Lakehead UNIVERSITY

SESBASS

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

3rd Biotechnology Virtual Symposium

BIO-INSPIRED ENVIRONMENTAL, HEALTH AND WELL-BEING RESEARCH

Lakehead University

AUGUST 27 - 28, 2021

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

SESBASS 2021

Abstract Booklet

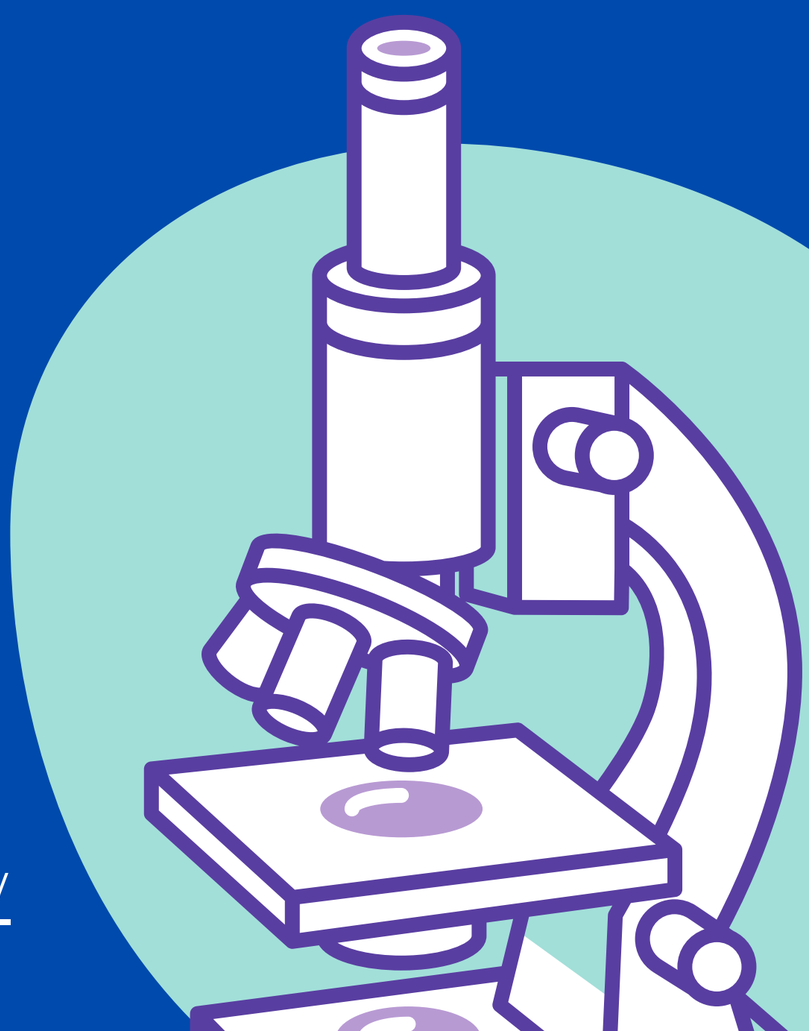
Science and Environmental Studies,
Biotechnology and Allied Sciences Symposium

Bio-Inspired Environmental, Health and Well-Being Research

Steering Committee:

Dr. Jinan Fiaidhi
Dr. Sabah Mohammed
Dr. Brenda Magajna
Dr. Amarjit Chahal
Dr. Carlos Zerpa
Jessica Allingham
Dr. Wensheng Qin
Dr. Paolo Sanzo
Dr. Ali Tarokh
Dr. Garima Bajwa
Dr. Sreekumari Kurissery
Dr. Ahmed Elshaer
Dr. Biaoqiang Liao
Dr. Michael Cardinal-Aucoin

https://sesbass21.weebly.com/



Thank you to our sponsors!

Thank you to the following sponsors for their support of the 2021 Science and Environmental Studies, Biotechnology and Allied Science Symposium.

THUNDER BAY CEDC COMMUNITY ECONOMIC DEVELOPMENT COMMISSION

IEEE ComSoc™ IEEE Communications Society

entrepreneurcentre.ca

Confederation COLLEGE

NORTHWESTERN ONTARIO INNOVATION CENTRE

Thunder Bay Regional Health Research Institute

Lakehead UNIVERSITY

Alumni Office
Faculty of Graduate Studies
International Office
VP Research and Innovation
Faculty of Science and Environmental Studies
Faculty of Health and Behavioural Science

CUPE 3905
REPRESENTING WORKING STUDENTS AT LAKEHEAD UNIVERSITY

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Welcome

Welcome to our third annual Biotechnology Symposium and our very first virtual symposium.
SESBASS brings together researchers with diverse skills and knowledge who share common goals, enabling them to discuss and develop projects together. Talks and posters will focus on:

- Environmental Sustainability
- Digital Agriculture
- Medical Imaging
- Biomechanics
- Tissue Engineering
- Digital Health Technologies

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

SESBASS 2021-SCHEDULE

FRIDAY AUG 27		
8:30	30 min	Gather Space Acclimatization
9:00	10 min	Welcome and Intro
CLINICAL HEALTH RESEARCH		
Session 1 - Biomechanics		
Session Chair - Dr. Paolo Sanzo		
9:10	10 min	Session Introduction
9:20	**40 min**	**WALTER HERZOG - Biomechanics - Osteoarthritis**
10:00	10 min	*Introduce students and postdocs*
10:10	10 min	Celia Barry
10:20	10 min	Jordan Bedel
10:30	10 min	James Fimognari
10:40	10 min	Social Break
10:50	10 min	Dr. Zerpa student
11:00	30 min	LU Faculty Presentation - Dr. Carlos Zerpa
11:30	30 min	**PANEL: Biomechanics (Chair - Dr. Sanzo)**
12:00	50 min	POSTER SESSION
Session 2 - Medical Imaging		
Session Chair - Dr. Mitch Albert		
12:50	10 min	Session Introduction
1:00	**40 min**	**CHARLES CUNNINGHAM - Medical Imaging**
1:40	10 min	*Introduce students and postdocs*
1:50	10 min	Sarah Tribe
2:00	10 min	Jonas Olsen
2:10	10 min	Branden Mandaric
2:20	10 min	Clifford Agyei
2:30	10 min	Jessica Allingham
2:40	10 min	Darien Sawyer
2:50	10 min	Social Break
3:00	30 min	**PANEL: Medical Imaging (Chair- Dr. Mohammed)**
Session 3 - Tissue Engineering		
Session Chair - Dr. Ali Tarokh		
3:30	10 min	Session Introduction
3:40	**40 min**	**ALI TAMAYOL - Tissue Engineering**
4:20	10 min	Behrooz Afra
4:30	10 min	Dr. Tamayol's student
4:40	10 min	RegenMed presention

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

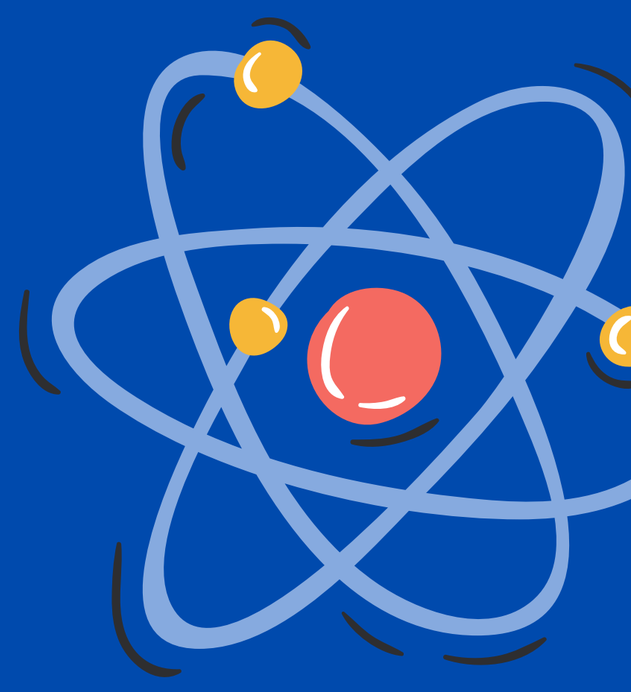
SESBASS 2021-SCHEDULE

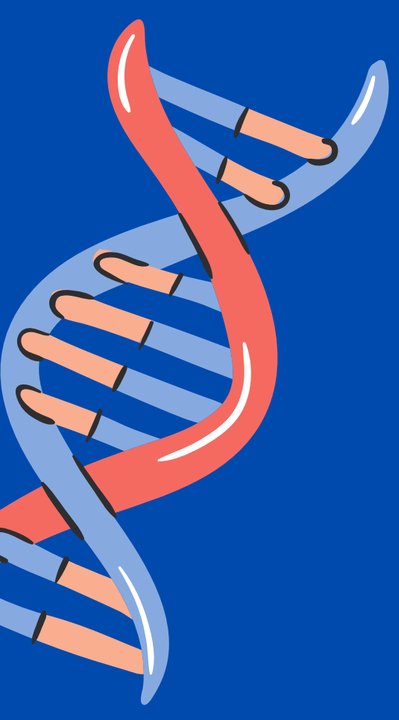
SATURDAY AUG 28		
8:30	30 min	Gather Space Acclimatization
DIGITAL HEALTH TECHNOLOGIES		
Session Chair - Dr. Jinan Fiaidhi		
9:00	10 min	*Introduction*
9:10	**40 min**	**CRAIG KUZIEMSKY - Digital Health Systems Based Approaches for Health Care Transformation**
9:50	10 min	Introduce students and postdocs
10:00	10 min	Shiv Hansoti, Divarsh Patel
10:10	10 min	Lisa Ewan
10:20	10 min	Social Break
10:30	10 min	LU Faculty Presentation - Dr. Sabah Mohammed
11:00	30 min	Dr. Arnold Kim
11:30	30 min	**PANEL: Problem Oriented Medical Records (POMR) (Chair - Dr. Fiaidhi)**
		Panelists: Dr. Bajwa, Dr. Kim, Dr. Mohammed, Dr. Kuziemsky
12:10	40 min	LUNCH /POSTERS
ENVIRONMENTAL SUSTAINABILITY		
Session Chair - Dr. Sreekumari Kuriserry		
12:50	10 min	*Dr. Sreekumari Kurissery to open the session and introduce Dr. Lesley Lovett-Doust*
1:00	**40 min**	**LESLEY LOVETT-DOUST - Environmental Sustainability**
1:40	10 min	Social Break
1:50	10 min	*Introduction*
2:00	**40 min**	**CHRISTOPHER HENRY - Digital Agriculture**
2:40	10 min	Introduce environment related students and postdocs
2:50	10 min	Nadia Sufdar Ali
3:00	10 min	Sarita Shrestha
3:10	10 min	Xuantong Chen
3:20	10 min	Chris Chio
3:30	10 min	Janak Khatiwada
3:40	10 min	Afrooz Tarokh
3:50	10 min	Social Break
4:00	30 min	**PANEL: Current Issues in Environmental Sustainability (Chair - Dr. Kuriserry)**
		Panelists: Dr. Tarokh, Dr. Qin, Dr. Pendea, Dr. Kanavillil
4:30	30 min	Concluding session - Thank you and awards

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium





SESBASS 2021- KEYNOTE SPEAKERS

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Leslie Lovett-Doust

Leslie Lovett-Doust, Professor Emeritus, Nipissing University

Biography: Research areas: Ecology, Population Biology, Conservation, Environmental Restoration. Currently working on "contours of contamination" in water and sediment in the Laurentian Great Lakes Basin, and studies on the changing vegetation of the Middle East.

The TerraByte Project

https://www.acs.uwinnipeg.ca/terrabyte/

Christopher Henry, Associate Professor in the Dept. of Applied Computer Science at the University of Winnipeg, Adjunct Professor in the Dept. of Electrical and Computer Engineering at the University of Manitoba.

Biography:Dr. Henry has held NSERC Discovery funding throughout his career. The focus of Dr. Henry's work is the theory and application of machine learning, such as his work in developing machine learning data sets for digital agricultural applications. This has led to machine learning collaborations with Sightline Innovation, Northstar Robotics, and DecisionWorks.

Dr. Henry has also pioneered approaches to classify pixels obtained from satellite images using deep neural networks developed for semantic segmentation for the creation of land-use/land-classification maps. The success of this work has led to industry research contracts and grants with GeoManitoba, Manitoba Hydro, the Canada Centre for Mapping and Earth Observation (CCMEO), as well as collaborations with researchers at the Norwegian University of Science and Technology. This work has generated a start-up company, DeepGeo, to commercialize this work. DeepGeo was created through the Creative Destructive Laboratory in the Rotman School of Management at the University of Toronto, and secured its first contract with Manitoba Agricultural Services Corp on a project to perform crop yield prediction from satellite data.

Dr. Henry has also been collaborating for many years on GPU-based computing initiatives, including collaborations with Manitoba Hydro, Ubisoft, and Manitoba Hydro International. He has worked to establish a provincial consortium of researchers in high performance computing that ran several roundtable meetings with industry as well as two conferences; he has co-founded the Applied Parallel Computing and Collaborative Research Laboratory; and co-led the process to establish the University of Winnipeg as an NVIDIA GPU Education Centre

The TerraByte Project

https://www.acs.uwinnipeg.ca/terrabyte/

Abstract:

BACKGROUND/OBJECTIVES: A lack of sufficient training data, both in terms of variety and quantity, is often the bottleneck in the development of machine learning (ML) applications in any domain. For agricultural applications, ML-based models designed to perform tasks such as autonomous plant classification will typically be coupled to just one or perhaps a few plant species. Consequently, each crop-specific task is very likely to require its own specialized training data, and the question of how to serve this need for data now often overshadows the more routine exercise of actually training such models.

METHOD: To tackle this problem, we have developed an embedded robotic system to automatically generate and label large datasets of plant images for ML applications in agriculture. The system can image plants from virtually any angle, thereby ensuring a wide variety of data; and with an imaging rate of up to one image per second, it can produce labeled datasets on the scale of thousands to tens of thousands of images per day. As such, this system offers an important alternative to time- and cost-intensive methods of manual generation and labeling.

RESULTS: The result is a labelled data of over 1.5 million labelled images and over 500 thousand multi-plant images with bounding boxes (Figs. 1 & 2). The images will be made publicly available via a web portal being developed in collaboration with the Enterprise and Machine Intelligence Learning Initiative (EMILI) and Compute Canada.

Figure 1. Labelled single-plant images.

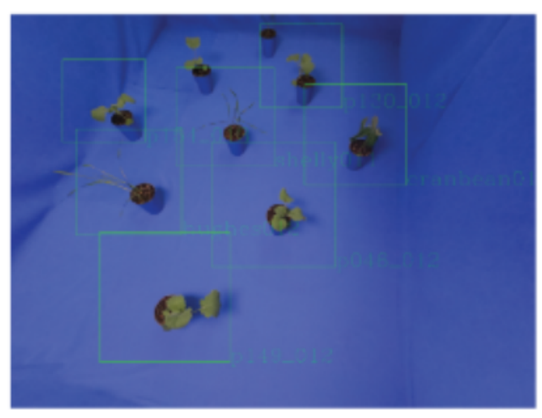


Figure 2. Multi-plant images with bounding boxes.

CONCLUSION/IMPLICATION: Whether one speaks of precision agriculture, digital agriculture or Agriculture 4.0, this movement is expected to bring critical innovations based on automated methods and algorithms that are dependent on large amounts of data. Our hope is that our public dataset will spur innovation by researchers and industry in the agricultural sector in much the same way that ImageNet did for computer vision.

The Many Faces of Knee Joint Osteoarthritis

Walter Herzog, Tier I CRC-Molecular/Cell Biomechanics, Professor, Herzog Research Group, Director - Human Performance Lab, University of Calgary

Biography: Dr. Herzog's research is focused on the neuro-biomechanics of the musculoskeletal system with emphasis on mechanisms of muscle contraction focusing on the role of the structural protein titin, and the biomechanics of joints focusing on mechanisms of onset and progression of osteoarthritis. Expertise is in the area of growth, healing, and adaptation of soft (ligament, tendon, muscle, and articular cartilage) and hard (bone) tissues. Within this area we work experimentally and theoretically on the molecular/cellular, in vitro, in situ, and in vivo level. It also includes cell manipulation and mechanical testing and finite element modeling, continuum mechanics, simulations and theories of growth and adaptation. https://contacts.ucalgary.ca/info/kn/profiles/196-1425

Abstact: Osteoarthritis is the most common type of arthritis. It is characterized by a breakdown of the cartilage surfaces that cover the ends of bones, resulting in pain, swelling, and stiffening of the joint. In the past, osteoarthritis was considered a wear and tear disease that occurred due to natural aging. However, today we accept that osteoarthritis is a joint disease that can be caused by a variety of factors and affects all tissue of a joint.

We studied the etiology of knee joint osteoarthritis in pre-clinical models for the past twenty years. In my presentation, I will focus on three risk factors for knee joint osteoarthritis:
(i) Trauma
(ii) Muscle weakness/imbalance and
(iii) Obesity

Knee trauma can be simulated in pre-clinical models by the transection of ligaments, the (partial) removal of the menisci, and by damage of the cartilage surface. Muscle weakness and imbalance can be achieved using muscle ablation, tenotomies, nerve transection, or a variety of chemical interventions that prevent muscle activation, for example botulinum toxin. Finally, obesity can be induced by genetic manipulation or by exposing animals to a high fat and/or a high fat and high sucrose diet.

The Many Faces of Knee Joint Osteoarthritis

In my presentation, I will specifically focus on models of anterior cruciate ligament transection (trauma), botulinum toxin injections into target muscles to produce muscle weakness and imbalance and exposing animals to high fat/sucrose diets that produce obesity, metabolic syndrome, and knee joint osteoarthritis. These studies provided the following general conclusions:
(i) Restoring normal joint function following trauma does not stop the progression of osteoarthritis
(ii) Knee extensor muscle weakness and imbalance is an independent risk factor for knee osteoarthritis, and
(iii) Diet-induced obesity causes metabolic syndrome, which in turn causes knee joint osteoarthritis.
(iv) Fibre diet interventions, aerobic exercise, and resistance training alleviate knee joint osteoarthritis by reducing metabolic syndrome, even in the absence of obesity reduction.
The following recent review paper addresses these issues in greater detail for the interested reader.
de Brito Fontana, H., & Herzog, W. (2021). The Role of Muscles in Knee Joint Osteoarthritis. Sports Orthopaedics and Traumatology

Ali Tamayol

Ali Tamayol, Associate Professor, Biomedical Engineering Department, University of Connecticut.

Biography: Micro- and nanoscale technologies are increasingly used in multidisciplinary research areas such as tissue engineering and biomedical sciences. These technologies have merged with advanced materials to enable engineering constructs, which mimic the biochemical, topographical, and physical features of the native tissues. In addition, microfabrication technologies have enabled scientists to mimic the complexity of the native tissues through controlling cell-cell and cell-microenvironment interactions. Dr. Tamayol's research is focused on the utilization of fiber-based techniques such as weaving, knitting, braiding, and 3D printing for the treatment of musculoskeletal disorders. His lab has developed novel strategies that facilitate 3D direct write printing of structures from various hydrogels and bioinks. In addition, LIMB and Dr. Tamayol has been actively fabricating and characterizing bioelectronics and sensors as well as smart drug delivery systems for treatment of chronic wounds. More information can be found at: http://tamayol-lab.weebly.com/

Charles Cunningham

Charles Cunningham, Senior scientist, Physical Sciences, Schulich Heart Research Program, Sunnybrook Research Institute, Associate professor, department of medical biophysics, University of Toronto.

Biography: Charles Cunningham completed an undergraduate degree in Engineering Science at the University of Toronto and a Ph.D. in the Dept. of Medical Biophysics at the University of Toronto where he specialized in new MRI methodology. During his postdoctoral training in Electrical Engineering at Stanford, he became interested in measuring metabolic processes in patients using MRI, in close collaboration with Radiology at UCSF.

Dr. Cunningham's lab uses magnetic resonance imaging (MRI) and 13C-labelled metabolites to make measurements and images of biochemical reactions occuring in the tissue of human subjects. His group develops the required imaging methodology and hardware to perform this new form of MRI and carry out clinical trials in patient populations.

Metabolic MRI of the human brain has revealed consistent regional patterns of 13C-metabolite production, and understanding how these signals change with aging and with disease is the current focus of the lab. This has led to a parallel interest in the potential role of lactate produced by astrocytes in the brain.

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Systems Based Approaches for Health Care Transformation

Craig Kusiemsky, Vice-President, Research, Professor in the School of Business, MacEwan University, Edmonton.

