

# Simon Fraser University Postdoctoral Research Day 2018

## *Interdisciplinary Research: A Source of Novelty and Discovery*

SFU, Burnaby, AQ 3153

March 28th, 2018

### Keynote Lecture

#### Tipping Points and Transformation in Coupled Human-Ocean Systems

By Dr. Anne K. Salomon, Associate Professor, School of Resource & Environment Management

Anne Salomon is an Associate Professor in the School of Resource and Environmental Management at SFU and runs the Marine Coastal Ecology and Conservation Lab. She is a principle investigator with the Hakai Network for Coastal People, Ecosystems and Management, an interdisciplinary partnership with Coastal First Nations and the Hakai Beach Institute aimed at devising solutions to pressing coastal conservation problems.

Ecological surprises challenge science and society. While emerging evidence points to the existence of abrupt shifts in ecosystems worldwide, predicting when and where they will occur is notoriously difficult because unraveling their mysteries requires understanding both ecological and social phenomena that occur across different scales of space and time. By drawing on examples from kelp forests, ancient clam gardens and forage fish, while gleaned insights from ecological, archaeological and traditional knowledge, I will share our recent discoveries on these tipping points, how humans coped with them in the past, and how these strategies can inspire and catalyze solutions to the world's environmental challenges of today.



## Spotlight Talks

### Model Estimations of Time-Varying Muscle Forces in Rats

By Dr. Chris Tijs, Biomedical Physiology and Kinesiology, Supervisor: Dr. James Wakeling

Hill-type muscle models are widely used to estimate skeletal muscle forces during human and animal movements. These models are computationally efficient and relatively simple, and estimate muscle forces based on its contractile properties and activation dynamics. These properties are often based on experimental data combined from studies of various muscles from various animal species, which may explain inaccuracies in the models' estimation of muscle forces. Here, we used experimentally obtained contractile properties and activation dynamics of the rat medial gastrocnemius muscle (MG) to predict cyclic time-varying muscle forces from in situ work loop experiments using a Hill-type muscle model. The imposed muscle-tendon unit length changes, stimulation phase and stimulation duration mimicked those found during uphill galloping. MG was given supramaximal or submaximal stimuli (~45% of muscle being activated), while MG force and electromyography (EMG) was measured. EMG was quantified using wavelet analysis, and then a series of differential equations transformed this to provide the muscle activation. During supramaximal MG stimulation, the model data showed remarkably high agreement with the experimental data ( $r^2=0.97$ ) with an RMSE of 4.0% (relative to MG isometric optimum force). For submaximal MG stimulation, model accuracy decreased, which was most apparent by an overestimation of muscle force during the initial period of muscle activation. Nonetheless,  $r^2$  remained high (0.84) with an RMSE of 4.9%. These initial results indicate rather good estimations of muscle forces for controlled in situ work loops when subject specific parameters are available, and can help improving the accuracy of skeletal muscle models.

# Context is Everything: Creating Data Tools for Better Infectious Disease Control

By Dr. Emma Griffiths, Molecular Biology and Biochemistry, Supervisor: Dr. Fiona Brinkman

Globalization increases opportunities for the spread of infectious disease beyond borders and jurisdictions. “Disease detectives” in public health agencies worldwide are implementing high resolution whole-genome sequencing for the identification of microbial pathogens to improve our ability to track and control infectious disease. To maximize the utility of genomic sequence data, it must be combined with epidemiological, clinical, laboratory and other health care data (called “contextual data”) to be meaningfully interpreted for regulatory and health interventions. However, sharing and integrating this data between jurisdictions is complicated as different types of data are collected in different ways and in different formats at different organizations. As such, before health agencies and researchers can make use of this information, it often needs to be re-entered in different systems, recoded and curated, which is time-consuming, labour intensive, and error-prone. A solution to these challenges is the use of special data tools called 'ontologies' - hierarchies of well-defined and standardized vocabularies interconnected by logical relationships. We work with Canadian and international public health, regulatory and research institutions, to develop fit-for-purpose ontologies and other tools to better support the accuracy, interoperability and utility of public health data. Our research efforts include the development of a Genomic Epidemiology Ontology (GenEpiO), the Antimicrobial Resistance Ontology (ARO), and the Food Ontology, as well as other tools to improve data standards and data collection practices. The improved computability provided by these technologies can enhance data linkages, resulting in faster hypothesis generation during investigations, and ultimately, better health outcomes.

