

Emphasis on short-term gains worries Australia's science community **FREE**

Researchers maintain that excellence in science requires a long-term strategy, money, and closer interactions with the commercial sector.

Toni Feder



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TIM WETHERELL

The tandem Van der Graaff accelerator at Australian National University is among the many facilities across Australia for which future funding hangs in the balance. The source of accelerated ions is at the top of the 35-meter-high column.

The space part of his portfolio involves tracking spacecraft; it is not affected because it is funded by NASA (see “The Deep Space Network at 50,” by Joseph Lazio and Les Deutsch, on page 31 of this issue).

Tension in the system

University researchers, for their part, have their eyes on the ARC, which funds research across many fields. The 2014–15 ARC budget was cut Aus\$75 million, or 3.25%, and its competitive grants program was pared from Aus\$887 million to Aus\$879 million. The success rate for grant applicants, which had been about 20%, will likely drop to roughly 18%, according to ARC chief executive officer Aidan Byrne. But, he says, “the situation is not dire. The challenge is that there are not many other sources of funding. That causes tension in the system.”

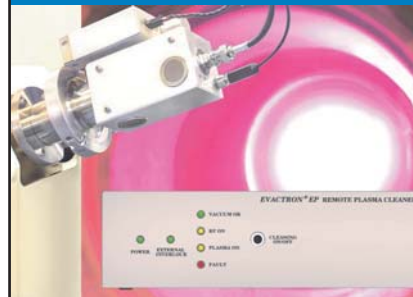
Researchers, however, see things differently. Grants are funded at such low rates, says University of Melbourne physicist Steven Praver, “that confidence is being eroded. Success is seen as having a large luck component.” And, he says, new and innovative but risky ideas are not getting funded. The message to younger people is that “a career in research is not a realistic option.”

Tanya Monro, founding director of the new Centre of Excellence for Nanoscale Biophotonics at the University of Adelaide, notes that earlier this year 750 applications came in for just 10 postdoctoral positions. She also notes that among the 200 or so researchers in the university’s School of Chemistry and Physics, only about 25 are tenured faculty members. “Non-tenured researchers certainly have tenuous career pathways,” she says.

A large proportion of the research funding is for only one or two years, says Rob Robinson, president of the Australian Institute of Physics. “One ends up hiring people on short-term contracts, which inevitably means that we sometimes do not attract the best candidates or that they leave science for more fertile parts of the economy.” Until a few years ago, says Stephen Buckman, director of ANU’s Research School of Physics and Engineering, the National Collaborative Research Infrastructure Strategy (NCRIS) “had a two- to three-year funding landscape for major research equipment but now there is uncertainty from that having collapsed to a year-by-year budget for science.” The NCRIS supports shared facilities in areas ranging from marine observation to plasma physics.

Another sore point is money for international travel. The Australian government used to fund travel to work at facilities or meet with collaborators. That pot of money dried up in 2011 and has not been renewed. Instead, the government at the time set aside funding for researchers to travel to India and China. That arrangement is largely seen as political, and scientists resent that they can’t get money to go wherever the best science is. The earlier scheme “was not a lot of money,” says Buckman. “But combined with other funds, it really enabled a strong international presence for Australia.” For example, he says, over the three years he had funding from the International Science Linkages program, “we had something like 50 visits with our European collaborators and more than 70 publications.”

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ROBERT ROBINSON



The Parkes Radio Telescope in New South Wales has been shifted to remote operation and limited switching of frequency bands as a result of budget cuts. The 64-meter telescope has been in use for more than 50 years. The Commonwealth Scientific and Industrial Research Organisation has also switched its six-dish Compact Array to remote-only operation with a reduced wavelength range and will close or hand off its Mopra radio telescope.

Hot-button tuition

A hotly debated issue is the deregulation of university tuition. At present, university tuition is set by the national government, and all Australian universities receive the same government subsidy per student in a given discipline. But the government wants universities to raise money for research by charging more for undergraduate tuition. "Most universities realize that deregulation is the only way forward," says Byrne. "Either that or re-regulate the number of student places."

Not surprisingly, the prospect of higher university tuition is controversial. People anticipate that tuition could price out economically disadvantaged students, that the new scheme will push students to choose their field of study based increasingly on perceived lucrativeness rather than intellectual interest, and that the best universities will do fine but others will have a hard time attracting students. In a bill that is yet to be voted on, the deregulation proposal has been linked politically with the continuation of a grants program for mid-

career academic researchers, called "future fellows," and support for shared scientific facilities.