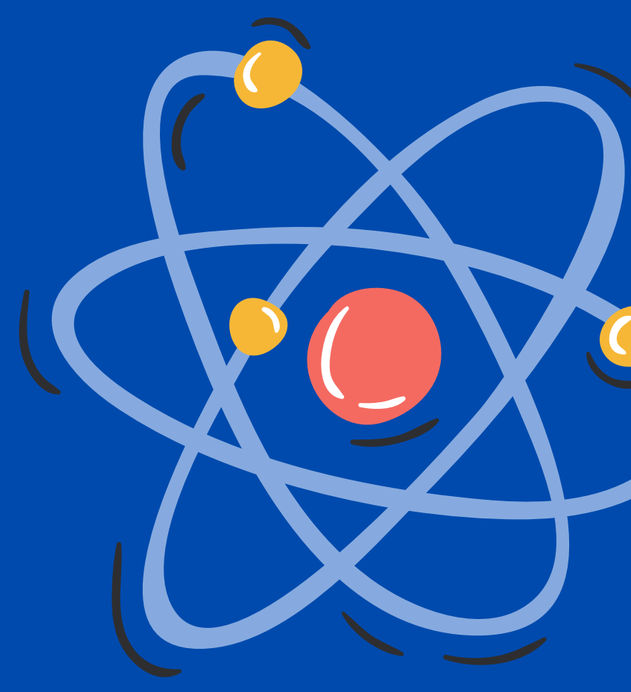
Biography:

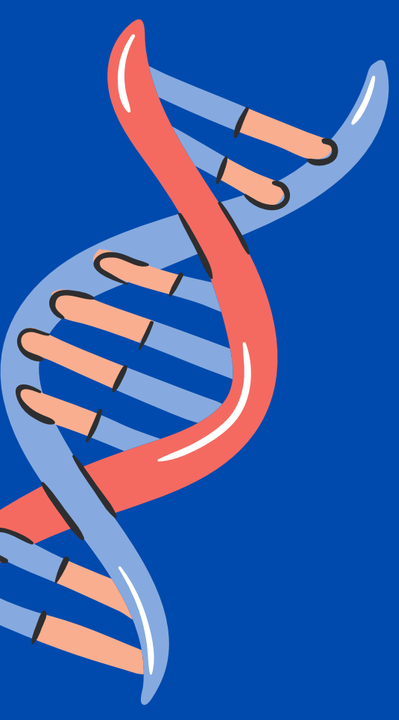
Abstract: Healthcare systems worldwide are transforming into collaborative patient centered systems, defined by new interactions across patients, providers, and settings. While these new interactions can be a means of improved access and quality of care delivery, managing the interactions can be a significant challenge. The COVID-19 pandemic has helps us create a digital world including great advances in digital health delivery. We need to ensure we maintain the momentum we have made at digitizing society while also ensuring that digitization does not bringing undesired unintended consequences.

Healthcare transformation efforts such as the design of digital health tools must be informed by systems thinking. Systems thinking allows us to understand all the interacting concepts in healthcare transformation so that we can best manage these interactions including the need to balance trade-offs across providers, settings, and processes. However, we lack rigor in how we use systems thinking or modeling approaches to assist with healthcare transformation efforts. Existing system modeling approaches (e.g. Business Process Management) often fail to properly represent health system complexity. This talk will introduce systems thinking and our research at using it to guide healthcare transformation efforts.

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium





SESBASS 2021- ORAL ABSTRACTS

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

The Effects of Neurocognitive and Physical Tasks on End-Tidal Carbon Dioxide Levels in Healthy Reserve and Concussed Special Forces Military Members

Jordan Bedel 1& Paolo Sanzo1

1Lakehead University, Ontario, Canada

BACKGROUND/OBJECTIVES: Within the Canadian Military Special Forces Unit, active duties expose individuals to dangers such as explosive devices, loud gunfire, and hand-to-hand physical combat. Due to the inherited risks, individuals are at constant risk of various injuries including concussion. Damage may occur to neural and vascular tissue that can cause physiological changes in the brain. Abnormal breathing patterns may emerge if there is damage to the brainstem or middle cerebral artery reducing blood flow to the thalamus, brainstem, and respiratory control centres. The purpose of this proposed study is to examine differences between healthy reserve and concussed special forces military members when completing a neurocognitive and physical task on measures of breathing function.

METHOD: Prospective participants will be asked to complete the self-report Nijmegen Questionnaire (NQ) to assess the individual's breathing pattern. Participants will be fitted with a single-use nasal cannula and worn throughout the entire data collection process and connected to the CapnoTrainer® capnography breath analyzer. A neurocognitive test will be completed via the Immediate Post-concussion Assessment and Cognitive Test® (ImPACT) battery designed specifically for measuring executive function. End-tidal CO2 (ETCO2) measures will be collected during the different tasks. The second task will involve participants walking on a treadmill under two different walking speeds for 3 minutes. The participants will be equipped with a 13.6-22.6kg weight pack to simulate a standard work environment. The variables of interest will be analyzed using descriptive and inferential statistics for each specific condition with an alpha level of $p < .05$.

CONCLUSION: It is hypothesized that after completing a physical and neurocognitive task, there will be a statistically significant difference between groups for ETCO2 measures. Based on the possible damage to the brain caused by the concussion, breathing dysfunctions may be present and be an area that needs to be addressed from a treatment perspective.

https://sesbass21.weebly.com/

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Static Measures of Prosthetic Show Materials for Transtibial Amputees

Celia Berry 1 , Meilan Liu, PhD. 2 , Carlos Zerpa, PhD. 1

1 School of Kinesiology, Lakehead University, Ontario, Canada
2 Department of Mechanical Engineering, Lakehead University, Ontario, Canada

BACKGROUND/OBJECTIVES: Patients with lower limb transtibial amputations frequently report lower limb and back pain with the use of prosthetic devices. The increased transient forces produced by the prosthetic device during walking puts these patients at a high risk of developing degenerative joint conditions in the knees, hips, and lower back. Commercially available shock-absorbing insoles show promising evidence in reducing these forces; however, they are not currently recommended for transtibial amputees due to the high degree of compression leading to feelings of instability. This concern highlights the need for innovative, low-cost solutions to improve the functional outcomes of passive prosthetic devices by mitigating pain and the risk of injury. Thermoplastic polyurethane (TPU) material shows a promising use as insole or heel material for this population due to its shock-absorbing capabilities. The purpose of this research was to analyze the material properties of TPU and conventional prosthetic shoe materials by statically testing the energy absorption capabilities of each material.

METHOD: Several materials underwent static compression testing using a Chatillon force tester and AMTI force plates to analyze the energy absorption capabilities. The samples tested included TPU material arranged to form a heel lift or thin insole, a conventional prosthetic heel lift, and each heel lift type (TPU or conventional) combined with a foam insole commonly used with prosthetic heel lifts. The samples were compressed for 15 trials at a speed of 25 mm per minute to ensure that the testing could be considered static, and the force tester was modified to allow the materials to be compressed at a 30° angle, resulting in both compressive and shear forces being applied. The compression, shear, and total energy absorption was found for each material tested and the means of each were compared.

.

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Static Measures of Prosthetic Show Materials for Transtibial Amputees

RESULTS: When comparing the conventional heel lift with the TPU heel lift, the TPU heel lift absorbed the highest meant percent of shear (M=37.8%), compressive (M=54.6%) and total (M=48.2%) energy (see Figure 1). When comparing the conventional heel lift combined with a foam insole and the conventional heel lift combined with a TPU insole, the conventional heel with the TPU insole absorbed the highest mean percent of shear (M=27.2%), compressive (M=35.7%) and total (M=32.4%) energy (see Figure 2). When comparing the conventional heel lift combined with a foam insole and the TPU heel lift combined with a foam insole, the TPU heel with the foam insole absorbed the highest mean percent of shear (M=26.1%), compressive (M=32.3%) and total (M=30.1%) energy (see Figure 3).

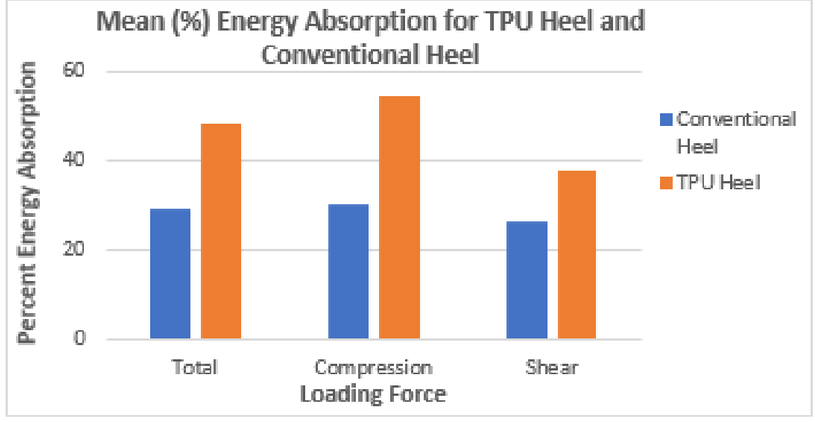


Figure 1. Mean energy absorption for a TPU heel versus a conventional heel

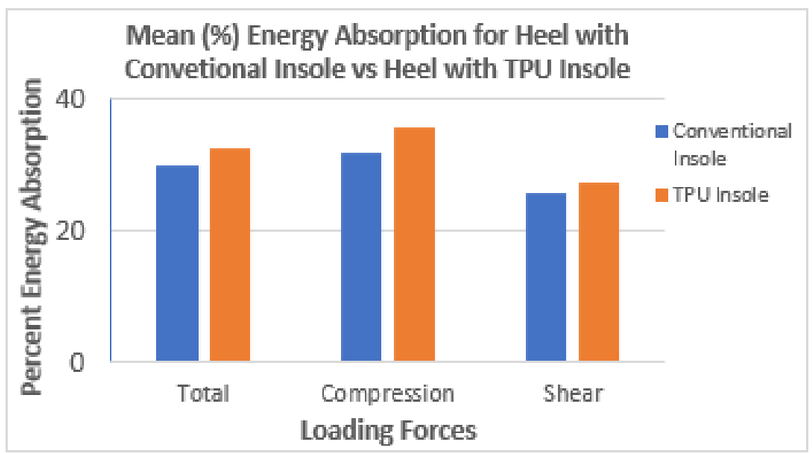


Figure 2. Mean (%) energy absorption for a conventional heel with a conventional insole versus a conventional heel with a TPU insole

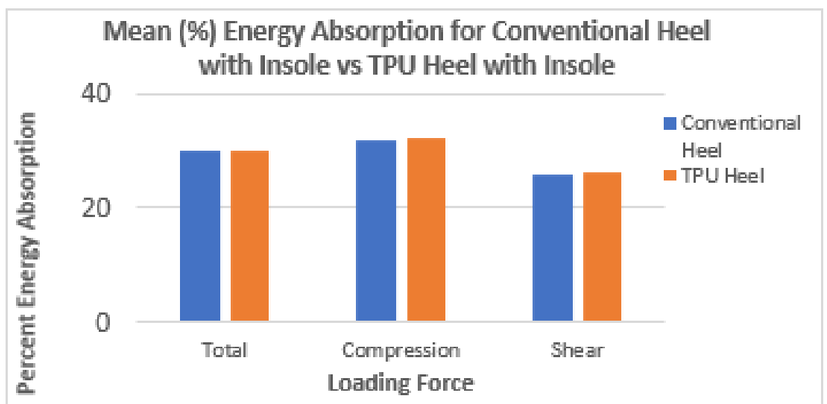


Figure 3. Mean (%) energy absorption for a conventional heel with a conventional insole versus a TPU heel combined with a conventional insole

https://sesbass21.weebly.com/

Static Measures of Prosthetic Show Materials for Transtibial Amputees

CONCLUSION: The results of this preliminary research show that the TPU material has the potential to replace either a conventional heel lift or conventional foam insole that are commonly used by amputees with their prosthetic devices. More specifically, this outcome highlights the potential use of the TPU material for future research with humans to examine its capability to absorb energy and attenuate transient forces in amputee populations to decrease the risk of injury without disrupting their gait mechanics. This information will allow clinicians to provide solutions for transtibial amputees that are low cost and improve their walking symmetry.

The Effects of Knee Bracing on Reactive Soccer Agility, Kicking Velocity, and Muscle Activation

Fimognari, J.1 & Paolo Sanzo 1

1Lakehead University, Ontario, Canada

BACKGROUND/OBJECTIVES: Low brace compliance remains an issue among athletic populations and whether protective knee braces impact soccer performance after anterior cruciate ligament (ACL) reconstruction is unclear. In soccer, we also see the highest reinjury rate for ACL injuries but the reason for this is not well understood. The purpose of this study is to see if performance differences exist between soccer players who have undergone ACL reconstruction and do not wear a brace and those who
do wear a brace.
METHOD: Prospective participants with an ACL injury will be recruited using purposive and snowball sampling and placed into one of two groups: 1) use a brace and 2) do not use a brace. Participants will complete three trials of a soccer-specific modified Y-agility test to measure reactive agility time. Participants will also complete a kicking drill which will measure kicking velocity. Surface electromyography (SEMG) of the participants' biceps femoris (BF), rectus femoris (RF), and gluteus medius (GM) will also be measured during the completion of the agility and kicking tasks.
Statistical analysis will be completed for the variables of interest using descriptive and inferential statistics using IBM SPSS© statistics software, with an alpha level of p<05.
CONCLUSION/IMPLICATION: It is hypothesized that the use of a protective knee brace will result in no significant difference in reactive agility time, a moderate increase in kicking velocity, and SEMG will significantly increase in the BF and RF, due to the skin contact from the brace activating sensory receptors leading to improvements in neuromuscular control of the knee joint, while the GM will have a moderate increase. The results can be used to determine if knee bracing affects soccer players' performance abilities.

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Brigthening Up Brain Injuries: The Design, Synthesis and Characterization of a PET Diagnostic Agent for Neuronal Trauma

Jessica Allingham1, Dr. Wely Floriano 1 , Dr. Michael Cambell 1,2

1Lakehead University, Ontario, Canada
2Thunder Bay Regional Health Research Institute, Ontario, Canada

BACKGROUND/OBJECTIVES: The expression of S100B is upregulated in the presence of neuronal trauma, such as concussions. This correlate with astrocyte hypertrophy and proliferation as well as inflammation, thus S100B is a reliable biomarkers of the onset and progression of astrogliosis in neuronal trauma. Concussions are an increasingly significant issue, especially in the sports community. There is currently no single standard for diagnosing mild traumatic brain injuries. This research is conducted to fill the void in concussion diagnostics with a fluorine-18 radiotracer.

METHOD: This research is conducted to fill the void in concussion diagnostic techniques by identifying hit compounds using virtual screening, synthesizing them and labelling them with 18F. The radiopharmaceutical will bind to the biomarker. Once bound, the build up of S100B can effectively be imaged using a PET scanner to aid in the diagnosis of mild brain trauma. The ability to bind with the biomarkers will be tested using unlabelled probes using enzyme-linked immunosorbent assay (ELISA) experiments.

RESULTS: A hit compound for S100B, selected after virtual screening has been synthesized, radiolabeled and tested in vitro. The radiotracer performed very well and will continue to be tested using a cell assay.

CONCLUSION/IMPLICATION: This research could provide a very exciting advancement in concussion diagnostics to fill an eminent void in the health care system.

The Development of New High-capacity Solid Resin for Use in Mo/Tc 99m Generators

Clifford Agyei, Michael Campbell

Lakehead University, Ontario, Canada

Tc-99m is the most widely used radioisotope in nuclear medical imaging accounting for over 76000 scans per day. Currently, all Tc-99m used in Canada are derived from Mo-99/Tc-99 generators where Mo-99 is isolated from the fission of U-235 produced by a limited number of aging reactors. These reactors rely on highly enriched uranium (HEU) as feed stock. There is increasing pressure to move away from uranium sources that requires HEU because of its alternate use in weapons. This presentation will focus on the development of a new high-capacity solid support resin for use in Mo/Tc-99m generators resulting from non-uranium-based processes which to permit higher loading capacity and allow for use with low specific activity Mo-99 such as that produced by linear accelerators and neutron activation.

Development of Small Molecule Ligands Targeting the Lysophosphatidic Acid Receptor 1 for PET Imaging

Jonas E. Olsen1, Wenjie Liu2, Jinqiang Hou3
1,2,3Lakehead University, Ontario, Canada

BACKGROUND/OBJECTIVES: Lysophosphatidic acid receptors are a class of G protein coupled receptors responsible for a range of signaling functions, typically mediated by lysophosphatidic acid. Lysophosphatidic acid receptor 1 (LPA1) signals various processes such as cell motility, proliferation, and survival, as well as angiogenesis. Due to the significant upregulation of LPA1 in some types of cancer, it has high potential to be a target for positron emission tomography (PET) imaging agents. Using radiolabeled small molecules as imaging agents in PET is a relatively unexplored modality, and it could provide a means of quickly and efficiently imaging tumours with high contrast. Our group is focused on the development of novel small molecule LPA1 ligands to be radiolabeled and tested as imaging agents.

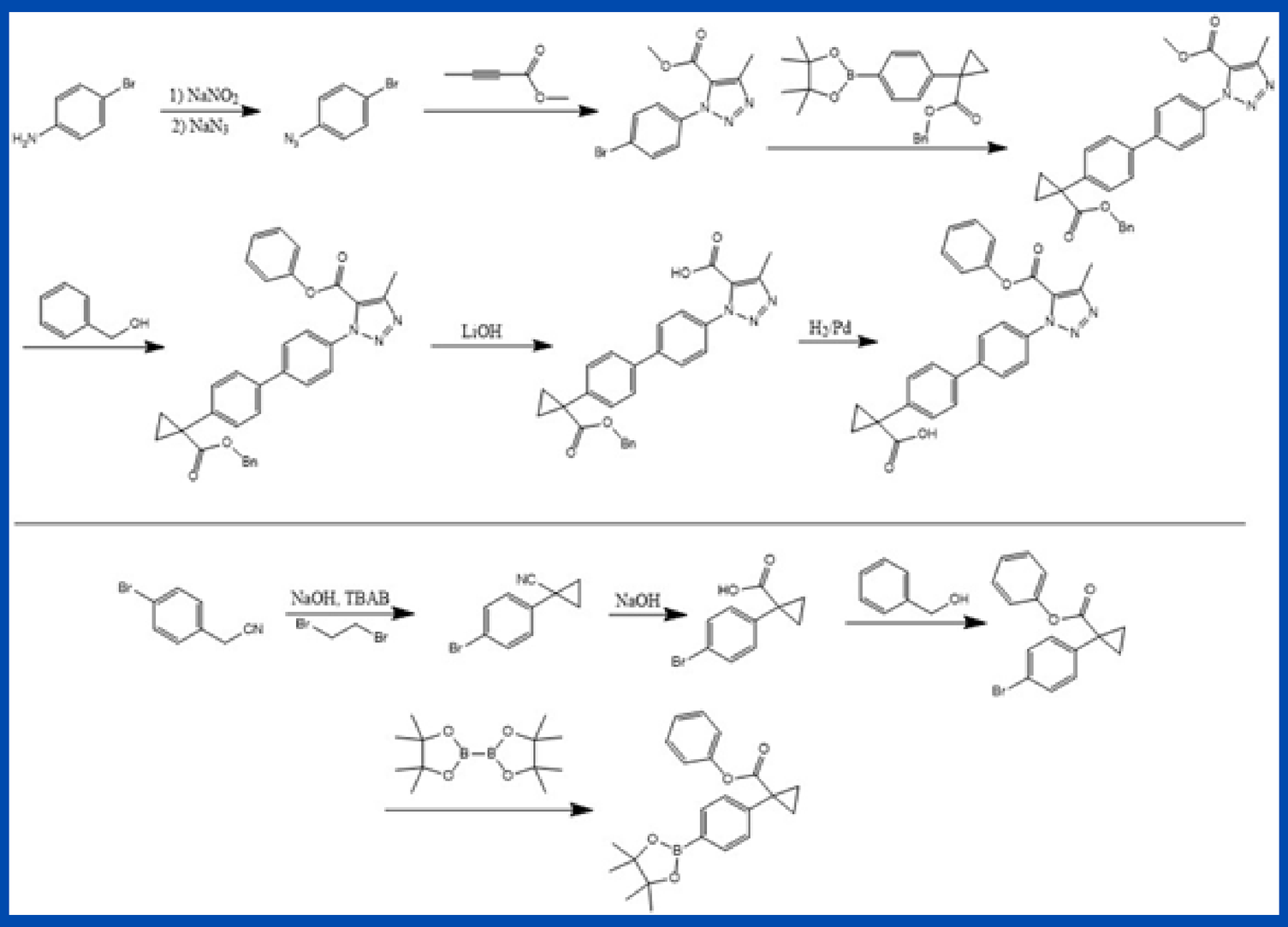
METHOD: Our current approach is to create a small library of analogues based on reported LPA1 antagonists through multi-step organic synthesis. Once a large enough library is created, ligand binding will be assessed in vitro and ligand structure will be optimized. Promising candidates will be radiolabeled and tested in vivo.

