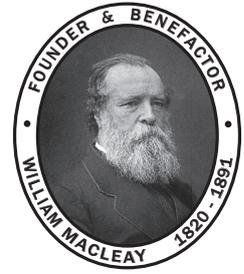




# THE LINNEAN SOCIETY OF NEW SOUTH WALES

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## The William Macleay Microbiology Research Fund

Grants are available from the William Macleay Microbiology Research Fund to support original research in an Australian natural history context within the field of Microbiology.

### History of the Fund

In 1890, Sir William Macleay left an endowment of 12,000 Pounds to the University of Sydney to establish a Chair or Lectureship of Bacteriology. He was convinced of the extreme importance of this then fledgling science, but doubted that others held this view so he set strict conditions on his bequest.

The Senate of the University of Sydney accepted the bequest but in 1894 sought to have one of the conditions modified in the Equity Court. This was Sir William's condition that "... It shall be necessary for every student before being admitted to a Science or Medical Degree at the University to attend a six months course of Bacteriology". The Senate requested the court to rule on whether "Science Degree" meant science generally or just biological science. The judge ruled in favour of biological science. The other request was to define "a six months course of Bacteriology". It was put to the court that the science of bacteriology, in its then state of development, could not profitably fill a six months' course. The judge ruled in favour of Sir William's original intention. In 1895, the Senate returned the bequest to the executors, who, following directions in Sir William's will, passed the money to the Linnean Society of New South Wales to provide a salary for a position to be called 'The Bacteriologist to the Linnean Society'. The Society set up its own laboratory in Linnean House, Elizabeth Bay, and employed a bacteriologist to conduct original research and to give instruction to one or two pupils. A full account is given in the Presidential Addresses of March 1895 and March 1896. The first Macleay Bacteriologist (1898-1927) was Robert Greig Smith, who did pioneering work on root-nodule bacteria during his long tenure.

This state of affairs continued until the late 1920s when the Society sold Linnean House and relocated the office of the Society to Macleay House, College Street, Sydney. The new headquarters did not have provisions for a laboratory so the new Macleay Bacteriologist, Hans Laurits Jensen, was located at the University of Sydney in 1929 and the Society paid bench fees to the University. When the Linnean Society and the Royal Society of New South Wales jointly built Science House in Gloucester Street in the city, it did not have a laboratory either. By the early 1950s, inflation had eroded the value of the endowment so that it no longer supported a full-time bacteriologist. The third and last Macleay Bacteriologist Dr Yao-Tseng Tchan resigned in 1955 and was appointed Senior Lecturer in Microbiology at the University of Sydney. The Society negotiated a legal Deed with the University of Sydney for the income from the bequest to pay part of a salary for a Linnean Macleay Lecturer in Microbiology. After this proposed Deed was approved by the N.S.W. Supreme Court in Equity in 1956, the University set up this lectureship and Dr Tchan was transferred to it. After Dr Tchan was promoted to the Chair in Microbiology, Dr Kai Yip Cho was appointed in 1969 as the second holder of the Linnean Macleay Lectureship in Microbiology. He was succeeded in 1991 by Prof. Peter Reeves.

By 2012, income from the bequest was small and was no longer being used towards a salary. Council decided to reactivate this fund as the ‘Linnean Macleay Microbiology Research Fund’. The Fund would be managed similarly to the other research funds to award grants to support original research in the field of microbiology and thus maintain the intent of the Macleay bequest. The first two grants from the fund were awarded the following year.

(Compiled from information from Dr Helene Martin and in the *Proceedings*)

### **Annual awards from the William Macleay Microbiology Research Fund**

Summary of the awards made from the William Macleay Microbiology Research Fund since its inception.

<b>Year</b>	<b>Capital invested</b>	<b>No. grants</b>	<b>Total Awarded</b>
2012	\$100,599		
2013	\$103,515	2	\$2,300
2014	\$106,695	1	\$2,000
2015		2	\$2,640
2016		5	\$5,500

## 2016 Awards

### Julian E. Tenison Woods Award

**Recipient:** Ms Leeora **Gubbay-Nemes**, University of New South Wales

**Project:** The sources & transport mechanisms of metals in submarine arc volcanoes.

**Synopsis:** The Kermadec Arc is the most hydrothermally-active segment of an intra-oceanic arc in the world. Hosting at least three Volcanogenic Massive Sulfide (VMS) deposits, it is seen as a natural laboratory for understanding the formation of modern VMS systems. The arc comprises a chain of 30 major submarine volcanoes that extends ~1200km northeast from the North Island of New Zealand towards Tonga. Brothers Submarine Caldera Volcano, situated 1.5km below sea level is the most hydrothermally active volcano found along the arc. It hosts the largest accumulation of VMS mineralization rich in Cu-Au-Ag (up to 90 ppm Au) and clearly shows the close association between arc volcanism and large deposits of important economic ore metals. Ancient VMS ore deposits in Australia and globally yield much of the world's significant mineral resources and were formed through analogous volcanic systems. However, the ultimate source of the metals and the role that magmatic volatiles (sulfur and chlorine) play in their transportation onto the seafloor as economic ore deposits is still largely unknown. Brothers volcano is also a unique ecological site and was recently included in the world's largest marine park, hence a better understanding of the evolution of the volcano that forms the underlying basis for the marine ecology will help in their understanding of the development of life on this volcano.

