

2011 Our scientists identify and characterise a new population of stem cells in the adult heart



Victor Chang
Cardiac Research Institute



CELEBRATING
20 YEARS OF
DISCOVERY
1994-2014

Annual Report 2014




The difference

How often do you look at the world with a new perspective? At the Victor Chang Cardiac Research Institute we do it everyday. It's in our DNA, our culture, our attitude, and our approach. **It's the way we see, think and feel about everything we do, that is the 'difference'.** For over 20 years, through the power of discovery, we have been able to imagine the unimaginable, revolutionising the understanding of heart disease – still the leading cause of death and disability in our society. From the legacy of legendary heart transplant surgeon Victor Chang, the Institute's team have rapidly pioneered research with a shared and life changing vision – to reduce the incidence, severity and impact of heart disease... to make a 'difference'.



Founded in 1994, the Victor Chang Cardiac Research Institute is the legacy of legendary heart transplant surgeon Dr Victor Chang. It is a not for profit, internationally recognised, medical research facility dedicated to finding cures for deadly heart conditions. Beginning with just two scientists, the institute has now grown to over 170 full-time staff, united in a single vision – to reduce the incidence, severity and impact of heart and vascular diseases – still the leading causes of death and disability in our society.



9/10

Australians have at least one risk factor for cardiovascular disease



1/5

Australians, or 3.72 million people, are affected by heart disease



4x

Four times more women die of heart disease than breast cancer in Australia

1st ♥

The heart is the first organ to form.
You don't need a brain to develop a heart!

\$6 billion

Cardiovascular disease costs Australia around \$6 billion in healthcare spending per year

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Women

Most women have different heart attack symptoms to men: instead of chest pains, women often have nausea, indigestion and shoulder aches

75 trillion

cells receive blood from the heart

About us



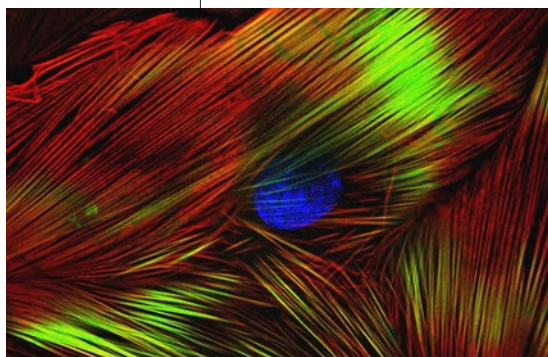
Our aspirations

To conduct the highest quality research, with an emphasis on 'molecules and mechanisms'.

- To be a world-class research facility and one of the best independent medical research institutes in Australia that contributes in a major way to the health of all people, but particularly those of Australia and South-East Asia, through research into cardiovascular diseases.
- To advance knowledge and make fundamental discoveries in cardiovascular research that can be rapidly translated into improved diagnostics, preventions and treatments, and to provide advice on health and research policy at both the federal and state levels.
- To be a leader in the adoption, application and integration of genomics, stem cell and regenerative medicine, and other cutting edge technologies and approaches, and in the training of clinicians in the interpretation of discoveries made using these technologies for improved patient management.
- To be Australia's leading institute for training in fundamental cardiovascular research and its application to clinical problem solving.

Our mission

The relief of pain and suffering, and the promotion of wellbeing, through an understanding of the fundamental mechanisms of cardiovascular biology in health and disease.



World class research

The Victor Chang Cardiac Research Institute has earned its place on the global stage as one of the most respected heart research facilities in the world. Internationally recognised for the quality of its discoveries, the Institute is also a centre-of-excellence in cardiovascular research training, and in the rapid translation of discoveries into new diagnostics, preventions and treatments of cardiovascular disease. Our research spans from complex fundamental work using techniques such as x-ray crystallography, to innovative transplantation techniques and clinical trials.

Our research focus

- Congenital heart disease
- Arrhythmias
- Inherited heart disease
- Ischemic heart disease
- Heart failure
- Heart transplantation
- Cardiomyopathies
- Coronary artery disease
- Bacterial endocarditis



2014 statistics

170+

researchers and staff

5

research divisions

19

laboratories

9

clinical faculty based
at St Vincent's Hospital

95

publications

16

public lectures

86

seminars

763

people toured the institute

17

awards and accolades

170+

international collaborators

44

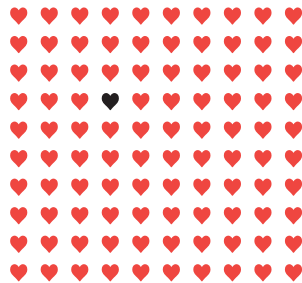
ambassadors

22

scholarships

Health impact

Millions of Australians suffer from diseases of the heart or blood vessels, which can affect anyone regardless of age or gender. In addition to heart attacks and heart failure, congenital heart diseases affect 1 in every 100 children.



Risk factors

Several factors increase your risk of heart disease:

- ☐ Family history
- ☐ Age
- ☐ Smoking
- ☐ High blood pressure
- ☐ High blood cholesterol
- ☐ Diabetes
- ☐ Poor diet
- ☐ Lack of exercise
- ☐ Obesity
- ☐ Stress

20:20

In 2014 the Victor Chang Cardiac Research Institute celebrated 20 years at the forefront of research into heart disease. In our 20th year we have launched a new campaign with the aim of raising an additional \$20 million on top of our regular fundraising efforts, by 2020. These are much needed funds required to help us find cures for broken hearts.

The Institute is a member of the St Vincent's Healthcare Campus, is a University of New South Wales affiliated Institute and is a National Health and Medical Research Council accredited organisation.





Through heart surgery,
Dr Victor Chang was
able to save hundreds
of lives. But he
knew that through
research, he could
save thousands.



Our inspiration



Dr Victor Chang, AC (1936-1991)

Dr Victor Chang was one of Australia's most gifted heart surgeons, a pioneer of modern heart transplant surgery and a humanitarian.

A national hero, Victor Chang was hailed as 'the most prominent doctor in the southern hemisphere', and his revolutionary work in the field of heart transplantation had implications for cardiac patients, not only in Australia and Southeast Asia but around the globe.

Dr Chang personally saved hundreds of lives. In 1984, he led a team of surgeons who successfully performed a heart transplant on schoolgirl, Fiona Coote. At the age of 14, Fiona defied all odds to become Australia's youngest heart transplant survivor, and some 31 years later remains very well.

In that same year, Dr Chang founded the National Heart Transplant Program at St Vincent's Hospital, which has since performed thousands of successful transplants.

Dr Chang also played a key role in developing an artificial heart valve and an artificial heart assist device.

Born in Shanghai to Australian-born Chinese parents in 1936, Victor Chang (Yam Him) came to Australia in 1953 and completed his schooling at the Christian Brothers College in Lewisham. In 1962 he graduated from Sydney University with a Bachelor of Medicine and Bachelor of Surgery.

After training in cardiothoracic surgery at the Mayo Clinic (USA) and in the UK, he returned to St Vincent's Hospital, Sydney. For the next two decades, he operated alongside his colleagues Dr Harry Windsor and Dr Mark Shanahan, who had performed Australia's first ever heart transplant in 1968.

In 1986, Dr Chang was awarded our country's highest honour, a Companion of the Order of Australia (AC) and in 2000, was voted Australian of the Century by the people of Australia.

A caring surgeon and humanitarian, Dr Chang was passionate about the power of discovery. He had a bold vision to establish a world-class medical research institute, knowing that while he could save hundreds of lives through surgery, he could save thousands more through research.

Victor Chang died in tragic circumstances in Sydney on 4 July 1991. He is remembered as a quiet, charming man, much loved by his patients and friends, his wife Ann and his children Vanessa, Matthew and Marcus.

The Victor Chang Cardiac Research Institute is dedicated to his memory.



▲ Dr Chang with a model of a human heart.



▲ Dr Chang with heart transplant patient, Fiona Coote.

History of the Victor Chang Cardiac Research Institute



1936

Victor Chang born in Shanghai to Australian-born Chinese parents.

1953

Victor migrates to Australia as a student at the Christian Brothers College, Sydney.



1962

Victor graduates from Sydney University with a Bachelor of Medicine, Bachelor of Surgery, becoming an intern and, later, a registrar in cardiothoracic surgery at St Vincent's Hospital, Sydney.

1968

Dr Harry Windsor and Dr Mark Shanahan perform Australia's first heart transplant at St Vincent's Hospital.

1984

The National Heart Transplant Program is founded at St Vincent's Hospital by Dr Victor Chang.

April 8th, a team of doctors led by Dr Chang, operates on 14-year-old Fiona Coote, who becomes Australia's youngest heart transplant recipient.

1986

Dr Chang awarded Australia's highest recognition, a Companion of the Order of Australia (AC).

1990

Dr Victor Chang spearheads the Heart of St Vincent's Appeal. This appeal raises much-needed funds for a Cardiac Transplant Ward and Cardiac Diagnostic Unit at St Vincent's Hospital, Sydney.

1991

Victor Chang dies in tragic circumstances in Sydney on the 4th of July.

1994



The Victor Chang Cardiac Research Institute is officially launched on the 14th of February by then Prime Minister, the Hon Paul Keating MP, with Kerry Packer, AC, as Patron and Prof Robert Graham as Executive Director. It was founded, originally under the auspices of the Sisters of Charity and St Vincent's Hospital – the Sisters recognising the importance of research as fundamental to better health outcomes.



1995

The Victor Chang Cardiac Research Institute is accredited as an independent research organisation, with the Hon Neville Wran, AC, QC as its inaugural chairman.

1996

The Institute's temporary premises at the Garvan Institute of Medical Research are opened by the late Diana, Princess of Wales.



The Victor Chang Cardiac Research Institute hosts its first International Symposium on Molecular Structure, Function and Development of the Heart.

1997

Death of Diana, Princess of Wales – Victor Chang White Rose Day named in her memory.

The Victor Chang Cardiac Research Institute formally becomes affiliated with the University of New South Wales.

1998

The inaugural Princess' Lecture held in honour of the late Diana, Princess of Wales, delivered by Professor Sir Magdi Yacoub.

The Paul Korner Seminar series is established to recognise the outstanding contributions of Professor Paul Korner, a pioneer of cardiovascular research in Australia. The series is presented weekly, providing our young scientists with the opportunity to present an update of their research progress and achievements.

2000



Dr Victor Chang voted Australian of the Century by the people of Australia.

2004

Launch of the Victor Chang School Science Awards to recognise the scientific achievements of students from schools within the west, south and south west of Sydney.

2005



Her Royal Highness Crown Princess Mary of Denmark is Guest-of-Honour at The Victor Chang Royal Ball.

The Victor Chang Cardiac Research Institute mourns the death of Patron, Kerry Packer, AC.

2006



Construction commences on the nine storey Lowy Packer Building in Darlinghurst, which will become the Victor Chang Cardiac Research Institute's new home.

2007

Michael Renford, son of the late Des Renford, swims the English Channel to raise money for the Victor Chang Cardiac Research Institute.

Chain Reaction inaugural charity bike ride, raising money for children with heart defects.

2008



Construction of the Lowy Packer Building is complete and formally opened by

Her Royal Highness Crown Princess Mary of Denmark on September 3rd. Princess Mary also attends a dinner with His Royal Highness Crown Prince Frederik at the Institute.



The Hon Neville Wran retires as Chairman and becomes a Patron of the Institute.

Paceline INC. founder, Steve Quinn, cycles across the USA to raise money for research into cardiac arrhythmias and the Victor Chang Cardiac Research Institute.

2013

Steven Lowy AM, stands down as Chairman, leaving the board after 19 years as a Director of the Institute, including the last six as Chairman. Matthew Grounds is appointed as Chairman of the Board.

2014



The Hon Neville Wran dies, aged 87. *Tribute on page 54.*



Fiona Coote celebrates 30 years since her life saving heart transplant performed by Dr Victor Chang.

20 CELEBRATING
20 YEARS OF
DISCOVERY
1994-2014

The Victor Chang Cardiac Research Institute celebrates 20 years of discoveries.

Celebrating 20 years of innovation and discovery



Over the past two decades, the Victor Chang Cardiac Research Institute has made a plethora of major advances, many revolutionising our understanding of disease causation, mechanisms and medical treatments. Here are just a few examples of what we have achieved.

2014

World first transplantation of a 'dead' heart that had stopped beating for 20 minutes, to save the lives of patients with severe heart failure.

2012

Thanks to our scientists, an entire family is cured of a life threatening, inherited heart rhythm disorder. Some family members had such severe heart failure they were on the transplant waiting list.

2013

For the first time, our scientists show the importance of a single gene (Nkx2-5) in forming the large vessels of the heart.

2009



The Victor Chang Cardiac Research Institute develops a unique preservation solution to protect transplant hearts for up to eight hours. Previously four hours was the maximum time.

2009

Researchers discover that a poorly functioning placenta during pregnancy can affect kidney development of an unborn child.

2007

Our breakthrough discovery demonstrates that certain types of congenital heart defects occur at a much earlier stage in the development of a baby than ever expected.

2000

We discover that without both copies of a single gene mutation, the heart cannot grow during development in the womb, but if only one is defective, it can result in a heart defect, such as a hole-in-the-heart.

1999

We demonstrate that epigenetic 'signals', which regulate the functioning of our genes, can be passed on from one generation to the next along with our DNA.

