# 2017/18 Vacation Scholarships

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| **Job Title:** | CSIRO Undergraduate Vacation Scholarships – **Energy** |
| **Reference No:** | 43693 |
| **Classification:** | CSOF1.1  |
| **Stipend:** | $1462.77 per fortnight (before tax) |
| **Location:** | Please refer to the list of ***Projects*** at the end of this document |
| **Tenure:** | 8 to 12 weeks from November 2017 to February 2018 |
| **Role Purpose:** | The 2017/18 Vacation Scholarship Program is designed to provide students with the opportunity to work on real-world problems in a leading R&D organisation. Participation in the Vacation Scholarship Program has influenced previous scholarship holders in their choice of further study and future career options. Many have gone on to pursue a PhD in CSIRO or to build a successful research career within CSIRO, a university or industry. |
| **Project Description:** | Please refer to the list of ***Projects*** at the end of this document. *If you require more information please contact the person listed for the project.* |
| **Eligibility/** **Pre-Requisites:** | To be eligible to apply you must be an Australian/New Zealand Citizen, Australian Permanent Resident, or an international student who has full work rights for the 8 to 12 weeks duration (does not require visa sponsorship).Vacation scholarships are for students who:* are currently enrolled at an Australian university;
* have completed at least three years of a full-time undergraduate course (however exceptional second year students may be considered);
* have a strong academic record (credit average or higher); and
* intend to go on to honours and/or postgraduate study.
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| **How to Apply:**  | Please apply online at [www.csiro.au/careers](http://www.csiro.au/careers). **You will be required to:**1. select your **top 2 preferred research projects** in order of preference;
2. submit a **resume/cover letter** (as one document) which includes:
* the reasons why the research project/s you have selected are of interest to you; and how your previous skills/knowledge and experience meets the project requirements;
* an outline of your longer-term career aspirations and detail how this program will help you achieve them; and
* using the project numbers listed below, list in order of preference, **all of the projects** you are interested in.
1. upload your **academic results** in the ‘***Requested Information’*** field.

**Referees:** If you would like to include referees (either work or university lecturers/ tutors)in your application, please add their name and contact details into your resume**.** If you experience difficulties applying online call 1300 984 220 and someone will be able to assist you. Outside business hours please email: csiro-careers@csiro.au.  |

**There are 18 projects available in Energy:**

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| **Project No.** |  **Location** |  **Project Title (see the following pages for more information)** |
| [**Energy 1**](#_Energy_1) | Newcastle, NSW | Exploring the landscape of Australia’s energy use  |
| [**Energy 2**](#_Energy_2) | Newcastle, NSW | Trends in Australian energy storage technology  |
| [**Energy 3**](#_Energy_3) | Newcastle, NSW | Energy Data Analysis software development |
| [**Energy 4**](#_Energy_4) | Newcastle, NSW | Discovering the drivers of Australia’s energy use  |
| [**Energy 5**](#_Energy_5) | Newcastle, NSW | Optimisation of grid integration of renewables |
| [**Energy 6**](#_Energy_6) | Newcastle, NSW | Renewables laboratory interface development |
| [**Energy 7**](#_Energy_7) | Newcastle, NSW | Investigation into non-contact current sensing and smart solar hot water |
| [**Energy 8**](#_Energy_8) | Newcastle, NSW | Towards modelling the key drivers of aggregate energy behaviour across Australia |
| [**Energy 9**](#_Energy_9) | Pullenvale, QLD | Development of activated carbons using CSIRO-produced deep cleaned coals |
| [**Energy 10**](#_Energy_10) | Pullenvale, QLD | 3D imaging and analysis for mining applications |
| [**Energy 11**](#_Energy_11) | Pullenvale, QLD | Developing Digital Mining Solutions using Cloud-based Platforms |
| [**Energy 12**](#_Energy_12) | Pullenvale, QLD | Optical Microscopy of Urban Dust |
| [**Energy 13**](#_Energy_13) | Newcastle, NSW | Developing catalysts for C02 conversion in aqueous amines |
| [**Energy 14**](#_Energy_14) | Newcastle, NSW | Novel gas-liquid contacting applications |
| [**Energy 15**](#_Energy_15) | Newcastle, NSW | Energy from CO2 |
| [**Energy 16**](#_Energy_16) | Newcastle, NSW | Optimised transparent conductive electrode deposition for semi-transparent perovskite solar cells |
| [**Energy 17**](#_Energy_17) | North Ryde, NSW | Gas phase Ammonia emissions and qualification from amine solvent |
| [**Energy 18**](#_Energy_18) | Newcastle, NSW | Spatial distribution of Mercury and exposure in regional and urban NSW  |

