RESEARCH ABSTRACT BOOK	OPEN ACCESS

The 1st URNCST Journal Research Abstract Competition: Undergraduate Discoveries in Science and Technology

Molly H.R. Cowls, BSc Student [1], Jeremy Y. Ng, MSc, PhD Student [2]*

[1] Deputy Editor, URNCST Journal, Toronto, Ontario, Canada
[2] Editor-in-Chief, URNCST Journal, Toronto, Ontario, Canada

*Corresponding Author: editor@urncst.com

Abstract
The URNCST Journal Research Competition provides undergraduate students with the opportunity to experience the peer-review and publication process associated with research they have conducted under the supervision of a research mentor (i.e. a scientist or a professor) in an academic setting. The following research abstracts were submitted by undergraduate students to the 1st URNCST Journal Research Competition held during August 2018. To learn more about this abstract competition and submit your own, please visit: https://urncst.com/index.php/competition/about.

Keywords: undergraduate research; research abstract competition; URNCST Journal

Table of Contents

Conference Abstracts
Note: These abstracts were peer-reviewed for quality of research content following being submitted to the URNCST Journal Research Competition. Abstract discipline categories are defined by authors themselves.

Note: We regret that the final abstract authored by Vora et al. was omitted from the original version that was published on September 13, 2019. This has now been corrected and all other content remains unchanged. We regret any inconvenience caused.

URNCST Journal Research Competition

Research Abstracts in Biology

Quantitative analysis of Ra-226 biomagnification near fracking sites: A research protocol

Paras Kapoor, BSc Student [1], Bhairavei Gnanamanogaran, BSc Student [1], Saranya Naraentheraraja, BSc Student [1], Nayha Eijaz, BSc Student [2], Silvija Stefanovic, PhD [2]
[1] Department of Psychology, University of Toronto Scarborough, Toronto, Ontario, Canada M1E4Y3
[2] Department of Physical & Environmental Sciences, University of Toronto Scarborough, Toronto, Ontario, Canada M1E4Y3

Introduction: Hydraulic fracturing is a controversial method of natural gas extraction that has gained its fair share of critics. Although research has been conducted on the environmental impact of fracking, research concerning naturally occurring radioactive materials (NORM) has been scarce. Radionuclides are known to bioaccumulate in the environment and can have detrimental toxic effects on humans.
Methods: This study aims to examine the extent of biomagnification of radium-226 (Ra-226) from fracking sites to local water and agriculture. Fluid samples from areas near fracking sites as well as homogenized samples of soil and crops will be analyzed by gamma spectroscopy. The data set is expected to be non-normal, and therefore the Mann-Whitney U-test will be used to compare samples between fracking and non-fracking regions. If this contamination is significant, it can then be linked to health impacts in humans by assessing carcinogenic risk.
Results: If the results show that there are higher levels of Ra-226 in the water near fracking sites and cattle water compared to the control water, as well as progressively higher levels of Ra-226 contamination throughout trophic levels, it can be concluded that fracking poses a potentially radioactive threat to human health.
Conclusion: The severity of radionuclides on human health drives further research into legislation against hydraulic fracturing as well as determining efficient methods to remove radionuclides from entering domestic sources in order to prevent bioaccumulation into the specific food chain.
Implications: The results of our proposal may indicate tremendous implications on human health as Ra-226 is a chemical that bioaccumulates in the body. The ecosystem is interconnected, thus a change in the food and water humans consume can have detrimental effects on our health, specifically related to cancer. Therefore, the results of our study may demonstrate the detrimental impact of radium through fracking.

Research Abstracts in Biological Engineering

Predicting drug metabolite structures

Ayush Kumar, BSc Student [1], Tyler B. Hughes, PhD [1], and Joshua Swamidass, MD/PhD [1]
[1] Department of Pathology and Immunology, Washington University in St. Louis, MO, 63130

Introduction: Adverse drug reactions (ADRs) are the 4th leading cause of death in the U.S. Especially problematic are idiosyncratic ADRs (IADRs), which are unpredictable and oftentimes severe. Due to the relatively small sample size of clinical trials, many IADRs are detected only after approval, resulting in significant patient morbidity and mortality. Currently, it is impossible to accurately predict IADRs from the pharmacokinetics of the drug.
Methods: In this study, we devise a comprehensive model of drug metabolism that predicts all possible metabolite structures from a given molecule. The iterative algorithm has a set of 24 rules that can be applied to the molecule of interest and develop an array of metabolite molecules. A set of human Phase I reactions were used to test the accuracy of the model in predicting the correct metabolites formed in vivo.
Results: The depth-one, depth-two, and depth-three searches (number of iterations) of the algorithm had an accuracy of 79.39%, 88.74%, and 89.14%, respectively.
Conclusion: By generating a tree of possible structures arising from a specified number of metabolic steps, this tool detects unexpected routes leading to reactivity. Almost all previous models of metabolism have focused on predicting sites of metabolism (SOMs), which are the specific atoms that are targeted by metabolic enzymes. However, SOMs are merely a proxy for metabolic structures, because the same site can often be metabolized in several different ways. In contrast, our much more nuanced prediction of the actual possible metabolic structures distinguishes previously ambiguous possibilities.
Implications: This novel tool enables medicinal chemists to rapidly generate a tree of multistep metabolites for analysis, and anticipate the formation of reactive metabolites even in non-obvious cases. Overall, this algorithm could expedite the drug discovery process and identify major parts of toxicity in the drug design.