# Combining Forces to Fight Fake News

By Dr. Fatemeh Torabi Asr, Department of Linguistics, Supervisor: Dr. Maite Taboada

A series of events around the world during the past few years have unveiled the scale of unfortunate results of misinformation on social media.[1].A recent study published in Science Journal showed that false news not only gets a wider audience, but also is propagated nearly 10 times faster than real news.[4] Given the scale of the problem, manual investigation and moderation of content on web would not be a possible solution. The “Fake News” project at the Discourse Processing Lab is an attempt to study misinformation in news articles. The goal is to provide a psycholinguistic analysis of this phenomenon and develop a robust and scalable system for automatic detection of fake news based on distinguished characteristics of deceptive texts. We have collected about 10K news articles from websites evaluated by fact-checking services, which are tagged as misleading or truthful. This talk will provide some interesting insights into the problem of fake news drawn from our comparative analysis of this dataset as well as findings of previous related work in linguistics, psychology and computer science.[2,3] I will explain the difficulty of recognizing misinformation by humans and machine learning algorithms. While our current system can distinguish between false and true news articles with 75% accuracy, there is ample room for exploring features of misinformation. The proposal of the ongoing project is that a machine learning system developed based on multi-perspective data could assist human readers to decide what to read and share on social media.

[1] Connolly, K., Chrisafis, A., McPherson, P., Kirchgaessner, S., Haas, B., Phillips, D., Safi, M. (2016). Fake news: an insidious trend that's fast becoming a global problem. *The Guardian*, 02 Dec 2017.

[2] Rashkin, H., Choi, E., Jang, J. Y., Volkova, S., & Choi, Y. (2017). Truth of varying shades: Analyzing language in fake news and political fact-checking. In *Proceedings of the 2017 conference on empirical methods in natural language processing*.

[3] Rubin, V. L., Conroy, N., & Chen, Y. (2015). Towards news verification: Deception detection methods for news discourse. In *Hawaii International Conference on System Sciences*.

[4] Vosoughi, S., Roy, D., & Aral, S. (2018). The spread of true and false news online. *Science* 09 Mar 2018:Vol. 359, Issue 6380, pp. 1146-1151

# Sexual Conflicts of Interest in Mammals

By Dr. Mika Mikkonen, Department of Biological Sciences, Supervisor: Dr. Bernard Crespi

Social interactions between the sexes during reproduction play a prominent role in defining Darwinian fitness, yet rarely do individual reproductive interests align. Such conflicts-of-interest can arise due to the action of sexually antagonistic genes. Recent studies have provided empirical support for the prevalence of these genes, which are beneficial to one sex while at the same time costly to the other. Using an integrative approach that combines genetics, physiology, ecology, and behaviour within an evolutionary framework, I have been conducting studies on small mammals and humans to understand how such sexually antagonistic genetic variation impacts females and males. My aims include the assessment of the prevalence of sexually antagonistic genes, how such genes impact health and disease, and how these genes affect the allocation of resources to sons and daughters during pregnancy and postnatal parental care. Thus far, this research has yielded some of the first causal evidence for the presence of sexually antagonistic genes in mammals, as well as a new technique for tracking genetic variants from parent to offspring. A major implication of this work is that the experimental insights gained from studying small mammals can be applied to understanding human health and disease.