RESULTS: As of now we are developing novel ligands; most of our current work is focused on optimizing synthetic pathways and synthesizing more analogues. We have completed several steps of a multistep organic synthesis scheme, and plan on having more data to present by the end of August.

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Development of Small Molecule Ligands Targeting the Lysophosphatidic Acid Receptor 1 for PET Imaging



CONCLUSION/IMPLICATION: PET imaging agents developed to image tumours could have significant implications for cancer diagnosis and treatment. PET provides a quick and non-invasive means of taking good resolution images, and designing small molecule ligands could allow for imaging of cancer types inaccessible to other imaging modalities.

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Thick Data Analytics for Segmenting COVID-19 from CT-Scans

JDarien Sawyer1, Jinan Fiaidhi1, Sabah Mohammed1

1Lakehead University, Ontario, Canada

BACKGROUND/OBJECTIVES: Machine learning tools must be trained with large amounts of data to make learning models perform with high accuracy. In many applications such as healthcare and medical imaging, collecting big amount of data is sometimes not feasible. Thick data analytics attempt to solve this challenge by incorporating qualitative interventions like expert's heuristics to annotate and augment training data. We investigate the addition of heuristics of a radiologist for identifying COVID-19 with few cases of CT-Scan images using image annotation and augmentation techniques. Identification of new COVID-19 is carried out utilizing transfer learning in a Siamese network which extracts the features of the augmented images compared to the new CT-Scan image to determine whether the new image is COVID-19 positive using a similarity criterion.

METHOD: We use augmentations expected to enhance the characteristic hazy gray areas indicating ground glass opacities, a heuristic used by radiologists to indicate COVID-19: center cropping, contrast, random erasing, sharpening kernel, and bounding boxes. Our SNN was trained using 40 training images: 20 covid positive and 20 covid negative. The network was tested using 5 testing images: 3 covid positive and 2 covid negative. Testing images are compared to a covid positive and a covid negative image. Euclidean distance is used as similarity criterion, and a classification is considered correct if the smaller distance is between the images with the same classification.

https://sesbass21.weebly.com/

Thick Data Analytics for Segmenting COVID-19 from CT-Scans

RESULTS:

TABLE I. PREDICTION ACCURACY OF SNN AFTER DIFFERENT IMAGE AUGMENTATIONS

Augmentation	Accuracy (%)					
	Tests					Average
	1	2	3	4	5	
No filters	60	60	0	20	60	40
Center crop	60	20	40	60	40	44
Contrast	40	60	100	80	60	68
Random erasing	60	40	60	100	60	60
Shapren kernal	60	60	40	60	40	52
Bounding boxes	60	60	60	100	40	64

CONCLUSION/IMPLICATION: Results show that the proposed model of using augmentation heuristics trained on small datasets outperforms classification capabilities if trained on unaltered data. By continuing research of thick data heuristics, we aim to develop methods for an automatic diagnostic tool with classifications accurate enough to be incorporated in everyday healthcare. Additional heuristics-based augmentations will be investigated like key points and landmarking similarity, as well as testing the use of multiple augmentations at once.

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Development of an 18F Radiolabeling Method Using Solid Phase Chemistry

Branden Mandaric

Supervisor: Dr. Michael Campbell
Lakehead University

Background/Objectives: The expansion of clinical applications for positron emission tomography (PET) is dependent on the development of new PET tracers. One challenge in the design/synthesis of a radiotracer is the process of adding the radioactive component. PET tracers must incorporate a radioactive positron emitting isotope, the most popular being 18F. With a decay half-life of 110 minutes, it is important that 18F radiolabeling synthesis is done quickly. Our goal is to design a simple and fast method of incorporating 18F into a molecule.

Method/Preliminary Results: Performing reactions using solid phase reagents has the potential to simplify the synthesis and speed up purification through filtration. This project focuses on using solid phase methods to radiolabel a small molecule and couple this molecule to compounds that need radiolabeling. We are currently developing a method for solid phase fluorination and have already refined a solid phase coupling procedure to work quickly and efficiently in a way that is ideal for hot synthesis.

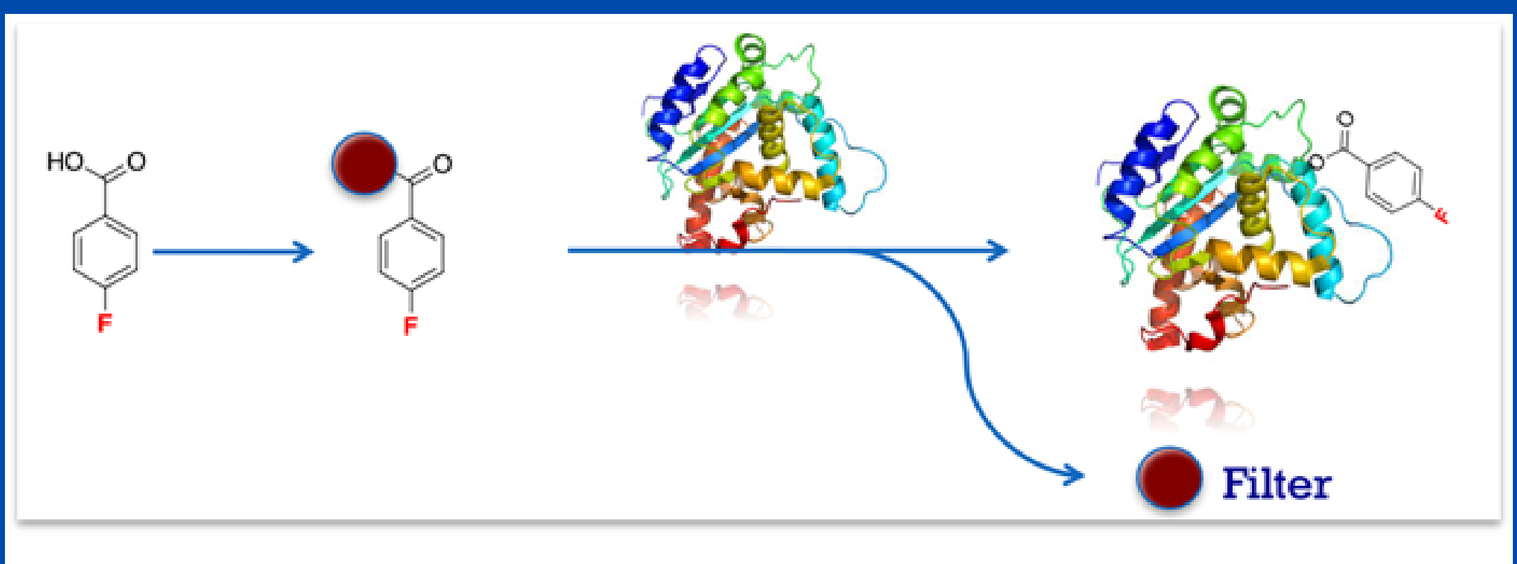


Figure – Using a solid phase coupling procedure the left-over starting material can be filtered, simplifying purification.

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Designing and Otimizing Hand Gesture Detection and Recognition Using Advanced Computational Techniqes

Shiv Himanshubhai Hansoti1, Devarsh Ajitbhai Patel1, Dr. Jinan Fiaidhi1

1Lakehead University, ON, Canada

BACKGROUND/OBJECTIVES:
Over 2.3% of the world population suffer from speech disorder and use sign language to communicate. Most of the population do not learn sign language. Hence, there is a communication gap. It became our motivation to build a bridge and to develop a hand gesture recognition system for American Sign Language (ASL) which can serve as a translator. In most of the current research work, the size of the dataset was small, various edge cases like hand color, brightness, size of hand, background colours were not considered during testing due to which performance of the designed system was reduced. Hence, we are trying to create an optimized solution for this partially solved problem.

METHOD: Detecting a gesture is a challenging problem. Various parameters such as complex background, different camera angles, size and color of hand, and opposite hand edge case make the problem more difficult. Thus, in our research we propose a fast and robust method for hand gesture recognition based on RGB video. In order to achieve desired results, first we detect the skin based on their color. Then the region of interest is segmented. After segmentation the RGB image is converted to binary image.. Finally we recognize the gesture using CNN. The results of our system demonstrate that the proposed method is efficient to recognize gestures with a higher accuracy.

RESULTS: Using the above methodology, the system handled major of the edge cases like background light, size difference and other colour ambiguities and detected the gestures with accuracy of 83% and using natural language processing techniques it translates the performed gesture into its meaning in real-time.

CONCLUSION/IMPLICATION: In this research, we have Analysed a dynamic hand gesture recognition system for American Sign Language, capable of translating the gesture into text and the sound.

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Meidcal Workflow Design and Planning Using Node-Red Data Fusion

Lisa Ewen1, Sabah Mohammed1, Arnold Kim1

1Lakehead University Department of Computer Science, Ontario, Canada

BACKGROUND/OBJECTIVES: The process of clinical planning relies heavily on different data points about a patient, and these data points are often scattered among different reports, charts, EMR/EHR systems, etc. In order to identify all of the pertinent information regarding a patient, and keep that information in mind when making important clinical decisions, healthcare providers are undertaking a significant amount of mental strain – or cognitive load – to complete clinical tasks. EMR/EHR systems are often intended to help mitigate this cognitive load, and improve overall speed, accuracy, and workloads. Unfortunately, most of these systems fail in this direction, and often do not provide enough support in the way of clinical planning. We propose a tool using data fusion processes which can be used to provide a workflow-based design that better encompasses the thought process and procedures healthcare providers follow in order to make meaningful clinical plans

METHOD: Using Node-Red, a series of custom node-types were implemented to define patient-relate information, data sources, perform data fusion, and monitor patients using system alerts. These nodes are supported by a DSL that allows the prototype to enact the appropriate functions, as well as allow users to define the rules that the data abides by while undergoing data fusion to produce the appropriate outputs. These nodes are demonstrated through an implementation of 3 different care pathways to simulate different clinical workflows.

CONCLUSION/IMPLICATION: Through the care pathways, it is evident that data fusion has the capacity to provide meaningful clinical plans using data fusion. This process provides a more complete overview of a patient than a singular dataset, and with proper research and development this tool may also provide opportunities for machine learning and automation to incorporated to allow further time and cognitive load reduction among healthcare providers.

A Newly Characterized Steptomyces sp. is of High Potential Value in Converting Organic Wastes into Value-added Bioproducts

Sarita Shrestha1, Wensheng Qin1
1Department of Biology, Lakehead University, Thunder Bay, Ontario, P7B 5E1
*Corresponding author: wqin@lakeheadu.ca

Background/Objectives: The increase in population has a direct or indirect relation with increase in agro-waste. These waste if not managed properly, there may be various subsequences which may further develop health issues. However, those biomasses can be utilized as resources for enzymes, bioactive compounds, pectin production, and substrate for the growth of microorganisms as they are renewable and inexpensive natural resource. In addition, natural resource utilization help solving the energy shortage problem, pollution concerns, and waste disposal issues.

Method: In this study, forest soil was collected, and the pectinolytic bacteria were screened by flooding potassium iodide over the colonies. Further, the pectinolytic bacteria were identified based on morphological and microscopical characteristics, different biochemical tests, and 16s rDNA sequencing. Different biomasses were used as substrate for enzymes production, for bioactive compound screening and studied their degradation. In addition, total phenolic content and flavonoids of different biomasses were analyzed.

Results: A bacterial isolate was identified as Streptomyces sp. and it was used for pectinase production using different agro-waste. Among biomasses, pomegranate peel illustrated as the best substrate for pectinase production.

A Newly Characterized Steptomyces sp. is of High Potential Value in Converting Organic Wastes into Value-added Bioproducts

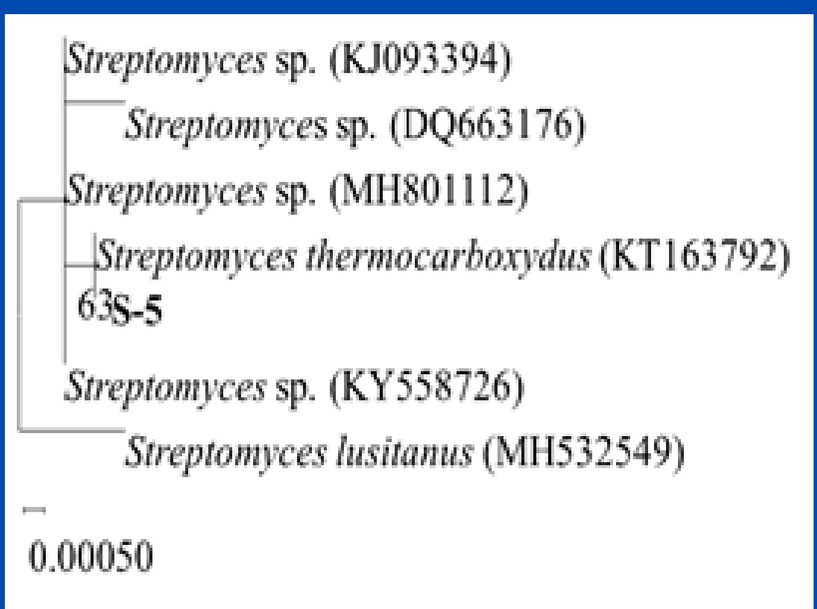


Fig.1 Phylogenetic relationship

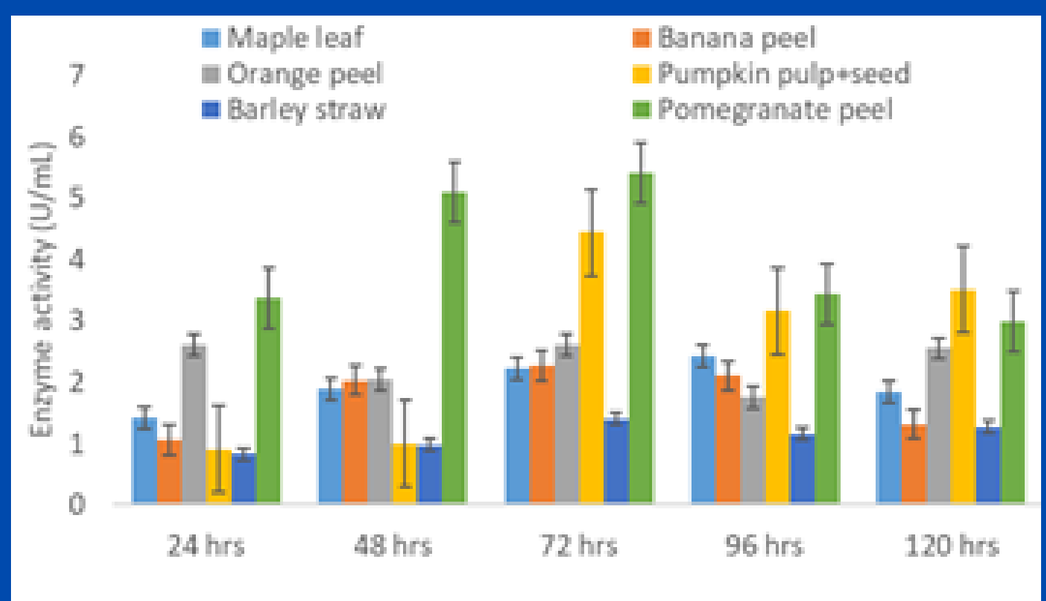


Fig.2 Pectinase activity from different biomasses

Conclusions:Streptomyces sp., one of the isolated pectinolytic bacteria from forest soil, was used for pectinase production using different agro-waste. Among biomasses, pomegranate peel illustrated as the best substrate for pectinase production. Simple pretreatment like washing biomasses with warm water might decrease the production cost. However, further details such as different optimization conditions for maximum production of different value-added products and characterization of enzymes for industrial applications should be explored.

Keywords: pectinase, agrowaste/biomass, Streptomyces sp., degradation

Malting Effluent for Microalgae Cultivation and Subsequrnt Biomass and Lipid Production

Janak Raj Khatiwada1, Sarita Shrestha1, Chonlong Chio1, Xuantong Chen1, Aristide Laurel Mokale Kognou1, Haipeng Guo2, Wensheng Qin1*
1 Department of Biology, Lakehead University, Thunder Bay, Ontario P7B 5E1, Canada
2 School of Marine Sciences, Ningbo University, Ningbo, 315211, China
* E-mail: wqin@lakeheadu.ca

Microalgae can effectively grow in nutrient-rich environment and have ability to accumulate nutrients from wastewater. Malting effluent is rich in nutrients suitable for microalgae cultivation. However, there are limited studies on growth characteristics of freshwater microalgae using malting effluent as cultivation medium. This study examined the potential of diluted malting effluent for growth of freshwater green algae Chlorella sp. and Chlamydomonas sp. isolated from northern Ontario and subsequent for biomass and lipid production. Under a 18:6 light-dark cultivation cycle, a distinct linear increasing trend of chlorophyll content was observed in both Chlorella sp. and Chlamydomonas sp. Chlorella sp. showed highest chlorophyll content in 50% of dilution concentration of malting effluent whereas 70% dilution concentration was most productive for Chlamydomonas sp. The total lipid content was higher in 50% of dilution concentration of malting effluent in both Chlorella sp. (max 20.5%-min 11.5% of dry weight) and Chlamydomonas sp. (max 39.3%-min 25.9% of dry weight). The results showed that the non-sterile diluted malting effluent is an excellent medium for microalgae cultivation.
Keywords: Microalgae, Non-sterile malting effluent, Chlorophyll content, Lipid accumulation

Production of Laccase from *Serratia proteamaculans* and its Potential in Decolourisation of an Anthraquinonoid Dye - Remazol Brilliant Blue R

Nadia Sufdar Ali1, 2, Fang Huang2, Dr. Trent Yang2, and Dr. Wensheng Qin1

1Department of Biology, Lakehead University, Thunder Bay, Ontario, Canada, 2Aquatic and Crop Resource Development Research Centre (ACRD), National Research Council, Ottawa, Ontario, Canada

A potential ligninolytic γ- proteobacterial strain originally screened and isolated from decomposed biomass near Ottawa riverside was identified as Serratia proteamaculans. The impacts of cultural conditions on laccase production of the bacterial strain in submerged culture conditions was investigated using one-variable-at-a-time methodology (OVAT). The bacterial strain was found to produce laccase between 20-35°C (opt. 30°C) and 6 - 11 pH (opt. 9 pH). Maximum enzyme production was observed after 48 hours of incubation time and the production of laccase increased at alkaline pH. Laccase production was enhanced by using yeast extract and NaNO3 as organic and inorganic nitrogen sources, respectively. Significant increase in laccase production was found in the presence of cations like Cu2+, Li+, Mn2+, Ca2+ (0.5mM) and in the presence of organic solvents like acetone and chloroform (10%). The OVAT method of optimization resulted in a 6-fold increase (3523 U/ml) in the yield of laccase from the unoptimized media. Decolourisation of recalcitrant anthraquinone dye Remazol Brilliant Blue R (RBBR) by Serratia proteamaculans was also investigated and the bacterial strain effectively decolourized the dye at an alkaline pH range in 48 hours of incubation. The results of this study indicate a promising potential of this strain and its enzymes in industrial applications and wastewater treatments.
Keywords: Laccase; screening; Serratia proteamaculans; optimization; Remazol dye

A Deep Insight into the Applications fo Computational Fluid Dynamics in Bio-Engineering Problems

B. Afra 1 , A. Tarokh 1,2

1 Department of Science and Environmental Studies, Lakehead University, Thunder Bay, CANADA,
2 Department of Mechanical Engineering, Lakehead University, Thunder Bay, CANADA,

* Email: bafra@lakeheadu.ca

Study the self- propulsion of flexible filaments in viscous flows has seen considerable attention due to its promise for bioengineering applications. Motion of microorganisms by their flagella and cilia, reciprocal motion of scallops, semi-driven motion of sperms, bacterial flagellar swimming motion, fishing and heaving motion of aquatic creatures and development of artificial micro-swimmers are the most attractiv research areas whose numerical simulations require a deep understanding on efficient and less-costly numerical methods in concept of computational fluid dynamics. Analysis the fluid dynamics of a flexible, swimming organism is namely Fluid Induces Vibration (FIV). When it comes to the accurate capturing of flags propulsion, the analysis becomes very difficult, even when an organism's waveform is assumed to be as a driver component (known in advance). It has been shown that simulation of microorganism motility is the easiest study as the low Reynolds number does simplify the mathematical analysis. In fact, the equations of fluid mechanics in this regime are linear. However, even at low Reynolds numbers, the unsteady wavy configuration of a microorganism body is a complex nonlinear system, comprising of the organism's force generation mechanisms, its passive highly flexible structure, and the unsteady external momentum. To the best of authors knowledge, the problems of FIV are not extensively studied when fluid is non-Newtonian. On the other hand, literature indicates that some real problems like ciliary motions in airways require study of the interaction between non-Newtonian fluid and structures. Nevertheless, a robust model for simulation of non-Newtonian fluid in the vicinity of the wavy shape is almost rare. Therefore, authors proposed a hybrid immersed boundary- non-Newtonian lattice Boltzmann method linked to the Lattice Spring Model to investigate Fluid-Induced Vibration (FIV) in non-Newtonian fluid flow. In this concept, complex partial differential equations of structure motion replaced by much more simple algebraic correlations.

