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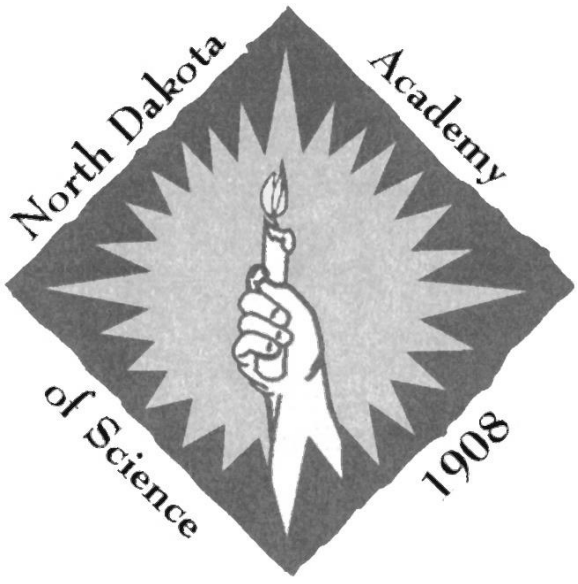

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Volume 71 April 2017

NORTH DAKOTA ACADEMY OF SCIENCE
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2016-2017

OFFICERS AND MEMBERS OF THE EXECUTIVE COMMITTEE

109th Annual Meeting

April 28-29, 2017

Grand Forks, North Dakota

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EDITOR'S NOTES

HISTORY

The *Proceedings of the North Dakota Academy of Science* (NDAS) was first published in 1948, with Volume 1 reporting the business and scientific papers presented for the 40th Annual Meeting, May 2-3, 1947. Through Volume 21, the single yearly issue of the *Proceedings* included both abstracts and full papers. Commencing with Volume 22, the *Proceedings* was published in two parts: A, published prior to the Annual Meeting, contained an abstract of each paper to be presented at the meeting, and B, published later, contained full papers by some of the presenters.

In 1979 (Volume 33), the *Proceedings* changed to an 8½ x 11-inch format. Produced from camera-ready copy submitted by authors, it was distributed at the Annual Meeting. As desktop computing became more prevalent, Volumes 51-64 of the *Proceedings* were assembled with desktop publishing software from submitted computer disks. The current volume was assembled from electronic submission of abstracts in a standardized format through submission of a form and the *Proceedings* archived online as a portable document file (.pdf).

VOLUME 71 ORGANIZATION

In 2003 the NDAS council voted to accept all abstracts scheduled for presentation at the Annual Meeting. Thus, communications in Volumes 58 to present have not undergone a "typical" peer review. Rather, they provide an accurate reflection of the material presented to the NDAS membership at the Annual Meeting. The presentations in this year's *Proceedings* are presented in five major sections. The first contains the Undergraduate Communications presented as part of the A. Rodger Denison Undergraduate Student Research Competition. The second section comprises the Graduate Communications presented as part of the Denison Graduate Student Research Competition. The third section comprises Professional Communications presented by Postdoctoral members of the Academy. The fourth section comprises Professional Communications presented by Faculty members of the Academy. Postdoctoral and Faculty Communications were separated was due to the addition of awards for postdoctoral presentations, which were generously provided by the University of North Dakota Provost's Office. The final section comprises all abstracts of posters presented at the meeting. Readers may locate communications by looking within the major sections of these *Proceedings* (see Table of Contents) or by referring to the Author Index.

IN APPRECIATION

The Academy wishes to acknowledge current and *emeritus* members of the Academy who continue to support the mission of the North Dakota Academy of Science Research Foundation through their special gifts. The Academy also wishes to express its thanks to the presenters of papers at the Annual Meeting, the session chairs, as well as all who have helped in organizing spaces and places, soliciting manuscripts, and compiling of this year's communications.

Julia Xiaojun Zhao, President

Stuart J Haring, Secretary

NDAS LISTSERV

To promote better communication between Academy members, an NDUS LISTSERV (NDUS-NDACADSCI@listserv.nodak.edu) was established in 2015. All registrants for the Annual Meeting providing their email address will be added to this listserv. Anyone else wishing to receive communications from the North Dakota Academy of Science, including information on future Annual Meetings, may subscribe.

To Subscribe – send an email (no subject) as follows:

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The listserv will be maintained and updated throughout the year. In addition to receiving periodic email from NDAS, one may also send email to all subscribers of the listserv. All communications will be approved by a moderator for the listserv to avoid the forwarding of any spam or unsolicited emails.

SCHEDULE

All events will be held UND Memorial Union.

Friday, April 28		
Time	**River Valley Room**	**Badlands Room**
8:00 AM	REGISTRATION AND BREAKFAST – River Valley Room	
8:45 AM	WELCOME AND OPENING REMARKS	
9:00 AM	Neupane (G)	Han (G)
9:20 AM	Al Areef (G)	Kalbach (G)
9:40 AM	Mahmood (G)	Manocha (P)
10:00 AM	Parent (F)	Loganathan (P)
10:20 AM	BREAK	
10:40 AM	Zhang (P)	Lapka (G)
11:00 AM	Chowdhury (G)	Madoff (P)
11:20 AM	Singh (G)	Schroeder (G)
11:40 AM	Kulas (G)	Bucholz (U)
12:00 N	LUNCH	
1:00 PM	Upadhaya (G)	Kumar (P)
1:20 PM	Germundson (U)	Yang (G)
1:40 PM	Plaisance (G)	Edwinson (G)
2:00 PM	Xiao (F)	de Anda-Jáuregui (G)
2:20 PM	BREAK	
2:40 PM	Ghosh Dastidar (G)	Pirner (U)
3:00 PM	Storandt (U)	Steffan (G)
3:20 PM	Hicks (G)	Xu (G)
3:40 PM	Gonnella (F)	Liu (G)
4:00 PM	**POSTER SESSION – Ballroom**	
5:30 PM	DINNER	
6:30 PM	**KEYNOTE SPEAKER** ***Dr Zeev Rosenzweig*** **"Environmentally Benign Luminescent Quantum Dots – Challenges and Opportunities"**	
7:30 PM	STUDENT TOUR OF UND CHEMISTRY DEPARTMENT	

Saturday, April 29		
Time	**River Valley Room**	**Badlands Room**
9:00 AM	Hernandez (U)	Sharma (P)
9:20 AM	Munski (F)	Ali (G)
9:40 AM	Torgunrud (U)	Marwarha (P)
10:00 AM	Baumgartner (G)	Gupta (F)
10:20 AM	BREAK	
10:40 AM	Chikara (G)	Mohammad (G)
11:00 AM	Schaar (G)	Rahman (F)
11:20 AM	Xing (G)	Chauhan (P)
11:40 AM	Bedane (P)	Ramakrishna (G)
12:00 N	Haring (F)	Banerjee (P)
12:30 PM	**LUNCH AND DENISON COMPETITION JUDGING** *All faculty members are encouraged to participate.*	
1:45 PM	**BUSINESS MEETING – River Valley Room** *All Academy member are encouraged to attend.*	
3:00 PM	**AWARD CEREMONY** AND CLOSING REMARKS	

PRESENTERS AND PRESENTATION TITLES

River Valley Room

Friday, April 28 – Morning Session

9:00 AM	Neupane (G)	ELUCIDATING THE MOLECULAR INTERACTION BETWEEN NANOPARTICLES AND ENZYMES
9:20 AM	Al Areef (G)	THE EFFECT OF β-PHENYLETHYLAMINE ON REDUCING BACTERIAL CELL COUNT IN GROUND BEEF
9:40 AM	Mahmood (G)	EFFECT OF SILICA CONCENTRATION ON DIATOM'S OXYGEN ISOTOPE COMPOSITION
10:00 AM	Parent (F)	TOWARDS CATALYTIC OXIDATIONS USING OXYGEN GAS
10:20 AM		BREAK
10:40 AM	Zhang (P)	GRAPHENE OXIDE-BASED 3D SCAFFOLD WITH A TUNABLE POROSITY AND MECHANICAL PROPERTIES FOR CELL CULTURE
11:00 AM	Chowdhury (G)	EVALUATING VIRULENCE TYPES OF SOYBEAN CYST NEMATODE POPULATIONS IN INFESTED FIELDS IN NORTH DAKOTA
11:20 AM	Singh (G)	PEDV: A MODEL FOR RAPID RESPONSE VACCINES
11:40 AM	Kulas (G)	AMYLOID PRECURSOR PROTEIN REGULATES INSULIN DEGRADING ENZYME

Badlands Room		
Friday, April 28 – Morning Session		
9:00 AM	Han (G)	CHARACTERIZATION OF GOLD NANOPARTICLES USING SP-ICP-MS
9:20 AM	Kalbach (G)	DEVELOPING A SOFT VESICLE SYSTEM FOR EFFICIENT SOLAR ENERGY CONVERSION
9:40 AM	Manocha (P)	THE CONTRIBUTION OF NEUROINFLAMMATION TO PARKINSON'S DISEASE USING HUMANIZED IMMUNE SYSTEM MICE
10:00 AM	Loganathan (P)	PIPERLONGUMINE ACTIVATES JNK SIGNALING IN PANCREATIC CANCER CELLS
10:20 AM		BREAK
10:40 AM	Lapka (G)	HIV-1 TAT INDUCED ACIDIC STORE-OPERATED CALCIUM ENTRY (ASOCE) IN NEURONS
11:00 AM	Madoff (P)	CAN WE MEASURE THE EFFECT OF CLIMATE ON EROSION RATES?
11:20 AM	Schroeder (G)	DEVELOPMENT OF A MICROFLUIDIC SYSTEM THAT SIMULTANEOUSLY ASSESS BIOACTIVITY AND DRUG CONCENTRATION
11:40 AM	Bucholz (U)	TIME INTERVAL PROFILES OF CAFFEINE CONCENTRATIONS EXTRACTED FROM HUMAN SALIVA ANALYZED BY GC/MS

River Valley Room		
Friday, April 28 – Afternoon Session		
1:00 PM	Upadhaya (G)	PIN NEMATODE: A POTENTIAL THREAT TO PEA PRODUCTION IN NORTH DAKOTA
1:20 PM	Germundson (U)	FOOD SENSITIZATION ALTERS INNATE BEHAVIOR AND BRAIN CELL DYNAMICS IN A MOUSE MODEL OF MILK ALLERGY
1:40 PM	Plaisance (G)	CHEMICAL APPLICATIONS TO CONTROL STUBBY ROOT NEMATODES AND CORKY RING SPOT DISEASE OF POTATO
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2:20 PM		BREAK
2:40 PM	Ghosh Dastidar (G)	ENHANCER FUNCTION IN LUNG CANCER CELLS
3:00 PM	Storandt (U)	SUBPOPULATIONS OF DOPAMINE TRANSPORTERS SHOW ENRICHMENT IN PHOSPHORYLATION OR PALMITOYLATION
3:20 PM	Hicks (G)	ELECTRONIC STRUCTURE CALCULATIONS OF CATALYZED LIGNIN DECOMPOSITION
3:40 PM	Gonnella (F)	THE USE OF OPEN EDUCATIONAL RESOURCES (OERS) IN COLLEGE PHYSICS: THEY FEEL GOOD, BUT DO THEY WORK?

Badlands Room		
Friday, April 28 – Afternoon Session		
1:00 PM	Kumar (P)	A ROLE FOR THE TRANSCRIPTION FACTOR SNAIL IN ALTERNATIVE SPLICING
1:20 PM	Yang (G)	INHIBITION OF CANCER MIGRATION AND INVASION BY KNOCKING DOWN D5D IN COX-2 OVEREXPRESSED CANCER CELLS
1:40 PM	Edwinson (G)	GAL AND GALNAC GLYCOMIMETIC POLYMERS TRIGGER REPLICATIVE TROPHOZOITE DEVELOPMENT IN CRYPTOSPORIDIUM
2:00 PM	de Anda-Jáuregui (G)	USING SYSTEMS PHARMACOLOGY TO IDENTIFY COMMON MECHANISMS OF DRUG-INDUCED PERIPHERAL NEUROPATHY
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2:40 PM	Pirner (U)	DETERMINING MOTILITY IN ESCHERICHIA COLI ISOLATED FROM SOIL
3:00 PM	Steffan (G)	FUNGAL ASTHMA AND DISEASE SEVERITY WITH PSEUDOMONAS AERUGINOSA CO-INFECTION
3:20 PM	Xu (G)	DELTA-5-DESATURASE KNOCKDOWN AND DGLA INHIBIT COLON CANCER GROWTH IN VITRO AND IN VIVO
3:40 PM	Liu (G)	A CORE/SHELL STRUCTURE OF RGO@MSILICA WITH OLIGONUCLEOTIDE GATES FOR CANCER TREATMENT

River Valley Room		
Saturday, April 29 – Morning Session		
9:00 AM	Hernandez (U)	PTC2 AND PTC3 PHOSPHATASE DELETIONS AND CHECKPOINT EXIT IN CELLS
9:20 AM	Munski (F)	ONGOING ASPECTS OF DEVELOPING HERITAGE TOURISM IN PEMBINA AND WALSH COUNTIES, NORTH DAKOTA
9:40 AM	Torgunrud (U)	RAPID SYNTHESIS OF N-(4-CHLOROBENZYL)MORPHOLINE
10:00 AM	Baumgartner (G)	PHOSPHORYLATION OF REPLICATION FACTOR A (RFA) PROMOTES CHECKPOINT ADAPTATION
10:20 AM		BREAK
10:40 AM	Chikara (G)	ANTICANCER MECHANISMS OF FLAXSEED AND ITS DERIVED MAMMALIAN LIGNAN ENTEROLACTONE IN LUNG
11:00 AM	Schaar (G)	REGULATION OF ADIPONECTIN BY TRPC1: A KEY TO UNDERSTANDING OBESITY
11:20 AM	Xing (G)	G-QUADRUPLEX/HEMIN: A BIOCOMPATIBLE ADDITIVE FOR ENHANCING THE ANTIBACTERIAL ACTIVITY OF H2O2
11:40 AM	Bedane (P)	THERMAL AIR OXIDATION OF BIOMASS-DERIVED BLACK CARBON
12:00 N	Haring (F)	FUNCTION OF THE REPLICATION PROTEIN A2 N-TERMINUS IN PREVENTING MUTATION AND CELLULAR DISEASE

Badlands Room		
Saturday, April 29 – Morning Session		
9:00 AM	Sharma (P)	MECHANISM OF NEUTROPHIL EXTRACELLULAR TRAP FORMATION: ROLE OF MINCLE AS AUTOPHAGY REGULATOR
9:20 AM	Ali (G)	CRISPR EDITING OF ENDOTHELIAL CELLS TO INVESTIGATE THE ROLE OF GRAVIN IN ANGIOGENESIS
9:40 AM	Marwarha (P)	VITAMIN D3 DECREASES AMYLOID-β GENESIS BY ATTENUATING NF-κB – MEDIATED BACE1 EXPRESSION
10:00 AM	Gupta (F)	NEXT GENERATION STRUCTURAL MATERIALS FOR MULTIFUNCTIONAL APPLICATIONS
10:20 AM		BREAK
10:40 AM	Mohammad (G)	PIPERLONGUMINE ENHANCES GEMCITABINE EFFICACY IN IN VITRO AND IN VIVO HUMAN PANCREATIC CANCER MODELS
11:00 AM	Rahman (F)	GENOME-WIDE ASSOCIATION STUDY FOR ELECTROLYTE LEAKAGE IN RAPESEED/CANOLA (BRASSICA NAPUS L.)
11:20 AM	Chauhan (P)	MACROPHAGE POLARIZATION TO M1- INFLAMMATORY PHENOTYPE REQUIRES STORE OPERATED CALCIUM ENTRY BY TRPC1
11:40 AM	Ramakrishna (G)	IMPROVING PHENOLIC-LINKED ANTIHYPERGLYCEMIC FUNCTIONS OF BARLEY SPROUTS USING SEED ELICITORS
12:00 N	Banerjee (P)	COULOMB BLOCKADE AT ROOM TEMPERATURE: SELF-ASSEMBLED IRIDIUM QUANTUM DOTS ON SILICON(110) SURFACE

KEYNOTE SPEAKER

Zeev Rosenzweig

Chemistry and Biochemistry, University of Maryland-Baltimore

ENVIRONMENTALLY BENIGN LUMINESCENT QUANTUM DOTS – CHALLENGES AND OPPORTUNITIES

Luminescent semiconductor quantum dots (QD) have attracted the attention of the science and engineering communities due to their unique photo-physical and chemical properties, which enable their use in a broad range of technological applications ranging from luminescence biomedical imaging to consumer electronic devices like TVs, cell phone and tablet screens. The chemical composition of first generation luminescent QD, which often contain toxic elements like cadmium and lead, and their chemical degradation in the environment have raised significant environmental and health concerns about their use, particularly in widely used consumer electronic products. The presentation will describe the fundamental principles and state of the art of first generation luminescent QD, and recent advances towards the synthesis and application of benign by design QD that retain their function while minimally impact human health and the environment.

Biography

Zeev Rosenzweig obtained his PhD degree in Physical Chemistry from the Hebrew University of Jerusalem in 1992. In 1995, following three years of postdoctoral training at Iowa State University and the University of Michigan, he assumed a faculty position in the Chemistry department of the University of New Orleans where he developed a research program in nanosensors. He quickly rose through the academic ranks and became a Full Professor in 2001. In 2005, in the aftermath of Hurricane Katrina, Dr Rosenzweig joined the National Science Foundation as a Program Director in the Chemistry Division and served the community in this role until 2014. He then assumed the position of Professor and Chair of the Department of Chemistry and Biochemistry at the University of Maryland Baltimore County where he developed a new research program in nanoscience, with a strong focus on developing environmentally benign nanoparticles. Dr Rosenzweig has published over 100 research articles and book chapters pertaining to his research and has mentored 25 graduate students and postdocs during his career.

UNDERGRADUATE COMMUNICATIONS

IN THE

A. RODGER DENISON COMPETITION

(Communications are listed alphabetically by the last name of the presenting author)

TIME INTERVAL PROFILES OF CAFFEINE CONCENTRATIONS EXTRACTED FROM HUMAN SALIVA ANALYZED BY GC/MS

Alex Buchholz* (U1), Annika Kraft (1), Brett Nespor (1), Belinda Zabka (1), Shirley Cole-Harding (2), and Naomi Winburn (1)

(1) Chemistry, Minot State University, Minot, ND and (2) Psychology, Minot State University, Minot, ND

The aim of this research was to quantify the amount of caffeine present in human saliva after coffee ingestion. Subjects were given decaffeinated coffee on day one of the trial and decaffeinated coffee spiked with 2 mg of caffeine per kilogram of body weight on trial day two. Saliva samples were taken throughout a two-hour time frame. Caffeine was extracted from the saliva samples using ethyl acetate and 15% sodium dodecyl sulfate. The extraction solvent was analyzed using gas chromatography/mass spectrometry. Subjects on day one of the trial had an average baseline saliva-caffeine concentration (S-CC) of 1.16±0.73 mg/L and a peak S-CC of 1.94±1.1 mg/L. On trial day two subjects had S-CC at baseline, 15, and 30 minutes of 1.10±0.80, 8.53±3.30, and 4.34±0.80 mg/L, respectively. After 30 minutes, subjects' S-CC decreased only slightly for the remainder of the 2-hour study; subjects completed trial day two with an average S-CC of 3.04±0.78 mg/L at 120 minutes. It can be concluded that peak S-CC occurs 15 minutes after ingestion with a large decrease thereafter. Finally, two hours after ingestion S-CC remained above baseline levels.

