



the  
**Move**  
is **On**

*To prevent falls in the elderly and those with neurological conditions by studying human movement...p.4*

ILLAWARRA HEALTH AND MEDICAL RESEARCH INSTITUTE  
**RESEARCH MATTERS**

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IHMRI is a joint initiative of the Illawarra Shoalhaven Local Health District and the University of Wollongong

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## Illawarra Cancer Carers thank-you

Cancer researchers Professor Marie Ranson and Dr Kara Perrow recently took the opportunity to formally thank The Illawarra Cancer Carers for their help, over many years, in raising funds for cancer research (see page 3).

The group donated \$15,000 to help purchase a \$140,000 Incucyte ZOOM machine, recently installed in IHMRI's laboratories, which allows the real-time imaging of live cells which can then be manipulated in various ways or treated with some of the drugs in development.

Members of The Illawarra Cancer Carers visited IHMRI for morning tea and to learn more about Professor Ranson and Dr Perrow's current research and how the Incucyte ZOOM has dramatically improved their work practices.

"The Incucyte comes with a range of very sophisticated software for image analysis and quantification, allowing us to track cellular behaviour through time," Professor Ranson said.

"This then enables us to perform experiments which are impossible to do with existing equipment. We are already generating great data with this machine."

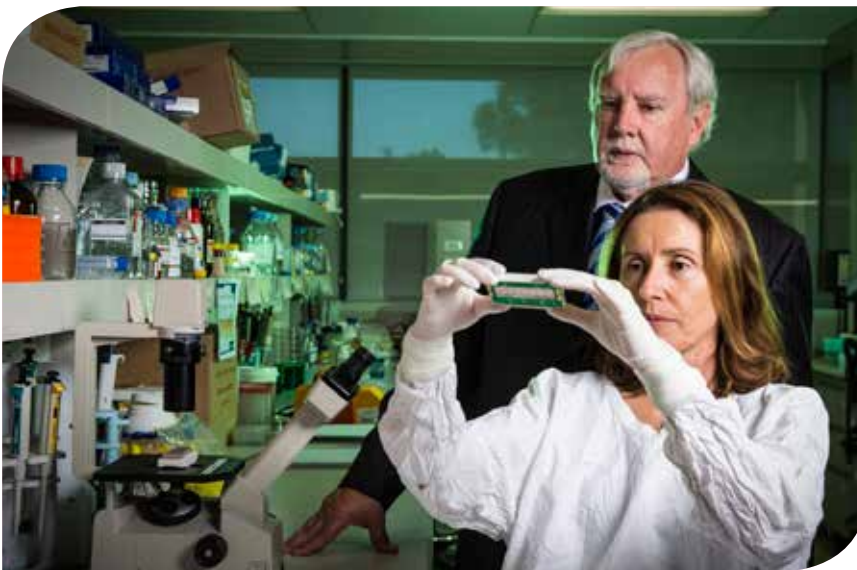
The Illawarra Cancer Carers not only raises funds but trains volunteers to work in conjunction with Illawarra Shoalhaven Local Health District medical staff to offer practical, emotional and physical support to cancer patients and their families.

IHMRI would also like to extend its thanks to The Illawarra Cancer Carers. If you would like to donate to IHMRI's research, visit: [www.givenow.com.au/ihmri](http://www.givenow.com.au/ihmri)



Professor Marie Ranson (front) and Dr Kara Perrow (behind) take members of The Illawarra Cancer Carers on a tour of IHMRI's laboratories.

# Anti-cancer formulation begins clinical trial



Cancer researchers, Professors Philip Clingan and Marie Ranson celebrate the culmination of several years' work as their new drug, Deflexifol, is approved for a phase 1 clinical trial in the Illawarra.

*It may have been several years in the making, but in a first for the Illawarra, a new drug developed by IHMRI-affiliated researchers for the treatment of metastatic colorectal cancer (mCRC) and other cancers has begun a phase 1 clinical trial in humans to determine a safe dosage and identify any possible side effects.*

The Wollongong trial is the culmination of a long-term research project led by Professors Marie Ranson, Philip Clingan and John Bremner. The resulting drug, called Deflexifol, has the potential to overcome key adverse events associated with current mCRC treatment regimens and performed very well in pre-clinical testing.

Deflexifol was licensed in 2012 to drug development company, FivePhusion, which obtained the necessary approvals to test the drug in humans and is

conducting the phase 1 trial at the Southern Medical Day Care Centre and Liverpool Hospital (it is only available to patients who have failed all other available treatment options and is not for patients on active treatment).

"Many colorectal cancer patients cannot tolerate existing 'standard of care' treatments which leads to interruption or discontinuation of therapy," said Professor Clingan, a local oncologist.

"The main benefit of Deflexifol is the ability to deliver an effective chemotherapeutic regimen which patients can tolerate over repeated treatment cycles."

To date, treated patients are tolerating Deflexifol well.

Professor Ranson said the progress was heartening. "As a cancer researcher, it is very rewarding to see our drug make it from the laboratory bench to the clinic. This has only been possible with the faith and funding from local charities, as well as government funding. I can only hope that Deflexifol performs as well in humans as it has done in pre-clinical trials; in any case, a precedent has now been set for translational research from benchtop to the patient in the Illawarra."

The project received financial support from many local organisations including The Illawarra Cancer Carers, Kiama, Minnamurra and Gerringong Sunrise Rotary, The Robert East Memorial Fund, Southern Medical Day Care Centre, the Gay Bates Memorial Foundation and UOW Alumni. The project also received funding through the National Health and Medical Research Council and AusIndustry's COMET scheme.

Several other IHMRI/UOW collaborators played an important role in the early phases of Deflexifol's development. They include biologists, Dr Kara Perrow and Dr Samantha Stutchbury, medicinal chemist, Dr Julie Locke and Commercialisation Manager, Dr Gavin Dixon.



# The move is on to prevent falls



A/Prof Paul Stapley and participant.