Select the **Project Numbers** above to take you directly to the project details, including relevant fields of study, Project Duties/Tasks and Locations for these projects (which are on the following pages).

Pease read though these and decide **which 2 projects are your preferred choices** as you will need to enter these into your application. If you require more information please contact the person listed for each project.

Note: CSIRO are advertising vacation scholarships by the different business units we have. You can apply for more than one CSIRO business unit, but your application for **Energy** should only refer to Energy projects, such as ***Energy 1***, ***Energy 2***, etc.

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| Project Number | **Energy Vacation Scholarships Project Details** |
| Energy 1 | **Project Title**Exploring the landscape of Australia’s energy use**Project Description**The Australian Energy Use Data Model (EUDM) is a ~$19M federally-funded project focussed on unifying energy datasets from across the sector and then unlocking their hidden value. This project will investigate the breadth of energy-related research (and data) across sectors, institutions and states in Australia to identify emerging trends in energy use, cost and generation.You will catalogue and review these data assets in response to one of several research questions on energy pricing, energy efficiency or emerging new technologies, as dependant on the experience of the successful applicant.**Project Duties/Tasks**Specific tasks will be tailored to the expertise of the successful applicant, but may include:* A review of literature in the field and relevant to the Australian context
* Documentation of evidence found throughout the investigation
* Cataloguing and creating metadata to support the evidence base

**Relevant Fields of Study**• Energy• Engineering and/or science• Economics• Data collection and management • Software**Location:** Newcastle, NSW**Contact:** For more details please contact Kate Cavanagh by email Kate.Cavanagh@csiro.au |
| Energy 2 | **Project Title**Trends in Australian energy storage technology**Project Description**Energy storage is very topical in Australia currently and a crucial link in the transition to Australia’s renewable future. Many energy storage technologies can have an impact across Australia’s energy system (from residential to grid scale). This project will investigate the trends (with evidence) in energy storage technology (including batteries) for performance, economics and market in the Australian context.**Project Duties/Tasks**Specific tasks will be tailored to the expertise of the successful applicant, but may include:* A review of literature in the field and relevant to the Australian context
* Documentation of evidence found throughout the investigation
* Cataloguing and creating metadata to support the evidence base

**Relevant Fields of Study**• Energy• Engineering and/or science• Economics• Data collection and management **Location:** Newcastle, NSW**Contact:** For more details please contact Kate Cavanagh by email Kate.Cavanagh@csiro.au |
| Project Number | **Energy Vacation Scholarships Project Details** |
| Energy 3 | **Project Title**Energy Data Analysis software development **Project Description**Software model development, primarily in python, for use in multiple scale, temporal and spatially disaggregated, analysis of electrical load usage and network impacts.**Project Duties/Tasks**Two alternative projects are presented, the choice depending on the aptitude and interests of the successful candidate.* Rewrite existing analysis tools that are currently expressed in Matlab or Excel to perform analysis calculations on energy use at the scale of individual customer, through zone substation and distribution network service provider. For background reading see *Economic benefits of the Electricity Network Transformation Roadmap: Technical report*, Energy Networks Australia, 2017

OR* Write a library module of functions to
	+ - enable data to be aggregated or disaggregated over arbitrary sets of (spatial or temporal) partitions and sub-partitions including enabling parallel or batch scheduled processing and
		- optimisation of processing time through choice of calculation workflow

For background reading, see Do V.H., C. Thomas-Agnan and A. Vanhems 2014, *Spatial reallocation of areal data – another look at basic methods*, Toulouse School of Economics, France, Working Paper TSE‐397.**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:Software engineering/ programming1. With a programming focus - preferably with familiarity with python and awareness of Matlab and Excel
2. With a computer science/ mathematics focus - some familiarity with group theory and shortest path optimisation in graphs.