An additional subject was dosed with 200, 300, and 400 mg of caffeine over three weekends. S-CC mirrored the data from trial day two when the subject was given 200 and 300 mg of caffeine. When dosed with 400 mg of caffeine, S-CC peaked at 17.1±2.4 mg/L and remained above 6.31±1.40 mg/L for the remainder of the seven-hour study.

Support: Support: This work was supported by an Institutional Development Award from the National Institute of General Medical Sciences of the National Institutes of Health under grant number P20GM103442.

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Germundson
Undergraduate
Talk

FOOD SENSITIZATION ALTERS INNATE BEHAVIOR AND BRAIN CELL DYNAMICS IN A MOUSE MODEL OF MILK ALLERGY

Danielle L Germundson* (U) and Kumi Nagamoto-Combs

Pathology, University of North Dakota School of Medicine and Health Sciences, Grand Forks, ND

Food allergy is often comorbid with behavioral disorders such as depression and autism. However, it is not clear how allergy-triggered immune responses can affect brain functions. Mast cells are likely participants in this gut-brain communication since they are the major contributors in allergic responses, and known to migrate into the brain and influence glial activity. Therefore, we hypothesized that food allergy would increase the number of mast cells in the brain and alter the function of the central nervous system.

To test this idea, a mouse model of milk allergy was generated by oral sensitization to whey proteins (WP). One- and ten-month-old male and female mice were subjected to five-week WP sensitization or sham treatment followed by an oral WP challenge. Changes in innate digging behavior, mast cell numbers in the brain and ileum, and glia cell morphology were assessed.

WP sensitization significantly lowered digging activity in male mice of both age groups, and resulted in increased numbers of mast cells in the brain of young male mice and in the ileum of the old mice. Perivascular astrocyte hypertrophy was also noted in select brain regions of the old, but not young, WP-sensitized male mice.

Our results showed that induction of food allergy in mice altered their intrinsic behavior and the number of mast cells in the brain or gut in gender- and age-dependent manners, thus supporting the involvement of mast cells in food allergy-associated behavioral disorders.

Support: This study was supported by an Institutional Development Award from the National Institute of General Medical Sciences of the National Institutes of Health under grant number P20GM103442.

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Hernandez
Undergraduate
Talk

PTC2 AND PTC3 PHOSPHATASE DELETIONS AND CHECKPOINT EXIT IN CELLS

Cristian Hernandez* (U) and Stuart J Haring

Chemistry and Biochemistry, North Dakota State University, Fargo, ND

DNA damage is a regular occurrence in organisms, and therefore, cells must have mechanisms for repair of these lesions. When a DNA lesion is detected, cells are programmed to stop cell cycle progression (arrest) and repair the DNA damage. A critical factor for repair and cell cycle regulatory mechanisms is Replication Factor A (RFA) – a highly conserved heterotrimeric complex found in all eukaryotic cells. Furthermore, upon DNA damage, one subunit of the RFA complex, Rfa2, is post-translationally modified by phosphorylation.

In addition to Rfa2, a master checkpoint regulator, Rad53, is also recruited to sites of DNA repair. Rad53 is activated through phosphorylation by other checkpoint kinases and deactivated through dephosphorylation by phosphatases. Rad53 activation and deactivation ultimately determines entry and exit of the checkpoint. It has been demonstrated in our lab that phosphorylation of Rfa2 appears to be important for regulating Rad53 dephosphorylation and ultimately exit from checkpoint arrest.

I have generated knockouts of the ptc2 and ptc3 genes, which normally encode for phosphatases that dephosphorylate Rad53. The characterization of these mutants and their ability to exit a checkpoint will be presented. Ultimately, the goal is to determine whether different phospho-forms of Rfa2 can lead to dephosphorylation of Rad53 in the absence of ptc2 and ptc3, to determine if these are the phosphatases through which Rfa2 interacts to regulate Rad53 activity.

Support: This work was supported by NSF-CAREER-1253723 from the National Science Foundation to SJH.

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DETERMINING MOTILITY IN ESCHERICHIA COLI ISOLATED FROM SOIL

Collin Pirner* (U), Shelley Horne, Birgit Pruess, and Peter Bergholz

Department of Microbiological Sciences, North Dakota State University

Escherichia coli is continuously dispersed into diverse non-host environments and this process may lead to the selection for biodiversity in its genome. Previous work has demonstrated that a small set of E. coli isolates from soil exhibit enhanced biofilm motility. Further work demonstrated that these phenotypes were enhanced, compared to E. coli K-12, at soil relevant temperatures of 15 and 22oC. To test theories about the role of the soil environment in E. coli biodiversity, we isolated a collection of 322 E. coli from phylogroup D, the most genetically diverse of E. coli subspecies. We asked, “What is the diversity of motility phenotypes in these isolates?”

The environmental Escherichia coli isolates taken from soil samples were tested for their motility. We assessed their motility in swim plates. 15 were found to be non-motile, 72 slightly motile, and the remaining 235 isolates were motile or very motile. The isolates that proved to be non-motile were screened by PCR to determine the size of their flhD operons. The flhD operon encodes the flagellar master regulator FlhD/FlhC. Insertion sequence elements in the operon can eliminate motility. None of the 15 non-motiles showed an increase in size of their flhD operon. The isolates were then tested for mutations in the flhD operon with complementation analysis, using a plasmid that expressed both FlhD and FlhC to see if motility could be restored. Motility has been complemented in two of eight isolates tested.

Support: Support: The work was funded by Research and Creative Activates (NDSU).

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Storandt
Undergraduate
Talk

SUBPOPULATIONS OF DOPAMINE TRANSPORTERS SHOW ENRICHMENT IN PHOSPHORYLATION OR PALMITOYLATION

Michael H Storandt* (U), Moriah J Hovde, Daniel J Stanislowski, Roxanne A Vaughan, and James D Foster

Biomedical Sciences, University of North Dakota School of Medicine and Health Sciences, Grand Forks, ND

The dopamine transporter (DAT) is a key regulator of duration and intensity of dopaminergic signaling through its uptake of dopamine from the extraneuronal space. DAT dysregulation has been hypothesized to play a role in dopaminergic diseases such as attention deficit hyperactivity disorder. DAT consists of 12 transmembrane spanning domains, and cytoplasmic N- and C-termini that contain sites for regulatory post-translational modifications. Phosphorylation of the N-terminus occurs on Ser7 and Thr53, which leads to decreased transport Vmax. S-palmitoylation occurs on Cys580 at the membrane-cytoplasm interface of the most C-terminal transmembrane helix, which leads to increased transport Vmax. We previously showed that palmitoylation and phosphorylation occur in a reciprocal manner, with high phosphorylation promoting reduced palmitoylation and visa versa, but it has not been established if these modifications can coexist on a single molecule of DAT. To address this issue, we isolated palmitoylated DAT by acyl-biotin exchange and neutravidin affinity chromatography, followed by phosphospecific immunodetection of Thr53 phosphorylation. Our results indicate that only a small percentage of total DATs are simultaneously phosphorylated and palmitoylated, suggesting near mutual exclusivity. Additionally, we show a trend towards increased Thr53 phosphorylation in S7A DATs, indicating complex interplay between subregions of the N-terminus, as well as between N- and C-termini.

Support: NIH-DA031991 to JDF, DA13147 to RAV, P30-GM103329, P20-GM12345, 5P20-104360 to UND

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RAPID SYNTHESIS OF N-(4-CHLOROBENZYL)MORPHOLINE

Jordan Torgunrud* (U) and Mikhail Bobylev

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Background: Benzylamines are important structural elements in many pharmaceutically active compounds. Recently, a novel method for the synthesis of N,N-dialkyl-N-benzylamines via a direct coupling of benzyl alcohols and secondary amines was published. The method showed lower reactivity with less electron rich substrates. For example, N-(4-chlorobenzyl)morpholine was obtained with the yield of only 40%. Recently, we developed a rapid procedure for the synthesis of N-benzylformamides via the Leuckart reaction. The procedure was equally successful with substrates containing either electron-donating or electron-withdrawing substituents. It was interesting to determine if it can be used for the synthesis of N,N-dialkyl-N-benzylamines.

Hypothesis: Our rapid procedure may produce high yields of N,N-dialkyl-N-benzylamines with electron withdrawing substituents. In this work the hypothesis was tested by conducting the reaction of 4-chlorobenzaldehyde and N-formylmorpholine.

Methods: The reaction was conducted on 10 mmol scale at 220ºC. Column chromatography was used for the isolation of the reaction products. NMR-spectroscopy and elemental analysis were used to determine the structures of the products.

Results: The reaction was fully completed in 3 minutes and produced N-(4-chlorobenzyl)morpholine with the yield of 82%.

Conclusions: A new rapid method for the synthesis of N-(4-chlorobenzyl)morpholine was developed.

Support: Research reported in this publication was supported by ND EPSCoR.

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GRADUATE COMMUNICATIONS

IN THE

A. RODGER DENISON COMPETITION

(Communications are listed alphabetically by the last name of the presenting author)

Al Areef
Graduate
Poster

THE EFFECT OF β-PHENYLETHYLAMINE ON REDUCING BACTERIAL CELL COUNT IN GROUND BEEF

E Al Areef* (G), SM Horne, and BM Pruess

Microbiological Sciences, North Dakota State University, Fargo, ND

Cattle are a natural reservoir of the foodborne pathogen E. coli. This study tested the effect of PEA on the naturally occurring beef spoilage flora, as well as externally added E. coli. First, we determined the effect of PEA on the microflora which is normally found on ground beef. Different amounts of PEA (0.5, 1, 5 and 10 g) were mixed with 200 g of ground beef that was harvested in between the first and second round of grinding. Second, E. coli were inoculated onto ground beef mixed with 1 g of PEA. Control samples of meat did not contain PEA. In both experiments, the meat samples were incubated at 10°C for 5 days. Bacteria were enumerated from the homogenized meat pieces on selective agar plates. PEA abolished the total number of bacteria by 5 logs at a concentration of 10 g per 200 g of meat. At the lower concentrations of PEA, reductions in cell counts were less dramatic. Specifically, PEA reduced Pseudomonas by 6 logs at 10 g of PEA, 5 logs at 5 g, 3 logs at 1 g. PEA reduced externally added E. coli K-12 by 80%, when compared to the untreated group. When E. coli O157:H7 was inoculated at 106 CFU, PEA reduced E. coli by approximately 50%.
In summary, PEA reduced the naturally occurring background flora of beef meat to significant extends. While non-pathogenic E. coli were still reduced by 80%, pathogenic E. coli were not reduced to any significant extent. Future research will establish whether PEA may be a suitable agent to increase shelf life of meat.

Support: This work was supported by State Board of Agriculture Research and Education, Graduate School through Food Safety to EA and North Dakota Agricultural Experiment Station to BMP.

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Ali
Graduate
Talk

CRISPR EDITING OF ENDOTHELIAL CELLS TO INVESTIGATE THE ROLE OF GRAVIN IN ANGIOGENESIS

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Angiogenesis and vascular integrity are highly regulated physiological processes influenced by several pro- and anti-angiogenic factors. These factors operate through diverse signaling pathways involving proteins such as PKA and Src. Several studies indicate that the A Kinase Anchoring Protein gravin/AKAP12 has a role in regulating endothelial cell motility and angiogenesis, but the specific mechanisms are unknown. Because gravin is a scaffolding protein for both PKA and Src, we hypothesize that gravin regulates endothelial cell integrity and angiogenesis by targeting PKA and Src to the plasma membrane where they control cytoskeletal organization and cell adhesion. Our long-term approach to test this hypothesis is to investigate the effect that eliminating each gravin splice variant and the PKA and Src binding domains on endothelial cell migration and angiogenesis. Here, we report on the effect of knocking out gravin splice variant 1, using CRISPR/cas9, on angiogenic sprouting in a collagen gel. The gravin gene was edited in HUVEC-TERT2 cells by targeting CRISPR-Cas9 construct to a site on exon 3 of the gene. Following screening using an RFLP assay, a clone lacking variant 1 was selected and assessed in an angiogenic sprouting assay. Results of the assay showed that angiogenic sprouting in this cell line was impaired. This study demonstrates that gravin variant 1 plays an important role in a model of angiogenic sprouting.

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Baumgartner
Graduate
Talk

PHOSPHORYLATION OF REPLICATION FACTOR A (RFA) PROMOTES CHECKPOINT ADAPTATION

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Major events (G1, S, G2, and M) within the cell cycle are well understood; however, the molecular mechanism(s) controlling cell cycle progression is still being deciphered.

When a DNA break occurs, a cell initiates a checkpoint, ideally preventing the start of mitosis (G2/M checkpoint) until after the break is fixed. Initiation of the G2/M checkpoint involves the formation of single-stranded DNA (ssDNA), a substrate bound by Replication Factor A (RFA). This leads to the phosphorylation of the N-terminus of the 32 kDa subunit of RFA (Rfa2). Another factor recruited to the DNA break is the master checkpoint regulator, Rad53, which has long been used as a marker for activation of and exit from the G2/M checkpoint.

In cases where there is an irreparable break, cells dephosphorylate Rad53 to deactivate it and exit from the checkpoint occurs even in the presence of unrepaired DNA – termed checkpoint adaptation. Three phosphatases are known to act on Rad53 to deactivate it. Furthermore, phosphorylation of Rfa2 has also been shown to lead to Rad53 deactivation (dephosphorylation).

To study the role of Rfa2 phosphorylation on checkpoint exit (adaptation), several phosphatase deletion and Rfa2 phospho-mutant strains have been created. The goal is to determine whether Rfa2 phosphorylation promotes early checkpoint exit (adaptation) through regulation of phosphatases identified to act on Rad53, or through a yet unidentified pathway.

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Chikara
Graduate
Talk

ANTICANCER MECHANISMS OF FLAXSEED AND ITS DERIVED MAMMALIAN LIGNAN ENTEROLACTONE IN LUNG

Shireen Chikara* (G) and Katie M Reindl

North Dakota State University

Whole flaxseed and its derived lignans exert anti-cancer properties in a variety of malignancies. However, their potential remains uninvestigated in lung cancer, the leading cause of cancer-related deaths worldwide. We investigated the in vitro anti-tumor effects of flaxseed-derived mammalian lignan enterolactone (EL) in a panel of lung cancer cell lines and the chemopreventive potential of flaxseed in a mouse model of lung carcinogenesis. EL inhibited cell proliferation by decreasing mRNA and protein expression levels of G1-phase cell cycle promoters and increasing mRNA and protein expression levels of p21WAF1/CIP1, a negative regulator of cell cycle. EL inhibited cell motility by modulating cytoskeleton organization, inhibiting the activation of the FAK-Src-paxillin signaling, and expression of down-stream motility regulators. Our in vivo study revealed that 10% whole flaxseed reduced the incidence, number, and size of lung tumor nodules in A/J mice exposed to the tobacco smoke carcinogen, nitrosamine 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK). RNA sequencing revealed altered expression of genes whose products modulate inflammation and oxidative stress, and are likely to be responsible for chemopreventive potential of whole flaxseed. The results from our in vitro studies highlight the anticancer potential of EL in lung, while the results from our in vivo study show that whole flaxseed holds promise as a chemopreventive dietary agent in lung.

Support: National Science foundation and National Institute of Health

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EVALUATING VIRULENCE TYPES OF SOYBEAN CYST NEMATODE POPULATIONS IN INFESTED FIELDS IN NORTH DAKOTA

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Soybean cyst nematode (SCN; Heterodera glycine Ichinohe) is responsible for the greatest annual yield loss, more than $1 billion, among all pathogens of soybean in the United States. To characterize the virulence types of SCN populations in North Dakota, soil samples were collected in 2015 and 2016 from soybean fields or fields with a history of SCN. SCN was extracted from soil in infested fields and used as inoculum. HG type bioassays were performed with seven soybean Plant Introduction lines including PI 548402 (PI number: 1), PI 88788 (2), PI 90763 (3), PI 437654 (4), PI 209332 (5), PI 89772 (6) and PI 548316 (7), used as test lines, and a local cultivar (Barnes), used as a susceptible control. HG means Heterodera glycines and the type indicates the seven PI lines with various sources of resistance. For example, HG type 2.5.7 refers to a SCN population that is capable of reproducing on the PI line numbers 2, 5, and 7. In 2015, forty-five SCN populations from ND fields were assessed for the HG types. Among the successful experiments, the most common HG types were HG type 0 (frequency rate expressed as percentage: 46) and HG type 7 (17), followed by HG type 2.7 (13), 2.5 (8), 5 (8), and 2.5.7 (8). In 2016, 28 fields were assayed. The HG types of these populations were 7 (36 percent), 2.5.7 (25), 5.7 (18), 0 (14), and 2.7 (7). Our results demonstrated that there are SCN populations in ND that can successfully reproduce on PI 88788, the most widely used source of resistance.

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GAL AND GALNAC GLYCOMIMETIC POLYMERS TRIGGER REPLICATIVE TROPHOZOITE DEVELOPMENT IN CRYPTOSPORIDIUM

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The diarrheal disease cryptosporidiosis is caused by the apicomplexan parasite Cryptosporidium. Infections can become chronic and life threatening in immunocompromised individuals and there is no effective treatment for those at risk for severe disease. Previous work has shown host glycoproteins and galactose n-acetyl-galactosamine (Gal-GalNAc) glycans trigger invasive Cryptosporidium sporozoites to develop into replicative trophozoites. Here we use glycomimetic polymers to begin identifying the effect density and glycan type have on trophozoite formation as native glycoproteins can be difficult to purify and experimentally manipulate. Glycomimetic polymers allow for precise modification of carbohydrate structure and control of spatial presentation. Trophozoite development was greatest after Cryptosporidium sporozoites were exposed solubilized glycomimetics decorated with Gal and GalNAc. Glycomimetic polymers were also grafted onto a glass slide in a microarray format to determine how glycan density impacts trophozoite development. Higher density spots imprinted with Gal or GalNAc triggered the greatest trophozoite development. Spots imprinted at lower densities and displaying glycans not found in glycoproteins, such as rhamnose, were poorer triggers for initiation of replication. Consistent with reports of Gal-GalNAc targeting during invasion of host cells, these observations suggest Cryptosporidium sporozoite invasion is closely related to replication initiation.

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Ghosh Dastidar
Graduate
Talk

ENHANCER FUNCTION IN LUNG CANCER CELLS

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Enhancers are regulatory regions of DNA that play significant roles in determining the fate of a cell. Enhancers can be present in active or inactive state in a cell and these states can directly affect gene expression. Cancer cells are often found to lose cell identity resulting in aberrant gene expression. Interestingly, enhancers are often found to be dysregulated in cancer. My work involves characterization of LYN enhancer and identification of different states of the enhancer in response to inflammatory stimulus in lung cancer cells. LYN is a critical regulator of inflammation and its overexpression is often associated with poor prognosis of the patient. However, no mutation has been identified in the LYN gene in lung cancer. Thus, determining how LYN is upregulated in lung cancer cells with response to inflammatory stimulus is necessary to understand the mechanism of activation of various other genes that are transcriptionally upregulated in cancer cells.

Our preliminary result analyzing publicly available data predicts a putative enhancer region 35kb upstream of LYN gene in A549 cells. Our chromatin immunoprecipitation (ChIP) results confirmed enrichment of enhancer-specific histone marks in predicted LYN enhancer region. Our goal is to explore how these histone marks in LYN enhancer change in response to inflammatory stimulus such as LPS and IL-1β, and how changes in LYN enhancer region can affect LYN gene expression.