*It may sound rather daunting, and some of the equipment certainly looks peculiar, but researchers in the Neural Control of Movement Laboratory are conducting experiments into an area that everyone cares deeply about – how to prevent falls in the elderly and those with neurological disorders such as stroke.*

Led by Associate Professor Paul Stapley and involving a large cohort of Higher Degree Research (HDR) students, as well as national/international collaborators, the laboratory occupies a large room in IHMRI's headquarters and features several pieces of strange equipment including a state-of-the-art Vicon 3D Motion Capture System and 360-degree light array that enables the researchers to track, in very fine detail, how people move when reaching, touching or grasping objects.

By analysing how people coordinate voluntary movement and balance, the team hope to identify patterns that could be improved or refined to reduce risk as people age, or to help those suffering neurological disorders.

With Dr John Carmody, a Senior Staff Specialist at Wollongong Hospital, Dr Darryl McAndrew (UOW Graduate School of Medicine), and Associate Professor Stephen Palmisano (Psychology) the team have been working with local stroke patients to understand how the central nervous system (CNS) controls movement and balance. In these studies, they measure postural muscles during multi-directional arm movements in different directions while the person is standing.

"To date and with funding from IHMRI, we have been able to collect data from a large cohort of elderly participants and local volunteers who have suffered a stroke within the past few years," explained A/Prof Stapley.

"The information acquired from these testing sessions, which have taken over nine months, will be used to formulate long-term strategies of exercises that can be prescribed to the elderly to reduce their risk of falling by focusing on the consequences of expected and unexpected movements of the limbs while standing.

"In the stroke population, we hope to eventually implement non-invasive brain stimulation to possibly re-awaken the areas of the brain affected to improve both movement and balance."

A/Prof Stapley is also examining the effects of posture (standing vs sitting) on the control of eye movements in the elderly, with initial results showing that the standing position actually slows the person's ability to fixate on a new target appearing in their visual field.

"This effect is not seen in the young and may mean that the ability to correct arm movements when standing; for example grasping a moving object, is impaired because they have trouble fixating on the target," he explained.

The results of several other studies recently conducted in the laboratory have been submitted to international journals.

In the *Journal of Neurophysiology*, the team described how the elderly struggle to make the necessary postural adjustments before changing their arm movement and therefore often miss their target or goal (ie, picking up a cup of tea). They will soon also test how the elderly control for unexpected perturbations to balance as well.

"My hypothesis is that the elderly lose the ability to predict the dynamic effects of their own movements and become unstable as a result. The implications of this may be far-reaching in terms of providing specialised rehab services with focused areas of balance to work on."

In another paper to be submitted to *Experimental Brain Research*, A/Prof Stapley and HDR student, Alexander Stamenkovic, found that, when young people reach in multiple directions, the CNS actually produces coordinated trunk muscle activity before the movement begins, thereby 'driving' the body towards the target, rather than ensuring stabilisation.

"This somewhat goes against traditional theory and suggests that the trunk segment is part-and-parcel of the movement when standing. Again, we will use this model to test if the elderly demonstrate a similar pattern, or if they use the trunk in another manner.

"Even though these experiments are very time-intensive and require the active participation of volunteers, progress has been excellent."

If you would like to volunteer for any of these studies, phone: 02 4239 2514 or email [pstapley@uow.edu.au](mailto:pstapley@uow.edu.au).

# Next generation **condom** goes beyond the **pleasure zone**

*It was sure to generate a lot of press; stories about sex usually do. Indeed, a group of IHMRI-affiliated researchers attracted international media attention by showing the world a next generation condom which, they claim, could “significantly preserve or enhance pleasure in order to improve uptake and regular use”.*

But that’s only half of the story. The condom (known as the Geldom) is also designed to help people in developing countries access better birth control and limit the spread of sexually transmitted infections (STIs) by providing better protection and, potentially, by delivering drugs directly through the innovative material.

The condom is made from tough hydrogels, which are part water and part polymer and completely safe, being used in everyday products like contact lenses and food packaging.

Led by Dr Robert Gorkin, a biomedical engineer and Research Fellow at the Intelligent Polymer Research Institute (IPRI), the project has been made possible through the Bill & Melinda Gates Foundation, which offered grants in 2013/14 to any research group which could develop a “better-feeling” condom.

Dr Gorkin and his colleagues had been testing hydrogels for use in 3D-printed bionics and human prosthetics and found that by varying the basic ingredients they could “dramatically alter the properties of the material to make the texture more like human tissue”.

The \$US100,000 foundation grant was further boosted with a UOW Global Challenges grant to allow the team to pursue further research.

“This project is a great demonstration of IHMRI’s capacity to bring multidisciplinary teams together to find innovative solutions; in this case expertise from the fields of biomedical engineering, materials science, industrial design and population health,” Dr Gorkin told *Research Matters*.

“For example, we wouldn’t have been able to ensure that the condom provides a biological barrier without the guidance of Dr Jason McArthur, an IHMRI-based molecular microbiologist who is investigating the pathogenesis of bacterial skin infections and the application of transdermal delivery techniques to antimicrobial compounds.”

The team also includes Dr Sina Naficy, a polymer scientist at IPRI, Dr Chris Magee, a health and social psychology researcher from the UOW’s Centre for Health Initiatives, Dr Gianni Renda and Bridgette Engeler Newbury from Swinburne University’s Centre for Design Innovation, IHMRI post-doctoral researcher, Dr Simon Cook (who, Dr Gorkin says, “has done a lot of the grunt work on the project”) and Honours student, Alysa Carter.

IHMRI and IPRI’s laboratories have been used for testing and a partnership grant has also enabled the Sydney-based company Enersol, which tests male and female condoms, gloves, syringes and other medical devices, to support the project through the various stages of testing to ISO standards.

The team have moved out of the “pleasure zone” to take a more medical approach to the issue and is looking at how the hydrogel materials can be loaded with anti-viral compounds which may provide further protection from STIs for people in high risk groups.

“The ability of the hydrogel to act as a delivery platform could also allow integration of lubricants and even sensation agents into the condom itself, instead of as a coating,” added Dr Gorkin.



