraging other members of your team to submit abstracts and/or attend the conference!



2. Continue to coordinate national consultation and feedback on relevant documents, legislation, codes of practice, guidelines, mandatory registration etc. Currently, there is a consultation out on ORS C4 Code of Practice for Dental Radiology, which has been circulated amongst the DIMP members. However, there are some concerns that any feedback around the level of technical detail required or not within these codes might be more broadly applicable to more codes than just C4, so anyone who has opinions on the other Codes is encouraged to get in touch with the relevant spokesperson – Brian Lunt is collecting feedback on the radiology related codes while Matthew Paris will collate feedback for the radiotherapy ones when they are due. With the change to Te Whatu Ora, there seem to be additional constraints placed on the ability of individual clinics to respond to documents like this, so the NZ Branch is a nice vehicle for getting our opinions and feedback out there.

There has been no further progress on the idea of mandatory registration since the last newsletter/AGM, and the next steps for this currently lie with the ACPSEM office. I will keep you updated if and when things progress in this area.

3. Promote NZ as a good place to work for Medical Physicists. This is an area we intend to look into later in the year.

4. Provide opportunities for interdepartmental collaboration and sharing of expertise. Based on the success of last year's KKC SABR workshops, casual conversations at NZPEM, and the increasing discussion around national cooperation that is happening with the move of the public centres to be operating under the Te Whatu Ora umbrella, we are keen to explore how we can best support sharing of experience between departments.
You will have hopefully seen the recent emails about the upcoming webinars - the first on Patient Specific QA for Radiation Therapy patients (coordinator = Matthew Paris) and then subsequent ones on Isotope Shielding Calculations (coordinator = Brian Lunt) and External Beam Radiation Therapy Plan Quality (coordinator TBC).
These are meant to be a relaxed format where people share their current practice, compare to what others are doing, and discuss best practices. We encourage people to participate as much as possible. The initial feedback around this idea is very positive already, so we hope that translates into good attendance and discussions to make these sessions worthwhile!

5. Consider what cultural competence looks like for NZ physicists. This goal is led by Christine Thompson, who has already put a lot of effort and thought into this. She has recently been surveying other related professions to understand more about cultural competency requirements and recommendations across some other allied health and technical professions.
The next stage is to prepare and then conduct a survey of New Zealand medical physicists to establish the current levels of cultural competence locally, as well as what training is available in the context of each clinic. You can look forward to receiving a copy of this survey in the next few months, thank you for the time taken to fill it out. The next steps will be informed by the results of this survey.

6. Refocusing on patient outcomes/Re-emphasising the 'Medical' in medical physics. This goal was suggested by Brian Lunt, and to get the ball rolling he has started by writing an article that you will find in this newsletter! We would love to get a response if this particularly speaks to anyone.

Additional small things:
This is a reminder to everyone that we have a funding application form available now to streamline and clarify the process of applying for NZ Branch funding. If anybody has any areas in which a small amount of financial support would enable them to undertake work or research, or travel which would further the aims of the Branch, then I encourage you to fill in one of these forms!
We will also be opting to continue acquiring contributions for the Branch History document, as the committee believe this is a worthwhile undertaking. If you had agreed to take part in this but have not heard from me on this topic for a while, you can expect contact soon! That's all from me for today, enjoy the rest of the newsletter, and a big thank you to Grace for putting it all together!

AN UPDATE FROM

WELLINGTON HOSPITAL

AND A CHAT WITH

SHELLEY BULLING

CHIEF PHYSICIST, WELLINGTON

Kia ora! I was born and grew up in the Deep South, in Invercargill. In high school, I caught the medical physics “bug” when an article on hadron therapy in New Scientist sparked my interest. Subsequently, I moved to Dunedin to study, eventually graduating with a Master's degree in Medical Physics from the University of Otago.

I then started my career as a “Junior Physicist” in the radiotherapy department at Wellington Hospital, commissioning the TLD reader and scaring the residents of Wellington in my lime-green Mitsubishi Mirage with the meanest mags and louvres north of Gore.

When I started my career in medical physics, I was especially lucky to be in Wellington. My first boss/mentor was Lynne Grieg. I learnt a lot from her, including gaining confidence and learning to stick up for myself as a physics professional.

After three years in Wellington, I had the opportunity to go on my first-ever overseas trip to do a high-energy maintenance course at Varian in Palo Alto, California. A year later, curious to see new things and to be near the latest developments in radiotherapy, I moved there to work as a consultant medical physicist and to study for the American Board of Radiology Certification in radiotherapy physics.

Apart from the infernal California traffic, Palo Alto was a great place to live and work. At the same time, my boyfriend from Wellington had moved to Geneva with the New Zealand Government, and then the United Nations.

Eventually, after a very nice holiday together in the Swiss Alps (touring around in a convertible), I succumbed to his secret plan and agreed to relocate to Switzerland. So much for being a California girl.

I finished my ABR certification in Switzerland, working as a Medical Physicist at the University Hospital in Lausanne (CHUV) for 6 years and then in beautiful scenic locations with lovely colleagues at two Genolier Swiss Medical Network clinics in Genolier and Geneva for about fifteen years, where I was eventually made the chief physicist.

I was also involved in the Swiss Board of Radiation Physics (SSRPM). A lot of my work at the Genolier group was clinical, but there were industry collaboration aspects that I really loved, including learning to work agilely with cutting-edge private companies to trial and introduce new therapeutic technologies in the field.

Finally, the lure of family and the love of my home country brought me back to New Zealand with my now-husband (no longer with convertible). In January 2023 I began a new role as the chief in Wellington.

It's fair to say that Wellington regional hospital is a very different environment from a private hospital group in Switzerland. But I was ready for new challenges, and I don't regret my decision, especially as I've been welcomed by a caring and dedicated physics team.
It's also pretty multicultural in its own right: the Wellington physics group hails from New Zealand, Argentina, England, Ireland, Scotland, Wales, Germany, and South Africa. This diversity makes for interesting conversations about life and Medical Physics, and I think it strengthens us as a team. I'm learning a lot, although I'm worried that I'll lose my hard-won (but limited) French language skills if I don't keep them up!