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CHARACTERIZATION OF GOLD NANOPARTICLES USING SP-ICP-MS

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Engineered nanoparticles are now used in many industrial fields and consumer products but challenges persist in the rapid and simultaneous characterization of their elemental composition along with concentration, size, and size distribution at a very low concentration. To address these challenges, we have applied the technique of single particle inductively coupled plasma-mass spectrometry (sp-ICP-MS) and demonstrated high level of performance. The technique uses a traditional ICP-MS to perform a particle-by-particle analysis with high sensitivity and isotopic specificity. In this study, we used National Institute of Standards and Technology (NIST)-certified gold nanoparticles (Au-NPs) with different diameters (10, 30, and 60 nm) to validate that our sp-ICP-MS system for both sensitive and selective nanomaterial characterization. In addition to validating the certified size and particle concentration characteristics of the Au-NP reference materials, we confirmed our sp-ICP-MS measurements with transmission electron microscopy (TEM) and dynamic light scattering (DLS). The results of this study indicate that our sp-ICP-MS system works well for the Au-NPs with different diameters, and the particle size observed by sp-ICP-MS corresponded to TEM observation. Furthermore, the particle size and particle concentration can be simultaneously measured in the mixture of 50 µg/L, 60 nm Au-NPs and 10 µg/L, 30 nm Au-NPs.

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ELECTRONIC STRUCTURE CALCULATIONS OF CATALYZED LIGNIN DECOMPOSITION

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Lignin is a branched and crosslinked network polymer which exists in the cell walls of wood and various plants where it binds the cells, fibers and vessels. Second only to cellulose, lignin is one of the most abundant renewable carbon sources on earth. Despite its abundance, lignin has only seen limited use due to its chemical stability and complex structure, thus lignin is typically disposed of as non-commercialized waste product. However, if a viable path could be found for the decomposition of lignin, the by-products could be used to replace high-value petrochemicals. Catalytic decomposition by silica-alumina based catalysts may be a viable path, but the mechanisms and the effects of metal doping are not strictly known. In this work, DFT calculations, as implemented in the NWChem software package, are used to elucidate this information with the intention of aiding experimentalists in the design of novel silica-alumina based catalysts for lignin decomposition.

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Kalbach
Graduate
Talk

DEVELOPING A SOFT VESICLE SYSTEM FOR EFFICIENT SOLAR ENERGY CONVERSION

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Though solar energy is one of the leading sources of alternative energy needs, there are still many technological challenges that have yet to be solved. Our group is developing methods, which mimic biological photosystems, that enable efficient conversion of solar energy into hydrogen gas. Initial efforts to identify materials capable of reducing charge recombination during light harvesting will be discussed.

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AMYLOID PRECURSOR PROTEIN REGULATES INSULIN DEGRADING ENZYME

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The amyloid hypothesis of Alzheimer's disease (AD) posits that neurodegeneration in AD patients occurs due to the accumulation of plaques in the central nervous system with age. Plaques in AD patients are composed of the neurotoxic peptide Aβ, which is cleaved from the larger amyloid precursor protein (APP). While abundant in the brain and detectable in many peripheral organs, the physiologic role of APP is uncertain, though transgenic animal studies demonstrate the APP family of proteins is necessary for life. We have utilized the transgenic APP-/- mouse to identify APP as a novel regulator of the insulin degrading enzyme (IDE) in both the brain and peripheral organs. Using primary cultures we show that APP and IDE are detectable in all the major cell types of the central nervous system as well as the insulin secreting pancreatic islets themselves, and that IDE is robustly regulated by APP in all cell types examined. We have also performed immunohistochemistry for IDE in aged brain tissue sections from WT, APP-/- and the APP/PS1 mouse model of Alzheimer's disease to determine the location of IDE in the brain including around Aβ plaque deposits. Finally, we show that IDE levels are significantly increased in hippocampus tissue extracts from APP-/- animals, with lower levels of hippocampal insulin and abnormal fasting glucose. Collectively these data identify APP as a novel and robust regulator of the IDE and provide a new molecular link connecting diabetes to AD.

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Lakpa
Graduate
Talk

HIV-1 TAT INDUCED ACIDIC STORE-OPERATED CALCIUM ENTRY (ASOCE) IN NEURONS

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Increased lifespan of HIV-1 infected individual, as a result of combined anti-retroviral therapy, is accompanied by a high prevalence of HIV-1 associated neurocognitive disorders (HAND). Because HIV-1 virus does not infect neurons and HAND is not proportional to viral load, it is likely that secreted HIV-1 viral proteins and other soluble factors cause HAND. Of the neurotoxic HIV-1 viral proteins, transactivator of transcription (HIV-1 Tat) has been shown to disrupt neuronal calcium homeostasis; however, the underlying mechanisms are not fully understood. We have shown recently that calcium release from endolysosomes (acidic calcium stores) as induced by endolysosome de-acidification triggers calcium influx across the plasma membrane, a phenomenon we term acidic store-operated calcium entry ("aSOCE"). Based on our findings that HIV-1 Tat de-acidifies endolysosomes following its internalization into endolysosomes, we determined here the extent to which HIV-1 Tat affects aSOCE in neurons. Mechanistically, we demonstrated that lysosome proteins, LAMP1 and TRPML1, are involved in HIV-1 Tat-induced aSOCE. Our findings help elucidate further a novel mechanism first described by us whereby HIV-1 Tat disrupts calcium homeostasis in neurons. Tat-induced endolysosome-dependent calcium influx (aSOCE) may contribute to neuronal cell death and to the development of HAND. Thus, attenuating HIV-1 Tat-induced aSOCE may be a promising therapeutic strategy against HAND.

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Liu
Graduate
Talk

A CORE/SHELL STRUCTURE OF RGO@MSILICA WITH OLIGONUCLEOTIDE GATES FOR CANCER TREATMENT

Karen Xiao Liu* (G), Xuefei Zhang, Yuqian Xing, Ying Zhang, and Julia Xiaojun Zhao

Chemistry Department, UND

Cancer has been considered as one of the most intimidating problems in human life. To fight with various cancers, multiple functional therapies have been developed and the cooperative consequence is not only the simple addition. Graphene based materials such as graphene oxide, reduced graphene oxide have great potential to serve as photothermal therapy agents. In this project, bifunctional cancer treatment system was designed to contain a core of reduced graphene oxide, a shell of mesoporous silica, and an outmost layer of double strand DNAs for a combination of photothermal and chemo-therapy. The doxorubicin was loaded in the silica layer. In a remote control manner, the nanoparticles were irradiated by a near infrared laser to cause the reduced graphene oxide releasing the heat, which leads to the dsDNAs despiralization. Thus, the drug was driven to the outside of the nanoparticles through the pores. This drug delivery system showed low drug release at physiological pH and higher release under acidic conditions. In vitro study, the bifunctional nanoparticles prove to be low toxicity to the cancer cells and normal cells. The data proved its great potential in new cancer therapy.

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Mahmood
Graduate
Talk

EFFECT OF SILICA CONCENTRATION ON DIATOM'S OXYGEN ISOTOPE COMPOSITION

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Harold Hamm School of Geology and Geological Engineering, University of North Dakota, Grand Forks, ND

Stable isotope studies of calcareous marine fossils such as foraminifera have provided a wealth of paleoclimate data. However many marine deposits are devoid of foraminifera but contain abundant biogenic silica. As with calcareous organisms, oxygen isotope composition of diatoms must be a function of both temperature and the isotopic composition of water in which they grow, and thus may provide a valuable record of paleoclimate. Methods of extracting a temperature record from fossil and batch-cultured diatoms have not always produced consistent results. Some of the disagreement may result from varying silica concentration during diatom growth, meaning that chemical equilibrium was not achieved. The objective of this study is to run chemostat continuous culturing experiments to grow pure strains of marine diatoms at different silicic acid concentrations to investigate the effect of silica concentration on oxygen isotope composition. These experiments will be conducted at the Bigelow National Center for Marine Algae and Microbiota (NCMA) in Maine. Temperature and results from oxygen isotope analyses of biogenic silica and the water where the diatoms were cultured, will be used to calculate fractionation factors for each experiment. The results of these experiments will establish a foundation for interpreting oxygen isotope composition of biogenic silica of different ages and from different environments. The data will also be used to support an external funding request.

Support: This project will be supported by Harold Hamm School of Geology and Geological Engineering Student Experience Fund.

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Mohammad
Graduate
Talk

PIPERLONGUMINE ENHANCES GEMCITABINE EFFICACY IN IN VITRO AND IN VIVO HUMAN PANCREATIC CANCER MODELS

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Effective treatment options are not currently available for advanced-stage pancreatic cancer. We are investigating a small molecule, piperlongumine (PL), for its potential to enhance the effects of currently used chemotherapy (gemcitabine; GEM) for pancreatic cancer treatment. We found PL + GEM reduced viability in vitro and reduced tumor weight and volume in an orthotopic human pancreatic cancer model. RNA sequencing revealed PL + GEM up-regulated genes involved in cell cycle arrest and apoptosis and down-regulated genes involved in cell growth. Our results suggest that PL has a potential to be used in combination with gemcitabine to more effectively treat pancreatic cancer

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ELUCIDATING THE MOLECULAR INTERACTION BETWEEN NANOPARTICLES AND ENZYMES

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Nanoparticles (NPs) have been advancing a number of fields. Meanwhile, the exposure of NPs to the environment therefore becomes inevitable. These interactions complicate the understanding of the “nanobio” interface and result in loss of NP and protein functions. The current knowledge gaps we want to fill in are the structure and dynamics changes of proteins upon exposure to inorganic and polymeric NPs. Filling in these gaps is a non-trivial task, mainly due to the complexity inherent in the range of intermolecular interactions and the intrinsic heterogeneity in the molecular interaction. These challenges can be overcome by employing the Electron Paramagnetic Resonance (EPR) spectroscopy to probe structure and dynamics information at the nano-bio interface. Our data provide molecular level details of the mechanistic mechanisms of the interaction between several synthetic NPs and proteins. These information pave the ground for exploring more complicated nano-bio interfaces.

Support: This work was supported by NSF ND EPSCoR startup funds and new faculty startup funds of NDSU College of Science and Mathematics.

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CHEMICAL APPLICATIONS TO CONTROL STUBBY ROOT NEMATODES AND CORKY RING SPOT DISEASE OF POTATO

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Corky ringspot (CRS) disease on potato is caused by Tobacco rattle virus, which is vectored by stubby-root nematodes (Trichodorus and Paratrichodorus) and can result in up to 55% of potatoes from a harvest to be unmarketable. In April 2016, a field where CRS and Paratrichodorus allius were found was used to test the efficacy of 10 experimental chemical treatment regimes (including a control) on Yukon Gold potatoes in 4 replicates with border rows separating each treatment. Each seed tuber was planted 1ft apart, with a total of 200 tubers per treatment. Treatments utilized insecticides (Spirotetramat and Clothianidin), a nematicide (Oxamyl), fungicides (Penthiopyrad and Fluopyram) and biological agents (Vacillus subtilis, Myrothecium verrucaria). Disease incidence and severity were determined from tuber subsamples after harvest and after three months (90 DAH) in storage at 4.4°C. Most treatments had statistically (alpha≤0.05) similar yield, but differences in disease. Overall, treatments with Vydate had a 5-30 percent reduction in disease compared to the control. Treatment 5 had the most disease (26-50 percent) and the greatest number of P. allius at harvest, indicating a relationship between nematode population and disease. Although the treatments with Vydate had less disease, the nematode populations were not reduced. Chemical applications may not produce an economic return as their effects are variable depending on location and environmental conditions.

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Ramakrishna
Graduate
Talk

IMPROVING PHENOLIC-LINKED ANTIHYPERGLYCEMIC FUNCTIONS OF BARLEY SPROUTS USING SEED ELICITORS

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Barley grains are a good source of phenolic antioxidants with diverse human health benefits & can be targeted as functional dietary ingredients to manage chronic hyperglycemia associated with type 2 diabetes (T2D). Improving such human health relevant phenolics, by stimulating metabolic responses linked to plant endogenous defense responses during seed germination has significant merit. The study aimed to enhance phenolic-linked anti-hyperglycemic functions in dark germinated barley sprouts using seed elicitors. Seeds of malting barley cultivars (Pinnacle & Celebration) were treated with chitosan oligosaccharide/COS & marine protein hydrolysate/GP & dark germinated. Aqueous extracts of sprouts were evaluated for total soluble phenolic content (TSP), phenolic acid profile, total antioxidant activity & potential to inhibit hyperglycemia relevant enzymes like α-amylase & α-glucosidase, at days 2, 4 & 6 post seed treatment. Total antioxidant activity, TSP content & α-amylase inhibitory activity of sprouts decreased, while α-glucosidase inhibitory activity & gallic acid increased from day 2 to 6. Cultivar Celebration showed higher phenolic-linked anti-hyperglycemic potential than Pinnacle. Selective doses of GP & COS treatments improved T2D relevant phenolic-linked anti-hyperglycemic functions in 6 day old sprouts. Thus, such seed elicitation methods can be strategically used to develop functional food ingredients from cereal grains for dietary management of early stages T2D.

Support: No financial support was provided for this work.

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Schaar
Graduate
Talk

REGULATION OF ADIPONECTIN BY TRPC1: A KEY TO UNDERSTANDING OBESITY

Anne Schaar* (G1), Pramod Sukumaran (1), Yuyang Sun (1), Danielle Krout (2), James Roemmich (2), Kate Claycombe-Larson (2), and Brij Singh (1)

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Dysregulation of adipose secreted cytokines can lead to metabolic dysfunction and obesity. In this study, we investigate the role of TRPC1 modulated Ca2+ on the regulation of adipose derived cytokine adiponectin, a key modulator of glucose and lipid metabolism. Transient Receptor Potential Canonical (TRPC) channels are a major class of Ca2+ permeable channels found in key metabolic tissues such as the hypothalamus, adipocytes, and skeletal muscle. Fluctuations in intracellular Ca2+ are due to the release of Ca2+ stores from the endoplasmic reticulum (ER) that initiates store-operated Ca2+ entry (SOCE) mechanism or by direct Ca2+ entry from the extracellular space upon membrane depolarization. Within our work, we provide evidence that Ca2+ entry into the adipocyte, especially upon store-depletion, plays an important role in adipocyte functionality and subsequently metabolic regulation. Our work has found that mice deficient in the Ca2+ channel TRPC1-/- have significantly increased adipose deposition without an increase in overall weight as compared to control. Further, TRPC1-/- mice were found to have reduced serum adiponectin levels with an opposing increase in stored adiponectin levels within adipose tissue. These results suggest TRPC1 may contribute to the mechanism of adiponectin secretion, indicating TRPC1 has a vital role in the regulation of metabolic homeostasis.

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DEVELOPMENT OF A MICROFLUIDIC SYSTEM THAT SIMULTANEOUSLY ASSESS BIOACTIVITY AND DRUG CONCENTRATION

Meredith L. Schroeder* (G1), Raquib Hasan (2), Jordan Nodland (3), Ryan P Striker (3), Andrew Vetter (3), Shelley M Horne (1), Jake Droel (2), Ben D Brooks (3), Birgit M Pruess (1), Daniel L Ewert (3), and Amanda E Brooks (2)

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Over 26 million Americans have chronic renal failure and 25% of those patients require a catheter. Over 6.4% of the total Medicare budget goes to vascular access catheters totaling about $23 billion (in 2006). As high as 29.6% of vascular catheterizations result in infection; treating this complication in a single patient can cost up to $56,000. Most of these infections are caused by bacterial biofilms, which are 1000x harder to treat with antibiotics than free floating bacteria. Bacterial biofilms put bacteria with in close proximity to one another, which facilitates the development and propagation of antibiotic resistance. Antibiotic development can require decades and billions of dollars. Moreover, in vitro experimental results do not readily translate to in vivo systems. In an attempt to mimic in vivo conditions, we are developing a microfluidic based system that will simultaneously monitor drug concentration using absorbance and bioactivity of a biofilm using fluorescence. We were able to prove our concept by administering an antibiotic solution (vancomycin) through flow to a mature Staphylococcus aureus (RN4220) biofilm. Preliminary data shows that when vancomycin is added prior to the establishment of a mature biofilm, no growth or biofilm forms. Whereas, when vancomycin was added to a mature biofilm, growth and biofilm was observed at even high concentrations of vancomycin using fluorescence microscopy.

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PEDV: A MODEL FOR RAPID RESPONSE VACCINES

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Porcine epidemic diarrhea virus (PEDV) causes substantial economic duress due to high mortality rates (80-100%) in neonatal piglets. While endemic in other parts of the world, PEDV was first reported in April 2013 in US. It quickly spread to majority of the states resulting in a loss of about one quarter of swine population. The rapid development of vaccines is a critical component of successful pandemic preparedness plans. The enormous and urgent need for technology to develop rapid response vaccines is the focus of this study. To combine safety and efficacy advantages of inactivated and attenuated vaccines, we disrupted the integrity of the viral genomic RNA, without alternating viral structure to develop the PEDV rapid-response vaccine candidate. Four-week-old piglets were immunized with developed vaccine and challenged with same PEDV virus strain. Vaccinated piglets mounted strong spike-protein specific binding antibody responses and virus neutralization titers. Post challenge viral shedding and intestinal lesions as assessed were undetectable in vaccinated pigs, while they were evident in control pigs, indicating complete protection. No shedding of the vaccine virus prior to challenge or any untoward reactions at the site of injection or in tissues were noted. Hence the developed method showed significant promise in terms of efficacy, safety and rapidness of development; characteristics which were targeted for vaccine development in outbreak or pandemic situations.

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Steffan
Graduate
Talk

FUNGAL ASTHMA AND DISEASE SEVERITY WITH PSEUDOMONAS AERUGINOSA CO-INFECTION

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Asthma accounts for over 1.6 million emergency room visits and 4,000 deaths in the U.S. each year. Asthma deaths appear to have a prevalent neutrophil component not seen in other asthmatics, in which eosinophils are the predominant granulocyte. Severe asthma can require intubation, especially in children, and is associated with an increased mortality rate of 10-25%. Ventilator-associated pneumonia caused by bacteria, such as Pseudomonas aeruginosa, increases mortality in severe asthma. In this current study, we looked at the impact of the bacterium, P. aeruginosa, on an individual that is already chronically allergic to the fungus Aspergillus fumigatus. We first used our murine model of fungal allergic asthma to establish the allergic phenotype, followed by an intranasal exposure to the bacterium. We found a significant increase in neutrophil recruitment, airway hyperresponsiveness, and disease severity to the point of mortality in allergic mice exposed to P. aeruginosa infection, in comparison with either bacteria- or fungus-only controls. This research not only allows insight into severe asthma, but also opens avenues of research in the relationship between P. aeruginosa and A. fumigatus that can be important for other respiratory disease states, such as cystic fibrosis and chronic obstructive pulmonary disease.

