UC - MEXICO
RESEARCH SYMPOSIUM

C1 LECTURE THEATRE

SATURDAY 18TH JULY

2020

UC PHYSICAL AND CHEMICAL SCIENCES

University of Canterbury *Physics, Astronomy, Chemistry, Biochemistry, Medicinal Chemistry, Environmental Science.*

MORNING SESSION

REFRESHMENTS FROM 9:30AM IN C BLOCK FOYER

9:45 AM - RUDI MARQUEZ - WELCOME

Alfredo Pérez Bravo- Ambassador for Mexico -Introduction

HECTOR MANCILLA DIAZ

BIOLOGICAL CHEMISTRY APPROACHES FOR TREATING DIABETES COMPLICATIONS

SAMUEL AGUILAR ARGUELLO

DEPTH PERCEPTION IN JUMPING SPIDERS

LAURA REVELL

TBC

ANTONIO HERRERA MARTIN

THE ROAD TO A PLANET: MICROLENSING USE IN PLANET DETECTION.

SIMON BROWN

BUILDING A COMPUTER THAT THINKS LIKE THE BRAIN USING PERCOLATING NANOPARTICLE NETWORKS.

AFTERNOON SESSION

AFTERNOON SESSION BEGINS 1:30PM C1

RICARDO LOPEZ GONZALEZ

FROM THE SOIL TO THE BENCH

SAUL VAZQUEZ COLUNGA

DESIGN OF CONNECTIONS FOR BRACED STEEL FRAMES

MIGUEL ANGEL MOYERS GONZALEZ

A MATHEMATICIAN, A FLUID MECHANICIST AND A RHEOLOGIST WALK INTO A BAR

JULIA TORRES VENTURA

INTERACTIONS OF RECONCILIATION, NEGOTIATION, AND CONTESTATION IN THE LEGAL PERSON MODELS. IDENTIFYING OPPORTUNITIES FOR THE RIGHTS OF INDIGENOUS PEOPLES IN THE UREWERA FOREST, NEW ZEALAND AND THE ATRATO RIVER, COLOMBIA.

ARTEMIO MENDOZA

INTERKINGDOM COMMUNICATION MEDIATED BY FUNGAL VOLATILE ORGANIC COMPOUNDS

HECTOR MANCILLA DIAZ

Biological Chemistry Approaches for Treating Diabetes Complications.
The incidence of diabetes has been steadily increasing all over the world. Diabetic foot ulcer is a major complication of diabetes and occurs in 10-25% of all diabetic patients. World-wide, over 60% of lower limb amputation are on diabetic patients. There are a number of advanced therapies that promote wound healing; however, they are expensive, long lasting and/or ineffective. Thus, the development of more effective techniques is crucial for the control and medical management of diabetic foot ulcer.
Migration Stimulation Factor (MSF) is a protein that takes a major role in angiogenesis. Its activity has been attributed to a tripeptide motif of Isoleucine-Glycine-Aspartic acid (IGD), which is a highly conserved feature within the protein. Thus, using the structural information available for MSF we designed a new generation of small weight compounds able to kick-start the tissue regeneration process.

Bio: Hector Mancilla is a doctoral student at the University of Canterbury (UC) who is passionate about his research and teaching. He graduated top 3 of his class at Universidad La Salle majoring in Biopharmaceutical Chemistry, and was awarded a full scholarship from CONACyT to complete a PhD program at UC. Hector has completed two summer research programs at XJTLU in China on the synthesis of (BODIPY)-based fluorescent probes for biological studies. Currently he is researching the design and synthesis a new generation of small weight compounds able to kick-start the tissue regeneration process as a novel technique for the management of diabetic foot ulcer.

SAMUEL AGUILAR ARGUELLO

Depth perception in jumping spiders.
The usefulness of vision is such that many animal taxa have independently evolved eyes. Research using optical illusions in non-human animals with different types of eyes has demonstrated that these can share characteristics to our own visual processes. In experiments with and without optical illusions, we evaluated depth perception in the jumping spider (Salticidae) Trite planiceps by the use of 'texture density' (depth estimation through surface texture comparisons, with greater distances having higher textural density). Salticids use exceptional vision to actively stalk and leap on prey, and to find mates. They have four pairs of eyes, two of which (anterior lateral (AL) and anterior medial (AM)) are forward-facing, but - in principal - stereopsis could only be mediated by the former. In Experiment 1, T. planiceps showed no preference to jump over an illusion resembling a trench over a no-illusion control pattern.

