DAVID HANNAH/LONELY PLANET/GETTY

Many people coming to work in Australia find its cities cosmopolitan and welcoming places to live.

AUSTRALIA

Scientists from across the world are attracted to the country, which competes internationally by focusing on its strengths.

BY KAREN MCGHEE

Australian research has delivered a series of major advances, from the bionic ear and Wi-Fi to the cervical-cancer vaccine and the black-box flight recorder. It has played crucial roles in the development of Google Maps, penicillin and ultrasound medical imaging.

The country's history of innovation and its model of scientific development are seen by many as consequences of its geography and demography. Australia's comparatively small population of 24 million lives in a vast country that is not only far removed from the world's major centres of development, but also dominated by an arid interior. It's of little surprise, then, that Australians have a reputation for resourcefulness and self-reliance.

Melbourne and Sydney, which are home

to almost half the population, are the nation's hotbeds of scientific endeavour. Each has more than a dozen internationally ranked universities and research institutes that have assembled international teams in specialist fields.

"We eat lunch every day with German, American, French, Chinese, Iranian, Spanish, Singaporean and Australian researchers," says J. J. Richardson, a bioengineer at Australia's largest research body, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Melbourne. Richardson, who moved to Australia from the United States in 2010, has been working alongside his Chinese colleague Kang Liang on biological applications of a class of crystalline materials called metal-organic frameworks.

Liang says that Australia has a reputation for making occasional, rather than

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SWINBURNE UNIV. TECH.

LINDA KRISTJANSON

Vice-chancellor at Swinburne University of Technology in Melbourne

How does Australia's geographical distance from Europe and the United States shape its research?

Distance is not a barrier. We build research alliances and new opportunities for our researchers and students through our partnerships and shared quest for knowledge. For example, our astronomy students in Melbourne have access to the most powerful telescope in the world, at the Keck Observatory in Hawaii, through both remote access and site visits. This has allowed our astrophysics team to be ranked among the best in the world.

Our researchers routinely collaborate with other leading scientists and academic leaders from around the world through participating in conferences, collaborative research projects and joint initiatives. Our digital connections keep us engaged, and we think in a global way to ensure the work we do has impact.

And what about collaborations within the Asia-Pacific region?

Australia is exceptionally well located to work with our academic and research partners in the Asia-Pacific region. We can undertake research that addresses issues of mutual concern, such as energy, food security, manufacturing, climate change and caring for older people.

What is it about Australia that made you stay?

When I first moved to this country from Canada 20 years ago to pursue a career in palliative-care research, I found Australia to be a resilient country that welcomes people with aspirations and a readiness to engage and reach high. Quality of life, an intellectually stimulating environment, and people's willingness to embrace diversity, adopt new technologies and build innovation capability make Australia an attractive place to pursue a scientific career. **K.M.**

This interview has been edited for length and clarity.

WHERE TO WORK

The top ten institutions in Australia, based on research output included in the 2015 *Nature Index*, May 1 2015–April 30 2016, shown as weighted fractional count (WFC), a measure of the relative contribution of an author to an article weighted to correct for imbalances between subjects. Bars are divided according to the proportion that each subject area contributes to the overall score.

1. Monash University / WFC 91.0

2. University of New South Wales / WFC 87.6

3. Australian National University / WFC 86.5

4. The University of Queensland / WFC 86.2

5. The University of Melbourne / WFC 82.4

6. The University of Sydney / WFC 73.1

7. The Commonwealth Scientific & Industrial Research Organisation / WFC 43.8

8. The University of Western Australia / WFC 38.3

9. The University of Adelaide / WFC 31.5

10. Curtin University / WFC 22.2

Overlaps in subject areas may cause some distortion to relative subject proportions.

SALARIES

Postdocs in Australia are the highest paid in the Asia-Pacific countries profiled, according to data collected in *Nature's* interviews.

COLLABORATIONS

Australia's average collaboration score (top) — the sum of *Nature Index's* fractional count (the relative contribution of authors to an article) for international collaborations divided by the number of countries Australia collaborates with.

RESEARCH FOCUS

The opening of the Sydney Nanoscience Hub has provided a boost to Australia's already rising international reputation for nanoscience research.

Unveiled in April, the Aus\$150 million (US\$112 million) precision built and engineered facility took six years to design and construct. It is the centrepiece of the new Australian Institute for Nanoscale Science and Technology, based at the University of Sydney.

Nanoscience is the study of nanoscale materials (a nanometre is one billionth of a metre) and involves working with electrons, molecules, atoms and photons. Experiments can sometimes last only trillionths of a second. Because of this, research needs to be conducted in precisely controlled environments. The Sydney facility meets this demand by offering researchers laboratory space designed to minimize possible disturbances such as dust, pressure and temperature fluctuations, mechanical vibrations and electromagnetic radiation.

One of the Hub's three initial flagship projects focuses on optical physics and nanoscale photonics — hardly surprising when you consider that photonics (the study and application of light) is used in communications, imaging and data storage, underpinning a multi-trillion-dollar industry. One team, led by Benjamin Eggleton, the director of the Institute of Photonics and Optical Science at the University of Sydney, is attempting to develop a photonic chip that's faster and more energy-efficient at gathering and processing information than conventional electronic devices. ■

The University of Sydney is home to the new Sydney Nanoscience Hub.