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PIN NEMATODE: A POTENTIAL THREAT TO PEA PRODUCTION IN NORTH DAKOTA

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Pin nematodes, migratory ectoparasites, are the smallest plant-parasitic nematodes that can cause significant reduction in plant height and yield of certain crops. Nematode surveys were conducted in pea fields in North Dakota where a total of 135 soil samples were collected during 2015 and 2016. Pin, stunt, root-lesion, spiral, lance, dagger and stubby root nematodes were observed in the two years' surveys. Pin nematodes were the dominant plant-parasitic nematodes, detected in 72% of the soil samples (mean = 3,560 and highest = 35,572 per kg of soil). Morphological and molecular tests confirmed the species of these pin nematodes as Paratylenchus nanus. Greenhouse experiments were performed to study the reproduction of these pin nematodes at the initial population level of 1,500 nematodes/kg of soil, using three cultivars of field pea (Columbian, Aragorn, and Cooper). Reproduction factor (Rf; final population/initial population) of pin nematode was significantly higher (P-value = 0.0114) in Columbian (Rf = 10) followed by Cooper (5) and Aragorn (3). In a separate greenhouse experiment, the plant height of six field pea cultivars was reduced; Arcadia (37 percent), Columbian (36), Bridger (29), Cruiser (22), Salamanca (20) and Aragorn (19) after inoculated with 4,500 nematodes/kg of soil. Our preliminary results from nematode distribution, abundance, reproduction, and effect indicated that pin nematodes could be a potential threat to field pea production in North Dakota.

Support: Financial support from North Dakota Department of Agriculture was provided to AU et al. for this work.

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Xing
Graduate
Talk

G-QUADRUPLEX/HEMIN: A BIOCOMPATIBLE ADDITIVE FOR ENHANCING THE ANTIBACTERIAL ACTIVITY OF H2O2

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G-quadruplex/hemin (G/H) complex has been broadly used in bioanalytical chemistry for the peroxidase-mimicking application. The property of G/H complex makes it possible to catalyze the decomposition of H2O2. The hydroxyl radical (·OH) generated during the procedure has a higher antibacterial performance than the original H2O2. Herein, an efficient and biocompatible antibacterial system, which provides the same antibacterial efficiency at lower H2O2 concentration to alleviate the H2O2 toxicity, has been demonstrated based on the conversion of H2O2 to ·OH. With adding G/H complex as the additive, the antibacterial activity of H2O2 vastly enhanced against both Gram-positive and Gram-negative bacteria in vitro experiment. Furthermore, the designed antibacterial system was also applied on the mice wound model in vivo and showed outstanding antibacterial activity to prevent wound infection and facilitate wound healing.

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DELTA-5-DESATURASE KNOCKDOWN AND DGLA INHIBIT COLON CANCER GROWTH IN VITRO AND IN VIVO

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As essential ω-6 fatty acids, dihomo-γ-linolenic acid (DGLA) and its downstream arachidonic acid are both substrates of Cyclooxygenase-2 (COX-2) which is commonly overexpressed in colon cancer. In contrast to arachidonic acid which promotes colon cancer growth by producing deleterious metabolites via COX-2-catalyzed peroxidation, our previous study showed that DGLA can be metabolized by COX-2 to produce a distinct byproduct, 8-hydroxyoctanoic acid, which actually possess anti-cancer activity. We thus hypothesize that, by knocking down delta-5-desaturase (D5D, a key enzyme that converts DGLA to arachidonic acid), the highly expressed COX-2 in cancer cells can be taken advantage to promote DGLA peroxidation and thereby to elicit anti-cancer activity. In present study, D5D knockdown along with DGLA supplement inhibited growth of human colon cancer cell (HCA-7) both in vitro and in a mice xenograft tumor model. A significant accumulation of 8-hydroxyoctanoic acid was observed in D5D knockdown cells/tumors treated with DGLA. In addition, our strategy also greatly enhanced the efficacies of various chemo-drugs, associated with activation of apoptotic pathway. For the first time, we demonstrated that D5D knockdown is an effective strategy to elicit DGLA's anti-cancer activity; and that the overexpressed COX-2 in cancer cells can be taken advantage to control cancer cell growth, which represents a paradigm shifting concept in contrast to the COX inhibition strategy.

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INHIBITION OF CANCER MIGRATION AND INVASION BY KNOCKING DOWN D5D IN COX-2 OVEREXPRESSED CANCER CELLS

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We recently reported that knockdown of delta-5-desaturase (D5D, a key enzyme that converts dihomo-γ-linolenic acid, DGLA, to the downstream omega-6 arachidonic acid) promotes formation of an anti-cancer byproduct 8-hydroxyoctanoic acid (8-HOA) from cyclooxygenase (COX)-catalyzed DGLA peroxidation. 8-HOA can exert its growth inhibitory effect on cancer cells (e.g. colon and pancreatic cancer) by serving as a histone deacetylase inhibitor. Since histone deacetylase inhibitors have been well-known to suppress cancer cell migration and invasion, we thus tested whether knockdown of D5D and DGLA treatment could also be used to inhibit cancer migration and invasion of colon cancer and pancreatic cancer cells. Wound healing assay, transwell assay and western blot were used to assess cell migration and invasion as well as the associated molecular mechanisms. Our results showed that knockdown of D5D along with DGLA supplement not only significantly inhibited cell migration and invasion, but also improved the efficacies of 5-flurouracil and gemcitabine, respectively. The molecular mechanism behind these observations is that 8-HOA inhibits histone deacetylase, resulting in downregulation of cancer metastasis promotors, e.g., MMP-2 and MMP-9 as well as upregulation of cancer metastasis suppressor, e.g. E-cadherin. For the first time, we demonstrated that we could take the advantage of the common phenomenon of COX-2 overexpression in cancers to inhibit cancer cell migration and invasion.

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POSTDOCTORAL COMMUNICATIONS

(Communications are listed alphabetically by the last name of the presenting author)

Banerjee
Postdoc
Talk

COULOMB BLOCKADE AT ROOM TEMPERATURE: SELF-ASSEMBLED IRIDIUM QUANTUM DOTS ON SILICON(110) SURFACE

Rasika Mohottige, Soumya Banerjee* (P), and Nuri Oncel

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Self-assembled quasi periodic Quantum Dots (QDs) were grown by depositing two monolayers of Ir on Silicon(110) (Si) surface. We investigated the physical and chemical properties of these QDs with the help of Scanning Tunneling Microscopy/Spectroscopy (STM/STS) and X-ray Photoelectron Spectroscopy (XPS). STM images showed that the surface was covered with large terraces corrugated with quasi-periodic superstructure of QDs. Current-voltage curves measured on QDs showed that a Coulomb gap of about 0.7 eV opens up around the Fermi level. XPS data suggests that the terraces are made out of Ir and at the interface between Ir terraces and Si(110) surface, Ir-silicide forms. The shifts in position of the Ir 4f and Si 2p peaks associated with Ir-silicide were comparable with the previously known bulk Ir-silicides.

Support: National Science Foundation and University of North Dakota

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THERMAL AIR OXIDATION OF BIOMASS-DERIVED BLACK CARBON

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Black carbon (BC) is a residue generated by combustion including wildfires and the burning of fossil fuels. It widespread in soils, which comprises 30–50% of total organic carbon in Midwest prairie soils.

In this study, we investigated the effects of thermal air oxidation (AO) on the properties and adsorptive functions of a temperature series corncob-derived BC made by pyrolysis anaerobically at 300–700 oC. The original BC has an underdeveloped pore structure with N2 micropore (< 20 Å) surface area (SA) less than 10 m2/g, mesopore (20–500 Å) SA less than 23 m2/g, and N2 B.E.T. SA less than 50 m2/g. Thermal AO of the BC significantly increased its porosities and SAs, which reached maximums at a AO duration of 30 min and then declined with longer AO time. The moderate- and high-temperature (500–700 oC) BC experienced a much lower mass loss (burn-off) and, interestingly, a greater increase in the porosities and SAs during thermal AO than low-temperature (300–400 oC) BC. The porosities and SAs of BC made by direct thermal AO of corncob were only slightly greater than those of the BC made anaerobically. The results suggest that the thermal AO treatment of corncob or low-temperature BC mainly caused the decomposition of biomass or non-carbonized portion, which did not lead to a significant formation of porosity. On the well-carbonized BC made at 500–700 oC, thermal AO caused the rearrangement of the pore structure and created new pores, especially in the mesopore range.

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Chauhan
Postdoc
Talk

MACROPHAGE POLARIZATION TO M1- INFLAMMATORY PHENOTYPE REQUIRES STORE OPERATED CALCIUM ENTRY BY TRPC1

Arun Chauhan* (P), Sun, Y, Quenum Zangbede, F, Jondle, CN, Sukumaran, P, Sharma, J, Singh, BB, and Mishra, BB

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Calcium influx via store operated calcium entry (SOCE) activates downstream signaling pathways and gene expression. However, its function in macrophage activation phenotype is not known. Here, we demonstrate that exposure of macrophages to IFN-γ, a classical (M1) pro-inflammatory phenotype inducer, leads to an increased SOCE in-vitro. This increased SOCE was required for IFN-γ –initiated signaling pathway activation and production of M1 inflammatory signature mediators. Electrophysiological recordings suggested that IFN-γ – induced SOCE is mediated by the calcium channel TRPC1. Importantly, macrophages from mice deficient in TRPC1 or silenced TRPC1 siRNA, failed to display IFN-γ- induced SOCE as well as production of M1-inflammatory mediators and signaling events. Finally, as M1-inflammatory phenotype is a hallmark of bacterial infection, the role TRPC1 channels in Ca2+ influx and its role in inflammatory mediator production was analyzed in mice infected with Klebsiella pneumoniae. Ex-vivo macrophages from Kpn infected WT mice showed increased SOCE consistent with TRPC1 channel activation. Moreover, macrophages from KPN infected WT mice showed abundant expression CXcl10, NOS2, NO, and increased P-STAT1 in comparison with TRPC1-/- cells. Together, these results demonstrate that TRPC1 plays a central role in activation induced Ca2+ influx, which in turn regulates signaling activation and inflammatory gene expression during macrophage polarization to M1-proinflammatory phenotype.

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de Anda-Jáuregui
Postdoc
Talk

USING SYSTEMS PHARMACOLOGY TO IDENTIFY COMMON MECHANISMS OF DRUG-INDUCED PERIPHERAL NEUROPATHY

Guillermo de Anda-Jáuregui* (P), Brett McGregor, Kai Guo, and Junguk Hur

Department of Biomedical Sciences, University of North Dakota

Many drugs can induce peripheral neuropathy, a side effect which can have a negative effect in patients quality of life. An understanding of the molecules that are affected by these drugs that can lead to the development of this condition has not been completely developed.

In this work, we used a systems pharmacology approach to explore the Connectivity Map, a collection of gene expression profiles from cell lines treated with a variety of drugs, to identify common genes targeted by neuropathy induced drugs.

We constructed a network model in which neuropathy-inducing drugs are connected to their gene targets, based on expression levels reported in Connectivity Map experiments, with a network topology that differs from that of randomly generated, comparable networks. We found genes with high connectivity to neuropathy-inducing drugs, and evaluated whether this connectivity is specific to this group of drugs, by comparing with networks generated from experimental data of drugs not associated to neuropathy.

We identified 27 genes involved in biological features such as mitochondrial function, cytoskeleton, ion channels, transcriptional and epigenetic regulation, signal transduction, and wound healing. We found evidence in literature that alterations in these genes and functions have been associated to other neuropathic alterations not related to treatment. We propose that alterations in these features may be linked to neuropathic manifestations induced by these drugs.

Support: University of North Dakota Post-Doc Pilot Grant (to K.G.)

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Kumar
Postdoc
Talk

A ROLE FOR THE TRANSCRIPTION FACTOR SNAIL IN ALTERNATIVE SPLICING

Janani Kumar* (P), Shawn Krueger, Humaira Qureshi, Jessica Warns, Adam Scheidegger, and Archana Dhasarathy

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The epithelial to mesenchymal transition (EMT) involves transcriptional and phenotypic changes in epithelial cells, resulting in loss of adhesiveness and a defined epithelial cell structure, and simultaneous acquisition of a mesenchymal, migratory phenotype. EMT is regulated in part by the master regulatory transcription factor SNAIL.Splicing is an important biological process that joins exons together while removing introns, resulting in mature mRNA, and alternative splicing mechanisms are known to generate proteome diversity by joining different combinations of exons together. Therefore, we hypothesized that SNAIL interacts with the spliceosome complex co-transcriptionally during EMT, which results in select alternatively spliced isoform production that contribute specifically to the mesenchymal state. To test this hypothesis, we induced EMT with transforming growth factor beta (TGF-β) in the mammary gland cell lines which resulted in isoform switching of mRNAs. Knockdown of SNAIL with siRNA prevents isoform switch of these mRNAs, indicating the involvement of SNAIL in alternative splicing. Taken together, our data support a novel role for the SNAIL transcription factor in alternative splicing. We are currently investigating genome-wide changes in alternative splicing regulated by SNAIL, and working to understand the mechanism by which SNAIL interaction with the spliceosome leads to alternative splicing.

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Loganathan
Postdoc
Talk

PIPERLONGUMINE ACTIVATES JNK SIGNALING IN PANCREATIC CANCER CELLS

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Pancreatic ductal adenocarcinoma has an extremely high mortality rate, warranting investigation of new therapeutic interventions to help increase survival in patients. In the present study, we investigated the anti-proliferative effects of piperlongumine (PL), a plant-derived natural product, on two different pancreatic cancer cell lines using an MTT assay. The effects of PL on JNK signaling using western blotting and the GSTP1-JNK interaction using co-immunoprecipitation were also determined. The results show that PL decreased cell proliferation in time- and concentration-dependent manners with an IC50 value of 1.98 µM and 3.3 µM for MIA PaCa-2 and PANC-1 cells at 72 hr, respectively. In addition, 10 µM PL enhanced JNK phosphorylation, and elevated c-Jun phosphorylation, a signaling protein downstream of JNK. Phosphorylation of c-Jun by PL was inhibited by the JNK inhibitor SP600125. Growth studies are on-going to determine if the JNK inhibitor blocks PL-induced pancreatic cancer cell death. Finally, PL resulted in a slight decrease in GSTP1 expression in a JNK pull-down assay, suggesting that PL may disrupt the association between GSTP1-JNK, and activate the JNK/c-Jun/AP-1 pathway leading to cell death. Knowledge of the mechanisms for PL-induced pancreatic cancer cell death may pave the way for combining PL with other agents currently used to treat this disease.

Support: The Center for “Diagnostic and Therapeutic Strategies in Pancreatic Cancer”

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Madoff
Postdoc
Talk

CAN WE MEASURE THE EFFECT OF CLIMATE ON EROSION RATES?

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Erosion can adversely affect land surfaces and pose hindrances to agriculture. Climate affects erosion rates, the magnitude of mass wasting, and local ecological systems. Around the globe land surfaces are shaped by different geologies that influence their response to climates. In order to quantify the short and long term effects of climate on the landscape, we mathematically relate hillslope degradation to changes in climate. In such models, an independent variable, called topographic diffusivity, expresses the cumulative effects of a climate on the land surface. In one scenario, we modelled hillslope degradation for eighty-five thousand years in a mid-latitude alpine region. Model results showed low sensitivity to the known glacial/interglacial history of climate fluctuations. However, because regions vary in their climatic histories and climate fluctuations vary at multiple scales, we want to determine where erosion is sensitive enough to climate to generate strong enough signals of past fluctuations that could be recorded by the model. For this, we will compare model results based on the empirically derived variables with results based on randomly generated variables in order to find those locations in the world where the effects on erosion would be strongly signaled by changes in climate. The results will be used in future work to model the hillslope degradation in those climate regions.

Support: No financial support was provided for this work.

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Manocha
Postdoc
Talk

THE CONTRIBUTION OF NEUROINFLAMMATION TO PARKINSON'S DISEASE USING HUMANIZED IMMUNE SYSTEM MICE

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Inflammatory changes have been associated with histological changes in Parkinson's disease (PD) brains and its mouse models. However, recent findings demonstrate significant differences in immune response between rodents and humans. This inaccuracy suggests that anti-inflammatory strategies based upon rodent models will be ineffective. To develop an improved model of PD with clear relevance to humans we used a mouse with a humanized immune system. These humanized mice were given a common toxicant MPTP injection model of Parkinson's disease. As expected, mice developed significant changes in microglial immune cell activation and elevations in specific human cytokines in the brain correlating with the loss of motor control and dopamine containing neurons in the substantia nigra. Control non-humanized mice demonstrated a uniquely different profile of mouse inflammatory cytokine changes following MPTP injection. More importantly, delivery of an FDA approved immunomodulatory drug, FK506, attenuated immune changes and produced motor recovery in the humanized but not control mice. These data suggest that the immune response associated with human Parkinsonism is unique from rodents and demonstrate our ability to use a clinically available drug to attenuate disease in the humanized mice. This novel model of Parkinson's disease will be a resource for ongoing therapeutic discovery against Parkinson's disease.

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Marwarha
Postdoc
Talk

VITAMIN D3 DECREASES AMYLOID-β GENESIS BY ATTENUATING NF-κB – MEDIATED BACE1 EXPRESSION

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Recent emerging evidence from prospective and cross-sectional epidemiological studies have suggested that lower plasma Vitamin D3 levels are associated with a higher risk for developing Alzheimer's Disease (AD). The excessive genesis and accumulation of the Amyloid-β (Aβ) peptide is considered as a core pathological event that evokes and drives other neurodegenerative pathological signaling cascades in the etio-pathogenesis of AD. The aspartyl protease β-site APP-cleaving enzyme 1 (BACE1) catalyzes the rate-limiting step in the genesis of Aβ from the amyloid-beta precursor protein (AβPP). Recent studies have shown that Vitamin D3 supplementation decreases Aβ burden and age-related cognitive decline in rodents. However, the molecular mechanisms that underlie the salutary effects of vitamin D3 have not been delineated. In this study, we treated human neuroblastoma SH-SY5Y cells with 1,25- dihydroxyvitamin D3 (1,25-D3) and determined the effects on the expression of BACE1 expression and Aβ levels. Our study shows that 1,25-D3 attenuates the basal expression of BACE1 and subsequently reduces Aβ genesis. Further delineation of the underlying mechanism unveiled that 1,25- D3 decreased the NF-κB transcriptional activity and NF-κB driven BACE1 expression. Our study highlights and delineates a novel mechanism through which Vitamin D3 decreases BACE1 expression and activity that culminates in the mitigation of Aβ genesis.

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Sharma
Postdoc
Talk

MECHANISM OF NEUTROPHIL EXTRACELLULAR TRAP FORMATION: ROLE OF MINCLE AS AUTOPHAGY REGULATOR

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Neutrophil extracellular traps (NETs) constitute antimicrobial function of neutrophils but have also been linked to perpetuation of inflammation. It's important but difficult to control NETs because of underdeveloped knowledge about the major regulating components. In the current study we examined the mechanism by which Mincle, a C-type lectin receptor, regulates NET formation. We found that Mincle mediates NET formation in response to several activation stimuli in-vitro and in-vivo during pneumoseptic infection with Klebsiella pneumoniae, indicating its regulatory role in NET formation. Mechanistically, we show that attenuated NET formation in Mincle-/- neutrophils correlates with an impaired autophagy activation in-vitro and in-vivo, while reactive oxygen species (ROS) formation in these neutrophils remained intact. The requirement of autophagy in Mincle-mediated NET formation was further supported by exogenous treatment with autophagy inducer tamoxifen, which rescued the NET formation defect in Mincle-/- neutrophils. This identification of novel role of Mincle as a regulator of autophagy addresses a major challenge in the field by positing this pathway to be targeted for modulation of NETs, while preserving ROS production, an important innate immune defense.