In visual cliff experiments, spiders tended to choose the area with a false 'low drop' over a false 'high drop' with the same texture densities, but showed no preference for either area when presented with substrates with different texture densities at a constant height. Finally, we selectively occluded either both AL and one AM eye (monocular treatment), both AL eyes (binocular treatment) or none (control), and induced spiders to jump over a 50 mm gap with two different physical drops. Neither control spiders, nor spiders with only binocular cues

from the AM eyes, exhibited a height preference, whereas spiders with monocular vision preferred to jump over the low drop gap. Results suggest that T. planiceps, although not fooled by the trench illusion, does use texture density as a depth perception cue.

Bio: I am from San Cristóbal de Las Casas, Chiapas, Mexico. I graduated with honours from Bachelors at BUAP (Benemerita Universidad Autónoma de Puebla), Mexico. I have a Masters in Ecology, graduated from INECOL (Instituto de Ecología), Mexico. And I just graduated as Doctor of Philosophy in Biological Sciences from UC (University of Canterbury) last month (2017-2020).
I have been studying invertebrate behaviour for over 10 years since my bachelors thesis. Thanks to diverse collaborations I have published 10 papers in Peer reviewed journals, 2 of which are product of my PhD research. On the other hand, I have presented my research in five International conferences (Mexico, Alaska, Australia, and New Zealand) until now, and I have served as a reviewer for the journal 'Zoology'.
Although most of my work has been focused on jumping spiders my research interests dwell in invertebrate navigation, cognition, predator-prey interactions, and invertebrate perception.

ANTONIO HERRERA MARTIN

The road to a planet: Microlensing use in planet detection.
Walkthrough the process of the different steps used on the astronomical technique of microlensing for analysis and study of faint astronomical objects. From the process used after the observations taken by the telescopes, the data extraction, data analysis, and the modeling description used for appropriate identification and characterization of stars or planets.
In particular the case of the discovery of OGLE-2018-BLG-0677Lb.

Bio,Postdoctoral fellow in the astronomy group in the School of Physical and Chemical Sciences at the University of Canterbury. PhD. in Physics and Astronomy by the University of Glasgow. Studying related topics in cosmology including dark matter, gravitational lensing, astrostatistics with numerical computation, and Machine Learning.

SIMON BROWN

Building a computer that thinks like the brain using percolating nanoparticle networks.
Simon Brown1
1 The MacDiarmid Institute for Advanced Materials and Nanotechnology, School of Physical and Chemical Sciences, University of Canterbury, 8140, Christchurch, New Zealand
Recent progress in artificial intelligence and machine learning means that humans are now far inferior to computers at playing games like chess and go. However the brain is still much better than even the largest supercomputers at performing some types of tasks, such as pattern or image recognition.
This has motivated a worldwide effort to build brain-like, or "neuromorphic", computers using a number of different approaches. I will review some of those approaches, which include the use of traditional silicon transistors to emulate neurons and synapses, and new solid-state devices which have synaptic and neuronal functionality.

I will then talk about how my group has attacked one of the key remaining challenges, which is to achieve truly brain-like networks using self-assembled nano-components. I will show that we have not only been able to build highly complex networks but that the dynamical signals within those networks are remarkably similar to those of the brain.

Bio Prof. Simon Brown is a physicist at the University of Canterbury and a Principal Investigator in the MacDiarmid Institute for Advanced Materials and Nanotechnology. His current work focuses on nano-electronic devices with brain-like properties, and on topological nanostructures. Simon holds a number of patents and was founder of NZ's first nanotechnology company.

RICARDO LOPEZ-GONZALEZ

From the soil to the bench.
In 2001, a group of researchers were impressed with promising results: a soil sample taken in a small village in Handa (Japan) showed antibacterial activity. They discovered the active component within and called it CJ-15,801. Interestingly, this new molecule presented similarities to vitamin B5. After isolation, the design and synthesis of this new molecule was achieved in our lab. It was found to be active against the neglected disease malaria. Now, we are studying the application of CJ-related compounds in treatments against other forgotten diseases, such as tuberculosis.