Research Abstracts in Cell Biology

Generation of type II alveolar epithelial cells from induced pluripotent stem cells: Avenues for therapy in ARDS

Ramy S. Gabarin, BHSc Student [1], Ryungrae Kim, MSc [2], Haibo Zhang, MD, PhD [3]
[1] Faculty of Health Sciences, McMaster University, Hamilton, ON, Canada, L8S 4L8
[2] Department of Physiology, University of Toronto, Toronto, ON, Canada, M5S 3H7
[3] Department of Medicine, University of Toronto, Toronto, ON, Canada, M5S 3H7

Introduction: Acute respiratory distress syndrome (ARDS) is a devastating lung condition characterized by damage to the lung epithelial-endothelial barrier, with mortality rates ranging from 32 to 45%. Resident type II alveolar epithelial cells (AE-CIIs) participate in lung regeneration through self-renewal and differentiation into type I alveolar epithelial cells, which participate in gas exchange. During lung injury, AECIIs undergo cell death and senescence. Thus, replenishing AECIIs could represent a possible source of treatment for ARDS. This project aims to generate AECIIs from human induced pluripotent stem cells (iPSCs).
Methods: iPSCs were cultured with growth factors and differentiated into a primitive streak and then endoderm. Cultures were subsequently either submerged or suspended, and supplemented with either noggin, an endogenous bone morphogenetic protein (BMP) signaling inhibitor, or dorsomorphin, a synthetic BMP inhibitor, yielding anterior foregut endoderm. Afterwards, cultures differentiated into lung progenitor cells, and then matured into lung epithelial cells. The percentage of AECIIs in the cell populations was determined at day 63 with immunofluorescent staining of pro-surfactant protein C, an AECII cytoplasmic marker.
Results: Percentage of AECIIs in the cell populations ranged from 47 to 75%. Submerged cultures showed total higher cell counts of AECIIs. Cultures with dorsomorphin had higher percentages of AECIIs.
Conclusion: Submerged cultures supplemented with dorsomorphin appeared to be the best conditions for cell proliferation and differentiation into AECIIs. Additional functional and genetic tests are needed for AECII cell characterization, including identification of specific cell surface markers, surfactant protein secretion and qRT-PCR gene expression profiles. In future tests, morphogens will be screened for their ability to increase cell proliferation and promote purity of AECIIs.
Implications: This project shows promise in demonstrating the production of AECIIs from iPSCs, as well as the feasibility of novel stem cell therapy for ARDS and perhaps other lung diseases including neonatal respiratory distress syndrome.

Research Abstracts in Clinical Medicine

The epidemiology of obstructive sleep apnea and mild cognitive impairment: A systematic review and meta-analysis

Deween L. Piyasena, BSc Student [1]*, Ayan Niazi, BSc Student [2]*, Talha Mubashir, MD [3], Lusine Abrahamyan, MD PhD [4,5], Frances Chung, MBBS FRCPC [6]
*Both authors contributed equally to this abstract
[1] Department of Health Sciences, University of McMaster, Hamilton, Ontario, Canada L8S 4L8
[2] Department of Biology, University of Trent, Peterborough, Ontario, Canada K9L 0G2
[3] Department of Anesthesiology, Toronto Western Hospital, University Health Network, Canada
[4] Institute of Health Policy, Management and Evaluation University of Toronto,
[5] Toronto Health Economics and Technology Assessment (THETA) Collaborative, Toronto General Research Institute, Toronto, Ontario, Canada
[6] Department of Anesthesiology, Toronto Western Hospital, University Health Network, University of Toronto, Canada