# Mental Health Resilience: Early-Life Adversity and Later-Life Mental Distress

By Dr. Theodore D. Cosco, Gerontology, Supervisor: Dr. Andrew Wister

Background: Robust and persistent links between early-life adversities and later-life mental distress have previously been observed. Individual and social resources are associated with greater mental health and resilience. This study aimed to test these resources as moderators and mediators of the association between childhood psychosocial adversity and later-life mental distress. Methods: Participant data came from the Medical Research Council National Survey of Health and Development, a nationally-representative birth cohort study. The General Health Questionnaire-28(GHQ-28) captured mental distress at ages 53, 60-64, and 68-69. An eight-item cumulative psychosocial adversity score was created (0,1,2,≥3 adversities). Individual and social resources were examined as mediators and moderators of CPA and GHQ-28 in longitudinal multilevel models. Findings: Greater adversity was associated with an average GHQ-28 score increase of 0.017, per unit adversity ( $\beta=0.017$ ,  $p<0.001$ , 95% CI 0.011, 0.022). Lower mental distress was associated with higher levels of physical activity, education, social support, and neighbourhood cohesion. There was no evidence that resources moderated the relationship between GHQ-28 and adversity. All resources, save for physical activity and occupational status, partly mediated this relationship. Conclusions: Individual and social resources were associated with lower mental distress. They did not modify, but partly mediated the association between childhood adversity and adult mental distress. Social support was the most important mediator, suggesting that interventions to promote greater social support may offset psychosocial adversities experienced in childhood to foster better mental health in older adults.

# An Interdisciplinary Assessment of the Sustainability of North American Shark Fisheries

By Dr. David S. Shiffman, Department of Biological Sciences, Supervisor: Dr. Nicholas Dulvy

Sharks are one of the most threatened taxa on Earth, and there is an ongoing debate in the environmental community about how best to protect them. In recent years, new types of policies focusing on banning all exploitation and trade have gained popularity, due to a belief that sustainable fisheries for sharks cannot and do not exist. However, the scientific evidence is clear that sustainable shark fisheries can and do exist, and a survey of scientific experts believe that sustainable fisheries management should be the goal. This interdisciplinary research project tackles this scientist-environmentalist disconnect from several angles, including surveys of environmental activists, content and discourse analysis of media coverage, and a look at consumer sustainable seafood guides. Reasons for, consequences of, and solutions to this disconnect are proposed.

# Waste not Wanted: Testing the Waste Hypothesis with an Agent-Based Model

By Dr. William C. Carleton, Department of Archaeology, Supervisor: Dr. Mark Collard

Humans seem to be prodigious wasters. While the term “waste” typically connotes garbage, from an evolutionary perspective other products of human behaviour from paintings to pyramids appear to be wasteful as well. These sorts of elaborate cultural displays are energetically expensive with questionable reproductive benefits—they ought to be selected against. Yet, throughout history humans have invested troves in ostensibly wasteful displays. The archaeological record is full of examples including enormous monuments, temples, and burial complexes. People who engage in elaborate displays must pay a reproductive cost. They must take time away from resource gathering and reproduction while individuals who are not being wasteful have more offspring. As a result, non-wasteful behaviour should proliferate while wasteful traits dwindle. Therefore, it is paradoxical that we have so many examples of seemingly wasteful behaviour. To explain it, several scholars have pointed to the waste hypothesis, according to which waste—like monument building—produces a counter-intuitive evolutionary benefit in variable environments. The hypothesis states that waste lowers the variability in offspring survivorship in variable environments leading to higher mean rates of population increase over time. Thus, the hypothesis predicts environmental variability should favour waste. Here we report a test of this prediction using an agent-based simulation in which we manipulated environmental variability and monitored changes in the inherited propensity for waste in successive generations of the agent population. Our results indicate the prediction does not hold. Consequently, other explanations should be sought for ostensibly wasteful cultural displays.

