**ACADEMIC PROJECT SUBMISSION DETAILS:**

<table>
<thead>
<tr>
<th>Supervisor/s:</th>
<th>Andrew Barnes and Michael Pingram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Title:</td>
<td>Investigating riparian planting as a climatic buffer for stream macroinvertebrate communities</td>
</tr>
<tr>
<td>Field:</td>
<td>Biology/Freshwater Ecology</td>
</tr>
<tr>
<td>Division/School:</td>
<td>HECS - Division of Health, Science, Computing &amp; Engineering</td>
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</tbody>
</table>

**EXPECTED OUTCOMES:**

1. The student will learn techniques in sampling and identifying freshwater macroinvertebrates as well as measuring a range of key environmental parameters for assessing water quality in agricultural streams.
2. This project will assess the importance of riparian planting for buffering impacts of climatic variation on macroinvertebrate communities in agricultural streams in the Waikato region, which will assist in enhancing management of future extreme climatic events.
3. The student will collect data that will allow for future analyses of macroinvertebrate food webs, allowing for the quantification of agricultural and climatic impacts on stream food web structure, stability and function.

**STUDENT TASKS:**

1. Field data collection
2. Aquatic macroinvertebrate collection
3. Logger deployment and retrieval
4. Taxonomic identification and counting of macroinvertebrates
5. Measurement of macroinvertebrate morphological traits
6. Data entry

**REQUIRED SKILLS:**

1. A good level of fitness and the general ability to work in the field is essential
2. Some experience in freshwater ecology would be preferred
3. Experience working in a laboratory
4. Some knowledge of freshwater macroinvertebrate identification would be beneficial
Intensifying agricultural and an increasingly variable climate pose a growing threat to the structure, stability and functioning of freshwater macroinvertebrate communities. In particular, intensive agriculture imposes a range of physical and chemical changes to streams, such as increased nutrient loading, sedimentation, plant growth, and temperature extremes. These changes impact stream macroinvertebrate species composition and ecosystem functioning, such as litter decomposition and dissolved oxygen dynamics. Additionally, agricultural streams are now faced with an increasing frequency of extreme climatic events, such as heat waves and drought, which may further exacerbate frequency and magnitude of physical factors impacting aquatic ecosystems.

Riparian planting has been suggested to ameliorate impacts of agricultural intensification and climate change by reducing nutrient runoff and sedimentation, as well as buffering daily fluctuations in temperature and dissolved oxygen, which may cause local extirpation of less tolerant macroinvertebrate species. This project will investigate the efficacy of riparian vegetation on lowland streams for moderating the detrimental effects of rising temperatures in agricultural landscapes at several streams throughout the Waikato region.

Working in close collaboration with Waikato Regional Council, the summer research student will carry out standard macroinvertebrate sampling in agricultural streams that have undergone extensive riparian planting versus streams with minimal riparian buffers, at multiple times throughout the summer. In addition to macroinvertebrate sampling, a range of environmental variables will be measured, such as dissolved oxygen, temperature, plant growth, riparian cover, and bed substrate. The summer research student will process collected samples in the laboratory by identifying species and describing macroinvertebrate communities across the sampled streams. Furthermore, species traits such as body size and life history will be examined to investigate how different characteristics of species mediate their responses to environmental drivers in agricultural streams.
### ACADEMIC PROJECT SUBMISSION DETAILS:

<table>
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<tr>
<th>Supervisors:</th>
<th>Clare Browne and Kate Richardson (Waikato Regional Council)</th>
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<tbody>
<tr>
<td>Project Title:</td>
<td>Using acoustic monitoring to monitor long-tailed bat roosting activity</td>
</tr>
<tr>
<td>Field:</td>
<td>Ecology/Conservation</td>
</tr>
<tr>
<td>Division/School:</td>
<td>HECS - Division of Health, Science, Computing &amp; Engineering</td>
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</table>

### EXPECTED OUTCOMES:

1. Quantify number of bats using roost sites across monitoring period
2. Compare this to the acoustic activity levels and patterns across the monitoring period
3. Clearly communicate the results in the form of a short report
4. Provide raw data to Project Echo

### STUDENT TASKS:

1. Collect camera data to quantify the number of bats exiting the roost across the monitoring period (note: this will be carried out at dusk)
2. Establish acoustic monitoring devices across the site on a set grid, and replace SD cards and batteries through out the monitoring period as needed.
3. Analyse the data from both cameras and acoustic monitoring devices (training will be provided)
4. Write a short report to summarise the findings.
5. Work collaboratively with Project Echo and other university bat researchers.

