

2018 POSTGRADUATE Science and environment

Cloud Campus | Geelong | Melbourne | Warrnambool

Biotechnology

Science

Sustainable regional development

Research





Science and environment courses explore all aspects of the world's development, whether it's social, economic or environmental. Our teaching is directly informed by our research program, industry connections and partners. Our research is driven by the need to make a difference and to find solutions to real-world problems, now and in the future.



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Science and environment at Deakin

Stimulating career paths

Science and environment at Deakin opens the door to a range of careers that are stimulating, challenging and rewarding. Choose science at Deakin if you are interested in finding solutions to issues such as the impact of climate change on our planet, reducing our carbon footprint, the use of stem cells in medical research to improve our quality of life or using nanotechnology to create new and innovative materials.

State-of-the-art facilities

Deakin science students have access to cutting-edge facilities and the latest research at the Geelong Technology Precinct (GTP). The GTP contains industrial-scale infrastructure and specialised research equipment that focuses on Deakin's core research areas in materials, biotechnology, chemistry and environmental engineering. Among the many tenants at the GTP is Carbon Nexus, the world's first dedicated, pilot-scale carbon fibre plant.

Photo courtesy Patricia Corbett



Deakin Hallmarks are awarded as digital credentials that can be shared through professional social platforms such as LinkedIn. They recognise students' outstanding achievement, at course level, of capabilities that are key to employment success.



Communication



Digital literacy



Teamwork



Critical thinking



Problem solving



Self management



Global citizenship

Science and environment at Deakin

A practical focus

Develop technical skills, a positive approach to problem-solving and the ability to work as part of a team. Your course focuses on practical experience and a supervised research or industry project that provide you with a broad skills base, as well as an understanding of your chosen field and its social and commercial contexts.



'My research is focusing on using remote sensing tools, such as drones and underwater video systems, to assist with monitoring changes across our oceans and coasts. I previously worked with drones in my honours project and wanted to expand my knowledge and see what else I can do with new technologies to help protect our marine environments. I love the variety of projects and fields of research available at Deakin, and the support of research students and staff is great.'

Sarah Murfitt
Doctor of Philosophy student



Photo courtesy RD Kirkby and BS Kirkby

Mapping the future of marine research

A team of 40 scientists from across the world have come together to create a road map for the future of marine life research, led by Alfred Deakin Professor Graeme Hays from the Centre for Integrative Ecology.

They aim to use advanced tracking devices to follow individual animals as they move around the oceans. The team will use the data to develop a better understanding of which areas of ocean need to be protected from fishing, and to help scientists assess how climate change may impact the movement of whales and turtles, whose distribution may change in the future.

World-class lecturers

Our courses in science and the environment disciplines are taught by staff who are internationally recognised researchers from the Centre for Regional and Rural Futures (CeRRF), Centre for Chemistry and Biotechnology (CCB), Centre for Integrative Ecology (ICE) and Centre for Molecular and Medical Research (MMR), with discipline area electives delivered by academic staff across the Faculty of Science, Engineering and Built Environment. Guest lectures are given in most units by researchers, including postdoctoral fellows.

Thriving research culture

Many of our academic staff members are active researchers and many of our students go on to undertake research degrees at Deakin. Two key pieces of research currently being conducted involve building a road map for the future of marine life research using tracking devices, and investigating the impacts that coastal 'blue carbon' ecosystems have on other ecosystem services. See above and page 12 for more.

What can I study?

Cloud Campus **C**
Melbourne Burwood Campus **B**
Geelong Waterfront Campus **WF**
Geelong Waurrn Ponds Campus **WP**
Warrnambool Campus **WB**

Gain credit towards your degree

With Credit for Prior Learning (CPL), your previous study or work experience may make you eligible for credit towards your Deakin degree, reducing the number of units you need to study and allowing you to complete your course earlier and often more affordably. Find out more at deakin.edu.au/courses/credit-for-prior-learning.