Introduction: Mild cognitive impairment (MCI) is a transitional state between normal ageing and development of early dementia. About 14% - 59% of MCI patients have sleep disturbances, including obstructive sleep apnea (OSA). However, the true magnitude of OSA prevalence in patients with MCI is unknown. Therefore, this systematic review aimed to expand upon the prevalence of OSA in individuals with MCI.
Methods: Keywords for MCI and OSA were used to search through ten electronic databases including Medline and Embase from their inception up to May 1, 2018. All stages of review were conducted by two reviewers independently. Studies on adults (age $\geq$ 18 years) with MCI and OSA were reported excluding (1) non-MCI studies; (2) non-OSA studies; and (3) non-English articles. Meta-analysis was performed using a random-effects model (to account for heterogeneity).
Results: We screened 11, 264 records out of which 5 full text articles were selected for review and analysis. We conducted meta-analysis with two studies which had patients with OSA diagnosed using polysomnography (PSG) and an Apnea-Hypopnea Index (AHI) cut off $\geq$ 5 events/hour. These two studies had similar characteristics with respect to age, BMI, AHI and

MCI diagnosis criteria. Furthermore, the two studies included complete data of a cognitively normal control population allowing for calculation of the odds ratio (OR). The pooled analysis indicated that the prevalence was 70% (95% CI: 57-82) and the OR of OSA was 1.06 (95% CI: 0.47-2.41) with no significant heterogeneity.

Conclusion: The prevalence of OSA in patients with MCI is high. Our findings suggest that MCI may not be an independent risk factor for the development of OSA.

Implications: Prospective cohort studies are needed to evaluate the risk of developing MCI in patients with treated and untreated OSA. This would be vital towards improving the quality of life of individuals with MCI and OSA.

Research Abstracts in Health Science

A review of opioid dependence treatment in Canada: Psychosocial and pharmacological interventions for substance use disorders

Ahmed Bagit, BSc Student [1], Ermias Nagatu, BSc [2], Kashif Pirzada, MD [3,4]
[1] Brock University, Saint Catharines, Canada
[2] York University, Toronto, Canada
[3] Department of Family Medicine, McMaster University, Hamilton, Canada
[4] Department of Family and Community Medicine, University of Toronto, Toronto, Canada

Introduction: Canada faces a growing opioid crisis. In 2017 alone, there were 3,987 opioid-related deaths, of which 92 percent was accidental or unintentional. Studies illustrate that increased opioid prescriptions, used for pain relief, heighten the risk of overdoses and/or opioid-dependence. Yet, many patients lack access to evidence-based information addressing these risks. We conducted a literature review to examine opioid therapy to improve patient education guidelines in Canada.

Methods: The review was conducted in PubMed, using keywords "opioid addiction" and "opioid dependence" in combination with "psychosocial interventions" or "pharmacological interventions", was assessed for the efficacy of pharmacological and psychosocial treatments. Two independent authors conducted searches, extracted data, and completed methodological quality assessment.

Results: 18 studies were obtained supporting the efficacy of pharmacological interventions. Treatments examined included Methadone Maintenance Treatment (MMT) and Buprenorphine. MMT proved successful at decreasing illicit opioid-use by 40% following 1 year of treatment. Some studies reported overdoses and/or opioid-dependence during MMT. Buprenorphine demonstrated equivalence to MMT in decreasing illicit opioid-use but may be safer to administer; as it was shown to have a lower risk of overdose and/or opioid-dependence. No studies were found on stand-alone psychosocial treatments.

Conclusion: In conclusion, there is some evidence that opioid-dependent users may benefit from MMT or buprenorphine. However, MMT may be associated with greater risk of overdose and/or opioid-dependence. Insufficient evidence exists to support stand-alone psychosocial treatments. Nevertheless, future studies should investigate the efficacy of psychosocial treatments and the effectiveness they may have when combined with MMT versus buprenorphine for opioid dependence therapy.

Implications: Adequately assessing and educating patients before initiating treatment is important to shape patient education guidelines and help physicians administer appropriate treatments. Considering the opioid crisis, further research on effective treatments for this growing dependent population is needed.

Exploring the use of vitamins and supplements: A critical analysis of the psychological, physiological process and risks associated for prenatal and maternal populations

Chelsia Watson, BSc Student [1], Ermias Nagatu, BSc [1], Kashif Pirzada, MD [2,3]
[1] York University, Toronto, Canada
[2] Department of Family Medicine, McMaster University, Hamilton, Canada
[3] Department of Family and Community Medicine, University of Toronto, Toronto, Canada

Introduction: In 2015, 45.6% of Canadians aged one year and older used at least one supplement. Moreover, women were more likely than men to take supplements across all groups over the age of 8. Additional studies indicate that many pregnant women have significant knowledge gaps about the use of supplements. The aim of this study is to evaluate the pathways of supplements, risks associated with use, and assess several populations, focusing on the prenatal and maternal populations.

Methods: A literature review was conducted in PubMed using the keywords "nutraceuticals" and "dietary supplements" combined with terms "physiological phenomena" or "prenatal". Three independent authors conducted the searches, extracted data and completed methodological quality assessment. Outcomes in infants related to use of multivitamin/mineral prenatal

supplements were included.