### REQUIRED SKILLS:

1. Ability to use cameras and acoustic monitoring devices (training will be provided)
2. Ability to analyse acoustic monitoring data on provided software (training will also be provided)
3. Some familiarity with experimental design would be useful
4. Ability to work collaboratively with other stakeholders and researchers
5. Ability to present data in a clear and easy to understand manner
6. Willingness to work outside of usual working hours (some work will need to be carried out at dusk)
PROJECT ABSTRACT:

Long-tailed bats are a critically endangered species endemic to New Zealand, and Hamilton is one of the few cities to have an urban population of these bats. As a cryptic, nocturnal species, monitoring bat populations is extremely challenging, and in particular identifying roost sites. Acoustic monitoring has allowed significant advances in our ability to monitor bats, but it is still not known how useful this tool is for identifying roost locations.

This project will monitor a known roosting site in Hamilton City, using both infrared cameras to quantify the number of bats roosting each night, and an array of acoustic monitoring devices established in the immediate area to monitor the acoustic activity. This will enable a demonstration of acoustic activity compared to the known number of bats present in the roost each night across the monitoring period, and provide a valuable contribution to long-tailed bat management.
**ACADEMIC PROJECT SUBMISSION DETAILS:**

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<tr>
<th><strong>Supervisor/s:</strong></th>
<th>Michael Clearwater</th>
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<tbody>
<tr>
<td><strong>Project Title:</strong></td>
<td>Mapping orchid distributions at Iwitahi Native Orchid Reserve</td>
</tr>
<tr>
<td><strong>Field:</strong></td>
<td>Botany</td>
</tr>
<tr>
<td><strong>Division/School:</strong></td>
<td>HECS - Division of Health, Science, Computing &amp; Engineering</td>
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</table>

**EXPECTED OUTCOMES:**

4. A vegetation plan of the site, including precise locations for named orchid species.
5. A GIS map and photos
6. A brief report exploring strategic and research issues for the orchid reserve

**STUDENT TASKS:**

1. The student will be working alongside orchid experts or other volunteers to locate and identify orchids within the reserve area
2. Examples of each orchid will be photographed, and precise GPS locations recorded
3. GIS maps would be created, with assistance from University of Waikato staff, to document current native orchid cover and distributions throughout the reserve
4. Investigate any opportunities for future restoration and replacement planting at the current site
5. Investigate the option for relocating the orchid reserve, in whole or in part, to a nearby site
6. The student would also be liaising with the OCNZ executive, orchid growers associated with the Iwitahi Reserve, staff at Timberlands Ltd., Iwi and District Council.

**REQUIRED SKILLS:**

1. An interest in native plants
2. Botanical or ecological knowledge preferred
3. Practical skills for field work opportunities
4. Organised and attentive to detail
5. Investigation, data collection and analysis
6. Communication and report writing
7. Highly motivated with abilities to work independently and within a team
8. Driver license required
The Iwitahi Native Orchid Heritage Protection Area is situated on State Highway 5 (the Napier -Taupo Highway) not far from Taupo. Although there are 150 native species of orchid found throughout New Zealand (mostly terrestrial), this 14.3 ha reserve is the only area dedicated to orchid protection, under the Heritage Protection Authority of the Orchid Council of NZ (OCNZ). Orchids tend to do quite well in exotic forests; the Iwitahi reserve is a pine plantation and Timberlands NZ has been cooperating with OCNZ for some time with managing the forest cover on the reserve.

A priority issue for the reserve is its long-term sustainability. Some of the Pinus nigra trees under which the orchids grow are now getting old and some new planting is occurring. A future possibility could involve planting a new stand of P. nigra nearby, and eventually transplanting the orchids. This raises several shorter-term issues, including gaining detailed knowledge of the orchid species on the current site and their precise location.

The project will be comprised of two parts:

- Identification and mapping of existing orchid plants within the reserve. Previous work in this area has identified a list of 37 native orchid species, and their approximate locations. However, some of this information is outdated. In the new survey, orchids will be photographed and their GPS locations will be integrated into a digital map.

- Strategic issues that relate to the future sustainability of the orchid reserve will be explored, in the context of it remaining in its current location or transplantation elsewhere.