Point-of-care detection of *Salmonella* in food and water using an optical aptasensor based on g-C 3N4@Cu2O composites

Afrooz Tarokh 1 , Azam Bagheri Pebdeni 1 , Morteza Hosseini 1

1 Department of Life Science Engineering, Faculty of New Sciences & Technologies, University of Tehran, Tehran, Iran

BACKGROUND: Food borne diseases are not only one of the leading causes of death worldwide, but also a serious obstacle to socioeconomic development of countries. These diseases are mainly caused by
consumption of food, water or other beverages contaminated with some pathogens, which can be transmitted through the digestive system. Among these pathogens, the importance of Salmonella is undeniable, since it has been known as the leading cause of foodborne bacterial infections in many countries for at least recent 100 years. Accordingly, a new colorimetric aptasensor equipped with a novel composite of graphitic carbon nitride (g-C 3 N 4) nanosheets and copper oxide (I) (Cu 2 O) nanocrystals was presented for detection of Salmonella typhimurium (S .typhimurium).
METHOD: A composite of g-C 3 N 4 nanosheets and Cu 2 O nanocrystals was employed as an optical biosensor in which Salmonella-aptamer could identify the presence of S .typhimurium. In fact, the dual-purpose structure of this composite could simultaneously contribute to superb peroxidase-like activity and interaction with label-free aptamer. Although g-C 3 N 4 @Cu 2 O could effectively create a visible blue color following the oxidation of 3,3',5,5'-tetramethylbenzidine (TMB) in presence of hydrogen peroxide (H 2 O 2), this catalytic activity of composite was severely decreased after the interaction with aptamers.

RESULTS: Following the presence of S. typhimurium in sample, aptamers bound to their specific target. subsequently, catalytic activity of g-C 3 N 4 @Cu 2 O was enhanced in proportion to S. typhimurium concentration. Under optimized conditions, this aptasensor exhibited an excellent detection performance in a range from 1.5×10 1 to 1.5×10 5 CFU/mL(Fig 1), with the detection limit of 15 CFU/mL. Furthermore, portable detection of S. typhimurium using the paper-based model of this method was successfully performed in just 6 min (Fig.2).

CONCLUSION: Analysis of spiked milk samples revealed high potency of this method as an ultrasensitive, rapid and label-free promising tool for S. typhimurium detection.

Point-of-care detection of *Salmonella* in food and water using an optical aptasensor based on g-C 3N4@Cu2O composites

Afrooz Tarokh 1 , Azam Bagheri Pebdeni 1 , Morteza Hosseini 1

1 Department of Life Science Engineering, Faculty of New Sciences & Technologies, University of Tehran, Tehran, Iran

BACKGROUND: Food borne diseases are not only one of the leading causes of death worldwide, but also a serious obstacle to socioeconomic development of countries. These diseases are mainly caused by
consumption of food, water or other beverages contaminated with some pathogens, which can be transmitted through the digestive system. Among these pathogens, the importance of Salmonella is undeniable, since it has been known as the leading cause of foodborne bacterial infections in many countries for at least recent 100 years. Accordingly, a new colorimetric aptasensor equipped with a novel composite of graphitic carbon nitride (g-C 3 N 4) nanosheets and copper oxide (I) (Cu 2 O) nanocrystals was presented for detection of Salmonella typhimurium (S .typhimurium).
METHOD: A composite of g-C 3 N 4 nanosheets and Cu 2 O nanocrystals was employed as an optical biosensor in which Salmonella-aptamer could identify the presence of S .typhimurium. In fact, the dual-purpose structure of this composite could simultaneously contribute to superb peroxidase-like activity and interaction with label-free aptamer. Although g-C 3 N 4 @Cu 2 O could effectively create a visible blue color following the oxidation of 3,3',5,5'-tetramethylbenzidine (TMB) in presence of hydrogen peroxide (H 2 O 2), this catalytic activity of composite was severely decreased after the interaction with aptamers.

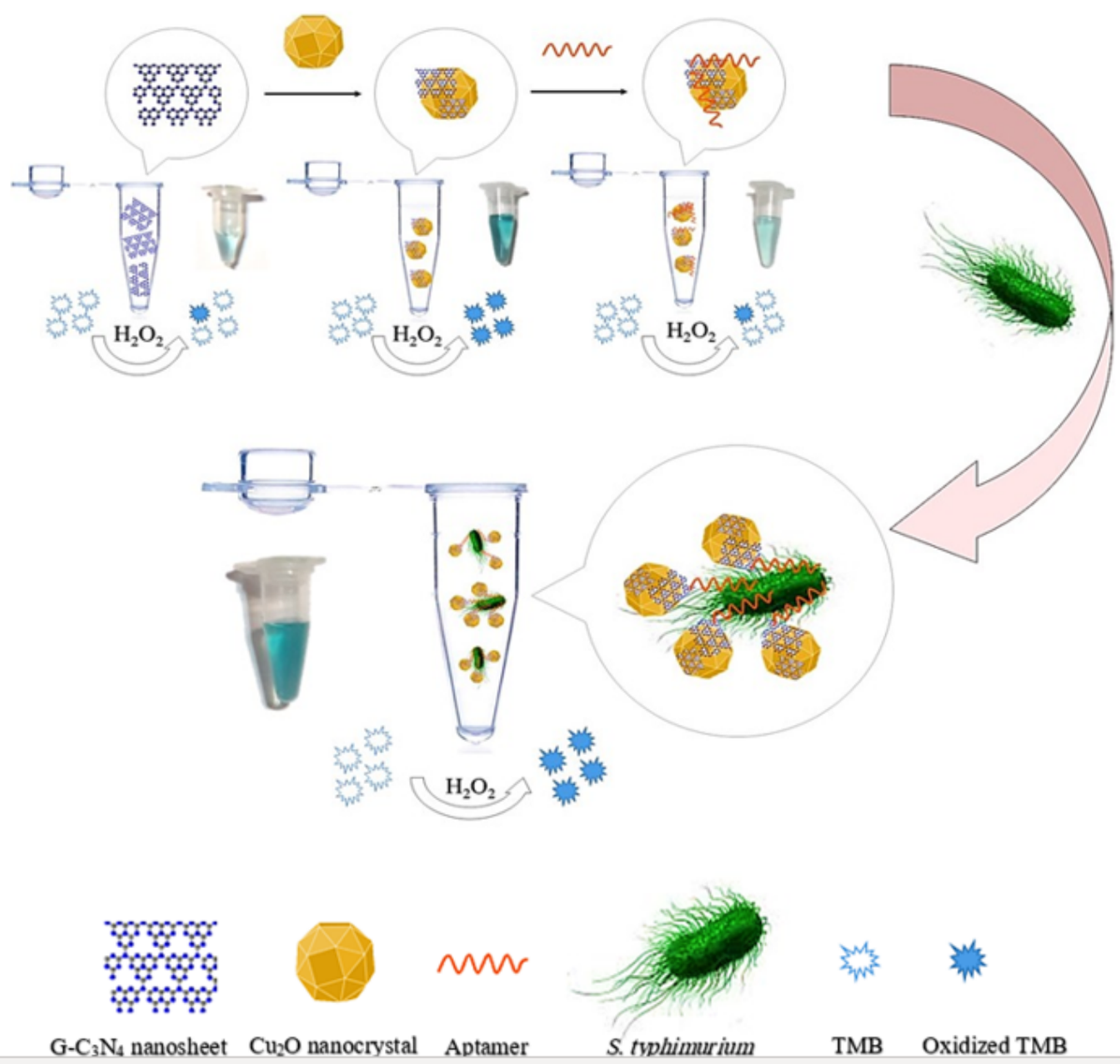
RESULTS: Following the presence of S. typhimurium in sample, aptamers bound to their specific target. subsequently, catalytic activity of g-C 3 N 4 @Cu 2 O was enhanced in proportion to S. typhimurium concentration. Under optimized conditions, this aptasensor exhibited an excellent detection performance in a range from 1.5×10 1 to 1.5×10 5 CFU/mL(Fig 1), with the detection limit of 15 CFU/mL. Furthermore, portable detection of S. typhimurium using the paper-based model of this method was successfully performed in just 6 min (Fig.2).

CONCLUSION: Analysis of spiked milk samples revealed high potency of this method as an ultrasensitive, rapid and label-free promising tool for S. typhimurium detection.

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Point-of-care detection of *Salmonella* in food and water using an optical aptasensor based on g-C 3N4@Cu2O composites



Scheme 1 Schematic illustration of colorimetric aptasensor for *S. typhimurium* detection

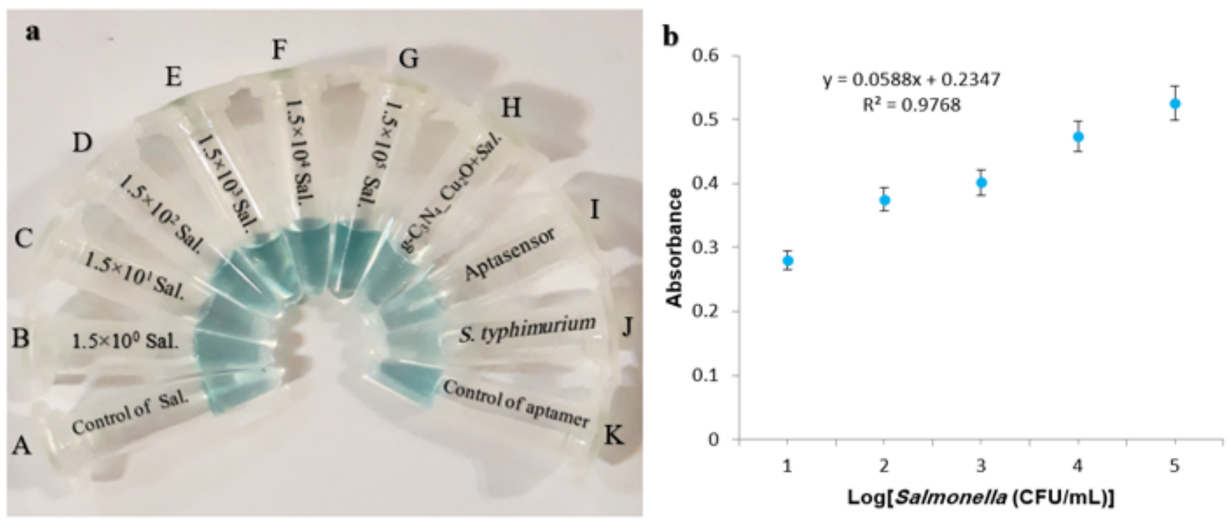


Figure 1. Positive correlation between the intensity of blue color, the absorbance and the logarithm of different concentration of *S. typhimurium* within the range of 1.5×10^1 to 1.5×10^5 CFU/mL

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Point-of-care detection of *Salmonella* in food and water using an optical aptasensor based on g-C 3N4@Cu2O composites

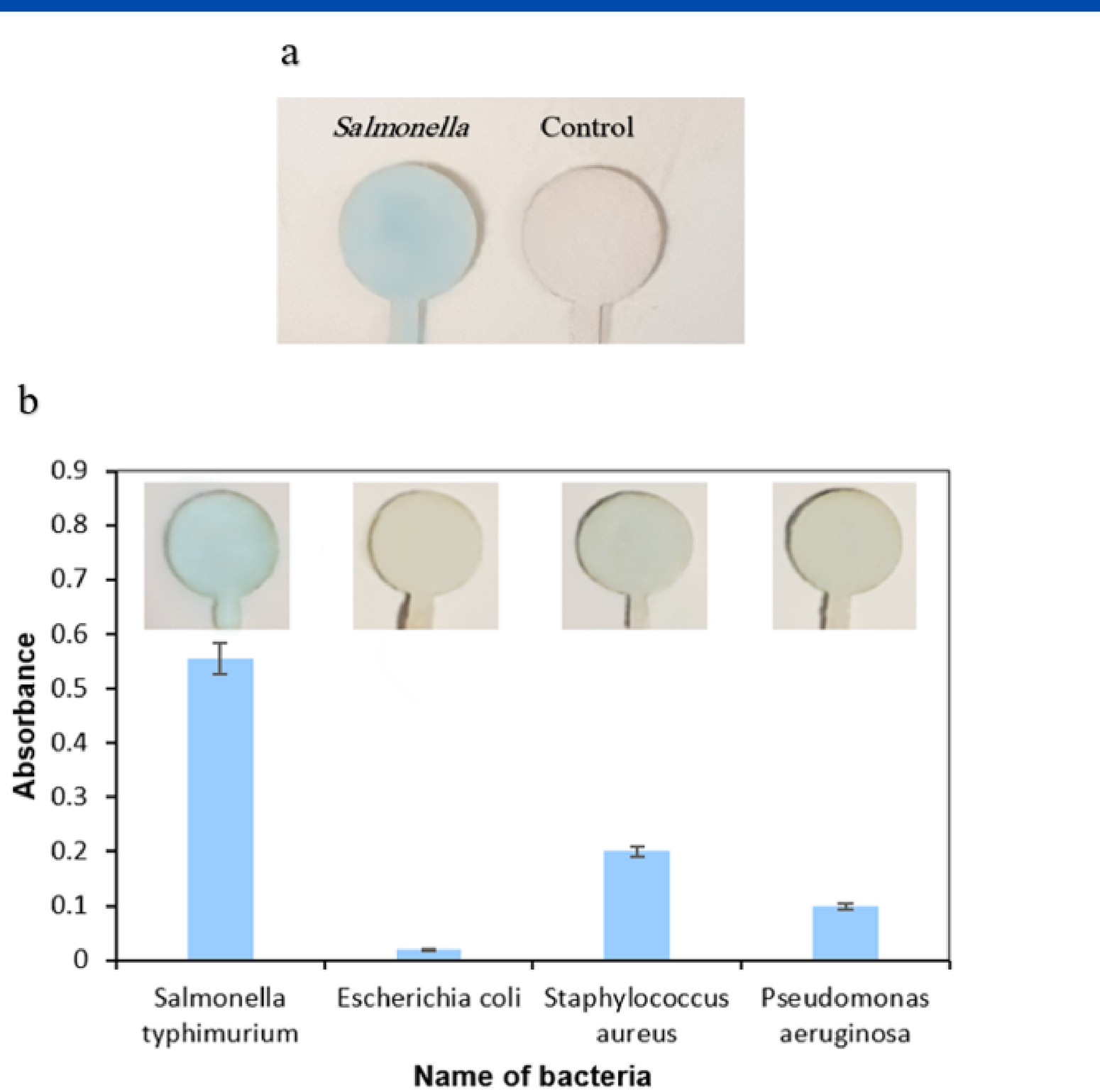


Figure 2. a) Paper-based detection of *S. typhimurium*, b) Selective detection of *S. typhimurium*

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Developing a Procedure for Radiolabeling Chemotherapy Drugs

Sarah Tribe1, Dr. Michael Campbell1,2

1Lakehead University, Ontario, Canada
2Thunder Bay Regional Health Research Institute, Ontario, Canada

BACKGROUND/OBJECTIVES:

Fluorine-18 fluorodeoxyglucose (FDG) is commonly employed for cancer detection as it accumulates in tumors, allowing them to be observed using PET imaging. However, this approach does not reveal appropriate cancer treatments as each cancer is different, needing targeted chemotherapy. After an initial treatment, a drug's efficacy is investigated to see its effect on the cancer; if no improvement is observed, a new drug is chosen and the process repeats. An objective of this project is to radio-fluorinate chemotherapeutic drugs. A patient will receive a drug and a PET scan can be performed. If the cancer is visible on the PET scan, then the drug has reached its target and will most likely be effective, eliminating the trial-and-error in patient treatment. Fluorine-18 has a half-life of 110 minutes so hot synthesis and purification must be performed quickly. Solid phase synthesis of F-18 radiolabelled compounds is being investigated to accelerate this process with filtration being the only necessary purification step.

METHOD/RESULTS:

The fluorination of alcohols using a literature Mitsunobu procedure was attempted with limited success. The procedure was successful when adding a pre-fluorinated chain with an alcohol to a free alcohol on a molecule (dehydration). The proposed solid-phase synthesis was performed using a sulphonyl chloride resin and attaching it to an alcohol as a leaving group. This reaction was successful using different fluorine sources; however, the reaction produced side-products that need to be eliminated or prevented altogether.

CONCLUSION/IMPLICATION:

Current cancer drug choice is time-consuming due to a trial-and-error process. This research attempts to remove guesswork from chemotherapy choice as well as proposing a synthetic pathway that is rapid, requiring little purification. Future research includes improving resin reactions and applying the fluorination of an alcohol to pre-existing cancer drugs to enhance their therapeutic use.

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Developing a Procedure for Radiolabeling Chemotherapy Drugs

Sarah Tribe1, Dr. Michael Campbell1,2

1Lakehead University, Ontario, Canada
2Thunder Bay Regional Health Research Institute, Ontario, Canada

BACKGROUND/OBJECTIVES:

Fluorine-18 fluorodeoxyglucose (FDG) is commonly employed for cancer detection as it accumulates in tumors, allowing them to be observed using PET imaging. However, this approach does not reveal appropriate cancer treatments as each cancer is different, needing targeted chemotherapy. After an initial treatment, a drug's efficacy is investigated to see its effect on the cancer; if no improvement is observed, a new drug is chosen and the process repeats. An objective of this project is to radio-fluorinate chemotherapeutic drugs. A patient will receive a drug and a PET scan can be performed. If the cancer is visible on the PET scan, then the drug has reached its target and will most likely be effective, eliminating the trial-and-error in patient treatment. Fluorine-18 has a half-life of 110 minutes so hot synthesis and purification must be performed quickly. Solid phase synthesis of F-18 radiolabelled compounds is being investigated to accelerate this process with filtration being the only necessary purification step.

METHOD/RESULTS:

The fluorination of alcohols using a literature Mitsunobu procedure was attempted with limited success. The procedure was successful when adding a pre-fluorinated chain with an alcohol to a free alcohol on a molecule (dehydration). The proposed solid-phase synthesis was performed using a sulphonyl chloride resin and attaching it to an alcohol as a leaving group. This reaction was successful using different fluorine sources; however, the reaction produced side-products that need to be eliminated or prevented altogether.

CONCLUSION/IMPLICATION:

Current cancer drug choice is time-consuming due to a trial-and-error process. This research attempts to remove guesswork from chemotherapy choice as well as proposing a synthetic pathway that is rapid, requiring little purification. Future research includes improving resin reactions and applying the fluorination of an alcohol to pre-existing cancer drugs to enhance their therapeutic use.

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

The effect of photoperiod on *Pleurochrysis dentata* and calcium carbonate accumulation and the novel discovery of calcium carbonate shell function

Xuantong Chen 1 , Fan Lu 2 , Wensheng Qin 1

1. Department of Biology, Lakehead University, 955 Oliver Road, Thunder Bay, Ontario, P7B 5E1, Canada
2. School of Civil Engineering, Architecture and Environment, Hubei University of Technology, Wuhan, China, 430068

BACKGROUND/OBJECTIVES:

Abiotic stresses produce reactive oxygen species (ROS) causing oxidative stress. The reaction between ROS and biomolecules will inactivate biomolecules and lead to organ dysfunction, cell structure change, and gene mutagenesis. Algae have antioxidant defense systems for coping with harmful effects of ROS and maintaining them under oxidative stress. However, the way of marine microalgae Pleurochrysis dentata responds to oxidative stress is not clear. This study explored two directions by adjusting the photoperiod to cultivate P. dentata. [1] Effect of oxidative stress on calcium carbonate and oil accumulation of P. dentata. [2] Oxidative stress caused by long-wavelength light of P. dentata.

METHOD:

We set 6 different photoperiod cycles: 10L/14D, 12L/12D, 14L/10D, 16L/8D, 18L/6D, 20L/4D. Total lipid contents of P. dentata samples were determined using the standard chloroform-methanol extraction method. The calcium ion content in the supernatant was measured using the ethylenediaminetetraacetic acid (EDTA) complexometric titration method. We also measured the algal dry weight and chlorophyll α content. Scanning electron microscope (SEM) was used to examine the thickness changes of $CaCO_3$ shells under different photoperiods on day 15.