What is your vision for the job?
I've already noticed the potency of the positive attitude that the Wellington physics team brings to their work. I want us to continue to enjoy what we do because that sharpens our commitment and makes us want to excel. Wellington has a reputation for training excellent physicists, and I want to maintain and build on that record. I believe it will strengthen not only health delivery in the Wellington region but the New Zealand health system as a whole. The next generation of medical physicists is crucial to our health system's ability to deliver fit-for-purpose radiotherapy care in the future.
We're capable of delivering world-class radiotherapy treatments. I want to sustain and bolster it to cut wait times and ensure we bring the greatest patient benefit. At all times, we are here to serve the New Zealand public. That sounds a bit serious, but there's also scope to have fun in what we do. Overall, I'm delighted to be part of this team and participate in the projects here, including brand new areas for me, like brachytherapy. The update below conveys more of a sense of what we are up to specifically.

What do you miss about Switzerland?
I would have to say the magnificent landscapes, my friends and colleagues from there, and the wonderful Geneva weather. Sorry Wellington, but there is at least a little bit of bad weather every day. I hasten to add, though, that I was quickly won over by Wellington's friendly people and vibrant city life. We love the restaurants, cafés, culture, and music. And, as mentioned, my new colleagues and friends are lovely.

What is a favourite project from your previous work?
A favourite project from my previous work was an industry collaboration with RaySearch and Accuray for the development of the RayCare OIS.

What is an exciting project you have coming up?
An exciting upcoming project in Wellington is the Master's project of our new registrar Chrizia Cayanan (a team member in Wellington even newer than me!) to develop an MR-only workflow for gynaecological brachytherapy.
As well as Chrizia and myself, there will be some other people in our team that some of you don't know yet thanks to previous COVID restrictions.
I have already met some of you, long ago, and I hope to have the occasion to reconnect with you at conferences and meetings soon as well as introduce myself to new colleagues.

In the meantime, check out the brief update from Wellington below.

New and recent arrivals

- Chrizia Cayanan – new registrar, started at the end of January 2023, from home town Timaru.
- Shelley Bulling started in January 2023.
- Rhys Hobbs – registrar – started in January 2022, doing TEAP in Wellington and Medical Physics papers at the University of Adelaide.
- Sophie Halliday qualified at the end of 2021 and stayed in Wellington from January 2022.
- Gray Lu joined Wellington in October 2021 from Palmerston North.
- Leon Aldrovandi started in September 2021, from Argentina, and leads the brachytherapy physics group.
- Liam Doonan started in May 2021, recruited internally, in the scripting team.
- Shauna Nic A Bhaird arrived from Ireland in September 2020, just after the last update from Wellington.

Completed projects:

- EPID in-vivo dosimetry is now used for most VMAT and 3DCRT sites.
- The release of video coaching for breath hold treatments.
- All HDR treatments are now prescribed electronically in Aria.
- We released upgraded algorithms AAA16.1 and eMC 16.1.
- We implemented VMAT breast with IMN as well as VMAT axilla SCF as a class solution.
- We also implemented Hyperarc for multimet treatments with jaw tracking.
- The introduction of e-Learning modules for I-131 education for nurses and allied staff.
- We moved to the use of "3Done" externally manufactured electron cutouts.
- We also hosted two UK students from Clatterbridge in 2022 with projects on MCO and Hyperarc margins review.
- Commissioned Radcalc for SXR treatment time calculations.

Current projects:

- MR only workflow for gynae brachy (also Chrizia's MSc thesis topic).
- Commissioning new brachytherapy ring applicators.
- Machine Performance Check (MPC – automated Linac QC using the EPID) for daily machine checks.
- Further use of Knowledge Based Planning /Rapidplan (looking at implementing external H&N model, and building own rectum model) and implement Multi-Criteria Optimisation (MCO) for VMAT planning.
- TRUS-TRUS image fusion for HDR prostate treatments.
- Release of Jaw Tracking for all VMAT treatments.

- Switching to waterproof chambers and measured kQ factors, commissioning new PTW Romeo electrometers
- Rebecca Day is doing a thesis about the challenges of delivering the Medical Physics registrars' training in the clinical environment (and how best to support the team to deliver the training). This is part of the University of Otago Postgraduate Certificate in Higher Education to complement clinical supervision of the TEAP program in Wellington.
- Evaluation of FilmQA Pro to replace in-house software.
- Upgrade Radcalc from v6.3 to v7.2.

- Assessment of whether 6 MV and 10 MV beams would be adequate for all treatment indications for a future machine.
- Emergency planning using CBCT scans (for when CT is not available).
- VMAT class solutions for cervix, and prostate & nodes patients.

Upcoming projects:

- Commissioning collapsed cone convolution and Monte Carlo based modules for RadCalc 3D independent dose calculations, including comparing the sensitivity and specificity of the Radcalc independent 3D dose calculations for introduced errors, validated against time resolved ion chamber measurements.
- Hosting 2 UK Medical Physics students for 4 week elective projects in Wellington in May-June 2023. This is an opportunity for us and our registrars to exchange with trainees from an overseas Medical Physics training program about their different curriculum and training approach.
- Evaluating AI contouring tools for radiotherapy.
- Expand the use of Eclipse scripting and auto-planning tools.
- New stereo sites (pancreas (MASTERPLAN clinical trial), oligomets (soft tissue, non- spine bone))
- MPC for daily Linac QC.
- New planar dosimetry methods (EPID/arrays) for PSQC to supplement/replace EBT film QC.

WANT TO CONTRIBUTE TO THIS NEWSLETTER?

This Newsletter would not be possible without the contributions of our membership. If you would like to respond to any articles in this issue or having anything that would be of general interest, submissions can be sent to the Newsletter Editor at Grace.Healy@cdhb.health.nz.

SUZANNE LYDIARD

THE KATHLEEN KILGOUR CENTRE, TAURANGA

KKC has had a busy 6 months with lots of Linac downtime and issues, largely with XVI on different machines and troubles getting WL isocentre size within tolerance.

