



# Partnering for progress

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The wide ranging impacts of engineering, mathematics and information sciences demonstrate not only the importance of funding and excellence in research, but the vital roles of industry and international linkages to scientific progress in this field. In an exclusive interview, ARC's Executive Director for Engineering, Mathematics and Information Sciences Professor Brian Yates highlights the Council's key endeavours towards this end

## What is your academic background and how has this and your other activities helped prepare you for your current role at the Australian Research Council (ARC)?

I joined ARC in January 2013 as Executive Director for Engineering, Mathematics and Information Sciences (EMI). Prior to this, I was a Head of School, a Professor in Chemistry and Deputy Chair of the Academic Senate at the University of Tasmania. My university-wide roles enabled me to experience a variety of scientific disciplines and disciplinary issues.

In my research years I headed up an active computational chemistry programme with particular applications to organometallic, inorganic and organic chemistry, publishing over 140 papers. I also sat on the Board of the National Computational Infrastructure, which provides national supercomputing resources for researchers across Australia.

## Can you discuss your responsibilities as Executive Director?

My role is to help develop new policy initiatives within ARC, support excellent research in Australia, oversee grant awarding processes and provide a conduit for the research sector to interact with ARC. In particular, I manage some of our fellowship and research infrastructure schemes. This has given me a wonderful opportunity to work with researchers at the very beginning of their careers, as well as more seasoned academics with considerable experience and expertise.

## Through which mechanisms does ARC support the EMI community?

ARC supports the highest-quality fundamental and applied research and research training through national competition across a broad range of disciplines, including those in EMI. All funding proposals are assessed based on the quality of the application, which is assessed against specific selection criteria and reviewed by academic experts. Around 25 per cent of all ARC funding awarded goes to disciplines within EMI.

Recently, some new and exciting projects have been kick-started in the field through the relatively new ARC Industrial Transformation Research Program (ITRP). This Program is showing its effectiveness in facilitating the coordination of research and industry partners through its research hubs and training centres. Of particular interest for EMI are two research hubs focused on making improvements in the mining and engineering sector: ARC Research Hub for Transforming the Mining Value Chain and ARC Research Hub for the Australian Copper-Uranium.

Based at the University of Tasmania, researchers from the ARC Research Hub for Transforming the Mining Value Chain are collaborating with partner organisations including AMIRA International, BHP Billiton Olympic Dam, Corescan and Newcrest Mining to improve industry practices to enhance ore deposit discovery, mineral processing, and environmental management of ores and waste materials. Furthermore, scientists from the ARC Research Hub for the Australian Copper-Uranium at The University of Adelaide are collaborating with industry experts including BHP Billiton Olympic Dam, Defence Science and Technology Organisation and University College London, to position the Hub as a world leader in copper production and associated technology.

## What are some of the most pressing and prevalent concerns you hear from Australian researchers? How is ARC addressing these issues?

The most pressing issues for EMI researchers are shared with most other disciplines, including opportunities for early-career researchers and women. Both of these issues are being addressed through our Discovery Early Career Research Award (DECRA) and senior fellowship schemes, as well as by the careful monitoring of project funding schemes and a pro-active consideration of performance evidence in the context of research opportunity.

The underlying principle of Research Opportunity and Performance Evidence (ROPE), completed as part of the ARC grant application process, is to provide a more realistic consideration of a researcher's capabilities and is designed to assist those who have had career interruptions for family or other reasons. DECRA improves gender equality among early-career researchers by using ROPE to take into account career breaks and carer responsibilities.

The Australian Laureate Fellowships scheme includes dedicated fellowships for female researchers. They are named after distinguished and inspiring female researchers: Kathleen Fitzpatrick (humanities, arts and social sciences); and Georgina Sweet (science and technology). These are offered to outstanding female researchers and provide resources to enable these researchers to undertake activities to support and mentor young women.

A general issue facing most disciplines is the support for multidisciplinary research. ARC is addressing this by taking into account the multidisciplinary expertise of people when forming its panels of assessment, as well as ensuring a wide choice of expert assessors.