# Investigating Thermally Induced Cation Mixing in a Layered Lithium-ion Battery Cathode Material and its Effect on Performance

By Dr. Jeffrey S. Ovens, Department of Chemistry, Supervisor: Dr. Byron D. Gates

Research on lithium ion batteries has quickly expanded in recent years due in large part to the prospect of their use in electric vehicles and household energy storage solutions. Efforts to improve lithium ion battery performance have typically focussed primarily on improving the cathode material, as it is the limiting factor in terms of capacity and overall battery lifetime. In particular,  $\text{LiNi}_{1/3}\text{Mn}_{1/3}\text{Co}_{1/3}\text{O}_2$  (NMC 111) has been a material of focus for commercial production. A significant challenge in synthesizing this material is the propensity for Ni/Li cation mixing in the octahedral sites. While several studies have been conducted correlating synthetic and processing methods to the observed levels of cation mixing and electrochemical performance of the final material, so far none of these studies have probed in-depth the cation mixing phenomenon in situ on a mechanistic level. Thus, presented herein is a detailed investigation into the processing conditions (thermal and compositional) for NMC 111 beginning with a pre-lithiated precursor material. Through in situ, variable temperature XRD methods, the relationship between cation mixing, sintering temperature and time, as well as potential methods for its reversal, were investigated. The importance of this knowledge in the determination of ideal processing conditions for NMC 111 (by extension cathode materials in general) is further demonstrated through a final analysis of the quality of  $\text{Li}^+$  distribution in these materials as assessed by microscopy and spectroscopy techniques, and electrochemical coin cell tests.

# Are the Public's Concerns About Diabetes Addressed in the Research Literature?

By Dr. Fereshteh Didegah, School of Publishing, Supervisor: Dr. Juan Pablo Alperin

Diabetes is a growing public health problem and is therefore the subject of much academic research. However, there are no well-established mechanisms to understand if the research reflects public concerns, or if the most recent findings are taken up by the public. This study therefore aims to uncover the areas of public interest and needs, as seen in online platforms, and their relationship to the published research. In particular, this study uses topic modeling to investigate to what extent the language used on a popular diabetes forum aligns with the language used in published research articles and on Wikipedia pages about diabetes. The results show that not all the highly discussed topics on the diabetes forum are of interest to researchers. While a high percentage of research outputs discuss diabetes testing methods, control and treatments, a large number of forum posts focused on topics of emotional support and motivation for patients and diabetes diet. Moreover, comparing topic prevalence over time shows that the language used to discuss diabetes treatments in the public forums is found one year later in the published research. However, no such relationship was observed between research articles and public discussions in few other topics. The alignment and misalignment found between research interests and public discussions may be informative for the scientific community and health policy makers to value some understudied areas that are of higher interest to public.

# Speciation and the Latitudinal Diversity Gradient: Insights from the Global Distribution of Endemic Fish

By Dr. Patrick Hanly, Department of Biological Sciences, Supervisor: Dr. John Reynolds

The remarkable increase in species richness from the poles to the tropics (the latitudinal diversity gradient, or LDG) is the Earth's predominant biodiversity pattern, recognized since the time of Wallace and Darwin. Although a consensus explanation for the LDG remains elusive, recent advances have narrowed the possibilities to geographical variation in: 1) productivity, 2) time and area available for diversification, and 3) differences in speciation and/or extinction rates. Through a new compilation of the global distribution of nearly 2,000 endemic freshwater fishes in the world's 2,746 largest lakes, I demonstrate an association between latitude and the probability of speciation (and species richness) that is independent of age, area, and energy, suggesting that there are unique features of low-latitude (tropical) environments that promote speciation. These results, along with an ongoing collection of fish diet data that show greater and more divergent niche utilization in tropical fish, suggest that low latitude fish may diversify more rapidly through increased ecological opportunities in tropical climates and the coevolution of strong species interactions.

