# Keeping it real:
## Authentic and work-integrated learning for biochemistry undergraduates in Australia

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## Structure for today

The state of science employment in Australia

Our philosophy of authentic learning

The initiatives:
- Authentic Large-Scale Undergraduate Work Experience
- Work Integrated Learning

What we have learned from our experience

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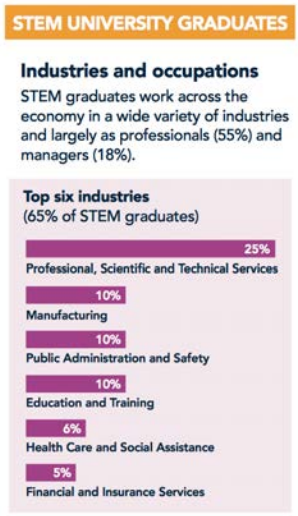
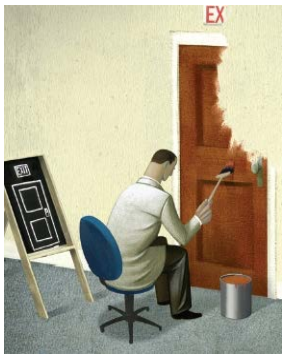
## The state of science employment in Australia



Office of the Chief Scientist (2016) *Australia's STEM Workforce*. Canberra: Office of the Chief Scientist. http://www.chiefscientist.gov.au/2016/03/report-australias-stem-workforce/

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## Our philosophy: Modern students need more than content in the classroom

- Students are time-poor and goal-driven
- Assessment drives student and academic behaviour
- Opportunities need to be flexible, scalable, & immediately bankable for ALL students, not just the elite

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## What is “authenticity”?

…the most frequent conceptions of authenticity in science education involve the ideas that students experience what scientists “do,” how science is done, and what science “is.”

This is a loose definition, but it appears to encompass most of the concepts that authors use as the foundations for their design and delivery of “authentic” science education.

Rowland, Pedwell, Lawrie, Lovie-Toon, Hung (2016) CBE-LSE

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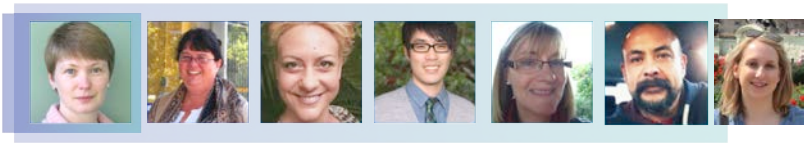
## Team ALURE

**Authentic Large-Scale Undergraduate Research Experiences**



**Team ALURE**
From left Dr Susan Rowland - Primary Project Leader (s.rowland1@uq.edu.au), Co-leaders Dr Gwen Lawrie and Dr Kirsten Zimbardi, Team members Dr Jack Wang and Dr Paula Myatt, and Project manager Mr Peter Worthy Research officer Rhianna Pedwell

Take a tour of the ALURE project here:
www.alure-project.net/

Take a virtual tour of SCMB here:
http://www.scmb.uq.edu.au/virtual-tour

ALURE PROJECT

## Project Impact

We identified and documented, or implemented and evaluated 21 ALUREs. Eleven were developed in association with the authorship team. This represents an annual engagement of over 7000 undergraduate students in authentic research. We also built a nationwide Community of Practice of 39 academics, some of whom have formed new mentor-mentee relationships, and have received recognition for their teaching and learning contributions.

## Deliverables

- The Implementer's Checklists for novice implementers designing and developing an ALURE
- Detailed exemplars of the implementer experience in ALUREs from around Australia
- An evaluation instrument trialled in multiple course evaluations
- Artefacts from ALURE implementations; protocols, task descriptions, and student work
- Exemplar data on the impact of ALUREs on student perceptions and attitudes towards research and their learning gains

Support for this project has been provided by the Australian Government Office for Learning and Teaching.
The project participants are gratefully acknowledged.