*IHMRI-affiliated researcher, Dr Robert Gordon, leads the Geldom project.*

The condom was recently featured on ABC TV’s Catalyst program, with Dr Gorkin telling viewers that due to the tactile nature of the material, it may enhance sensation during sex, compared to traditional condoms.

It may take some time to complete the experiments and for the product to be commercialised, but it does appear that the team are onto something special.

To find out more, visit <http://projectgeldom.com/> or [@projectGELdom](https://twitter.com/projectGELdom)



*Post-doctoral researcher, Dr Simon Cook, examines the strength of the hydrogel material.*

# 3D drug delivery - the future of cancer treatment?

*IHMRI's stated position – that the best way to solve complex health and medical issues is by bringing multidisciplinary teams together to look at problems from different angles - is being born out in a novel project that may change the way pancreatic cancer is treated.*

With expertise in molecular biology, anti-cancer drug development and delivery, advanced material fabrication and clinical management, a team of IHMRI-affiliated researchers have come together to develop a degradable 3D drug-delivering polymeric structure that may be able to target difficult to treat or incurable tumours.

"Despite advances in cancer screening, diagnosis and therapy, pancreatic cancer remains a highly malignant disease with a poor prognosis," explained Dr Kara Perrow, who is working with Dr Jarvad Foroughi (UOW Intelligent Polymer Research Institute), Associate Professor Morteza Aghmesheh (Illawarra Shoalhaven Local Health District) and Professor Simon Moulton (Swinburne University) on the project.

"For all stages combined, the one and five-year relative survival rates are 25 per cent and six per cent respectively. For local disease, the five-year survival rate is around 20 per cent, while the median survival rate for locally advanced and for metastatic disease, which collectively represent over 80 per cent of individuals, is about 10 and six months respectively."

Dr Perrow said that surgery remains the only curative option, but unfortunately more than 80 per cent of patients present with cancer that is not surgically removable.

Their drug delivery system will be surgically-implanted directly at the site of the tumour using minimally

invasive, image-guided placement, or alternatively, be implanted via laparoscopy. The implantable device will deliver two chemotherapeutic drugs to reduce the tumour burden.

"This novel drug delivery strategy is expected to convert non-surgically removable pancreatic cancer cases to removable cases which, if successful, will improve patient survival rates," added Dr Perrow.

The team have already demonstrated that drug-loaded fibres can significantly inhibit the growth of pancreatic multicellular tumour spheroids (a 3D model system that more accurately recapitulates a tumour in the body) over a two-week period.

## Study examines 12 years' worth of data to map health risk

The SIMLR Cohort Study is a unique, Illawarra-based initiative which aims to geographically map health risk factors in the region over many years to assist with health service planning to improve the long-term health of the community.

The project had its genesis in discussions arising from IHMRI networking events and has since developed into strategic population health research initiative between IHMRI and Southern. IML Pathology, a Wollongong-based laboratory servicing general practitioners, medical specialists, nursing homes and private hospitals.

The project utilises a large, longitudinal community-derived database of objectively measured Body Mass Index indicators and routinely-collected

pathology tests (ie, serum lipid levels, diabetes and kidney function) from Illawarra Shoalhaven residents aged over 18.

These data have been collected by Southern.IML Pathology in routine practice since 1 January 2003 and are de-identified and linked to a code using a geographic information system. This enables the researchers to examine the geographic clustering of health risk factors. The information is also linked to publicly-available datasets and health service location data.

The results are yet to be released, but the plan is to refresh the data annually for the duration of the data licence period (up to ten years), providing the basis of a large-scale population health cohort study.

The foundation research team included Professor Don Iverson, Dr Steven Anderson, Dr Lawrie Bott, Mr Bryan Jones and Professor Peter Caputi. It also included Darren Mayne and Professor Andrew Bonney, who now lead the project and are supported by a strong governance framework to ensure privacy and security safeguards are in place.

IHMRI-affiliated researchers with an interest in population health research may be able to access the data, provided their research aligns with the goals of the SIMLR Cohort Study.

Contact Prof Bonney on T: 02 4221 5819 or E: [abonney@uow.edu.au](mailto:abonney@uow.edu.au) for details.

# Mixed **messages** around **nutrition** during **pregnancy**



Photo with thanks to Jamie Baker via Flickr

*Ensuring that Australian women get reliable and accurate information on what's best to eat when they are pregnant is something that Associate Professor Karen Charlton has become increasingly concerned about.*

A/Prof Charlton recently wrote a piece entitled: "Don't judge pregnant women, give them good nutrition advice" for *The Conversation*. In it she claimed that women are becoming confused and anxious about their diet because they receive conflicting information from antenatal clinics and mixed messages from their healthcare providers, the media and the internet.

As she noted, good nutrition in pregnancy can set babies up for lifelong health, with research suggesting that low birth weight babies who are later exposed to excess food are more prone to developing diabetes, hypertension and

heart disease in adulthood. There also appears to be a link between women eating too much in pregnancy and an increased risk of chronic disease in adulthood.

In fact, Australian women receive a lot of nutrition-related advice during pregnancy but, according to A/Prof Charlton, much of it is confusing.

One of the examples she gave was about material given out in antenatal clinics emphasising the risks of eating fish and seafood because of concerns about food safety and the detrimental effects of mercury.

She said that there is good evidence that consuming fish and seafood is beneficial. In fact, with fellow academic Dr Anne McMahon and their research students, Phoebe Starling and Catherine Lucas, A/Prof Charlton recently conducted a systematic review of the evidence regarding fish intake during pregnancy and foetal neurodevelopment.

The paper, published in the journal *Nutrients*, examined seven cohort studies which demonstrated an association between consumption of one or more servings of fish per week during pregnancy and better offspring neurodevelopment. Six of those studies demonstrated a benefit; the seventh reported a neutral effect.

"The six studies showing benefits involved follow-up studies ranging from six months to nine years, whereas the seventh study involved infants at just three days old, which indicates that longer follow-up may be needed to determine significant associations," said A/Prof Charlton.

"The Australian Government's dietary guideline, of two to three servings of fish per week, is particularly important for women during pregnancy. Fish and seafood provide good sources of protein, omega-3 polyunsaturated fatty acids and iodine. However, women need clear advice on safe choices from this food group."