If the package bill passes, NCRIS will get Aus\$150 million; it's currently funded with Aus\$186 million over two years. That extension in funding would be "excellent news" for many facilities, says Robinson. "But it's only for a single year. We really could do with more predictable ongoing funds." The future fellows program funds academics who are 5 to 15 years post-PhD for five years, with the expectation that the host university will keep them on. The program was started a few years ago and is winding down, but the package bill would make it permanent, with 100 new fellowships awarded annually. The senate began debating the bill in late October. Observers say it is unlikely to pass on the first try.

Shifting weights

Bachor notes that the funding problems lie in "the labeling of the money as much as in the actual money." For example, CSIRO took delivery this year of a vessel for marine investigation. Counting the Aus\$80 million price tag of the vessel, on paper CSIRO has more funds this year than previously. But it actually has less money available because other areas of the organization will have to be raided to pay to operate the new vessel.

Another example is with ARC funding; the government decided that Aus\$126 million will go to new research programs in dementia, diabetes, tropical health, and Antarctic research. "Due to the reprioritization of funding for these special initiatives there is less funding available for award through our core schemes," the council's Byrne says.

"The government is shifting weights from fundamental long-term research toward short-term research with immediate gains," says Bachor.

Open for business

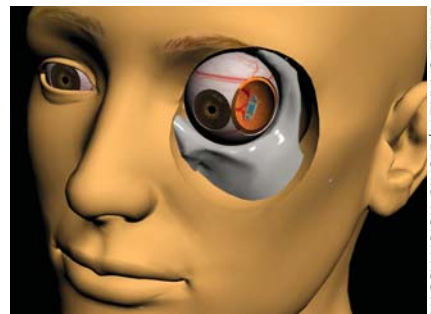
Science advocates and researchers in Australia point to their country's poor rankings by the Organisation for Economic Cooperation and Development (OECD). For example, out of 20 advanced economies it ranked ahead of only Greece and Slovakia for R&D investment as a percentage of GDP in 2013.

And the OECD ranked Australia last for "business collaboration within higher education and public research agencies," Schmidt noted in his 28 August lecture for the Australian Broadcasting Corp's "Big Ideas" radio series. "We have the capacity to get a lot more for our research dollar if we get that part of the equation correct," he said.

Australia's science community widely acknowledges that interactions between research and industry need to be improved. "Lack of venture capital and the paucity of opportunities for young people to translate science into businesses via startups is a big hole in the Australian system," says Prawer.

Matthew Hole, a plasma physicist at ANU, notes that the catch phrase for the current government is "Australia is open for business," and that the government is "interested in industry and commercialization." But in that case, asks the science community, why slash CSIRO's budget? And why did the government cut Aus\$80 million over four years from Cooperative Research Centres, collaborative efforts among industry, research organizations, and universities whose *raison d'être* is to bring research to market? "There are a lot of contradictions," says Schmidt.

In his "Big Ideas" lecture, Schmidt noted that, "in 2008, for every dollar in pure basic research that Australia spent, we spent \$5 in strategic basic research ... and \$10 on applied research. And the push today is to move even more money from fundamental to the strategic and the applied." He also noted that directed research is good at improving what is already known, but



DAVID GARRETT, BIONIC VISION AUSTRALIA

A bionic eye could restore vision to people suffering from retinal degenerative diseases. Images from an external camera are processed into electrical signals that stimulate surviving nerve cells in the retina; the stimuli are interpreted by the brain as spots of light. Funding from the Australian Research Council for this multidisciplinary project runs out in mid-2015.

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“it turns out not to be very good at uncovering the new things that can lead to revolutions in our understanding.” Without the correct balance of pure and applied research, he said, “the revolutionary ideas that empower breakthroughs will dry up, and the government will end up getting far less from its research dollar than it does now.”

“We need a fundamental change in how universities interact with industry. We need a change in culture,” says Schmidt. “The question we are all asking ourselves is, What is the government’s plan to work with industry and develop new industry? You can’t just add a program and expect it to purr.”

Encouraging signs

Ian Chubb, Australia’s chief scientist since 2011, campaigns tirelessly for science. His recent 44-page document, *Science, Technology, Engineering, and Mathematics: Australia’s Future*, puts forth recommendations as a follow-up to his strategy paper from last year. In the recent document he writes, “The end we aim to achieve is to build a stronger Australia with a competitive economy. We will need to facilitate growth in ways and on a scale that we have never achieved before. It is time to do what so many other countries have already done: take a long-term strategic view of STEM’s pivotal role in securing a stronger Australia.”