The site is approximately 2 hours from Hamilton. Overnight motel stays in Taupo would be arranged for the student, which would be a 20-minute drive from the research site, to perform two consecutive days of field work at a time. Field work would occur periodically over the timeline to suit timing of orchid flowering.
### ACADEMIC PROJECT SUBMISSION DETAILS:

<table>
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<tr>
<th>Supervisor/s:</th>
<th>Joanne Ellis</th>
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<tbody>
<tr>
<td>Project Title:</td>
<td>The effects of nutrient enrichment on carbon emissions in temperate Avicennia marina soils</td>
</tr>
<tr>
<td>Field:</td>
<td>Soil Science/Earth Sciences Marine Science/ Microbiology/ Ecology/ Environmental Science /Human impacts</td>
</tr>
<tr>
<td>Division/School:</td>
<td>HECS - Division of Health, Science, Computing &amp; Engineering</td>
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</tbody>
</table>

### EXPECTED OUTCOMES:

1. Understanding of spatial variations in biogeochemistry of soils under nutrient enrichment
2. Student will gain experience in collaborating with iwi
3. Student will gain experience in working with spatial data using R

### STUDENT TASKS:

1. Setting up experimental plots, each day for one week
2. Participation in sampling efforts: soil samples, in situ measurements
3. Processing sediment samples for grain size distributions etc.
4. Data analysis

### REQUIRED SKILLS:

1. Marine science
2. Organised and self-motivated
3. Background in environmental science/ ecology or similar
4. Proficient in computing (preferably R or excel)
5. Communication skill

### PROJECT ABSTRACT:

Mangrove forests are important coastal habitats, that provide a range of ecosystem services of both, local and global importance. Bays and estuaries, which are the environments mangroves inhabit, are however affected by an increased input of nutrients from altered land use practices and growing population density in the catchment area. While the effects of nutrient enrichment on mangrove trees has been intensely studied, the soils and their inhabiting microbiome have been widely overlooked. A surprising fact, considering the importance of the microbial community for the health and the functioning of the ecosystem. Bacteria, Archaea, and Fungi play an important role in the degradation of organic material, and the conversion of nutrients into organically available forms, a cycle which upholds not only plant growth but also creates a setting to store carbon underground. The effects of nutrient enrichment on this vital part of the ecosystem, has not yet been studied in situ, even though the results may yield far reaching implications for the management of mangrove forests.
### ACADEMIC PROJECT SUBMISSION DETAILS:

<table>
<thead>
<tr>
<th>Supervisors</th>
<th>Shari Gallop, Joanne Ellis &amp; Kura Paul-Burke</th>
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</thead>
<tbody>
<tr>
<td>Project Title</td>
<td>Te ehu o Waihi - Mapping suspended sediments and grain size distribution in Waihi Estuary and ecological implications</td>
</tr>
<tr>
<td>Field</td>
<td>Marine Science/ Earth Science/ Ecology/ Environmental Science /Integrating Mātauranga Māori &amp; western science</td>
</tr>
<tr>
<td>Division/School</td>
<td>HECS - Division of Health, Science, Computing &amp; Engineering</td>
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</tbody>
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### EXPECTED OUTCOMES:

1. Spatial map of grain size in Waihi estuary
2. Understanding of spatial and temporal variations in suspended sediment concentrations in Waihi Estuary
3. Student will gain experience in collaborating with iwi
4. Student will gain experience in working with spatial data in Arc GIS and data interpretation
5. Student will gain experience in marine field work and lab work

### STUDENT TASKS:

1. Sediment sampling on the sea bed via field work
2. Water sampling and filtering of suspended sediments
3. Processing sediment samples for grain size distributions
4. Liaise with Ngati Whakahemo to gain perspectives and history of sedimentation in Waihi estuary
5. Analyse existing sediment data from the Bay of Plenty Regional Council
6. Explore relationships between sedimentation and pipi health/ distribution
7. Summarise and collate information to present to Ngati Whakahemo and the Bay of Plenty Regional Council

### REQUIRED SKILLS:

1. Interdisciplinary engagement and collaboration
2. Comfortable doing field work in estuaries
3. Organised and self-motivated
4. Identify avenues and areas requiring further investigation is future work
5. Background in at least one of marine science/ environmental science/ earth science/ ecology or similar
6. Proficient in computing, Arc GIS an advantage
7. Communication skills
8. Research skills
Estuaries provide a wealth of ecosystem services and play a fundamental part of the culture, identity, and resources for many iwi and hapu in New Zealand. Many New Zealand estuaries have experienced significant reductions in shellfish populations including Waihi in the Bay of Plenty. This summer research project complements our ongoing research focused on an integrated mātauranga Māori-western science approach to understand the health and dynamics of Waihi estuary, particularly kaimoana such as pipi. A key aspect of this is understanding the effects of sedimentation and suspended sediments on filter-feeders such as pipi and tuangi (cockles), which are highly sensitive to levels of suspended sediment in the water column and changes in grain size.