**Awarded** \$1,250

**Recipient:** Ms Lucy N. **Wenger**, Australian National University

**Project:** Could coral reef fishes have evolved from seaweed-associated ancestors?

**Synopsis:** Coral reefs support a spectacular diversity of fishes and evidence suggests many families of coral reef fishes have undergone dramatic radiations. Using the closely related genera *Macropharyngodon* and *Xenojulis* of coral reefs and seaweed meadows, this project will explore whether the *Macropharyngodon* radiation and *Xenojulis* could have arisen from a common seaweed-associated ancestor at Ningaloo Reef. *Macropharyngodon* spp have an unusual diet of benthic foraminifera and *Xenojulis* is a microcarnivore. Morphology, biology, ecology and gene sequence will be studied to determine the degree of specialisation and how the coral reef fish radiation may have evolved.

**Awarded** \$1,250

### William Macleay Award for Microbiology Research

**Recipient:** Mr Matt **Johansen**, Veterinary Science, University of Sydney

**Project:** The role of cholesterol-associated genes for the early pathogenesis of *Mycobacterium marinum* in a zebrafish model.

**Synopsis:** Johne's disease is a chronic intestinal inflammation in ruminants caused by *Mycobacterium avium* subspecies *paratuberculosis*. Once the animal is exposed, macrophages engulf the bacterium but many mycobacterial species are capable of persisting intracellularly. Research with other species has shown that cholesterol is a key requirement for establishment and persistence of infection and cholesterol is utilised by *M. tuberculosis* as a primary carbon-based energy source. Within the *M. a. paratuberculosis* genome there is a large cluster of genes with functions to do with fatty acids and cholesterol metabolism. This project will explore the genes involved in the cholesterol metabolism. Completing such studies in ruminants is not feasible hence zebrafish, a widely used model for mycobacterial infection will be used.

**Awarded** \$1,200

**Recipient:** Ms Valentina H. **McCormick**, University of Technology Sydney

**Project:** Assessing the threat of anthropogenic impacts to seagrass meadows as a consequence of the un-coupling of seagrass-microbe associations.

**Synopsis:** Evidence suggests that ecological interactions between seagrasses and associated microorganisms strongly control the physiology, health, and function of meadows. Disruptions to the delicate balance results in declines of seagrass stocks. Seagrass meadows grow in estuaries, sheltered bays etc. and have substantial economic importance as a nursery for fish. Anthropogenic pressures threaten seagrass meadows, particularly in Lake Macquarie where thermal and nutrient discharges from power stations occur. This study will monitor the ecological conditions and the microbial communities to determine if this method is useful as a management tool.

**Awarded** \$600

**Recipient:** Mr Arjun **Verma**, University of Technology Sydney

**Project:** Population genomics and local adaptation of toxic marine microbial eucaryotes along the East Australian Current.

**Synopsis:** Marine microbial eucaryotes (protists) are amongst the most important primary producers in the marine ecosystem. Few species cause harmful algal blooms that can contaminate food webs and seafood and pose a significant public health threat. *Ostreopsis* cf. *siamensis* is a palytoxin producing epi-benthic dinoflagellate found along 1,500 km of southeast Australian coastline and is known to produce severe toxic blooms. Population structures and variability are important to understanding the environment and for developing improved tools to monitor and predict toxic blooms.

**Awarded** \$1,200

## 2015 Awards

**Recipient:** **LARSSON, Michaela (University of Technology Sydney)**

**Project:** Understanding the ecological niche of toxin producing dinoflagellates.

**Synopsis:** Ciguatera Fish Poisoning (CFP) is a human illness which arises from consumption of marine fish whose flesh and viscera have been contaminated with ciguatoxins. Globally, it is estimated that between 50,000 and 200,000 people each year are affected by CFP, making it the most prevalent nonbacterial human illness associated with seafood consumption. The aims of my project are to: i) Identify strains of *Gambierdiscus* isolated from Australian waters using molecular methods; ii) Characterise the toxin profiles of identified strains using advanced analytical techniques; and iii) Deposit the strains into a national collection so they are made publically available for further research. As CFP is a global human health issue, this work is significant both nationally and internationally.