Results: A total of three studies met the selection criteria and were used after exclusion of irrelevant articles. The articles examined a range of outcomes including prenatal and maternal findings; infant birth weight, preterm delivery, morbidity, and mortality. A significant positive correlation was demonstrated between low-income, urban women in the use of prenatal multivitamins/mineral supplements and the potential to diminish infant morbidity and mortality.

Conclusion: Particular attention should be paid to pregnant women considering the use of supplements. In comparison to women who did not take a supplement, there was a twofold reduction in the risk of preterm delivery in those who started taking a supplement in their first and second trimester. This review suggests that more rigorous studies are required to understand the impact of dietary supplements in prenatal and maternal populations.

Implications: This review offers insight into the physiological pathways and beneficial effects of vitamins and supplements on prenatal and maternal health. This review may provide pregnant women with knowledge to guide their choices consciously as new mothers.

Development of a geriatric competency framework for undergraduate medical curricula in Canada

Dorothy Qian, BHSc Student [1], Andrew Costa, PhD [2,3]
[1] Faculty of Health Sciences, McMaster University, Hamilton, Ontario, L8S 4L8
[2] Department of Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, Ontario, L8S 4L8
[3] Department of Medicine, McMaster University, Hamilton, Ontario, L8S 4L8

Introduction: With seniors being the fastest growing population in Canada, there is an urgent need to more effectively prepare medical students in providing care in an aging context. This may be done through the consolidation and integration of a core set of geriatric competencies, a set of concepts and themes with which a graduating student would be expected to be familiar, into undergraduate medical curricula. The purpose of this project is to review and critically evaluate existing literature in order to develop a core set of geriatric competencies that would have the most potential impact upon future performance and positive attitude towards geriatrics.

Methods: An environmental scan was conducted regarding current teaching structures as well as geriatric competencies, using keywords including: "geriatric competencies", "undergraduate medicine", "clerkship", and "interprofessional education". The literature was analyzed for recurring themes as well as relevance to the pertinent problems in geriatric attitudes and competencies in Canada.

Results: Six core competencies encompassing medication management, falls, balance, and gait disorders, cognitive and behavioural disorders, functional assessment, transition of care, and atypical presentation of disease were found. Preliminary recommendations were made on the implementation of these competencies within undergraduate medical curricula.

Conclusion: The consolidation of geriatric competencies highlights specific challenges and areas of focus that are unique to the aging population. Future research will focus on the collection of qualitative data on the effectiveness of existing medical school curricula in preparing students for geriatric care, which may be used to guide future improvements in such curricula.

Implications: Altogether, the integration of these geriatric competencies and skills will both increase understanding of unique challenges and perspectives within geriatric care, and improve attitudes and confidence among undergraduate medical students in Canada.

Research Abstracts in Health Technology

The clinical utility of genetic testing: Development of a novel measurement tool

Ayushi Bhatt, BMSc Student [1,2], Robin Hayeems, ScM, PhD [1] , Stephanie Luca, HBSc, MA [1], Eleanor Pullenayegum PhD [1], M. Stephen Meyn MD, PhD [3], Wendy J. Ungar, PhD [1]
[1]Program in Child Health Evaluative Sciences, The Hospital for Sick Children, Toronto, ON, Canada M5G 0A4
[2] Department of Pathology, University of Western Ontario, London, ON, Canada N6A 3K7
[3] UW Center for Human Genomics and Precision Medicine, University of Wisconsin-Madison, Madison, WI, USA 53705

Introduction: Clinical utility is a generic term used to describe a genetic test's value to patients, families, health care providers, health care systems, or society. Despite rapid improvements in the laboratory performance of genetic/genomic tests, they remain costly and complex. As such, payors are increasingly seeking evidence which demonstrates the clinical value of these tests. This study aims to define the concept of clinical utility and develop a novel clinician-reported outcome measure that operationalizes this concept.

Methods: Semi-structured interviews were conducted with geneticists, genetic counsellors and other medical specialists (n=35). Qualitative interview data and an importance scale was used to inform revisions to the tool. A Delphi survey was then conducted, and clinicians were asked to rate the importance and clinical sensibility of the revised tool (n=113). Responses from the Delphi survey were used to inform a third iteration of the tool.

Results: Based on qualitative interview data, the importance scale and Delphi survey, missing items were added to the tool and less relevant items were removed. The wording of items was changed to better reflect clinical utility and to improve readability. The total number of items was reduced from 26 to 16. Current tool items include "provided a genetic explanation for my patient's health condition" and "indicated that further diagnostic testing can be avoided".

Conclusion: The draft generated after the Delphi survey will be reviewed by an expert panel who will be asked about the importance of the items and will comment on possible scoring options. Their input will be used to finalize the tool, which will then undergo further validation testing.

