

Regenerate

Issue 2 December 2014

Australian Regenerative Medicine Institute – Harnessing the natural powers of regeneration for healing and restoration

Nobel Prize winner Sir John Gurdon visits ARMI



Sir John Gurdon with ARMI's Peter Currie and Nadia Rosenthal and WEHI Director Doug Hilton.

Invited as part of ARMI's Fifth Anniversary Celebrations, Nobel laureate Sir John Gurdon enthralled an audience of over 300 people with tales of his ground-breaking work in cloning and his ongoing fascination in genetics, cell reprogramming and the future of stem cell research. At a presentation held at Monash University's Clayton campus, Dr Gurdon provided a fantastic opportunity for staff and students to hear insights from such an esteemed scientist.

Dr Gurdon was awarded the 2012 Nobel Prize for Physiology or Medicine, together with Professor Shinya Yamanaka, for their discovery that mature cells can be converted back into primitive cells capable of forming all cells in the body.

In experiments conducted in the 1960s, Dr Gurdon first demonstrated that it was possible to reset or reprogram cell fate by showing that a frog could be cloned from a tadpole's intestine – substantially changing how we view development and cell fate.

With thanks to Associate Prof Megan Munsie for this story.

However it wasn't until 40 years later that Professor Shinya Yamanaka was able to expand on Gurdon's work and develop a slightly different approach to reprogram mammalian cells to restore developmental capacity and create stem cells capable of developing into all the tissues of the body. Combined, their discoveries have made an important contribution to medical research and may lead to new medical treatments.

Reflecting on this important visit to ARMI, Director Professor Nadia Rosenthal said that Dr Gurdon was an inspiration. Not only had he contributed substantially to stem cell research, the fact that he pursued his passion for science despite being actively discouraged by his school teachers. Famously one teacher wrote in his mid term report "I believe he has ideas about becoming a scientist...this is quite ridiculous...it would be a sheer waste of time, both on his part, and of those who have to teach him." Luckily his teacher was proven wrong and Sir John decided to pursue his passion in science.

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The Director's Words

When the general populace think of scientific research, do they consider it a creative process? I am not sure they do. Yet creative ideas and insights are critical to moving science ahead. Any new endeavor in science contains elements of uncertainty and requires tolerance of contradictory findings. Sadly, current research funding systems around the world tend to encourage relatively safe projects that will provide only incremental advances and are not likely change things very much. That is why unconventional, creative ideas need to be fostered within our institutes, so that science can continue to profit from the benefits of risk.

At ARMI, we encourage unorthodox, invalidated approaches as a starting point for research projects, to leverage our most creative minds in attempting to solve the greatest challenges in regenerative medicine. It's a risky approach but it is paying off – our success is tangible in the quality of the publications we produce and the funding we attract.

Because younger, inexperienced scientists often generate the most creative and revolutionary breakthroughs in science, ARMI actively recruits early career scientists from different backgrounds, to work together on biomedical research that gains novelty and innovation from its diverse origins.

Creative scientists use a wide range of mental tools during problem solving, but in today's scientific environment, their ideas cannot be realized without the necessary physical tools and technical support. It's an iterative process, where the availability of a new technology can provide inspiration for a new research direction. ARMI provides state-of-the-art, purpose built infrastructure to support our talented scientists' most adventurous projects.

Community also contributes to creativity. The best scientific ideas may have their origins in the shower, but fleshing them out benefits from the feedback of colleagues in halls and seminar rooms. ARMI is situated at the heart of Monash University's lively and progressive biomedical hub, providing easy access to a variety of experts to offer advice and new insight into our work.

Although personality, perseverance and pure serendipity contribute to breakthrough moments in our research, conducive environments are also important to mental refreshment, shaking up our thinking patterns. At ARMI we have paid attention to the research environment at all levels. The institute's walls abound with colourful aboriginal artworks and hand designed

scientific posters.

Just ask any of our seminar speakers who typically remark not only on the art, but also on the feel of the institute's spaces. ARMI laboratories and office working spaces were designed specifically to encourage creativity as an integral part of the scientific process.



Finally, international connections and collaborations keep us current and inspired. Our adjunct Professors hail from Europe, Canada, and Asia, and we are committed to attracting future science leaders from all corners of the globe.

As the word spreads about the creative research at ARMI, we are getting the attention of students and postdoctoral fellows from around the world who would like to work with us. You will read some of their stories in this issue of Regenerate.