**Awarded:** \$1,640.00

**Recipient:** **NOORIAN, Parisa (University of New South Wales)**

**Project:** Investigation of an iron-dependent antiprotozoal factor in *Vibrio vulnificus*

**Synopsis:** *Vibrio vulnificus* is an opportunistic pathogen responsible for wound infections and septicemia following ingestion of contaminated seafood, and has the highest reported mortality rate for seafood-related diseases. It is an autochthonous inhabitant of coastal marine environments where it is exposed to predation by heterotrophic protozoa. Protozoan predation on bacteria acts as a selective force, leading to evolution of antiprotozoal mechanisms that may also function as virulence factors.

An environmental strain of *V. vulnificus* showed toxicity towards the filter-feeding ciliate *Tetrahymena*

*pyriformis*. Further investigations showed that this toxicity is dependent on presence of iron in the media. Next generation sequencing (RNA-seq) will be used to further investigate the antiprotozoal factor by comparing the difference in the transcriptome of *V. vulnificus* in iron replete and deplete conditions.

**Relevant** genes (or sets of genes) that are differentially expressed will be further investigated through generation of knockout mutants and qPCR.

The aim of this study is to identify the genetic features that are likely to contribute to the survival of the opportunistic pathogenic bacteria *V. vulnificus* in the natural aquatic environment by resisting its natural predators.

**Awarded:** \$1,000.00

## 2014 Awards

**Recipient:** RANASINGHE, Purnika L, (Queensland University of Technology)

**Project:** Analysis of bacterial diversity, abundance and dynamic responses to environmental challenge in an insect microbiome using “next generation” sequencing and data visualization.

**Synopsis:** Lepidopteran insect species have complex communities of microorganisms the “microbiome” in their guts that are important in the insect biology. The composition, ecology and functional responses are poorly understood. Molecular analysis has allowed identification of multiple microbes with previously unexplained communities. The diamondback moth (*Plutella xylostella* L. (Lepidoptera: Plutellidae), DBM) is a pest of brassicas and has evolved resistance to many insecticides. Two molecular methods of analyses have established an initial base line of the presence of microbial phyla and differences between two populations, one on cabbage and the other on broccoli. The ‘next generation’ sequencing is able to establish generic identity. Experiments raising DBM larvae on cabbage for three generations then switching onto the broccoli for three generations shows that the microbial communities in the gut change to those resembling the ones in larvae permanently reared on broccoli. Similarly, those changed from broccoli to cabbage have changed microbial communities. This project will use next generation sequencing to follow the changes in the microbial populations during the changeover.

**Awarded:** \$2,000.00

## 2013 Awards

**Recipient:** Armbrecht, Linda H (Macquarie University)

**Project:** Phytoplankton characterization and related biogeochemical processes in a biological hotspot: Solitary Island Marine Park, Eastern Australia.

**Synopsis:** In the light of climate change, the global subtropical western boundary currents are experiencing an above-average sea surface temperature warming. The East Australian current, which transports warm tropical water masses to temperate latitudes, is one of these currents. As the physical parameters of the East Australian current have changed over the past 60 years, changes are expected for the inhabitants of the currents, the free-floating phytoplankton. This research will provide the first detailed taxonomic phytoplankton survey in the Solitary Island Marine Park region, an area that is regarded as a hotspot for climate change. By sampling throughout a complete annual cycle, covering various oceanographic regimes, and along an elaborated sampling design, temporal and regional small-scale variations in phytoplankton distribution will be determined. This dataset will comprise

the first comparison to the Port Hacking Station (Sydney) and in addition, reveal further information about phytoplankton microhabitats and carbon, nitrogen and silica uptake and export, which cannot be determined from depth-integrated net sampling.

**Awarded:** \$1,102.00

**Note:** *The above recipient has also received an award from the Joyce Vickery Scientific Research Fund.*

**Recipient: Vardeh, David (University of New South Wales)**

**Project:** Assessing the microbial composition of extant Australian stromatolites from differing geochemical settings.

**Synopsis:** Stromatolites, accretionary microbial structures, were the dominant life forms on early Earth for billions of years, but due to grazing pressure and competition today, are limited to a few isolated places. In the development of a stromatolite, phototrophic cyanobacteria are the first to settle on a substrate. Through filaments and production of extracellular polymeric substances cyanobacteria create the foundation for biofilm development by providing micro-niches in which other microbes can find favourable conditions in terms of light, oxygen availability and pH. Stromatolites are mostly found in hypersaline, marine or freshwater settings, thus very little is known about caves specimens (semi-open Nettle Cave in Jenolan and Victoria Arch in Wombeyan Caves in NSW). The proposed study will focus on microbial diversity, not geological processes. Therefore, only small amounts of stromatolite material will be removed during sampling, as DNA extraction from the living part of the stromatolite (top 5mm) will yield enough microbial cells for genetic analysis. Extracted DNA samples will be sent off for sequencing and sequences will be analysed and compared.

**Awarded:** \$1,198.00