	Campus	Course duration in years [#]	Trimester intake options [^]	2018 domestic full fee (8 CP)*	2018 international fee*	IELTS~
Coursework degrees						
Master of Science (Research)[§] S820 SPECIALISATIONS: Biotechnology Sustainable regional development ADMISSION REQUIREMENTS: A bachelor's degree or other qualification at a higher AQF level in a related discipline. The undergraduate qualification must be equivalent to an Australian degree of at least three years of full-time study with a minimum weighted average mark (WAM) or grade point average (GPA) of 65% in the final year units/subjects. Exit options are available at the graduate certificate (4 credit points) and graduate diploma (8 credit points) levels for students undertaking the sustainable regional development specialisation.	B WP	2	T1, T2	\$27 000	\$33 368	6.5/6
Graduate Diploma of Sustainable Regional Development S604 ADMISSION REQUIREMENTS: A bachelor's degree in the same discipline with a minimum WAM or GPA of 65% in the final year units/subjects; or five years of relevant work experience in the same discipline deemed equivalent to a bachelor's degree. Exit option is available at the graduate certificate (4 credit points) level.	C B	1	T1, T2	\$27 000	\$33 368	6.5/6
Graduate Certificate of Sustainable Regional Development S504 ADMISSION REQUIREMENTS: A bachelor's degree in any discipline; or at least three years of relevant work experience (or part-time equivalent).	C B	1 PT [†]	T1, T2	\$14 000 ^ø	\$16 684 ^ø	6.5/6

Information correct at July 2017. Deakin University reserves the right to alter, amend or delete course offerings and other information listed.

* A unit or subject is usually 1 credit point (CP). Fees quoted are based on an annual full-time study load (8 CP/1 FT), regardless of your unit selection. If the course duration is more than one year full-time study (1 FT), the annual fee does not represent the full cost of the course; it represents the cost of one year full-time study (8 CP) in 2018. Fee-Paying Place (FPP): 2018 annual course fees for FPPs are shown in the 2018 domestic full fee (8 CP) column. Fees displayed should be used as a guide only and are subject to change. International fees are based on 8 CP in one year of full-time study, unless otherwise indicated. Please visit deakin.edu.au/fees for the most up-to-date information.

[^] Most courses start in Trimester 1 (March to June). This column indicates whether you have the option of commencing your studies in Trimester 2 (July to October) or Trimester 3 (November to February). Not all units are offered in every trimester.

[#] Course lengths may vary in response to requirements within the Australian Qualifications Framework (AQF). Applicants should refer to the handbook for the latest information: deakin.edu.au/handbook.

[~] IELTS is the International English Language Testing System. The IELTS scores in the table above reflect the minimum overall score required as well as the lowest score allowed for any band (overall score/lowest band score).

[†] International students are eligible for Cloud Campus study only.

[§] Specialisations are not available at all campuses. Please visit deakin.edu.au/courses for further information.

^ø Fee depicts 4 credit points.

Top ranking university

Deakin is ranked #3 in Australia for graduate employability by the prestigious Times Higher Education index. Deakin was recently ranked Victoria's #1 university under 50 years old by Times Higher Education (2016 and 2017). And as a result of our renowned quality of research and teaching, all three international university rankings put us in the top 2% of the world's universities.

Data sources: Quacquarelli Symonds (QS); Academic Ranking of World Universities, Times Higher Education and QS World University Rankings.

Deakin students discover new insects

You'd think that after all of these years roaming the earth humans would have discovered every species possible. But senior lecturer in the School of Life and Environmental Sciences Dr Anneke Veenstra is currently assessing a possible four new insect species, two of which were found by Deakin students, who discovered the insects when investigating abnormal plant tissue while doing fieldwork. The insects are *Cecidomyiidae* – a family of flies commonly known as gall midges and small enough to walk on a strand of spider's web without getting caught in it. There hasn't been a lot of research into the gall midge family in Australia yet, and there could be hundreds of gall midge species to discover, according to Dr Veenstra.

'Insects may be small, but they play a vital role in Earth's ecosystems – if they disappear, so do many of our large animals. In Australia, many insects don't even have a name. Naming insect species new to science is the part of my research I enjoy most,' says Dr Veenstra.



Science laboratory, Melbourne Burwood Campus.

Courses

Deakin code	S304	Cloud Campus	C
Course duration in years	3	Melbourne Burwood Campus	B
Trimester	T	Geelong Waterfront Campus	WF
		Geelong Waurn Ponds Campus	WP
		Warrnambool Campus	WB

Master of Science (Research)[§] S820 B WP 2 T1, T2

Comprising a unique combination of coursework and research, this advanced degree prepares you for a career in industry and can serve as a pathway to doctoral studies.