In related research, A/Prof Charlton has also been examining how much women, pharmacists and GPs know about folic acid and good iodine intake in pregnancy.

In a paper published in *Pharmacy Practice and Research*, she surveyed 41 community pharmacists finding that,

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while they had good understanding about the need for folic acid during pregnancy, 73 per cent did not know the National Health and Medical Research Council's recommendation of 150 micrograms a day for iodine for the duration of pregnancy. Their knowledge about the mandatory fortification program and dietary sources of both folic acid and iodine was also limited.

In the *Australian and New Zealand Journal of Obstetrics and Gynaecology*, she also reported that women participating in antenatal shared care (where they are cared for by their obstetrician or antenatal midwife service in conjunction with their GP) had poor knowledge about the importance and role of iodine in pregnancy, with just 26 per cent of GPs discussing supplementation with their pregnant patients.

A/Prof Charlton's research has led her to conclude that more needs to be done to educate pregnant women about nutrition and what supplements they should be taking. Last year, in the journal *Maternal and Child Health*, the team reported that,

based on a literature review, antenatal care is missing valuable opportunities to educate women about nutrition.

"If we're going to help pregnant women ensure they're eating right for themselves and their babies, we need to start by educating the health professionals they encounter throughout their pregnancies.

This guidance should address myths about food risks and emphasise trustworthy sources of information," said A/Prof Charlton.

With Dr McMahon and PhD candidate, Catherine Lucas, A/Prof Charlton is now working with midwives at the Wollongong Hospital to develop professional education workshops to address this important gap.

*These projects have, in part, been funded through Catherine Lucas's UOW Global Challenges research scholarship. The research team wishes to thank the dedicated research students who assisted with the projects below.*

"Fish intake during pregnancy and foetal neurodevelopment—A systematic review of the evidence" was published by Phoebe Starling, A/Prof Charlton, Dr Anne McMahon and Catherine Lucas in *Nutrients*.

"Folic acid and iodine supplementation during pregnancy: how much do pharmacists know and which products are readily available?" was published by Souad Elmani, Dr Judy Mullan, A/Prof Charlton and Professor Vicky Flood in *Pharmacy Practice and Research*.

"Antenatal shared care: Are pregnant women being adequately informed about iodine and nutritional supplementation?" was published by Catherine Lucas, A/Prof Charlton, Lucy Brown, Erin Brock and Leanne Cummings in the *Australian and New Zealand Journal of Obstetrics and Gynaecology*.

"Nutrition advice during pregnancy: do women receive it and can health professionals provide it?" was published by Catherine Lucas, A/Prof Charlton and Professor Heather Yeatman in *Maternal Child Health*.

"Limited knowledge about folic acid and iodine nutrition in pregnant women reflected in supplementation practices" was published by Souad Elmani, Dr Judy Mullan, A/Prof Charlton and Professor Vicky Flood in *Nutrition & Dietetics*.



## Community awareness of IHMRI brand grows

The recent \$200M expansion of Wollongong Central has brought a flood of local residents back into the city. One of the most popular new eateries, Grill'd, recently helped to raise funds for IHMRI research through its "Local Matters" community donation program. Every month, Grill'd selects three community groups and encourages its customers to support them by placing tokens in glass jars.

IHMRI recently "won" its round, with Grill'd customers filling three jars full of tokens, resulting in a \$300 donation that will be pooled with other funds to support the next round of IHMRI project grants.

IHMRI would like to thank Grill'd – and the local community – for their support.

**\*IRIS Research was recently commissioned by IHMRI to conduct a community awareness survey with 400 local residents. When asked, "Have you heard of the Illawarra Health and Medical Research Institute on the University of Wollongong campus?" 28 per cent stated "yes" – a promising finding given that IHMRI is still a relatively young institute.**



# Community gets behind healthy lifestyle study

The Illawarra community's support for the HealthTrack Illawarra-Shoalhaven Healthy Lifestyle study has resulted in 100 per cent recruitment in just 10 months, with over 700 local residents contacting IHMRI to learn more about the 12-month lifestyle program which is comparing different approaches to helping people lose weight, improve their lifestyle and, hopefully, lower their risk of developing chronic disease.

Six hundred and twenty residents aged between 25 and 54 have now completed the HealthTrack survey, which will provide the HealthTrack team with a snapshot of chronic disease risk in the region. From this group, 377 people were screened as eligible to participate in the 12-month randomised controlled trial, with all now visiting IHMRI's Clinical Research and Trials Unit on a regular basis for check-ups and guidance on how to stick to their goals.

Rather than focusing on diet alone, the IHMRI-funded study brings a multidisciplinary team of academics and clinicians from the disciplines of medicine, dietetics, exercise science, psychology, nursing, statistics and public health together with the local community. HealthTrack specialists provide advice and support on diet, exercise and other barriers to good health.

HealthTrack's Scientific Leader, Professor Linda Tapsell, said that the researchers set out to break new ground in tackling one of the most intractable issues facing the community.

"Lifestyle related diseases such as overweight, type 2 diabetes and heart disease represent a complex problem for researchers, healthcare providers and the community at large," she said.

"Before we launched the study in May 2014, we invested a considerable amount of time analysing the problem



*The HealthTrack team includes (l to r): Research Fellow, Dr Allison Humphries, Clinical Trial Manager, Rebecca Thorne, Project Administrator, Jodi Barrie, Clinical Leader, Professor Maureen Lonergan, Accredited Practising Dietitian, Nikki Linolli, and Scientific Leader, Senior Professor Linda Tapsell.*

and working out what we could do in the Illawarra, drawing on our strengths and experiences. We conducted pilot studies to test design elements and worked together across many disciplines to develop the protocol and materials for participants. There were disappointments along the way as some ideas did not work out, but the teamwork has been commendable and has grown in strength over time."

In fact, she said that the study has demonstrated how well IHMRI-affiliated researchers can work with Illawarra Shoalhaven Local Health District (ISLHD) clinicians for the benefit of the community.