# Have You Heard? Why Pundits Share Scholarly Material Online

By Dr. David R. H. Moscrop, School of Publishing, Supervisor: Dr. Juan Pablo Alperin

To make political decisions, citizens need access to information to shape their preferences. Newspapers, magazines, radio, and television have long been primary sources of such information, in part through their reliance on pundits. The emergence of the digital public sphere has pluralized information sources, but pundits remain an important feature of the expanded media landscape. The arrival of the digital public sphere has made high-quality expert knowledge in scholarly publications available to policymakers and the public at large. Access to this material may be facilitated by pundits through sharing, but does this sharing occur? In this study, we ask whether Canadian political pundits share scholarly research on Twitter and what motivates them to do so. In our five-year dataset of 25 pundits who tweeted a link to a peer-reviewed paper, we find that pundits share such material infrequently and that they do so for one of four primary motivations: learning/teaching, socializing, debating, or promoting. Our results reveal that of the motivations, learning/teaching is most common. We also find that types of posts on Twitter tend to go hand-in-hand with certain types of motivations. Ultimately, our findings help us understand how public information flows in the digital public sphere, and why.

# Photoaffinity Labelling Probes for the Cystic Fibrosis Transmembrane Conductance Regulator

By Dr. Zafar Qureshi, Department of Chemistry, Supervisor: Dr. Robert Young

Cystic Fibrosis (CF) is a fatal genetic disorder caused by mutations in the Cystic Fibrosis Transmembrane Conductance Regulator (CFTR) gene. These mutations lead to a decrease in the CFTR protein function causing a dysregulation of epithelial mucus viscosity. CF patients suffer chronic infections and eventual lung failure. Ivacaftor was the first FDA approved therapy that partially restores CFTR function at the cell surface but its binding site on CFTR is unknown. This talk will present the design, synthesis and photoreactivity of a photoaffinity labelling (PAL) probe based on the Ivacaftor scaffold. The probe is to be used to gain insight into the mechanism of action of Ivacaftor on CFTR. The PAL probes reactivity was first tested on serum albumin (known to bind ivacaftor) to determine optimal conditions for labelling. BSA was covalently labeled by the probe and using trypsin digestion and mass spectrometry, the binding site identified, and degree of labelling was quantified. A fluorescent version of the probe was also prepared and shown to covalently attach to BSA and labelled BSA could be identified on SDS-PAGE. A biotin substituted probe was prepared and its use to purify tagged protein is currently being evaluated. Using optimized conditions from the studies on BSA, the probes will now be used to covalently label native, functional CFTR and then, using similar enzymatic digestion and mass spectrometry, identify the precise binding site(s) of Ivacaftor.

# What's Bringing Birds to YVR? An Investigation of Feeding Behaviour

By Dr. Sean M McCann, Department of Biological Sciences, Supervisor: Dr. Jennifer Cory

One of the major hazards associated with aviation are collisions with wildlife, particularly birds. In order to maintain safe operating conditions for aircraft, airports must expend a lot of effort mitigating the risk to property and life represented by birds. By better understanding the reasons birds congregate at airports, we can begin to plan appropriate management regimes that may help reduce the cost and difficulty of wildlife management. I am investigating insect feeding by birds in the grasslands surrounding the Vancouver International Airport and will present some early results of diet and field survey studies. Although my study is in the early stages, I am amassing a wealth of natural history information about insect feeding by birds on the airport grounds, which is valuable from both an ecological as well as a management standpoint.

# An in-depth Exploration of Instructors' Experiences with Flipped Classroom Design, Implementation and Evaluation with and Without Teaching and Learning Development Grant Support

By Dr. Birgit Schwarz, Institute for the Study of Teaching and Learning in the Disciplines, Supervisor: Dr. Sheri Fabian