The aim of this summer project is to measure and map turbidity (suspended sediment concentrations), and its temporal variations in Waihi Estuary. This project is co-supervised by School of Science staff and is based in Tauranga working with Dr Shari Gallop (Te Rarawa, Ngati Maru), Dr Joanne Ellis and Dr Kura Paul-Burke (Ngati Awa, Ngati Whakahemo, Ngati Makino). The external project partners are Ngati Whakahemo and the Bay of Plenty Regional Council who is co-funding the project. This project will contribute to and complement other research projects surrounding estuarine hydrodynamics and benthic ecology in Tauranga Moana and the wider Bay of Plenty.

This project will involve field work in the summer taking sediment samples throughout the estuary, and undertaking grain size analysis using a sediment laser sizer. It may also involve taking and processing water samples over tidal cycles at different locations in the estuary, and using a variety of equipment such as for measuring turbidity and light. The student will also make use of existing data from project partner Bay of Plenty Regional Council such as on sediment quality (such as particle size and nutrients) and sedimentation rate. A key aspect of this focus is strong relations with local iwi Ngati Whakahemo through supervisor Kura-Paul Burke. This project will provide a stepping stone for the student to work in marine science that has a strong community focus, and addresses underling physical factors that influence the health and distribution of taonga species such as pipi. This project also has the potential to develop into an exciting MSc project as well as developing inter-disciplinary research capability.
**ACADEMIC PROJECT SUBMISSION DETAILS:**

<table>
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<tr>
<th>Supervisor/s:</th>
<th>Ian Hawes</th>
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<tbody>
<tr>
<td><strong>Project Title:</strong></td>
<td>Factors controlling Filamentous Algal Blooms in Lake Taupo</td>
</tr>
<tr>
<td><strong>Field:</strong></td>
<td>Freshwater Ecology</td>
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<tr>
<td><strong>Division/School:</strong></td>
<td>Environmental Research Institute</td>
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**EXPECTED OUTCOMES:**

1. Development of techniques for monitoring filamentous algal blooms (FABs) in clear NZ lakes
2. Initial testing of the hypothesis that FABs are associated with influx of nutrient-rich groundwater
3. An understanding of the composition of plant and animal components of the FAB
4. An understanding of development of FABs over summer in Lake Taupo

**STUDENT TASKS:**

1. Participate in an extended field trip to Lake Taupo in early summer with the NZ science team to set up the project
2. Participate in an international workshop on Taupo FABs in February 2021
3. Undertake regular sampling (at least monthly) of selected sites in Lake Taupo to establish the seasonal development pattern of FABs
4. Process plant and invertebrate samples from selected locations within the lake
5. Assist with the collection and analysis of groundwater samples on at least three occasions during the summer
6. Complete observations of the distribution of FABs in at least two sites to allow the production of quantitative maps, and seasonal patterns of development
7. Assist in the production of an end of project report to Environment Waikato
8. Produce a poster on the project

**REQUIRED SKILLS:**

1. Happy to spend long days in the field essential
2. Some familiarity with freshwater ecology required
3. Experience with basic microscopy preferred
4. Familiarity with use of GPS an advantage
5. Familiarity with GIS an advantage
PROJECT ABSTRACT:

In recent years, around the world, clear lakes with high water quality have experienced a new phenomenon - proliferations of benthic filamentous algae in nearshore littoral zones. Such proliferations have occurred in iconic systems including Lake Baikal (Russia), Lake Tahoe and Crater Lake (USA) and, in New Zealand, in Lakes Wakatipu and Taupo. These filamentous algae severely degrade near-shore habitat, normally the most biodiverse area within lakes and the area most frequently interacted with by people. They come to present human health risks when toxic cyanobacteria species are present, as is known to be the case in Lake Taupo.