**Location:** Newcastle, NSW**Contact:** For more details please contact Thomas Brinsmead by phone on (02) 4960 6143 or email thomas.brinsmead@csiro.au  |

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| Project Number | **Energy Vacation Scholarships Project Details** |
| Energy 4 | **Project Title**Discovering the drivers of Australia’s energy use**Project Description**The Australian Energy Use Data Model is a ~$19M federally-funded project focussed on unifying energy datasets from across the sector and then unlocking their hidden value. As part of EUDM we run surveying programs that stretch across the nation, trying to understand the complex interconnection between energy-use and demographics, appliance uptake, environmental conditions and building characteristics. This project will explore the datasets that emerge from these surveying activities. You will be diving deep into the data to help us understand just what makes an Australian energy consumer act the way they do!**Project Duties/Tasks**Specific tasks will be tailored to the expertise of the successful applicant, but may include:* Application of computer science or statistical approaches (such as neural networks or mixed-effects modelling) to link observed energy behaviours with demographic and environmental factors.
* The application of quantitative social science skills in explaining observed residential energy consumption patterns and designing follow-up survey materials or sampling strategies.
* The development of software tools for the automated translation, transformation, cleaning or processing of survey and energy data.
* Documentation of design processes and final outputs.
* Review of relevant literature in the field.
* Working closely with other researchers within the Energy Use Data Model team.

**Relevant Fields of Study*** + Statistics
	+ Data science
	+ Computer science and software engineering
	+ Social science (including social demography)

**Location:** Newcastle, NSW**Contact:** For more details please contactAdam Berryby email adam.berry@csiro.au |

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| Project Number | **Energy Vacation Scholarships Project Details** |
| Energy 5 | **Project Title**Optimisation of grid integration of renewables **Project Description**The project involves the investigation of methods by which intermittent renewable sources can be optimally integrated in larger penetration levels into different types of electricity networks. This may include software modelling and experimental validation in CSIRO’s Renewable Energy Integration Facility (REIF). **Project Duties/Tasks**Specific tasks will be tailored to the expertise of the successful applicant, but may include:* Development of software models to simulate high-penetration renewable energy systems;
* Conducting of experiments with a mix of renewable energy and energy storage technologies in CSIRO’s REIF laboratory;
* Review of relevant literature in the field;
* Working closely with other researchers in the Grids and Renewable Energy Integration group.

**Relevant Fields of Study*** Electrical engineering
* Computer engineering

**Location:** Newcastle, NSW**Contact:** For more details please contactSaad Sayeef by email saad.sayeef@csiro.au  |
| Energy 6 | **Project Title**Renewables laboratory interface development **Project Description**The project involves developing software interfaces to enable control of a suite of electrical devices for use in experiments to investigate ways of increasing Australia’s renewable generation while maintaining energy security, stability and power quality. The equipment to be controlled forms part of the CSIRO’s Renewable Energy Integration Facility (REIF). **Project Duties/Tasks**Specific tasks will be tailored to the expertise of the successful applicant, but may include:* Development of software interfaces using industry-standard protocols such as Modbus, as well as proprietary protocol systems;
* Researching potential control options and liaising with equipment suppliers to access interface definitions;
* Conducting of experiments with a mix of renewable energy and energy storage technologies in CSIRO’s REIF laboratory;
* Working closely with other researchers in the Grids and Renewable Energy Integration area.

**Relevant Fields of Study*** + Software engineering
	+ Computer science
	+ Computer engineering

**Location:** Newcastle, NSW**Contact:** For more details please contactTim Moore by email Tim.moore@csiro.au  |
| Project Number | **Energy Vacation Scholarships Project Details** |
| Energy 7 | **Project Title**Investigation into non-contact current sensing and smart solar hot water**Project Description**This is a 2 part project. Part 1 is the investigation into new methods of determining current flows in a circuit without direct contact.Part 2 is the design and build of a smart booster system for solar hot water that takes various data feeds and determines an optimal decision for using the electrical booster. **Relevant Fields of Study*** + Mechatronics
	+ Electrical Engineering