We have been starting to collect panel data for SunCHECK Fraction N during treatment, and we are analysing the results to look at the impact of anatomical changes, etc. We have been working towards the clinical implementation of the Elekta Clarity ultrasound (US) guidance system for prostate EBRT.

This uses ultrasound and a series of probe and couch positioning indicators to monitor the position of the prostate during treatment delivery (without fiducials).

Initially, we will use Clarity for prostate-only treatments with a 20-fraction prescription to become familiar with the system. Once confident, we will progress to ultrasound-guided prostate SABR with a 5-fraction prescription and tighter margins.

We have welcomed Nicholas Lowther to our team. He has joined us from Wellington. He has been going through the Varian-to-Elekta transition that others have previously enjoyed and is a great addition to our team.

HIDDEN VARIABLES

The following is reproduced from physicsworld.com. Thank you Alicia for the submission.

How well do you know your medical physics? Find out with this fun, cryptic word search, created by Ian Randall. All answers are hidden in the grid vertically, horizontally or diagonally, with no letters skipped. The answers can be found on page 22.

T	C	H	Y	H	P	A	R	G	O	M	O	T	E
A	I	P	P	P	H	A	N	T	O	M	D	B	G
P	N	L	A	P	O	S	I	T	R	O	N	R	N
I	I	I	R	C	A	X	P	T	T	I	U	A	I
D	L	M	E	O	N	R	S	I	B	D	O	G	N
E	C	A	H	O	O	A	F	S	O	P	S	G	N
T	H	G	T	T	M	Y	Y	S	L	G	A	P	A
E	P	I	O	S	I	R	I	U	U	C	R	E	L
C	A	N	I	L	S	M	I	E	S	T	T	A	P
T	T	G	D	O	E	N	I	D	O	I	L	K	Y
O	I	C	A	T	S	C	A	N	H	E	U	A	L
R	E	T	R	E	V	I	T	A	I	L	L	A	P
H	N	Y	C	A	R	C	O	N	T	R	A	S	T
E	T	C	I	T	C	A	T	O	E	R	E	T	S

Wireless put hit music in pronoun, killing cancer cells (12)
Exposure measurement? Note sounds like beautiful proportion (9)
Particle physicists rarely order tapas or nachos, initially (6)
Röntgen's discovery in complex rayon (4)
Speakers' gambit locates part of the body (12)
See inside my body? Even smarties back off (3)
Fudge portions are used in three-dimensional imaging (8)
Long-suffering hospital visitor (7)
Angular momentum pinches to the left (4)
Cathode ray tube, for example, central to Kremlin accessories (5)
Medical physics technique? I'm getting older without direction (7)
Slicing method put right? OMG, a trophy! (10)
Use scant computed tomography procedure (3, 4)
Sonogram is extremely stable (10)
Bonobo lust conceals tissue equivalent (5)
We hear crow mountaintop is where protons stop travelling (5, 4)
Tune your imager with spirit (7)
Providing relief by cooking pie at villa (10)
Dull American colour is absorbed unit (4)
Norse god inside? That is I! (6)
Turncoat trades France for a model, device discerns (8)
Yeti's suede, at its heart, is flesh (6)
Scheduling dose modelling (8)
Agent for difference (8)
Surgery, detached, ejects gangster (6)

As an added bonus, all of the unused letters – when read top left to bottom right – reveal another related phrase.

CHRISTINE THOMPSON

AUCKLAND HOSPITAL

As you know, Auckland had a little rain at the end of January. Sadly, this was our kV unit (see below). Fortunately, due to the quick actions of our staff and great support from our supplier over the public holiday weekend, we managed to get our kV unit back into clinical use with only one clinical day of downtime. One of the desks in our registrars' office also became unusable. However, this is happily now the current state of the ceiling (see top right).

On a more usual note, in January we welcomed Nevin Koshy and Trulani Van der Heyde as Registrars. Nevin has come to us post-MSc, and Trulani joined us for orientation for a month and she has now headed down to Christchurch to complete her MSc academic papers.

Ruth Smith returned from parental leave. Last August, Ruth Hanly and Richard Moyse Fenning joined us. Ruth Hanly has joined us for a year (from Ireland, via Christchurch) and is bringing useful eye plaque experience to our service.

Before and After: The registrar office ceiling.

Richard has come from Brighton, UK and has picked up much of the Brain metastases work handed over from Alistair Templeton, who returned to the U.S.A. in September. Richard also has valuable Python skills, which he has been putting to good use.

Clinically, in the last few months we have implemented several new techniques: simple VMAT planning for the majority of our palliative plans, VMAT and DCAT treatments for small multi-focal metastases, IMRT planning of Breasts with CTV-derived PTVs, and Prostate SABR.

In March, we upgraded the control system on both of our Elekta Versa HD Linacs. This required reacceptance of the Linac, focusing on connectivity and imaging systems. This provided an opportunity for the team to get experience in acceptance testing, as there will be plenty to do over the next year.

We are close to being able to recruit patients to the Masterplan clinical trial in the next couple of months and anticipate starting the replacement of two Varian iX Linacs with True Beams later in the year.

Our oldest CT scanner will be replaced this year, and plans are underway for a new brachytherapy bunker. Patient numbers have been busy, with a record 104 referrals the other week – definitely enough to keep us out of mischief!

SOPHIE HALLIDAY

ARPANSA REFERENCE DOSIMETRY COURSE

While many plans were dashed with the introduction of Covid-19 to New Zealand and the rest of the world, my plans for a trip to Melbourne to attend the 2020 ARPANSA reference dosimetry course were no exception.

After waiting patiently for a few years, I attended the long-awaited course from 20-23 March 2023, along with 11 other attendees from Australia and New Zealand.

The 4-day course was a mixture of lecture-style learning and practical activities, covering topics from cavity theory to detector selection for various reference dose measurements.

There was also discussion around the considerations of dosimetric measurements in MR-Linacs and proton dosimetry, which was a great way to extend the kV and MV dosimetry learnings we had covered.