Limnology has traditionally focused on the problem of pelagic algal blooms. Benthic proliferations present a conundrum as they do not fit within the current eutrophication paradigms, since they occur in water that appears to be nutrient poor. To address this growing issue, leading NZ and US scientists have combined to focus research on filamentous algal blooms (FABs). Last year a workshop was held at Lake Tahoe and a second leg is planned at Lake Taupo in February 2021. In order to optimise the value of this second workshop, and with financial support from Environment Waikato and approval of Ngati Tuwharetoa, we are offering this studentship to allow a comprehensive evaluation of the extent and seasonality of FABs in Lake Taupo. It builds on research carried out by the supervisor, and recent concerns over developing techniques for monitoring of potentially toxic benthic cyanobacterial populations in the lake.

The student will be expected to work with the NZ science team during early summer to establish a series of monitoring locations, collect samples and install datalogging equipment. He or she will later participate in the February workshop. Between these meetings the student will be responsible for undertaking ongoing monitoring and analysis of FAB development at selected sites. For Lake Taupo we will specifically be addressing the hypothesis that FABs are supported in an otherwise nutrient-poor environment by nutrient-rich groundwater inflows that allow populations to escape control by local grazing communities. To address this hypothesis we will be correlating FAB occurrence with groundwater inflows, and monitoring the development of FAB plant and invertebrate communities over the summer period. Techniques will likely include the use of robotic cameras (including underwater drones) and surface based observations that may involve snorkel surveys. Water and FAB sampling will be from boats using quantitative grabs. Sample analyses will include quantitative characterization of plant and invertebrate communities associated with the FABs monitoring sites.
### ACADEMIC PROJECT SUBMISSION DETAILS:

<table>
<thead>
<tr>
<th>Supervisor/s:</th>
<th>Jo Lane</th>
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<tbody>
<tr>
<td>Project Title:</td>
<td>Identifying Critical Parameters for Supercritical Fluid Extraction of $\Delta$9-tetrahydrocannabinol from Cannabis Sativa L - Density vs. Temperature and Pressure.</td>
</tr>
<tr>
<td>Field:</td>
<td>Chemistry</td>
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<tr>
<td>Division/School:</td>
<td>HECS - Division of Health, Science, Computing &amp; Engineering</td>
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</tbody>
</table>

### EXPECTED OUTCOMES:

1. Identify how extraction efficiency and yield of THC changes as temperature and pressures are adjusted whilst maintaining the same density of supercritical CO2
2. Identify how extraction efficiency and yield of THC changes at various densities of CO2
3. Identify how the purity of THC in the extract changes as temperature and pressures are adjusted whilst maintaining the same density of supercritical CO2
4. Identify how the purity of THC in the extract changes at various densities of CO2
5. Identify if temperature or pressure has a greater contribution to the extraction efficiency of THC

### STUDENT TASKS:

1. Complete a police background check to verify suitability for working with controlled drugs
2. Run supercritical fluid extractions
3. HPLC analysis of samples
4. Produce reports outlining results of experiments
5. Accurately follow protocols outlined by Cannasouth
6. Maintain accurate records of controlled drugs

### REQUIRED SKILLS:

1. Analytical chemistry
2. Able to maintain tidy workspace
3. Precise report writing
4. Attention to detail
5. Able to keep accurate records
6. Able to learn new skills
7. Safety conscious
PROJECT ABSTRACT:

Identifying critical parameters for supercritical fluid extraction of ∆9-tetrahydrocannabinol (THC) from Cannabis Sativa plays a key role in method development and validation of extraction processes. Supercritical fluid extraction relies on the density of the extracting supercritical fluid (CO2). This density can be fine-tuned by adjusting the temperature and pressure of the supercritical fluid, however, many combinations of temperature and pressure result in the same density of CO2, (40 °C at 2130 PSI and 50 °C at 2800 PSI both give a density of 0.776 g cm\(^{-3}\)). This research project aims to better understand how the extraction profile of THC varies under different extraction parameters that result in the same density of CO2.

This research project will assist Cannasouth in the method development and validation of extractions for commercial-scale cannabis extractions. The student will be immersed in the medical cannabis industry for the duration of the project and be directly involved in the extraction of medicinal cannabis. Training will be provided on supercritical fluid extraction; however, familiarity with HPLC analysis is required.

This research project will require the student to accurately collect fractions of supercritical extract throughout the day while analyzing previous results on HPLC. This will require a student who is able to multi-task and maintain focus on multiple activities at the same time. The ability to learn quickly is also important as the student will likely be learning a new technique for the project (supercritical fluid extraction).