RESULTS:

Under 20L/4D photoperiod, P. dentata had highest algal dry weight, calcium content (Figure 1), and chlorophyll α, but lowest lipid content (Figure 2). The optimal photoperiod for lipid accumulation is 14L/10D. The SEM results (Figure 3) demonstrated the longer light exposure the thicker the shell of P. dentata.

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

The effect of photoperiod on *Pleurochrysis dentata* and calcium carbonate accumulation and the novel discovery of calcium carbonate shell function

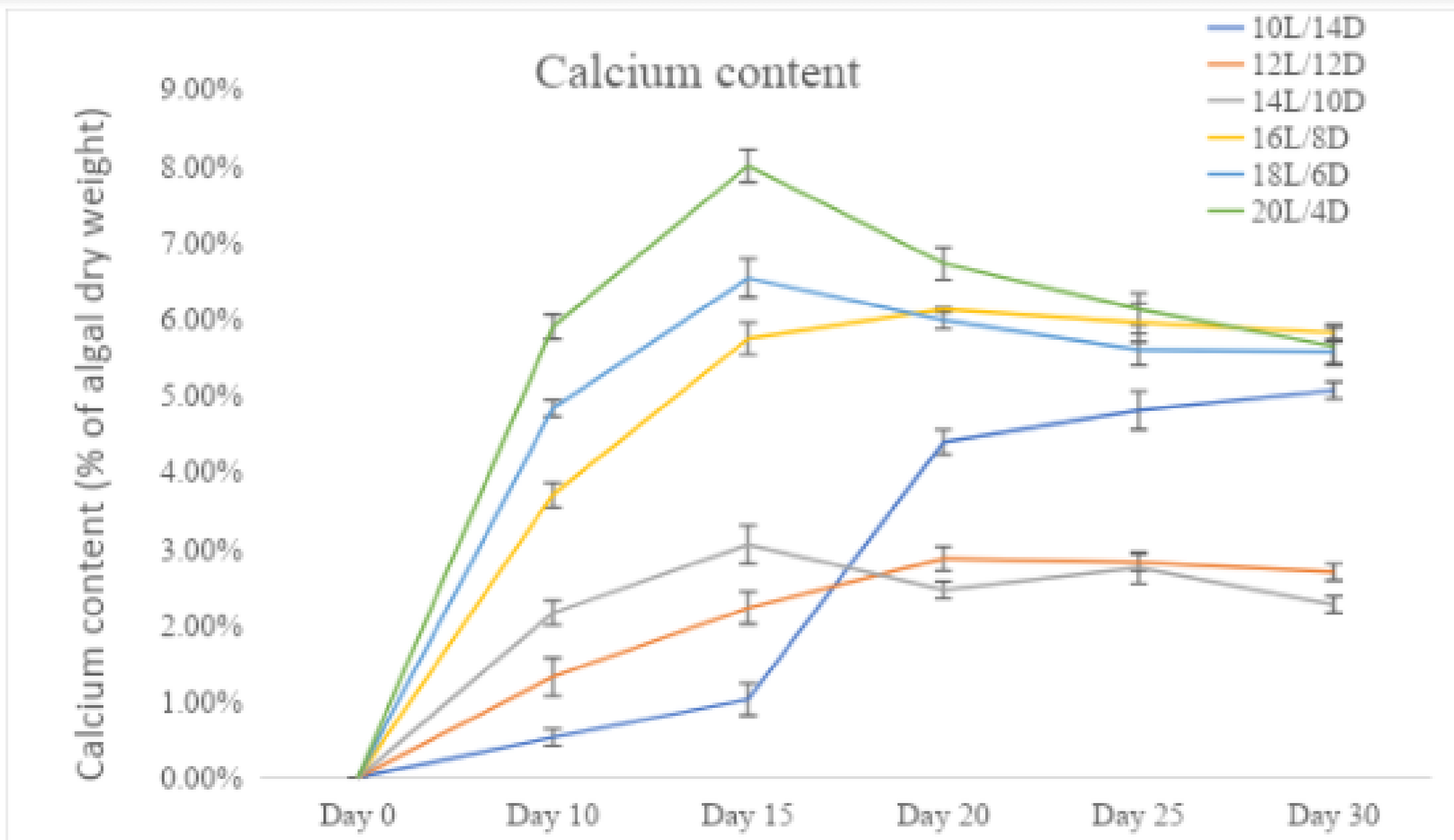


Figure 1 Calcium content of *P. dentata* under different photoperiod

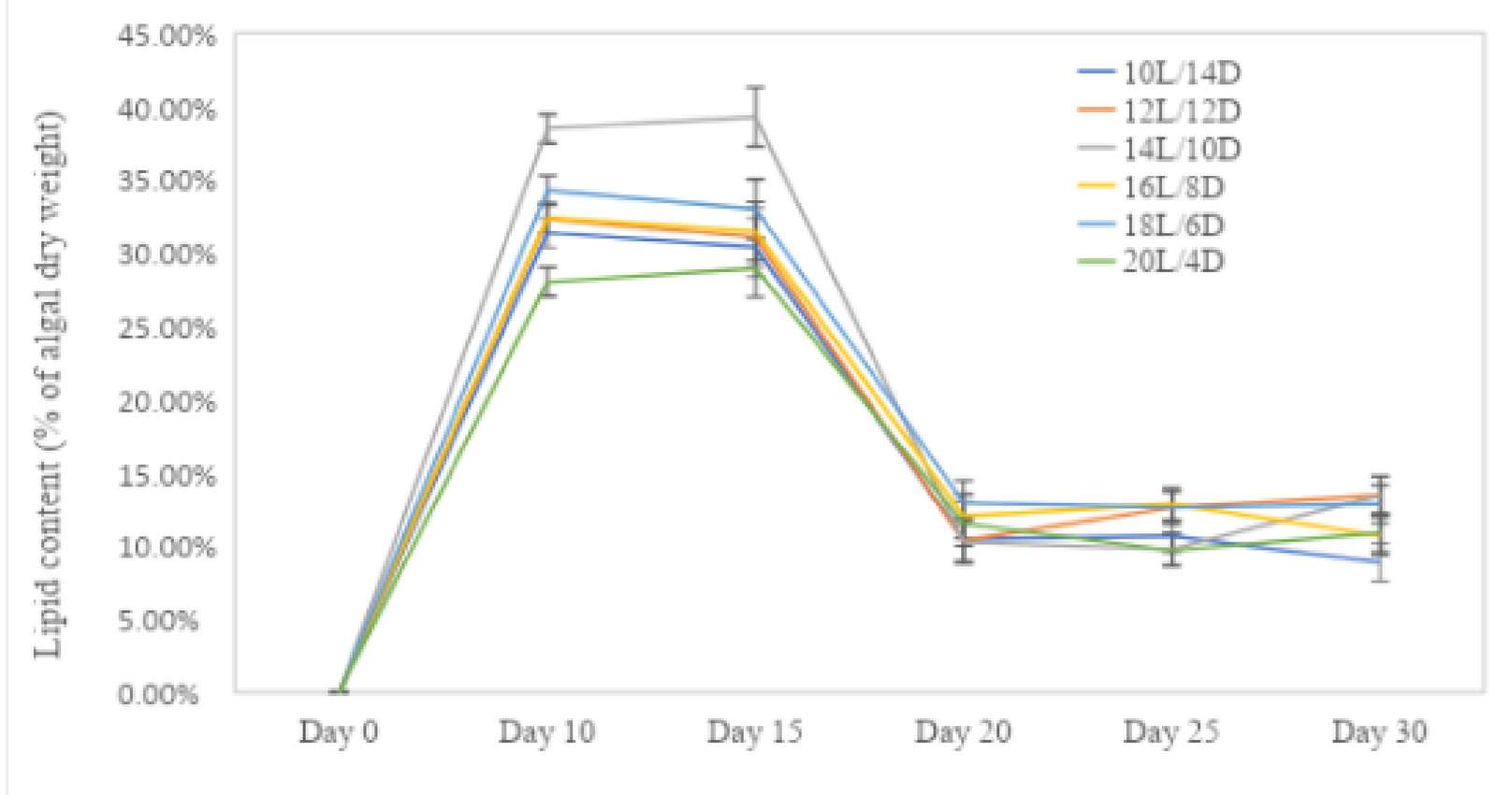


Figure 2 Lipid content of *P. dentata* under different photoperiod

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

The effect of photoperiod on *Pleurochrysis dentata* and calcium carbonate accumulation and the novel discovery of calcium carbonate shell function

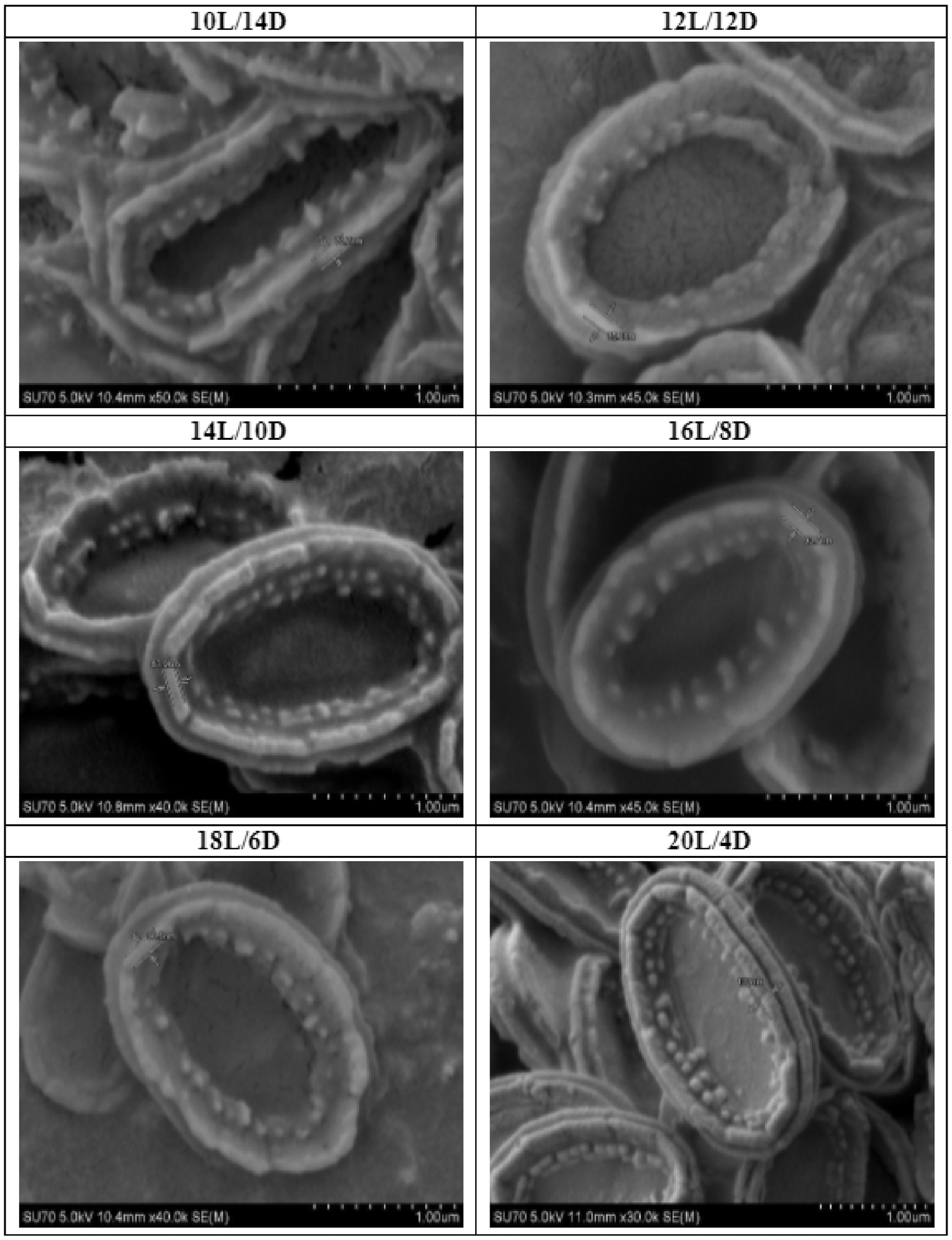


Figure 3 Scanning electron microscopy of calcium carbonate shell of *P. dentata* under different photoperiod

https://sesbass21.weebly.com/

Optimization and Purification of Amylase Production from *Bacillus velezensis* and Recovering of Its Derived Value-added Products

Chonlong Chio, Wensheng Qin

Department of Biology, Lakehead University, 955 Oliver Road, Thunder Bay, Ontario, Canada,

BACKGROUND/OBJECTIVES: Bacillus velezensis can produce numerous metabolites for various promising industrial and medical applications and bioremediation. However, even though there are lots of studies investigating the metabolites produced by B. velezensis, no multiple metabolites production and recovering process have been reported yet. In this study, we optimized the amylase production of B. velezensis Ph1 which is newly isolated from phenolic waste, and investigated the purification and application of several useful metabolites such as antioxidant and biosurfactant.

METHOD: The enzymatic activity was measured based on the amount of reducing sugar released from the starch by the hydrolysis of amylase. The reducing sugar was measured by the 3, 5-dinitrosalicylic acid method. The factors were optimized by the single factors experiments and response surface methodology. The purification of the enzyme and other metabolites was based on precipitation and solvent extraction.

RESULTS: Among all of these metabolites, amylase was chosen for the optimizing object since it would be the most easily deactivated product. The activity of the amylase was optimized by single factors experiments and response surface methodology (RSM) and the results suggested that it would have the highest activity at 301.03 U/mL under the fermentation conditions: temperature 36.6 ℃, pH 7.8, fermentation time 72.2 hours. The yellow substance recovered from the precipitate shown antioxidant activity. The biosurfactant was also tested for removing engine oil from the soil.

Optimization and Purification of Amylase Production from *Bacillus velezensis* and Recovering of Its Derived Value-added Products

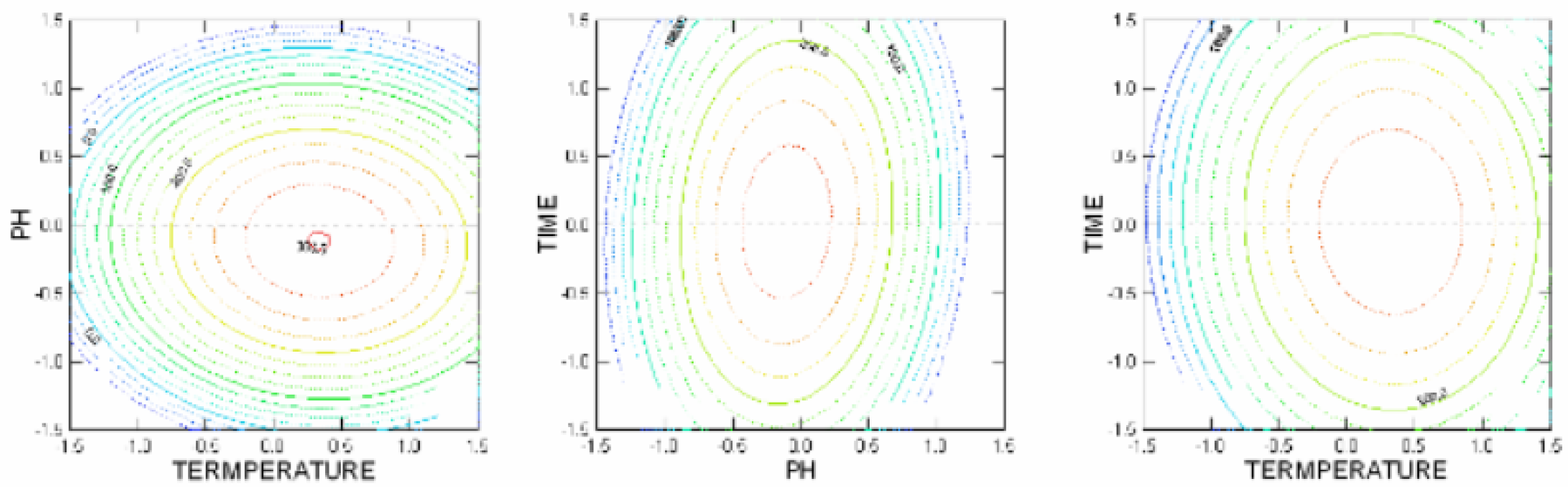


Figure1. The counterplot of the established RSM model.

Equation1. The estimated RSM equation. X_1 is temperature, X_2 is pH, and X_3 is fermentation time.

CONCLUSION/IMPLICATION: In this study, the potential of a newly isolated B. velezensis in producing value-added products and the method for recovering several useful metabolites have been investigated. This bacterium has high potentials in various industrial applications. Further genetic modification could be promising to significantly enhance its usage in various fields.

Malting effluent for microalgae cultivation and subsequent biomass and lipid production

Janak Raj Khatiwada and Wensheng Qin

Department of Biology, Lakehead University, Thunder Bay, Ontario P7B 5E1, Canada

BACKGROUND/OBJECTIVES: Microalgae can effectively grow in nutrient-rich environment and have ability to accumulate nutrients from wastewater. Malting effluent is rich in nutrients suitable for microalgae cultivation. The aim of this work was to evaluate the growth characteristics and lipid content of two green microalgae grown in the diluted malting effluent.

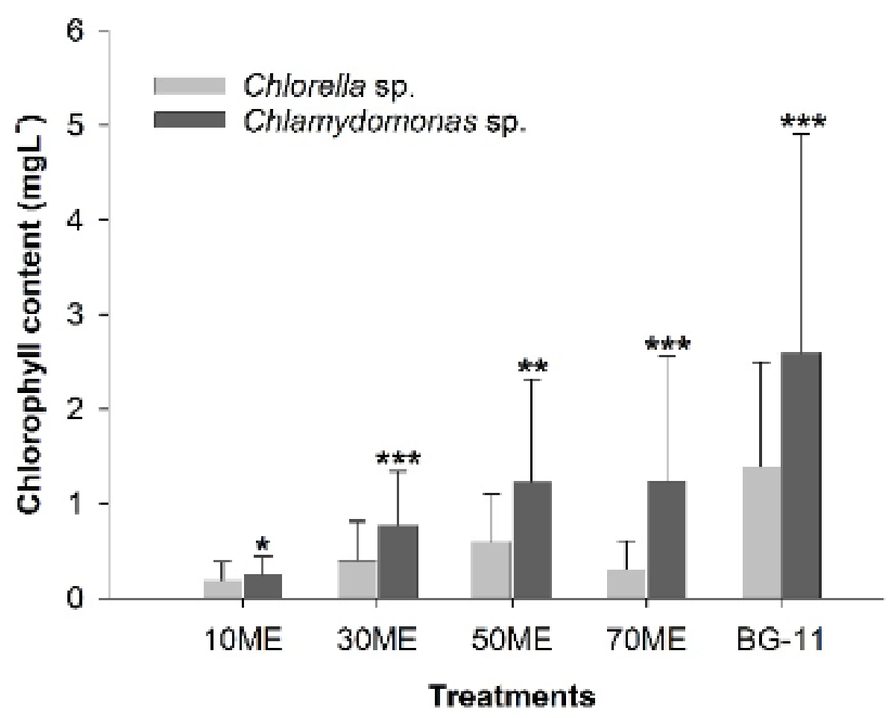
METHOD: Two green algae Chlorella sp. and Chlamydomonas sp. were isolated from Lake Superior and Lake Tamblyn, Lakehead University, Thunder Bay, Canada and cultivated in 1-L glass flask with a photoperiod of 16 h:8 h light:dark cycle. Total chlorophyll and lipid contents were tested into four dilution concentration of malting effluent: 10%, 30%, 50% and 70% dilution and control condition (BG-11 medium).