1999



Scientists discover the entire cellular machinery underlying growth and enlargement of skeletal muscle.

2014

In another world first, our scientists develop a faster more reliable way of diagnosing patients at risk of sudden cardiac death.

2014

Overtuning a century of dogma, we discover that the heart can regenerate in pre-adolescents, which potentially means a heart could heal itself.

2013

Researchers have found that obesity and diabetes during pregnancy can cause children to develop metabolic problems later in life.

2012

Our researchers make a landmark discovery that shows for the first time how 'nature' and 'nurture' interact to cause birth defects.

2011

Our scientists identify and characterise a new population of stem cells in the adult heart.

2011

Our team demonstrates how the potassium channels that carry electricity around the heart open and close, controlling heartbeats.

2010

Our breakthrough discovery reveals how the tiny motors on bacteria allow them to rapidly change direction and move towards nutrients and away from toxins. This is crucial to the spread of infections, such as those causing serious heart conditions.

2006

Scientists show that the diet of pregnant mothers can affect the health of their children and even their grandchildren.

2004

For the first time Victor Chang scientists prove diseases can be caused not only by a defective gene (mutation), but by an inherited defect in the expression of a gene (an epi-mutation).

2002

We find that a new drug treatment can slow the progression of pulmonary arterial hypertension – a serious and progressive disease.

2005

We discover how cells control the amount of protein produced by each gene, by studying tiny bits of genetic material called microRNAs.

1998

Victor Chang researchers participate in a major international trial that provides definitive proof that statins lower cholesterol and prevent death.

1997

Scientists develop a non-invasive test to predict those at risk of stroke from a clot in the heart.

1994

Groundbreaking research reveals an enzyme previously only associated with clotting, has many functions and, uniquely, can also regulate how vigorously our heart can beat.

Why support medical research?



Healthcare

- Thanks to research, death rates from cardiovascular disease have dropped by 76% since the 1960s.
- Australian patients are usually the first to benefit from Australian discoveries, and active research programs attract the very best doctors.
- The cost of healthcare is rising faster than the economy, and we believe the only meaningful solution is medical research which can lead to disease prevention, as well as better diagnosis and treatment. This will also result in fewer and shorter stays in hospital and faster returns to the workforce. To achieve this, medical research spending ideally should be coupled to healthcare spending.

Economy

- For every dollar invested in medical research, more than \$2 is returned to the economy.
- According to the Australian Institute of Health and Welfare, expenditure on health is estimated to be more than \$147 billion per annum.
- Currently the medicines industry is the largest high-technology exporter from Australia – earning upwards of \$4 billion in 2012.

Jobs

- Medical research employs about 25,000 people, including 15,000 who have PhDs.

Awards

- Seven Nobel Prizes attest to the fact that the lucky country is clever too. Australia not only produces 3% of the world's research with just 1% of the world's researchers, but has also relieved suffering for millions.

Blockbuster breakthroughs

The top 5 Australian blockbuster discoveries:



The world can thank Adelaide scientist, Howard Florey, for developing penicillin as a medical treatment in the early 1940s – a time when it was common for people to die from a simple bacterial infection. For producing the world's first antibiotic, Florey was jointly awarded the Nobel Prize in Physiology or Medicine in 1945. The breakthrough revolutionised the way infectious diseases are treated today and is estimated to have saved over 82 million lives.

Born in country New South Wales, a young boy named Graeme Clark told his primary school teacher he wanted to 'fix ears' when he grew up – inspired by his deaf father. Three decades later, Professor Graeme Clark would become the first person to develop and successfully implant a bionic ear. Since that initial procedure in 1978, cochlear implants have given the gift of hearing to more than 320,000 profoundly deaf people worldwide.

Queensland professor, Ian Frazer, created four vaccines for the prevention and treatment of cervical cancer, which affects half a million women annually. It took Prof Frazer and his colleagues more than 15 years to develop the world first vaccine, which protects against 70% of cervical cancer caused by the human papilloma virus.

Today it is widely known the risk of sudden infant death syndrome (SIDS) greatly increases if a baby sleeps face down. This discovery is thanks to the meticulous research carried out by South Australian doctor Susan Beal, who visited 500 families who had lost babies to cot death. Through public education, the rate of SIDS in Australia has now plummeted by more than 85% since 1989.

In 2014 the Victor Chang Cardiac Research Institute and St Vincent's Hospital made history when a surgical team successfully transplanted the first ever 'dead' heart. The heart had stopped beating for up to 20 minutes before it was reanimated using a unique preservation solution and a portable machine. This major medical breakthrough is expected to save 30 percent more lives by expanding the pool of suitable donor hearts.

Chairman's Report



This is my first report as Chairman of the Board of the Victor Chang Cardiac Research Institute and it has been a great privilege to have become involved with such an outstanding organisation with an extraordinary team of talented scientists and researchers.

Established just over 20 years ago to honour Dr Victor Chang's memory and continue his incredible work, the Victor Chang Cardiac Research Institute has developed to be one of the best known and most highly respected medical research organisations in Australia, and has an international reputation for its leading research into heart disease.

One of the challenges for medical research is to ensure we translate the intense efforts and advancements made by dedicated scientists into outcomes for the broader community. I am proud to say that the Institute has been very successful in doing this with over 50 per cent of our publications involving our clinical colleagues at St Vincent's Hospital.

Incredible discoveries and breakthroughs over the past 20 years range from developing a non-invasive test to predict those at risk of stroke from a clot in the heart, through to making history in collaboration with St Vincent's Hospital by successfully transplanting a 'dead' heart that had stopped beating for almost 20 minutes. Bob Graham and his team have also overturned more than a century of scientific theory by demonstrating that our hearts have the capacity to regenerate after they have been damaged. I encourage you to read more about our exciting discoveries in the following pages.

20:20 campaign launch

2014 was the 20th anniversary of the Victor Chang Cardiac Research Institute. To mark this important milestone and to celebrate two decades of major discoveries, the Institute launched a major fundraising campaign aimed at raising an additional \$20 million on top of our regular fundraising efforts, by 2020.

This ambitious five-year strategic plan will fund innovative and ground breaking research programs dedicated to reducing the number of lives lost to heart disease and improving the quality of life for sufferers. The funding also promises to attract internationally renowned scientists to the Institute, reinforcing its position as a global centre-of-excellence in cardiovascular research.

The Institute will rely heavily on philanthropic leadership and the support of the community to reach this goal.





It has been estimated that every \$1 spent on medical research produces more than \$2 in health benefits to the economy. By any measure that is a very good investment.

◀ Executive Director
Prof Bob Graham (left),
Chairman Matthew
Grouds

Credit: Wolter Peeters /
Fairfax Syndication

Farewell Chairman Mr Steven Lowy

2014 was also the year that Mr Steven Lowy retired from the Board, having served on the Board as a Director since 1995 and as Chairman for the past six years.

In May 2014, we celebrated and honoured Steven's extraordinary contributions as Chairman, with the NSW Premier, Mr Mike Baird; NSW Health Minister, Jillian Skinner, and Federal Health Minister, Mr Peter Dutton, in attendance. At this event, the NSW Government announced a \$2 million contribution to the Institute. This matched an earlier commitment from the Packer and Lowy families. Adding in a wonderful donation by the Vidor family of \$500,000 means we have a total \$4.5 million commitment to get the ball rolling for our 20:20 Campaign.

On behalf of everyone at the Institute, I would like to acknowledge Steven's significant financial and personal contributions and the Lowy family's longstanding commitment to the Institute. Steven was involved in the Institute from day one and was the driving force behind the seeding and development of the new building that now houses the Victor Chang Cardiac Research Institute in the Darlinghurst research and hospital hub. As Chairman, Steven led a renewal of the board and has left the Institute in a very strong position. Whilst we are sad that Steven's formal ties have come to an end, we appreciate his continued personal involvement and interest in our future success by accepting a role as a Patron of the Institute.

The importance of medical research

It is well understood that Australia's medical research institutes deliver very significant benefits to the community and are critical to providing better patient outcomes and lowering the long-term cost of healthcare.

From an economic point of view, it has been estimated that every \$1 spent on medical research produces more than \$2 in health benefits to the economy. By any measure that is a very good investment.

With the ageing of our population, coupled with rising rates of chronic disease, the importance of a strong and vibrant medical research sector has never been so vital for Australians.

This comes at a time when gaining Federal Government grant funding has become ever more challenging across the medical research sector as a whole and, hence, the greater reliance upon the broader community for philanthropic support.

The Federal Government's proposal to establish a Medical Research Future Fund (MRFF), which would apply its investment earnings to funding future medical research, is a good forward thinking policy and we would encourage the Senate to support this important initiative. The Government's support of increased funding for medical research is gratefully welcomed. In June 2014, we were pleased to host the Prime Minister, the Hon Tony Abbott MP, the Health Minister, the Hon. Peter

Dutton MP and our local Federal Member for Wentworth, the Hon Malcom Turnbull MP in a roundtable discussion with other members of the research community to consider these important issues.

Importantly, however, even if the MRFF is established in the 2015/16 year, the majority of the funding benefits will not flow until the MRFF is fully capitalised, which will be some four to five years away.

Addressing the challenges

In 2014 our total revenue ratio between Government and non-Government sources of income was approximately 55/45 per cent. This compares to a funding ratio of approximately 59/41 per cent in 2013.

I am pleased to report that the Institute's success rate in securing National Health and Medical Research Council (NHMRC) grants in 2014 continued to be well above average. But the reality is that over the course of this period there has been an overall decline in real Government funding across the sector. Of the 3,700 project grant applications submitted to the NHMRC in 2014, just 14.9% were funded. That's the lowest success rate in the 75-year history of the NHMRC, and this is expected to fall further in 2015, to just 12%.

Whilst our financial position today remains sustainable and strong, the forecast decline in Government funding over the short to medium term does mean we face some very real funding challenges.

To address these challenges, it will be important for the Institute to strengthen our fundraising capability to ensure the Victor Chang Institute Cardiac Research is actively promoting its work to the public and explaining its importance in the community.

The Board is committed to this objective and focussed on broadening the Institute's funding base and I am very confident that we will develop additional sustainable income streams for the future.

Thanking our board and committees

In my first year as Chair I wanted to especially thank my fellow Board members for their professionalism and their ongoing commitment to the Institute's mission. The Institute is very fortunate to have a very accomplished Board of Directors that is enormously supportive and active. In particular, I wish to acknowledge Mr David Craig, who chairs the Finance and Risk Committee; Mrs Louise Di Francesco, who chairs the Appeals Committee, and Ms Jill Margo, who chairs the Media and Communications Committee. My sincere thanks also to the Sisters of Charity and the Trustees of Mary Aikenhead Ministries for their ongoing support and guidance.

In August we welcomed Mrs Jennifer Doubell, Executive Director, Peter MacCallum Cancer Foundation, to our Board as a non-executive Director. Jennifer has a strong background in not-for-profit medical research organisations and has invaluable experience in the area of fundraising.



The Board is focused on broadening the Institute's funding base and I am very confident that we will develop additional sustainable income streams for the future.

We farewelled Mrs Barbara Ell from the Board, who remarkably has been involved with the Institute since its inception. We are enormously grateful for her tireless service to the Institute and the broader community. In recognition of her enormous contributions to the Institute over the past two decades, it seemed only fitting that Barbara was made an Honorary Life Member.

In April 2014, we paused to reflect on the passing of the Institute's founding Chairman, the Honourable Neville Wran, AC, QC. By all accounts, Neville was an inspirational leader of the Institute and was the founding force in getting the Institute off the ground.

Looking to the future

I want to specifically acknowledge the outstanding vision and steady leadership of Professor Bob Graham. The Institute's long term success and standing in the community are a direct result of Bob's great imagination, perseverance, enormous energy and commitment over his twenty years as the founding Executive Director of the Institute.

I would particularly like to thank Bob and his wonderful leadership team for welcoming me so warmly and for making my transition to the Chairman role so seamless.

Finally, I commend the amazing researchers, scientists and staff at the Institute for their continuing hard work, dedication and achievements this year. I would like to thank all of our donors for their continued generosity, as well as those in the wider community for your support and encouragement of the work of the Victor Chang Cardiac Research Institute. We all look forward to another exciting year of discoveries in the vitally important area of heart research.

Matthew Grounds
CHAIRMAN



Executive Director's Report



20 years of the Victor Chang Cardiac Research Institute

On Valentine's Day, 14th February 2014, we marked the twentieth anniversary of the Victor Chang Cardiac Research Institute. The Institute was established to honour the memory of Dr Victor Chang and to continue his ground-breaking work with a single mission – to prevent pain and suffering caused by diseases of the heart and blood vessels.

For two decades the Institute has been at the forefront of heart research and we have been able to contribute very meaningfully to advances in the diagnostics, preventions and treatments of heart and blood vessel diseases. The Victor Chang Cardiac Research Institute attracts world class researchers with the desire and commitment to find enduring solutions, whilst also providing a training ground for the next generation of cardiovascular researchers – the science stars of the future.