The course allowed attendees to engage with the tutors from ARPANSA to connect the theoretical concepts of dosimetry to clinical practice. The practical components were a personal highlight. Being able to peek behind the curtain of the reference dosimetry lab was a valuable experience

– and now I can say I've seen a Co-60 unit.

The practical nature of the exercises also served to solidify learnt concepts and allowed for in depth discussions with the tutors. I particularly enjoyed speaking with some of the team from ACDS about the auditing process. We had finished an audit no more than 5 days before the course.

As always with in person courses, it was great to meet with the tutors and other attendees whose experience ranged from brand new registrar to qualified ROMP.

The workshop was well run, interesting, and provided information I could take to the clinic and implement. If you are looking for an opportunity to brush up on your reference dosimetry knowledge, I would highly recommend this workshop to you, no matter your level of experience.

Thanks to the team from ARPANSA for having us!

RECENT PUBLICATIONS

Halliday SD, Day RA, Greig L, Louwe RJW. Clinical pilot study for EPID-based in vivo dosimetry using EPIgray™ for head and neck VMAT. *Phys Eng Sci Med.* 2022;45(4):1335-1340. https://doi.org/10.1007/s13246-022-01184-6

Telford T, Roberts J, Moggré A, Meyer J, Marsh S. Noise Considerations for Tomographic Reconstruction of Single-Projection Digital Holographic Interferometry-Based Radiation Dosimetry. *Photonics*. 2023; 10(2):188. https://doi.org/10.3390/photonics10020188

MARK ASHBURNER

WAIKATO HOSPITAL

Well New Zealand, having recently installed, accepted, and commissioned New Zealand's very first Halcyon Linac, we have been putting it to good use. In fact, we have already treated around 100 patients and are happy to report that we have not encountered any major issues so far. It has been a real game-changer for us, and we are getting more and more comfortable with this new treatment paradigm every day and looking at expanding our treatment capabilities beyond just the pelvis area. Currently, we treat around 25 patients a day, and we utilize the machine about 60% of the time. That means there is still plenty of room for more patients, and we are confident that the Halcyon will become the workhorse of our department in no time.

We recently switched to Aria Fullscale, an online-managed services platform that has truly been a game-changer for us. We all remember the infamous Waikato cyber-attack of 2021, and let me tell you, implementing this new system was no easy task. But, thanks to our stellar management team, we got it up and running smoothly and we have been reaping the benefits ever since.

Will this open the door for a position that allows a Physicist to work from home? Possibly – watch this space and the job vacancy pages, as we are advertising a temporary fill-in position for our beloved Mira, who is venturing into the world of Motherhood and gave birth to a beautiful baby girl in February.

But that's not all, folks. We have also been on a mission to streamline our equipment and get rid of those pesky TLDs and fiddly diode wires that we all love to hate. And how did we do it, you ask? By accepting and commissioning NanoDot technology, of course! With NanoDot, we have been able to say goodbye to those cumbersome TLDs and clunky diodes, and hello to a more streamlined and efficient process. It has made our technicians and registrars' jobs so much easier. We also look forward to decommissioning our TLD oven, and its Windows 95-only software package.

So there you have it, folks. Our department has been busy making some serious upgrades, and we are thrilled with the progress we have made. All is quiet on the publication front, however, our newly promote Principal Physicist, Moamen Aly, was able to advertise at the Varian User group meeting in the beautiful Gold Coast last month: "*Mobius3D®: A comprehensive tool for independent automatic QA checks*"

This is a great opportunity to spread the word about the work we are carrying out here at Waikato.

ACPSEM NZ BRANCH PEER REVIEW SESSIONS

The ACPSEM NZ Branch will be holding a series of virtual meetings to enable some relatively informal opportunities nationally for people to share experience on a clinical topic, put up work for peer feedback, or share the "state of play" of a diagnostic or treatment technique that is a specialty within their clinic. The first session is on Patient Specific QA (therapy) and will be held on June 9th, coordinated by Matthew Paris. A meeting invite has been circulated to all NZ-based members. If you have a topic you wish to propose for a future session please contact the Branch Chair at Alicia.moggre@cdhb.health.nz.

FROM THE ARCHIVES (1994)

Richard Jones

Chairman's Report

"Medical physics and biomedical engineering has been going through some very troublesome times in New Zealand over the past few years. First was Medical Physics' loss of identity in Dunedin where the Department was disestablished and its staff split up and placed within several clinical departments (primarily Oncology and Radiology).

Second was the imposed breakup earlier this year of the Biomedical Engineering Department at Wellington Hospital. As with Dunedin, its scientific staff were placed into clinical departments and its technical staff moved from the Clinical to the Facilities Division.

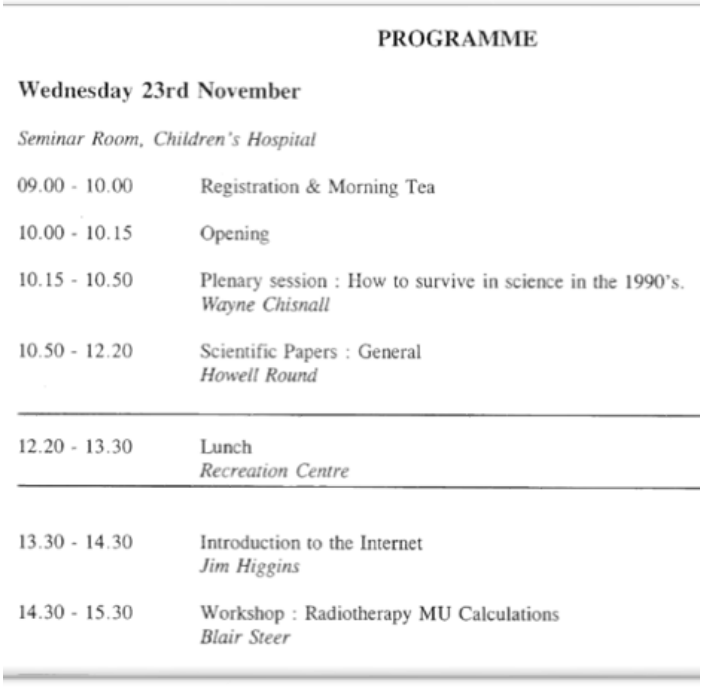
Third are the current proposals to "destructure" the Medical Physics & Bioengineering Department at Christchurch Hospital. Thanks to major strategic efforts within the Department and tremendous support from clinical departments and from College members, the most damaging components of the proposals appear to have been successfully fended off (at least until the next onslaught) i.e., Oncology Services physicists and technicians will remain administratively under the MPBD, the Diagnostic Physics & Bioengineering Section will remain within the Department, and Richard Tremewan will remain as its Head. However, matters have not been definitively set to rest, especially with respect to proposed 'merger' with Technical Services, and further communications are eagerly awaited from Division Management.