"It is this teamwork that has helped us recruit over 360 participants in under a year - a great achievement and a credit to all," added Prof Tapsell.

Local councils and the business community have also supported the study by publicising it within their networks. This includes organisations such as the Illawarra Business Chamber, Peoplecare, *The Illawarra Mercury*,

Catholic Education Illawarra, the Novotel, Wollongong Local Area Police Command, iPrime News, i98FM, Department of Education Illawarra, Warrigal Care, IRT, Bluescope Steel, Grand Pacific Health, UOW, ISLHD, *Kiama Independent*, *Wollongong Advertiser*, *South Coast Register*, *Nowra News*, *Lake Times*, Woolyungah Indigenous Centre, Wave FM, Beaton Park Leisure Centre, Illawarra Diabetes Service and Healthy Cities Illawarra.

Analysis of baseline data will commence in May 2015 with study follow-ups concluding in April 2016. The primary outcome for measuring effectiveness of the study is weight loss, but the team is also working with the community to determine how achievements in this area might be sustained long term.

"HealthTrack is the first study to take such an integrated approach and we are very much looking forward to seeing the results. We are also hoping to develop a strategy that can be used as a model Australia-wide," concluded Prof Tapsell.

# Healing with radiation physics



Senior Professor Anatoly Rozenfeld, MSc PhD, renowned physicist and Director of the Centre for Medical Radiation Physics

*Despite being one of Australia's most respected medical radiation physicists and someone who has worked tirelessly to build an international reputation for the IHMRI-affiliated Centre for Medical Radiation Physics (CMRP), Senior Professor Anatoly Rozenfeld's story remains largely untold.*

There are a couple of reasons for this. The first is that the sociable 60-something Ukrainian scientist is simply so busy running the CMRP that he hardly has time for interviews. Indeed the centre, which he founded with just a few full-time staff has grown to become an internationally-renowned institution with 18 academics and research fellows, more than 70 Higher Degree Research (HDR) students and 25 Adjunct Professors and Research Fellows from overseas institutions and all of the region's major hospitals and oncology units.

The centre also has active collaborations with 26 national and international institutes, including the European Organization for Nuclear Research (CERN), National Space Biomedical Research Institute (US), Massachusetts General Hospital (US), Harvard Medical School (US), Memorial Sloan Kettering Cancer Centre (US) and European Synchrotron Radiation Facility.

The other reason is that his field – medical radiation physics – is highly technical and doesn't lend itself to easy writing, or reading.

That said, his personal story, and how he ended up leading the CMRP is fascinating and tells you something about how he has managed to build the centre, which now attracts some of the world's brightest minds.

It all started 23 years ago when the Ukrainian physicist was in Moscow for business. While walking down a busy street contemplating his future, he noticed an Australian Embassy and decided to walk in and give them his CV, which listed qualifications from the prestigious Leningrad Polytechnic Institute (now Saint Petersburg State Polytechnical University) and Kiev Institute for Nuclear Research, where he gained 15 years' experience in radiation physics.

Embassy staff politely told him that they couldn't find him a job, but that he should definitely consider emigrating, as there were plenty of opportunities for skilled migrants in Australia.

His first port of call after arriving in Sydney was the Australian Nuclear Science and Technology Organisation (ANSTO) where he was offered a consulting position by

Professor Barry Allen. He collaborated with ANSTO's radiation medical physics scientists for six months, gaining a good understanding of the academic – and cultural – landscape of Australia.

It wasn't long before he was offered a lectureship appointment with School of Physics at the University of Wollongong with a special task to develop education and research programs in medical radiation physics. It was from this initial Australian springboard that he spotted an opportunity to establish a dedicated centre for medical radiation physics; one that could bring talented physicists, engineers and graduate students from all around the world together to develop new-generation devices and technologies to detect radiation and apply that to diagnose and safely treat cancer.

By now the UOW was aware of his talent as a radiation physicist, leader and mentor, agreeing to support his vision of founding and developing the CMRP.

"What I said to them was that, while there is a lot of fantastic research going on in places like ANSTO and in the universities around Australia, there needs to be more synergy between universities, the health system and industry to ensure that the basic research has clinical and commercial applications which, in turn, will have a positive impact on human health," Prof Rozenfeld told *ResearchMatters*.

Today the CMRP not only works with academics and industry groups, but has an extensive network of collaborating clinicians from oncology centres around Australia, as well as local centres such as the Illawarra Cancer Care Centre, St George Cancer Care Centre, Prince of Wales Hospital, Liverpool Hospital and associated Ingham Institute.

CMRP projects cover the full spectrum of fundamental and applied medical physics, from radiation detection and instrumentation to radiation transport simulations on micro and nano-scales and radiobiology/radiation physics of nanoparticles - all with applications in contemporary radiation therapy, including charged particle therapy and cancer diagnostics.

Examples include cheap, portable silicon-based microdosimeters which can measure radiation doses on a cellular level (in proton and heavy ion therapy), silicon mini dosimeters for synchrotron microbeam radiation therapies and many other radiation detectors to improve the safety and efficiency of cancer treatments.

The CMRP now leads Australia in the development of innovative Quality Assurance (QA) tools and techniques and holds several granted patents, including a recent US patent awarded to Prof Rozenfeld and Associate Professor Michael Lerch (see page 14) for a compact and inexpensive probe that can pinpoint the presence of cancerous tissue in the body. Another US, China and European patent has also been awarded to Prof Rozenfeld for radiation detection technology covering a wide range of applications in QA in radiation therapy.

While the main focus of activity is on the development of radiation therapy and radiation measurement techniques, CMRP researchers are also working in other radiation environments, including homeland security, aviation and space.

For example, the CMRP's portable silicon-based microdosimeter devices are being tested in deep space and low earth orbit space radiation environments to predict the effects of cosmic radiation on NASA astronauts and jet pilots.

From those early days, Prof Rozenfeld continues to maintain a strong and successful collaboration with ANSTO and is currently involved in projects investigating microdosimetry for space and hadron therapy (shooting charged particles at tumours), positron emission tomography (PET) medical imaging, neutron science and, recently, reactor dosimetry.