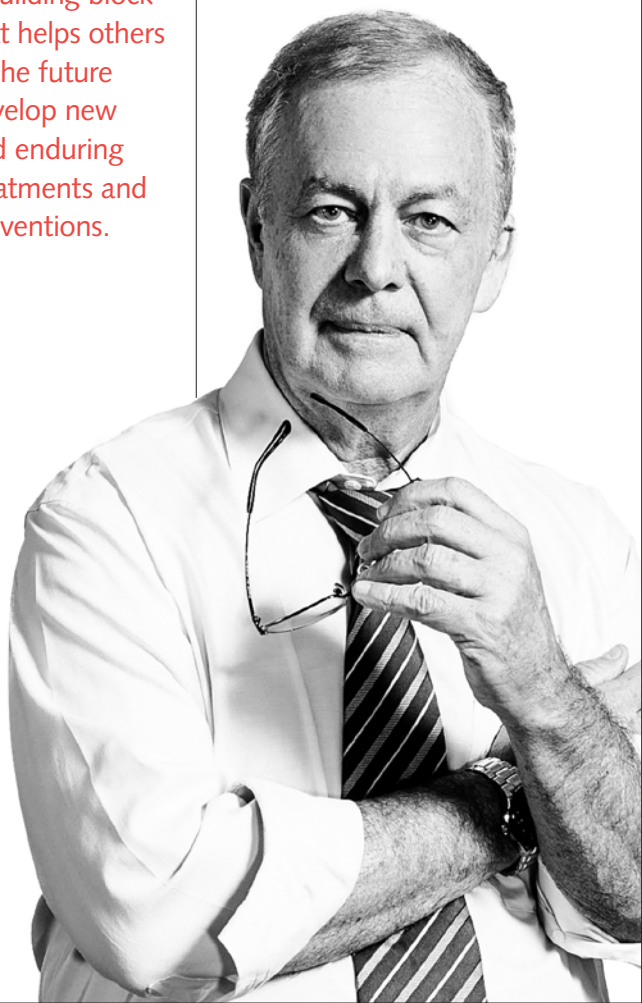
The problem persists

I feel particularly privileged to be a part of this Institute, but at the same time I feel frustrated that many people don't appreciate the importance of research into heart disease. All too often I hear that the heart disease problem has been solved. Nothing can be further from the truth! Heart disease still remains the number one cause of death in our society. It also affects one in 100 children and roughly 40 percent of babies will need lifesaving operations just days after they are born. You can imagine how traumatic this must be for a young family! And although heart transplants can save lives, we should never forget that for everyone saved, someone else, who donated their heart, lost their life. So it is all the more reason why we urgently need to find cures for deadly heart problems.

While there is still far more work to be done, the past 20 years have been marked by ground breaking research and a multitude of discoveries.



Our research is not flashy, it is more of a marathon than a sprint. But every piece of our research will stand the test of time and will serve as a building block that helps others in the future develop new and enduring treatments and preventions.



From artificial heart to heart-in-a-box

To highlight just a few of our many advances, the Victor Chang Institute and St Vincent's Hospital, Sydney made history by transplanting the world's first 'dead' heart which had been reanimated after it had stopped beating. Our researchers have also discovered a new type of stem cell in the heart, as well as the gene abnormalities underlying many congenital and adult heart diseases. On top of that, we have overturned more than a century of scientific belief through the discovery that heart muscle cells retain the ability to regenerate well after birth. And remarkably, scientists at the Institute managed to 'cure' a family with a severe rhythm disturbance of the heart that resulted in life threatening heart failure. I encourage you to read more about these exciting discoveries in the following pages.

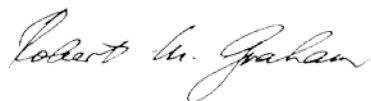
The work we have produced has come with a lot of grind and grunt, coupled with long days and often sleepless nights. Our research is not flashy, it is more of a marathon than a sprint. But every piece of our research will stand the test of time and will serve as a building block that helps others in the future develop new and enduring treatments and preventions. But none of it would be possible without tremendous support we have received from many, many people.

Our sincere thanks

We are enormously grateful to those who have given so generously over the past 20 years. We also particularly thank the Sisters of Charity, the Chang family, St Vincent's Hospital, our Chairman, Matthew Grounds, our Board and Appeals Committee, our patrons, life members, governors and ambassadors, our colleagues at the University of New South Wales, the Garvan Institute of Medical Research and other institutes, and politicians from both sides of the political spectrum, who have all helped transform us into what we are today.

Finally, it must be said, the Institute belongs not to us, nor our Board nor anyone other than those with heart disease, and their relatives and their friends. For that reason, we have actively reached out to the community and tried to give back, knowing how crucial research is to the health and survival rates of Australians, now and into the future.

We do hope you can take pride in the Institute's achievements over its initial 20 years, and we also sincerely hope we can look to you for continued much-needed support as we go forward.



Professor Robert M. Graham AO
EXECUTIVE DIRECTOR



10 min

One Australian suffers a heart attack every 10 minutes. That's 55,000 people every year!



12 min

One Australian dies from heart disease every 12 minutes. That's 46,000 deaths every year!

Trustee's Message



The Trustees of Mary Aikenhead Ministries are privileged to continue the unwavering commitment to the disadvantaged and marginalised as championed by the Sisters of Charity Australia.

At the heart of the Trustees' responsibilities lies their commitment to ensure all of those serving within Mary Aikenhead Ministries understand our 'story' and the 'gift' we share and the diverse ways in which we deliver on our mission. The Trustees' annual conference is a significant opportunity to share our story and engage with leaders from across the ministries. The fifth such conference was held in Melbourne on 1 and 2 May 2014 with the keynote speaker, Fr Noel Connelly SSC who explored the conference theme of 'Living the Mission – Hearts on Fire'. During 2014, the Trustees also facilitated Board Formation Sessions for Directors and Senior Executives from entities within our ministries.

The Trustees of Mary Aikenhead Ministries congratulate the Victor Chang Cardiac Research Institute on its many achievements this year, which are detailed in this Annual Report. Worthy of specific mention are its pioneering work in:

- the transplantation of a heart that had stopped beating
- the discovery that the heart can regenerate itself; this research overturned more than a century of scientific theory
- the world's first breakthrough using video game technology to better diagnose suffering from an arrhythmia which causes sudden death.

We express our gratitude to the Chair and Board of Directors, the Institute's Executive Director, staff and research students for their contributions during the past year and look forward to the continuance of cutting edge medical research. We acknowledge the exceptional work of outgoing Chair Mr Steven Lowy and welcome the leadership of Mr Matthew Grounds and his fellow directors in ensuring that the iconic institution which is the Victor Chang Cardiac Research Institute remains at the forefront of groundbreaking advances.

On behalf of the Trustees of Mary Aikenhead Ministries, I am pleased to commend to you the 2014 Annual Report of the Victor Chang Cardiac Research Institute.

David Robinson

CHAIRPERSON

ON BEHALF OF THE TRUSTEES
OF MARY AIKENHEAD MINISTRIES



Organisational structure



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Mary Aikenhead Ministries

CHAIR

David Robinson

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Cardiac Research Institute**

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Matthew Grounds

DEPUTY CHAIRMAN

David Craig

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New South Wales**

St Vincent's Health Australia

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David Craig

Appeals

CHAIR

Louise

Di Francesco

Media and Communications

CHAIR

Jill Margo AM

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DEPUTY DIRECTORS

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Prof Jamie Vandenberg

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Cardiac Physiology and Transplantation

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Prof Michael
Feneley AM

Developmental and Stem Cell Biology

DIVISION HEAD

Prof Richard
Harvey

Molecular Cardiology and Biophysics

DIVISION HEAD

Prof Robert
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Molecular, Structural and Computational Biology

DIVISION HEAD

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Vascular Biology

DIVISION HEAD

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Policy

Essential services

Fund Development

Media and Communications

Direct Marketing

Philanthropy

Health Check Booth

Board of Directors



The successful operations of the Victor Chang Cardiac Research Institute are heavily reliant on the loyalty, drive and vision provided by the Board of Directors, led by Mr Matthew Grounds, and subsidiary committees.



Matthew Grounds

CHAIRMAN BCOM, LLB (HONS)

Mr Grounds is currently Chief Executive Officer of UBS Australasia (since May 2008) and Head of Corporate Client Solutions, Asia Pacific. Prior to being appointed as Head of Corporate Client Solutions in November 2012, Matthew held the position of Joint Global Head of Investment Banking.

Mr Grounds is a member of the UBS Asia Pacific Management Committee, the UBS Investment Bank Global Executive Committee and a Group Managing Director. With more than 20 years investment banking experience, he is one of Australia's leading corporate advisers and has been responsible for a number of landmark transactions for major Australian and international companies.

Mr Grounds is also a member of the University of New South Wales Council, a Director of the Australian Business and Community Network Council and Director of the UBS Foundation. He graduated from the University of New South Wales and holds a degree in Commerce (Finance Major) and Law.

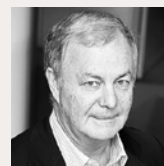


David Craig

DEPUTY CHAIRMAN BEC, FCA, GAICD

Mr Craig joined the Board in 2007 and took over as Chair of the Institute's Finance Committee in 2012. Since 2006 he has been the Chief Financial Officer of the Commonwealth Bank of Australia. Mr Craig has over 30 years of experience in financial management, strategy, mergers and acquisitions. His previous roles included: Chief Financial Officer for Australand; Global Transition Finance Leader for IBM Business Consulting Service; Global Chief Financial Officer of PwC Consulting, and Chief Operations Officer and for 15 years Senior Audit Partner of PricewaterhouseCoopers Australasia.

Mr Craig is a Director of the Financial Executives Institute of Australia and has also served as a Director of Australian Gas Light Company.



Professor Robert M Graham

AO, FAA, MBBS (HONS), MD, FRACP, FACP, FAHA, FAHMS

Professor Graham is Executive Director of the Victor Chang Cardiac Research Institute, and a member of its Finance & Risk, Appeals, Intellectual Property and Commercialisation and Media and Communications Committees. He is the Des Renford Professor of Medicine, and Professor of Biotechnology and Biomolecular Science, University of New South Wales, and Professor (adjunct) of Physiology and Biophysics, Case Western Reserve University School of Medicine, Cleveland, Ohio. He is a Fellow of the Australian Academy of Science and the Australian Academy of Health & Medical Sciences, and foreign member, Royal Danish Academy of Sciences and Letters. He is a member of the American Association for Clinical Research, the American Society of Clinical Investigation and the American Heart Association, and a Life Member, Heart Foundation of Australia.



Professor Terry Campbell

AM, MD, DPHIL, FRACP

Professor Campbell joined the Board in 2013. He is the Head of the Department of Medicine at St Vincent's Hospital, and Deputy Dean of Medicine, University of New South Wales. From 2003 to 2009, he served as Deputy Director of the Institute alongside Professor Richard Harvey.

He also served as President of the Cardiac Society of Australia and New Zealand from 2000 to 2002. Professor Campbell's research work has encompassed both laboratory research and clinical cardiology. He has published over 100 peer-reviewed papers in international journals, and has held competitive research funding from both the National Health & Medical Research Council and National Heart Foundation. In 2003, he was appointed as a Member of the Order of Australia (AM).



Chum Darvall

AM, BA, SF FIN, FAICD

Mr Darvall joined the Board in 2008, and is a member of its Finance & Risk Committee. Mr Darvall is also the Chairman of TransGrid – the owner, operator and manager of the high voltage network connecting generators in NSW and ACT. Previously, he was non-executive Vice Chairman of Deutsche Bank and before that, Chief Executive Officer of the bank in Australia and New Zealand from July 2002 to March 2011. Prior to this, Mr Darvall worked in a variety of roles across the banking industry including Director of Treasury and Head of Global Markets at Deutsche Bank and positions in the financial markets division of Westpac. In addition to TransGrid, Mr Darvall's other Chairmanship is that of Metrics Credit Partners Pty Ltd – a specialist loan fund manager providing expertise to wholesale fund managers seeking to invest in the Australian corporate loan market.

Other Board memberships include Wilson HTM, Pinnacle Investment Management Limited, Palisade Investment Partners Limited, BPAY

Group, The Macquarie University Council, The Major Performing Arts Panel of the Australia Council, The Australian Cricketers' Association Player Hardship Fund Pty Ltd, and The Financial Markets Foundation for Children.



Louise Di Francesco

Mrs Di Francesco joined the Board in 2010 and is the Chair of its Appeals Committee.

Mrs Di Francesco has worked in the media industry for more than 30 years, initially as a journalist, and for the past 22 years in media and corporate communications. She is a specialist in all areas of corporate media management, public relations, issues management and crisis management, and has worked on campaigns for AAPT, CeBIT, Mercedes Australian Fashion Week, Alterian, Carbon Planet, Australand, Lend Lease, Multiplex, Colliers, Landcom and James Fairfax.



Jennifer Doubell

MSC, MA, BA, DIP SOC STUDS, DIP CRIM, CFRE

Mrs Doubell joined the Board in 2014. She has worked in the not-for-profit sector for more than 30 years, initially as a social worker and criminologist, and for the past 24 years in development and fundraising.

Mrs Doubell is currently the Executive Director of the Peter MacCallum Cancer Foundation. Previous roles include National Fundraising Director at the

Heart Foundation, Director of Development and External Affairs at the University of Sydney and at the Australian Graduate School of Management, and Group Manager, at the Wesley Mission, Sydney. In total across her various senior management positions in a number of organisations she has helped raise in excess of \$380 million. She is the recipient of many industry awards for her work.