Thus, the ramifications of the major and never-ending restructuring of the Health System, driven by the Government's desire to introduce a funder-provider split and the commercially-oriented generic manager/accountant approach, have had and are continuing to have a major demoralizing/demotivating influence on the much needed contributions we can and do make towards health care and its advancement.

Small consolation that the pressures and "challenges" our profession are under appear to be a world-wide phenomenon/epidemic, with similar stories of 'Management bringing in management consultants to provide independent recommendations as requested by management!' being related in Australia and the USA.

Fortunately, on a more positive note, Auckland and Hamilton appear to have weathered and come through their storms essentially intact, if somewhat leaner."

Annual NZ Branch Conference Proceedings



PROGRAMME

Wednesday 23rd November

Seminar Room, Children's Hospital

09.00 - 10.00	Registration & Morning Tea
10.00 - 10.15	Opening
10.15 - 10.50	Plenary session : How to survive in science in the 1990's. *Wayne Chisnall*
10.50 - 12.20	Scientific Papers : General *Howell Round*
12.20 - 13.30	Lunch *Recreation Centre*
13.30 - 14.30	Introduction to the Internet *Jim Higgins*
14.30 - 15.30	Workshop : Radiotherapy MU Calculations *Blair Steer*

GEMMA WARNER (& CHAT GPT)
CHRISTCHURCH HOSPITAL
RADIATION ONCOLOGY

**Disclaimer: With the use of Chat GPT becoming more widespread, we thought it would be fun to task it with updating everyone on what our department has been up to the past six months. Extensive edits have been completed by Gemma and Grace.*

It has been a busy six months for our department, and we're excited to give you a quick update on what we've been up to. We've been working hard to upgrade our treatment techniques and equipment.

One thing we're excited about is using Dosecheck for independent MU checks. Dosecheck is a software tool that allows us to double-check our dose calculations and ensure that our patients are receiving the appropriate amount of radiation during their treatment. Implementing this tool into our treatment planning process has reduced the time required for IMRT QA by our physics team.

With Dosecheck, we can quickly and easily verify that the delivered dose matches the intended dose, allowing us to detect any discrepancies early on and make the necessary adjustments.

There have been many upgrades in our department. One of the latest treatment planning upgrades was Elekta Monaco 6.1. This offers advanced treatment planning capabilities, increasing our efficiency. Our CT scanner underwent the Siemens Evolve upgrade, which has enhanced image quality and improved scanning times. In addition to the CT upgrade, we have started commissioning a new Elekta Versa HD Linac for our T1 bunker. As is standard practice now, we made more Electron Trees, both the standard square shape and cylindrical ones. Furthermore, we have acquired 2 new PTW UNIDOS Romeo electrometers.

We've been busy with SABR treatments, especially for Spine and other Bone Mets, including a femur. These treatments allow us to deliver high doses of radiation to small areas, which have involved a lot of physics input. One of the Spine SABR patients had previously undergone a bone augmentation procedure using a new model of bone cement with radiopaque dye. The manufacturers kindly supplied a sample which allowed us to take transmission measurements and determine the appropriate RED.

Also, we have recently switched to DIBH from 4DCT for some Lung SABR patients. We recently treated our first UHF (Ultra High Fractionation) Prostate, a big milestone for us. We've also been using a reduced PTV margin for Brain SRT, based on risk analysis. Finally, we've been doing a lot of Lung VMAT planning, which once again is involving a lot of physics input.

We have been revisiting electron eyeshield dose characterisation. This is an essential

process that ensures the safety of patients during radiation therapy. The eyeshield is used to protect the patient's eyes during electron beam therapy, but can also cause unwanted scattering and dose effects. The results of this work can guide us in making appropriate adjustments to treatment planning.

Our department has made a significant switch in our HDR secondary output measurement process. We have moved from the old Swiss method and PMMA phantom to an in-house in-air jig based on IAEA Tecdoc 1274. This new method has removed some of the uncertainty involving some of the previously used factors.

A few of us recently presented at the Australasian Brachytherapy Group (ABG) and Elekta Users meetings. These meetings provide an excellent opportunity for our department to share our experiences and learn from others in the field.

The Australasian Brachytherapy Group is an organisation dedicated to advancing the practice of brachytherapy within the Australasian region. Similarly, the Elekta Users meeting is a gathering for professionals who use Elekta equipment and technology. These meetings offer an opportunity for users to share their experiences, discuss best practices, and learn about new advancements in radiation therapy technology.

Overall is has been a busy 6 months of new equipment, upgrades, planning techniques, and meetings. There also doesn't seem to be any slowing down on these fronts.

RICHARD DOVE

CHRISTCHURCH HOSPITAL

DIAGNOSTIC PHYSICS

Meanwhile, the diagnostic physics group have been working old school and with only biological intelligence to help them upgrade imaging facilities across the region.

This has required multiple trips to the West Coast, South Canterbury and Ashburton, which are all upgrading facilities or equipment currently. This capital investment pre-dates the Te Whatu Ora emphasis on providing equitable healthcare across the country, but it certainly aligns with that objective.

Even wider across the country, the team has taken on tutoring the bulk of radiology registrars in the RANZCR "rest of New Zealand" training network for the RANZCR applied imaging technology examination.

We have done this tutoring locally for many years with good results. With the change by RANZCR to training networks and the emphasis on regional and national coordination by Te Whatu Ora, we embraced this request to spread our tutoring wider.