Some EMI researchers are active in areas that cross over with medical research and ARC has worked closely with the National Health and Medical Research Council (NHMRC) to ensure that such projects do not fall into the gap between the two funding agencies. Furthermore, there is a need to streamline the grant application process, and ARC is consulting with researchers and developing consolidated sets of funding rules and new software to assist with grant applications.

### How crucial is fostering interactions and partnerships between academics and industry stakeholders to ARC?

ARC is conscious of the need to ensure a strong research-industry nexus; such collaboration will help solve the big problems facing our industries today and ensure that research is focused on an end-user perspective that delivers important outcomes.

Late last year the Australian Government released an Industry Innovation and Competitiveness Agenda and is actively seeking and assessing feedback from the sector on how to boost the commercial returns of research. Several of ARC's core funding schemes are designed to stimulate industry connections and attract industry co-funding.

The Linkage Projects scheme – a foundational scheme established in 2001 – has awarded over AUS \$1.4 billion to stimulate research industry linkages in its lifetime. ITRP is another scheme which is driving research and industry connections. The Program's Industrial Transformation Training Centres are specifically designed to provide innovative Higher Degree by Research (HDR) and postdoctoral training for the end-user focused research industries deemed vital to Australia's future. ARC funding awarded under this scheme allows at least 10 HDR candidates and three postdoctoral fellows per year to work in each training centre. This enables those students to pursue industrial training and to enhance competitive research in collaboration between universities and organisations outside the Australian higher education sector.

The ARC Centres of Excellence scheme offers significant long-term funding to focus on critical research issues and also plays an important role in uniting researchers with the core challenges that stimulate innovation, often with spin-offs into Australian business. The scheme is unique and differs from our other funding schemes in the scale and duration of funding – providing funding security for seven years – an extraordinary advantage for a research programme. This scale of support allows research to be nurtured through every stage – from conception right through to realisation.

This scheme also allows students to be mentored early in their research career, perhaps even undergraduate, through honours, to PhD and beyond. It enables relationships to be built nationally and internationally, and for them to be developed with universities and industry over time – which the longevity of an ARC Centre of Excellence facilitates.

### Are there any recently funded projects or Centres of Excellence that you are particularly excited about?

There are a number of ARC funded Centres that are primarily focused on EMI research, the most recent being:

- ARC Centre of Excellence for Nanoscale BioPhotonics
- ARC Centre of Excellence for Robotic Vision
- ARC Centre of Excellence in Convergent Bio-Nano Science and Technology
- ARC Centre of Excellence for Mathematical and Statistical Frontiers of Big Data, Big Models, New Insights (ACEM)

I attended the launch of ACEM last year. This Centre, based at The University of Melbourne, will create innovative mathematical and statistical models that can uncover the knowledge concealed within the size and complexity of big datasets. Researchers there will focus on using newly developed models to deliver insight into societal problems such as health, sustainable environments and prosperous societies.

### Do you have examples where ARC funding has facilitated the commercialisation of a research idea?

One example is ARC Laureate Fellow, Professor Veena Sahajwalla, who partners with Arrrium Mining and Materials (formerly OneSteel) across many projects. A particular success story was the 'Green steel' technology invented by Professor Sahajwalla's team at The University of New South Wales. This technology prevented more than two million waste rubber tyres from ending up in Australian landfill, with OneSteel using the discarded tyres to manufacture steel. Professor Sahajwalla now has two new projects, one part of her Fellowship to recycle e-waste and the second an ARC Research Hub (under ITRP), working with four partner organisations, to create value from mixed plastic and glass waste.

The story of Professor Mark Kendall, an inaugural ARC Future Fellow is also inspiring. Professor Kendall received funding to develop his Nanopatch technology (needle-free immunisation). The research and development under his Future Fellowship led to the spin-off company Vaxxas. Professor Kendall co-founded Vaxxas with \$15 million in capital investment – one of the largest investments in an Australian start-up biotechnology company. In September last year, Vaxxas signed an agreement with the World Health Organization (WHO) to trial the Nanopatch delivery system for polio vaccines – it is hoped this agreement will assist to move the technology through the next stage of clinical trials.