Barbara Ell

OAM

Mrs Ell has been a Board member since 2001 and is a Life Governor of the Institute. She is a member of the Institute's Appeals Committee and is the Chair of the Victor Chang Day Organising Committee. Mrs Ell was born in Auckland, New Zealand and educated at St Mary's College prior to her nursing training at Auckland Hospital. She then continued her nursing career at Merriwa District Hospital. In addition to serving on the Victor Chang Appeals Committee, Mrs Ell is widely recognised for her leadership in philanthropy and charity work.



Professor Leslie Field

AM, FAA, DSC, PHD, BSC

Professor Field joined the Board in 2009. He was appointed to his current position as Vice-President and Deputy Vice-Chancellor (Research) at the University of New South Wales in 2005. His main areas of research are organometallic chemistry, catalysis and NMR spectroscopy. He is the author of more than 200 scientific papers and 4 text books. He is the recipient of the Rennie Medal (1983); The Edgeworth David Medal (1986); The Organic Chemistry Medal (1992); the Centenary of Federation Medal (2003) and the RACI Leighton Medal (2010). He was elected as a Fellow of the Australian Academy of Science in 1996 and appointed as a Member of the Order of Australia in 2011 for his services to Chemistry and to Higher Education. In 2013, he was appointed Secretary for Science Policy with the AAS and is a member of the Council of the AAS.

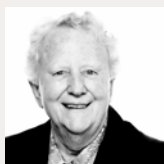


Angelos Frangopoulos

BA(COMM) MCAE, HONDA CSTURT, GAICD, JP

Mr Frangopoulos joined the Board in 2009 and is a member of its Media and Communications Committee. He is the CEO of Australian News Channel Pty Ltd, the owner and operator of Sky News Australia and Sky News New Zealand. Mr Frangopoulos is the Chairman of the Australia Day

Council of NSW, Pro-Chancellor, Sydney for Charles Sturt University, Chairman of the Advisory Board of Macquarie University's Centre for Media History, a Director of the Australian Subscription Television and Radio Association and a Board Member of the Walkley Foundation.



Sr Anthea Groves

RSC, OAM, RN LHA DIP. OF NURSING ADMINISTRATION

Sr Anthea has been a member of the Board since 2003. She is a member of the congregation of the Sisters of Charity and is Patient Liaison Officer at St Vincent's Hospital, Sydney. Sr Anthea is a Director of the Sisters of Charity Foundation.



John Kean

OAM, FCA, FAICD

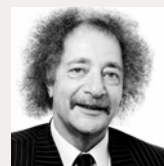
Mr Kean has been a member of the Board since 2003, is a Life Member of the Institute and was the Chair of the Institute's Finance Committee until retiring from this position in 2012. He acts as an Independent Business Advisor and holds directorships in various businesses involved in finance, trade, primary production, property and healthcare. In addition to serving as a Director of the Victor Chang Cardiac Research Institute, he was an inaugural member of its Appeals Committee.



Jill Margo

AM, BA (HONS)

Ms Margo joined the Board in 2008 and is the Chair of the Institute's Media and Communications Committee. She is the health editor of The Australian Financial Review. She has won numerous international and national media awards, including two Walkleys and a Churchill Fellowship. In 2006, Ms Margo was awarded an Order of Australia for services to journalism and cancer. She holds a BA (Honours) in English literature, and is a best-selling author and biographer.



Dr Gary Weiss

LLB (HONS), LL.M, JSD

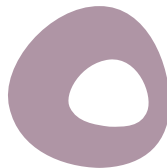
Dr Weiss joined the Board in 2009 and is a member of its Finance & Risk Committee. He holds the degrees of LL.B (Hons) and LL.M (with dist.), as well as a Doctor of Juridical Science (JSD) degree from Cornell University, New York. Dr Weiss is Chairman of Clearview Wealth Ltd and Secure Parking Pty Ltd, an Executive Director of Ariadne Australia Limited and a Director of several other organisations, including Premier Investments Limited, Ridley Corporation Ltd, Pro-Pac Packaging Ltd and The Centre for Independent Studies.

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Cardiac Physiology and Transplantation

Headed by Professor Michael Feneley, the Cardiac Physiology and Transplantation Division comprises five groups that take diverse and complementary approaches to heart disease, heart failure and transplantation.

Feneley Laboratory

Headed by

Prof Michael Feneley, AM

Key research areas

- Pressure overload hypertrophy
- Cardiomyopathies
- Ischemic heart disease
- Heart attacks

Professor Michael Feneley is a distinguished cardiologist with an international reputation in clinical echocardiography. He investigates how efficiently the heart pumps both in patients and experimentally. His research aims to understand the mechanisms of heart muscle thickening (hypertrophy) and failure.

The dangers of a big heart

Cardiac hypertrophy is a major risk factor for premature death and disability. It is caused by the heart having to work hard to pump blood against an increased load, as occurs with high blood pressure (hypertension) and with certain heart valve disorders.

“

The way the heart contracts is fascinating. It's not merely like a balloon inflating and deflating, it's more akin to the wringing of a towel.

Understanding these complexities is fundamental to treating heart failure.

Do you know the signs and symptoms of heart failure?

Common symptoms include:

- Shortness of breath
- Having trouble breathing when lying down
- Weight gain with swelling in the legs and feet
- Generally feeling tired or weak

Initially, hypertrophy, which is due to the enlargement of the heart's muscle cells, helps the heart to work against the increased load, but eventually, this increased work is harmful leading to heart failure and, if severe, to death.

Heart failure is a scourge with an enormous economic and societal cost, as it often requires repeated hospitalisation to be controlled, and increases in frequency with the ageing of our population. Moreover, the only definitive treatment for severe heart failure is a heart transplant.

50%

of people who develop heart failure die within five years of diagnosis, but early diagnosis and treatment can improve the quality and length of life

7,571

litres of blood is pumped around your body everyday

RIGHT Prof Feneley (centre) with Jane Yu and Scott Kesteven



Macdonald Laboratory

Headed by

Prof Peter Macdonald

Key research areas

- Heart transplantation
- Donor heart preservation
- New heart failure treatments



Prof Peter Macdonald

World first transplant: the biggest breakthrough in 30 years

Professor Peter Macdonald and his team are leading a new era in heart transplantation, responsible for the most significant advance in this field in the last 30 years.

Heart transplantation is by far and away the most effective treatment for patients suffering advanced heart disease. But a chronic shortage of donor organs means the life-saving procedure is available to very few people. Tragically many of those who need a new heart will die on the waiting list.

In 2014, Peter Macdonald and transplant surgeon Dr Kumud Dhital from St Vincent's Hospital, devised a remarkable way to increase the number of hearts available for transplantation.

Bringing hearts back to life

In a world first breakthrough, the transplant team revitalised a 'dead' heart that had stopped beating for up to 20 minutes.

The 'dead' heart was supplied with blood and oxygen using a mechanical device and a unique preservation solution which took our researchers more than a decade to perfect. Until now, such hearts were not available to be used for transplantation.

Throughout 2014 Professor Macdonald's team successfully transplanted four hearts using this groundbreaking technique. Surgeons at St Vincent's hospital anticipate that an extra 30 transplants will be performed per year in Australia and many more around the world using this technique. Which means more lives will be saved and more families spared the burden of caring for a severely ill relative.



In all of our years, our biggest hindrance has been the limited availability of organ donors. In many respects this breakthrough represents a major inroad to reducing the shortage of donor organs.

100

Australians are on the heart transplant waiting list

30%

more lives can now be saved thanks to the breakthrough at the Victor Chang Cardiac Research Institute and St Vincent's Hospital, Sydney

Did you know?

Previously surgeons had just four hours to transplant a heart. Now, doctors have as much as eight hours to complete the intricate procedure.

O'Rourke Laboratory

Headed by

Prof Michael O'Rourke

Key research area

- The damaging effects of ageing on the heart

With more than 50 years of experience in cardiovascular medicine and research, Professor Michael O'Rourke AM, and his team, analyse the effects of ageing on the heart and blood vessels.

They have shown that as you age the blood vessels become thicker, stiffer and less elastic. As a result, there is less 'give' in your blood vessels so the blood pressure increases markedly as the heart ejects blood.

This places an increased load on the heart so it has to work harder to pump blood around the body, which can lead to the thickening of heart muscle and heart failure.

This is the most common cause of death and disability in Australia, and accounts for most cases of cardiac failure, renal failure, and cerebrovascular disease.

Importantly, Professor O'Rourke has developed a way to surgically treat aortic stiffening using an elastic wrap, and has also identified a link between dementia and the deterioration of small vessels in the brain.

Did you know?

The number of people with heart disease steadily increases with age.

40-50%

of people over the age of 65 have high blood pressure



Trivia

Q:

What is the most common cause of death and disability in Australia?

A:

Cardiovascular effects of ageing are the most common cause of death and disability in our society, and account for most cases of cardiac failure, renal failure, cerebrovascular disease and dementia.



Prof Michael O'Rourke

Keogh Laboratory

Headed by

Prof Anne Keogh, AM

Key research areas

- Pulmonary hypertension
- Heart failure
- Immunosuppression

Professor Anne Keogh worked alongside Dr Victor Chang in the St Vincent's Heart Transplant Unit back in 1986, and was among the first to join the team at the Victor Chang Cardiac Research Institute when it was established in 1994.

Professor Keogh is a Senior Heart Transplant Cardiologist at St Vincent's Hospital, Sydney and spends much of her time caring for patients with severe heart problems.

Her research program at the Victor Chang Cardiac Research Institute focuses on pulmonary arterial hypertension, heart transplantation, immunosuppression and left heart failure clinical trials.

Did you know?

Professor Keogh has sometimes lent a helping hand to Taronga Zoo for heart check-ups on chimpanzees, orang-utans and gorillas. She has been a trustee of Medical Advances Without Animals since 2006.



Basically I keep patients alive for days, weeks, months and even years while they are waiting for transplant surgery, and then after their surgery, the team and I care for them for the rest of their lives.

1,200+

heart and lung transplants at St Vincent's Hospital since 1984

22

clinical trials were overseen by Professor Anne Keogh in 2014



Prof Anne Keogh

The right treatment for the right patient

There are varying classes of heart failure. Some patients will experience only mild symptoms and will not become fatigued or experience palpitations during physical activity. While on the other hand, some sufferers are severely limited by their condition, are unable to exercise and feel discomfort even when resting.

Professor Keogh's research aims to find the best treatment tailored to suit each individual patient with heart failure, through drug therapy, synchronised pacing and ventricular assist devices.

She has run innumerable research trials and has had more than 280 peer reviewed articles and 300 abstracts published over the past three decades. She was President of the International Society for Heart and Lung Transplantation in 2000, and founded the Pulmonary Hypertension Society of Australia and New Zealand in 2011.

Prof Keogh was awarded an Order of Australia for her services to cardiac transplantation, heart failure, pulmonary hypertension and animal welfare.

Muller Laboratory

Headed by

A/Prof David Muller

Key research areas

- Structural heart disease
- Valvular heart problems

Surgeons replace valve of beating heart

In 2014, Associate Professor David Muller, was among a team of surgeons from St Vincent's Hospital who performed a pioneering procedure on a patient with a leaky mitral heart valve.

Instead of stopping the heart from beating and using a bypass machine, the patient's heart was still contracting while doctors repaired the damage.

An incision was made between the ribs, and then an artificial valve shaped like a flower, was implanted inside the faulty valve. In the past, the patient would have required open heart surgery.

This ground breaking, less-invasive procedure took just over an hour and the patient has made a full recovery.



A/Prof David Muller

100,000

the number of times
your heart valves
open and close
every day

76 years

was the age of the
first ever patient
to undergo the
transcatheter mitral
valve implantation
(TMVI) procedure



Did you know?

There are four valves which control the flow of blood through the heart: the aortic, mitral, pulmonary and tricuspid valves.



Hopefully, many other critically ill patients, who previously would have been too sick to have heart surgery, will now have an option for treatment.

The procedure, orchestrated by A/Prof David Muller with cardiothoracic surgeon, Dr Paul Jansz, and anesthetist Dr Marty Shaw, was the first performed anywhere in a clinical trial of the novel valve. It represents the culmination of many years of hard work by a team of dedicated engineers and physicians.

"It was like training for the Olympics. Thankfully on the day, the procedure went like clockwork."

Associate Professor David Muller is the head of Interventional Cardiology at St Vincent's Hospital, specialising in structural heart disease. He has been a Laboratory Head in the Cardiac Physiology and Transplantation Division at the Victor Chang Cardiac Research Institute since 1996.

1.4m

people are prevented from living a full life because of disability caused by heart disease

No.1

Cardiovascular disease is the main cause of hospitalisations in Australia

32 km

Everyday your heart creates enough energy to drive a truck for 32 kilometres



Clinical Faculty

Dr Kumud Kumar Dhital
A/Prof Chris Hayward
A/Prof Cameron Holloway
A/Prof Andrew Jabbour
Dr Paul Jansz
A/Prof Jane McCrohon
Dr James Otton
A/Prof Jacob Sevastos
Dr Phillip Spratt
A/Prof Rajesh Subbiah

Honorary Faculty

Prof Oliver Freidrich
Prof Matthias Hentze
Prof Ahsan Husain
Dr Ming Li
Prof David Martin
Prof Andras Nagy
Prof Soren-Peter Olsen
Dr W. Andrew Owens
Prof Thomas Preiss
Prof David Winlaw

The world's first 'dead' heart transplant



Suffering from heart failure, gasping for breath and unable to walk more than 100 metres – grandmother Michelle Gribilas was given just months to live.