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Zhang
Postdoc
Talk

GRAPHENE OXIDE-BASED 3D SCAFFOLD WITH A TUNABLE POROSITY AND MECHANICAL PROPERTIES FOR CELL CULTURE

Ying Zhang* (P1), Karen Xiao Liu (1), Kayla Michelson (2), Eric Schepp (1), Yuqian Xing (1), Diane Darland (2), and Julia Xiaojun Zhao (1)

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One of the major challenges associated with modeling the influence of the cellular microenvironment on cell growth and differentiation is finding suitable substrates for growing the cells in a manner that recapitulates the cell-cell and cell-microenvironmental interactions in vitro. As one approach to address the challenge, we have developed graphene oxide (GO) 3D scaffold with tunable hardness and porosity for application in cell culture systems.

The synthetic method of GO 3D scaffold is simple, easily reproducible and low cost, which is combination of poly(ethylene)(glycol) (PEG) with GO together with a salt leaching approach (NaCl) with a controlled application of heat during the synthetic process to tailor the mechanical properties, porosity and pore size distribution of the resulting GO 3D scaffold. Varying the ratio of NaCl to GO controls porosity, pore size, and pore connectivity for the GO 3D mesh. When the porosity is less than 90%, with an increasing ratio of NaCl to GO, the number of pores increases with good interconnectivity. A qualitative comparison of the pores on the surface image of the 3D scaffold with the pores in cross section confirms that the interior pores appear bigger and more interconnected in the interior of the scaffold.

The GO 3D mesh generated with this approach provides an ideal scaffold that can be modified and optimized for a variety of in vitro applications with a range of cells types.

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FACULTY COMMUNICATIONS

(Communications are listed alphabetically by the last name of the presenting author)

THE USE OF OPEN EDUCATIONAL RESOURCES (OERS) IN COLLEGE PHYSICS: THEY FEEL GOOD, BUT DO THEY WORK?

Thomas P Gonnella* (F)

Science and Mathematics, Mayville State University, Mayville, ND

A study was conducted at Mayville State University with the College Physics course sequence to assess the value of switching to an open education resource textbook. To address the campus climate for this study, the cost savings to students over alternative textbook purchasing options was examined, the financial impact on the campus bookstore was evaluated, and a voluntary survey was developed and administered. The survey results indicated that out of the eight learning resources provided in the course, the students rated the OER textbooks the least useful in preparing for course exams. All respondents indicated that they would recommend more faculty use OER textbooks in place of traditional hard copy textbooks. More research needs to be conducted to understand why students recommend that more faculty use OER textbooks yet they consider them to be the least useful of their resources. Insight into this discrepancy could impact the design of OER texts to better meet the needs of students.

Support: This initiative was funded through the NDUS Open Education Resources Special Projects fund.

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NEXT GENERATION STRUCTURAL MATERIALS FOR MULTIFUNCTIONAL APPLICATIONS

Surojit Gupta* (F)

University of North Dakota

In this presentation, I will present recent results on the development of oil free engines and gears will be presented. More particularly, mechanical behavior of MAX and their composites will be presented. Briefly, Mn+1AXn (MAX) phases (over 60+ phases) are thermodynamically stable nanolaminates displaying unusual, and sometimes unique, properties. These phases possess a Mn+1AXn chemistry, where n is 1, 2, or 3, M is an early transition metal element, A is an A-group element, and X is C or N. The MAX phases are highly damage tolerant, thermal shock resistant, readily machinable, and with Vickers hardness values of 2–8 GPa, are anomalously soft for transition metal carbides and nitrides. MAX phases display nonlinear, hysteretic, elastic behavior due to kink band formation in the basal planes. Thus, there is a huge potential that these materials can be used for different tribological and engineering systems, for example, air-foil bearings, gas turbine seals, cylinder wall/piston ring lubrication for low-heat rejection diesel engines, various furnace components, among many others. In this presentation, we will present some of the recent studies in the development of novel composites etc.

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FUNCTION OF THE REPLICATION PROTEIN A2 N-TERMINUS IN PREVENTING MUTATION AND CELLULAR DISEASE

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(1) Chemistry and Biochemistry and (2) Interdisciplinary Cellular and Molecular Biology Program, North Dakota State University, Fargo, ND

Prevention of DNA mutations is the cornerstone for prevention of cellular dysfunction and disease. As such, cells contain many mechanisms in which to detect abnormalities in the DNA (lesions) and repair them before they become permanent changes (mutations) in the cellular genome.

At the center of DNA lesion detection is the heterotrimeric protein complex called Replication Protein A (RPA). This complex is essential, conserved among all eukaryotes, and has the biochemical function of binding to single-stranded DNA (ssDNA) intermediates formed during most DNA metabolic processes. By virtue of this activity, RPA acts a "sensor" of potentially harmful DNA and recruits and coordinates not only the proteins necessary to restore the DNA to an intact double-stranded form, but also the signalling machinery necessary to allow adequate time for completion of this task.

Replication Protein A function appears to be coordinated through post-translational modifications (PTMs) that occur throughout the three subunits. Despite many studies of these PTMs, it is still unknown how the PTMs actually regulate RPA function. I will present here an overview of RPA and how we believe one type of PTM (phosphorylation) of the medium subunit (Rpa2) N-terminus is regulating RPA's function, specifically in cell cycle regulation. This role may not only provide the time necessary to replicate or repair DNA, but also provide a "last-ditch" effort in cell survival when abnormal DNA cannot be dealt with properly.

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ONGOING ASPECTS OF DEVELOPING HERITAGE TOURISM IN PEMBINA AND WALSH COUNTIES, NORTH DAKOTA

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Geocaching and waypointing are means of creating a special form of heritage tourism that can help promote economic development. This particularly is the case in rural areas. Since the summer of 2015, elements of these aspects of geographic inquiry have been underlying a collaborative effort to encourage such tourism in the counties of Pembina and Walsh in northeastern North Dakota. Sponsored by the Red River Regional Council with supplemental support from the Virginia George Inheritance Fund, the research team undertook a multi-faced approach to create the materials needed for preparing and implementing a set of geocaches and waypoint trails. Beginning with archival work in various libraries, the foundations were laid to engage in field observations in the summer of 2016 for locations recommended by the Walsh County Historical Society and the Pembina County Historical Society. This work in turn were the basis for creating the data base and supporting items for documenting the geocaches and the assorted waypoint trails in the two counties. The success of the 2015-16 program stimulated a continuation of the efforts in 2016-17. Based upon those activities, plans are well underway for having a field season in the summer of 2017 that will include undergraduate students in the ongoing research as well as providing them an opportunity for service learning and professional development in applied historical geography.

Support: Red River Regional Planning Commission and the Virginia George Inheritance Fund

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Parent
Faculty
Talk

TOWARDS CATALYTIC OXIDATIONS USING OXYGEN GAS

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Transition metal catalysed oxidation reactions often require the use of sacrificial oxidizing agents, such as iodosylbenzene or di-tert-butylperoxide. These reagents significantly lower the atom economy of reactions when they are used, as only the oxygen atom(s) in each molecule may be incorporated into the product. A sustainable and atom-efficient alternative to these oxidizing agents is oxygen gas (O2), which is thermodynamically capable of oxidizing many organic substrates (E0 = 1.21 V vs. NHE) and is used extensively as an oxidant in biological systems. Oxygen gas, however, is kinetically slow to react with organic compounds due to its triplet electronic ground state, which is spin forbidden from reacting with closed-shell (singlet) substrates.

One method for overcoming this spin barrier is to use a photosensitizer to excite oxygen gas to its singlet excited state. Singlet oxygen (1O2) is well known to rapidly oxidize numerous organic substrates, however using 1O2 alone does not allow the same reaction selectivity obtainable with coordination catalysts. In order to combine the atom efficiency of molecular oxygen with the selectivity of coordination catalysts, new coordination catalysts capable of being oxidized directly by 1O2 must be developed. In this presentation the initial attempts by our group to harness the reactivity of 1O2 using transition metal coordination complexes, focusing on coordination complexes of ruthenium, will be discussed.

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GENOME-WIDE ASSOCIATION STUDY FOR ELECTROLYTE LEAKAGE IN RAPESEED/CANOLA (BRASSICA NAPUS L.)

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Plant Sciences, North Dakota State University, Fargo, ND

Freezing temperature/frosts can cause significant damage of plants by rupturing plant cells. Rapeseed/canola (Brassica napus) is susceptible to freezing temperature at early seedling stage. The degree of cell rupture or seedling damage can be evaluated through the measurement of electrolyte leakage. A protocol is developed to measure the electrolyte leakage of canola germplasm under simulated freezing conditions. The suggested protocol for electrolyte leakage measurement is cold acclimation of two-week old seedlings for 7 days at 4°C followed by freezing treatment at −8°C for 2 h. With this protocol, a genome-wise association study was conducted on 160 winter, semi-winter and spring types germplasm originated from 16 countries. A total of 37,769 single nucleotide polymorphism (SNP) markers based upon genotyping-by-sequencing were used for the analysis. The germplasm accessions were divided into three mixed subpopulations/clusters without any specific geographic or growth habit-related patterns. Twelve QTL were identified associated with electrolyte leakage of canola seedlings. The QTL were located on chromosomes A01, A02, A03, A04, A05, A07, A10, and C01. We have identified 5 orthologs of the functional candidate genes involved in freezing or cold tolerance. In addition, twenty-seven orthologs of Arabidopsis thaliana abiotic stress tolerance genes and transcription factors have been identified.

Support: The study was supported by the Northern Canola Growers Association under grant number NCGA-2013-10.

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IDENTIFICATION OF EMERGING POLYFLUOROALKYL SUBSTANCES BY A NON-TARGETED APPROACH

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Civil Engineering, University of North Dakota

Poly- and perfluoroalkyl substances (per- and poly-PFASs) comprise a group of synthetic organic surfactants with a wide range of industrial and commercial applications. Certain PFASs have become a global concern because of the toxicity and bioaccumulative properties. The compounds have been measured in 95% of Americans’ human blood samples at health relevant concentrations, with contaminated drinking water and fish as the major exposure sources.

The author of this study developed a novel nontarget identification method based on a high-resolution mass spectrometer. A total of 44 novel or infrequently reported poly-PFASs have been identified in three commercial surfactant products, 49%, 31%, and 19% of which are anions, zwitterions, and cations, respectively. These newly identified poly-PFASs have more complicated structures than those of legacy PFASs. Many of them are derivatives of perfluorooctane sulfonamide; the amine group is bonded to various nonfluorinated moieties, including betaines, which may be degradable to generate per-PFASs.

These newly identified PFASs appear to be nonvolatile, ionic or ionizable, moderately hydrophobic, and soluble in water. The aquatic environment will be the ultimate sink for these chemicals. There is insufficient literature that documents the removal of poly-PFASs by conventional, enhanced, or advanced drinking-water treatment and the pathways of exposure to humans. These gaps represent the greatest needs of research on PFASs.

Support: This work was supported by the UND VPR’s New Faculty Early Career Award Program.

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POSTER COMMUNICATIONS

(Communications are listed alphabetically by the last name of the presenting author)

Arif Uz Zaman
Graduate
Poster

ROOT TRAIT VARIATION IN SPRING AND WINTER CANOLA UNDER CONTROLLED AND WATER STRESSED CONDITIONS

Muhammad Arif Uz Zaman* (G) and Mukhlesur Rahman

Dept of Plant Sciences, North Dakota State University, Fargo, ND

Root system in canola (Brassica napus L.) varies largely in different growth habit types. A study was conducted with five winter and five spring types canola under controlled and water stressed conditions in the greenhouse to identify the variation of root traits at different growth stages. Data on different root traits were collected at 30, 40, 50 and 60 days after planting (d). Significant variations were appeared for taproot length (F= 10.17***) and root dry weight (F = 16.96***) between winter and spring types at 40d. All other root parameters such as basal taproot diameter (F= 22.14***), bottom taproot diameter (F= 4.59*), primary root branches (F= 78.70***) and root vigor (F= 47.18***) were significantly higher in the winter types compared to those of the spring types at 60d. Growth pattern curves indicated that all the root traits in spring types increased in a steady fashion, where the root traits in winter types increased rapidly after 40d. In water stressed experiment, the water stress was continuously applied from 20d to 60d, and data was taken at 60d. All the root parameters except taproot length were significantly ($P < 0.001$) lower in the stressed spring and winter plants compared to the control plants. The root growth reduction in stressed winter types was higher. Basal taproot diameter, bottom taproot diameter, primary root branches, root vigor, and root dry weight were decreased by 43%, 63%, 19%, 31% and 53%, respectively in stressed winter type plants.

Support: National Institute of Food and Agriculture (under North Central Region Canola Research Grants), and the Northern Canola Growers' Association.

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REGULATING CHECKPOINT EXIT THROUGH MANIPULATION OF REPLICATION FACTOR A2 N-TERMINAL PHOSPHO-STATE

Allison N Christensen* (U) and Stuart J Haring

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Replication Factor A (RFA) is highly conserved in all eukaryotes and plays an important role in DNA metabolism, preventing cellular disease through high-fidelity duplication (replication) and maintenance (repair) of the genome. This project involves the examination of the 32 kDa subunit of the complex, Rfa2, which appears to act as a regulator in the DNA damage response (DDR) through post-translational modification (phosphorylation) of the Rfa2 N-terminus (NT).

For a cell to respond to DNA damage, two things must occur. First, factors that directly process DNA damage must be recruited to the DNA lesion. Second, the cell must provide enough time to complete the repair (checkpoint arrest) before moving on to the next stage of the cell cycle. Recently, phosphorylation of the Rfa2 NT has been shown to facilitate exit from a checkpoint, even when the DNA lesion has not been repaired (called checkpoint adaptation). Lack of the Rfa2 NT appears to prevent checkpoint adaptation (ie, cells are adaptation-deficient).

This project examines whether the phospho-state of the Rfa2 NT has an effect when it is overexpressed and/or decoupled from the RFA complex in cells. The idea is that if a short Rfa2 NT peptide can influence checkpoint exit (adaptation-proficiency) by itself (decoupled from RFA), this peptide might be able to be used as a therapeutic to drive or prevent adaptation and affect the frequency of DNA mutations that ultimately lead to cellular dysfunction and disease.

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Christopher
Graduate
Poster

PHENOLIC ANTIOXIDANT-LINKED ANTI-HYPERGLYCEMIC PROPERTIES OF EMMER AND OTHER WHEAT CULTIVARS

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Cereal grains rich in phenolic bioactives and related dietary antioxidant have diverse health benefits and can be targeted against chronic oxidative stress-linked non-communicable chronic diseases or NCDs. The major aim of this study was to evaluate the phenolic bioactives and antioxidant profiles of North Dakota Common Emmer Wheat and compare it with other commercial wheat cultivars Barlow and Coteau, in order to target its anti-hyperglycemic properties and its subsequent integration into a healthy food design. Cold water and ethanol extracts of the North Dakota Common Emmer Wheat both with the hull and without the hull and two other commercial wheat varieties, Barlow and Coteau were used for biochemical analysis before and after the milling process. Total soluble phenolic content, phenolic acid profile, protein content, antioxidant activity, alpha-amylase, and alpha-glucosidase inhibitory activities of wheat extracts were determined using laboratory experimental assay models. Emmer wheat with hull had highest TSP content and associated antioxidant and anti-hyperglycemic properties at both before and after the milling stages when compared to the other wheat grain samples. These results indicate that North Dakota Common Emmer wheat with hull can be targeted as a functional food ingredient as part of dietary support against chronic hyperglycemia and oxidative stress commonly associated with type 2 diabetes.

Support: No financial support was provided for this work

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Guo
Postdoc
Poster

RNA-SEQ ANALYSIS OF HUMAN DIABETIC NEUROPATHY IN SUBJECTS WITH TYPE 2 DIABETES

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Diabetic neuropathy (DN) is one of the most common complications of diabetes mellitus (DM). Based on our previous results we identified HbA1c as the sole significantly associated clinical factor with myelinated fiber density change(%delta-MFD). Here, we performed a RNA-Seq profiling on 78 sural nerves from DN patients with type 2 diabetes (T2DM). We performed unbiased clustering analyses on the RNA-Seq gene expression data and identified three distinctive groups of samples. Multifactorial logistic regression analyses on the clinical data of these groups identified that these groups were significantly different in terms of baseline HbA1c level and O'Brien neuropathy score. 997 differentially expressed genes were identified between Group1 and Group2, respectively with the highest and lowest average HbA1c levels. Functional enrichment analysis in terms of Gene Ontology terms and KEGG pathways reveals that these DEGs were highly enriched with genes related to extracellular matrix organization, phagosome, antigen processing and presentation pathway as well as adaptive immune system. In conclusion, a deep-sequencing analysis of the peripheral nerves affected by T2DM revealed that the global gene expression patterns in these samples did not correlate with %delta-MFD. However, they were significantly associated with the baseline HbA1c and O'Brien neuropathy score, suggesting their critical roles in driving gene expression changes in peripheral nerves in T2DM.

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Hanson
Graduate
Poster

EMERGING POLYFLUOROALKYL SUBSTANCES: FATE AND REMOVAL FROM WATER

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Poly- and perfluoroalkyl substances (poly- and per-PFASs) are synthetic organic surfactants with a wide range of industrial and consumer applications. Their unparalleled surface-tension-lowering properties allow for a wide range of applications (e.g., Teflon and Scotchgard) beyond those of conventional surfactants. However, as is often the case with industrial chemicals, PFASs do not remain solely in their intended places. Once released to the natural environment they are not readily decomposable by physical and chemical mechanisms because of the strong carbon–fluorine bond. The widespread occurrence of PFASs in the environment coupled with their known adverse health effects on humans has aroused great concern for both the scientific community and the public.

We present in this study the removal of two emerging PFASs during conventional, enhanced, and advanced drinking-water treatment processes, including coagulation, flocculation, sand filtration, activated carbon adsorption, chlorination disinfection, and ozonation. The adsorption and biodegradation of these PFASs by soils and soil microorganisms was also investigated.

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Hassan
Undergraduate
Poster

DOES LACTOFERRIN AFFECT YEAST INFECTION?

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Lactoferrin is a glycoprotein that have been suggested to have antimicrobial activity. Previous studies suggest that, the activity of lactoferrin is based on its iron-binding ability. However, this mechanism fails to explain the reported ability of lactoferrin to inhibit viral infection. We hypothesize that disulfide bonds mediate lactoferrin function. In this research, brewers yeast acts as a pathogen to assess the effect of lactoferrin under different conditions. Yeast grown in liquid media were subjected to increasing doses of lactoferrin. After incubation, growth were measured by optical density to determine the IC50 value for lactoferrin. Lactoferrin, with or without iron, was unable to inhibit the growth of the yeast within 24 hours. Supplementation of the media with sub-lethal doses of fungicide to determine any additive effect also failed to inhibit growth. To investigate effect of lactoferrin on yeast adhered to human cells, a cultured adherent squamous carcinoma cells were co-incubated with yeast in the presence or absence of lactoferrin. The presence of lactoferrin, with or without iron, failed to decrease the adherence. The cumulative results of the activity assay and adherence assay indicate that lactoferrin does not have any immunological effect on brewers yeast.