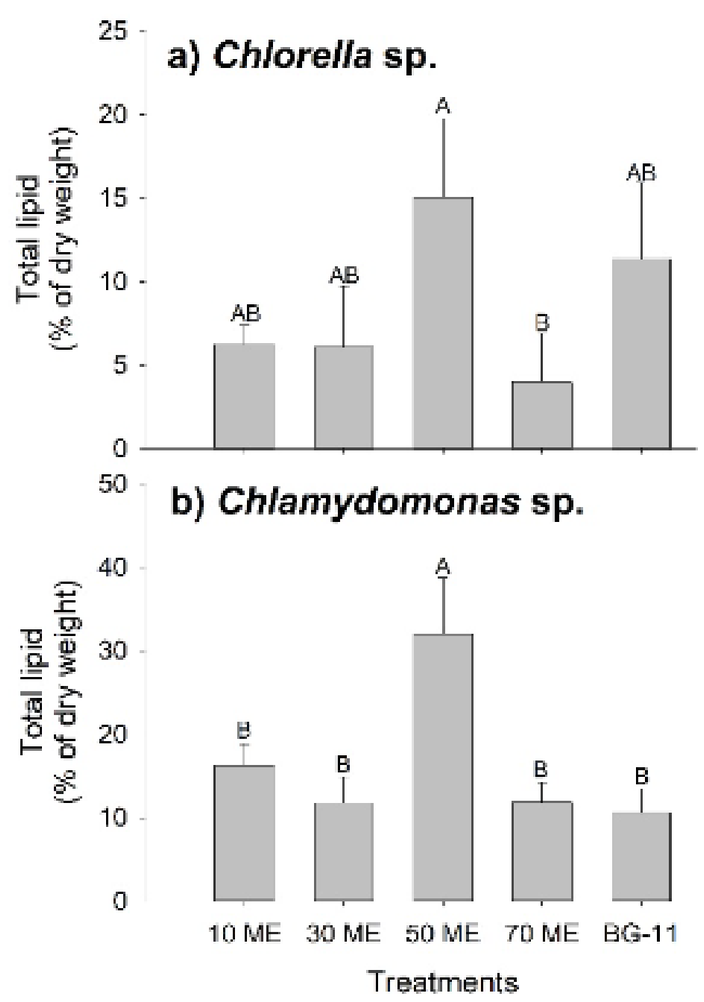
RESULTS: A distinct linear increasing trend of chlorophyll content was observed in both Chlorella sp. and Chlamydomonas sp. Chlorella sp. showed highest chlorophyll content in 50% of dilution concentration of malting effluent whereas 70% dilution concentration was most productive for Chlamydomonas sp. The total lipid content was higher in 50% of dilution concentration of malting effluent in both Chlorella sp. (max 20.5%-min 11.5% of dry weight) and Chlamydomonas sp. (max 39.3% - min 25.9% of dry weight).

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Malting effluent for microalgae cultivation and subsequent biomass and lipid production



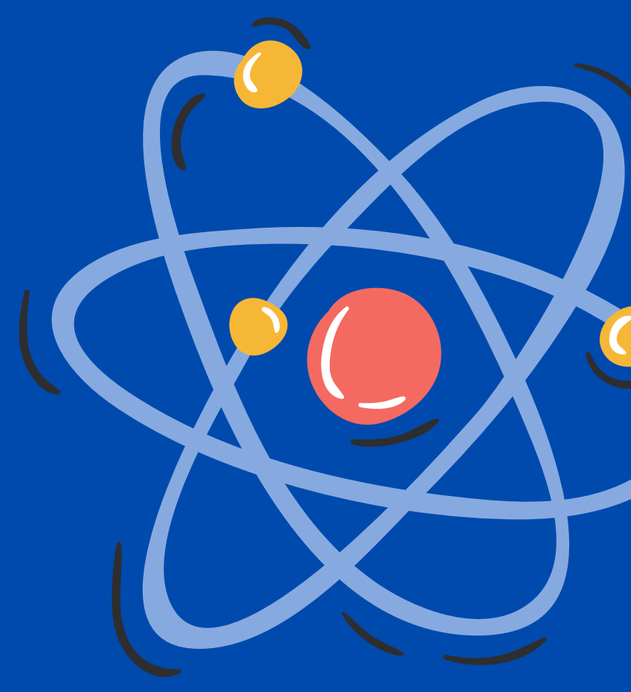


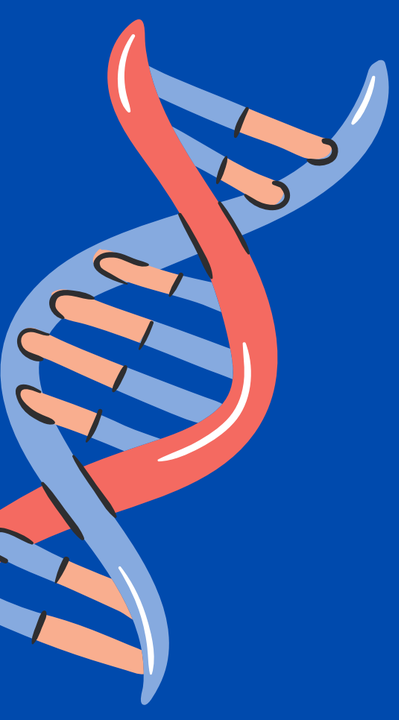
CONCLUSION/IMPLICATION: The results showed that the non-sterile diluted malting effluent is an excellent medium for microalgae cultivation. Microalgae can be used for bioremediation in one hand and production of biofuel and value-added products in other.

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium





SESBASS 2021- POSTER ABSTRACTS

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Genome and Transcriptome Sequencing of Novel Pseudomonas sp. NLX-4 Strain Involved in Bio-restoration of Over Exploited Mining Sites

Yanwen Wu,1, 2# Ayyappa Kumar Sista Kameshwar,2# Bo Zhang,3 Feifei Chen,4 Wensheng Qin,2 Miaojing Meng,1 Jinchi Zhang1*

1 Co-innovation Center for Sustainable Forestry in Southern China, Jiangsu Province Key Laboratory of Soil and Water Conservation and Ecological Restoration, Nanjing Forestry University, 159 Longpan Road, Nanjing, Jiangsu 210037, China

2 Department of Biology, Lakehead University, 955 Oliver Road, Thunder Bay, Ontario, P7B 5E1, Canada

3 Department of Natural Ecology Resource and Management, Oklahoma State University, Stillwater, OK 74078, United States

4 Co-innovation Center for Sustainable Forestry in Southern China, Jiangsu Province Key Laboratory for Prevention and Management of Invasive Species, Nanjing Forestry University, 159 Longpan Road, Nanjing, Jiangsu 210037, China

*Corresponding author; # Y.W. and A.K.S.K. contributed equally

BACKGROUND: Relentless mining operations have destroyed our environment significantly. Soil inhabiting microbes play a significant role in ecological restoration of these areas. Microbial weathering processes like chemical dissolution of rocks significantly promotes the soil properties and enhances the rock to soil ratio respectively. Earlier studies have reported that bacteria exhibit efficient rock-dissolution abilities by releasing organic acids and other chemical elements from the silicate rocks. However, rock-dissolving mechanisms of the bacterium remain to be unclear till date.

METHODS: Thus, we have performed rock-dissolution experiments followed by genome and transcriptome sequencing of novel Pseudomonas sp.NLX-4 strain to explore the efficiency of microbe-mediated habitat restoration and its molecular mechanisms underlying this biological process. Results obtained from initial rock dissolution experiments revealed that Pseudomonas sp. NLX-4 strain efficiently accelerates the dissolution of silicate rocks by secreting amino acids, exopolysaccharides, and organic acids with elevated concentrations of potassium, silicon and aluminium elements.

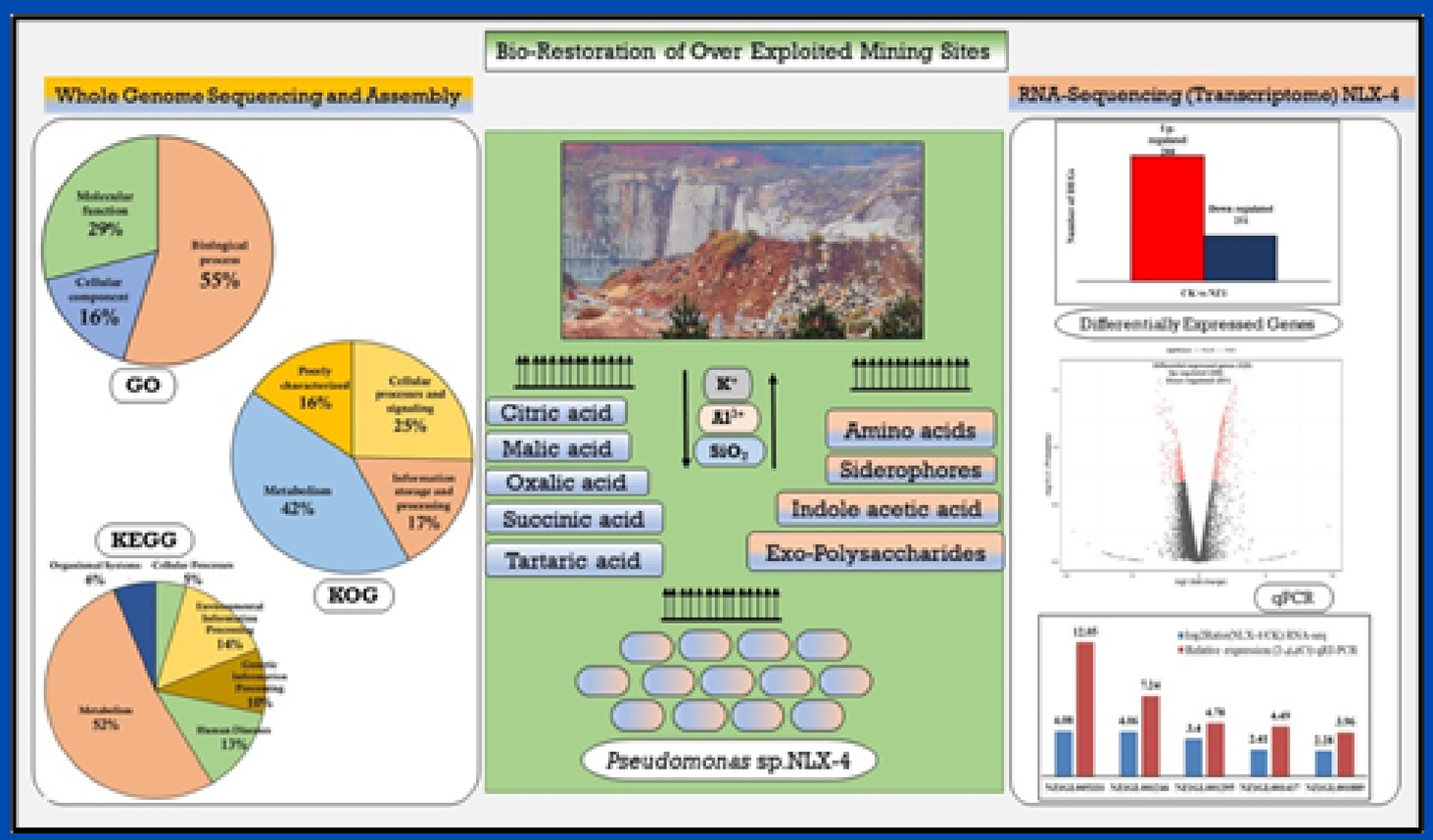
RESULTS: The rock dissolution experiments of NLX-4 strain exhibited an initial increase in particle diameter variation values between 0-15 days and decline after 15 days-time respectively. The 6,771,445-base pair NLX-4 genome exhibited 63.21 GC percentage respectively with a total of 6041 protein coding genes. Genome wide annotations of NLX-4 strain exhibits 5045-COG, 3996-GO, 5342-InterPro, 4386-KEGG proteins respectively Transcriptome analysis of NLX-4 cultured with/without silicate rocks resulted in 539 (288-up and 251-down) differentially expressed genes (DEGs). Fifteen DEGs encoding for siderophore transport, EPS and amino acids synthesis, organic acids metabolism, and bacterial resistance to adverse environmental conditions were highly up-regulated by cultured with silicate rocks.

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Genome and Transcriptome Sequencing of Novel Pseudomonas sp. NLX-4 Strain Involved in Bio-restoration of Over Exploited Mining Sites



CONCLUSION: This study has not only provided a new strategy for the ecological restoration of rock mining areas, but also enriched the applicable bacterial and genetic resources.

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Development of PET Molecular Probes for Lysophosphatidic Acid Receptor Type 1

Wenjie Liu1, 2, Jonas Olsen1, 2, Jinqiang Hou1, 2*,
1. Lakehead University, Thunder Bay, Canada
2. The Thunder Bay Regional Health Research Institute, Thunder Bay, Canada

Lysophosphatidic Acid Receptor 1 (LPA1) is one of the GPCR targets that is under-exploited for diagnostics and therapeutics with only a few ligands being developed. LPA1 is modulated by lysophosphatidic acid (LPA) which is a pleiotropic bioactive lipid presenting in nearly all cells, fluids, and tissues of the body [1]. LPA exerts a wide range of cellular responses, such as calcium mobilization, cell proliferation, migration, and chemotaxis via acting on LPA receptors [2]. The LPA receptors consist of six family members designated LPA1-LPA6. Among them, LPA1/2/3 from the EDG (endothelial differentiation gene) family shares a relatively high homology. It has been revealed that targeted deletion of the LPA1 on every organ system studied resulted in physiological effects that were linked to a range of diseases including cancer, pain, infertility, fibrosis, and hydrocephalus [3]. Moreover, LPA1 is highly expressed in breast carcinoma and prostate cancer, and the expression of LPA1 is significantly higher in human hepatocellular carcinoma than non-tumor liver [4]. The development of small molecules and positron emission tomography agents targeting LPA1 will provide powerful tools to study the receptor function and density related to those diseases. 11C-BMT-136088, the only one LPA1 radioligand developed to date showed high liver uptake on rhesus monkeys [5]. The aim of this study is to develop novel small molecule modulators and molecular imaging agents to study LPA1 related biological processes in vivo. We started with N-aryltriazole derived LPA1 ligands initially discovered by Roche for the treatment of idiopathic lung fibrosis [6] and designed a series of compounds with low binding free energy guided by computational molecular modelling. Multiple compounds bearing fluorine atom have been synthesized successfully. Candidate molecules with desirable binding affinity will be radiolabeled with 18F, and evaluated in vivo using mouse models of diseases with PET. The radiotracer will be useful for quantifying receptor density in vivo and studying LPA1-related cancers for developing LPA1-targeting drugs.

Reference:
1. Dorsam RT, Gutkind JS. G-protein-coupled receptors and cancer. Nat Rev Cancer 2007; 7(2):79-94.
2. Mills GB, Moolenaar WH. The emerging role of lysophosphatidic acid in cancer. Nat Rev Cancer 2003; 3(8):582-591.
3. Choi JW, Herr DR, Noguchi K, Yung YC, Lee CW, Mutoh T, et al. LPA receptors: subtypes and biological actions. Annu Rev Pharmacol Toxicol 2010; 50:157-186.
4. Willier S, Butt E, Grunewald TG. Lysophosphatidic acid (LPA) signalling in cell migration and cancer invasion: a focussed review and analysis of LPA receptor gene expression on the basis of more than 1700 cancer microarrays. Biol Cell 2013; 105(8):317-333.
5. Gallezot JD, Nabulsi NB, Holden D, Lin SF, Labaree D, Ropchan J, et al. Evaluation of the Lysophosphatidic Acid Receptor Type 1 Radioligand (11)C-BMT-136088 for Lung Imaging in Rhesus Monkeys. J Nucl Med 2018; 59(2):327-333.
6. Qian Y, Hamilton M, Sidduri A, Gabriel S, Ren Y, Peng R, et al. Discovery of highly selective and orally active lysophosphatidic acid receptor-1 antagonists with potent activity on human lung fibroblasts. J Med Chem 2012; 55(17):7920-7939.

https://sesbass21.weebly.com/

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

The Design and Synthesis of PAR2 Imaging Agent

Austin Hopkins[1,2], Jinqiang Hou[1,2]

[1,2]Lakehead University, Department of Chemistry, Ontario, Canada
[1,2]Thunder Bay Regional Health Research Institute, Ontario, Canada

BACKGROUND/OBJECTIVES: Lung, breast, and liver cancers are some of the most common and deadly forms of cancer in Canada. There are existing methods that can diagnose these diseases, but each has its own flaws. Positron emission tomography imaging is a relatively non-invasive imaging method that allows for the early diagnosis of diseases. It does this by targeting a protein biomarker for the disease within the body with a radioactive molecule called a radiotracer. The synthesis of a novel radiotracer that specifically targets the human PAR2 receptor, a biomarker for these cancers, has been proposed based on a paper published to Nature in 2017. This radiotracer has potential as a diagnostic cancer imaging agent.

METHOD: A seven-step organic synthesis has been proposed for the development of a PAR2-specific radiotracer, shown below in Figure 1.

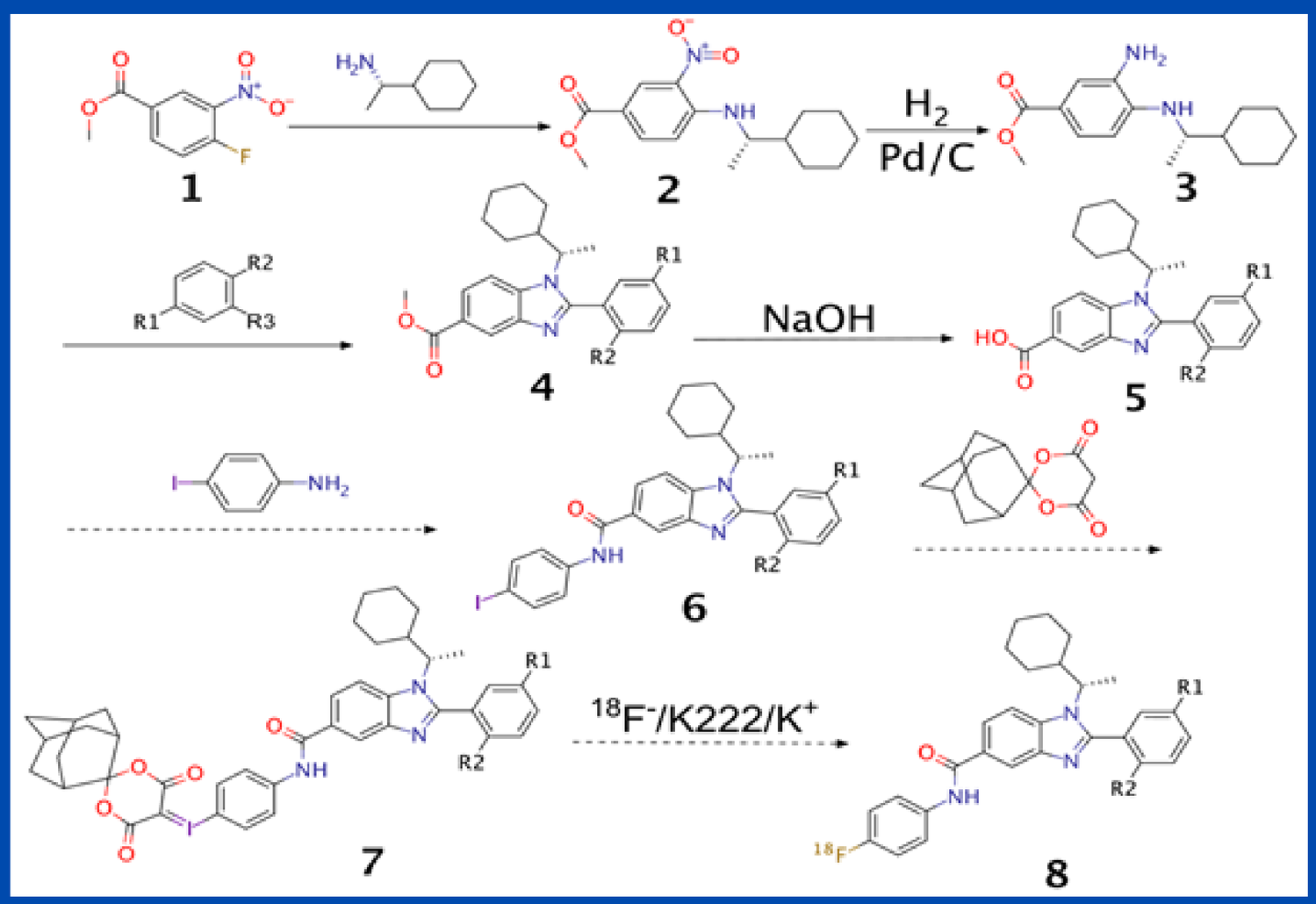


Figure 1. Proposed scheme for the synthesis of a novel PAR2 radiotracer

https://sesbass21.weebly.com/

The Design and Synthesis of PAR2 Imaging Agent

RESULTS: The first four reaction steps have been attempted thus far. The products of these reactions have been characterized by mass spectrometry, and 1H NMR spectra have been produced for the products of the first two reactions. 2 and 3 have been confirmed as the desired products, but further purification of 4 and 5 will need to be performed in order for their confirmation.

CONCLUSION/IMPLICATION: Further synthesis will be performed to attain the final radiotracer. If successful, this project has the potential to move on to clinical trials, and eventually, be marketed as a potent and useful tool in the early detection and diagnosis of lung, breast, and prostate cancer.