**Location:** Newcastle, NSW**Contact:** For more details please contactSam West by phone on (02) 4960 6129 or email Sam.West@csiro.au |
| Energy 8 | **Project Title**Towards modelling the key drivers of aggregate energy behaviour across Australia**Project Description**This project would be the first step towards modelling the key drivers of aggregate energy behaviour across Australia. We are aiming to do that by gathering demographic, building and energy data across the sector, and then by implementing several correlation analyses. In particular, we are interested in the behaviour of aggregate total electricity demand, aggregate air-conditioner demand, and aggregate PV generation at the zone substation level. **Project Duties/Tasks*** Review of the available datasets at Energy Model Cluster, CSIRO Energy Centre
* Extensive search across the sector for demographic, building, and energy data gathering
* Put all the data in a unified structure, clean and filter them, ready to be used by researchers
* Link the desired datasets to the electricity demand data of zone substations distributed across Australia
* Correlation analysis between the desired features and i) total electricity demand, ii) air-conditioner demand, and iii) PV generation on several selected zone substations
* Documentation of work and findings and final presentation

**Relevant Fields of Study*** + Electrical Engineering
	+ Renewable Energy Systems
	+ Computer Science
	+ Applied mathematics

**Location:** Newcastle, NSW**Contact:** For more details please contactNariman Mahdavi by phone on (02) 4960 6085 or email nariman.mahdavimazdeh@csiro.au |

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| Project Number | **Energy Vacation Scholarships Project Details** |
| Energy 9 | **Project Title**Development of activated carbons using CSIRO-produced deep cleaned coals**Project Description**Deep cleaned coals with an ultra-low ash amount have been considered as promising starting materials for producing low-cost and high-performance activated carbons for various applications. The proposed project is to study the development of activated carbons using the deep cleaned coals that are produced by CSIRO in a more cost-effective and environmentally-friendly approach. The main objectives of the project are to study the carbonisation and activation characteristics of CSIRO-produced deep cleaned coals, and characterise the porous structures of the developed activated carbons and their adsorption performance for CO2 and CH4 capture. **Project Duties/Tasks*** Preparation of activated carbons by carbonisation and CO2 activation of CSIRO-produced deep cleaned coals under various conditions such as varied carbonisation and activation temperatures and varied activation durations
* Characterisation of porous structures of developed activated carbons by measuring N2 sorption at 77 K and CO2 adsorption at 273 K
* Evaluate adsorption capacities of CO2 and CH4 by measuring adsorption isotherms of CO2 and CH4 at 298 K

**Relevant Fields of Study*** + Chemical Engineering

**Location:** Pullenvale, QLD**Contact:** For more details please contactYonggang Jin by phone on (07) 3327 4146 or email yonggang.jin@csiro.au  |
| Energy 10 | **Project Title**3D imaging and analysis for mining applications **Project Description**The Mining Geoscience team has commercialised technologies for the mining sector utilising novel 3D imaging and analysis technologies. The student will work with the team in developing new algorithms and sensor configurations including:* 3D reconstruction of mining environments using stereo vision
* Analysis of rock mass features using 3D models.

**Project Duties/Tasks*** Algorithm design
* Software development (C++/C#/Matlab)
* Hardware configuration and testing

**Relevant Fields of Study*** Software engineering
* Physics
* Mechatronics

**Location:** Pullenvale, QLD**Contact:** For more details please contactMarc Elmouttie by phone on (07) 3327 4775 or email marc.elmouttie@csiro.au  |
| Project Number | **Energy Vacation Scholarships Project Details** |
| Energy 11 | **Project Title**Developing Digital Mining Solutions using Cloud-based Platforms**Project Description**Our research group delivers advanced technology solutions that are changing the way that mining is being performed in Australian and around the world. This exciting project will explore state-of-the-art cognitive and machine learning algorithms to evaluate new digital solutions for mining. You will develop cutting edge software that incorporates real-time mine sensor data, advanced cloud-based data processing, and web-based user interface. A great opportunity to gain insights into digital technology evolution in mining.**Project Duties/Tasks*** Rapid prototyping and validation of key system components
* Demonstrate the prototype system to CSIRO staff