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Herath
Graduate
Poster

DESIGNING RU CATALYSTS FOR SELECTIVE OXIDATION USING OXYGEN GAS

Hashini Herath* (G), Christian K Nilles, and Alexander R Parent

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Oxidation reactions are fundamentally important reactions in organic synthesis. These reactions involve numerous chemical transformation and provides powerful synthetic methodology with synthetic values. Thus the development of highly effective and selective oxidation methods represents a critical technology and also the area of growing concern in research and development. In particular, oxidation reactions using a combination of earth abundant transition metals and environmentally friendly green oxidants is an attractive approach. Molecular oxygen is considered as an ideal oxidant in many ways due to its natural abundance, and low toxicity. In addition, oxygen gas only produces water as a by-product. Despite these advantages, using molecular oxygen as an oxidant is very challenging due to its triplet ground state. This triplet state shows slow reaction kinetics with organic compounds due to a spin barrier. In order to overcome this spin barrier, transition metal coordination complexes can be designed to activate oxygen gas to yield to selective metal based oxidants. Our group is designing transition metal catalysts capable of activating oxygen gas. In order to develop these catalysts, we are designing Ru-Based catalysts containing redox active ligands. This presentation will highlight our initial attempts to develop these ruthenium catalysts and an analysis of their electrochemical and catalytic behavior.

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Huber
Undergraduate
Poster

VASOACTIVE INTESTINAL PEPTIDE RECEPTOR DEFICIENCY INCREASES ANTIBIOTIC PRODUCING BACTERIA FREQUENCY

Benjamin Huber* (U), Caleb Laney, Manpreet Baines, Amanda Brooks, Jane Schuh, Angela Hodgson, and Glenn Dorsam

Microbiological Sciences, North Dakota State University

There is a necessity for new antibiotic discovery due to bacteria becoming resistant to currently prescribed antibiotics. Evidence suggests certain populations of bacteria may act as sources for natural antibiotics. A mammalian neuropeptide that possess antibacterial activity and is highly expressed in the gut, called vasoactive intestinal peptide (VIP), and its G protein coupled receptors, designated VPAC1 and VPAC2, have been shown to cause significant gut microbiota composition changes when knocked out (KO). Therefore, we hypothesized that mice deficient for VIP signaling would be good candidates for exploring the existence of novel antibiotic-producing bacteria (APB). To this end, fecal material from wild type (WT), heterozygous (HET) and KO strains were plated on nutrient agar, incubated aerobically, and zones of inhibition against Escherichia coli, Staphylococcus epidermidis and Staphylococcus aureus were tested. Our results showed elevated numbers of previously characterized APB from both HET receptor strains, but not from WT or VIP HET strains. We conclude that reduction in VIP receptor signaling in the gut, as opposed to loss of the VIP ligand, elevates the frequency of aerobic APB. Future studies will also utilize VPAC1 and VPAC2 KO strains to mine for the existence of novel anaerobic APB, many of which have yet to be investigated and therefore represent a potential antibiotic “treasure chest” waiting to be harvested.

Support: Frank J. Cassel Research Award

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Ibrahim
Graduate
Poster

PREDICTING POTATO YIELD LOSS DUE TO METRIBUZIN SENSITIVITY IN NORTH DAKOTA

Razi Ibrahim* (G), Harlene H Valenti, and Asunta L Thompson

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Potato cultivars often show differences in tolerance to metribuzin. As new cultivars are released, it is important for growers to know the cultivar's response to metribuzin to avoid injury and yield loss. Love et. al. established a model which can predict yield loss due to metribuzin injury in Idaho. The model can help scientists and growers quickly evaluate a large number of potato cultivars. The objective of our work is to evaluate this model for application in North Dakota (ND).

In 2016, 26 potato genotypes were evaluated for metribuzin sensitivity following the post-emergence application (1.12 a.i./ha) when potato plants are 8-12 inches tall, compared to untreated control plots, per the model protocol, at Inkster, ND. Plant injury was rated as the percent of foliage from an average plant showing typical symptoms 21 days post treatment; plant height was determined prior to harvest. Predicted yield reduction was calculated by comparing treated to untreated plots, using the equation of Love et. al. [1-(1.142+0.176(log(plant height treated/plant height untreated))X 0.00796(foliar injury)].

Most genotypes showed differences for their predicted and actual yield reductions. The model equation predicted yield reductions for AND00272-1R, ND8068-5Russ, ND8305-1 and ND092355CR-2Russ; however, all had a yield increases.

Based on one year of evaluation, this model does not appear to accurately predict metribuzin sensitivity in ND.

Support: USDA Specialty Block Grant

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Irby
Undergraduate
Poster

IDENTIFYING AREAS SUITABLE FOR EFFICIENT MIXED-USE DEVELOPMENT IN BISMARCK, NORTH DAKOTA

Noah Irby* (U), Tim Englesgaard, and Samuel Sherman

UND - Department of Geography and GISc

It is important to strive for sustainability when planning for urban development, and it is only a matter of time before urban infrastructure needs revitalization. While assessing the efficacy of mixed-use development is difficult due to general lack of empirical methodology, preliminary research of mixed-use development in Seattle suggests that it is indeed possible to locate, design and develop financially viable mixed-use projects that are also sustainable spatial solutions. In this study we examine social, economic, and geographic factors in the city of Bismarck to determine potentially viable locations for mixed-use developments. This includes but is not limited to analyzing the geography of critical infrastructure, current zoning districts, access to basic services, and estimating financial viability. We believe this strategy of development is crucial to consider in order to alleviate the growing concerns of urban sprawl, such as loss of agriculturally viable land, increased water and air pollution, increased traffic fatalities, and increasing dependence on cars for transportation. The objective of this study is to provide an independent analysis of areas that may be suitable for mixed-use development in the city of Bismarck, North Dakota, based on local geography, population demographics, and current planning and zoning by the City of Bismarck's Community Development Department using statistical processing software and ArcGIS 10.4.1.

Support: None

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Kraft
Undergraduate
Poster

OPTIMIZATION OF CAFFEINE ANALYSIS FROM HUMAN SALIVA USING GC/MS

Annika Kraft* (U), Alex Buchholz, Brett Nespor, Belinda Zabka, Shirey Cole-Harding, and Naomi Winburn

Minot State Chemistry Department, Minot State Psychology Department

The complex matrix of human saliva requires the use of an internal standard for accurate quantification of caffeine. Previous methods used acetaminophen, whereas this study investigates the use of salicylic acid. Salicylic acid was chosen because it is soluble in ethyl acetate and has a retention time that does not interfere with caffeine retention time, so peak overlap does not occur. The optimal concentration of salicylic acid was found to be 15 mg/L. Three subjects were given 12 ounces of Coca Cola and their saliva was collected at 15 minute intervals for 2 hours including a baseline collection before caffeine consumption. Caffeine was extracted by a liquid-liquid extraction with ethyl acetate. The samples were analyzed using a gas chromatography/mass spectrometry method. Caffeine was successfully detected and processed in two subjects. Maximum caffeine concentrations occurred at 15 minutes for both subject one and two with values of 1.78 and 2.25 respectively. The data for subject three failed to process.

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Krueger
Undergraduate
Poster

DETERMINING TOXICITY OF BORON IN COAL ASH USED AS PLANT GROWTH MEDIA

Isaac Krueger* (U) et al

VCSU

The concentration of boron (B) in soil is typically 26-33 ppm. The concentration in fly ash is often much higher than that. Once boron reaches 100 ppm in plants it is considered toxic. This toxicity causes a plant to have necrosis along the leaf margins and its growing points. High levels of boron can also cause seeds to not germinate. We conducted these experiments to determine if the levels of boron in coal ash are toxic If the concentrations were toxic we wanted to see if grass seeds could germinate in the ash and remediate the boron concentrations to a less toxic level. Phytoremediation is the use of green plants for their ability to uptake and then stabilize or reduce contamination caused by arsenic, mercury, lead, uranium, etc. in soils, surface water, and ground water. Over the cross of 4 experiments, 11 grasses were grown on various growth media consisting of soil, coal fly ash, and bottom ash and all plants and growth medias were tested for boron concentration. The concentration of boron in growth media containing fly ash reached 2274 ppm. That is much higher than the boron levels measured in the soil samples (15-22 ppm). The highest levels of B concentration in plant tissues reached 760 ppm. Being as 100 ppm of boron is considered a toxic level for plants, the grasses showed signs of necrosis along leaf margins and at growing points.

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Larson
Graduate
Poster

PREVENTION OF REPLICATION FACTOR A (RFA) MODIFICATIONS AT LYSINES AFFECTS CHECKPOINT EXIT

Wendy A Larson* (G), Barbara L Senger, and Stuart J Haring

Chemistry and Biochemistry, North Dakota State University, Fargo, ND

Replication Factor A (RFA) is a three-subunit complex conserved in all eukaryotic organisms essential for maintaining the fidelity of genomic information during cellular replication and in response to DNA damage. When breaks occur in the cellular genome, they are processed to form ssDNA that RFA binds to and functions to recruit both repair proteins and proteins that activate cell cycle arrest (checkpoint). Ideally, checkpoint activation ensures that cellular division is delayed until the broken DNA has been repaired. If checkpoint exit occurs prior to complete repair of DNA damage, this is referred to as checkpoint adaptation.

The RFA complex and subunits therein are post-translationally modified at several residues in response to DNA damage. To test the significance of post-translational modifications (PTMs) occurring on lysines (eg, ubiquitination and sumoylation), all lysine residues in the two largest RFA subunits, Rfa1 and Rfa2 were mutated to arginines (39 in Rfa1 and 15 in Rfa2). We report the DNA damage-sensitivities of these mutants. Interestingly, Rfa2 lysine-less mutants display drastically-increased phosphorylation of Rfa2. Similar to Rfa2 phospho-mimetic mutants, Rfa2 lysine-less mutants drive checkpoint adaptation in otherwise adaptation-deficient mutants. This suggests that Rfa2 phosphorylation is driving checkpoint exit in Rfa2 lysine-less mutants, and that PTMs that occur on lysines may function to inhibit RFA from driving premature exit from a checkpoint.

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Marwarha
Postdoc
Poster

VITAMIN D3 INDUCES LEPTIN EXPRESSION IN THE BRAIN VIA C/EBPα ACTIVATION

Gurdeep Marwarha* (P) and Othman Ghribi

University of North Dakota

Leptin is a pleiotropic adipocytokine known to be expressed endogenously in the mammalian brain that plays an indispensable role in learning and memory. Leptin is a bona-fide neurotrophic cytokine and a growth factor that is integral in the regulation of a multitude of physiological and biochemical neuronal processes. Contemporary studies have shown that vitamin D3 can regulate leptin expression in the adipose tissue and modulate peripheral circulating plasma levels of leptin. However, no studies have yet examined the effects of Vitamin D3 on leptin expression in the brain and neuronal cells. In this study, we determined the effects of calcitriol (1,25-dihydroxyvitamin D3) on leptin expression in cultured SH-SY5Y human neuroblastoma cells. Herein, we show that 1,25 dihydroxyvitamin D3 (1,25-D3) increases leptin expression levels by Vitamin D Receptor (VDR)-dependent and -independent mechanisms. Further elucidation and delineation of the underlying mechanisms unveiled the indispensable involvement of the transcription factor, C/EBPα, in the 1,25-D3 induced increase in leptin expression. Our study is the first to demonstrate that 1,25-D3 modulates leptin expression in neuronal cells and delineate the signaling cascade. Our study highlights and characterizes a novel salutary role of Vitamin D in neuronal cells as it increases the expression of leptin, a pleiotropic cytokine in the brain known to thwart neurodegenerative cascades and augment neuronal survival.

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A GPS-BASED APPROACH FOR PROMOTING HERITAGE TOURISM IN NORTHEASTERN NORTH DAKOTA

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Rural Northeastern North Dakota's economic development includes tourism that focuses upon more than scenic amenities. Cultural amenity-oriented tourism also exists. This type of heritage tourism increasingly is using waypointing and geocaching-based techniques and materials to inform people about the key changes of the local landscapes in terms of the area's physical geography and cultural geography. Starting in the summer of 2015 and continuing to the present, waypointing and geocaching materials have been created and revised for North Dakota's Red River Regional Planning Council based in Grafton. This particular collaboration includes the Walsh County Historic Preservation Commission, the Pembina County Historic Preservation Commission, the Dakota Science Center, the University of North Dakota's Department of Geography & GISc plus private citizens who are avid geocachers. This poster is focused upon presenting the methodologies used to investigate the assorted sites in the two counties plus some examples of those efforts. The end result of this phase of the ongoing research was highlighted in summer of 2016 as part of the Red River Regional Council's plans for promoting such tourism, notably to Canadian tourists, so to diversify local economic development. The project is anticipated for continuation in summer of 2017 as an extension of service learning for the GEOG 263 (Geography of North Dakota) course being taught then as a field-based class.

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Nayakasinghe
Graduate
Poster

SUPPORT EFFECTS OF BENZENE ADSORPTION ON CRYSTALLINE SILICA FILMS SUPPORTED ON MOLYBDENUM(112)

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Kinetics of benzene adsorption on crystalline silica films supported on Mo(112) and Mo(112)-p(1x3)-O were studied employing temperature programmed desorption (TPD) and Auger electron spectroscopy (AES). Benzene adsorbed molecularly on both surfaces according to TPD and AES. Strong chemisorption is evident on oxidized Mo(112) with two different binding sites while physisorption is seen on crystalline silica films with a single adsorption site. Support effects of benzene adsorption on silica films were also studied. Silica films are not transparent to benzene adsorption and no support effects are evident according to TPD results.

Support: RCA Internal Funding-Seed award

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Oncel
Professional
Poster

EFFECTS OF THE SATURATED FREE FATTY ACID PALMITATE ON HEAT SHOCK FACTOR 1

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The heat-shock response is activated in response to environmental and physiological stressors to help cells cope with the consequences of the accumulation of misfolded proteins. Heat Shock Factor (HSF)-1 is a prime regulator of transcriptional response to stress and reduction in its levels may result in the progression of aging-related diseases, such as Alzheimer's disease (AD). We showed that the palmitic acid (PA) can trigger AD-like pathological hallmarks. However, the extent to which PA trigger pathological hallmarks involve changes in HSF-1 levels is yet to be examined.

We study to determine the effects of PA on HSF1 status in cultured cells. HSF-1 is activated by translocation into the nucleus and is also translationally modified by phosphorylation, sumoylation and acetylation, either increasing or reducing its activity. We treated neuroblastoma cells (SH-SY5Y) and astrocytic cells (1321N1) with various concentrations of PA for 24h. To visualize changes in protein levels, western blot, immunocytochemistry and immunoprecipitation techniques were used.

Preliminary data suggests that HSF1 phospho S 121 and HSF1 phospho S 303 (repressors of HSF1) are decreased with increasing concentrations of PA. Conversely, HSF1 and phospho S 326 (activator of HSF1) increase with increasing concentration of PA suggesting that the deleterious effects of PA are associated with increased activity of HSF-1 as a mean to protect cells from PA effects.

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Patel
Graduate
Poster

SERVICE LEARNING FOR MAPPING NORTHEASTERN NORTH DAKOTA'S CANADIAN HERITAGE

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Geographers engage in many forms of service learning. A case in point is when the Grand Forks County Historical Society needed a map created for its 2016 summer exhibit about historical Canadian settlements in Northeastern North Dakota. The University of North Dakota Geography and GISc Department undertook preparing that piece of cartography as another exercise of the ongoing collaboration between the county-sponsored Myra Museum and the geographers. While the research revealed that overall pre-statehood settlers generally came from Canada, Russia, Germany, Great Britain, Norway, and the Eastern United States, many of the Canadian immigrants also were of Scottish descent. Further findings regarding late 19th century settlement in the region indicated it was in what became today's Pembina, Walsh, and Grand Forks counties that most Canadian settlers arrived and settled. Canadian-named towns, historic places, and oxcart trails specifically were mapped. Not too surprisingly, this revealed locations no longer marked on maps but as once existing in this part of North Dakota. The confirmation of the existence of this “hidden” Canadian settlement heritage highlights a unique dimension of the region's historical geography. Thus, this poster helps to celebrate the American immigration history of Canadian settlers to North Dakota as well as exemplifies the success of a service learning project involving geographers with a local historical society.

Support: Virginia George Inheritance Fund

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Richmire
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Poster

CHARACTERIZATION OF FRICTION STIR WELDED AM60 MAGNESIUM ALLOY

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An experimental research approach has been used to assess friction stir behavior of cast AM60 magnesium alloy. Friction stir welding tests were performed at different feed rates of 60, 114, 219, and 422 mm/min and at tool rotational speed of 635 and 1200 rpm. This paper then aims at assessing the effect of the main processing parameters, including transverse travel rate (mm/min) and rotation speed (rpm), on the joint efficiency in terms of the mechanical properties. Since AM 60 is a cast alloy, it is expected that friction stir welding modify the grain structure and eliminate casting defects such as shrinkage and porosity. This in turn enhances mechanical performance, assessed through tensile testing and instrumented indentation testing, as well as fatigue life of the alloy. To assess the nature of fatigue failure, fracture surface is also studied through scanning electron microscopy.

Support: This work was supported by ND EPSCoR

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Rowell
Undergraduate
Poster

ENVIRONMENTALLY FRIENDLY APPROACH TO COAL ASH UTILIZATION

Jason Rowell* (U) et al

VCSU

The project being conducted at Valley City State University (VCSU) since 2009 is oriented on environmental health aspects of coal fly ash utilization for plant media, and focuses on the utilization of coal fly ash (FA) for growing plants in to examine aspects of potential for plant cultivation, uptake of metals, and phytoremediation of FA. Coal FA is a major industrial by-product from electric power plants. Disposal of FA is becoming a major issue because of the potential to contaminate air, surface, and groundwater with arsenic, boron, heavy metals, sulphate anions, etc. A promising solution to the FA issue is phytoremediation, the use of green plants to clean up our environment. The principal objective of this research project is to study the potential use of FA as the medium for growing a variety of crops.
Student involvement is central to the project at Valley City State University.
Each year 3-5 undergraduates from VCSU are involved in this project. Nine have decided to pursue graduate studies, such as chemistry, biology, plant sciences, environmental sciences and environmental toxicology. Up to date, 26 undergraduate students have been involved into our grant funded research, and our project resulted in a total number of 11 scientific papers and 30 abstracts published since 2009.

Support: Research reported in this publication was supported by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences of the National Institutes of Health under grant number P20GM103442.

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Roy
Graduate
Poster

ASSOCIATION MAPPING FOR SCLEROTINIA STEM ROT DISEASE IN RAPESEED/CANOLA (BRASSICA NAPUS L.)

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Rapeseed/canola (Brassica napus L.) is the second largest oilseed crop in the world after soybean. Sclerotinia stem rot caused by Sclerotinia sclerotiorum, is one of the major fungal diseases that severely limits canola production in North Dakota. Average yield losses have been estimated 13%, and the loss can reach to 50% in some locations. The canola growers in Minnesota and North Dakota have seen disease caused economic losses of 17.3, 20.8, and 16.8 million dollars in 1999, 2000, and 2001, respectively. Identification of resistant gene in diverged germplasm accessions is one of the best options to develop disease resistant cultivar. In the present study, a panel of 300 germplasm accessions originated from 29 countries will be screened in a controlled environment to identify potential resistant/tolerant germplasm. The germplasm will be evaluated using the petiole inoculation technique at 4th leaf stage. After inoculation, the respective germplasm will be scored every three days for three weeks as moderately affected (moderate infection), highly affected (seriously affected plants but alive) and dead. The germplasm accessions have been genotyped using Ilumina genotyping-by-sequencing (GBS) platform at the Institute for Genomic Diversity at Cornell University, and 42,575 single nucleotide polymorphisms have been identified. Finally, a genome-wide association study will be conducted to identify the genomic region containing sclerotinia stem rot resistant genes in B. napus.