Bio-Ricardo Lopez-Gonzalez is a postdoctoral fellow at University of Canterbury. His work focuses in design, synthesis and evaluation of new molecules with pharmacological activity.

SAUL YAHDIEL VAZQUEZ COLUNGA

Design of connections for braced steel frames.
Recommendations are developed for the analysis and design of the connections needed in braced steel frames. The objective is to ensure an adequate performance of structure under earthquakes.

Bio: Saul is from a small town 20 minutes away from the city of San Luis Potosi, Mexico. He enjoys watching football and is a Club America supporter. He studied his Bachelor's in Civil Engineering at the Autonomous University of San Luis Potosi. In 2010, he moved to Mexico City and studied his Master's at the National Autonomous University of Mexico. He worked in Mexico City as a practicing engineer for 4 years participating in several structural projects. In 2016, he moved to Christchurch to study a PhD in Earthquake Engineering, which he hopes he can finish this year.

MIGUEL MOYERS GONZALEZ

A mathematician, a fluid mechanicist and a rheologist walk into a bar.
In this talk, I will walk through some of the projects I have been involved in and explain how an applied mathematician can contribute to the fields of Non-Newtonian Fluid Mechanics and Rheology.
Miguel's research field is the mathematical and computational modeling of problems in Continuum Mechanics. In broad terms, the problems Miguel focuses on involve the combination of physical understanding, i.e. of a particular application, coupled with both theoretical and computational techniques for partial differential equations and integral equations. Some examples are:
Viscoplastic fluids
i) Characterization of thixotropic materials that present a yield stress.
ii) Hydrodynamic stability of a thixotropic material with a yield stress.
iii) Mathematical modelling of viscoplastic fluid flows. For example, displacement flows of viscoplatic materials in an annular gaps.
iv) Numerical Simulations of Viscoplastic Fluid Flow. This work presented a numerical method which has linear convergece properties. Previous to this result, state of the art methods had only sublinear convergence.
Inferring rheological properties through surface velocity data
Identification of the rheology of materials using a strategy based on inverse problem theory and using experimental and field data. In this work it is assumed that the free surface velocity field of a material contains a unique signature of its rheology. The goal is to extract these rheological properties. The main applications are in geophysical flows, for example lava flows where this strategy has an enormous advantage over traditional methodologies as it could be applied to remotely sensed data on real lava flows to make real time assessments of changing rheology to help with risk management.
Rheological characterization of asphalt-concrete
Miguel is involved in the ongoing project "Investigation of Viscoelastic Behaviour and Permanent Deformation Modelling for New Zealand Hot Mix Asphalts". In collaboration with his colleagues in Civil Engineering.

Bio. Dr Miguel Moyers Gonzalez is an Associate Professor in the School of Mathematics and Statistics of University of Canterbury, NZ. Previously he was a Lecturer in the Department of Mathematical Sciences at Durham University, UK. He spent two years in the Laboratory of Applied Mathemathics in University of Montreal as a CRM Postdoctoral Fellow. He did his postgraduate studies in the Department of Mathematics and the Institute of Applied Mathematics in UBC, Canada. His Doctoral Thesis was awarded the 2005 Cecil Graham Doctoral Dissertation Award from the Canadian Applied and Industrial Mathematics Society (CAIMS). He graduated with a Bsc (Hons) in Applied Mathematics from the Instituto Tecnológico Autónomo de México (ITAM).

JULIA TORRES VENTURA

Interactions of reconciliation, negotiation, and contestation in the legal person models. Identifying opportunities for the rights of Indigenous Peoples in the Urewera Forest, New Zealand and the Atrato River, Colombia.
Granting rights and/or legal personality to rivers and ecosystems ('legal person model') is an emerging movement to protect places and an opportunity to include the rights of Indigenous Peoples. Legal person models are creating innovative constructive relationships between Indigenous peoples and governments incorporating the recognition of indigenous peoples' distinctive link with the land and their worldviews. However, legal person models are using old institutions, mechanisms and processes of law that have damaged indigenous peoples' rights. Not identifying whether the legal person models offer feasible opportunities for the rights of indigenous peoples to manage land and natural resources risks repeating historical wrongdoings in times of urgent and effective measures. My PhD research aims to identify opportunities for the rights of indigenous peoples to manage land and natural resources analysing the interactions of hybrid law of two legal persons models, the Urewera Forest in New Zealand, and the Atrato River in Colombia.