Chubb’s efforts may finally be gaining traction. For example, his recommendations are on the agenda of the Commonwealth Science Council, a new advisory body made up of representatives from government, industry, and science. “I’ve gotten signs that the government wants to do more for science,” says Schmidt, an appointee to the council. “We can’t have everything we want, but it would be good to plan sensibly instead of having to stab in the dark about what may be around in the future.” The uncertainty and lack of money are already having an impact, he says. “You can’t have a vacuum for three years and have no impact. People are leaving the country. But if we act quickly, we’ll curb the damage. We hope we can build up capacity and not erode it further.”

Monro, also a council member, says the formation of the new advisory body is promising. “We have to get out the message of the importance of science. We have to alleviate the cultural and structural barriers to scientists getting closer to industry.” If things go well, she says, the new council “could tackle some of the issues.”

Toni Feder

Fractures are widening on nonproliferation treaty

Nonnuclear states’ patience with weapons states’ inaction on disarmament is wearing thin.

When delegates from the 155 signatories of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) convene in Vienna in April, they will have little to point to in the way of progress toward the NPT’s promise, from its entry into force in 1970, of worldwide nuclear disarmament. In the five years since the last NPT review conference, no nation possessing nuclear weapons has given them up. Most, if not all, are updating their arsenals, making it plain that they intend for nuclear weapons to remain a key part of their strategic plans for the foreseeable future.

“The state of nuke disarmament is not good. The NPT is in serious trouble from a number of sides,” says Alexander Kmentt, director for disarmament, arms control, and nonproliferation in Austria’s foreign ministry. The intransigence of the nuclear weapons states on curtailing their arsenals threatens the continued existence of the treaty, he warns.

Progress is “so painfully slow that it too often feels as if we are moving backwards,” complained Desmond Browne, former UK minister of defense, at the annual meeting of the Arms Control Association (ACA) on 20 October. “It’s difficult to see a path forward when the nuclear weapons states can’t agree on how to proceed and the nonnuclear weapons states are angry about the pace of progress towards disarmament.”

“It’s pretty clear that neither the weapons nor nonweapons states have made particular progress on their NPT commitments,” says James Acton of the Carnegie Endowment for International Peace.

Article 6 of the NPT obligates the declared weapons states—the US, UK, France, China, and Russia, known as the P5 nations—to proceed quickly toward disarmament, although it sets no timetable. With the continued obduracy of P5 members, the quid pro quo that NPT’s 150 non-nuclear-weapons nations gave in agreeing not to seek nuclear weapons capabilities of their own has grown increasingly fragile.

In addition, the fact that India, Pakistan, and Israel remain outside the NPT continues to undermine it. North Korea was a member but has renounced

the treaty and conducted several underground nuclear tests. And the nuclear program of Iran, which is an NPT member, may be in violation of the treaty.

An action plan

A major agenda item for April’s NPT review conference is the implementation of a 64-point action plan issued at the conclusion of the last review conference, in 2010. The document includes 22 specific steps to be taken toward disarmament; the remaining action items deal with nonproliferation and the peaceful uses of nuclear power. The 2010 declaration was the first such plan ever to be issued unanimously by NPT members and was hailed as a major achievement.

By most measures, though, little has been accomplished for most of those steps. According to a report card issued in February by the disarmament advocacy group Reaching Critical Will, no concrete progress has been made on 11 of the 22 items, limited progress has been made on 6, and substantial progress has been made on just 5. Particularly disappointing, the report said, is that the P5 nations will not meet their commitments to work toward global stockpile reductions by addressing tactical nuclear weapons, diminishing the role of nuclear weapons in their security policies, lowering the operational readiness status of weapons, reducing the risk of accidental use, and increasing transparency and mutual confidence.

Some progress has been made on the plan’s call for negotiations to begin on a treaty to end the production of fissile materials. The ban would affect only the nuclear weapons states, all of which are believed to have ended their production of fissile materials for weapons decades ago. Actual treaty negotiations have yet to begin, though preliminary discussions have been held.

Four of the items in the plan, including the development of a verification regime, concern the Comprehensive Nuclear-Test-Ban Treaty (CTBT), which has not yet entered into force. (See the PHYSICS TODAY articles by Matthias Auer and Mark Prior, September 2014, page 39, and by Pierce Corden and David Hafemeister, April 2014, page 41.) The verification system is nearing