We are investigating the experiences of SFU faculty with the implementation of flipped classes. The flipped classroom is a teaching approach that focuses heavily on active learning in the classroom, while the initial encounter with new material takes place outside of the classroom. The approach has enjoyed increasing popularity but can be challenging to implement successfully. There is a wide range of ways in which the 'flip' can be done, hence instructors must choose how to approach this in the context of their classes. We are exploring why faculty chose to pursue this educative approach, how they designed and implemented the changes in their classroom, how they evaluated their effectiveness, what worked or did not work so well for them and what practical advice they would give to those considering this approach. In addition, we wanted to know what support was most useful or would have been helpful to them and in this context are exploring possible impacts of the Teaching and Learning Development Grants program. To answer these questions, we conducted detailed interviews with professors and lecturers from different departments and are conducting thematic analyses of their responses in NVivo. We hope that our results can serve as a useful resource for other instructors who are considering the flipped classroom approach. Furthermore, our results may inform SFU and other institutions regarding possible ways in which they could support faculty to facilitate the successful implementation of flipped classes and other innovative teaching strategies.

# Microstructural Aspects of Degradation Mechanisms of Graphite Anodes Used in Li-ion Batteries

By Dr. Sandeep Bhattacharya, Mechatronic Systems Engineering, Supervisor: Dr. Ahmet Alpas

This research identified the micromechanisms of exfoliation/delamination mechanisms at the negative electrode sub-surfaces and electrode/electrolyte interfaces that cause loss of electrochemical capacity of Li-ion batteries. An in-situ observation system was implemented during electrochemical tests using a large depth-of-field digital optical microscope and a micro-Raman spectrometer to determine severity of particle fragmentation, crack formation and phase transformation in the anodes. Graphite electrode damage was the most intense during the first cycle that led to a drastic capacity drop. Once a solid electrolyte interphase (SEI) layer covered the electrode surface, the rate of graphite damage decreased. Yet, a gradual loss of capacity continued by the formation of interlayer cracks as revealed by analytical cross-sectional FIB and high-resolution TEM. A low Li-ion diffusion coefficient produced a uniform SEI that prevented damage at 25°C. At 60°C, a high diffusion coefficient formed a lithium carbonate-enriched SEI and ensued a 28% increase in the capacity. Attention was also given to the determination of intercalation-induced local strains that control crack propagation in graphite under battery cycling conditions. Crack closure due to (1) a rough fracture surface morphology, and (2) the deposition of SEI on faceted crack surfaces, reduced crack propagation rates. Novel lithium carbonate surface treatment reduced the strain in the graphite lattice from 0.4% (for uncoated electrodes) to 0.1%, and hence improved the long-term durability of graphite. The microstructure-property relationships, obtained in this way, prompted the fabrication of high capacity and durable Sn-coated carbon fibre anodes for advanced Li-ion batteries.

## 3 Minute-Pitches

### Red, White, and Grey: Canada's Aging Population

By Dr. Theodore D. Cosco, Gerontology, Supervisor: Dr. Andrew Wister

There is a demographic shift afoot: the 2016 Canadian census revealed that there were 5.9 million seniors vs 5.8 million children. Since 2011 the number of older adults in Canada has increased by 20%, compared to a 5% increase in the overall growth of the population. Even more impressive: the number of Canadian aged over 100 increased by 40%. This shift in the population's age distribution has important and far reaching implications. From an economic perspective, the number of people entering employment is being outpaced by the number of people retiring. With fewer tax dollars, there will tough decisions to be made at a government-level. This issue is compounded by the increasing pressure being placed on healthcare systems. Of the strongest predictors of illness is age. Therefore, more resources will be needed to address the care needs of older adults. However, it's not all doom and gloom, older adults are remarkably resilient. There is a phenomenon known as the "wellbeing paradox" in which older adults experience high levels of wellbeing despite age-related declines in health. Further, older adults are increasingly able to stay in the workforce longer and to enjoy better physical and mental health. By being able to tap into individual, social, and environmental resources, available to them, such as positive attitude, social networks, and supportive environments, older adults are living longer and living better. The hope is that by tapping into these resources we can not only add years to life, but also life to years.