Lead Institution:

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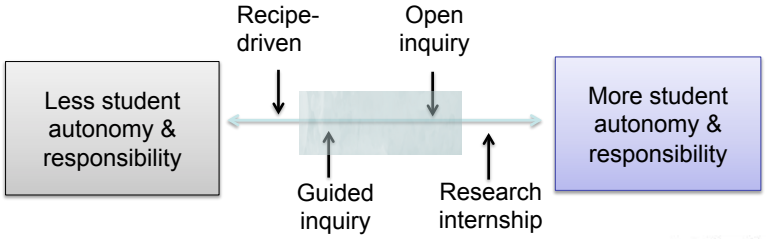
# What is an ALURE?

- Hands-on research in the **undergraduate-course** laboratory
- Projects are part of **authentic** research initiatives and results are communicated to "someone who cares"
- Allows **many students** to participate in research
- **Varies** by year level, desired learning outcomes, and discipline – no single model

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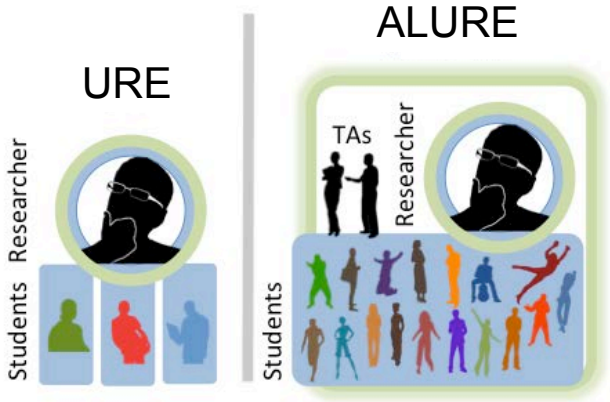
# The ALURE Model

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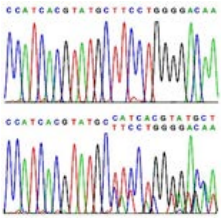
# Example 1 - MICR2000
# Traditional or Molecular Methods?

Gram-Staining
Microscopy
Selective & differential culturing
Metabolic tests
Antibiotic Sensitivity testing

VS

16S rRNA sequencing



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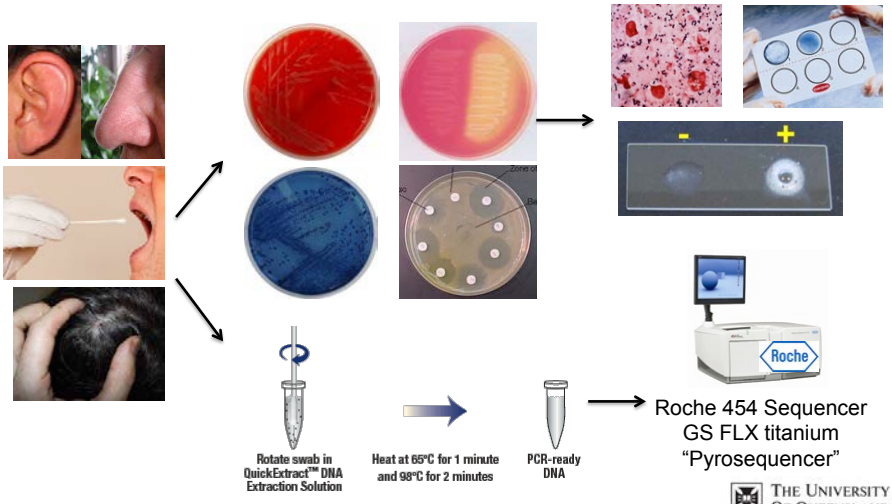
## Example 1 - MICR2000
## 500 students examine the human microbiome