Implications: The tool will be used to generate a body of evidence pertaining to the clinical utility of genetic testing. This will inform health policy decisions as well as resource allocation and utilization.

Research Abstracts in Medicine

The extent of cognitive impairments in elderly survivors of war suffering from PTSD-meta-analysis and system review: A research study

Cindy X. Zhang, BHSc Student [1], Yasir Rehman, PhD [2], Lionel Fernandes, BSc Student [3], Haolin Ye, BSc Student [4]
[1] Department of Health Sciences, McMaster University, Hamilton, ON, Canada/L8S4M1
[2] Department of Sciences, McMaster University, Hamilton, ON, Canada/L8S4M1
[3] Department of Sciences, McMaster University, Hamilton, ON, Canada/L8S4M1
[4] Department of Sciences, McMaster University, Hamilton, ON, Canada/L8S4M1

Introduction: Posttraumatic Stress Disorder (PTSD) is associated with cognitive deficits. However, cognitive deficits can be confounded by age. We performed a meta-analysis and systematic review on elderly survivors of war suffering from PTSD to estimate the variability in their cognitive impairment based on individual neuropsychological tests.

Methods: This review was conducted under Cochrane (PRISMA) guidelines. We searched for eligible studies using MEDLINE, Embase, PsycINFO. We pooled the test data for meta-analysis if the results were reported in mean and standard deviation, and if the study enrolled elderly patients (age > 60 years). The risk of bias was assessed using the Newcastle–Ottawa Scale for case-control studies, whereas the quality of evidence was determined using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE).

Results: Elder PTSD survivors of war (PTSD+) have shown increased cognitive deficits when compared to elderly survivors of war not suffering from PTSD (PTSD-) and elderly healthy control not exposed to war trauma (HC). Moderate quality evidence showed that the PTSD+ group performed significantly worse than the PTSD- and HC groups on the Color-Word Inhibition Test (CWIT) and showed delayed memory on the Verbal Learning Test. High-quality evidence showed that PTSD+ participants performed poorly on the short-term Verbal learning Test relative to their comparators.

Conclusion: The magnitude of the cognitive deficits in our pooled analysis was small to moderate depending on the neuropsychological test. Most of our pooled analysis had a low risk of bias, which increased the confidence in our results.

Implications: Patients suffering from PTSD also suffers from cognitive impairment, compromising their quality of life. Since the population of elder patients are growing and their recovery rates are slow, it is important to uncover the reason for their cognitive impairment. In the future, it is essential to formulate more effective treatment/management plans tailored for PTSD+ patients.

Research Abstracts in Microbiology

Characterizing clinical isolates of Staphylococcus aureus for the development of a multi-faceted biofilm treatment method

Connor Davis, BSc [1], Zeinab Hosseini-Doust, PhD [2], Michael G. Surette, PhD [1,3]
[1] Department of Biochemistry and Biomedical Sciences, McMaster University, Hamilton, ON, Canada L8N 3Z5
[2] Assistant Professor, Department of Chemical Engineering, McMaster University, Hamilton, ON, Canada L8N 3Z5
[3] Professor, Department of Medicine, McMaster University, Hamilton, ON, Canada, L8N 3Z5

Introduction: *Staphylococcus aureus* (*S. aureus*) biofilm infections are difficult to treat, and often associated with indwelling medical devices or implanted foreign bodies. As a result, these infections pose a large risk to human health. Biofilm formation can also significantly impair the function of these devices, resulting in medical and economical costs. The purpose of this study is to characterize clinical isolates of *S. aureus*, with the end goal of developing a method to more efficiently eradicate these biofilm infections.

Methods: A Kirby-Bauer assay, static biofilm assays, and multiple phenotypic assays (ex. protease) were performed to characterize clinical isolates of *S. aureus*. A coagulase tube test was also performed to confirm the presence or absence of the coagulase enzyme. One-way ANOVA was performed to determine the significance of biofilm assays.

Results: All clinical isolates are coagulase positive, and many of them show a strong biofilm phenotype. Out of twelve antibiotics (from various classes) tested, each strain demonstrates resistance to a maximum of three different ones. The majority of strains show protease activity, and the majority demonstrate hemolytic activity in human blood, which may correlate with increased virulence.

Conclusion: These results are essential for the project, as a strong background on each isolate will result in a more informed treatment method. The next step is to quantify the minimum inhibitory concentration of antibiotics needed to eradicate the biofilms, which is expected to be significantly higher than that of planktonic cells. The long-term goal is to develop a multi-faceted treatment against *S. aureus* biofilm infections with better efficacy than current treatments.

Implications: Due to the difficulty in completely eradicating *S. aureus* biofilms from indwelling medical devices, finding better ways to target and treat these infections is necessary. More effective treatment means less *S. aureus* related deaths, and the deceleration of antibiotic resistance development.