**Relevant Fields of Study*** Electronic, information technology or software engineering
* C++, HTML, JSON, machine learning, and/or IBM Bluemix advantageous

**Location:** Pullenvale, QLD**Contact:** For more details please contactJonathon Ralston by phone on (07) 3327 4702 or email jonathon.ralston@csiro.au  |
| Energy 12 | **Project Title**Optical Microscopy of Urban Dust**Project Description**This project will be focused on the development of Dust marker's reference library for Coal Grain Analysis (CGA) technology for the assessment of wide range of particulates in urban dust samples. CGA is an optical reflected light microscopy system which provides a calibrated reflectance fingerprint of individual particles greater than one micron. A set of reference particles including coal of different ranks, coke, graphite, organic particles, minerals, soot, plastic, paint, rubber and combustion chars will be provided to the vacation student by CSIRO. The vacation student will have a role in the sample preparation of the reference particulates, their imaging by Zeiss optical microscope and creating a particle reference library in CSIRO's Particle Imaging System (ParlS). Dust markers reference library will then be used as a CGA module for semi-automated characterisation of urban dust samples.**Project Duties/Tasks*** Sample preparation of dust reference samples
* Creating high resolution mosaicked images by using Zeiss optical microscope
* Creating dust reference library

**Relevant Fields of Study*** Environmental Sciences

**Location:** Pullenvale, QLD**Contact:** For more details please contactSilvie Koval by phone on (07) 3327 4728 or email silvie.koval@csiro.au  |

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| Project Number | **Energy Vacation Scholarships Project Details** |
| Energy 13 | **Project Title**Developing catalysts for CO2 conversion in aqueous amines**Project Description**The mitigation of carbon dioxide emissions is of utmost importance for slowing the rise in greenhouse gases. To this end, aqueous amines have been developed that can efficiently capture CO2. A highly desired process is to convert the captured CO2 into useful chemical commodity products such as methanol. For this transformation new catalysts need to be developed that are stable to air and water, long lived, and sufficiently active. This project will be based on synthesizing potential catalysts .**Project Duties/Tasks*** Learn how to understand and manage risks, while safely operating in an air-free synthetic laboratory
* Synthesis a variety of ligands and coordinate to transition metals learning air-free techniques
* Testing coordination compounds for CO2 conversion.

**Relevant Fields of Study*** Organometallics/inorganic chemistry, catalysis, organic synthesis.

**Location:** Newcastle, NSW**Contact:** For more details please contactMichael Webster-Gardiner by email Mike.Webster-Gardiner@csiro.au  |
| Energy 14 | **Project Title**Novel gas-liquid contacting applications**Project Description**This project is experimental in nature and involves the development of a novel gas liquid contacting device for applications including post-combustion CO2 capture. A knowledge of and interest in mass transfer and fluid dynamics and practical experience in assembling equipment and carrying out experiments are the prerequisites of this project.**Project Duties/Tasks*** Assist with the design and construction of experimental apparatus to test novel gas-liquid contacting applications
* Carry out experiments and analyse data using, for example, spreadsheets
* Prepare and deliver oral and written reports of the work.

**Relevant Fields of Study*** Chemical Engineering
* Mechanical Engineering

**Location:** Newcastle (Mayfield West), NSW**Contact:** For more details please contactLeigh Wardhaugh on phone on (02) 4960 6026 or email leigh.wardhaugh@csiro.au  |

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| Project Number | **Energy Vacation Scholarships Project Details** |
| Energy 15 | **Project Title**Energy from CO2 **Project Description**Our research has shown that electrical energy can be produced from an amine based CO2-capture process. This can have significant benefits for the CO2-capture process, also providing a new route to convert renewable energy more effectively into electricity. This multi-disciplinary project is aimed at the development of a conceptual design for an overall process for two relevant cases.**Project Duties/Tasks*** Familiarisation with the energy harvesting concept
* Developing a process concept for case 1
* Developing a process concept for case 2.

**Relevant Fields of Study*** (electro-)chemical engineering
* (electro-)chemistry
* physics or
* renewable energy engineering.