"For two years I couldn't move. I just signed the transplant papers because I was getting worse and I thought, 'Well, I'm going to die!'"

As she signed on the dotted line, Michelle had no idea she was about to become the world's first transplant patient to receive a 'dead' heart.

Bringing hearts back to life

In the 30 years surgeons have been performing heart transplants, it has always been a race against the clock. Doctors had just four hours to complete the intricate operation, with the precious organ stored and transported in an Esky filled with ice – but not anymore.

In 2014, researchers from the Victor Chang Cardiac Research Institute and St Vincent's Hospital discovered how to bring a donor heart back to life and then keep it beating outside the human body.

After it is removed, the donor heart is immediately injected with a groundbreaking preservation solution and then placed on a portable machine that keeps it warm and oxygenated. The unique solution reduces the amount of damage to the heart and makes the heart more resilient to transplantation.

The technique took almost two decades to perfect, but now it works a charm! Michelle has made a full recovery and now walks three kilometres and climbs more than 100 steps every day.

In October, surgeons transplanted a second heart that had stopped beating.

Speaking to the media just two weeks after his operation, father-of-three, Jan Damen said he felt 100 per cent better already.

"I have to say I never thought I'd feel so privileged to wear St Vincent's pyjamas! I didn't know how big a deal it was. Without the donor I might not be here. It's a wild thing to get your head around".

Their gratitude and excitement is matched by the team of doctors, headed by Professor Peter Macdonald, involved in the breakthrough. When cardiothoracic surgeon, Associate Professor Kumud Dhital, knew the operation was a success, he 'kicked the air' in jubilation, knowing full well that none of this would have been possible without medical research, technological advances and the incredible generosity of the donors and their families.

Overall, four successful 'dead' hearts were transplanted by the team in 2014, with all recipients doing very well.



I'm alive again
and I feel like a
different person
altogether.
I feel like I'm
40 years old.
I'm very lucky.

Michelle Gribilas

TOP

The heart is kept warm and oxygenated in a portable machine while awaiting transplantation

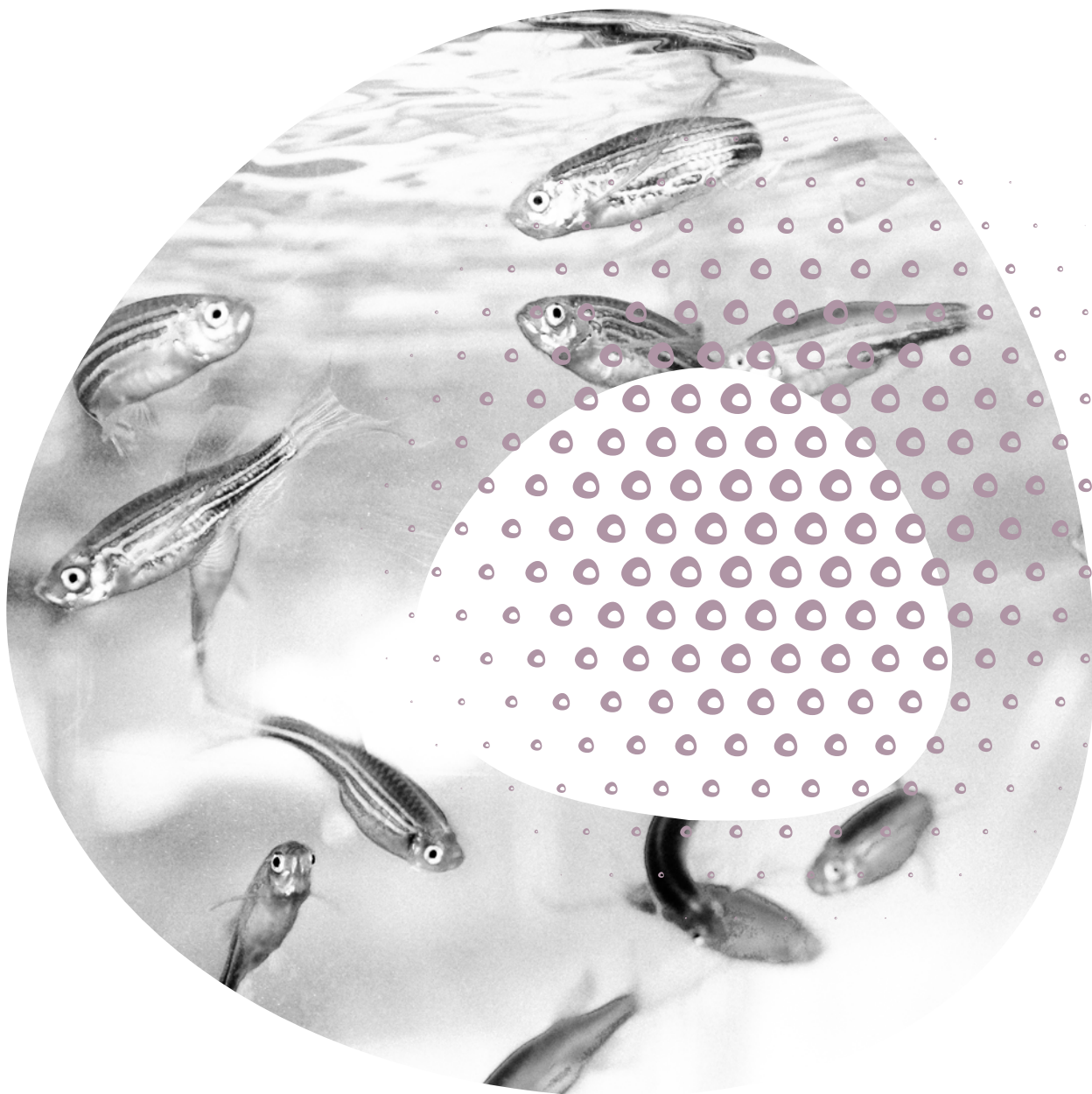
ABOVE

'Dead' heart transplant patients Michelle Gribilas and Jan Damen with Dr Kumud Dhital

Credit: AAP

BACKGROUND

Dr Kumud Dhital



Developmental and Stem Cell Biology

Headed by Professor Richard Harvey, this division aims to understand the molecular basis of inherited birth defects, the identification and characterisation of adult cardiac stem cells and the genetic pathways controlling cardiac regeneration. The groups in this division use both mouse and zebrafish as model genetic systems as well as collaborating with clinicians to analyse inherited birth defects in humans.

Harvey Laboratory

Headed by

Prof Richard Harvey

Key research areas

- Heart development
- Congenital heart disease
- Cardiac stem cells and regeneration

How does the heart form in the embryo?

Deputy Director Professor Richard Harvey and his laboratory study how the heart forms in the embryo and the mechanisms of heart repair in the adult.

In humans, the heart begins to beat after only the first few weeks of embryonic life, when it is still a simple muscular tube. As heart structure develops further through the addition of valves, specialised pumping chambers, and a more sophisticated electrical system, its output increases to meet the demands of the growing embryo.

The forming heart seems especially vulnerable to defects in the gene pathways that control its shape and component tissues, and this is why structural malformations of the heart (congenital heart disease) are relatively common in newborn children.

The Harvey group is seeking to understand how gene defects cause heart defects, and how this information can be used to help families with congenital heart disease.

The laboratory also studies how the adult heart compensates for wear and tear after a lifetime of mechanical activity, and how it repairs itself after an injury such as a heart attack.

Professor Harvey and his colleagues in Israel have discovered how to promote the expansion of heart muscle cells in a way that stimulates heart regeneration after injury.



Ten years ago most people doubted that the heart could regenerate at all. Thanks to ground breaking studies, we can now dream of new medicines that will augment the human heart's innate ability to regenerate the muscle cells lost after a heart attack.



Did you know?

Many millions of heart muscle cells are lost after a heart attack.

52

Australian women have a heart attack every day

RIGHT Harvey Laboratory team



Dunwoodie Laboratory

Headed by

Prof Sally Dunwoodie

Key research areas

- Congenital heart disease
- Embryonic development

Congenital heart disease is the most common cause of birth defect in Australia. 42 babies are born with a heart defect every week, but despite how common it is doctors have absolutely no idea why 80% of cases occur. Not enough research has been done into what causes heart defects and consequently, most parents are given zero explanation as to why their baby was born with a heart problem.

World renowned scientist, Professor Sally Dunwoodie has dedicated her life's research to understanding the causes of congenital heart disease and is trying to identify the gene in each baby that is not working properly.

In the last decade the Dunwoodie laboratory has already discovered a number of genes that cause defects and diagnostic genetic tests are now available as a direct result of their research findings.

Did you know?

In 2014 Professor Sally Dunwoodie was named as one of Australia's 100 Women of Influence for her outstanding work in congenital heart disease and for her leadership within the Victor Chang Cardiac Research Institute.



I find it amazing that we know so little about the most common type of birth defect in both Australia and around the world. Every child deserves the right to a healthy start to life, but sadly this is not always the case.

4

babies die from congenital heart disease each week in Australia

30

babies undergo heart surgery in Australia every week



Prof Dunwoodie and some of her colleagues

Searching for the missing pieces in the puzzle

Finding a defective gene is like trying to find a needle in a haystack. Scientists have to sift through billions of pieces of genetic code to find answers.

This is about to change thanks to an incredible advance in technology and a new \$10 million 'Gene Machine'.

Importantly, it promises far more answers for the parents of a sick baby. And not only that, scientists will also be able to tell families the likelihood of having a second baby with a heart problem.

Kikuchi Laboratory

Headed by

Dr Kazu Kikuchi

Key research areas

- Heart muscle regeneration
- Heart failure

Something fishy!

Believe it or not, humans are very similar to zebrafish. Our organs develop in similar ways and almost 70 percent of our disease-causing genes are related to those found in the tiny freshwater fish.

The Kikuchi Laboratory uses zebrafish to study heart muscle regeneration.

In humans the heart does not regenerate after it is damaged, for example from a heart attack. Instead, the damaged tissue is replaced by fibrotic scar tissue, which provides a quick repair from the damage, but fails to restore cardiac function and increases susceptibility to heart failure.

By contrast, zebrafish and other vertebrates like the salamander, are known to naturally regenerate heart muscle with little scar formation after injury. The Kikuchi Laboratory has a long-term objective of finding out how this type of regeneration might be used to repair damaged human hearts.

Did you know?

Zebrafish embryos are transparent and develop rapidly outside the body, making them very easy to study!

300

eggs are laid in one week by a zebrafish

18,000

zebrafish call the Victor Chang Cardiac Research Institute home!



Kikuchi Laboratory team



I became inspired to work in heart research when I was a medical student in Japan. I was seeing patients who were suffering from heart disease, and I couldn't help noticing how badly they struggled to recover.

A heart healed without a scar

To understand how the zebrafish heart is able to regenerate without much scar formation, the Kikuchi Laboratory is investigating the role of immune cells, which are essential to fight microbes and viruses but are believed to be critical for successful repair and regeneration of damaged tissues.

It is hoped this research may lead to the development of novel therapies to grow new heart muscle in damaged human hearts.

Brave baby Lara full of heart



Little Lara was born with a broken heart. Her parents, Kirsteen and Kevin, found out there was a problem with Lara's heart when Kirsteen was just 20 weeks pregnant.

"We were told her condition was severe and very complex. It was very confronting and I wouldn't wish it on anyone".

Growing up in Canberra, Kirsteen and Kevin always imagined raising their kids there too, but with Lara so sick, that wasn't an option anymore. The family relocated to Sydney to be close to Westmead Children's Hospital where Lara would spend weeks in intensive care.

As soon as she was born Lara needed open heart surgery. The size of a walnut, her tiny heart is on the wrong side of her body and one of her valves did not form properly. She also has a hole in the wall of her heart which was the first thing surgeons tried to fix. The intricate operation lasted almost six hours, and for Lara's loving parents the wait was long and terrifying.

Within weeks they had to go through the whole process all over again.

Like 80 percent of parents, Kirsteen and Kevin were given no explanation why Lara was born with congenital heart disease. Until now, doctors simply haven't had an answer to give them – even though 1 in 100 babies are born with a heart defect.



We were struggling to come to terms with everything. We don't know why this happened to Lara and we were wondering if we did anything wrong.

Kirsteen Martin



Gene machine to the rescue!

For more than a decade researchers at the Victor Chang Institute have been trying to find the faulty genes which cause congenital heart disease. It has been a slow and often frustrating process as scientists have only been able to analyse 2% of a human's entire genetic make-up.

But we are about to witness a paradigm shift in genetic research. Our laboratories will now be able to screen 100% of the human genome – analysing every single gene and every single strand of DNA, leaving no stone unturned.

It's all thanks to a \$10 million Gene Machine which is one of the most powerful machines of its kind in the world. Acquired by our neighbours at the Garvan Institute of Medical Research, it will allow researchers to undertake genetic studies of unprecedented scale for a fraction of the cost.