"Many years of CMRP research in the US and France on a new kind of radiation treatment that uses a uniplanar array of synchrotron X-ray microbeams have now been successfully translated to the Australian Synchrotron facility in Melbourne, including dose mapping in tumours with micron spatial resolution," he explained.

Other areas of study include neutron dosimetry and the use of Monte Carlo techniques, including GEANT4: a toolkit describing the interactions of particles with matter that is widely used to investigate and improve radiotherapy treatments, optimise detector technology and investigate new diagnostic imaging solutions.

The CMRP's international reputation saw it invited to be a partner in Europe's prestigious Seventh Framework Program Marie Curie Actions and CERN's Advanced Radiation Dosimetry European Network Training (ARDENT) initiative which has already enabled three CMRP PhD students to work in prestigious European institutions. The CMRP is the only international partner in a new European Network Training grant submitted recently by CERN.

Prof Rozenfeld says that, as a mentor, it has "been a great pleasure to train and work with young and enthusiastic students, look after their bright futures and enjoy their success. CMRP research students are working all over the world and CMRP members and PhD students are also regularly invited to present at major international conferences, which is very strong recognition for Wollongong".

CMRP publications are many and varied. From the beginning of 2014, 39 peer-reviewed papers have been published in prestigious journals such as *IEEE Transaction on Nuclear Science*, *Medical Physics*, *Physics in Medicine and Biology*, *International Journal of Radiation Oncology Biology and Physics (Red Journal)*, *Radiotherapy and Oncology (Green Journal)*, *Materials Letters* and *Nanomedicine*.

"After 18 years of hard work, we are finally reaping the rewards, with more patents and more intellectual property that will benefit the university and individuals with cancer for years to come," said Prof Rozenfeld.

"The mutual trust we have with our collaborators is critical to our ability to deliver next generation products. While we still face many challenges, such as long approvals for new medical devices and funding, particularly when we are competing with centres that receive huge amounts of funding, in some ways our size makes us more adaptable and flexible to meeting the needs of the market.

"The CMRP's success is due to the team of dedicated and highly professional colleagues. I am proud of the team I was able to build."

# Are healthy omega-3s protecting our brains as we age?

*IHMRI researchers have found surprising evidence that the amount of health-giving omega-3 polyunsaturated fatty acids in the human brain doesn't decrease with age. It increases.*

The finding, published recently in the journal, *Neurobiology of Aging*, is the first to emerge from an IHMRI research program looking at the role that phospholipids play in ageing and Alzheimer's disease (AD). Phospholipids help to form membranes that surround each cell, separating its contents from the environment.

Significant changes in phospholipid levels have been identified in post mortem Alzheimer's brain tissue, yet almost nothing is known about changes in phospholipid composition in the brain over the adult lifespan.

Using tissue samples donated to the University of Sydney's NSW Tissue Resource Centre and recent advances in mass spectrometry, IHMRI PhD candidate, Sarah Hancock (nee Norris), examined age-related changes in the major phospholipids in the normal human prefrontal cortex over the adult lifespan.

By capturing this data the team, which included Postdoctoral Research Fellow, Dr Michael Friedrich, and leading Australian lipids researchers Associate Professor Todd Mitchell and Professors Roger Truscott and Paul Else, were able to compare the changes in healthy brains to those with AD.

"A diverse range of molecular phospholipids were found to undergo changes with normal adult ageing," explained Sarah.

"To our knowledge, this is the first time that these changes have been reported. The main finding was that phospholipids containing a type of omega-3 called docosahexaenoic acid, or DHA, increase slowly but steadily over the adult lifespan within the human prefrontal cortex.

"This surprised us initially as it seems counter-intuitive. However, we know that DHA has a number of roles within the brain and is considered a neuro-protective molecule. We also know that DHA increases considerably in the brain in the early years of life, but it was previously thought that the levels of DHA declined in the brain over the adult lifespan. Past studies have shown that the level of DHA within the brain is considerably decreased in AD."

The specific age-related changes observed in the study also suggest that individuals with higher amount of phospholipids containing DHA in their cellular membranes may have a longer lifespan.

"Ours was not a dietary study, and we are not making any claims in this area, but the findings certainly seems to add to the body of knowledge about the health benefits of consuming DHA from natural sources like fish," said Sarah.

"While we were unable to determine what is driving the increase, the findings emphasise how little we know about the human brain and what happens with age."

The study provides several phospholipids to target for future research into cellular ageing within the human brain.



IHMRI PhD candidate, Sarah Hancock, discovers that the amount of omega-3 in our brains increases as we age.

# ISLHD

releases first

## Annual Research Report



Professor Ian Wright, as profiled in the ISLHD's first-ever Annual Research Report.

breathing support for babies in special care nurseries. A team led by Dr Simon Binks and involving professionals from the Emergency and Radiology Department and PEERVUE are also designing speciality computer software to improve the quality and timeliness in the reporting of X-rays and CT scans.

ISLHD clinicians remain eager to strengthen links with IHMRI-affiliated researchers and build on a strong foundation to further develop a research culture within the Illawarra.

To learn more about the research being conducted within the ISLHD, link up with researchers in your area, or obtain a copy of the Annual Research Report, contact the Research Office on: 02 4253 4891.

*Compared to some of Australia's larger health districts, the Illawarra Shoalhaven Local Health District (ISLHD)'s research profile is still relatively low. However, this is not representative of the district's growing appetite to conduct and participate in research.*

In October 2014, Ms Margot Mains commenced her role as Chief Executive of the ISLHD and began formal efforts to inculcate more of a research culture within the ISLHD and to communicate her desire to position the district as a leader in developing programs and initiatives that improve health service delivery in the region.

Research support is now being provided through the ISLHD's dedicated Research Support Office, located on level 8 of Wollongong Hospital, with research management being led by Dr Marianna Milosavljevic.

Under her direction, the Research Central team has just put the finishing touches on their first-ever Annual Research Report, which reflects a surprisingly rich and diverse range of activities conducted in

2014 by staff members from medical, allied health and nursing professions, and from all experience levels and speciality areas.