To read Professor Veena Sahajwalla's feature with *International Innovation*, please visit: <http://bit.ly/woman-of-steel>

## STRENGTHS IN AUSTRALIAN EMI RESEARCH

ACCORDING TO THE RESULTS PRODUCED AS PART OF THE ERA 2010 AND ERA 2012 NATIONAL REPORTS, THE EMI DISCIPLINES WHERE AUSTRALIA IS PARTICULARLY STRONG ARE:

- Materials Engineering
- Applied Mathematics
- Engineering
- Mechanical Engineering
- Mathematical Sciences
- Electrical and Electronic Engineering
- Artificial Intelligence and Image Processing
- Pure Mathematics
- Statistics
- Information and Computing Sciences
- Chemical Engineering
- Civil Engineering
- Information Systems
- Resources Engineering and Extractive Metallurgy
- Distributed Computing

From 2002 to 2015, the EMI disciplines that repeatedly make the top five in ARC awarded grants are:

- Materials Engineering
- Nanotechnology
- Artificial Intelligence and Image Processing
- Civil engineering
- Electrical and Electronic Engineering

### Does ARC address researcher mobility through its funding programmes?

ARC has a number of ways in which it facilitates the mobility of researchers, both in terms of geographical location and research career. Our fellowships can be taken up at any university in Australia and this encourages people to consider the best location for carrying out their research. This is particularly useful for early-career and mid-career researchers who are looking to establish and develop their research groups.

The Council emphasises that research performance should be evaluated within the context of research opportunity. It encourages researchers to recognise the value of industrial experience and the importance of this when building careers and assembling teams to tackle significant research problems – through ITRP, for example. This in turn facilitates the mobility of researchers between industry and academia.

Mobility is also facilitated through ARC's Centre of Excellence scheme. This scheme is built around collaboration between researchers and as part of this students and researchers are encouraged to spend time at the different nodes of each Centre and to share ideas and solutions across disciplines and institutions.

### How important is it that early-career Australian scientists gain international experience? To what extent is ARC prioritising global partnerships?

ARC is very conscious of building a strong international strategy. Australian-based researchers are working within an increasingly globalised sector, where cross-fertilisation of knowledge and ideas and researcher mobility are essential to advancing research and innovation capacity as well as addressing societal challenges. It is vital for researchers to gain international experience and ARC's funding schemes allow for this exchange.

In seeking to achieve its international mission, ARC undertakes a range of international activities including direct support of international researcher collaboration, participation in research forums, and liaison with funding agencies overseas. As a government funding body, ARC is also in dialogue with funding agencies internationally to discuss research policy matters of mutual interest, such as peer review processes, open access and capacity building.

ARC encourages international collaboration through opportunities for international researchers to partner with Australian researchers across the National Competitive Grants Program. Of new ARC-funded research projects commencing in 2014, more than 60 per cent involved international collaboration.

### What are your plans for the future of the Council's activities within EMI?

My main goal is to increase communication with EMI researchers at all levels. In this regard I plan to continue my visits to universities and give presentations on various topics of interest to EMI researchers. This is a two-way activity and I have found these sessions to be very important in terms of hearing about issues facing researchers and their feedback on various ARC initiatives. In addition, I intend to continue my meetings with representatives from the EMI sector, including people from professional bodies and academic leaders. This is a very important role for me as Executive Director to allow me to communicate the current thinking of ARC to EMI researchers and to ensure that we are taking into account the variety of situations in which EMI research is carried out.

#### KEY ELEMENTS OF ARC SUPPORT FOR INTERNATIONAL CONNECTIONS THROUGH THE NATIONAL COMPETITIVE GRANTS PROGRAM (NCGP) INCLUDE:

- Global eligibility for ARC funding schemes
- Travel costs included as budget items
- International Collaboration Awards which provide support for travel and subsistence costs
- Fostering cooperative use of national and international facilities through the Linkage Infrastructure, Equipment and Facilities scheme
- International and industry connections through ARC Centres of Excellence and Industrial Transformation Research Hubs and Training Centres
- Eligibility of overseas organisations as partner organisations under the Linkage Projects scheme