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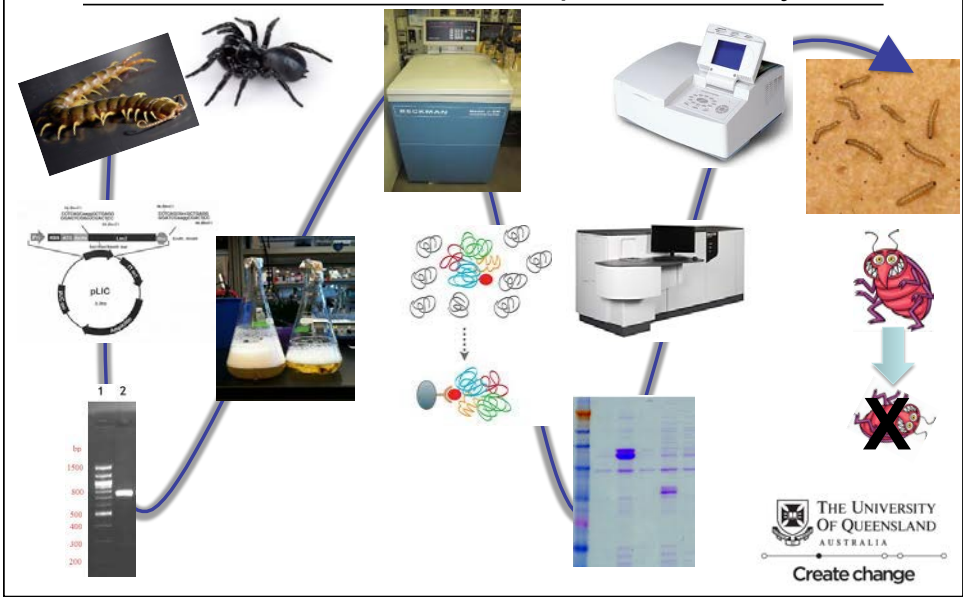
## Example 2 - BIOC2000
## 60 students examine venom protein toxicity

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## What about student learning gains?

- Students perceive multiple learning gains and changes in professionalism (pre-post skills self assessment and URSSA survey).
- They see this activity as authentic to the practice of science (coding of RBT reflections).
- Some volunteer to help the lab staff prepare; others bring protocols and ideas from their part-time jobs for the project.
- Students use this activity as a way of differentiating themselves when applying for positions in labs, for international study, and for higher degree programs (academic reporting of these behaviours).
- Students who complete optional 4th year Honours degree are predominantly ALURE participants (school enrolment reportal and student reporting).

**References:**


- ***Do we need to design course-based undergraduate research experiences for authenticity?*** Rowland, Pedwell, Lawrie, Lovie-Toon, Hung. CBE-LSE (just released)
- ***A unique large-scale undergraduate research experience in Molecular Systems Biology for non-mathematics majors.*** Kappler, Rowland, Pedwell. BAMBED (in press)
- ***Developing and resourcing academics to help students conduct and communicate undergraduate research on a large scale.*** Rowland, Pedwell, Lawrie, Worthy (2016) Sydney: Office for Learning & Teaching
- ***Assessment of course-based undergraduate research experiences: a meeting report.*** Auchincloss LC, et al. CBE Life Sci Educ (2014) 13(1):29-40.
- ***Is the undergraduate research experience (URE) always best?: The power of choice in a bifurcated practical stream for a large introductory biochemistry class.*** Rowland, Lawrie, Behrendorff, Gillam. BAMBED (2012) 40(1): 46–62


## SCIWILWORK

An experimental pilot program.

We developed a program that provides course credit for work that students are already doing in diverse settings.

The curriculum is designed to develop student understanding of the transformational role of work.

We ask students to look at themselves differently, and to make concrete plans for the future.

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# SCIWILWORK Learning Outcomes

Upon completion of the proposed course a student will be able to

1. Critically reflect on experiences in the workplace and explicitly link those experiences to potential employment opportunities as a science-based professional.

2. Have awareness of strengths and capabilities cultivated in a BSc and be able to articulate how those attributes can be applied in a workplace

3. Critically read the literature related to science employability and apply this knowledge to a reflection on current work experience

4. Present a learning portfolio that charts their development through the course, reflects their skills and interests, and provides a plan for their career development.