Finally, cannabis is a controlled drug and will be handled daily by the successful student. As such, the student must be responsible and willing partake in a police background prior to commencing the project. Additionally, the student must be competent in maintaining accurate records to ensure controlled drug activities can be monitored by Cannasouth employees.
ACADEMIC PROJECT SUBMISSION DETAILS:

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<tr>
<th>Supervisor/s:</th>
<th>Rebecca Lawton and Marie Magnusson</th>
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<tbody>
<tr>
<td>Project Title:</td>
<td>Nutrient dynamics in the freshwater macroalgae Oedogonium: implications for bioremediation</td>
</tr>
<tr>
<td>Field:</td>
<td>Aquaculture, Environmental Science, Ecology</td>
</tr>
<tr>
<td>Division/School:</td>
<td>HECS - Division of Health, Science, Computing &amp; Engineering</td>
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EXPECTED OUTCOMES:

1. Quantified growth rates in range of nutrient ratios
2. This project will provide insights into how operating parameters in bioremediation applications can be optimised to target nitrogen or phosphorus removal
3. Short project report
4. Final research poster

STUDENT TASKS:

1. Maintain algal cultures
2. Design experiments to identify optimal ratio of N:P
3. Quantify growth of Oedogonium calcareum in nutrient ratio experiments
4. Statistical analysis of experimental data
5. Write a short report summarising findings of this work
6. Create a final research poster

REQUIRED SKILLS:

1. This project would suit either a student with an applied interest in aquaculture, or someone with a more ecological or environmental science focus.
2. Experimental design
3. Written and verbal communication skills
4. Self-motivated and pro-active, ability to work independently.

PROJECT ABSTRACT:

Freshwater macroalgae can be directly grown in nutrient rich wastewater effluents as a biological treatment method to reduce nutrient concentrations in the effluent prior to discharge, a process known as algal bioremediation. As nutrient bioremediation by freshwater macroalgae is directly correlated to biomass productivity, understanding the effects of nutrient concentrations and flux on macroalgal growth is therefore important for bioremediation applications. A further consideration for bioremediation applications is the relative concentrations of nitrogen and phosphorus in the wastewater effluent.
When all other factors are equal, the nutrient with the lowest concentration relative to requirements will limit macroalgal growth and therefore bioremediation capability. This means that bioremediation of one nutrient may in fact be limited by the availability of the other. The concentration and relative abundance of dissolved inorganic nitrogen and phosphorus in wastewater effluents can vary significantly, even between effluents of the same type. Moreover, water quality targets for bioremediation can also vary. For example, reducing phosphorus loads may be the primary goal for bioremediation treatment of some wastewater effluents, while high nitrogen concentrations may be an issue for others. Therefore, in order to effectively implement algal bioremediation of wastewater effluents, the optimal ratio of N : P for maximal growth needs to be determined.

The aim of this project is to identify the optimal ratio of nitrogen to phosphorus that maximises growth in the freshwater macroalga Oedogonium calcareum. We will conduct a series of laboratory experiments under controlled temperature and light conditions to investigate this question.

The project will be based in Tauranga at the University of Waikato Coastal Marine Field Station. The student will be based within a larger team of researchers and technicians on an industry focused project that is working to develop novel science to grow a new high value macroalgal biotechnology industry in the Bay of Plenty.
### ACADEMIC PROJECT SUBMISSION DETAILS:

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<tr>
<th>Supervisors:</th>
<th>Chris Lusk, Ian Dickie (University of Canterbury)</th>
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<tbody>
<tr>
<td>Project Title:</td>
<td>Does mycorrhizal switching explain why mānuka and kānuka are so widespread?</td>
</tr>
<tr>
<td>Field:</td>
<td>Ecology</td>
</tr>
<tr>
<td>Division/School:</td>
<td>HECS - Division of Health, Science, Computing &amp; Engineering</td>
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### EXPECTED OUTCOMES:

1. Student will develop photomicrography skills.
2. Student will develop mycorrhizal ID skills.
3. Student will develop writing skills.
4. A manuscript for an international journal.
5. A poster report.
6. Results will also inform sampling decisions in an external research proposal currently under consideration.

### STUDENT TASKS:

1. Receive training in sample preparation and photomicrography at University of Canterbury.
2. Visit forest sites around the North Island to obtain root samples.
3. Prepare root samples for photomicrography.
4. Quantify ecto- and arbuscular mycorrhizal infection of root samples.
5. Analyse data.
7. Contribute to writing a scientific paper.