# Multimodal Skin Lesion Classification Using Deep Learning

By Dr. Philipp Tschandl, Computing Science, Supervisor: Dr. Greg Mori

Convolutional neural networks are currently exceeding other machine learning techniques in automatic image classification. Recent studies have shown those systems can perform on par with trained dermatologists in evaluating clinical images for skin cancer.[1] It is known though, that dermatologists perform more accurate when using dermatoscopy as opposed to the unaided eye.[2] This is a technique which renders the surface of the skin translucent and offers a richer detail of morphologic structures in superficial parts of the skin. In clinical practice dermatologists evaluate the clinical and dermatoscopic appearance of a lesion to come to a final conclusion. We have trained a neural network which is able to analyze one or two image modalities and combine them to a single prediction. If offered only one image, the network performed better using dermatoscopic- compared to clinical images. Accuracy was increased additionally when both modalities were combined. We propose such a network can aid health care systems as decision support or through triaging patients to dermatology visits.

1. Han et al. "Classification of the clinical images for benign and malignant cutaneous tumors using a deep learning algorithm," *Journal of Investigative Dermatology*, 2018
2. Sinz et al, "Accuracy of dermatoscopy for the diagnosis of nonpigmented cancers of the skin," *Journal of the American Academy of Dermatology*, vol. 77,no. 6, pp. 1100–1109, 2017

# Combining Forces to Fight Fake News

By Dr. Fatemeh Torabi Asr, Department of Linguistics, Supervisor: Dr. Maite Taboada

A series of events around the world during the past few years have unveiled the scale of unfortunate results of misinformation on social media.[1].A recent study published in Science Journal showed that false news not only gets a wider audience, but also is propagated nearly 10 times faster than real news.[4] Given the scale of the problem, manual investigation and moderation of content on web would not be a possible solution. The “Fake News” project at the Discourse Processing Lab is an attempt to study misinformation in news articles. The goal is to provide a psycholinguistic analysis of this phenomenon and develop a robust and scalable system for automatic detection of fake news based on distinguished characteristics of deceptive texts. We have collected about 10K news articles from websites evaluated by fact-checking services, which are tagged as misleading or truthful. This talk will provide some interesting insights into the problem of fake news drawn from our comparative analysis of this dataset as well as findings of previous related work in linguistics, psychology and computer science.[2,3] I will explain the difficulty of recognizing misinformation by humans and machine learning algorithms. While our current system can distinguish between false and true news articles with 75% accuracy, there is ample room for exploring features of misinformation. The proposal of the ongoing project is that a machine learning system developed based on multi-perspective data could assist human readers to decide what to read and share on social media.

[1] Connolly, K., Chrisafis, A., McPherson, P., Kirchgaessner, S., Haas, B., Phillips, D., Safi, M. (2016). Fake news: an insidious trend that's fast becoming a global problem. *The Guardian*, 02 Dec 2017.

[2] Rashkin, H., Choi, E., Jang, J. Y., Volkova, S., & Choi, Y. (2017). Truth of varying shades: Analyzing language in fake news and political fact-checking. In *Proceedings of the 2017 conference on empirical methods in natural language processing*.

[3] Rubin, V. L., Conroy, N., & Chen, Y. (2015). Towards news verification: Deception detection methods for news discourse. In *Hawaii International Conference on System Sciences*.

[4] Vosoughi, S., Roy, D., & Aral, S. (2018). The spread of true and false news online. *Science* 09 Mar 2018:Vol. 359, Issue 6380, pp. 1146-1151

## Walking on gecko's Feet

By Dr Irene Andreu Blanco, Department of Chemistry, Supervisor: Dr. Byron Gates

The small nano-sized structures on the feet of geckos have attracted a lot of interest due to their excellent adhesion properties, which allow geckos to climb walls. Researchers across the globe are trying to replicate gecko nanostructures with human-made materials for their use in glue-less adhesives.