The first year of the course includes units related to the specialisation of your choice, and is focused on research training and methods. The second year comprises a research thesis in an area of interest to you that is completed over two trimesters.

The flexibility offered by this course enables you to graduate with a specialised degree that has been customised to suit your research interests and career aspirations.

This course meets the growing need for well-trained scientists to work in applied, commercial and innovative industry environments, and government organisations and departments.

Course structure

The 16 credit points include four core units, two research thesis units (comprising 4 credit points each) and four units from a major study. You will be required to complete at least one major study as part of this course.

Core units

- Research Communication
- Research Frontiers Project 1
- Research Frontiers Project 2
- Research Planning and Management

Research

- Research Thesis 1 (4 credit points)
- Research Thesis 2 (4 credit points)

Plus four units chosen from one of the following specialisations.

Specialisations

Biotechnology

- Agricultural Biotechnology
- Frontier Techniques in Biotechnology and Nanotechnology
- Industrial and Analytical Techniques in Biotechnology
- Laboratory Techniques for Cellular and Molecular Biotechnology

Sustainable regional development

- Climate Change Adaptation and Mitigation
- Systems and Strategic Thinking
- Regional Development Economics and Planning
- Regional Development Modelling

Exit options are available for students who undertake the Sustainable Regional Development specialisation.

Pathway options

Deakin also offers a Graduate Certificate of Sustainable Regional Development (4 credit points) and a Graduate Diploma of Sustainable Regional Development (8 credit points), which can provide a postgraduate introduction and entry pathway to the master's program, or an alternative exit option for those commencing the Master of Science (Research) who no longer wish to pursue a Master's level qualification.

Join the most satisfied students in Victoria

For seven consecutive years, Deakin has achieved the highest level of overall student satisfaction among Victorian universities. These great results are from the responses to 'Overall Satisfaction' in the Australian Graduate Survey, 2010–2016.

Source: gooduniversities.com.au

Specialisation overview


Biotechnology

Biotechnology is one of the fastest-growing scientific sectors. You will benefit from the state-of-the-art facilities and cutting-edge research, while exploring your interests in agricultural, cellular and molecular biotechnology; nanotechnology; and analytical techniques. Graduates completing this specialisation may work in industrial, innovative, regulatory, emerging and commercial biotechnology sectors.

Sustainable regional development

This area is critical to the economic performance of both developed and developing countries, especially in the face of globalisation, population growth, economic structural adjustments and climate change. Demand has risen sharply for professionals with the ability to undertake regional socioeconomic and environmental planning that looks to the long-term competitive advantages of regional areas and to propose appropriate policy responses.

[§] Specialisations are not available at all campuses. Please visit deakin.edu.au/courses for further information.

 deakin.edu.au/course/master-of-science-research-science

'My research on Sustainable Intensification of Agriculture: Transitioning to Climate Smart Agriculture has allowed me to be involved in helping regional communities adapt to climate change. With rapid changes to the social, economic and environmental context in our regions, I am looking at alternative management practices to help facilitate the agricultural industry and the communities that both support, and are supported by it, by assisting them to adapt to change and increase their resilience.'

Madeleine Johnson
Master of Science (Research) student

Future of biotechnology

Did you know that there are currently more than 400 biotech drug products and vaccines undergoing clinical trials, targeting many diseases such as cancer, diabetes, multiple sclerosis and HIV? More than 325 million patients have benefited from approved medicines manufactured through biotechnology and gene technology.

Deakin students in the Master of Science (Research) undertaking the biotechnology specialisation will equip themselves with the expertise to work in this fast-growing scientific sector. Graduates with these skills are sought-after across industrial, innovative, regulatory, emerging and commercial biotechnology sectors.

Study areas include: agricultural biotechnology, laboratory techniques for cellular and molecular biotechnology, frontier techniques in biotechnology and nanotechnology, and industrial and analytical techniques in biotechnology.

Courses

Graduate Diploma of Sustainable Regional Development

Sustainable regional development is critical to the economic performance of both developed and developing countries, especially in the face of globalisation, population growth, economic structural adjustments and climate change. Two-thirds of Australia’s export earnings come from regional industries, such as agriculture, tourism, retail, services and manufacturing. As such, demand has risen sharply for professionals with the ability to undertake regional socioeconomic and environmental planning that looks to the long-term competitive advantages of regional areas, and propose appropriate policy responses.