**Location:** Newcastle, NSW**Contact:** For more details please contactPaul H.M. Feron by phone on (02) 4960 6022 or email paul.feron@csiro.au  |
| Energy 16 | **Project Title**Optimised transparent conductive electrode deposition for semi-transparent perovskite solar cells**Project Description**To absorb sunlight and collect chargers, solar cells need an electrode which is both transparent conducting electrode. Often this layer is fabricated onto a glass substrate, but for advanced concepts such as semi-transparent solar cells or tandem devices, at least one of these transparent electrodes needs to be fabricated into the active device.CSIRO is developing smart solar tinted windows, which requires the deposition of a transparent conducting oxide known as indium tin oxide (ITO) on top of a semiconductor stack. The student will be responsible for optimisation of the ITO layer deposition compatible for photovoltaic function, balancing transparency and sheet resistance.**Project Duties/Tasks*** Sputter deposition of indium tin oxide films to optimise conditions
* Characterisation of the physical properties of the films, such as sheet resistance, optical transmittance and work function
* Evaluate the compatibility of the films in perovskite photovoltaic devices

**Relevant Fields of Study*** Physics
* Materials Science
* Physical Chemistry

**Location:** Newcastle, NSW**Contact:** For more details please contactTim Jones by phone on (02) 4960 6250 or email tim.jones@csiro.au  |
| Project Number | **Energy Vacation Scholarships Project Details** |
| Energy 17 | **Project Title**Gas-phase ammonia emissions and quantification from amine solvent degradation**Project Description**The Energy Emissions and CO2 Capture group at CSIRO Energy specialises in the prediction and measurement of emissions from newly developed energy generation systems. One area of focus is in the emissions of ammonia and other basic nitrogen compounds from CO2 capture technologies using amine solvents. The transformation of these emissions in the atmosphere can be predicted based on their reaction chemistry, and can be studied at laboratory scale using facilities such as the CSIRO smog chamber.Ammonia is a ubiquitous compound in the atmosphere, emitted from agricultural, industrial and biogenic sources. It is anticipated to be emitted to some extent from carbon capture technologies, and can contributor to particulate matter (PM) formation in the atmosphere.For this project, the student will undertake work on the development of a lab­ scale system to quantify and determine possible ammonia emissions, in both gas and particulate form, from carbon capture solvents at different degradation levels. In addition, the student will work on measurement of gas­ phase ammonia and particle-phase ammonium using a number of analytical techniques utilised in both the CSIRO smog chamber and in energy emission measurement campaigns.**Project Duties/Tasks*** Development of lab-scale system to measure ammonia/ammonium emissions arising from amine solvents
* Validate and compare the various analytical methods used to quantify ammonia and assess its possible interactions with other gaseous components
* Assist staff members of the emissions group with sampling and analysis of ammonia and similar compounds from smog chamber experiments
* Presentation of the results in report or seminar format

**Relevant Fields of Study*** Atmospheric Sciences
* Chemistry
* Chemical Engineering

**Location:** North Ryde, NSW**Contact:** For more details please contactSteve White by phone on (02) 9490 5327 or email stephen.j.white@csiro.au  |

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| Project Number | **Energy Vacation Scholarships Project Details** |
| Energy 18 | **Project Title**Spatial distribution of Mercury and exposure in regional and urban NSW **Project Description**Mercury is an important pollutant from coal combustion and has been identified as a Hazardous Air Pollutant (HAP) in Australia. It is estimated that approximately 18 tonnes of mercury is released in Australia each year from anthropogenic sources. Due to the acute toxicity of mercury it is important to monitor and minimise human exposure to this element. The student will undertake fieldwork and laboratory experiments to assess human exposure to airborne mercury at different areas of the Hunter Valley, NSW. It is proposed that both regional and urban areas will monitored using the trace mercury analyses equipment located at CSIRO Energy Technology laboratories, Newcastle. If time permits the sampling program will be extended to other areas of NSW. It is expected that this work will results in a report/publication.**Relevant Fields of Study*** Atmospheric Sciences
* Chemistry

**Location:** Newcastle (Mayfield West), NSW**Contact:** For more details please contactBrendan Halliburton on phone on (02) 949606060 or email brendan.halliburton@csiro.au  |