### REQUIRED SKILLS:

1. Genuine interest in ecology.
2. Able to hike up and down hills (1-day hikes only).
3. Plant ID skills.
4. Basic microscopy skills.
5. Patience.
6. Good written and oral communication skills.
7. Conscientiousness.
Leptospermum scoparium and Kunzea robusta (mānuka and kānuka) are the most widespread pioneer trees in New Zealand, mānuka in particular ranging from coastal to alpine environments throughout the country. Both are widely used in restoration projects and essential oil production, and mānuka has assumed great economic importance as a honey producer. mānuka and kānuka are unusual in being the only native trees known to commonly form both ecto- and arbuscular mycorrhizas. The absolute and relative levels of ecto- and arbuscular mycorrhizal infection in mānuka and kānuka have been reported to vary with climate and forest type. However, sampling has so far been limited, and it is not clear what environmental factors ultimately shape plants’ allocation of photosynthate between ecto- and arbuscular mycorrhizal fungi.

Recent research suggests these two types of mycorrhizal associations bring somewhat different nutritional benefits to plants. Ectomycorrhizal fungi are able to access organic nitrogen sources that are unavailable to plants with arbuscular mycorrhizas, the main advantage of which appears to be enhanced access to mineral phosphorus. We hypothesize that the great ecological amplitude of mānuka and kānuka in New Zealand reflects switching between ecto- and arbuscular mycorrhizal associations in response to the relative availabilities of nitrogen and phosphorus. We predict that plants will be infected mostly with ectomycorrhizal fungi in environments where nitrogen is the nutrient most limiting to plant growth, and with arbuscular mycorrhizal fungi in environments where phosphorus is more limiting.

We will test this hypothesis by quantifying mycorrhizal infection of mānuka and kānuka growing on a range of sites known to differ in soil carbon:nitrogen:phosphorus stoichiometry. These include soils developed from a range of different parent materials: rhyolite, andesite, basalt, greywacke. Structural equation modelling will be used to determine which soil and climatic variables have most influence over the balance between ecto- and arbuscular mycorrhizal infection.

We envisage submission of a scientific paper for a peer-reviewed international journal, as dual mycorrhizal plants such as mānuka and kānuka present ideal opportunities for understanding the costs and benefits of different mycorrhizal symbioses without confounding host effects. Our findings will also inform sampling decisions in a Marsden proposal currently under consideration, and may have applications in forest restoration. As mycorrhizal infection is known to influence the growth and chemistry of mānuka, our findings may also have implications for the honey and essential oil industries.
### Academic Project Submission Details:

<table>
<thead>
<tr>
<th>Supervisor/s:</th>
<th>Marcus Wilson</th>
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<tbody>
<tr>
<td>Project Title:</td>
<td>Using Machine Learning to uncover changes in the brain following transcranial magnetic stimulation</td>
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<tr>
<td>Field:</td>
<td>Computer Science, Statistics, Physics, Electronics, Neuroscience, Cellular and Molecular Biology</td>
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<tr>
<td>Division/School:</td>
<td>HECS - Division of Health, Science, Computing &amp; Engineering, School of Science</td>
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### Expected Outcomes:

1. Identifying the effect of small TMS coils on evoked potentials
2. A journal paper (co-authored with supervisor and other team members, e.g. in Physics in Medicine and Biology) on the research.
3. A conference presentation (given most likely by the supervisor) at the Australasian Winter Conference on Brain Research, Queenstown, 28 August - 3 September 2021.
4. A final research poster

### Student Tasks:

1. Become familiar with basic electrophysiology, if not already
2. Become familiar with a Machine Learning package such as Kaggle, if not already
3. Collate existing data into an easy-to-navigate dataset
4. Apply Machine Learning to the dataset
5. Analyse output from the Machine Learning Tool; identify key features of the evoked potential and how they change with TMS.
6. Test the tool with unseen data
7. Document the research in a formal report and well-documented software project
8. Prepare and present a poster
9. Communicate on progress with supervisor and other research colleagues at least weekly

### Required Skills:

1. Competent with handling of numerical data (e.g. MATHS101 or 102)
2. Experience using numerical software packages (e.g. Matlab or similar)
3. Some experience with computer programming (e.g. a first-year computer science paper)
4. Ability to interact with other people in spoken and written forms
5. Ability and willingness to learn new skills quickly
6. Familiarity with electrophysiology and/or neuroscience would be advantageous, but not necessary
PROJECT ABSTRACT:

In this project, a student will work in an office-based environment, and use Machine Learning tools to analyse existing electrophysiological data (voltages recorded from brain tissue). In Transcranial Magnetic Stimulation (TMS), short pulses of magnetic field are delivered to the brain in order to stimulate groups of neurons (brain cells). TMS is used to develop understanding of brain function, and also to cause lasting changings in the brain and thus treat various conditions such as major depression, Parkinson’s disease, stroke, etc. The Cortical Modelling Group at the University of Waikato have been developing small TMS coils suitable for applying TMS to rodents, and we have collected data on the electrical excitability of small areas of mouse brain tissue before and after TMS. Specifically, we have measured evoked potentials; we apply a small pulse of electric current to a sample of brain tissue and measure the voltage response (evoked potential) elsewhere on the tissue with an electrode.

We ask the question “What change does TMS make to the evoked potentials?” This is not a straightforward question to resolve, since the evoked potentials typically have many peaks and troughs with time over the course of about 100 milliseconds, and the biophysical meaning of each peak and trough is not clear. In this project, we will use machine learning to address this question. Specifically, a student will use existing evoked potential data and use a machine learning tool such as Kaggle to identify meaningful features on the evoked potentials and quantify how these change with TMS stimulation and with time. The goal is to identify whether our small TMS coils are sufficiently strong to cause lasting changes in the brain, and, if so, what changes. This is a computational project, based in an office environment, and requires a student who is familiar with processing data with computational tools (e.g. Matlab, Kaggle and statistics packages, or similar). Some understanding of neuroscience would be helpful, but it is not necessary. The ability to work with other researchers is essential.
### ACADEMIC PROJECT SUBMISSION DETAILS:

<table>
<thead>
<tr>
<th><strong>Supervisor/s:</strong></th>
<th>Tim Coltman and Marie Magnusson</th>
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<tr>
<td><strong>Project Title:</strong></td>
<td>Blue Tech Aquaculture: Extending the Business Case for Investment in Brown Seaweed Cultivation</td>
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<tr>
<td><strong>Field:</strong></td>
<td>Science and Business Model Innovation</td>
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<tr>
<td><strong>Division/School:</strong></td>
<td>Division of Management/School of Science</td>
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### EXPECTED OUTCOMES:

1. Draft business case for brown seaweed cultivation
2. Complete analysis using Business Model Canvas framework to support thoughtful recommendations
3. Pitch for capital funding ppt presentation

### STUDENT TASKS:

1. Familiarise yourself with the 'Business Model Canvas' framework
2. Conduct research to identify how brown seaweed can create for customers (current products, market size and value)
3. Contact and interview customers, partners, competitors to identify opportunities and bottlenecks
4. Investigate supply chain logistics, harvest, drying, freight
5. Develop preliminary cost structure model for a minimum size farm and RoI
6. Document any regulatory/environmental issues and conduct a stakeholder needs analysis

### REQUIRED SKILLS:

1. Passion for innovation and entrepreneurship
2. Written and verbal communication skills
3. Ability to work with internal and external stakeholders
4. Self-motivated and pro-active

### PROJECT ABSTRACT:

Brown seaweed Ecklonia radiata is native to New Zealand. This seaweed has a range of potential uses and applications, including alginate production (e.g., material & food thickener), as an abalone feed, and as an agricultural biostimulant (e.g. AgriSea type products). The primary aim of this project is to build upon a highly successful 2019/2020 summer scholarship project that developed a business case for large-scale cultivation of Ecklonia radiata biomass. The logical extension upon this work is to develop a pitch proposal that is closely tailored to capital investment community expectations.
PROJECT ABSTRACT:

This will require a wider category perspective to shed further light on the:

- integrated customer solution
- size of the opportunity in domestic and international markets
- how integrated solution will be delivered to customers
- implementation plan for Ecklonia strategy
- key uncertainties

The project will require any successful applicant to engage with researchers in the Coastal Marine Field Station; talk to potential customers, partners, and industry competitors. During this summer project you will encounter first hand, the chaos and uncertainty of working on a real innovation project. The student will also have the opportunity to participate in Priority One’s Summer Open Lab (SOL) programme, which provides weekly workshops on the theme of innovation for students undertaking summer projects across the Western Bay of Plenty. This is designed to fit realistically within their workload, and will offer opportunity to network with local companies and other students, and build skills and capability relevant to their career development.