Graduates develop an in-depth understanding of the key biophysical, socioeconomic, geographic and infrastructure factors that influence the development of regions, as well as the strategic and technological tools to analyse and act on information to sustainably guide regional economic development.

Course structure

Five core units and three elective units selected from a prescribed list of discipline area elective units.

Core units

- Climate Change Adaptation and Mitigation
- Research Planning and Management
- Regional Development Economics and Planning
- Regional Development Modelling
- Systems and Strategic Thinking

Discipline area elective units

- Urban Planning
 - Ecological Cities and Futures
 - Urban Dynamics and Change
 - Urban Ecologies
 - Urban Patterns and Precedents

Environment

- Policy and Planning for Sustainable Development
- Risk Assessment and Control

Research

- Research Communication
- Research Frontiers Project 1
- Research Frontiers Project 2

Pathway options

Deakin also offers a Master of Science (Research) for those seeking opportunities in advanced research training and career development.

Alternatively, Deakin’s Graduate Certificate of Sustainable Regional Development (4 credit points) can provide a postgraduate introduction and entry pathway to the master’s program, or an exit option for those commencing the Master of Science (Research) who no longer wish to pursue a master’s level qualification.



deakin.edu.au/study-at-deakin/find-a-course/sustainable-regional-development

Deakin code	S304	Cloud Campus	C
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Satellite and drone mapping improve farm cropping

Scientists are drawing on high-tech data to help farmers increase yields. Associate Professor John Hornbuckle and his team, from Deakin University’s Centre for Regional and Rural Futures (CeRRF), with funding support from the Cotton Research and Development Corporation, have been investigating the use of drones and satellites to monitor crop performance and inform water management decisions.

‘Information collected from drone and satellite-based platforms can now be used to gain new insights into the effects of water and nitrogen management on plant growth,’ Associate Professor Hornbuckle says. ‘From there, growers can develop strategies to maximise yields across the farm, based on analysing the best and worst-performing areas.’

His research has identified significant improvements to technology, such as the recently launched Sentinel 2 satellite, which has the ability to monitor the health of crops and track their water use via the use of red, red-edge and near infrared photography. Developments in satellite imagery mean that farmers can gain a picture of plant health right across fields. For instance, specific elements, such as nitrogen and chlorophyll content of crops, can be measured from the satellites.

‘One of the major advantages of using a low-cost drone platform is the ability to take images when you want,’ explains Associate Professor Hornbuckle.

This customisation allows the farmer to monitor patterns and changes more closely, such as planning a flyover during key irrigation times. Other benefits include quicker access to the data and higher quality images – providing more-specific information. This can translate into ‘potential benefits for identifying weeds, and allowing effects of events such as soil compaction from wet harvests to be seen in collected images’.

Find out more at deakin.edu.au/research/research-news/articles/satellite-and-drone-data-improve-farm-cropping.

‘Our research is not only relevant to what employers are seeking, but students graduate with the skill set and knowledge needed. We do what we do because it is important to the environment and society as a whole. We can not only make a difference, but our graduates leave Deakin leading the way how to achieve it.’

Dr Trevor Thornton
School of Life and Environmental Sciences
senior lecturer

Research

Our research is focused on issues that reflect our surrounding environment and strives to make a positive contribution towards expanding knowledge and finding solutions across a range of fields, from molecules to global ecosystems.