Research Abstracts in Neuroscience

Time dependent memory assimilation

Shameelah Patel, BSc Student [1], Mariam Issa, BSc Student [1], Hassan Syed, BSc Student [1], Evangeline Tsagarakis, BSc Student [1], Huda Mirza, BSc Student [1], Blake A. Richards, PhD [1]
[1] Department of Biological Science, University of Toronto Scarborough, Toronto, Ontario, Canada M1C 1A4

Introduction: Memories are dynamic and can change over time. Recent studies have proposed that over time, memories initially stored in the hippocampus are transformed in to schematic representations in the prefrontal cortex. Each schematic representation exists as a cumulative memory trace of multiple experiences. This is the core of the memory transformation theory. However, evidence for memory transformation has only been obtained using a limited number of behavior tasks, such as the Morris water maze task. This study sought to find evidence for memory transformation using an object location task.

Methods: Mice were exposed to objects in various locations during training phases and after a specified time delay, the mice were presented with two objects; one in an outlier location and one in a location representative of the mean of training object locations. This mean object location was meant to emulate a schematic representation of the cumulative training object locations. We used four different time delays between the training and testing phase, and hypothesized that as time delay was increased, mice would assimilate the memory of the training locations and thus harbor a stronger memory for the mean object over the outlier. Since mice have an innate tendency to explore novel objects over familiar ones, later time delay groups were expected to interact more with the outlier.

Results: No significant discrimination was found between the different time delays in the mice's exploration of the mean versus outlier objects. Brain activity was also examined post-testing, and no temporal gradient was observed in the activity of specific regions of interest within the hippocampus and cortex.

Conclusion: Possible interpretation of these results are (1) that the mice are developing schemata in an instantaneous on-line manner, which asserts that the memory transformation process is not time dependent or (2) that memory transformation over time does not apply to the object location tasks, possibly due to its dissociation from areas of the brain which are affected by emotion.

Implications: Future work should examine whether evidence for memory transformation can be found with other types of tasks as well. If not, it would suggest that the theory of memory transformation is not applicable to all types of memory.

Research Abstracts in Pharmacy

Investing the utility of sulfonamides in the prevention of amyloids (Aß) aggregation
Shwetha Suresh, B.Sc. Student [1], Praveen Nekkar Rao, BSc, MSc, PhD [2,3,4]
[1] Department of Biology, University of Waterloo, Waterloo, Ontario, Canada
[2] Faculty of Pharmacy & Pharmaceutical Sciences, University of Alberta, Edmonton, Alberta, Canada
[3] Manipal College of Pharmaceutical Sciences, Manipal, Karnataka, Canada
[4] Manipal College of Pharmaceutical Sciences, Manipal, Karnataka, Canada

Introduction: Considering the prevalence of Alzheimer's disease (AD) and the lack of effective therapies, repurposing existing drugs can prove to be a more pragmatic and cost effective approach than designing, testing and approving new therapeutic agents. In this regard, the sulfonamide class of drugs has already been used with success to treat a broad range of diseases and has the potential to treat AD. The amyloid beta (Aß) cascade, which leads to the accumulation of neurotoxic Aß aggregates, represents a significant mechanism behind AD pathogenesis. This project aimed to investigate the ability of US FDA approved sulfonamide-based drugs to inhibit both Aß40 and Aß42 aggregation.
Methods: Anti-Aß activity of eight existing sulfonamide-based compounds was evaluated using thioflavin-T (ThT)-based fluorescence spectroscopy as a measure of Aß aggregation. Computational chemistry was then utilized to model the interactions between Aß dimers and promising compounds previously identified using the ThT-based Aß assay.
Results: Acetazolamide, celecoxib and zafirlukast, were found to exhibit anti-Aß42 aggregation properties while only zafirlukast demonstrated anti-Aß40 activity. Computational molecular docking studies identified the KLVFFA region of the Aß peptide to be crucial in interacting with the sulfonamide group of these three compounds. Zafirlukast exhibited favourable binding interactions with the NMR structures of both Aß dimers and was therefore able to prevent further aggregation and fibrillogenesis.
Conclusion: Zafirlukast was identified as the most promising Aß-aggregation inhibitor, exhibiting anti-aggregation properties towards both Aß40 and Aß42 aggregation with 44.4% and 85.5% inhibition, respectively at 50 µM. As a leukotriene receptor antagonist, zafirlukast would also target neuroinflammation that is associated with AD. Transmission electron microscopy of resulting aggregates will further clarify the effect of these drugs on AD inducing Aß aggregates.
Implications: Not only do these investigations provide evidence on repurposing well-understood existing drugs, they also suggest utility in incorporating sulfonamides in further drug design.