It provides a summary of research activity across the district accompanied by short biographies of clinicians within each of the clinical streams, as well as notable research initiatives for 2015.

Significant achievements include a world-first study (EMBRACA), led by Professor Phil Clingan, investigating the BRCA mutation (genes which suppress tumours) in cancer patients at the Southern Medical Day Centre and the awarding of a \$1.3M NHMRC grant to the Ambulatory and Primary Health Care team for their falls prevention research. Professor Ian Wright is also participating in over 20 studies, including a trial investigating early



Dr Simon Binks is designing new software to improve reporting of X-rays and CT scans.

# Radiation-detecting diamonds shine in new cancer technology

*Researchers in the IHMRI-affiliated Centre for Medical Radiation Physics (CMRP) are passionate about translating basic research into technology with clinical and commercial applications (see profile, pg 10).*

Following several recent successes comes news that a novel idea conceived by CMRP researcher, Associate Professor Michael Lerch, has attracted a \$337,000 grant from the National Health and Medical Research Council (NHMRC) to further promising research into new sensor technology for radiation detection and dosimetry.

The project, which received funding through the NHMRC's Development Grants Scheme, builds on the success of a unique quality assurance (QA) system developed at the CMRP for X-ray treatment monitoring and dosimetry (X-Tream) in Synchrotron X-ray Microbeam Radiation Therapy (MRT). X-Tream is the first system in the world to demonstrate real-time treatment monitoring and dosimetry in an MRT radiation field.

The development of new methods and tools for the treatment of cancer is essential to combat the continued increase in the number of cancer cases in Australia. Radiotherapy is a very successful treatment modality, with more than 50 percent of cancer patients receiving some form of radiotherapy. However, the treatment of radio-resistant tumours remains a challenge for radiotherapy as the radiation dose required for tumour control leads to intolerable doses being received by the surrounding normal tissues.



Members of the IPRI team. Front row (l to r): Natalia Roberts (CMRP Honours student), Dr Jayde Livingstone (AS Research Fellow), A/Prof Michael Lerch. Middle row (l to r): Dr Alessandra Malaroda (CMRP Research Fellow) and Mitra Safavi-Naeini (CMRP/ANSTO joint Research Fellow). Back row (l to r): Sianne Oktaria (CMRP Research Fellow), Andrew Dipuglia (CMRP Honours student), Dr Daniel Hausermann (AS IMBL Beamline Scientist/Co-Chief Investigator on the NHMRC Development Grant), Elette Engels (CMRP Honours student), Dr Andrew Stevenson (CSIRO Scientist), Matthew Cameron (CMRP Honours student) and Dr Iwan Cornelius (CMRP/AS joint Research Fellow).

MRT is a radiation medicine modality originally proposed in the nineties for the treatment of children with inoperable and otherwise untreatable brain tumours. The modality is a conduit for the delivery of very high, yet biologically tolerable, therapeutic doses to macroscopic targets. The dose is delivered via intense, microscopically-wide X-ray beams generated by a synchrotron source. In 2007 the first such source was built in Australia.

National and international preclinical studies continue to show that MRT is a viable treatment option for radio-resistant cancers and, very recently, MRT has even shown promise as a therapeutic strategy to treat other neurological disorders such as epilepsy. The radiation-related QA of MRT is a completely new paradigm for radiotherapy in general and is therefore a major challenge in the clinical advancement of MRT.

Conceptualised by A/Prof Lerch, the new X-ray Real-time Active Tissue Equivalent (X-RATE) will be developed with Professor Anatoly Rozenfeld, Dr Marco Petasecca and Dr Susanna Guatelli "whose experience and expertise in R&D commercialisation, radiation electronics and radiation transport simulations are essential to the project", said A/Prof Lerch.

"In collaboration with our industrial partners, the Australian Synchrotron and the European Synchrotron Radiation Facility, the project aims to fill an important technological gap, which is necessary for the clinical implementation of MRT."

X-RATE utilises silicon-on-diamond semiconductor technology where both the silicon and the diamond components play an active role in the dosimeter's operation.

"Individually these materials have limitations in relation to radiation dosimetry, but when utilised together, they are able to compensate for these limitations. Moreover, the technology has the ability to mimic the response of human tissue in other radiation fields, which is very important for QA in MRT," added A/Prof Lerch.

"It is this ability that makes the X-RATE dosimeter such an exciting commercial prospect."

In pilot studies, X-RATE has shown significant promise. In this project, the team will prototype three different versions of X-RATE; each with increasing fabrication complexity, and develop a commercialisation strategy to implement the dosimeter in common clinical radiotherapy situations.

Several Higher Degree Research students and early career researchers associated with the project will gain valuable skills and national and international exposure through the testing and benchmarking of X-RATE's performance at various MRT facilities, including the Australian Synchrotron and the European Synchrotron Radiation Facility.

"The X-RATE project will make an important contribution to an exciting radiation medicine modality that is emerging from the scientific bench to the clinical bedside," concluded A/Prof Lerch.

"The novel high-end detector technology, which has a tuneable radiation response, is also expected to find applications in other mainstream radiation oncology modalities, including megavoltage photon therapy, proton therapy and heavy ion therapy. Such outcomes are consistent with other successful projects which represent the CMRP's high international standing, built up over the past 18 years under the leadership of Professor Rozenfeld."

## China collaboration attracts leading psychiatrist

As part of its ongoing collaboration with the Beijing Huilongguan Hospital in China, the IHMRI-based Centre for Translational Neuroscience (CTN), recently welcomed Associate Chief Psychiatrist/ Psychotherapist Dr Shaoxiao Yan to the fold.