	Campus	Course duration in years [#]	Trimester intake options [^]	2018 domestic full fee (8 CP)*	2017 domestic indicative CSP fee*	2018 international fee*	IELTS [~]
Research degrees							
Biological, biomedical and chemical							
Bachelor of Biological Science (Honours) S411	B	1	T1, T2	–	\$9050	\$33 368	6/6
Bachelor of Biomedical Science (Honours) S433	B WP	1	T1, T2	–	\$9050	\$35 600	6/6
Bachelor of Forensic Science (Honours) S401	WP	1	T1, T2	–	\$9050	\$33 368	6/6
Bachelor of Science (Honours) S400	B WP	1	T1, T2	–	\$9050	\$33 368	6/6
Bachelor of Zoology and Animal Science (Honours) S469	WP	1	T1, T2	–	\$9050	\$33 368	6/6
Master of Science S811	C B WP	1–2	◊	–	–	\$36 712	6.5/6
Master of Science (Research) [§] S820	B WP	2	T1, T2	\$27 000	–	\$33 368	6.5/6
Doctor of Philosophy S911	C B WP	3–4		–	–	\$36 712	6.5/6
Environmental sciences							
Bachelor of Environmental Science (Honours) S494	B WP WB	1	T1, T2	–	\$9050	\$33 368	6/6
Master of Science S810	C B WP WB	1–2	◊	–	–	\$36 712	6.5/6
Master of Science (Research) [§] S820	B WP	2	T1, T2	\$27 000	–	\$33 368	6.5/6
Doctor of Philosophy S910	C B WP WB	3–4	◊	–	–	\$36 712	6.5/6

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CSP fees are indicative because they are calculated based on your unit selection. Fees displayed should be used as a guide only and are subject to change. International fees are based on 8 CP in one year of full-time study, unless otherwise indicated. If you're a successful applicant for research degree candidature, and you're an Australian citizen, permanent resident or New Zealand citizen, you won't pay any tuition fees. Please visit deakin.edu.au/fees for the most up-to-date information.

[^] Most courses start in Trimester 1 (March to June). This column indicates whether you have the option of commencing your studies in Trimester 2 (July to October) or Trimester 3 (November to February). Not all units are offered in every trimester.
[◊] Commencement of research degrees is not confined to Deakin's trimesters.
[#] Course lengths may vary in response to requirements within the Australian Qualifications Framework. Applicants should refer to the handbook for the latest information: deakin.edu.au/handbook.

[~] IELTS is the International English Language Testing System. The IELTS scores in the table above reflect the minimum overall score required as well as the lowest score allowed for any band (overall score/lowest band score).
[§] Specialisations are not available at all campuses. Please visit deakin.edu.au/courses for further information.

Research snapshot

Our ecologists are helping to protect Australia's vulnerable flora and fauna from disease, rapid development and climate change.

Our marine researchers have developed the purpose-built research vessel *Yolla*, which houses one of the most advanced sonar systems in the world. The data it collects plays a key role in supporting fishery and conservation management of marine environments.

The global aquaculture industry is also being supported by our nutritionists. The team is investigating the effect of farmed fish diets on human nutrition. It's of crucial significance given the global shortage of appropriate fish food.

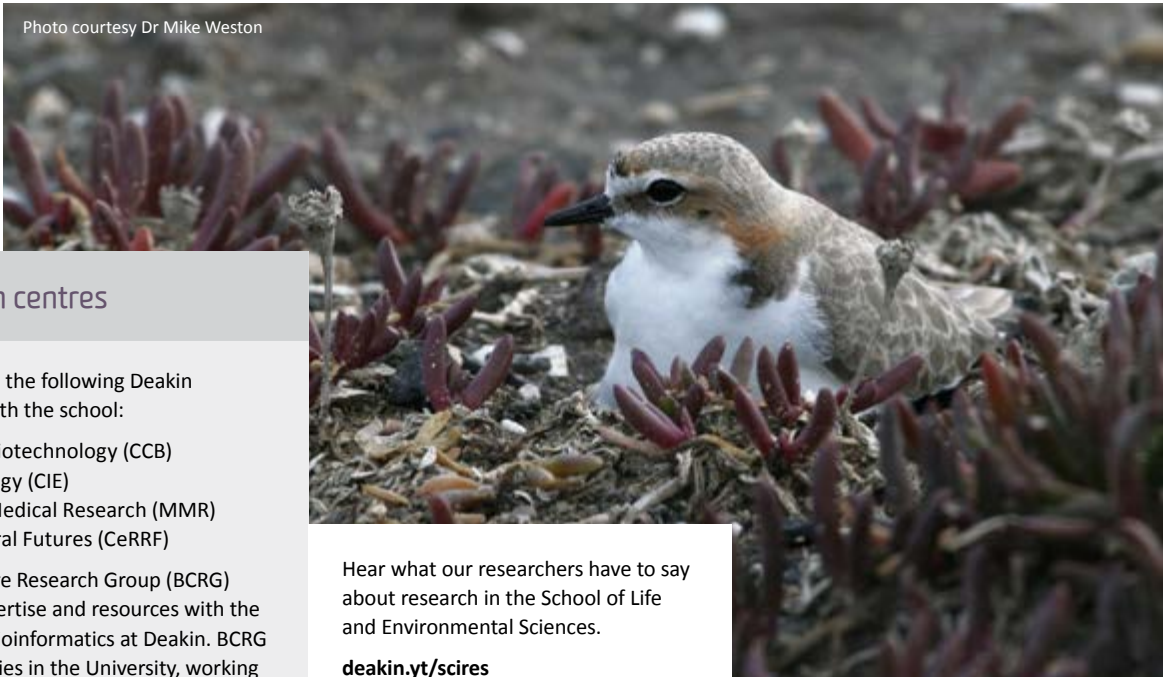
In the agricultural sphere, a team of experts is focusing on solving productivity problems. In consultation with farmers, scientists are developing sophisticated lab-on-a-chip technology to optimise livestock health.