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Targeting Leukemia Inhibitory Factor for Detection of Pancreatic Cancer

Karissa Kilby1 & Michael Campbell 1

1Lakehead University, Ontario, Canada

Pancreatic cancer is the development of a malignant tumor in the pancreas, it's the seventh leading cause of cancer-related deaths in the world and generally not diagnosed until it has metastasized. Pancreatic tumors have protective barriers called the stroma that surrounds tumors making them resistant to anti-cancer drugs. Stellate cells are a type of cell that are found in the stroma and pancreas, they are generally dormant and activated when malignancies are present. When activated, they secrete a variety of proteins that perform different functions, one of which is Leukemia Inhibitory Factor (LIF). LIF is a signalling protein that plays a role in cancer progression, it acts on the neighboring cancer cells and drives development and progression of cancer. Targeting LIF will be useful in developing diagnosis methods.

Computational chemistry for performing docking assays using libraries of molecules to discover small molecules that will bind to and have a high affinity for LIF. These molecules will be synthesized and radiolabelled or fluorescently tagged.

Radiolabelling will first happen with fluorine-19 and tested to ensure binding to LIF. Radiolabelling with fluorine-18 will follow a will be tested on mice with pancreatic cancer to determine if diagnosis is possible.

Fluorescently labelled molecules will go through various assays to ensure binding, florescence and specificity. These molecules will be tested using blood samples to ensure accuracy of detection of LIF in pancreatic cancer patients.

Pancreatic cancer is hard to diagnose and currently there is no method for early detection, it is not diagnosed until it reaches advanced stages. Methods for early diagnosis of pancreatic cancer are needed to be able to make it curable. Previous research done suggests that LIF has the potential to be a good biomarker for early diagnosis, this research will allow for development of techniques for early diagnosis of pancreatic cancer.

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Concussion Symptoms Related to Head and Neck Injuries

Nicholas Renyard1, Carlos Zerpa1, Dave Mckee2

1 School of Kinesiology, Lakehead University, Ontario, Canada
2 Concussion Clinic, Lakehead University, Ontario, Canada

Background/Objectives. Concussions, or Mild Traumatic Brain Injuries (MTBI), are potentially severe and complicated injuries with many long-term repercussions. In Canada, 200,000 concussions occur annually, and they are a leading cause of disability. Concussions are biomechanically induced brain injuries with the absence of gross anatomical lesions caused by impacts to the head or by whiplash, potentially causing secondary injuries to the neck. Due to their complexity, symptoms are categorized as physical, cognitive, emotional, and sleep behavior. This research aimed to determine: (a) if individuals who suffered a simultaneous head and neck injury would experience more severe symptoms than those with injuries to the head or neck separately, and (b) if females would experience a higher level of concussion symptoms than males from a head impact.

Methods. The researchers administered a self-report questionnaire to 1332 participants as a concussion diagnostic tool of symptoms. The researchers used analysis of variance (ANOVAs) statistical techniques to address the objectives of this study.

Results. One-way ANOVAs for independent samples revealed that individuals who suffered simultaneous head and neck injuries had significantly increased symptom scores ($F(2,294)=7.280$, $p=0.001$) than injuries to the head or neck alone. Females experienced higher level of symptom scores than males for head injuries only ($F(2,279) = 7.756$, $n2 = 0.053$, $p=0.001$)

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Concussion Symptoms Related to Head and Neck Injuries

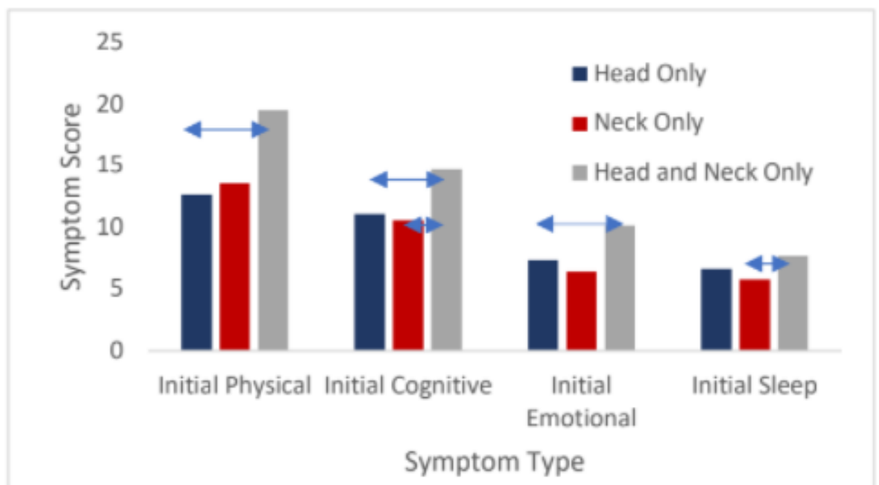


Figure 1. Symptom score and injury type

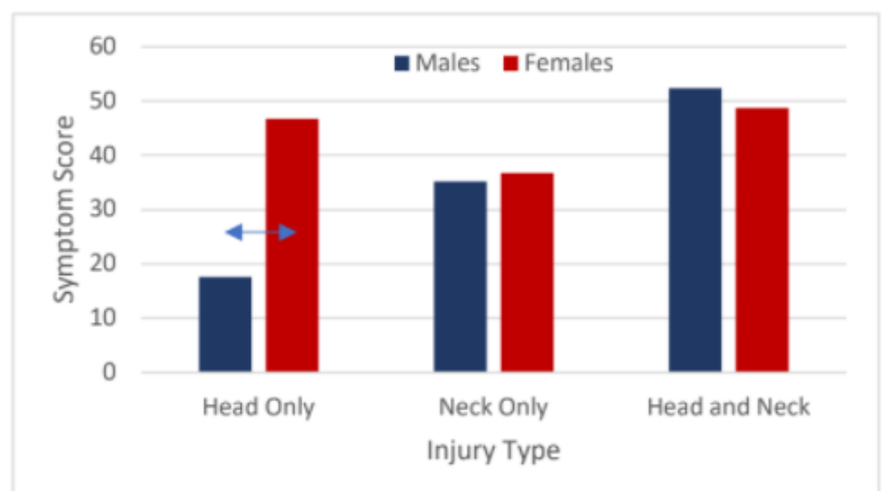


Figure 2. Total symptom score based on gender and injury type

Conclusion. This study provides preliminary evidence that individuals with head and neck injuries have more severe symptoms than those with head or neck injuries separately. Furthermore, the outcome highlights that females seem to experience more severe symptoms than males. Further research is needed to understand the depth and complexity of these differences.

https://sesbass21.weebly.com/

Cut-off values of anthropometry indices to predict cardiovascular disease incidence by ROC curve analysis in 10 years follow-up in study of Yazd healthy heart cohort (YHHC) of Iran

Abdollah Hozhabrnia 1 , Sara Jambarsang 1 , Seyedeh Mahdieh Namayandeh 2

1 Center for Healthcare Data Modeling, Department of Biostatistics and Epidemiology, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran
2 Yazd Cardiovascular Research Center; Center for Healthcare Data Modeling, Department of Biostatistics and Epidemiology, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

BACKGROUND/OBJECTIVES: Anthropometric indices are used to estimate obesity, and it seems necessary to determine the best one for appropriate screening of cardiovascular diseases (CVD) risk factors. The current study aimed to determine the optimal cut-off of anthropometric indices for detecting CVD in 10-years study of Yazd Healthy Heart Cohort (YHHC).

METHOD: This study conducted on 2000 participants aged 20-74 years. At cohort baseline, all enrolled individuals without CVD underwent a medical examination. They can succumb to disease during follow-up. Anthropometric indices were measured and calculated at baseline including, body mass index (BMI), waist circumference (WC), waist-to-hip ratio (WHpR), waist-to-height ratio (WHtR), body shape index (ABSI), abdominal volume index (AVI), body adiposity index (BAI) and body roundness index (BRI). Coronary artery bypass graft (CABG), percutaneous coronary intervention (PCI), myocardial infarction (MI), Rose Angina Questionnaire (chest pain) greater than 3 and ECG changes in favour of the CAD were considered as the CVD risks. A receiver operating characteristic (ROC) curve analysis was used to evaluate the sensitivity and specificity and the best cut-off of the anthropometric indices for CVD risk.
RESULTS: Overall, 1623 participants, free of CVD at baseline, with mean weight (SD) of 71.21 (12.94) kg were included. During 10 years follow up, 101 CVD event occurred. To identify the anthropometric index that best predicted incidence of CVD, the ROC curves of the anthropometric indices; WC, Hip, BMI, WHpR, WHtR, ABSI, AVI, BAI and BRI were plotted. ROC curve analysis suggested that WHpR was superior to the other indices as it was found to have the largest area under the ROC curve in predicting CVD, AUC: 0.64; Sensitivity: 0.67; Specificity: 0.57. Optimal WHpR cut-off was 0.92.

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Cut-off values of anthropometry indices to predict cardiovascular disease incidence by ROC curve analysis in 10 years follow-up in study of Yazd healthy heart cohort (YHHC) of Iran

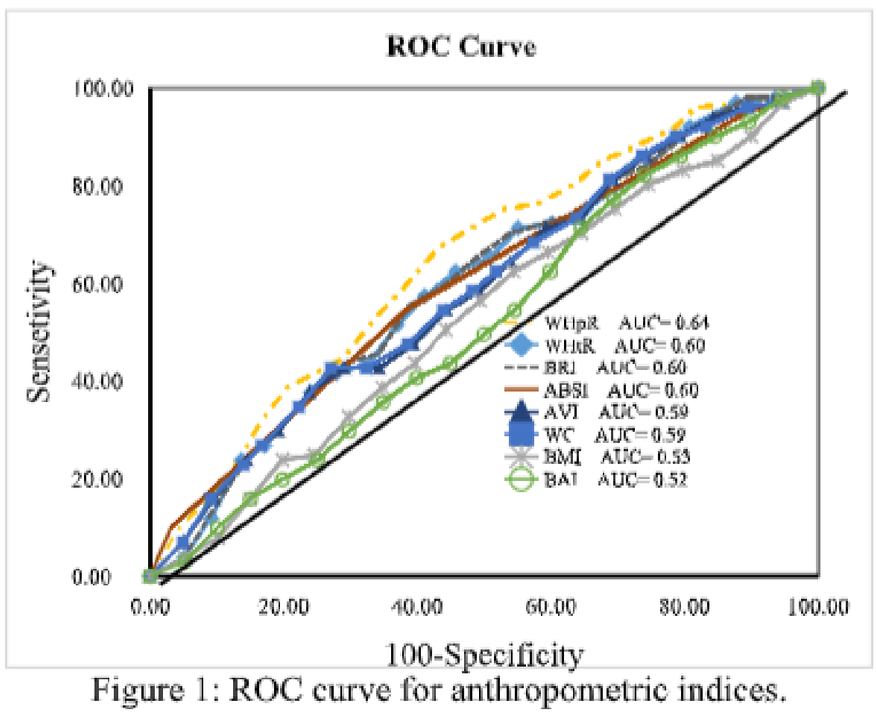


Figure 1: ROC curve for anthropometric indices.

Table 1: Baseline characteristics of study population, CVD-positive group, and CVD-negative group

Characteristics	NO CVD[1] (n=1522) Mean (SD)	CVD[2] (n=101) Mean (SD)	P-value*
Age (yr)	47.24 (14.74)	61.6 (10.15)	<0.001
Weight (kg)	71.21 (12.95)	71.31 (12.95)	0.939
Height (cm)	165.15 (10.38)	163.83 (9.47)	0.215
WC (cm)	93.45 (12.18)	97.09 (11.58)	0.004
Hip (cm)	102.81 (9.82)	102.53 (9.20)	0.776
BMI	26.15 (4.45)	26.53 (4.13)	0.403
WHpR	0.91 (0.08)	0.95 (0.08)	<0.001
WHtR	0.57 (0.08)	0.59 (0.07)	0.002
ABSI	0.08 (0.007)	0.09 (0.007)	<0.001
AVI	17.87 (4.52)	19.19 (4.34)	0.004
BAI	30.78 (6.41)	31.14 (5.69)	0.578
BRI	4.85 (1.87)	5.39 (1.58)	0.004

Values are mean and standard deviation (SD).
*t-test performed for anthropometric indices.
[1] CVD-negative group: No cardiovascular diseases during 10-years follow-up
[2] CVD-positive group: With cardiovascular diseases during 10-years follow-up

Table 2: The sensitivity, specificity, AUC, and cut-off of anthropometric indices

indices	Sensitivity	Specificity	AUC	Cut-off	%95 CI AUC	P-value
BMI	0.62	0.46	0.53	25.46	(0.476 , 0.590)	0.25
WC	0.43	0.73	0.59	100	(0.535 , 0.648)	0.001
Hip	0.53	0.46	0.49	101	(0.431 , 0.544)	0.68
WHpR	0.67	0.57	0.64	0.92	(0.592 , 0.698)	0.000
WHtR	0.62	0.54	0.60	0.57	(0.546 , 0.656)	0.0003
ABSI	0.54	0.62	0.60	0.08	(0.568 , 0.679)	0.000
AVI	0.58	0.51	0.59	17.73	(0.532 , 0.645)	0.0021
BAI	0.71	0.36	0.52	27.71	(0.467 , 0.574)	0.45
BRI	0.55	0.61	0.60	5.20	(0.546 , 0.656)	0.0003

CONCLUSION/IMPLICATION: WHpR index which indicated the anatomical and skeletal status of the body was considered as good indicator for predicting the risk of cardiovascular diseases.

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

The development of PET radiotracers for imaging Aurora Kinase

Dong Zhao 1,2 , Jinqiang Hou 1,2

1 Department of Chemistry, Lakehead University, ON, Canada
2 Thunder Bay Regional Health Research Institute, ON, Canada

BACKGROUND/OBJECTIVES: Cancer is the leading cause of death in Canada. Comprehensive and personalized treatment starts with an accurate diagnosis. Positron emission tomography (PET) imaging is a non-invasive imaging technique that allows receptor density studies, early cancer diagnosis, and in vivo therapy monitoring. Aurora kinases (AKs) play a key role in cell division via mitotic regulation. Both the kinase activity and expression level of AKs are up-regulated in many human cancers including prostate, breast, ovarian cancers, etc. Therefore, the inhibition of AKs has been regarded as a promising approach for the development of novel anticancer agents. To date, 27 classes of inhibitors have been reported to target AKs, though none have passed clinical trials. Current efforts in AK PET imaging and anticancer drug discovery have been limited. Only one radiolabeled inhibitor ([11C]Alisertib) for PET imaging has been synthesized and evaluated as diagnostic imaging probes for cancer characterization. Unfortunately, the tumor-to-background ratios in A431 tumor were low due to the off-target binding to P-glycoprotein. To develop PET imaging tracers for tracking biological pathways associated with AKs and quantifying the receptor density in malignant tumors in vivo, this project aims to design and prepare novel Fluorine-18 radiolabeled AK inhibitors with high binding affinity and selectivity.

METHOD: Tozasertib initially developed by Vertex was selected as our lead due to its highest binding affinity for Aurora-A among all the inhibitors reported and high selectivity to any other kinases in a 55-kinases panel. The compound was optimized guided by structure-based-drug-design method and synthesized. The IC50 will be evaluated by in vitro enzyme assay to compare the binding affinity. Based on the IC50 data, the structure-activity relationships will be summarized. Candidate molecules with highest binding affinity will be radiolabeled with Fluorine-18 and further evaluated using Bio-distribution (BD) and PET imaging studies to demonstrate the ability of imaging AK expression in cancers in the murine models.

RESULTS: From the binding positions we get the conclusion that as a stretching out group, the variation of R2 doesn't change the binding model, as a group at the back of binding pocket the carbon number in R1 should be lower than 6 (Fig.1 D the binding pose of VX-680 could not be kept). The designed radiolabeled analogues could keep the binding affinity with Aurora-A from VX-680, indicating that the designed analogues potentially have high potency with Aurora-A, therefore it could a good imaging agent for PET. Base on the proposed synthesis route, two compounds without fluorine were synthesized successfully.
f

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

The development of PET radiotracers for imaging Aurora Kinase

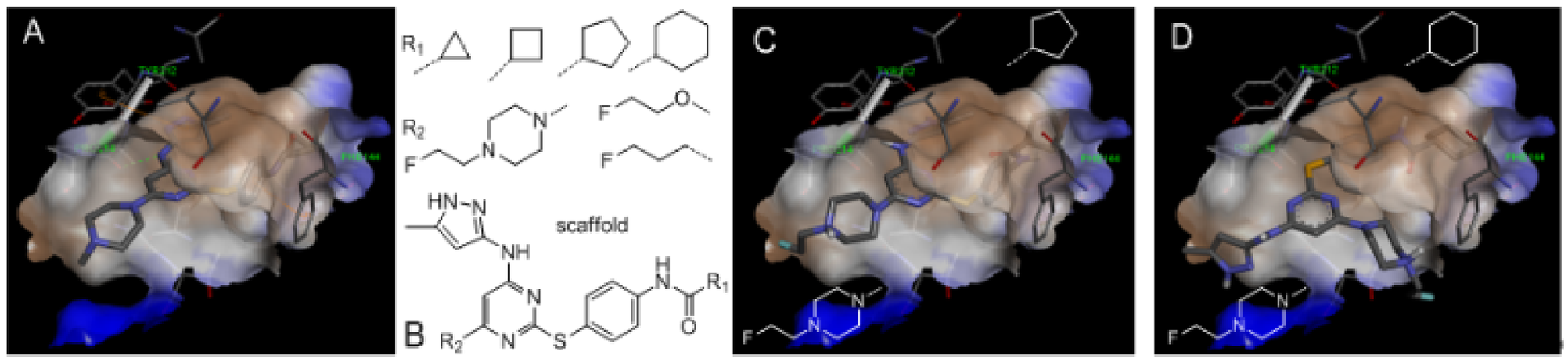


Fig. 1 Binding of VX-680 and designed analogues with Aurora-A. A) The crystal structure of Aurora-A with VX-680; B) First series of VX-680 analogues. C) and D) Binding model of two analogues.

IMPLICATION: The novel radiotracers targeting Aurora kinases could be a promising clinical tool for accurate liver cancer diagnosis. In addition to its utility for detection, this technique will be useful for monitoring disease progression and evaluating efficacy of therapy. Our research also has the potential to provide a powerful tool for quantifying Aurora expression in vivo, and provide a unique understanding of the behavior of Aurora-targeting-drugs and their interactions with the target to assist anti-cancer drug discovery.

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Design, Synthesis and Analysis of Small Molecule Aurora Kinase Inhibitors As Possible Cancer Diagnostics and Therapeutics

Antal Kovacs 1 , Jinqiang Hou 2
1 Lakehead University, Ontario, Canada
2 Lakehead University, Ontario, Canada

BACKGROUND:
Numerous studies have shown that overexpression and gene amplification of Aurora kinases (AKs) can induce tumorigenesis. AKs have been found to be interconnected with an array of human malignancies. The AK family consists of three serine / threonine kinases, known as Auroras A, B and C. These AKs play an essential role in mitosis and meiosis of human cells. Aurora kinase inhibitors (AKIs) have been shown in-vivo to inhibit the development and activity of malignancies. Thus, AKs represent a unique approach to both diagnostics and pharmacotherapeutic treatments of human malignancies. Synthesizing and evaluating novel AKIs for their possible use as cancer diagnostics and treatments could epitomize some of the restrictions of current cancer diagnostics and treatments.

METHODS:
Molecular docking analysis was first used to evaluate potential AKIs and their probable binding affinity. Next, respective AKIs will be synthesized using standard organic synthesis techniques. Crude AKIs will be extracted and further purified using standard chromatography practices. 1 H-NMR spectroscopy will be used to evaluate and confirm the structure of the newly synthesised AKIs. Finally, IC 50 testing will be used to examine the binding affinity of the newly synthesized compounds to their respective AK targets.

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Design, Synthesis and Analysis of Small Molecule Aurora Kinase Inhibitors As Possible Cancer Diagnostics and Therapeutics

OBJECTIVE:

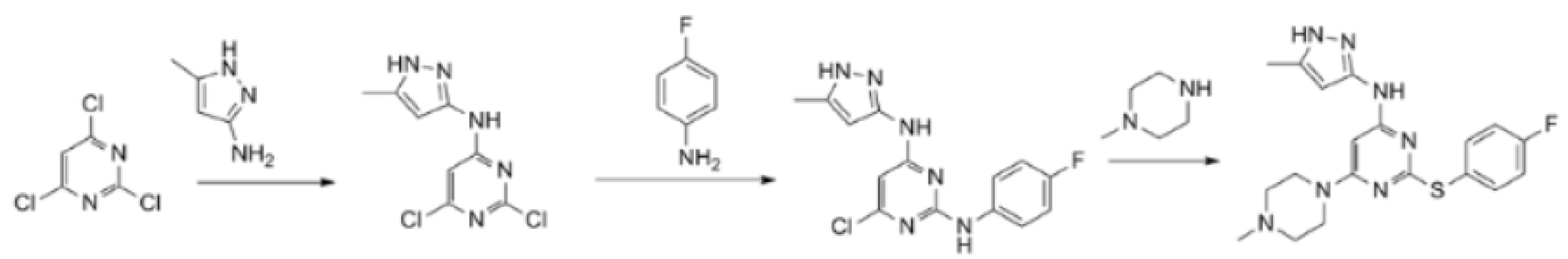


Figure 1: Proposed Synthesis of the Respective AKI

CONCLUSION:

The intent of this research is to synthesize novel AKIs that will allow for new pharmacological therapeutic agents that can be used to treat and diagnose human malignancies. Due to the overexpression of AKs in human malignancies, small molecules that selectively bind to AKs may be useful in cancer diagnostics when radiolabelled with Flourine-18 and evaluated using Position Emission Tomography. In the future, further synthesis and analysis of AKIs as well as further research regarding the molecular pathways of AKs and AKIs will allow for more possibilities regarding the anticancer and diagnostic potential of AKIs.