Support: National Sclerotinia Initiative

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Shipunov
Faculty
Poster

THE AQUATIC VASCULAR FLORA OF THE RICHLAND COUNTY, NORTH DAKOTA

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North Dakota is among a few North American regions which have not been researched in full for plant diversity. Before 2011, only 55% of state territory was studied botanically. From 2011, we are surveying “botanical white spots”, but in North Dakota, we have also under-researched “hot spots” where plant diversity is dramatically higher than in the surrounding areas. Richland county is one of the examples (Seiler & Barker, 1985). However, most of the botanical research there was restricted to 1970s and to the Sheyenne National Grassland sites. This might be one of explanations to the phenomenon observed in the the distribution of white waterlily, Nymphaea odorata Ait. which presents on (almost) all territory of continental U.S. but absent in North Dakota.

In 2016 summer, we planned and performed multiple trips around Wahpeton, ND, concentrating on lakes, oxbows and still rivers. We were able to recover the more than 100 year old location of Nymphaea in western Minnesota and found many interesting and unusual aquatic and semi-aquatic species in North Dakota. We did not recover Nymphaea in North Dakotan part of Red River valley, this is probably due to the outstandingly high levels of pH in lakes there. Data collected was used to update the North Dakota plant checklist, plant samples were dried, pressed, mounted, databased and finally deposited in the herbarium of Minot State University (international herbarium code “MISU”).

Support: Our research was supported by Minot State University.

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Singh
Graduate
Poster

GSTP-1 KNOCKDOWN AND INHIBITION IMPAIRS PANCREATIC DUCTAL ADENOCARCINOMA (PDAC) GROWTH

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Glutathione S-transferase (GSTP1) was recently shown to regulate breast cancer cell metabolism by binding to and activating glyceraldehde-3-phosphate dehydrogenase (GAPDH), an integral glycolytic enzyme. However, the role of GSTP1 in pancreatic ductal adenocarcinomas (PDAC) metabolism is currently unknown. PDAC show three discrete metabolic subtypes: glycolytic, lipogenic, and one with reduced proliferative capacity. We are studying the effects of GSTP1 knockdown on a panel of PDAC cell lines with different metabolic needs. Our results clearly show the dependency of a glycolytic PDAC cell line on GSTP1 for growth and survival. Our preliminary data also indicate enhanced sensitivity of glycolytic cancer cells towards an ROS inducing agent piperlongumine (PL). PL physically binds to and inhibits GSTP1. Interestingly, we have found PL is not as cytotoxic to cells with reduced GSTP1 levels, which indicates PL primarily works by inhibiting GSTP1 activity. Together, these data suggest GSTP1 is a therapeutic target for PDAC.

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Warns
Graduate
Poster

THE CHOLESTEROL METABOLITE 27-HYDROXYCHOLESTEROL REGULATES SCHLAFEN 12- RELEVANCE TO COLON CANCER

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A major aspect of cancer development is the shift from normal epithelium cell differentiation to increased proliferation. An important protein involved in maintaining differentiation of epithelium cells is Schlafen 12 (SLFN12). Several cholesterol metabolites, including 27-hydroxycholesterol (27-OHC), also play a role in cell differentiation and is involved in various cancers. However, the extent to which 27-OHC regulates SLFN12 and cell proliferation in colon cancer is unstudied. The goal of our study is to investigate the effects of 27-OHC on SLFN12 expression levels and the role of 27-OHC in colon cancer.

To study the effects of 27-OHC, SW620 and Caco-2 cells colon cancer cells were treated with 0.5µM to 300µM of 27-OHC for 24 hours and western blotting for SLFN12, MTT and CyQUANT® cell proliferation assays, and LDH cytoxicity assay was performed. We found an increase in SLFN12 protein at 0.5µM and 1µM in SW620 cells but not at supraphysiological concentrations. Additionally, we found in both the MTT and CyQUANT® cell proliferation assay that there was a significant decrease in cellular proliferation at supraphysiological concentrations of 27-OHC (10µM to 300µM), however there was no significant cell death per the LDH cytoxicity assay in both colon cancer cell lines. This data shows that 27-OHC leads to a decrease in cell proliferation without a loss of cell death that is independent to SLFN12. Future experiments include measuring proliferation and apoptosis markers.

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Welch
Undergraduate
Poster

CRYPTOSPORIDIUM CAUSES A PRO-INFLAMMATORY RESPONSE LEADING TO A PATTERN OF MUCIN EXPRESSION IN VITRO

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Cryptosporidium is an intracellular parasite that causes the diarrheal disease cryptosporidiosis. Current treatments are ineffective in the most vulnerable populations, where infections can be fatal. Our lab has shown that secreted host glycoproteins trigger Cryptosporidium to transition from invasion to replication. Mucin glycoproteins are the major component of mucus that overlays and protects the intestinal epithelium. Secreted mucins act as decoys for host receptors, engaging pathogens away from the epithelium and preventing invasion. We hypothesized that Cryptosporidium infection causes an increased expression of decoy mucins by a pro-inflammatory pathway, and that these mucins trigger the switch from an invasive to a replicative form. Our approach was to quantify the expression of genes encoding pro-inflammatory cytokines (TNF-α, IL-8, and IL-1β), COX-2, an enzyme necessary for mucin synthesis, and the mucins MUC2 and MUC 5AC and enzymes involved in mucin production at different time points during a Cryptosporidium infection of human ileocecal colorectal adenocarcinoma cells (HCT-8). Post infection, we found the coordinated expression of pro-inflammatory cytokines; COX-2, an enzyme necessary for mucin synthesis; and the mucins MUC2 and MUC 5AC, indicating that infection causes increased mucin production. A better understanding of the host cell response to Cryptosporidium will provide insight into novel therapies to prevent and treat cryptosporidiosis.

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Young
Graduate
Poster

HISTORIC PRESERVATION ATTRIBUTES OF THE RIVERSIDE NEIGHBORHOOD IN GRAND FORKS, NORTH DAKOTA

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The Riverside Neighborhood is one of four historic districts in Grand Forks, North Dakota. This particular 16-block area, a somewhat unique regional cultural landscape, became designated as a historic neighborhood through local efforts by residents and the Grand Forks Historic Preservation Commission to maintain the neighborhood's sense of place. The Riverside Neighborhood is especially significant in the built-environment of eastern North Dakota because of the remarkably well-kept and diverse number of types of architectural styles that span the period of the 1880s through 1940s. Home construction types in the historic district, include Queen Anne, Gable Front “Mechanic’s” Cottage, American Foursquare, Bungalow, Craftsman, Prairie, and Hipped Roof. Also, there are examples of Tudor Revival, Classical Revival, and Dutch Revival styles sprinkled throughout the neighborhood. Furthermore, a 1941-built Works Progress Administration project, the Riverside Pool and Bathhouse, survives almost intact to remind visitors of the once common Streamline Moderne style of civic structures that has disappeared overall regionally. By re-examining the various buildings identified as significant within the historic district, it is possible to understand better how this specific cultural landscape still functions as a dynamic part of the city’s built-environment. Thus, promoting this neighborhood's historic preservation attributes is a key facet of developing heritage tourism for the city.

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DCB: Dakota College at Bottineau
DSU: Dickinson State University
JU: Jamestown University
LRSC: Lake Region State College
MiSU: Minot State University
MaSU: Mayville State University
NDSCS: North Dakota State College of Science
NDSU: North Dakota State University
TMCC: Turtle Mountain Community College
UND: University of North Dakota
VCSU: Valley City State University
WSC: Williston State College

USDA: US Department of Agriculture
USFW: US Fisheries and Wildlife Services

GEI: Gene Editing Institute (Newark, DE)
UMich: University of Michigan
SDSU: South Dakota State University
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CONSTITUTION OF THE NORTH DAKOTA ACADEMY OF SCIENCE

Founded 1908, Official State Academy 1958

ARTICLE I. *Name and Purpose*

Section 1. This association shall be called the NORTH DAKOTA ACADEMY OF SCIENCE.

Section 2. The purpose of this association shall be to promote and conduct scientific research and to diffuse scientific knowledge.

ARTICLE II. *Membership*

Membership in the Academy shall be composed of persons who share the stated purpose of the Academy and who are active or interested in some field of scientific endeavor.

ARTICLE III. *Council*

The officers of the Academy shall be a President, a President-Elect, and a Secretary-Treasurer. The Council, consisting of the officers, the retiring President, and three elected Councilors, shall be responsible for the fulfillment of the scientific and business obligations of the Academy.

ARTICLE V. *Dissolution and Limits of Action*

Section 1. In the event of dissolution of the Academy, any remaining assets shall be distributed to organizations organized and operated exclusively for education and scientific purposes as shall at the time qualify as exempt organizations under Section 501(c) (3) of the Internal Revenue Code of 1954.

Section 2. No substantial part of the activities of the Academy shall be the carrying on of propaganda, or otherwise attempting to influence legislation, and the Academy shall not participate in or intervene in, any political campaign on behalf of any candidate for public office.

Section 3. No part of any net earnings shall inure to the benefit of, or be distributable to, Academy members or officers, or other private persons, except that the Academy may authorize the payment of reasonable compensation for services rendered.

ARTICLE VI. *Amendments*

Section 1. This Constitution may be amended at any annual Business Meeting of the Academy by a two-thirds vote. Proposed amendments shall be submitted in writing to the Secretary-Treasurer who shall send them to the members at least two weeks before the meeting at which such amendments are to be considered.

Section 2. Bylaws may be adopted or repealed at any regular business meeting by a two-thirds vote.

BYLAWS

BYLAW 1. *Meetings*

Section 1. *Scientific Meetings*. The Academy shall hold at least one annual scientific meeting each year at a time and place determined by the Council. Other scientific meetings, regional, state, or local, may be held at times and places determined by the Council. The Council shall establish regulations governing the presentation of papers at Academy sessions. Such regulations shall be made available to members at least three months before any meeting at which they are to apply.

Section 2. *Business Meetings*. A Business Meeting of the membership shall be scheduled at the regular, annual scientific meeting of the Academy. Ten percent of the active members shall constitute a quorum at the annual business meeting.

Section 3. *Special Meetings*. Special meetings shall be called by the President upon the request of ten percent of the active members and require twenty percent of the active members for a quorum. Notice of the time and place of such meetings shall be sent to all members of the Academy at least four weeks in advance of the meeting. Only matters specified in the call can be transacted at a special meeting.

Section 4. *Procedure*. Parliamentary procedures to be followed in all business meetings shall be those specified in “Standard Code of Parliamentary Procedure” by Alice F. Sturgis.

BYLAW 2. *Financial*

Section 1. *Fiscal year*. The fiscal year shall run concurrently with the calendar year from January 1 to December 31.

Section 2. *Dues and Assessments*. The annual dues and assessments may be changed from time to time by the Council, subject to approval by a two-thirds vote of the members at an annual Business Meeting. These dues are payable by January 31 for the current fiscal year or by the Annual North Dakota Academy of Science Meeting for those registering for the meeting.

Section 3. *Supporting Members*. Council shall maintain a program to encourage members to voluntarily contribute funds over and above the regular dues and assessments for the support of activities of the Society.

Section 4. *Sustaining Members*. Any association, corporation, institution, or individual desiring to support the Society with funds or services valued at $50 or greater may be invited by the President or designee to become a Sustaining Associate.

Section 5. *Audit and Reports*. The Nominating Committee shall appoint on a yearly basis one member who is not a member of Council to conduct at least one internal audit per year. The Secretary-Treasurer shall report on the financial affairs of the Society, including the results of an annual audit, as may be requested by the Council.

BYLAW 3. *Membership*

Section 1. *Membership Categories*. Classes of membership shall include the following: (a) Regular, (b) Student, (c) Emeritus, (d) Honorary, (e) Supporting, (f) Sustaining, and (g) Lifetime Members.

Section 2. *Eligibility and Procedure for Membership*. Candidates for membership, except Sustaining Member, may be proposed by any regular or emeritus member of the Academy by submitting the candidate's name to the chairman of the Membership Committee.

(a) *Regular Members*. Any person who is active or interested in some field of scientific endeavor shall be eligible for regular membership. A majority vote of Council shall elect to regular membership.

(b) *Student Members*. Any student who is an undergraduate or graduate student in some field of science shall be eligible for student membership. A majority vote of Council shall elect to regular membership.

(c) *Emeritus Members*. Any member in good standing upon formal retirement is eligible for emeritus membership. A majority vote of Council shall elect to emeritus membership.

(d) *Honorary Member*s. The Academy may recognize, by awarding honorary membership, any person (nonmember or member) who has in any way made an outstanding contribution to science. It shall be the responsibility of the Membership Committee to be aware of individuals whom it would be fitting for the Academy to honor in this fashion. A two-thirds vote of members attending the annual business meeting shall elect to honorary membership.

(e) *Supporting Members*. Regular or student members may voluntarily contribute funds over and above the regular dues and assessments for the support of activities of the Society.

(f) *Sustaining Associates*. Any association, corporation, institution, or individual desiring to support the Society with funds or services valued at $50 or greater may be invited by the President or designee to become a Sustaining Associate.

(g) *Lifetime Members*. Any regular member in current good standing for at least one year may become a Lifetime Member by paying an assessment equal to 18 times the current annual dues in one lump sum or in two equal payments over the current and following year.

Section 3. *Privileges of Membership*.

(a) Voting at the annual business meeting is permitted of regular and emeritus members.

(b) Members of all categories may attend business meetings of the Academy.

(c) The Secretary-Treasurer and members of Council must be regular members in good standing.

(d) Regular, student, and emeritus members may submit abstracts or communications for scientific meetings of the Academy.

(e) Emeritus and Honorary Members shall be exempt from payment of dues.

(f) A Sustaining Member is provided a display area at the annual scientific meeting of five linear feet per $50 donation up to a maximum of 20 linear feet.

(g) Every member in good standing shall receive a printed copy or an electronic copy (if available and of equal or lesser cost than the printed copy) of the annual *Proceedings of the North Dakota Academy of Science*, the form to be determined by the member.

(h) Special offices such as Historian may be created by the unanimous vote of the regular members at the annual Business Meeting.

(i) All student research participants shall receive a properly inscribed certificate.

Section 4. *Forfeiture of Membership*.

(a) *Nonpayment of dues*. Members shall be dropped from the active list on 31 November following the non-payment of dues during the membership year commencing the previous 1 December. A member may return to the active list by paying the current year dues.

(b) *Expulsion for Cause*. Membership may be terminated for conduct injurious to the Academy or contrary to the best interests of the Academy. The accused member shall be given an opportunity for a hearing before the Council. If a majority of the Council votes to expel the member, the action must be ratified by at least two-thirds of the members present at the next annual business meeting of the Academy. An expelled member shall forfeit all paid dues and assessments.

BYLAW 4. *Duties and Responsibilities of the Council and Council Members*

Section 1. *Council*. The Council shall meet, at the call of the President, at least twice a year. The Council shall:

(a) be the governing board of the Academy, responsible only to the membership.

(b) arrange for programs, approve committee appointments, be responsible for the fiscal affairs of the Academy, and transact such business as necessary and desirable for function and growth of the Academy.

(c) determine the location of the Annual Meeting three years in advance.

(d) annually appoint an Academy representative to the National Association of Academies of Science and to Section X (General) of the American Association for the Advancement of Science.

(e) shall appoint and may compensate a Secretary-Treasurer.

(f) shall appoint and may compensate an Editor of the *Proceedings* and other publications.

(g) shall be empowered to charge a publication fee of authors on a per page basis.

(h) shall control all activities of the Academy including grant applications.

Section 2. *President*. The President shall preside at meetings of the Council and over the annual business meeting of the Academy at the close of the regular term office. The President shall vote only to break a tie. Unless otherwise specified, the President shall, with the approval of the Council, appoint members to serve on Standing Committees and *ad hoc* Committees, designate the chair of each Committee, and appoint representatives to other organizations. The President serves as Coordinator of the Local Arrangements Committee for the Annual Meeting that occurs at the end of the President's term.

Section 3. *President-Elect*. The President-elect shall be considered a vice president and shall serve as such in the absence of the President.

Section 4. *Past-President*. The retiring President shall serve as Past-President and chair of the Nominating Committee. The Past-President shall serve *ex officio* on those committees designated by the President and shall serve in the absence of the President and President-Elect.

Section 5. *Secretary-Treasurer*. The Secretary-Treasurer shall:

(a) Assist Council in carrying on the functions of the Academy including the receipt and disbursement of funds under the direction of Council.

(b) Manage the Academy Offices under Council's general supervision.

(c) Serve as Managing Editor of the *Proceedings of the North Dakota Academy of Science*.

(d) Prepare a summary of the most recent audit and a report of the Academy's current financial status. This information shall be shared with the membership at the annual business meeting and published in the *Proceedings* following the business meeting.

(e) Perform all other duties of the Secretary-Treasurer listed in the Bylaws.

(f) Serve as archivist and be responsible for all official records, archives, and historic material which shall be in reposit with the Secretary-Treasurer.

BYLAW 5. *Appointment, Nomination and Election of Members of Council*

Section 1. *Eligibility for Office*. All candidates for election or appointment to the Council must be regular members in good standing. Nominees for President-Elect must be members who reside within easy commuting distance of the site of the Annual Meeting selected by the Council that occurs when the President-Elect serves as President.

Section 2. *Nomination Procedures*. The Nominating Committee shall be responsible for all nominations to elective office, shall determine the eligibility of nominees, shall ascertain that nominees are willing to stand for office, and shall be required to advance to the Secretary-Treasurer at least two names for each open position as needed. Academy members shall have

been encouraged to suggest nominees to the committee prior to the Committee submitting its report.

Section 3. *Election Procedures*. Election shall be by secret mail ballot. The Secretary-Treasurer shall prepare a printed ballot that bears all names submitted by the Nominating Committee, that contains a brief biography of each candidate, and that has space for write-in candidates for each office. This ballot is to be mailed to all members no later than 1 November. Each member wishing to vote must return the marked ballot in a sealed signed envelope to the Secretary-Treasurer postmarked not more than thirty days after the ballots were mailed out to members. The President shall appoint tellers, who shall count the ballots that have been received by the Secretary-Treasurer and the tellers shall present the results in writing to the President. A plurality of the votes cast shall be necessary to elect and in the case of a tie vote, the President shall cast the deciding vote. The results of the election shall be announced at the annual Business Meeting.

Section 4. *Term office*. A President-Elect shall be elected annually by the membership and the following years shall succeed automatically to President and Past-President to constitute a three-year nonrenewable term. Three Councilors shall be elected by the membership to three-year, non-renewable terms on a rotating basis. All elected Council members shall take office at the end of the next annual Business Meeting following election and shall continue until relieved by their successors. Council is empowered to appoint and compensate a Secretary-Treasurer to successive three-year terms that commence with the beginning of the fiscal year.

Section 5. *Removal from office or position.* If for any reason any elected member of Council is unable to fulfill his/her duties, the Council member may be removed from office by two-thirds vote of Council. If for any reason the Secretary-Treasurer is unable to fulfill his/her duties, the Secretary-Treasurer may be relieved of all duties by a majority vote of Council.