Research Abstracts in Psychology

A cognitive model towards understanding delusions in schizophrenia
Vasfiye D. Sen, BSc Student [1], Timothea. Touloupoulou, PhD [2]
[1] Department of Psychology, University of Bilkent, Ankara, Turkey, 06800
[2] Department of Psychology, University of Bilkent, Ankara, Turkey, 06800

Introduction: Delusions and hallucinations are the positive symptoms of schizophrenia which is mainly diagnosed by whether they exist or not. There are some explanations why delusions might occur. One of them is prediction error (PE) that is a cause of mismatch between what is expected and what is actually experienced. This paper aims to review the literature on how PE explains formation of delusions.
Methods: In order to examine how PE approach explains delusion formation, we conducted a systematic review through online library catalogues. We initially reappraised 50 articles which were published between 2000 and 2017. Search terms included "delusion formation", "prediction error", "schizophrenia", and "neurobiology of delusions". We selected 16 of them directly related to our subject and mostly belonging to Corlett and colleagues who are the researchers claiming this approach in order to explain delusion formation in schizophrenia for the first time.
Results: Dysregulated, hyperdopaminergic state that people with schizophrenia have causes them to aberrantly assign salience to external objects and internal representations. These aberrantly salience objects allocate their attention to be learn. This process is mediated by frontal cortex. According to results of fMRI studies, greater activation in right dorsolateral prefrontal cortex occurs in the presence of PE, but people with delusions show inappropriate PE signals.

Conclusion: Beliefs are the results of associative learning processes that are driven by prediction error. Aberrations in how brain circuits compute and respond to PE cause delusion formation. We can say that formation of delusion is caused by dysfunction of the mesocorticolimbic system through an aberrant PE signaling.

Implications: Since this approach enables to show a relationship between a specific psychological process (PE), its neural instantiation (rPFC), and a psychotic system (delusions), it promises a path to better treatment for people with schizophrenia.

Come together: Community support and housing stability in the Minneapolis metro area

Katie E. Twyman, BA Student [1], Biftu N. Bussa, BA [1,2], Rebecca L. Prigge, BA [1], Lydia Lamport, BA Student [1], Naw D. Doh, BA Student [1], Maria C. Pabón Gautier, PhD [1]
[1] Department of Psychology, St. Catherine University, St. Paul, Minnesota, 55105
[2] Department of Public Health, St. Catherine University, St. Paul, Minnesota, 55105

Introduction: This study examined the relationship between structured community support, community demographics, and housing instability. Previous research suggests that disenfranchised groups may suffer from lack of access to social resources. By observing trends in non-profit presence, eviction rates, and population demographics in an inner city neighborhood and a Minnesota suburb, we found that the quantity and functions of the non-profits in a community may align with sustaining housing stability in diverse communities, ultimately serving historically overlooked groups.

Methods: This study used data collected by a non-profit organization in a low-income Minneapolis neighborhood. Surveyed participants (N=780) identified their reasons for leaving affordable housing. Participant demographics were compared to 2010 Census data from a similar Minnesota suburb. Research also examined presence of community-directed non-profits (N=131) and 2016 rates of eviction in both communities. Non-profits were categorized by mission and programs into seven groups. We used Chi-square testing to identify relationships between non-profit presence, demographics, and eviction rates in the targeted populations.

Results: The inner city community showed lower eviction rates and higher overall non-profit density than its suburban counterpart. The inner city notably contained more non-profits dedicated to community enrichment and human services. The suburb had more non-profits dedicated to community development. Inner city participants also showed greater diversity in all demographic measures including gender, age, and race/ethnicity.

Conclusion: Previous research suggests that minority groups may face greater obstacles in obtaining and retaining adequate housing. Despite this research, our selected inner city neighborhood demonstrated lower eviction rates than its suburban counterpart. This may be due to the presence of non-profit programming intentionally directed at serving the needs of these disenfranchised groups.

Implications: Our research may aid both non-profit organizations and government agencies in focusing their energy on effective services, thereby efficiently serving communities in greatest need of support.

Research Abstracts in Virology

Pleiotropic roles of cytokines in HIV-1 pathogenesis and control

Homaira Hamidzada, HBSc [1], Christina Guzzo, PhD [1,2]
[1] Department of Biological Sciences, University of Toronto Scarborough, Toronto, Ontario, Canada M1C 1A4
[2] Department of Cell & Systems Biology, University of Toronto, Toronto, Ontario, Canada M5S 3G5

Introduction: Human Immunodeficiency Virus 1 (HIV-1) is a retrovirus that infects human immune cells, primarily CD4$^+$ T cells and macrophages. During HIV-1 disease progression, infected individuals have declining CD4$^+$ T cell counts and increasing HIV-1 RNA, indicative of virus replication. Cytokines are small molecular weight proteins that communicate signals between a broad range of cells in the immune system. Numerous studies have identified the pleiotropic roles of cytokines in immune responses during HIV-1 infection. Our objective was to pinpoint a subset of cytokines which have high potential to be targets for prevention and treatment of HIV-1 infection.