It also means far more answers for parents, like Kirsteen and Kevin who are desperate to find out what went wrong and still don't know why baby Lara was born with a broken heart.



Molecular Cardiology and Biophysics

The Molecular Cardiology and Biophysics Division, headed by Professor Robert Graham, aims to understand both the molecular signaling pathways that operate within the heart and the molecular basis of inherited genetic heart diseases including cardiomyopathies and arrhythmia syndromes. The division consists of six laboratories.

Graham Laboratory

Headed by

Prof Bob Graham

Executive Director

Key research areas

- Cardiac regeneration
- Heart failure
- Hypertension

100 Years of dogma out the window

Overtaking more than a century of scientific theory, our researchers have discovered that heart muscle cells retain the ability to replicate long after birth.

For more than 100 years scientists believed the heart, much like the brain, stops being able to make new muscle cells either immediately before or soon after birth, limiting the organ's ability to repair itself after injury.



The implications of our findings could be huge, as it may give us a significant window of opportunity in which to repair the hearts of babies born with heart defects, or even to reactivate heart muscle cells damaged after a heart attack in adults.



Did you know?

Genes are turned on and off in different patterns during development to make a heart cell look and act different from a liver cell or a brain cell.

Can we mend a broken heart?

The groundbreaking research, led by Executive Director, Professor Bob Graham and his team working with colleagues in the US, proved that heart muscle cells undergo an intense 24 hour 'burst' of division in preadolescence in response to a surge in thyroid hormone.

During this burst, the number of heart muscle cells increase by more than 40 per cent, or half a million cells, and compared with later in development, enhanced the ability of the heart to recover after injury.

The findings suggest that thyroid hormone therapy could stimulate the process, and may even enhance the heart's ability to regenerate in patients with heart disease.



4x

The heart increases almost four-fold in size from birth to preadolescence, when a child is roughly eight to ten years of age



LEFT Graham Laboratory team

Vandenberg/Hill Laboratories

Headed by

Prof Jamie Vandenberg
Dr Adam Hill

Key research areas

- Arrhythmias
- Electrical activity in the heart

World first breakthrough

In a world first, scientists at the Victor Chang Cardiac Research Institute have achieved a brilliant breakthrough. They can now better detect those with an underlying heart rhythm disorder, which could save the life of someone just like heart attack survivor, Jamie Donaldson. *See page 45.*

Until now, experts have struggled to predict why young and otherwise healthy people will simply drop dead without any warning. But that could soon change.

Did you know?

Arrhythmia is one of the most common causes of death in Australia. The life threatening, electrical disorder kills around 12% of people by stopping the heart from pumping blood effectively – causing sudden death.

40

Australians die because of a heart rhythm disorder everyday



In the past we were limited because we didn't have enough computational grunt to do an effective job.

Video games help doctors with diagnosis

Using the same technology that powers video games, doctors Arash Sadrieh and Adam Hill have built a virtual heart and simulated hundreds of thousands of heart beats. The team then screened all of those heart beats searching for abnormalities.

The simulation took just ten days, thanks to a multimillion dollar CSIRO supercomputer, that's been ranked among the world's most efficient computers. By comparison, if you were to use a standard desktop PC, it would take 21 years to get the same job done. Analysis on this scale has never been possible before.

Once the simulation was complete, our scientists discovered tiny 'biomarkers' visible on the ECG scans of patients suffering from a heart rhythm disorder.

The breakthrough will improve a doctor's ability to interpret an ECG scan. It is also a huge step forward in speeding up accurate diagnosis and developing better treatment plans for thousands of Australians.

The next step

For many people at risk of sudden cardiac death, the only effective treatment option is an implantable defibrillator. These devices are expensive, and come with significant side effects. Some patients will respond well to the implant, while others will struggle to adjust to it. Doctors need to assess whether the odds of sudden cardiac death outweigh the risk of implanting the device.

LEFT Vandenberg/Hill Laboratory team



Fatkin Laboratory

Headed by

Prof Diane Fatkin

Key research areas

- Dilated cardiomyopathy
- Atrial fibrillation
- Inherited heart disease

On the hunt for faulty genes

The Fatkin Laboratory focuses on two of the most common types of heart problems; dilated cardiomyopathy and atrial fibrillation. Led by Prof Diane Fatkin, her team of researchers is trying to find the faulty genes that cause inherited heart diseases and work out how these gene changes affect heart function.

Research in the Fatkin Laboratory is taking a whole new direction. Thanks to our colleagues at the Garvan Institute of Medical Research our scientists now have access to a multimillion dollar Gene Machine which is revolutionising the way they conduct research.



Fatkin Laboratory team



Did you know?

Dilated cardiomyopathy occurs when the heart muscle becomes enlarged and weakened.

Grand opening

In 2014, Australia's first ever clinic solely dedicated to patients with inherited forms of dilated cardiomyopathy was established by the Victor Chang Cardiac Research Institute and St Vincent's Hospital, Sydney. The Familial Cardiomyopathy Clinic is the brain child of Prof Peter MacDonald, Dr Andrew Jabbour, Dr Renee Johnson and Prof Diane Fatkin. The clinic provides genetic testing for patients with a family history of the disease, so those at risk can be closely monitored for early warning signs.



Family management of dilated cardiomyopathies has been seriously overlooked in the past. We need to change our focus from treating patients with severe symptoms and established disease – to prevention.

1/500

people are affected by cardiomyopathies in Australia

29

Australian women die of heart disease every day

Martinac Laboratory

Headed by

Prof Boris Martinac

Key research areas

- Ion channels in the heart
- Mechanical forces

Good vibrations electrify the heart

Humans and animals are able to perceive vibrations when they hear something, or something touches their skin. Similarly, even our heart cells can respond to touch and a variety of mechanical forces.

When the heart is beating and pumping blood, its cells feel the motion and respond by sending an electrical current throughout the heart.

This current is made possible by a type of protein known as an 'ion channel', which pokes through the membrane of the cell. It acts much like a tap on a hose, opening to let ions flow through the cell membrane, and closing to shut off the electrical current.

Scientists currently have a limited understanding of the role these ion channels play in heart and cardiovascular disease. Professor Martinac and his team hope to change that.

His research has already disproved 30 years of scientific belief regarding the mechanical properties of a cell membrane. Prof Martinac discovered that the membranes are about five to ten times softer than previously believed.



Prof Martinac with some of his collaborators



I worked day and night for years on this discovery. There's nothing more exciting than understanding how this world works and I'm very proud of this breakthrough.

Innovative cancer treatment to target killer tumours

Next, Professor Martinac plans to develop an innovative, new method of targeting tumours using magnetic forces, which could vastly improve the treatment and wellbeing of cancer patients.

Working in collaboration with the University of Wollongong, the proposed treatment involves attaching tiny magnetic particles to drug carriers that can be guided through the body to the exact site of the cancer.

Currently, large doses of highly toxic cancer medications are required to kill a tumour, often leading to serious side effects and damaging healthy tissues and organs.

Our magnetically targeted drug delivery method would help to reduce the amount of cancer-killing medication needed to kill the tumour and would markedly reduce side effects.



Did you know?

With a single punch, a boxer can generate a force of 4000 newtons! That is 160 times the force needed to break an egg. By comparison, the protein ion channels in the heart require a force a thousand billion times smaller (that's 1,000,000,000,000!) than this to open.

Hool Laboratory

Headed by

Prof Livia Hool

Key research areas

- Cardiomyopathy
- Heart failure associated with muscular dystrophy

Professor Livia Hool decided to pursue a career in heart research after observing how quickly heart attack patients deteriorated to heart failure and death in the Coronary Care Unit at Royal North Shore Hospital.

Now an expert in electrophysiology, Prof Hool leads a team of nine talented researchers who are investigating the effects of calcium and free radicals on heart function.

Prof Hool is also currently optimising treatments to help people with ischemic and hypertrophic cardiomyopathy, as well as heart failure associated with muscular dystrophy.



I get a real buzz out of collaborating with other research organisations and seeing the results of clinical trials. This is the most rewarding aspect of my work.

1/3,500

boys are affected by muscular dystrophy – a fatal muscle wasting disorder which can weaken or damage the heart and results in death by the age of 20-30 years

Hope for boys with muscular dystrophy

Muscular dystrophy is a fatal muscle wasting disorder affecting 1 in 3,500 boys. The boys show signs of weakness as infants and are restricted to a wheelchair by age 12.

Our researchers have collaborated with scientists from Murdoch University to develop a drug therapy to help these young boys suffering from muscular dystrophy.

The drug was administered to a wheelchair-bound 10 year old in the United States as part of a clinical trial and it helped enormously! So much so the boy was able to run in the Boston Children's Marathon in June 2014.

Based at The University of Western Australia, Professor Livia Hool is the newest faculty member to join the Victor Chang Cardiac Research Institute. Her appointment is the initial phase of the Institute's plans to give back to the west coast community and to enhance cardiovascular research in WA.

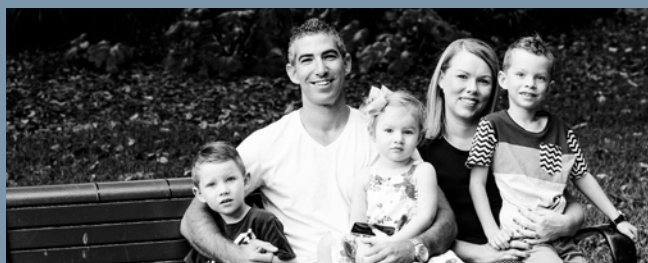


Prof Livia Hool

Did you know?

Measuring calcium build-up in the arteries could give doctors a better indicator of the likelihood of heart attack and stroke.

Meet Jamie, the man who came back from the dead



From one day to the next, 34-year-old Jamie Donaldson's life changed. The morning started full of promise as Jamie was going to run his first half marathon. He'd trained for it and was ready to go, cheered along by his wife Kylie and their two toddlers. Kylie, who was 5 months pregnant at the time, waited at the sidelines for Jamie to finish the race. He remembers waving at them as he passed. Kylie waited and waited... She did not know that Jamie was dying just a few metres away.

Jamie was clinically dead for six minutes.

He'd collapsed just past the finishing line, right next to a first aid station. St John's Ambulance volunteers rushed to him, ready to jolt his heart back to life. Every second counted. 1 in 10 people who suffer a heart attack outside of a hospital do not survive.

Jamie did not know he was walking around with a time bomb, slowly ticking away inside his chest.



As soon as I stopped I realised something was definitely wrong. I grabbed onto the fence but pushed myself away as I knew I was going to collapse. It was an eerie feeling.

Jamie Donaldson

Should survival depend on luck?

Jamie is one of the lucky ones. It took weeks in hospital before he was diagnosed with an underlying heart condition known as Long QT syndrome, a heart rhythm disorder that is usually only discovered during an autopsy.

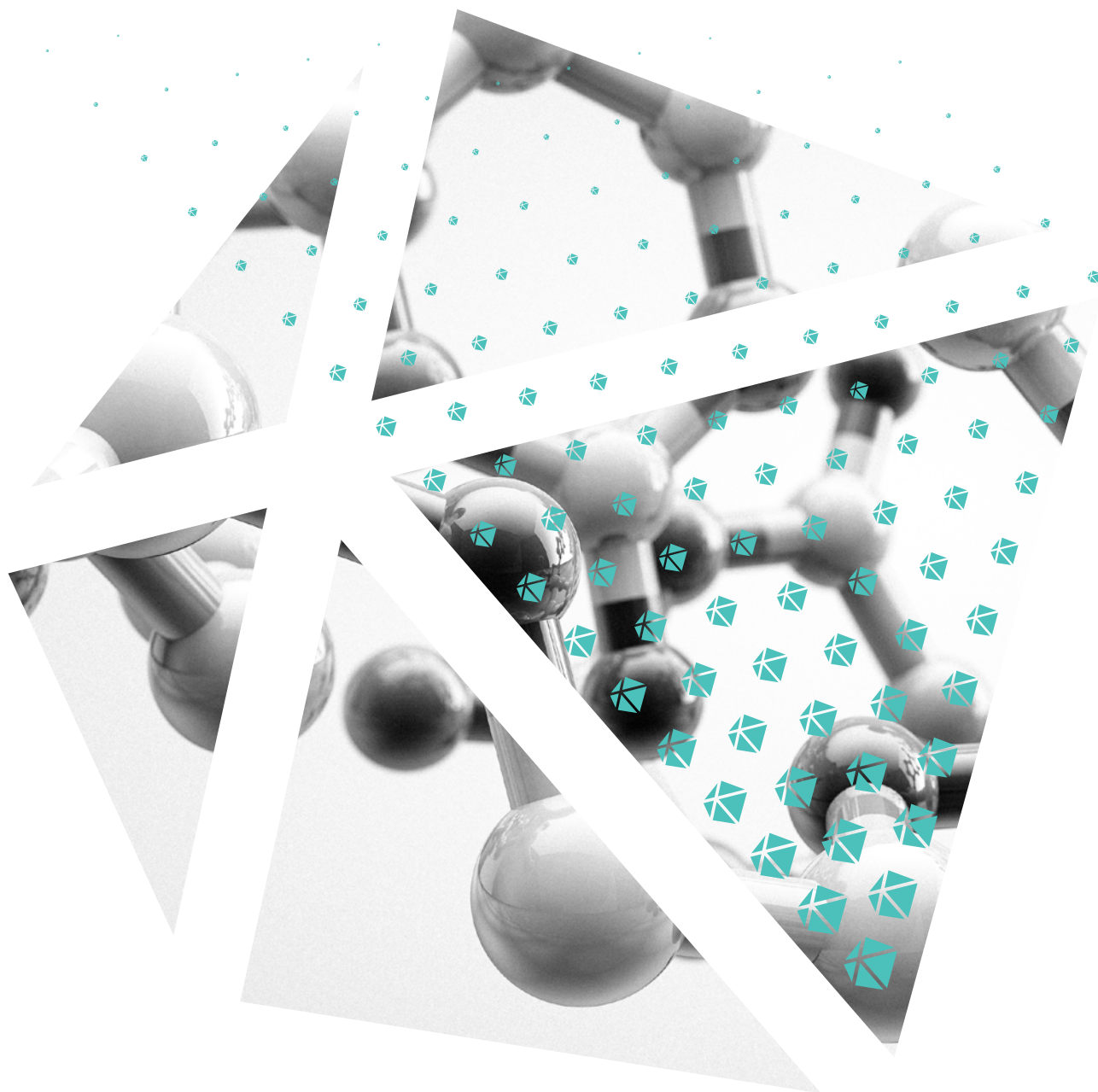
"I was bewildered. There was no warning, no precursor and I had no idea."