KOKKAI NG/GETTY

► consistent, scientific advances. “It’s like a bubble that pops and a great innovation comes out, then it recedes for a while,” he says.

Partly because of its small population, Australia has developed a number of specialisms, on which it focuses its efforts and resources. Health and medical research, for instance, has brought the country seven Nobel prizes. Physics and chemistry researchers have claimed three.

“AUSTRALIANS ARE NOT AFRAID OF TRYING NEW THINGS.”

Astronomer Brian Schmidt shared the 2011 Nobel Prize in Physics for the discovery of the accelerating expansion of the Universe through observations of distant supernovae. US-born Schmidt, who is vice chancellor of the Australian National University in Canberra, is among many advocates who have spoken out about boosting the country’s science, technology, engineering and mathematics (STEM) capacities.

There is certainly room for improvement. In 2012, for example, just 0.4% of those entering tertiary education studied mathematics, compared with the 1% average reported for countries in the Organisation for Economic Co-operation and Development. The lack of home-grown STEM talent provides opportunities for postdoctoral and PhD applicants from other countries.

AUSTRALIA'S ISOLATED LOCATION MEANS THAT MORE THAN 80% OF ITS TERRESTRIAL PLANTS AND ANIMALS — INCLUDING KANGAROOS, WOMBATS, KOALAS AND PLATYPUSES — ARE FOUND NOWHERE ELSE IN THE WORLD.

ENTRY REQUIREMENTS

- Most researchers coming to Australia use the Temporary Work (Skilled) 457 visa, which allows skilled workers with dependents to work in their chosen field for up to four years. Applicants may be sponsored by an employer or considered a good fit for an open position. The visa costs start at Aus\$1,060 (US\$800) and applications are usually processed within 90 days.
- Another option is the Skilled Independent 189 visa. This is aimed at English-speaking applicants under the age of 50 who are qualified to fill positions relevant to the country’s skill shortage list, but who are not sponsored by an employer. The price starts at Aus\$3,600 (US\$2,587) and the visa is assessed under a points-based system.

Although overall research and development expenditure as a proportion of gross domestic product (GDP) has remained constant at a little over 2% in recent years, the funding of specific subjects has fluctuated as a result of changing political priorities. For example, 75 climate-science positions at CSIRO will be lost this year as a result of successive government cuts to the organization’s budget in 2014 and 2015.

The geographical distance to international centres in the Northern Hemisphere can put some people off relocating to Australia. Sydney is around a 20-hour flight from either London or New York, for example. But many view Australia’s remoteness as an advantage.

“Being a little distant from the mainstream, you’re not influenced so much by what everyone else is doing; sometimes it means more space to pursue your own research interests,” says Kelan Chen, a postdoc at the Walter and Eliza Hall Institute of Medical Research in Melbourne. Chen came to Melbourne from China to do her undergraduate degree and is now investigating an epigenetic regulator implicated in a form of muscular dystrophy.

A five-hour flight away in Perth, Sophie Monnier, a French PhD student studying exploration geophysics at the University of Western Australia, agrees. “Australians are not afraid of trying new things,” she says, “because they are not hindered by historical cultural values.” ■

OPPORTUNITIES & CONTACTS

- International Postgraduate Research Scholarships provide tuition fees and health cover for two years for master’s degrees and three years for doctoral degrees.
- Commonwealth Scientific and Industrial Research Organisation (CSIRO) Postdoctoral Fellowships are for PhD graduates with no more than three years of postdoc experience.
- The National Health and Medical Research Council offers five-year fellowships for health and medical researchers.
- Forrest Research Foundation Scholarships are available to students who want to study towards a PhD at Curtin University, Edith Cowan University, Murdoch University, Notre Dame University or the University of Western Australia.

LARRY MARSHALL

Chief executive of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Canberra

How do you think the way science is done in Australia could improve?

There is a lot of great science being done and investment in science is quite high. But we need to get better at ensuring that more of this research yields innovations that have social, environmental and economic impact.

What are the forces shaping the research landscape?

There is too much ‘science push’ rather than ‘market pull’. The science is being pushed out from universities and from organizations such as CSIRO. The approach is ‘This is what we have done. What can you do with it?’ We need to recognize that our national challenges should be shaping our priorities. That will be a difficult transition, but it is one that this country needs to make.

In what areas is Australia looking to recruit expertise from overseas?

One focus is on digital technology and big data. We could achieve huge productivity gains in precision agriculture, and our health services are ripe for disruption. We also need to increase our ability to understand the impacts of ‘blue-economy’ developments, such as new fisheries. Other groups are looking at ways to obtain information in real time from living biological tissue by embedding sensors for diagnosis and intervention.

Does the Australian public value scientific research?

There is huge support for science in Australia because people recognize how much it has contributed to their day-to-day lives. Despite this, there is not much knowledge of the way that scientists work. We need to get better at explaining the scientific process in a way that relates to most people. **K.M.**

This interview has been edited for length and clarity.