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STUDENT PROJECTS

Supervisor: Dr. Roland Treu
Research expertise: Mycology

Main research program: Bioremediation with fungi
My overall research program aims at the removal of contaminants from soil and water through bioremediation with fungal cultures. As part of this larger research program several undergraduate research projects are available.

Development of floating fungal systems for bioremediation (2 students)
These projects deal with bioremediation of water based pollution. Students will develop various approaches to build fungal floating systems (FFS) and test their performance both in artificial and natural environments. FFS will consist of a container device that includes a substrate inoculated with fungal cultures. The outcome of this project will be one or more efficient FFS that will become the base for future research projects and for practical applications in pollution control.

Compatibility and competition reactions in multi-fungus systems (1 student)
This project deals with bioremediation of soil based pollution. In an attempt to create suitable multi-species systems of several potent fungi for soil bioremediation a student will test compatibility and competition for various combinations of fungi in vitro. The aim of this project is to find combinations (multi-species systems) of highly efficient white rot fungi with the least amount of competition between species.

Past and ongoing projects

The study of wild orchid species in the Exshaw area and their mycorrhizal association
In this two-part, ongoing project the ecology and distribution of orchids are investigated and their mycorrhizal associations are studied.

Cryopreservation of fungi
This project looked at the feasibility of long term preservation for basidiomycetes fungi. Cultures of basidiomycetes were successfully stored and revived at -80^0 C.

Supervisor: Dr. Shauna Reckseidler-Zenteno

Research expertise: Microbiology

Identification of genes responsible for persistence of *Pseudomonas aeruginosa* in water

The objective of this project will be to investigate the ability of the bacterial pathogen *Pseudomonas aeruginosa* to survive at length in water. *P. aeruginosa* can survive for years in water without available nutrients due to its ability to switch to a dormant or persister phenotype. This goal of this project will be to test mutant strains of *P. aeruginosa* for their ability to survive in water to identify genes responsible for this phenotype and to elucidate the mechanism of persistence by this organism.

Past projects

Gene expression of *Pseudomonas aeruginosa* in water

This objective of this project was to screen a mutant library of *P. aeruginosa* strains to identify genes that were expressed in water and responsible for long-term survival in water.

***Pseudomonas aeruginosa*, biofilm-specific gene expression patterns**

This project involved the analysis by computer and cluster analysis software of the expression of *P. aeruginosa* genes in a number of conditions to determine those genes that may contribute to biofilm formation in this organism.

Footwear as an infection vector in healthcare settings

Soil is a reservoir for bacteria and therefore workers' boots may be a viable vector for bacterial transmission to the work surfaces of the clinic. This theory was tested by quantifying the bacterial colony growth on agar plates placed on the work surfaces and by correlating bacteria found in the soil with bacteria found on the work surfaces in a medical clinic in northern Alberta.

Comparison of biofilm development and water survival between *Pseudomonas aeruginosa* strains

This project was focused on investigating the differences in biofilm development and survival in water between wild type *Pseudomonas aeruginosa* and three mutant strains designated 19D3, 23F9, and 21A9.

H1N1 and the 2009 Pandemic

A report on the virology of the H1N1 virus and the ensuing outbreak in Alberta was presented. A literature review of the data pertaining to the epidemic was prepared including background information on the H1N1 virus, data from the epidemic, the response of the community to the epidemic, and conclusions.

Analysis of gene expression of *Pseudomonas aeruginosa* mutant strains in water

Gene expression data from *P. aeruginosa* incubated in water over time was analyzed by computer for those genes that were suppressed or induced in a low nutrient environment. Genes involved in biofilm formation were identified in the literature and the expression patterns of the genes were determined.

***Pseudomonas aeruginosa* displays a dormancy phenotype in water**

This project involved the use of flow cytometry to study the cell response of *P. aeruginosa* in the

presence of water. Dyes were utilized to determine the following: cell viability, DNA content, membrane integrity, metabolic activity, and membrane potential.

Investigating mutants of *P. aeruginosa* for the ability to become dormant and survive in water
This project involved using flow cytometry and fluorophores to study the cell response of membrane mutants with high expression in water compared to wild type. One membrane mutant was identified that demonstrated a reduction in survival and it was determined that this mutant in lipopolysaccharide may contribute to the ability of the organism to exist in a dormant state.

Supervisor: Dr. John Ulici-Petrut
Research expertise: Animal and Human Anatomy and Physiology

Students may select from a range of topics on animal and human biology. Students may choose to write a review on a particular subject with no restrictions. If the student is in a setting where actual research can be carried out, he or she is welcome to propose how this research can form the basis of a project. The topics proposed by the students should include original work and experimental content, especially required for BIOL 496.

Past projects

The Effects of Developmental Stress on Cognition Measured using a Maze Learning Task in a Cichlid Fish

A Comparison Analysis Study of the Dermis Layer Thickness from Various Areas of the Face

Adaptation of the Hematoxylin and Eosin Frozen Tissue Stain from Manual to an Automated

Staining Method used in Mohs Micrographic Surgery

Model of a Nanoplatform Specifically Designed to Target Primary Cancer Cells

The differences between psychological and biological addiction: A classification

Comparing Diabetes in Asian and Aboriginals

Effects of water chlorination and its byproducts on human health

Supervisor: Shawn Lewenza
Research expertise: Biosensors for use in detection and bioremediation of contaminants in oilsands tailings.

Bitumen production from the Alberta oilsands is the largest industrial project in the world. The process of extracting oil/bitumen from the surface sands using hot water also generates wastewater that accumulates many complex, organic pollutants. Due to the toxicity of the oilsands tailings, the wastewater is heavily reused and stored in large volume tailings ponds. This water must ultimately be treated before eventual release back to the Athabasca River. Bioremediation remains one of the most cost---effective and scalable approaches to treat large volumes of contaminated water.

My lab is developing bacterial biosensors for detecting numerous pollutants that accumulate in the oilsands wastewater. We are constructing engineered bacteria that produce light in response to contaminated water. This approach can be used for any environmental pollutant, and we're extending our approach to design biosensors for pharmaceuticals that end up in municipal water and are not sufficiently treated during water treatment.

I am seeking motivated undergraduates to help us develop the biosensor technology for wastewater pollutants. We use molecular and synthetic biology approaches to engineer the genetic circuits that permit the detection of a pollutant, and to produce a measureable output of light production. Projects may also use bacterial genomics, bioinformatics, and help understand how bacteria respond to ollutants, and ultimately to discover the bioremediation pathways that bacteria use to detoxify pollutants by using them as nutrient sources.

Lab---based projects will take place in my lab at the University of Calgary. Bioinformatic projects may also be available, that are not restricted to the lab, and can be carried out using a home computer.

Please contact me if you are interested to learn more.