Section 6. *Interim vacancies*. Should a vacancy occur in the Presidency, the Council by a majority vote shall appoint a member of the Academy able to coordinate the next Annual Meeting to fill the unexpired term. A retiring interim President shall succeed automatically to Past-President. Should a vacancy occur in the Presidency-Elect, the Council shall reassess and change the location of the coinciding Annual Meeting as necessary and then call for a special election by mail ballot. An interim vacancy in the Past-Presidency shall be filled by the most recently retired Past-President able to fill the duties of the Past-President. Persons appointed to fill the unexpired term of Secretary-Treasurer are expected to remain in the position for a minimum of three years. A vacancy in the office of Councilor shall be filled by a majority vote of Council until the following election at which time the interim Councilor may stand for a full three year nonrenewable term.

BYLAW 6. *Committees*

Section 1. *Standing Committees*. Standing committees shall include but not be limited to, the following: Editorial, Education, Denison Award, Necrology, Nominating, Resolution, Membership, and Audit Committees. The President shall appoint members of committees other than the Nominating and Audit Committees.

Section 2. *Editorial Committee*. The Editorial Committee shall consist of three regular members appointed to three-year terms. The duties are explained in BYLAW 7 (Publications).

Section 3. *Education Committee*. The Education Committee shall consist of five regular members and two high school teachers appointed to five-year terms. The Education Committee shall work with high school students and teachers in the state, in visitation programs, Science Talent Search programs, and other programs to stimulate an interest in science by the youth of the state. It shall operate the Junior Academy of Science program and administer the AAAS high school research program.

Section 4. *Denison Awards Committee*. The Denison Awards Committee shall consist of six regular members appointed to three-year terms. The Denison Awards Committee shall have as its prime duty the judging of student research and paper competitions, both undergraduate and graduate, and any other similar competitions. The committee shall also maintain the criteria to be used in the judging and selection of papers, such criteria to be circulated to prospective competitors.

Section 5. *Necrology Committee*. The Necrology Committee shall consist of three regular members appointed to three-year terms. The Necrology Committee shall report to the Annual Meeting on those deceased during the preceding year. Obituaries may be included in the minutes of the Annual Meeting and/or published in the *Proceedings*.

Section 6. *Nominating Committee*. The Nominating Committee shall consist of the five most recent past-presidents. The major duties of the Nominating Committee are listed in BYLAW 5 (*Appointment, Nomination and Election of Members of Council*). The Nominating Committee will also administer the selection process, develop a separate funding source for a monetary award, and develop, for Executive Committee approval, the criteria for the North Dakota Academy of Science Achievement Award.

Section 7. *Resolution Committee*. The Resolution Committee shall consist of three regular members appointed to three-year terms. The Resolution Committee shall prepare such resolutions of recognition and thanks as appropriate for the Annual Meeting. Further, the Committee shall receive suggested resolutions for the membership and transmit such resolutions and the Committee recommendation to the membership.

Section 8. *Membership Committee*. The Membership Committee shall consist of unlimited numbers of regular members appointed annually.

Section 9. *Audit Committee*. The Nominating Committee shall appoint on a yearly basis one member who is not a member of Council to conduct at least one internal audit per year.

Section 10. *State Science Advisory Committee*. The State Science Advisory Committee (SSAC) shall consist of five regular or emeritus members appointed to four-year terms. The SSAC shall serve to direct questions of a scientific nature to the appropriate expert as requested, shall inform regional granting agencies and state and national science policymakers of its expertise and availability and shall counsel those agencies and persons upon their request. The SSAC shall adhere in particular to the guidelines described in Article V, Section 2 of the Constitution.

Section 11. *Ad hoc Committees*. The President may appoint such additional committees as may be needed to carry out the functions of the Academy. *Ad hoc* committees serve only during the tenure of the president who appointed them. Reports of *ad hoc* committees shall be presented to Council or to the Annual Meeting.

BYLAW 7. *Publications*

Section 1. *Editorial Committee*. Three regular members are appointed to the Editorial Committee for renewable three-year terms. The Editorial Committee shall develop and recommend the Academy publication program and policies to the Council. It will assist the Editors of each official publication in reviewing manuscripts for those publications that include the *Proceedings*. Chairs of symposia will review manuscripts written for relevant symposia.

Section 2. *Managing Editor*. The Secretary-Treasurer shall serve as the

Section 3. *Editor*. Editors shall serve three-year terms. The Editors shall edit all official publications of the Academy, including the *Proceedings*.

BYLAW 8. *Memorial Fund*

The Council of the Academy shall establish a J. Donald Henderson Memorial Fund and administer this fund so that the proceeds will be used to promote science in North Dakota.

BYLAW 9. *Fiscal Year*

The fiscal year of the North Dakota Academy of Science, for the purpose of financial business, shall be 1 January to 31 December.

BYLAW 10. *Achievement Award*

The Academy establishes the North Dakota Academy of Science Achievement Award to be given periodically to an Academy member in recognition of excellence in one or more of the following:

(a) Nationally recognized scientific research.

(b) Science education.

(c) Service to the Academy in advancing its goals.

The Nominating Committee will administer the selection process, will develop a separate funding source for a monetary award, and will develop, for Council approval, the criteria for the award.

BYLAW 11. *Research Foundation*

The North Dakota Science Research Foundation is established as an operating arm of the Academy. The purposes of the Foundation are:

(a) to receive funds from grants, gifts, bequests, and contributions from organizations and individuals, and

(b) to use the income solely for the making of grants in support of scientific research in the State of North Dakota.

Not less than 50% of the eligible monies received shall be placed in an endowment from which only the accrued interest shall be granted.

The Foundation shall be responsible for soliciting the funds for the purposes described. The Foundation funds shall be in the custody of the Secretary-Treasurer of the Academy and shall be separately accounted for annually. The Foundation Board of Directors shall be comprised of five members of the Academy, representing different disciplines. Members shall be appointed by the President of staggered five-year terms. The chairperson of the Board shall be appointed annually by the President. The Board shall be responsible for developing operating procedures, guidelines for proposals, evaluation criteria, granting policies, monitoring procedures, and reporting requirements, all of which shall be submitted to the Executive Committee for ratification before implementation.

The Foundation shall present a written and oral report to the membership of the Academy at each Annual Meeting, and the Secretary-Treasurer shall present an accompanying financial report.

BYLAW12. *Affiliations*

The Academy may affiliate itself with other organizations that have purposes consistent with the purposes of the Academy. Such affiliations must be approved by the Council and by a majority of those attending a regularly scheduled business meeting of the membership.

BYLAW13. *Indemnification*

Section 1. Every member of the Council or employee of the North Dakota Academy of Science shall be indemnified by the Academy against all expenses and liabilities, including counsel fees, reasonably incurred or imposed upon him/her in connection with any proceedings to which he or she may be made part, or in which he or she may become involved, by reason of being or having been a member of the Council, or employee at the time such expenses are incurred, except in such cases wherein the member of the Council or employee is adjudged guilty of willful misfeasance or malfeasance in the performance of his or her duties. Provided, however, that in the event of a settlement of the indemnification herein shall apply only when the Council approves such settlement and reimbursement as being for the best interests of the Academy. The foregoing right of indemnification shall be in addition to and not exclusive of all other rights to which such members of the Council or employee may be entitled.

ACADEMY OFFICERS AND COMMITTEES

Executive Committee Membership

President	Secretary (three-year term)
Past-President	Treasurer (three-year term)
President-Elect	Councilors (three-year term)

President

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Past-President

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President-Elect

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Secretary

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Councilor

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Treasurer

COMMITTEES OF THE NORTH DAKOTA ACADEMY OF SCIENCE

Executive Committee	Julia Xiaojun Zhao, University of North Dakota Stuart J Haring, North Dakota State University Zeni Shabani, Minot State University Daniel Clayton, Minot State University Andre Delorme, Valley City State University Christopher Keller, Minot State University
Editorial Committee *	Joshua Steffan, Dickinson State University
Education Committee	Douglas Munski, University of North Dakota Yun Ji, University of North Dakota Sergei Nechaev, University of North Dakota
Denison Awards Committee *	Van Doze, University of North Dakota Diane Darlan, University of North Dakota Yarong Yang, North Dakota State University
Necrology Committee *	
Nominating Committee	
State Science Advisory Committee *	Frank Xiao, University of North Dakota Mafany Mongoh, Sitting Bull College
Resolutions Committee	Kaylee Dockter, Minot State University Joel Collins, Minot State University Paul Lepp, Minot State University
Membership Committee *	
Audit Committee *	
North Dakota Research Foundation – Board of Directors	Birgit Pruess, North Dakota State University Jerzy Bilski, Valley City State University Paul Lepp, Minot State University
Historian	Alexey Shipunov

* Indicates currently available openings.

PAST PRESIDENTS AND LOCATIONS OF ANNUAL MEETINGS OF THE NORTH DAKOTA ACADEMY OF SCIENCE

Year	President	Location
1909	M A Brannon	Grand Forks
1910	M A Brannon	Fargo
1911	C B Waldron	Grand Forks
1912	L B McMullen	Fargo
1913	Louis VanEs	Grand Forks
1914	A G Leonard	Fargo
1915	W B Bell	Grand Forks
1916	Lura Perrine	Fargo
1917	A H Taylor	Grand Forks
1918	R C Doneghue	Fargo
1919	H E French	Grand Forks
1920	J W Ince	Fargo
1921	L R Waldron	Grand Forks
1922	Daniel Freeman	Fargo
1923	Norma Preifer	Grand Forks
1924	O A Stevens	Fargo
1925	David R Jenkins	Grand Forks
1926	E S Reynolds	Fargo
1927	Karl H Fussler	Grand Forks
1928	H L Walster	Fargo
1929	G A Talbert	Grand Forks
1930	R M Dolve	Fargo
1931	H E Simpson	Grand Forks
1932	A D Weedon	Fargo
1933	G C Wheeler	Grand Forks
1934	C I Nelson	Fargo
1935	E A Baird	Grand Forks
1936	L R Waldron	Fargo
1937	J L Hundley	Grand Forks
1938	P J Olson	Fargo
1939	E D Coon	Grand Forks
1940	J R Dice	Fargo
1941	F C Foley	Grand Forks
1942	F W Christensen	Fargo
1943	Neal Weber	Grand Forks
1944	E A Helgeson	Fargo
1945	W H Moran	Grand Forks
1946	J A Longwell	Fargo
1947	A M Cooley	Grand Forks
1948	R H Harris	Fargo
1949	R B Winner	Grand Forks
1950	R E Dunbar	Fargo
1951	A K Saiki	Grand Forks
1952	Glenn Smith	Fargo
1953	Wilson Laird	Grand Forks
1954	C O Glagett	Fargo
1955	G A Abbot	Grand Forks
1956	H B Hart	Jamestown
1957	W E Comatzer	Grand Forks
1958	W C Whitman	Fargo
1959	Arthur W Koth	Minot
1960	H J Klosterman	Fargo
1961	Vera Facey	Grand Forks
1962	J F Cassel	Fargo
1963	C A Wardner	Grand Forks
1964	Fred H Sands	Fargo
1965	P B Kannowski	Grand Forks
1966	Paul C Sandal	Fargo
1967	F D Holland, Jr	Grand Forks
1968	W E Dinusson	Fargo
1969	Paul D Leiby	Minot
1970	Roland G Severson	Grand Forks
1971	Robert L Burgess	Fargo
1972	John C Thompson	Dickinson
1973	John R Reid	Grand Forks
1974	Richard L Kiesling	Fargo
1975	Arthur W DaFoe	Valley City
1976	Donald R Scoby	Fargo
1977	Om P Madhok	Minot
1978	James A Stewart	Grand Forks
1979	Jerome M Knoblich	Aberdeen, SD
1980	Duane O Erickson	Fargo
1981	Robert G Todd	Dickinson
1982	Eric N Clausen	Bismarck
1983	Virgil I Stenberg	Grand Forks
1984	Gary Clambey	Fargo
1985	Michael Thompson	Minot
1986	Elliot Shubert	Grand Forks
1987	William Barker	Fargo
1988	Bonnie Heidel	Bismarck
1989	Forrest Nielsen	Grand Forks
1990	David Davis	Fargo
1991	Clark Markell	Minot
1992	John Brauner	Grand Forks
1993	John Brauner	Jamestown
1994	Glen Statler	Fargo
1995	Carolyn Godfread	Bismarck
1996	Eileen Starr	Valley City
1997	Curtiss Hunt	Grand Forks
1998	Allen Kihm	Minot
1999	Joseph Hartman	Grand Forks
2000	Mark Sheridan	Moorhead, MN

Year	President	Location
2001	Ron Jyring	Bismarck
2002	Jody Rada	Grand Forks
2003	Richard Barkosky	Minot
2004	Anna Grazul-Bilska	Fargo
2005	Holly Brown-Borg	Grand Forks
2006	Andre Delorme	Valley City
2007	Chris Keller	Minot
2008	Van Doze	Grand Forks
2009	Birgit M Pruess	Fargo
2010	Paul W Lepp	Minot
2011	Lyle Best	Belcourt
2012	Michael A Bingle-Davis	Wyoming
2013	Keith Henry	Grand Forks
2014	Jerzy Bilski	Valley City
2015	Stuart J Haring	Fargo
2016	Stuart J Haring	Fargo
2017	Julia Xiaojun Zhao	Grand Forks

MINUTES OF THE NORTH DAKOTA ACADEMY OF SCIENCE

ANNUAL BUSINESS MEETING 2016

President Haring called the annual business meeting to order in the Arikara Room of the Memorial Union on the campus of North Dakota State University in Fargo, North Dakota on April 15th, 2016 at 6:15 PM. President Haring welcomed all and thanked them for their attendance.

Minutes from the 2015 Annual Meeting were approved by all academy members present by voice vote.

The first new business was a motion by Dr Bryan Schmidt to separate the Secretary-Treasurer position into two separate positions: (1) a Secretary who will be responsible for management of the daily operations of the Academy, and (2) a Treasurer who will be responsible for oversight of the financial holdings of the Academy. After discussion, the motion was approved unanimously.

The following vacant executive committee positions were voted on and filled. Dr Zeni Shabani from Minot State University was elected as President-Elect. Dr Christopher Keller from Minot State University was elected as Councilor to replace Dr Douglas Munski. Dr Stuart Haring from North Dakota State University was elected as Secretary. Dr Daniel Clayton from Minot State University was elected Treasurer.

Discussion was held regarding the dates and duration of the 2017 Annual Meeting. Dr Christopher Keller from Minot State University motioned for two-day meeting. Ismail Hassan from Minot State University seconded, and the motion unanimously carried. Meeting dates were discussed at length. Concern was expressed about meetings late in the semester conflicting finals schedules. Concern was also raised about inclement weather impacting earlier meeting dates. After lengthy discussion, Ismail Hassan from Minot State University motioned to have incoming President Zhang determine the 2017 meeting date after looking at venue availability at the University of North Dakota. Joel Collins from Minot State University seconded the motion. The motion carried unanimously.

Registration for upcoming annual meetings was discussed. Some members are facing difficulties with separate membership fees as department- and/or university-specific rules prevent payment for professional memberships using a university account. Dr Christopher Keller from Minot State University motioned to have registration and membership fees combined into a single registration/membership fee. Dr Daniel Clayton from Minot State University seconded. The motion carried unanimously. Dr Christopher Keller from Minot State University motioned to offer an exempted registration fee for lifetime members. Dr Daniel Clayton from Minot State University seconded. The motion carried unanimously. Dr Ron Jyring from Bismarck State College motioned to have regular registration/membership fee plus a discounted early bird registration/membership fee. The motion carried unanimously.

Discussion was held regarding abstract formatting for the *Proceedings*. The role of the Editorial Board in accepting submissions for publication in the *Proceedings* was discussed. Dr Stuart Haring from North Dakota State University motioned that the Secretary has final authority for establishing a reasonable character limit for submitted abstract. Ismail Hassan from Minot State University seconded. The motion carried. Joel Collins from Minot State University

motioned to have an Abstract Book with a 1500 character limit, including spaces, for submission and a separate non-peer reviewed publication for submitted articles with no character limits. Breanne Hatfield from Minot State University seconded. The motion carried. Discussion was had regarding continued printing of the *Proceedings* or if it should become an electronic-only publication. Joel Collins from Minot State University motioned to retain the print copy. Dr Ron Jyring from Bismarck State College seconded. The motion carried.

Dr Christopher Keller from Minot State University motioned to charge the academy Historian with finding more information on A. Rodger Dennison. Dr Ron Jyring from Bismarck State College seconded. The motion carried.

The Academy budget was presented by Secretary-Treasurer Schmidt. There was $12,264 in the Academy checking account. This did not include the expenses incurred for the current Annual Meeting, which were approximately $3,500-4,000. There is currently approximately $4,000 in the Scholarship Fund, $10,312 in the Research Foundation Fund, and approximately $200,000 in stock holdings. The stock accounts started with $4,000 in stock donated in 1983 and a further $10,000 donated in a second account in 1993. Both of these accounts are near being considered delinquent for lack of activity. Without original paper stock certificates, taking possession of these accounts is difficult. A company contacted the Secretary-Treasurer offering to regain possession of the accounts in the name of the Academy in exchange for a fee determined as 5% of the current value of the stock. Breanne Hatfield from Minot State University motioned to use such a company to regain possession of the stock. Ismail Hassan from Minot State University seconded. The motion carried.

There were 8 professional talks, 17 Denison graduate student talks, 11 Denison undergraduate student talks, and 29 poster presentations. The Denison Awards were presented by President Haring. The award winners were:

	Undergraduate Awards		**Graduate Awards**	
Place	Recipient	Award	Recipient	Award
2nd runner-up	Stephanie Kitowski (UND)	$100	Sunitha Takalkar (NDSU)	$100
1st runner-up	Suzannah Miller (MiSU)	$150	Timothy Wilson (NDSU)	$125
Winner	Belinda Zabka (MiSU)	$200	Atrayee Bhattacharya (UND)	$150
			Nilushni Sivapragasam (NDSU)	$150

At 7:57 PM, Breanne Hatfield from Minot State University motioned to adjourn the meeting. Ismail Hassan from Minot State University seconded the motion. The motion carried and the meeting was adjourned.

Respectfully submitted,
Bryan Schmidt, Secretary-Treasurer

LIFETIME MEMBERS

FD “Bud” Holland
Ron Jyring
Allen Kihm

ADDENDUM

PROMOTING UNDERGRADUATE MILITARY GEOGRAPHY RESEARCH WITH A CASE STUDY OF THE 164TH INFANTRY REGIMENT

Douglas Munski* (F1), Daniel Yun (1), and Daniel Sauerwein (2)

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American collegiate interest in military geography has fluctuated since the 1960s. It seldom is taught outside the military service academies. While aspects of military geography are found within Army ROTC and Air Force ROTC courses, these topics infrequently have been available outside the Armory at the Grand Forks campus. However, there seems to be some local interest in reviving this type of geography course. Thus, a GEOG 491 (Directed Studies in Geographical Problems) was created for one undergraduate in Sp16. The course focused upon promoting undergraduate research as a stepping-stone to future studies in military geography. Under the joint tutelage of a faculty member and an archivist specializing in military history, the undergraduate "pilot student" delved into primary sources available at the Chester Fritz Library's Elwyn B. Robinson Department of Special Collections regarding the 164th Infantry Regiment. Starting as the Dakota Territory Militia before becoming the 1st North Dakota Infantry Regiment, it eventually was part of the North Dakota National Guard that was activated into Federal service in February of 1941. These troops joined with two other regiments to form the Americal Division and notably saw action in the Guadalcanal Campaign in October of 1942. This poster has the outline of the curriculum for the proposed future course and is a showcase for elements of the current research of the participating undergraduate.

Support: None

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