Jamie has now been fitted with an Implantable Cardioverter Defibrillator (ICD), a device that detects and corrects abnormal heart rhythms.

Thanks to the ICD and bi-annual check-ups, Jamie is thriving, leading a normal life, treasuring time with his children and wife Kylie. They have been screened for the disease, as have his parents and siblings and they are all thankfully well.

40 Australians die because of a heart rhythm disorder every day. The disease is a secret killer that can strike anyone unexpectedly as it is notoriously hard to detect with current technology.

"To detect or prevent others dying suddenly in the future is awesome!"



Molecular, Structural and Computational Biology

This division seeks to understand the function of the heart in health and disease at the molecular level, and to understand the mechanisms of gene regulation. Understanding the molecular mechanisms of proteins that are central to the development, maintenance and proper functioning of our hearts, as well as the processes of gene expression, is crucial for diagnosis, drug design and treatment of disease.

Stock Laboratory

Headed by

Prof Daniela Stock

Key research areas

- Protein structures
- X-ray crystallography

X-ray vision: zooming in on protein structures

Have you ever wondered why blood is red, grass is green, diamonds are hard and wax is soft, why graphite writes on paper and why silk is strong?

The answers lie in the science of X-ray crystallography – a vital scientific method for determining the precise structure of biomolecules on the smallest possible scale.

Crystallography remains relatively unknown to the public, yet it underpins many fields of study and enables researchers to understand the functions of proteins in health and disease.



Dr Stock and some of her colleagues

Lead by Dr Daniela Stock, the Structural Biology Laboratory uses X-ray crystallography to visualise proteins and enzymes, such as ATP synthase, at extremely high resolution.

ATP synthase is a biological motor that provides energy for a cell and is manufactured inside the mitochondria.

Mitochondrial bioenergetics is very complex, tightly regulated, finely balanced and also very little understood. For any real breakthroughs in repairing damaged hearts or even better, to prevent damage, we need to understand these processes in molecular detail. This is what the Structural Biology Laboratory is aiming to achieve in the long term.

Did you know?

The father of X-ray crystallography, Lawrence Bragg, was born in Adelaide in 1890. He received the Nobel Prize when he was only 25 years old and remains the youngest Nobel Prize winner of all time.



Think of structural biology like a broken down car. If you take it to the mechanic they will be able to understand how a motor works and fix the problem. Similarly, we are trying to understand how the engines in our body work at the molecular level. That way we hope to be able to fix problems in the future.

6 kg

Life needs energy. ATP synthase produces the biological fuel ATP. We turn over our own body weight in ATP every day. Our heart alone burns 6 kg of this fuel to beat roughly 100,000 times a day.

Suter Laboratory

Headed by

A/Prof Cath Suter

Key research areas

- Epigenetics
- Parental obesity

Obesity is written in our genes

Researchers from the Suter Laboratory have previously shown that the diet of each parent can program the behaviour of genes in their children to be 'fat genes.'

But how exactly does the memory of obesity get carried from the parent's genes to their children?

Scientists used to believe that DNA was the be-all and end-all of inheritance. However DNA has been knocked off its pedestal by a newcomer, called small noncoding RNA. Only in the last few years has the pervasive role of these tiny RNAs, a close chemical cousin to DNA, been realised, and no doubt there remains more to be discovered.



This is an exciting new area of research that may have far-reaching implications for how we understand inheritance.

10.8 million

adults are either overweight or obese in Australia

LEFT
Suter Laboratory team

Small RNAs: a magic bullet against obesity

Small RNAs are a tiny fragment of genetic material that tweaks the activity of genes, and controls how much or when proteins are produced in a cell. In some cases, these small RNA particles totally silence a gene, turning off the production of proteins, much like turning off a tap.

An RNA signature from a parent may be passed down to the embryo, where the RNA can interfere with gene expression during development. This gene silencing may lead to obesity-related conditions such as inflammation, glucose intolerance, and hypercholesterolemia.

Researchers are hoping that in the future these RNA signals can be manipulated – perhaps even acting like a magic bullet to stop obesity-related conditions.

In 2013 Associate Professor Cath Suter together with Dr Jennifer Cropley discovered that while obesity and type 2 diabetes in pregnancy can program children to develop metabolic problems in life, if the children are careful about what they eat, it can be overturned. They have since found the same goes for a father's metabolism.



Did you know?

The DNA in your cells is shaped like a tightly coiled spiral. If you stretched out all of the DNA in your body, end to end, it would reach further than the moon and back again!

Ho Laboratory

Headed by

Dr Joshua Ho

Key research areas

- Bioinformatics
- Mass analysis of human genomic data
- Inherited heart disease



Ho Laboratory team

Bioinformatics is the application of computer science, mathematics and statistics to understand how complex biological systems work. We can now solve previously unthinkable biological questions by analysing a large amount of genetic data using cutting-edge computational methods, such as fast database search engines, artificial intelligence, computational linguistics, and cloud computing technology.

Did you know?

Analysing a whole genome sequencing dataset using a standard desktop computer will take up to a week. Using highly parallelised cloud computing technology, the same task can be completed in a matter of hours.



Through bioinformatics, research and discoveries will become far cheaper, less time consuming and more powerful.

The needle in the haystack

The Victor Chang Cardiac Research Institute now has access to state of the art gene sequencing technology which enables our researchers to look at a patient's entire genetic make-up and find mutations that cause heart diseases. Nonetheless, sifting through 6 billion characters in a human genome to pinpoint the disease-causing mutations is like finding a needle in a haystack.

A genetic roadmap

In 2014, Dr Ho led a team of scientists worldwide to produce the world's most comprehensive map of the chromatin organisation of roundworm, fruit flies and humans. Chromatin organisation controls how genes are switched on or off. By comparing the chromatin maps of three evolutionarily distant organisms, the team was able to gain a glimpse of how chromatin might have evolved and how it may be regulated at a fundamental level.

Another highlight in 2014 is that Dr Ho was awarded the prestigious Human Frontier Science Program grant – one of the few awarded among 800 international entries. The fund will enable Dr Ho's team to develop new computational methods to uncover how DNA sequence elements are organised and regulated – essentially decoding the language of life!

20,000+

genes are in the human body

12

bioinformaticians were working at the Victor Chang Cardiac Research Institute in 2014

Lee Laboratory

Headed by

Dr Lawrence Lee

Key research areas

- Synthetic biology
- Molecular motors
- DNA self-assembly

The bacteria flagellar motor – faster than a racing car

The bacteria flagellar motor is nature's fastest nanoscopic machine on the planet, rotating five times faster than a formula one engine! The flagellar motor enables bacteria to swim rapidly towards nutrients and away from toxins, which is crucial to the spread of infection.

Bacteria are responsible for many of our most serious diseases, including bacterial endocarditis that destroys heart valves and rheumatic fever that causes inflammation of heart muscle.

Despite the damage it causes, a lot can be learnt from the bacteria flagellar motor. Not only is it extremely agile, but it is also an incredible detective, using its powerful sensor to survey its surroundings.

Taking a fundamentally new approach, Dr Lee's laboratory is trying to understand how the flagellar motor works by building a synthetic copy of it at an atomic scale.



Lee Laboratory team

100,000 rpm

Bacteria's flagellar motor has been clocked spinning at over 100,000 revolutions per minute, yet it can switch directions in just a few milliseconds

Did you know?

One day antibiotics may no longer work. In 2012 alone it is estimated there were 450,000 new cases of antibiotic resistant tuberculosis.

Nature knows best

Tiny machines like the flagellar motor have been fine-tuned over 4 billion years of evolution to perform tasks with unprecedented effectiveness.

By imitating Mother Nature, Dr Lee's laboratory hopes to develop a fresh generation of vaccines and new diagnostic tools to detect diseases caused by viral and bacterial pathogens.

The team has already had enormous success!

In October, 'Team Echidna' became the first undergraduates in the southern hemisphere to win the Grand Prize in Harvard University's BioMod Championships – beating some of the world's best young minds along the way.



We have built a DNA machine that works a bit like a light switch. When the DNA comes into contact with a disease, it turns on and starts to glow like a beacon – alerting scientists to its presence.

How heart research saved Julie



By sharing her story with you Julie Owens can thank the research and medical teams who saved her life, time and time again. Her life started quite routinely, but soon became one of courage and tenacity for her, her parents and three siblings. When she was one Julie was diagnosed with congenital heart disease and given 3 months to live.

"Back then, they didn't have the technology to do what they needed to do to fix the problem. I spent a lot of my time in and out of hospitals".

Julie had open heart surgery twice as a child; the first to fix the mitral valve of her heart and five years later to mend the wall of her heart.

"Each time I went into hospital in those days you were in hospital for nine months and you had to learn to walk again, because they kept you bedridden. I was in hospital more than I was at home with my family".

Knowledge about the heart and how it functions have progressed to such a degree that today Julie's damaged heart could have been fixed with one operation, with minimal time spent in hospital.

Julie refused to let her damaged heart rule her life. She was warned it would not be wise to have children as her heart could not withstand the pressure, but Julie and her husband Mark wanted to be parents. Her first pregnancy went well and she gave birth to Barrett, a boy named after the brilliant surgeon who had operated on Julie when she was a child.

The next pregnancy did not work out as well – a healthy baby boy was born, but Julie's heart failed.



We are so lucky with the technology we have and it's so important that we continue with that research, because if we didn't, I wouldn't be here.

Julie Owens

Two more open heart surgeries later, Julie takes each day of her life as a special gift – made possible by advances in heart research.

Julie is grateful that research and medical breakthroughs ensure no child will have to suffer like she did and that one day there will be cures for congenital heart disease. A wish Julie knows is not farfetched as she is a prime example of how the pace of research discoveries has escalated in her lifetime.

"I feel incredibly lucky I reached 21 and now I'm going to reach 60, that's an amazing feat".

"If it hadn't been for the surgeons and the people around me I'm not sure if I would have pulled through. We are so lucky with the technology we have and it's so important that we continue with that research, because if we didn't, I wouldn't be here".



Vascular Biology

The aim of the Vascular Biology Program is to better understand the process called atherosclerosis, or hardening of blood vessels. Atherosclerosis is the single biggest cause of heart attacks, stroke and death in Australia. This program studies the contribution of oxidative processes to atherosclerosis, and how the disease can be inhibited.

Stocker Laboratory

Headed by

Prof Roland Stocker

Key research areas

- Atherosclerosis
- Heart attack
- Stroke

A silent killer

There's a reason atherosclerosis is notoriously known as the 'silent killer'. The deadly disease can slowly, secretly ravage your heart undetected, often leading to heart attack and stroke.

It is caused by a build-up of fatty deposits, cholesterol and plaque on the inside of the arteries due to high blood pressure, high cholesterol and smoking. It leads to life threatening blockages in your arteries and puts blood flow at risk – without you ever feeling a thing.

Professor Roland Stocker and his team of researchers are trying to work out what goes wrong in the blood vessels, how they become diseased and how the process of atherosclerosis can be stopped.

Does the heart run out of gas?

Professor Stocker has been awarded a grant from the Australian Research Council (ARC) to discover the role that a particular molecule may have on the heart. Coenzyme Q10 is naturally present in all cells and is found in highest amounts in the heart. The Stocker Laboratory is investigating what regulates the formation of coenzyme Q in our body and its transport to the 'power plants' of our cells where coenzyme Q is needed to produce energy. The work is directly relevant to heart failure which may be due in part to a gradual decrease in coenzyme Q10 as we age.

Think of it in terms of a car that starts with a full tank of petrol. If you drive it around and around it will slowly run out of fuel until it conks out. Similarly, as our hearts grow older and the levels of the coenzyme drop off, it's like our bodies have run out of gas, causing heart failure.



Most cardiovascular disease is caused by a fault in the pipes of your heart. To do its job effectively in pumping blood around the body, the heart needs the blood vessels to be in good condition too.