Real advances in science come from raising new questions, proposing new possibilities, finding new angles on old problems. If we recognize the innovative potential of creative imagination and cultivate it in our scientists, we can design change even in the most challenging environment. At ARMI, we are committed to supporting the opportunities our creative minds provide.

Prof Nadia Rosenthal

From the Editor Professor Peter Currie



Welcome to the summer edition of Regenerate and I am pleased to report in this, our fifth year of operation, there have been many highlights. My personal favorite was meeting the esteemed Nobel Laureate Sir John Gurdon for the first time face to face, as part of our anniversary celebrations and hearing first hand how his seminal studies came about and his thoughts about the development and direction of the field of regenerative medicine as a whole.

However, Dr Gurdon was just one of eighteen seminar speakers to visit the Institute during 2014. The quality of our speakers was outstanding and further indicates the importance of collaborative research sharing with both the local and international science community. At ARMI, we take great pride in the level of excellence and innovation in research all our staff undertake, and we are passionate in our commitment to working and growing together to create a healthier future for all.

One of the most frequent questions asked of the Institute is what makes ARMI unique, what makes us different from other regenerative medicine institutes? The answer is that ARMI researchers look at disease across the entire human lifespan.

Examples include the work of our Group Leaders such as Dr Nico Plachta. Nico and his team have developed special microscope technology that allows him to study single embryonic cells. For his efforts Nico was recently shortlisted for very prestigious "The Centenary Institute Lawrence Creative Prize", an initiative to promote medical research amongst young talent in Australia.

The work of Associate Prof Jose Polo has lead him to being one of the inaugural winners of the Metcalf Prize for Stem Cell Research. The \$50,000 was awarded to Jose for unveiling the details of how stem cells can be produced from adult

cells through a process of 'identity' theft and reprogramming. These are just two examples of the research being undertaken at ARMI, each focusing on different areas of human development. It has been an outstanding year for ARMI researchers on the awards and prizes front. On page five of Regenerate there is a list of those successful in 2014.

A priority in our fifth year has been to update our Social Media strategy. ARMI has finally entered the world of Twitter and our hashtag is @ARMI_Labs. Please join us to keep up to date with all our current developments. We are also working on a new look website and Facebook page. Keep an eye on our Twitter feeds for further developments.

During 2015 we will be opening the Institute to the public and I look forward to you taking part in at some of the events we have planned, including tours of our facilities.

On behalf of the ARMI Advisory Board, staff and students of the Institute, I would like to express thanks to all of our visitors and seminar speakers that have supported us in this our fifth year of operation. We look forward to building relationships with those of you who would like to help us to find new and innovative ways to fight some of the most challenging degenerative diseases. You will find details on how to donate to ARMI on the last page of this newsletter.

We wish you the best for the coming season.

ARMI – has its own “Tower of Babel”



ARMI prides itself on being part of an internationally collaborative scientific community. Just take for example a high proportion of our staff and students come from 30 different nationalities and were recruited from 20 different countries. Take a walk around the institute and you will hear staff and students chatting away in earnest in French, Spanish, Portuguese, Mandarin..... and sometimes all at once to each other!

To find out *why ARMI?* we asked four of our post-docs the following questions:

- Why did you choose the EMBL/ARMI program?
- How will this experience fit in with your future academic and professional plans?
- How much/little did you know about Australia before you arrived here?
- Tell us one interesting fact about yourself.



**Alasdair Wood –
Currie Group**

- I chose ARMI principally to have an opportunity to work with Prof Peter Currie simply because he is a world leader in modelling muscular dystrophy in zebra fish.
- It is hard to answer my future academic or professional plans, I guess it comes down to what I can produce with my time in Pete's lab. A move where I could gain some solid glycobiology insight would perhaps be a good.
- I based all my knowledge of Australia on Crocodile Dundee and Neighbours! Though not strictly true as we visited some friends in Perth when I was younger.
- A few years ago some mates and I paddled the White Nile in Uganda, complete with snakes, monkeys and a croc. To Australians this probably seems pretty weak because here everything is out to get you!



**Madeline Cao –
Nilsson Group/ CSIRO**

- As a postdoc employed by CSIRO, joining ARMI has provided me with a larger platform to enable me to learn more techniques, share equipment facilities and collaborate.
- Working with ARMI creates a direct connection between CSIRO and the university and brings more chances to develop teaching experiences, which assists in my professional career development.
- I did not know much about Australia before I came here. I only knew Australia as a multi-cultural country with nice and friendly people coming from different regions of the world.
- I like music and listen a lot. One interesting fact is I have very small right ear, which cannot fit most earphones. I always had to hold it to my ear until Apple released its 'EarPods'. Now it fits much better.