Water management advice is also being provided to farmers and rural planners both here in Australia and overseas.

Through every project and program, our research is driving outcomes that provide solutions to global environmental and sustainability issues. Find out more at deakin.edu.au/post-lesres.

Research areas

- Cellular and molecular biology
- Chemistry, biotechnology and forensic sciences
- Environmental management and sustainability
- Integrative physiology and biochemistry
- Marine, freshwater and aquaculture sciences
- Palaeobiology and global change
- Behaviour, ecology, evolution and ecophysiology
- Wildlife and conservation biology



Our strategic research centres

Students can get involved with the following Deakin research centres associated with the school:

- Centre for Chemistry and Biotechnology (CCB)
- Centre for Integrative Ecology (CIE)
- Centre for Molecular and Medical Research (MMR)
- Centre for Regional and Rural Futures (CeRRF)

As well, the Bioinformatics Core Research Group (BCRG) brings together a range of expertise and resources with the aim to support and facilitate bioinformatics at Deakin. BCRG currently sits across two faculties in the University, working in collaboration with numerous research groups.

Hear what our researchers have to say about research in the School of Life and Environmental Sciences.

deakin.yt/scires
deakin.yt/envres

Research

Finding much needed carbon resources

The world's largest and most comprehensive study of Australian tidal marshes has revealed they are worth more than \$USD7 billion to the national economy and provided much-needed benchmark data that will guide future management of these vital blue carbon sinks.

Dozens of scientists around Australia with expertise in blue carbon joined forces for the three-year study led by the CSIRO, collecting and analysing 323 soil samples from tidal marshes in temperate locations around the coast.

The samples and associated data were coordinated by Deakin's Blue Carbon Lab. Dr Peter Macreadie, director of the lab, says that scientists had long suspected that Australia had a lot of blue carbon in its tidal marshes, but the amount hadn't been quantified or valued until now.

'From our data, we estimate that Australia's 1.4 million hectares of tidal marshes contain an estimated 212 million tonnes of organic carbon with a CO2 equivalent value of \$USD7.19 billion.

'Importantly, the total value of these blue carbon ecosystems far surpasses this figure due to the other ecosystem services they provide, such as nutrient filtration, flood mitigation, nursery grounds for fisheries, and biodiversity.'

Find out more at deakin.edu.au/about-deakin/media-releases/articles/new-study-reveals-value-of-tidal-marshes-in-fight-against-climate-change.



Your digital learning tools

DeakinSync is a digital study hub giving Deakin students and staff easy access to relevant University resources, customised to their specific needs. You can access everything from unit sites to enrolment details, study tools to your calendar, as well as IBM Watson – a question and answer tool.

Visit deakin.edu.au/deakinsync or deakin.edu.au/life-at-deakin/why-study-at-deakin/ibm-watson for more information.

IBM Watson is a trademark of International Business Machines Corporate, registered in many jurisdictions worldwide.



Contact us

Need to contact Deakin?

Prospective student enquiries

Domestic students
1800 693 888
myfuture@deakin.edu.au

International students
+61 3 9627 4877
study@deakin.edu.au

Applying to Deakin
deakin.edu.au/how-to-apply

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learning and career

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1800 MYFUTURE (1800 693 888)
deakin.edu.au

For information on upcoming events and activities, please visit deakin.edu.au/deakin-events

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