This has required new thinking about how we deliver the tutoring, both theory and practical sessions. Fortunately, the technology platforms have developed a lot over the past 3 years, and the education sector has many hard-won lessons to teach us.

No doubt there are some lessons for our team to learn, but we are committed to providing high-quality tutoring across our training network.

Back in Christchurch, St Georges Cancer Care is well advanced with their MR-Linac, as you'll no doubt read elsewhere. We are fortunate to have Nick Cook in our diagnostic physics team as a graduate of the ACPSEM MR Safety Expert (MRSE) certification last year. We have been happy to have him providing some support and advice while the St Georges radiotherapy team get up to speed with the new safety aspects of their new equipment.

And finally, we bid farewell to Rob McLeod, who has been a mainstay of our equipment testing team for 20+ years.

We find the model of using a Physics Technician/Associate Physicist to increase the reach of our certified medical physicists effective, and we are delighted to have already lined up a replacement for Rob.

We wish Rob a long and enjoyable retirement.

BRIAN LUNT

RADIOLOGY PHYSICS - THROUGH A DIGITAL LENS

Preamble: I suggested a couple of topics as themes for this year at a recent ACPSEM NZ branch committee meeting. These included: aligning priorities with patient outcomes; reviewing medical physics practice through a digital lens. The committee asked me to write articles for the newsletter covering these, with the first one of these topics below.

Introduction

Has anybody checked if their spreadsheet formulas have drifted lately? Reason would suggest this is nonsensical in a digital system that is, by design, immune to drift. If there was a problem with our spreadsheet it would take a very different form. Yet our tendency to assess digital imaging systems like their analogue predecessors, prone to drift, influenced by voltage drops in mains power, etc., is still a persistent model that permeates technical guides on evaluating the performance and quality control of medical imaging technology. There are sources of change, such as an errant adjustment by a service engineer, but these still, on the whole, behave as a digital fault, abrupt persistent stable change.

Rather than testing digital imaging systems at fixed time intervals with numerous settings looking for variations in standard output characteristics, it is, in my opinion, time to have a critical look through a digital lens at where the problems actually are and model quality control effort and activities where they will add the most value to diagnostic accuracy and patient outcomes. The scope of this opinion piece will concentrate on medical physics involvement with imaging systems, but the same principles will likely apply in oncology and clinical engineering.

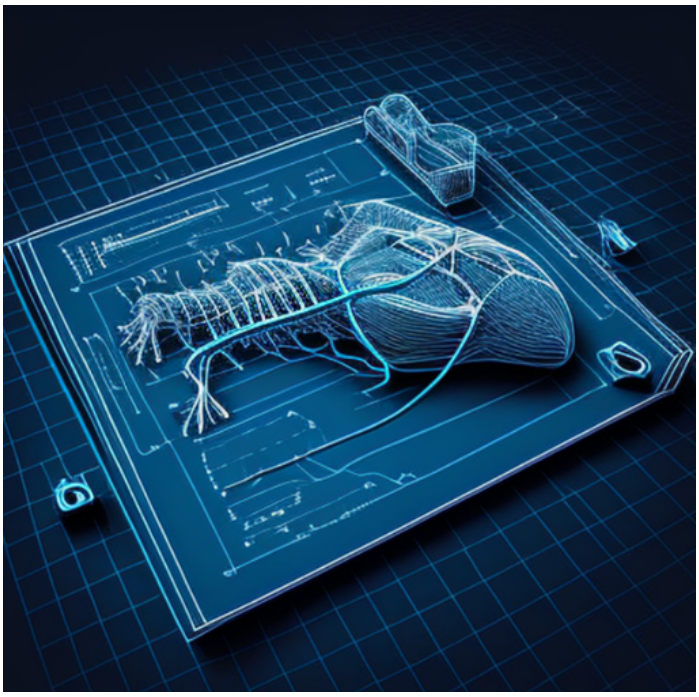
History - the old problems no longer occur

Resistor-capacitor timing circuits, voltages fixed by transformer tappings, and electrical switching with mechanical contactors have long since been replaced with crystal oscillators, closed-loop feedback control on high-frequency high-voltage power supplies, precision voltage reference sources, optical position encoders, and continuous computerised and networked monitoring of performance often with multiple levels of redundancy. The probability of x-ray outputs silently drifting or suddenly changing due to a single fault has effectively been eliminated from modern x-ray systems.

In a twist of fate, the now inherently stable hardware characteristics of much of the technology we deal with have had a layer of malleable control software added over the top.

Software settings are now frequently defined by subjective 'flavours' rather than well-defined physical quantities that the users choose from, e.g. mild, average, strong, and very strong.

These flavours have meanings buried inside the algorithm that the settings feed into. Imaging equipment users and application experts frequently do not have access to information on what these settings do in any well-defined way.



Nevertheless, the settings inherently influence the performance of the imaging system and patient radiation dose and are left to the subjective opinion of the application experts and users of the day to set whatever they feel is appropriate. The problem of variability in performance has moved from the hardware to the software/user preference domain. The behaviour of the system settings is generally deterministic in that a given setting will reliably produce a given outcome under the same conditions.

> “The problem of variability in performance has moved from the hardware to the software/user preference domain”

It should come as no surprise that despite the significant improvements digital technology have brought to medical imaging, these flavours and subjective approaches to fine-tuning an imaging system result in measurable variability in diagnostic quality and patient radiation doses. The source of variability is encoded by whoever last adjusted the settings of each protocol, often in the long list of techniques to choose from.

The variability introduced through software and subjective technique settings is far greater than the variability arising from the system hardware calibration. It follows that evaluating and testing a system for constancy and adequacy in performing diagnostic tasks needs to refocus on system use and protocol settings.

The challenges with this are significant but not unsolvable, and include the following:

- The number of protocols that need to be evaluated. If you multiply the number of body regions that may be imaged by the variations in patients' size categories, you're looking at hundreds, if not thousands, of technique settings.
- The limited adoption of the DICOM Standard for protocol export.
- The lack of information on the physical definition of the various flavours.
- The lack of agreed, objective, quantifiable clinical image quality standards.
- The need to work more closely on clinical techniques with our time-poor clinical colleagues.