**Wouter Masselink –
Currie Group**

- When investigating where to pursue a PhD I came across a listing in Nature Jobs as Pete was looking for people to start a PhD degree in his group. I learned that ARMI has a sizeable fish colony and provides access to a lot of different microscopes.
- The experience of learning in a highly international setting is of key importance. It allows me to make contact with people from all over the world and learn from their experiences. It is very clear to me now that I want to stay in academia
- I was not that familiar with Australia before arriving here. I had not visited Australia before although a friend of mine did and he very much enjoyed it. I can now say for myself that it is indeed a great place to be. To learn about the 'Aussie' obsession with the AFL was interesting.
- I only learned how to ride a motorbike in Australia. (What about those incredible cakes Wouter????)



**Julia Wilmanns – Rosenthal
Group (Visiting Student – now
back in Germany to complete
a Degree in Medicine)**

- I really enjoy the vision and aim of ARMI to investigate regenerative medicine and to gain a better understanding of complex diseases. In addition to that, EMBL creates a unique international setting to work in.
- Since I am a medical student, my research experience enriches my understanding of medicine by establishing a different perspective. Going back to Germany, I will still have four more years of studies, but I am sure that I will stick to science in some way.
- Honestly, I thought that it is summer all year long and had to learn what and where Canberra is.
- My favourite moment with ARMI was watching the World Cup half final Brazil vs. Germany with 20 mates at 6 a.m. in the tearoom and frying bacon and eggs on the sandwich toaster. That's team spirit!

2014 Awards, Grants and Prizes Highlights

ARMI congratulates the following members of staff and their teams in an outstanding year of recognized research excellence!

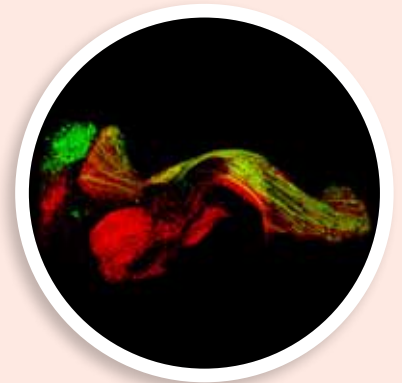
- Professor Nadia Rosenthal (Director) was elected earlier this year as a **Fellow of the Academy of Medical Sciences** in the UK for her outstanding contributions to advancing medical science. Nadia joins 43 other researchers elected to join the Academy this year, bringing the total membership to 1134;
- Professor Peter Currie (Deputy Director) **3 NHMRC** grants: Molecular mechanisms underlying induction of Haematopoietic Stem Cells in the embryo; The role of misfolded actin in myopathies; Modelling Emery-Dreifuss muscular dystrophy in zebrafish and one **ARC** grant for Molecular mechanisms that generate muscle cell type diversity;
- Associate Professor James Bourne (Group Leader): **NHMRC Senior Research Fellowship** and an **NHMRC** grant for: A novel treatment for ischemic stroke: preclinical assessment in the nonhuman primate;
- Dr Robin Hobbs (Group Leader): **ARC Future Fellowship** to continue work on the role of adult stem cells in tissue maintenance;
- Dr Anja Knaupp (Polo Group): awarded the **NHMRC Peter Doherty Early Career Fellowship**;
- Professor Graham Lieschke (Group Leader): **NHMRC** grant for Defining the in vivo contribution of leukocyte extracellular traps to infective disease;
- Professor Christopher Marcelle (Group Leader): **NHMRC** grant for Seeing is believing: imaging muscle maintenance and repair
- Associate Professor Susie Nilsson (Group Leader): **NHMRC** grant for Bone marrow Endothelial Stem Cells have the capacity to form both the endothelial and haemopoietic hierarchies;
- Associate Professor Jose Polo (Group Leader): joint winner of the inaugural **Metcalf Prize Award**; **NHMRC** grant for Inducing and controlling cellular plasticity; **Vice-Chancellor's award for Excellence in Research for an Early Career Researcher**; 2014;
- Leon Teo (Bourne Group): SFN Graduate Student Travel Award, **Society for Neuroscience**
- Dr Hieu Tri Nim (SBI Australia): **Richard Pratt Fellowship in Prostate Cancer** 2014;
- Dr Natalie Payne; (Bernard Group): **MS Society of Australia** grant
- Dr Nico Plachta (Group Leader): **Viertel Senior Research Fellowship** for Seeing How Mammalian Life Starts: Quantitative Single-Cell Imaging of Living Embryos and a **NHMRC Career Development Fellowship**;
- Dr Melanie White (Bourne Group): **ECR Prize for Outstanding Published Research** from the Faculty of Medicine, Nursing and Health Sciences.