## What is a Flipped Classroom and Why Should You Try It?

By Dr. Birgit Schwarz, Institute for the Study of Teaching and Learning in the Disciplines, Supervisor: Dr. Sheri Fabian

As most postdocs either are or will be teaching at the post-secondary level, this should be a topic of broad interest. The basic model of a traditional university lecture – with a lecturer presenting information and students as a more or less passive audience – has been around for centuries. It has been criticized for its paucity of active student participation and because it is ill suited to teaching critical thinking skills. Nowadays, we have so many more tools available to us so why not change it to something that more effectively promotes active learning and critical thinking? One innovative teaching method that has enjoyed increasing popularity in recent years is the flipped classroom. The basic idea behind this approach is simple: Take what was traditionally done in class (i.e. the first exposure to a topic) and move it outside of the classroom. Then replace it with the kind of activities that would normally have taken place outside class time – e.g. critical examination of the material, problem-solving or discussions with classmates. In practice it is not quite as simple, of course. It requires the instructor to take on a very different role and, for best results, needs careful planning e.g. around what pre-class materials to use (e.g. online videos), how to best guide students in using these and what activities to create for the in-class portion. The potential reward? Actively learning, engaged students and direct interactions with students that make teaching a fun experience.

## Posters and Exhibits

### Nanoparticles for Drug Delivery

By Dr Irene Andreu Blanco, Department of Chemistry, Supervisor: Dr. Byron Gates

The small size of nanoparticles allows them to interact directly with cells, viruses and proteins in your body. Nanoparticles made of different materials, such as polymers, gold or iron oxide, can be used to deliver drugs directly to the injured site, reducing side effects to nearby organs. The ability of administering drugs locally has potential to increase quality of life for patients with cancer or inflammatory diseases.

### Characterizing Muscle Function During Movement Using Computational Modeling

By Dr. Adrian Lai, Department of Biomedical Physiology and Kinesiology, Supervisor: Dr. James Wakeling

Muscles contract to generate force required for producing and controlling body movement. Because of this mechanism, they are often viewed as a tissue that works similar to a motor but recent research has found that they can function differently across movement tasks and species [1]. For example, a muscle can function like a spring, stretching and storing elastic strain energy, which can be reutilised later to help propel the body into the air such as during running and jumping. However, obtaining the necessary measurements to quantify muscle function experimentally in humans can be very difficult, time consuming and highly invasive. Computational simulations, built through interdisciplinary collaborations with engineers, are powerful alternatives to uncover muscle function and coordination patterns because not only can they give access to these difficult-to-measure quantities, they can also be used to simulate and distil the functional consequences of clinical interventions and rehabilitation plans. Our current research aims to use musculoskeletal modelling simulations, validated with experimental techniques, to quantify muscle function in the human lower limb during different movement tasks. We have developed a framework that uses an index-based approach to correlate a muscle's function with shifts in their location in the lower limb, in how they are designed and due to varying demands placed on the body. This knowledge has furthered our understanding of the age-old question of how a muscle's structure relates to its function.

1. Dickinson, M.H., Farley, C.T., Full, R.J., Koehl, M.A., Kram, R., Lehman, S., 2000. How animals move: An integrative view. *Science* (80-. ). 288, 100–106

# Molecular Modeling of Advanced Energy Materials

By Dr. Mohammad J. Eslamibidgoli, Department of Chemistry, Supervisor: Dr. Michael Eikerling

Our research explores the realms of theoretical chemical physics and electrochemistry. It combines a hierarchy of methods and approaches in theoretical and computational materials science to unravel the “multiscale” relations between the structure, properties and performance of materials for electrochemical energy conversion. Our goal is to understand, how complex multifunctional materials come to life during self-organization, how they live, e.g., by breathing in oxygen and breathing out water vapour, and how they age and die because of improper use or degradation. In close collaboration with experimental groups and industry we translate theoretical findings into better designed materials that are less expensive to make, more efficient during operation, and longer lasting. Ultimately, this research serves the development of highly efficient, clean, and sustainable energy technologies.