It is clear there are not enough hours in the day to manually investigate imaging techniques on a protocol-by-protocol basis.
It is also clear that the traditional tools of physical phantoms cannot be practically applied on a protocol-by-protocol basis across a range of patient sizes.

“The standard deflection at this point is "the radiologist will know" when the image quality is not up to standard.”

The standard deflection at this point is "the radiologist will know" when the image quality is not up to standard. Unfortunately, at the edges of visibility for subtle pathologies, "the radiologist will know" is unsubstantiated and demonstrably untrue in many cases.

Changing the Physics Sampling Paradigm

Once a digital system has been developed and released, a common approach for performance testing is to measure what happens at a known reference setting and the “edge” or “corner cases”, so a combination of the lowest, mid and highest values are typically used. If there is a problem, it will almost certainly reveal itself at these points.
Multiple fine measurements between these points are unlikely to produce any new information. For a digital imaging system, we can drop the detailed measurements over a wide range of settings and concentrate on a middle reference plus minimum and maximum settings. Bearing in mind, we don’t want to drive a system to the point of failure by operating it outside of the normal clinical settings - driving a DR system at 1000mAs and 150kV may result in a sudden loss of reputation and a very expensive bill.

The Image Quality Part

The image quality of the finally presented image is influenced by both the detector performance and the image processing applied before image presentation. Our current test methodology can deal with the detector performance by looking at the raw or “for processing” image, checking resolution, measuring MTFs or looking at a contrast-detail type phantom. Digital systems invariably apply additional processing to prepare the image for the final diagnostic presentation.
The “raw” image, and the “for processing” image which has been corrected for dead pixels and nonuniformities in the digital detector, typically behave in a near-linear stationary fashion, so our traditional techniques can be applied when evaluating detector fundamental performance. The added digital processing of the image adds an adaptive, nonlinear layer that changes the game.
Image processing often shows both spatial and temporal variability.

A simple chest x-ray will show significant variations in noise and resolution characteristics over different regions that cannot be explained by photon counting statistics, but rather due to the algorithm adapting to different regions.

The photon-starved mediastinal region may be processed to emphasise contrast steps with less emphasis on resolution, whereas the lung region is likely to be presented with enhanced resolution. Cardiac imaging will show temporal and spatial variations in the characteristics of the image processing. Motion detection automatically causes image averaging to be reduced in specific image regions.

We now also have machine learning arriving on the image processing scene, and its impact will be substantial and complex. Evaluating these adaptive image processing algorithms using simple test objects fails to evaluate the significant contribution made to the image by the more advanced image processing flavours.

The physics testing then often becomes disconnected from the final clinical image quality. My question is, without resorting to the standard "the radiologist will know" deflection, how can you optimise an x-ray system if you cannot quantify its clinical imaging performance? Subjective judgment is the current go-to. Opportunities for improvement from physics contributions in this area are significant.

There is an objective image quality truth

It is easy to demonstrate that subjective assessment cannot and does not result in consistent imaging. In practice, the radiologist will only know when the quality is inadequate when it reaches a threshold too bad for them to tolerate. Well before this point, it is also easy to demonstrate that subtle image information is already being modified or lost.

Our vision lacks specificity to judge image noise and its effect on subtle pathology detection. This lack of specificity manifests in the lack of available language to describe important image characteristics. Compare this to colour, where thanks to the cones in our retinas and our trichromatic vision that arises from it, we do have specificity and a vast language available to describe different colours.

I can easily describe the burnt orange shirt I was wearing last night, and you would have a good chance of accurately understanding its colour. Yet the CT scan I was looking at yesterday had significant structural noise. I cannot subjectively describe that to you in a way that you could replicate on a CT imaging system, or accurately describe what changes to the noise were needed other than it needs to be “less”.

Despite being able to demonstrate the predictable characteristics and various shortcomings in our visual perception and verbal language, we have deep-seated, yet unfounded confidence, in being able to subjectively judge and describe the

characteristics of an image as adequate for a given diagnostic task. We forge on in our established practice with all its shortcomings because of the lack of conscious awareness and lack of apparent alternatives.

Misdiagnosis is a significant issue in radiology - its causes are complex and numerous. Variability in imaging performance is likely one of the many contributing factors and is an area where physics can help.

Taking a high-level view

Rather than being overwhelmed with the complexity and enormity of the problem and hanging on to our tried and trusted but increasingly less productive methods, maybe it is time to lift our sights from the fine metrological detail of physics measurements to a broader view of the problems affecting clinical outcomes.

Closed loop feedback is a technique that works well for controlling complex systems in biology and engineering and is a concept that can be introduced into Radiology to manage the performance of imaging coming out of the service.

One established framework that could be used to establish this is 'statistical process control'. This approach to quality control was pioneered in the 1920s and is equally applicable to medical imaging. Taking a 'statistical process control' level approach is in a domain where medical physics knowledge and practice can be brought to the table within the radiology service if effective quality control is to be introduced as an integral part of the imaging team. Within the framework of closed-loop feedback to help control the quality of imaging coming out of radiology, opportunity abounds. We have a stream of digital information playing continuously through the network from the imaging systems to the reading stations, with vast quantities of relevant data reliably recorded.

Case Study: Routine Digital Radiography QC

Looking at quality control through the digital lens gives rise to a review and refresh in the list and the extent of testing that should be performed.

AI (MidJourney) was used to create the original artwork in this article. As a demonstration of AI going wrong - the woman on the left has been drawn with her head on backwards.

If wrote out a list of some of the tests I do now and what my testing processes might look like if I approached it through a digital lens, my suggested approach would be as follows (see below).

This list is incomplete and is only meant to be a taste of the type of changes that may follow from reviewing a practice through a digital lens.

As much as anything, I hope this will serve as a conversation starter. Similar reviews of any of the other modalities including CT, mammography, fluoroscopy, and angiography could and, in my opinion, should be performed.