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Design and Synthesis of Aurora Kinase Inhibitors

Joseph Deschamps 1 , Jinqiang Hou 2
1 Lakehead University, Ontario, Canada
2 Lakehead University, Ontario, Canada

BACKGROUND/OBJECTIVES: The Aurora Kinase (AK) family is made up of three serine/threonine kinases, Aurora A, B and C, all of which are implicated in diverse cell cycle events, including mitosis and meiosis. Previous studies have shown that Aurora A and B play a major role in tumorigenesis and that both are significantly overexpressed in multiple cancers. Therefore, the targeted inhibition of AKs represents a promising approach for the development of novel anticancer agents. The aim of this research project is to design and synthesize a small organic molecule that selectively binds to AKs with high affinity and specificity. In subsequent research projects, this molecule would be radiolabelled with Fluorine-18 and its efficacy and specificity in detecting AK expression in murine malignant tumours would be detected using PET imaging.

METHOD: Small molecules with potential high binding affinity were first identified via molecular docking analyses. The molecule of interest will then be synthesized by standard organic synthetic procedures and purified using chromatographic techniques. 1 H-NMR and TLC data will be used to confirm the identity of the products. In subsequent investigations, IC 50 assays will be used to evaluate the efficacy of the synthesized compounds in terms of its inhibitory effect on the target kinase.

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Design and Synthesis of Aurora Kinase Inhibitors

RESULTS:

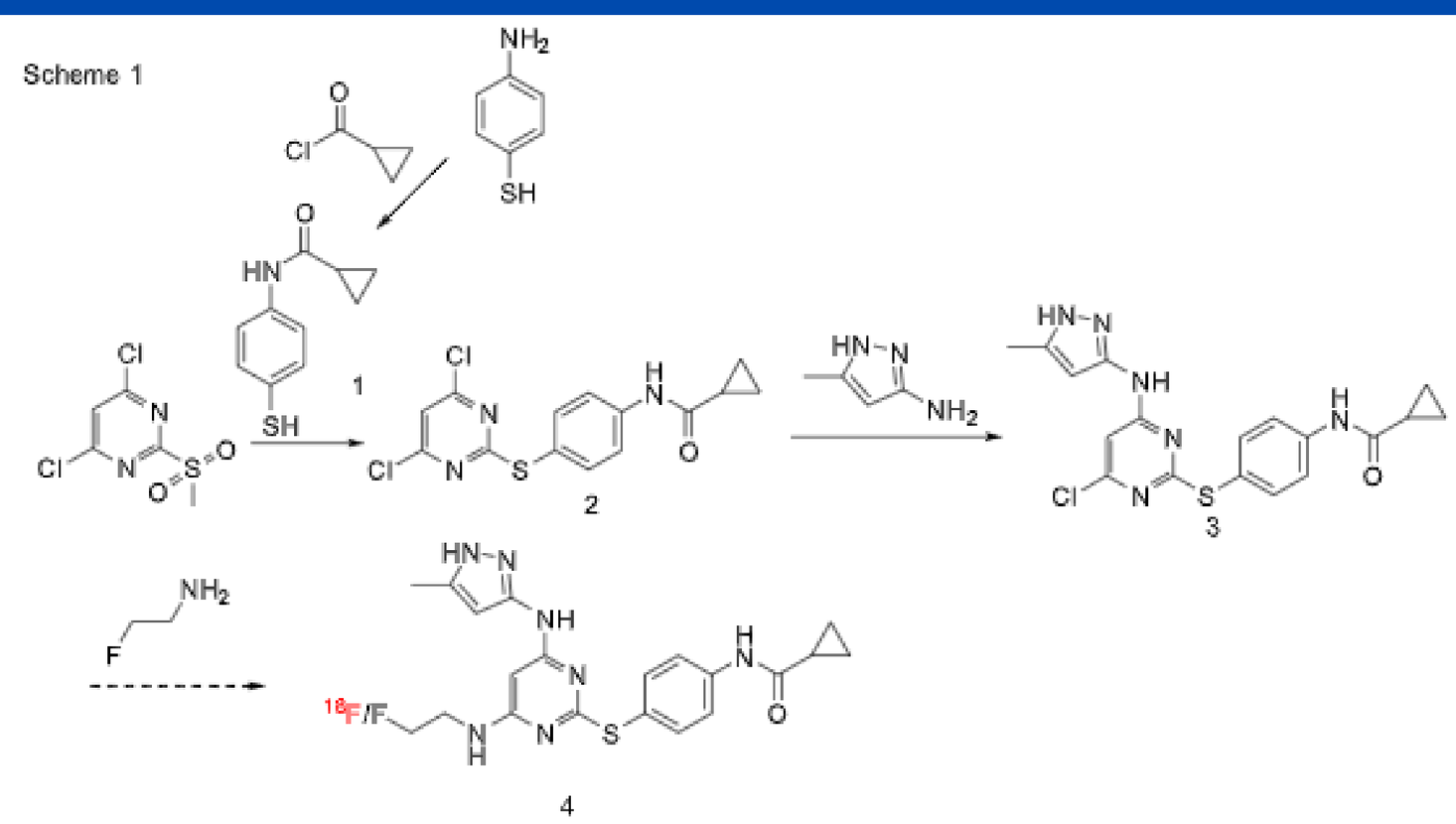


Figure 1. Synthetic Scheme for the Proposed Small Molecule Radiotracer

The above figure represents the proposed synthetic route for the synthesis of the small molecule with potential high binding affinity based on molecular docking analyses. The first three step reactions have been performed successfully.

CONCLUSION/IMPLICATION: The development of novel radiolabeled compounds that bind with high affinity and high specificity to AKs has many ramifications in the field of cancer research and in the early detection of cancer as well as anticancer therapy monitoring *in vivo*.

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Developing a Descriptive Chatbox for Mental Health Awareness Among Youth in Canada

Desiree Mary D'Mello 1 , Garima Bajwa 1
1 Lakehead University, Ontario, Canada

BACKGROUND/OBJECTIVES: The Canadian Government has funded many mental health support platforms however, not many people seek help from these resources as they are unaware of the available support or unsure about their mental health concerns. In such scenarios, people often consult online applications or social media that could be misleading or suggest self-help treatments that might not help people with severe risk issues. To help create awareness and support for the younger population in Canada, this research focuses on a Chatbot system that will provide information based on user's queries from reliable medical sources and encourage users to understand and seek support from reliable support platforms available in Canada.

METHOD: The Chatbot interface incorporates Natural Language Processing and Deep Learning Techniques to provide users with a more interactive and friendly conversation when discussing mental health issues and the help required. All resources added into the application were taken from reliable Canadian medical platforms aided by the Canadian Government. The Chatbot will respond to user's queries and provide reliable support information to help encourage users to seek help if needed.

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Developing a Descriptive Chatbox for Mental Health Awareness Among Youth in Canada

RESULTS: Figures 1. and 2. display the user's conversation with the Chatbot, and the interface is used to understand the reluctance of youth towards asking about concerns regarding their mental health.

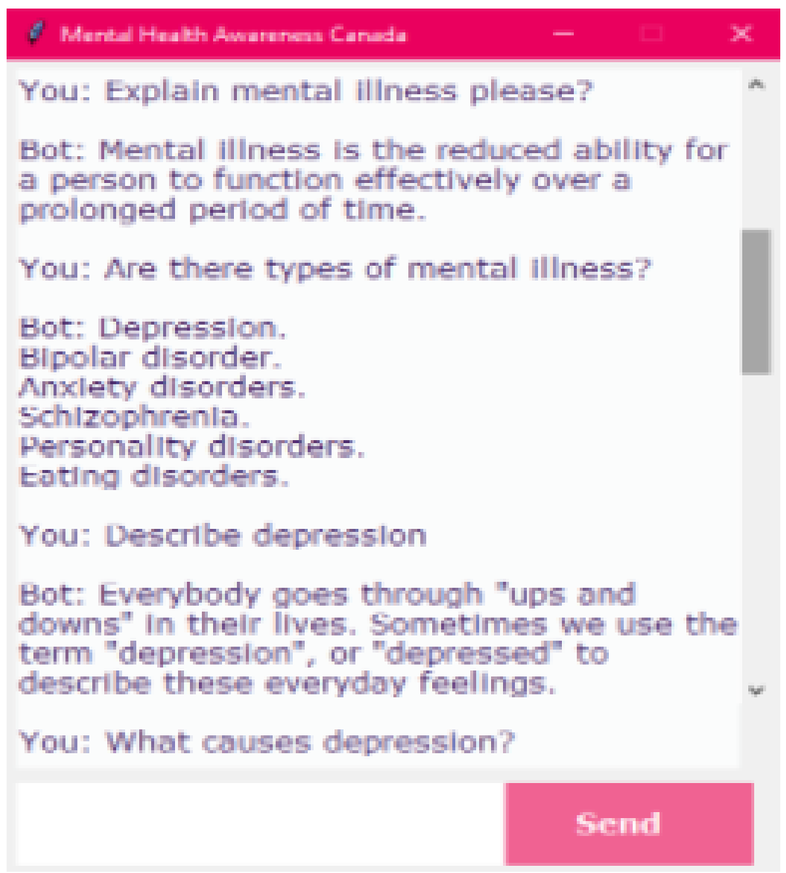


Figure 1. Chatbot providing information regarding Mental Health Issues.

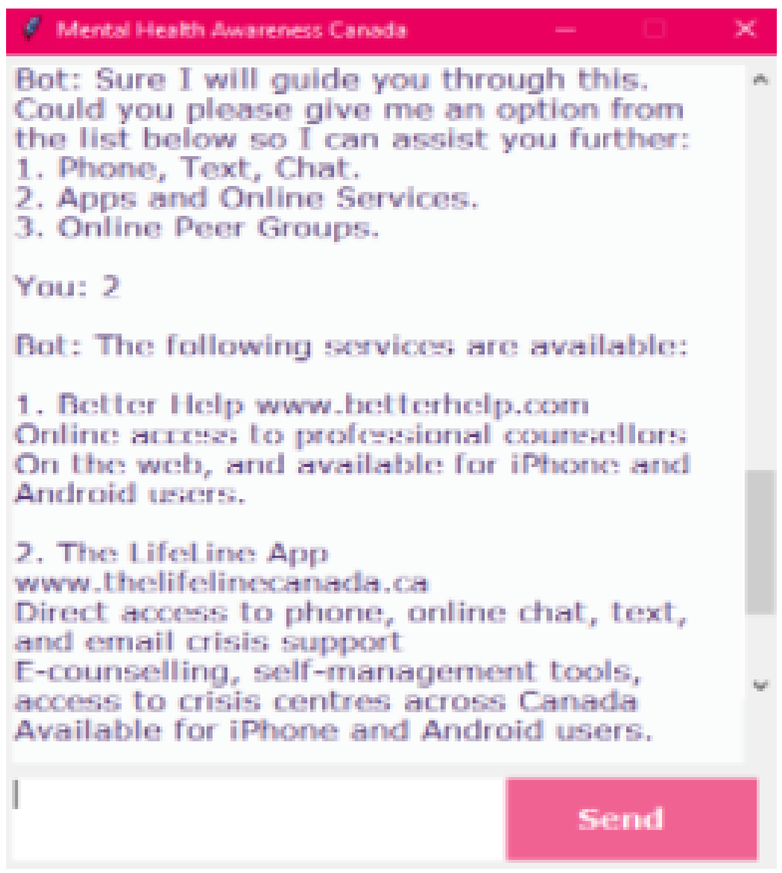


Figure 2. Mental Health Resources aided by the Canadian Government.

CONCLUSION/IMPLICATION: This research provides insight into developing a Chatbot application to create awareness regarding mental health issues and recommend users to seek help from reliable resources available in Canada. Rather than focusing on self-help therapies, this application encourages users to discuss their concerns without feeling judged. Further research is needed to incorporate more methodologies into the Chatbot for addressing the reluctance of users from contacting mental health support platforms.

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Production of Glucose Isomerase from Soil Bacterial Isolates

Aristide Laurel Mokale Kognou 1 , Zi-hua Jiang 2 , Chunbao Xu 3 , Wensheng Qin 1 *
1 Department of Biology, Lakehead University, Thunder Bay, Canada
2 Department of Chemistry, Lakehead University, Thunder Bay, Canada
3 Department of Chemical and Biochemical Engineering, Western University, London, Canada

BACKGROUND/OBJECTIVES: The enzymatic isomerization of glucose into fructose by glucose isomerase (GI) is a crucial step in producing high fructose corn syrup, a precursor of valuable bio-based chemicals and materials synthesis. This study was performed with the objective of microbial strain selection and optimization of fermentation conditions for fructose production.

METHOD: Bacillus sp, Hymenobacter sp, Paenathrobacter sp, Mycobacterium sp, Chryseobacterium sp and Stenotrophomonas sp were isolated from soil samples in Kingfisher Lake and the University of Manitoba campus. These isolates were screened for their ability to produce GI. The GI production was optimized by varying some parameters such as pH, temperature, incubation period, nitrogen, and carbon sources.

RESULTS: All isolates exhibited maximum GI activity at 40°C. Optimum pH for the GI production by Paenathrobacter sp (Figure 1), Chryseobacterium sp, and Bacillus sp occurred at pH 8 while Hymenobacter sp, Mycobacterium sp, and Stenotrophomonas sp was at pH 6. Xylose and a mixture of peptone and yeast extract boosted enzyme activity.

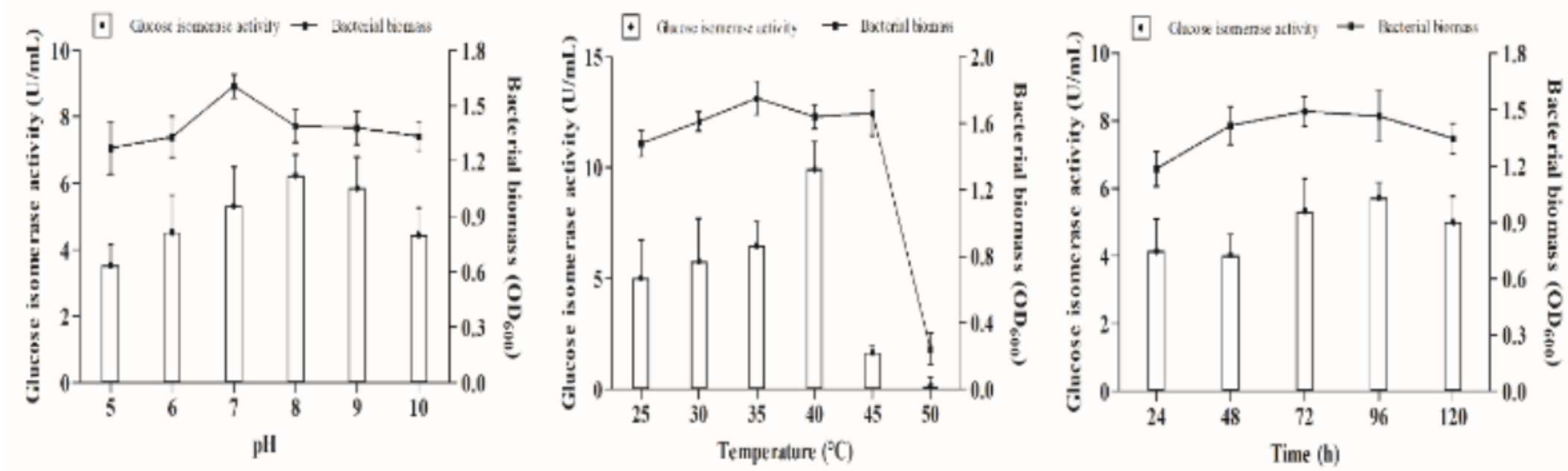


Figure 1. Effect of pH, temperature, and incubation time on the glucose isomerase production by *Paenathrobacter* sp.

CONCLUSION/IMPLICATION: These isolates could be promising bacteria for biomass conversion into useful compounds. The co-culturing of bacteria and enzyme immobilization for maceration, liquefaction, extraction and clarification processes are being studied.

https://sesbass21.weebly.com/

Lakehead UNIVERSITY

Science and Environmental Studies, Biotechnology and Allied Sciences Symposium

Effects of nZVI modified biochar and earthworms on the dissipation of sulfamethoxazole, microbial antibiotic resistance genes and microbial community structures in soil

Yuen Zhu 1 , Yuanyuan Li 1 , Jiarui Miao 1 , Guixiang Zhang 2 , Hua Li 1

1 Shanxi University, Shanxi, China
2 Taiyuan University of Science and Technology, Shanxi, China

BACKGROUND/OBJECTIVES: Sulfamethoxazole (SMX) potentially enters soils due to its higher water solubility, low chelating ability, and low binding constants. The effects of biochar on soil microbial communities are quite significant for contaminant dissipation in soil. Earthworm modifies the composition and activity of soil microorganisms and enhances the dissipation of contaminants in soil.

METHOD: Established soil incubation experiments to evaluate the effect of nZVI modified biochar and its interaction with earthworm on the dissipation of SMX, corresponding microbial antibiotic resistance genes (ARGs), as well as microbial community structures.

RESULTS: The addition of earthworm in the SMX-contaminated soil significantly reduced the abundance of SMX by 50.93%-78.36% in soils, it reached to 81.66% in nZVI modified biochar treated soils. The addition of earthworm significantly increased the expression of the ARGs such as the intI1 gene in soil. The nZVI modified biochar significantly reduced the expression of the ARGs and the abundance of earthworm in soil.

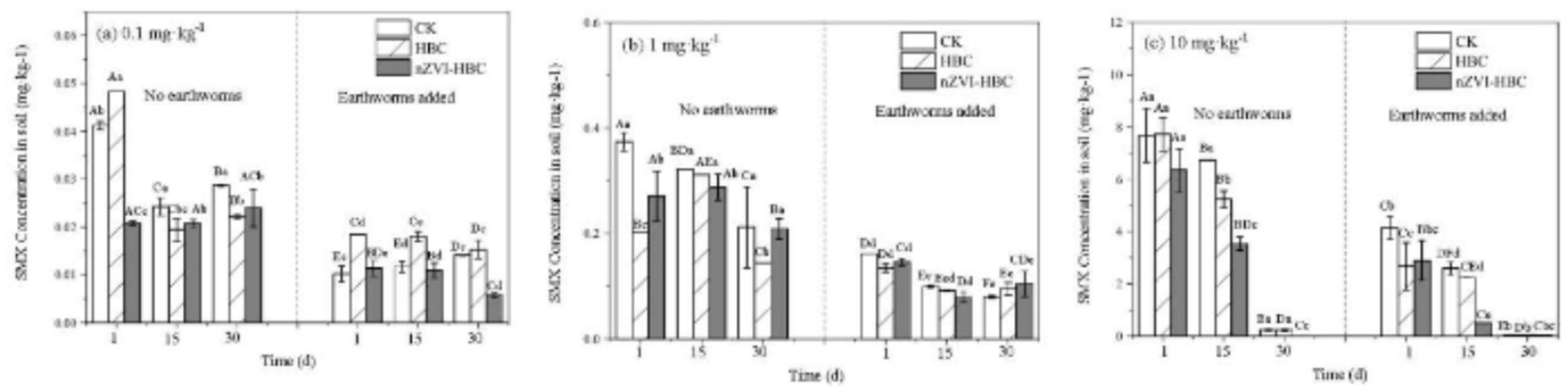


Fig.1 The effects of nZVI modified biochar and earthworm on the concentrations of SMX in soil.

CONCLUSION/IMPLICATION: The nZVI modified biochar and earthworm could separately or interactively accelerate the SMX dissipation in soil. Treatment of soil with nZVI modified biochar and earthworm enriched microbial community associated with SMX degradation in soil.

a

https://sesbass21.weebly.com/

Thank you

Thank you very much for attending and participating in our third annual SESBASS. We hope to see you again next year!

https://sesbass21.weebly.com/