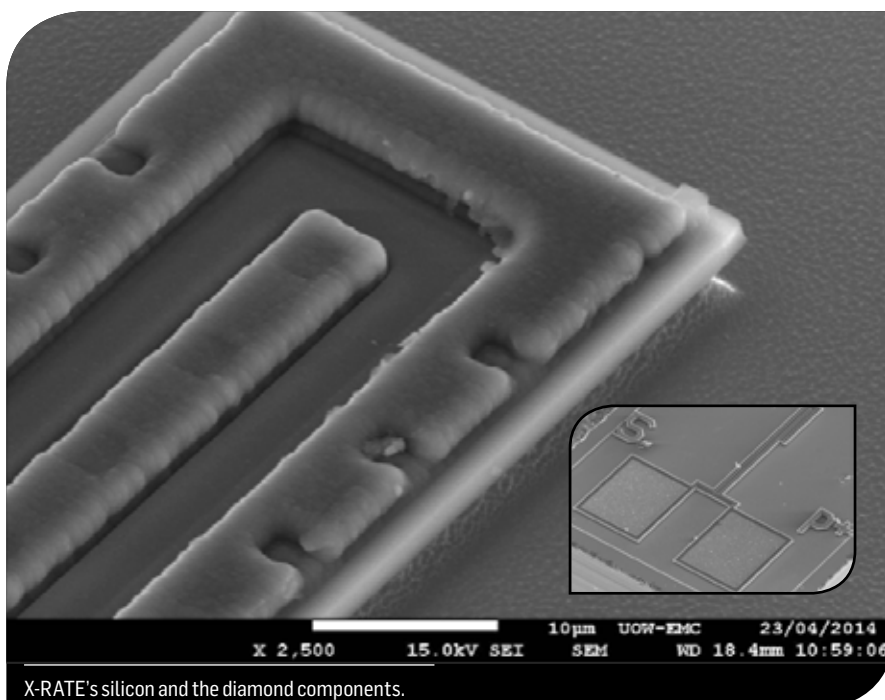
Dr Yan (above left) will spend six months at IHMRI furthering investigations into how to improve the cognitive function of people living with schizophrenia. Cognitive deficits, such as poor attention, verbal skills, memory, reasoning, decision-making and social cognition/emotional intelligence are found in almost all patients with schizophrenia and are an important cause of functional disability in this patient group.

Dr Yan will work closely with CTN Director, Senior Professor Xu-Feng Huang (above right), and a group of highly skilled researchers and students affiliated with IHMRI and the Schizophrenia Institute of Australia.

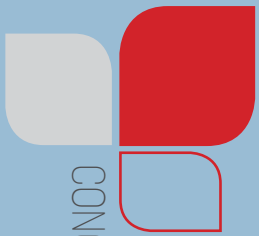
At the Beijing Huilongguan Hospital, which is the largest in northern China, Dr Yan sees thousands of patients each year and has developed a number of tools and techniques to assess cognition in this patient group.

"This collaboration will open a new avenue for possible clinical trials testing new compounds identified by IHMRI researchers," said Prof Huang.

"These kinds of international linkages increase our capability and speed of research. Cognitive deficit happens not only in schizophrenia but also in Alzheimer's disease, dementia and Parkinson's disease. We hope that the patients will benefit from our research."



X-RATE's silicon and the diamond components.



CONGRATULATIONS

## World Transformation Scholarship awarded

Congratulations to IHMRI PhD candidate, Benjamin Buckley, who recently received a University of Wollongong (UOW) World Transformation Scholarship and best poster prize at the First Australian Cancer and Metabolism Meeting, held at the Garvan Institute of Medical Research Institute in April.

Ben did well to win the UOW scholarship, given that selection is largely based on how well the applicant demonstrates their commitment to addressing the United Nations' Millennium Development Goals, which include eradicating extreme poverty and hunger, gender equality and women's empowerment, reduction of child mortality, improving maternal health, combating HIV/AIDS and other diseases, ensuring environmental sustainability and global partnerships for development.

Ben's work seeks to decrease the incidence and prevalence of tuberculosis in a specific target group, with the anti-tuberculosis side of his work aligning well with the UN's goals, supported by the UOW.

His best poster presentation prize was for his work entitled: Evolving Amiloride into anti-cancer drugs with dual modes of action.



*Dr Kelly Newell*



*Dr Katrina Green*

## Funding boost for young schizophrenia researchers

Early and mid-career researchers, Dr Kelly Newell and Dr Katrina Green continue to win recognition for their work investigating the underlying cause of, and possible treatment strategies for, schizophrenia and other mental illnesses.

Both researchers, who are affiliated with IHMRI and the Schizophrenia Research Institute, recently won Peter Meyer Grants from the Schizophrenia Fellowship of NSW. Dr Newell has published several important papers on the role of the glutamatergic system, which performs a variety of functions in the central and peripheral nervous system, which influences learning, memory, anxiety and other factors.

Dr Green is investigating new combinations of antipsychotic drugs with more efficacy and fewer side-effects, such as obesity and type 2 diabetes.

The grants were established by Peter Meyer's parents after Peter took his life at the age of 22 because of the torments of schizophrenia.

## Good governance the order of the day

Since IHMRI's inception, all commercial clinical trials conducted in the Clinical Research and Trials Unit (CRTU) have been overseen by a Governance Committee. Now, the CRTU is expanding the process to include Investigator Initiated Studies (IIS).

All research must be 'governed' to ensure that each project meets its objectives and conforms to relevant institutional, jurisdictional and national standards and applicable laws.

Previously the responsibility of the faculty/school supporting the study, the CRTU's new IIS process involves reviewing the proposed study to ensure

the research team, and IHMRI, have the resources to safely complete the study, that study staff have the required skills and participant safety is controlled.

Investigators and study coordinators will now be required to complete Good Clinical Practice to ensure that the responsibilities and accountabilities for individuals and groups are understood, enacted and maintained.

Quarterly reports and end of study reports will also be submitted to the Governance Committee to ensure there is adequate monitoring of the research and that financial probity, legal and regulatory matters, risk management

and good research practices are maintained.

"While there are many benefits to clinical research, it also has the potential to involve risk - to participants, institutions and the investigators themselves," said Clinical Research Services Coordinator, Sarah Amos.

"Good governance and the management of these risks ensure that our research meets the highest ethical, scientific, regulatory and professional standards and means that everyone can have confidence and trust in the research conducted at IHMRI."