Reduced Emphasis*	Remains the Same	Increased Emphasis
• KV (3 measurements per focal spot – high/mid/low kV). • mA (3 measurements per focal spot - high/mid/low kV). • Time (3 measurements - 2 short one long - mostly to test mA settling time). • Filtration (1 measurement at minimum filtration). • AEC behaviour (1 measurement of AEC input dose at standard clinical setting, no kV, density, patient thickness compensation). • DRL's (Changing dose using a self-selected sample without understanding the effect on diagnostic performance is not really optimisation). • MTFs. • … * Acceptance testing - would involve more test points.	• EI Accuracy. • Mechanical alignment/collimation. • Image artefacts & defects on "for processing" image. • Detector conversion efficiency – SNR at one beam quality. • …	• Querying of protocol changes. • Protocol management - reduce the number of bespoke redundant protocols for the same clinical indication. • Protocol consistency across same model systems. • Digital resilience (protocol/configuration Comprehensive clinical dose performance assessment for all patients. • Involvement in protocol optimisation groups. • Far greater use of digital performance data flowing through PACS network. • …

Concluding Remarks

We should hold our own practice to a critical-thinking, hard-nosed rational scientific scrutiny that is expected of a physics discipline. Avoiding conversions on these topics is not a good long-term strategy, nor a good look.

Technology is marching forward at an extreme pace. There is an overdue need to adapt to these changes to add tangible value to patient safety and clinical outcomes.

In my view, the best approach is for our profession to front-foot the changes and lead the migration of our practice further into the clinical and digital imaging domains.

Good health,
Brian Lunt.
Medical Physicist/Software Developer - Health Physics Services Ltd/MyXrayDose Ltd

Conflict Of Interest

I have been adapting my medical physics practice to better fit the changing radiology technology over several years and in the process have developed several commercial tools for medical physicists to work in the digital radiology domain including:

- *www.MyXrayDose.com - Large scale quantitative Image Quality and patient dose monitoring service*
- *LesionSim - Virtual Clinical Trial Software*
- *ViewIQ - Display Calibration Software*
- *GammaSim - Nuclear Medicine/PET shielding design and simulation software*

Physics Tools - Tools for individual system evaluation (my go-to list)

- BeyondCompare (My go-to Windows application for comparison of complex files).
- A DICOM inspection tool (e.g. ImageJ).
- A DICOM send node on PACS network to send sample images to.

There is some hope on the horizon in the form of a DICOM standard for technique protocol storage & exchange, though as far as I can tell it has had a slow adoption.

New Physics Tools - for systematic evaluation

- Large scale systematic monitoring of technique, dose and image quality data for all patients on all x-ray systems
- Virtual clinical trials.

Additional Physics Technical Skills

- Writing SQL/LINQ queries.
- Programming/scripting Image analysis (ChatGPT is my new friend here)

New Physics Management Skills

- Statistical process control

Change in Physics Practice

- Working more closely with imaging colleagues in the team, not from outside.
- Letting clinical colleagues set physics/image quality project priorities.

POINT/COUNTERPOINT

As always, counter/supporting views and respectful discussions are welcomed. If you would like to respond to this article, send your correspondence to the newsletter editor at Grace.Healy@cdhb.health.nz or to the author at BrianLunt@HealthPhysics.co.nz. Responses can also be included in the November newsletter.

HIDDEN VARIABLES - ANSWERS

The following is reproduced from physicsworld.com. Thank you Alicia for the submission.

Here are the answers to the cryptic word search, created by Ian Randall.

T	C	H	Y	H	P	A	R	G	O	M	O	T	E
A	I	P	P	P	H	A	N	T	O	M	D	B	G
P	N	L	A	P	O	S	I	T	R	O	N	R	N
I	I	I	R	C	A	X	P	T	T	I	U	A	I
D	L	M	E	O	N	R	S	I	B	D	O	G	N
E	C	A	H	O	O	A	F	S	O	P	S	G	N
T	H	G	T	T	M	Y	Y	S	L	G	A	P	A
E	P	I	O	S	I	R	I	U	U	C	R	E	L
C	A	N	I	L	S	M	I	E	S	T	T	A	P
T	T	G	D	O	E	N	I	D	O	I	L	K	Y
O	I	C	A	T	S	C	A	N	H	E	U	A	L
R	E	T	R	E	V	I	T	A	I	L	L	A	P
H	N	Y	C	A	R	C	O	N	T	R	A	S	T
E	T	C	I	T	C	A	T	O	E	R	E	T	S

Wireless put hit music in pronoun, killing cancer cells [RADIOTHERAPY]
Exposure measurement? Note sounds like beautiful proportion [DOSIMETRY]
Particle physicists rarely order tapas or nachos, initially [PROTON]
Röntgen's discovery in complex rayon [XRAY]
Speakers' gambit locates part of the body [STEREOTACTIC]
See inside my body? Even smarties back off [MRI]
Fudge portions are used in three-dimensional imaging [POSITRON]
Long-suffering hospital visitor [PATIENT]
Angular momentum pinches to the left [SPIN]
Cathode ray tube, for example, central to Kremlin accessories [LINAC]
Medical physics technique? I'm getting older without direction [IMAGING]
Slicing method put right? OMG, a trophy! [TOMOGRAPHY]
Use scant computed tomography procedure [CAT SCAN]
Sonogram is extremely stable [ULTRASOUND]
Bonobo lust conceals tissue equivalent [BOLUS]
We hear crow mountaintop is where protons stop travelling [BRAGG PEAK]
Tune your imager with spirit [PHANTOM]
Providing relief by cooking pie at villa [PALLIATIVE]
Dull American colour is absorbed unit [GRAY]
Norse god inside? That is I! [IODINE]
Turncoat trades France for a model, device discerns [DETECTOR]
Yeti's suede, at its heart, is flesh [TISSUE]
Scheduling dose modelling [PLANNING]
Agent for difference [CONTRAST]
Surgery, detached, ejects gangster [CLINIC]

BONUS [THE APPLICATION OF PHYSICS TO HEALTHCARE]