Methods: We conducted a systematic review categorizing pertinent cytokines on the basis of four criteria: correlations with HIV-1 replication, impact on host immune cells, characteristic expression in elite controllers and involvement in antiviral synergistic functions.

Results: We identified several cytokines in the interleukin (IL) family and the C-C and C-X-C chemokine families with important roles in HIV-1 control. The levels of many cytokines are correlated with reduced HIV-1 replication (e.g. IL-21, IL-32, IL-27). Several cytokines directly impact cells of the innate immune system in their HIV-1 control mechanism. Among many, IL-7 and IL-15 work to enhance natural killer cell function, while IL-27 enhances macrophage resistance to HIV-1 infection.

Elite controllers, individuals who have suppressed HIV-1 replication and preserved CD4$^+$ T cell levels without exogenous antiviral drug treatment, express a uniquely characteristic array of chemokines. Namely, CCL14, CCL27, CCL21, XCL1 and CXCL12 are upregulated in elite controllers compared to non-controllers. These chemokines synergize in their function to more effectively reduce HIV-1 replication.

Conclusion: Here, we highlighted the antiviral roles of several cytokines, demonstrating that many cytokines are key regulators of HIV-1 replication.

Implications: This work provides a focus for future research aiming to better understand HIV pathogenesis and informs novel preventative and therapeutic designs.

Research Abstracts in Nanobiotechnology

A protein-triggered DNAzyme motor enabling operation on live cells
Ami Vora, MD Candidate [1], Divya Shah, BSc Student [2], Jing Yang Xu, MSc Candidate [1], Hongquan Zhang, Principal Investigator [1]
[1] Faculty of Medicine and Dentistry, University of Alberta, Edmonton, Canada, T6G 2B7
[2] Faculty of Science, University of Alberta, Edmonton, Canada, T6G 2B7

Introduction: The use of nanoparticles in biomedical research has become a new avenue for improvement of cancer detection and treatment. Methods of high sensitivity and ease of use are desirable for early cancer detection. We hypothesize that the construction of a DNAzyme motor enabling operation on live cancer cells can achieve amplified and higher sensitivity detection of cancer cells, without the need for separation, in unpurified samples.

Methods: The DNAzyme motor system consists of two main components: 1) a DNAzyme linked to an affinity ligand and 2) a nano-/micro particle bound to a second affinity ligand and the substrate for the DNAzyme. The nano-/micro particle serves as a scaffold to construct three-dimensional DNA tracks of substrate molecules. Binding of a specific target molecule on cells to the two ligands induces hybridization between the DNAzyme and its substrate on the DNA track. This hybridization initiates the cleavage of the substrate and autonomous movement of the DNAzyme along the AuNP. Each moving step restores the fluorescence of a dye molecule on the DNA track, enabling amplified detection of cancer cells. One target molecule will produce a strong, amplified signal that is easier to detect allowing for this system to be of high sensitivity. We have constructed three DNAzyme motor systems using quantum dots, gold nanoparticles, and magnetic beads as scaffolds.

Results: Magnetic bead and AuNP DNAzyme motors led to the best signals and are most suitable for operation on live cells.

Conclusion: We have demonstrated the feasibility of constructing of a DNAzyme motor, which would allow for amplified detection of surface molecules on live cells. This motor system will be applied to live cells to assess its function.

Implications: Potential applications of this motor system include molecular sensing/detection, cell imaging, molecular interaction monitoring, and controlled delivery and release of therapeutics.

Conflicts of Interest
The author(s) declare that they have no conflict of interests.

Authors' Contributions
MHRC: Assisted authors with their abstract submissions, ensured abstracts adhered to correct formatting standards, sourced and assigned peer-reviewers, drafted the abstract booklet, and gave final approval of the version to be published.
JYN: Designed and founded the URNCST Journal Research Abstract Competition, ensured abstracts adhered to correct formatting standards, assisted authors with their abstract submissions, sourced and assigned peer-reviewers, reviewed the drafted abstract booklet, and gave final approval of the version to be published.

Acknowledgements

Desmond She – University of Toronto
Jennifer Williams – Queen's University

Do you research in earnest? Submit your next undergraduate research article to the URNCST Journal!
| Open Access | Peer-Reviewed | Rapid Turnaround Time | International |
| Broad and Multidisciplinary | Indexed | Innovative | Social Media Promoted |
Pre-submission inquiries? Send us an email at info@urncst.com | Facebook, Twitter and LinkedIn: @URNCST
Submit YOUR manuscript today at https://www.urncst.com!