Significant Publications in 2014

"Holy grail cell hope" – ARMI scientists published in Nature

A team led by ARMI researchers including ARMI Deputy Director, Prof Peter Currie has discovered how the stem cells used in bone marrow transplants are produced. Published in August this year in the Nature, researchers discovered that these stem cells need a "buddy" or "friend cell" to make signals that turn them into haematopoietic stems cells. The research was done in collaboration with a scientist from The Garvan Institute.

Full details: Nature 512, 314–318 (21 August 2014)



With thanks to Dr Alasdair Wood, Dr Guizhi Sun, Daniel Sieiro Mosti and Zhenhua Li for the images used in the newsletter, each winning prizes in the MMI Image of the Year Award 2014. Images collected using MMI Instruments.

ARMI Group Leader Profile



Our major research goals are devoted to the study, in man and experimental animals, of facets of immunology (immunopathology, genetics), biochemistry, microbiology and behaviour pertaining to the causation of progressive and destructive demyelinating diseases, such as multiple sclerosis.



Who is Claude Bernard?

I was born in Paris, France. I graduated from the Sorbonne, Paris in 1968 and received an MSc (1970) and a PhD (1973) from the University of Montreal and a DSc from the University Louis Pasteur, Strasbourg (1978).

Where did you come from?

My early work focused on enhancing the survival of organ transplants at the Hospital St Antoine in Paris. This led to a lifelong interest in immunology, autoimmunity and ultimately to research into multiple sclerosis (MS).

The first time I came to Australia was in 1973. I was very fortunate to be invited by the eminent immunologist Sir Gustav Nossal to join the 'crème de la crème' of scientific research institutions, the Walter and Eliza Hall Institute of Medical Research (WEHI). I was then invited to join the famous Basel Institute of Immunology, where I spent a few years. I returned to Australia in 1980 and appointed as the first Chair at La Trobe University before becoming the Director of the Brain Behaviour Research Institute. Before joining Monash, I was a Distinguished Invited Professor at Stanford and the University of California, San Francisco.

Why are you now working in Australia?

I love Australia – its people, fauna and flora. Indeed my return in 1980 was in great part due to this as well as the quality of life - something not always appreciated by Australians, I am afraid to say. From a working point of view, it is also a great place to be creative. On one hand, being relatively far away from the rest of the world one is not really influenced by the "research fashion". On the other, and in contrast to many other countries, funds for medical research are relatively low, so we need to be clever about research themes as well as our research approaches.

What is the focus of your research?

I have spent my life researching many aspects of multiple sclerosis (MS) a puzzling and crippling illness occurring in young adults and more frequently in woman. Our major research goals are devoted to the

study, in man and experimental animals, of facets of immunology (immunopathology, genetics), biochemistry, microbiology and behaviour pertaining to the causation of progressive and destructive demyelinating diseases, such as multiple sclerosis. Our work is particularly focusing on finding ways by which we can suppress the disease process as well as promoting repair within the central nervous tissue, the target of unwanted immune responses.

What would be your most inspirational moment in medical research to date?

They have been too numerous to really list but perhaps our ability to produce routine basis models of MS in the mouse, was one of those moments. This in turn was instrumental for the development and testing of a drug, which is currently used in MS.

Another was the first demonstration that the highly specialized function of killer cells, well documented in mammals, has appeared very early in evolution; at least by the time of the emergence of the amphibians 300 million years ago. We also were the first to report and clone the gene of a new and important target in MS and unravelled its structure. More recently, my colleagues made the exciting discovery that targeting a specific molecule responsible for the failure of the central nervous system to regenerate following injury and trauma blunts clinical signs and pathology associated with the EAE model of MS. This approach is now helping patients with spinal cord injury and we hope that in the near future, such an intervention will be applied to MS. More recently we reported for the first time that we could generate mature brain cells from a small piece of skin of MS patients, thus paving the way to understand further the role of genetic factors implicated in this disease as well as opening new avenues by which new drugs for MS can be tested.

So as you realize, it has been an exciting journey, made so much easier by the fact that I am truly passionate about our research and the possibility of helping MS sufferers, even if it is on a very small scale. As I often say to them, half a slice of bread is better than none...