Bio Julia Torres holds a bachelor's degree in Law from the University of Chiapas, Mexico. In 2010 she obtained one of the five Fulbright scholarships for Mexicans to study a master's in law at the Washington College of Law of American University in the Unites States. Currently, she is studying for a PhD in the University of Canterbury in the Department of Earth and Environment. In her professional career, Julia has advocated for Mayan Indigenous groups in the border region of Mexico and Guatemala on issues of land, natural resources, and human rights. She has participated in different negotiations representing indigenous communities in Chiapas. In 2016, she led a landmark case that granted Mexican nationality to stateless Guatemalan refugees that have lived in Mexico since the refugee exodus of the 1980s.
Her academic research focuses on indigenous rights and environmental law with special interest on comparative law and Latin America. She has collaborated with research teams on themes of Wind energy, climate change, rights of nature and has visited indigenous peoples' environmental projects and resistance movements in Central America, Colombia, Ecuador, Peru, Bolivia, Chile, and Argentina.
Currently, Julia is a member of the Australasia Latin America Legal Research Network of the School of Law of the University of Canterbury and part of the Mexican Global Network chapter New Zealand. Julia Torres is also a member of the World Commission on Environmental Law of the International Union for the Conservation of Nature (IUCN) and part of the United Nations Harmony with Nature Network of Young Experts.

ARTEMIO MENDOZA-MENDOZA

Interkingdom communication mediated by fungal volatile organic compounds.
Trichoderma species are soil-borne filamentous fungi widely utilized for their many plant health benefits. Trichoderma spp. establish associations with plants, nematodes and other fungi, including plant pathogens. In these interactions, diverse molecules, such as microbial volatile organic compounds (mVOCs) have an essential role during this inter- and intra-kingdom communication. Diverse species of Trichoderma produce different blends of mVOCs and are also differences between isolates from the same species, most likely in the capacity to respond to the environment. Here, we present the role of reactive oxygen species in T. atroviride and how mVOCs affect plant and plant-pathogen interactions. By using gene deletion mutants in T. atroviride we demonstrated that Δnox1, ΔnoxR and Δnox2 strains showed quantitative differences in the emission of several volatile organic compounds (VOCs). The effects of a blend of these volatiles on the plant-growth promotion of Arabidopsis thaliana seedlings were determined in closed-chamber experiments. ΔnoxR and Δnox1 significantly lowered the increase in root and shoot biomass induced by T. atroviride VOCs, but not by Δnox2. In terms of fungistatic activity at a distance, Δnox2 had a significant reduction in this trait against R. solani and S. sclerotiorum, while ΔnoxR and Δnox1 highly increased fungistasis. GC-MS performed identification and quantification of individual VOCs in the blends emitted by the strains, and the patterns of variation observed for individual volatiles, such as 6-Pentyl-2H-pyran-2-one (6PP-1) and (E)-6-Pent-1-enylpyran-2-one (6PP-2) were consistent with their negative effects on plant-growth promotion and positive impact on fungistasis at a distance. Nox1 and NoxR appear to have a ubiquitous regulatory role in a variety of developmental and interactive processes in T. atroviride, either as positive or negative modulators. Nox2 may also have a role in regulating the production of VOCs with fungistatic activity.

Bio, Artemio Mendoza-Mendoza is a leading researcher in the field of plant beneficial microorganisms and how to use them for solving issues associated with climate change. He is currently Senior Research Officer at the Bio-Protection Research Centre, a Centre of Research excellence at New Zealand. Before he joined the BPRC, he worked at the Max-Planck Institute in Germany for a period of 5 years, working with Ustilago mayidis “Cuitlacoche” as is known in Mexico. Dr Mendoza-Mendoza has published extensively as author and co-author of over 40 papers in high ranked, peer-reviewed journals. He frequently speaks at international conferences and his research has been supported by the Tertiary Education Commission from New Zealand, and the Marsden Fund among others. He has supervised six Mexican PhD students at his lab at Lincoln University and many from other from different nationalities, including NZers.

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