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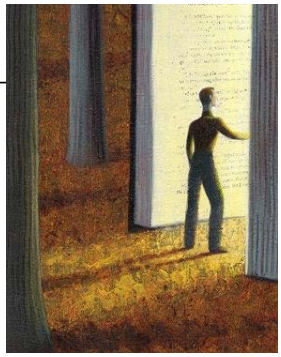
# Readings



During the program students are completing readings and question sets around a number of key areas.

Here are some example papers.

**Office of the Chief Scientist (2016) *Australia's STEM Workforce*. Canberra: Office of the Chief Scientist.**

This article lets students see the career pathways of science graduates in particular areas.

**Harris, K-L (2012) *A Background in Science – What science means for Australian Society.* University of Melbourne: Centre for the Study of Higher Education.**

This article has first hand descriptions of the kinds of attributes and habits of mind that are developed in science.

**Hobin, JA, Fuhrmann, CN, Lindstaedt, B, and Clifford, PS (2012) *You need a game plan*. Sciencemag.org.**

This article encourages students to take a good hard look at themselves and complete an IDP.

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## Workshop activities

**Workshops (~10 x 2 h workshops – trial has 5 x 2 h workshops)**
Each workshop involves students reflecting on readings, sharing experiences from their workplace and their university training, and creating action plans for assignments and later workshops.

Students
1) compare themselves, as science students, to others around them in their lives and their workplaces;
2) define their own strengths;
3) find job advertisements and build answer sets to selection criteria;
4) define their own weaknesses;
5) make an action plan to deal with those weaknesses;
6) do LOTS of impromptu public speaking by the cohort.

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## Peer mentoring

All students are required to mentor peers (2 h total) and be mentored (2 h total).

This supported process helps students understand the strengths and weaknesses they have. They are guided in how to learn from others, how to ask for help, and how to offer help in a professional and gracious way.

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Students complete self-assessments

http://sciencecouncil.org/about-us/10-types-of-scientist/

Students will create an IDP using this link: myidp.sciencecareers.org

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## SCIWILWORK Students

Students
- find a science graduate or employer;
- interview them about their career pathway or their employee requirements; and
- present this interview to the other students in the class.

Students must use their network for find this graduate and reflect on:

a) the size and scope of their network and
b) the ways they build and use this network.

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## Me in Three

Finally, our students stand up in front of the class and provide a “Me in Three” statement.

They talk about themselves and what they have learned from SCIWILWORK.


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## What do students see as the benefits?

In a final reflection students said:

- **I learnt that I need to market myself not as a student but as a future professional.** Engaging with everyone as a potential person that may know someone to employ me has made me optimistic about how I can grow my network.
- Through the program, and really identifying the skills I already had and the skills I was learning in my Science degree, I have actually applied and interviewed for a job (after really addressing the selection criteria!!). **Without completing the SCILWORK program, I would not have even considered applying for this role.** So all being well, this is the direction my career will take from now.
- The most impressive session for me is mentor and mentee activity. As a mentor, I needed to get myself well-prepared and tried to link the message to the daily activities of the mentee. By doing so, I can engage and interact more with the mentee. As a mentee, it is a great opportunity for me to learn from others. During the process, I paid extra attention and showed great interest**. I found that asking questions is an effective way to interact well with the mentor.**

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## What have we learned?

We have learned that, although our students seem confident on the outside, on the inside they are looking for guidance and help.

We can provide this on a large scale **if** we limit the intensity of our teaching practice and provide a framework for students to explore with their peers.

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## Thank you

- The Australian Office for Learning and Teaching
- Australian Council of Deans of Sciences and the Office for Learning and Teaching
- My many collaborators at UQ and beyond
- The student volunteers in all of our studies
- Our student researchers who help collect and analyse data
- UQ Faculty of Science
- Images - http://jonkrause.com
- You for your attention!

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