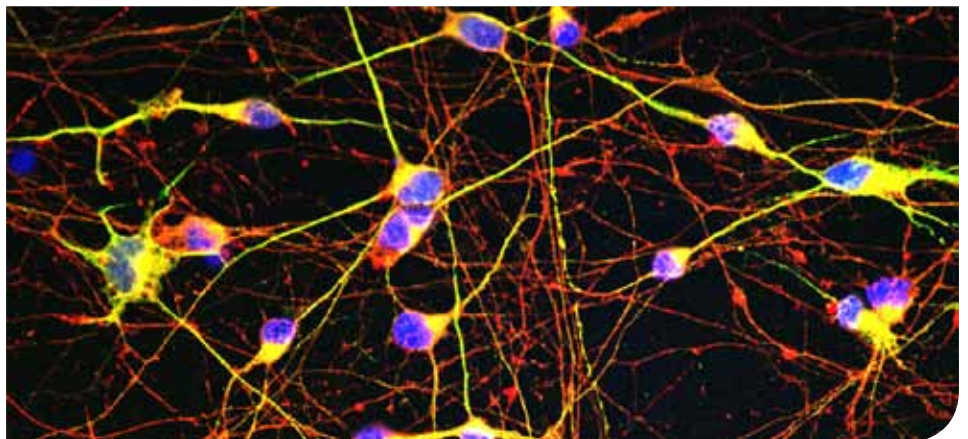


Image by Dr Guizhi Sun, Research Fellow in the Bernard Group.

The Eva and Les Erdi Zebrafish Research Group

Gratitude and generosity are just two of the many words that come to mind when describing the immense contribution made by Eva and Les Erdi to the ARMI Zebrafish facility at Monash University. The generosity of Eva and Les has enabled the facility to grow to become the largest fish core research facility in the Southern Hemisphere. It is overseeing vital research into regenerative medicine by deciphering ways to help the human body repair, replace, restore, and regenerate damaged tissues and organs.



Eva Erdi, Patron of the Institute with late husband, Les.

Les Erdi passed away in January 2013 but his legacy lives on through the support his wife Eva continues to give to the facility. Eva was formally announced as Patron of the Zebrafish research facility in October 2013 in a ceremony presided over by Monash Vice Chancellor Ed Burn and Members of the ARMI Board.

Eva and Les's personal philosophy has always been two-fold. The first is to encourage the careers of up-and-coming talented scientists who could bring 'novel' ideas to a specialised area. The facility with the Erdi's support now has a Group Leader and a team of scientists and students to oversee its running. These scientists

recruited are the future scientific leaders in this particular area of research. The second Erdi philosophy is to support the community by donating to research work that aims to bring about healthier lives not only for today but future generations. The research facility is instrumental in developing and finding ways to benefit those inflicted with muscle-wasting diseases or injury damaged muscles.

With Eva Erdi's Patronage and generous donation, the Zebrafish research facility will continue to uncover ways for the human body to repair and regenerate damaged tissues and organs. ARMI could not be more grateful (yes another G word).

BioEYES Australia

The impact that BioEYES has on student engagement in science is undeniable. The program has received extremely positive feedback from teachers, parents and students alike.

Primary and secondary students are becoming increasingly disengaged with classroom science. In an attempt to overcome this, BioEYES Australia, a school outreach program run by ARMI and the School of Biomedical Science, strives to re-ignite student's natural curiosity. Not only does BioEYES excite students about the prospects of science, it also provides a unique opportunity to share with students cutting edge research currently being performed at Monash and empowers teachers to implement their own science lessons in a student-centred, hands-on way.

Due to the diverse biological concepts associated with zebrafish and their development, the program can be tailored to the learning needs and ages (grade 2 to year 12) of all students. The BioEYES program is currently running at capacity, reaching approximately 1500 students per year. While BioEYES is in desperate need of expansion, our limited funding means that this is currently impossible and we are seeking partners to help maintain the program in its current state as well as expand as we move into the future. For more information, please contact Sharon Flecknoe (Sharon.flecknoe@monash.edu) or Laura Reid (laura.reid@monash.edu).



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You can find out more about ARMI and the work we are doing on www.armi.org

Donate



Yes I would like to donate to ARMI's research and make a difference!

All contributions to ARMI go directly to advancing medical research. If you have a particular interest do not hesitate to let us know.

Please follow this link: <https://community.monash.edu.au/givetoarmi>