Did you know?

Atherosclerosis is the biggest cause of heart attack, stroke and death in Australia.

The raw price of Coenzyme Q10 used to be double the price of gold! Now it costs roughly more than \$5,000 per kilogram.



340,000+

Australians are estimated to have had a heart attack at some time in their lives

LEFT Stocker Laboratory team

Vale Neville Wran



Neville Wran was the inaugural Chairman of the Victor Chang Cardiac Research Institute. He spent 14 years at the helm, before retiring in 2008.

Neville took on the Chairmanship when the Institute was first incorporated as an independent organisation in 1995, and at a time when the Institute was beginning to establish itself as a first-class research organisation.

A one-time patient of Dr. Victor Chang himself, and having served as Chairman of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) for several years, Neville had a keen interest in science and medicine and threw himself into the job.

He was responsible for the recruitment of an outstanding Board, attracting people of the calibre of Mark Johnson, Steven Lowy, John Laws, Anne Keating, Paul Kelly and Sam Chisholm, as well as long-term supporters Bob Oatley and John David.

Under Neville's tenure we saw the Institute grow from having very few staff, and renting a floor in the Garvan building, to having its own purpose built facility, proudly housing the Neville K Wran Boardroom, and with a team of more than 150 world-class scientists.

He gave his time freely during his Chairmanship, and loved to visit the Institute and mix with the young doctors and scientists to hear about their latest work and discoveries.

Neville ran a tight ship, Board meetings always lasted exactly one hour, but he made himself available to all and sundry at fundraising events. These spanned high profile events, such as visits from Diana, Princess of Wales and Her Royal Highness Crown Princess Mary of Denmark, to early morning jaunts through the Flemington Markets to visit staunch Institute supporters in the fruit and veggie trade.

He was also incredibly generous and inclusive, encouraging those around him and seeking their views. Neville possessed consummate political skills and tact, a wicked sense of humour, and always kept the interests of the Victor Chang Cardiac Research Institute at the front and centre of his work.

Indeed, the Institute is what it is today thanks in no small part to Neville's Chairmanship. We are extremely grateful for his mentoring, guidance and wisdom. He will be sorely missed by us all, and for many, he will also be sadly missed as a personal friend and mate.



NEVILLE WRAN AC, QC 1926 – 2014

Professor Robert Graham

EXECUTIVE DIRECTOR, VICTOR CHANG CARDIAC RESEARCH INSTITUTE

Statement of income and expenditure



For the year ending 31 December	2014 \$	2013 \$
Income		
Grants	12,270,564	13,572,060
Donations and fundraising	5,061,592	5,567,651
Investment income	1,608,199	1,356,661
Other	159,211	129,383
Total income	19,099,566	20,625,755
Expenses		
Research expenses	14,725,785	14,803,420
Administration expenses	5,739,681	5,455,736
Fundraising expenses ¹	764,183	586,390
Total expenses	21,229,649	20,845,546
(Deficit) before non operating income	(2,130,083)	(219,791)
Non operating income		
Unrealised gain on investment revaluation to market	889,278	1,520,276
Net (deficit)/surplus for the year	(1,240,805)	1,300,485

1. Fundraising expenses are funded from investment income, so that 100% of donations are used for research
Comparative figures have been adjusted to conform with changes in presentation for the current year.

Fundraising



Ladies who lunch ♥

In May 2014, more than 300 guests gathered for the third Monica O'Loughlin Women Against Heart Disease luncheon. Hosted by the Victor Chang Cardiac Research Institute in partnership with the Commonwealth Bank's Women in Focus group, the event raised more than \$90,000. Our guests heard from a stellar panel consisting of heart transplant survivor, Fiona Coote, Dr Joanna Emanuel, heart attack survivor Margaret Kilby and Professor Diane Fatkin. Their message? Heart disease kills four times more women than breast cancer, though few people realise how widespread it is.



One link in a chain reaction ♥

The Victor Chang Cardiac Research Institute is also supported by Chain Reaction – a charity dedicated to helping babies born with congenital heart disease. In March a group of business executives swapped their suits for lycra to take part in The Chain Reaction Challenge – a 1,000km cycle in Tasmania. This year a team of 29 cyclists raised \$250,000 to help our Institute undertake research into the most common form of birth defect in newborns.



Thank you!

A big shout out to all of our other fundraisers who are helping us find a cure for heart disease! The Victor Chang Cardiac Research Institute was lucky enough to be chosen as the beneficiary for all kinds of events – big and small. From fun runs and trivia nights, to golf events and family fun days, we know that every contribution brings us closer to a healthier future... And for that we will always be very grateful.



A night to remember

The Victor Chang Cardiac Research Institute celebrated 20 years of world first discoveries in style at the Victor Chang 20th Anniversary Ball in August. The Prime Minister, the Hon Tony Abbott MP, attended as the guest of honour, and our supporters were entertained with an explosive performance by Australian music icon, Jimmy Barnes. We are delighted to report \$600,000 was raised for medical research on the night.



Giddy up!

Dressed to impress in the Victor Chang marquee, 150 guests attended the Polo in the City event at Centennial Park in November. Champagne flowed as the cheering crowd watched one of the oldest sports in the world. Raising money for the Victor Chang Cardiac Research Institute, a holiday for two to Africa was raffled. The sensational prize was donated by The Classic Safari Company, South African Airways, Sunlux Collection and supported by South African Tourism.



Paceline riders unstoppable

Nothing could stop Paceline founder, Steve Quinn, from taking part in the 2014 Paceline tour through Victoria. The cycling enthusiast was still recovering from his fourth heart surgery when he hopped on his bike to raise money to find a cure for cardiac arrhythmias. Joined by 35 other cyclists, Steve was only well enough to ride a small portion of the eight day, 1400 kilometre challenge. But he considers himself lucky to be cycling at all. Since establishing Paceline more than seven years ago, Steve and his team of cyclists have raised hundreds of thousands of dollars for research into cardiac arrhythmias, knowing it brings scientists one step closer to finding a cure.

The Victor Chang Health Check Booth



Keeping Australian hearts pumping

The Victor Chang Health Check Booth travels the length and breadth of the nation, testing Australians for key heart disease risk factors by checking their blood pressure, blood cholesterol and blood sugar levels.

Staffed by nurses, 2014 was another milestone year for the Booth. We have now tested over 26,000 people Australia wide and visited 84 separate locations across four states.

Importantly, 33 percent of people tested had results outside of the normal range and were referred to their GP.

The Health Check Booth is generously supported by HCF, IMB Community Foundation, Sydney Markets Foundation and many other corporate partners.

To book the Victor Chang Health Check Booth for your next corporate or public event, please contact Jayne Baric on **(02) 9295 8760** or **j.baric@victorchang.edu.au**





2014 statistics

171

testing days across Australia

4

states and a multitude of
NSW regional locations visited

53

people tested per day on average

124

record number of individuals
tested in one day

9,126

individual tests carried out



2,912

or **33%** had one or more
results outside of ideal range,
recommended to visit GP



635

or **7%** had high glucose/blood
sugar levels



704

or **8%** of participants
had high blood pressure



2,846

or **32%** had high cholesterol



5,919

or **65%** did not know
their cholesterol levels

Awards



And the winners are...

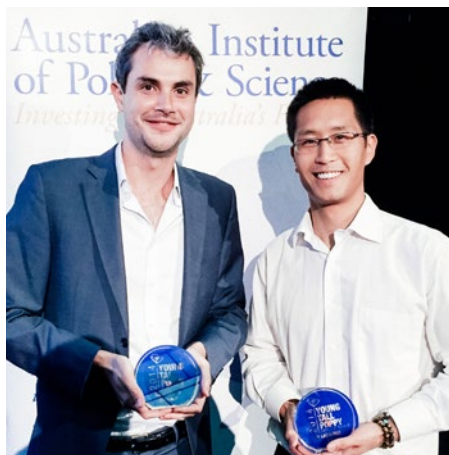
News reporter, Ellie Laing, has been named the 2014 metropolitan winner of the **Victor Chang Awards for Excellence in Cardiovascular Journalism**. Ellie's touching story aired on Channel Ten's 5pm bulletin in May, and was a stand out amongst entries – which came from right around Australia and for the first time, the Asia Pacific region as well. Journalist, Lo Wei, was named the inaugural Asia Pacific winner, while reporter Mandy Squires was also recognised for her story on heart disease.

Young Einsteins

More than 100 talented students from 97 schools have been acknowledged for their outstanding achievements in scientific studies throughout 2014. The **Victor Chang School Science Awards** were handed out in ceremonies held across New South Wales, with recipients demonstrating the highest level of educational achievement, innovation, creativity, and hard work in their science classes. The awards were established to foster and encourage a career in science and research.

Tall poppies

We are thrilled to announce two young scientists from the Victor Chang Cardiac Research Institute have made it into the **2014 Young Tall Poppy** hall of fame! Dr Lawrence Lee and Dr Alastair Stewart were honoured alongside eight of the best emerging researchers from across New South Wales. The Tall Poppy awards honour up-and-coming scientists who combine world-class research with a passionate commitment to communicating science. Dr Stewart also received a **Crystal 29 Rising Star Award** and a **Young Investigator Award**.





Winners are grinners

Beating 33 teams from around the globe, a group of undergraduate scientists representing the Victor Chang Cardiac Research Institute took home the **Grand Prize in Harvard University's 'BioMod' Championships**. It is the first time a team from Australia and the Southern Hemisphere has ever competed in the Ivy League university challenge. An extraordinary achievement in itself, but to go on and win the Grand Prize – is something usually only seen in movies! Proudly wearing the green and gold for Team Australia, were Dr Lawrence Lee, with students Robbie Oppenheimer, Andrew Tuckwell, Jon Berengut, Nicholas Berg, Cyril Tang and Anirudh Balachandar.

Girl power

Also in 2014, internationally renowned Professor Sally Dunwoodie was named on the **100 Women of Influence** list. Sponsored by Westpac and The Australian Financial Review, the awards were established to highlight the important contribution women make towards the future of Australia. A constant source of inspiration and a wonderful mentor, Sally has dedicated her life's work to finding cures for babies born with congenital heart disease.

But wait, there's more...

We'd also like to congratulate **Paul Korner Award** winners, Anita Ayer, Charles Cox, and Navid Bavi. This year the **Executive Director's award** was given to Grants Officer, Jenny McKellar, for her outstanding work and commitment to the Victor Chang Cardiac Research Institute.



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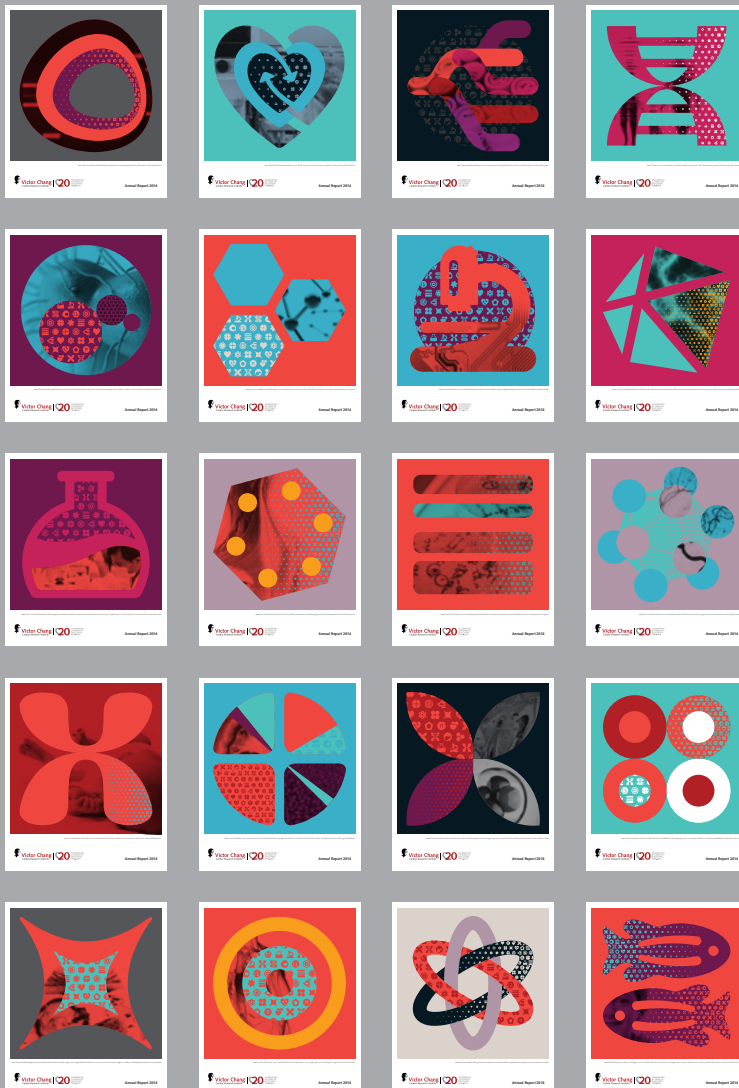
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Celebrating 20 years of discovery 1994-2014

To mark the 20th Anniversary of the Victor Chang Cardiac Research Institute, we have designed 20 different Annual Report front covers to showcase our groundbreaking work and innovative discoveries.



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