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Volume 72 April 2018

NORTH DAKOTA ACADEMY OF SCIENCE
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2017-2018

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110th Annual Meeting

April 27, 2018

Minot, North Dakota

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EDITOR'S NOTES

Welcome to the *Proceedings of the North Dakota Academy of Sciences* for the 110th Annual Meeting of the Academy.

Within the *Proceedings*, you will find information pertaining to the history of the Academy, membership and participation, Academy business, how to receive communications from the Academy, the list of presenters at the Annual Meeting, and of course, abstracts pertaining to each presentation. This communication will be available online and will be archived following the Annual Meeting.

I would like to take this opportunity, on behalf of the Academy, to acknowledge current and *emeritus* members of the Academy who continue to support the mission of the North Dakota Academy of Science through their special gifts and participation in Academy business.

On behalf of the Academy, I also wish to express gratitude to the presenters at this meeting and their mentors who have devoted the time, effort, and often finances to provide students with the opportunity to experience a conference where they are exposed to a diverse range of research areas and to provide guidance for students as they develop skills towards becoming the next generation of scientists.

Finally, I would like to thank those who have volunteered their time to help make this meeting possible and allow it to run efficiently. This includes those who have organized the spaces, arranged for accommodations, ensured that finances were in order, and have volunteered as judges and/or session chairs. Voluntary participation in these endeavors are what ensure that the Academy can continue its mission "to promote and conduct scientific research and to disseminate scientific knowledge", not only in the state of North Dakota, but also regionally, nationally, and globally.

Sincerely,

Stuart J. Haring
Secretary, North Dakota Academy of Science

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SCHEDULE

All events will be held in the Student Center on the campus of Minot State University.

Friday, April 27			
Time	**Conference 1: Missouri/Metigoshi**	**Conference 2: Westlie**	**Conference 3: Audubon**
8:00 AM	*REGISTRATION AND BREAKFAST*		
8:30 AM	**WELCOME AND OPENING REMARKS** *President Shirley and Chancellor Hagerott*		
9:00 AM	Limke (U)	Mohammad (G)	
9:20 AM	Kraft (U)	E. Biggane (G)	
9:40 AM	Webster (P)		
10:00 AM	*BREAK*		
10:20 AM	Sundhagen (U)	Baryeh (G)	Houlton (U)
10:40 AM	Larson (G)	Jacob (U)	Amjaour (G)
11:00 AM	Mensah (U)	Smith (G)	Baumgartner (G)
11:20 AM	Koney (G)	Skinner (U)	Super (P)
11:40 AM	*LUNCH*		
12:40 PM	Clark (U)	Adsero (G)	J. Biggane (G)
1:00 PM	Davis (G)	Germann (U)	Liu (G)
1:20 PM	Han (G)	Burnett (U)	Singh (G)
1:40 PM	*BREAK*		
2:00 PM	Joshi (G)	Richards (U)	Clark (U)
2:20 PM	Adeleke (U)	Heimdal (U)	Ghimire (U)
2:40 PM	Hernandez (U)	Rodriquez (G)	Best (P)
3:10 PM	**COMPETITION JUDGING** *All faculty members are encouraged to participate.*		
3:20 PM	**POSTER SESSION** in the Atrium		
4:30 PM	**BUSINESS MEETING** *All Academy members are encouraged to attend.*		
5:30 PM	*DINNER*		
6:30 PM	**KEYNOTE SPEAKER** *Dr Tamara Philips* *"Methods for Identifying Modifiers of Genetic Risk for Methamphetamine Intake"*		
7:30 PM	**AWARDS AND CLOSING REMARKS**		

PRESENTERS AND PRESENTATION TITLES

Student Center - Conference 1: Missouri/Metigoshi		
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UNDERGRADUATE COMMUNICATIONS

IN THE

A. RODGER DENISON COMPETITION

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

Adeleke
Undergraduate
Talk

EXAMINING THE ROLE OF ABP1 IN ELONGATION OF EXCISED ARABIDOPSIS HYPOCOTYL SECTIONS

Adedayo F. Adeleke and Christopher P. Keller

Biology, Minot State University, Minot, ND

Major features of plant development are controlled by auxin (indole-3-acetic acid; IAA). The role of the putative auxin-receptor Auxin binding protein 1 (ABP1), however, is not well understood. In the model plant Arabidopsis, leaf expansion and leaf epidermal cell development have been linked to auxin and ABP1. But it remains unclear if ABP1 is involved in other aspects of auxin-controlled development especially as Arabidopsis plants homozygous for an abp1 null allele develop nearly normally. A rapid elongation response to exogenous auxin by excised hypocotyl sections of dark-grown plants suggests a membrane receptor such as ABP1 should be involved. In this project, we are compared the elongation, plus and minus exogenous auxin, of excised sections of dark-grown hypocotyl sections. In initial experiments we found substantial but inconsistent differences between the growth of excised hypocotyl sections of wild-type (Col-0) and those of the abp-1-c1 null allele treated with and without exogenous auxin after 24 hours. Standardizing growth conditions, however, by planting both seed types in the same petri dishes revealed that, while both Col-1 and abp-1-c1 plants have a growth response to 10 mM IAA, the magnitude of the response does not differ between them. While our results suggest that ABP1 is not involved in auxin-induced elongation of excised hypocotyl sections, this must be confirmed with other concentrations of IAA.

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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Burnett
Undergraduate
Talk

EFFECT OF NULL MUTATION OF AUXIN BINDING PROTEIN-1 ON ARABIDOPSIS GERMINATION AND HYPOCOTYL GROWTH

Brody J. Burnett and Christopher P. Keller

Biology, Minot State University, Minot, ND

Auxin (indole-3-acetic acid) controls several aspects of development in plants. Binding of auxin to the TIR1 family of nuclear receptors is known to alter gene expression while rapid non-genomic auxin effects may be mediated through Auxin Binding Protein-1 (ABP-1). Arabidopsis plants homozygous for an abp1 null allele, however, develop nearly normally in the light. Because, hypocotyl growth in the dark rapidly responds to auxin, here we ask if ABP-1 plays a role in the auxin-controlled dark development. We compared time to germination and hypocotyl length in wild type (Col-0) Arabidopsis with that of the abp1-c1 null mutant. We hypothesized that the null mutant would show decreased hypocotyl growth when compared to the wild type. Wild type and abp1-c1 seeds were planted on agar, stratified 4 days, and grown in the dark for up to 96 hours at 25C. Both seed types were planted in each petri dish to ensure identical growth conditions. Abp1-c1 null mutants were consistently slower to germinate. For example, after 36 hours 38.3% +/- 4.6 of wild type seeds had germinated versus 6.67% +/- 1.3 abp1-c1 and after 48 hours 81.4% +/- 0.87 wild type had germinated versus 39.3% +/- 1.68 abp1-c1. In spite of earlier germination, however, wild type hypocotyl length never exceeded that of abp1-c1. These results show a role for abp1-c1 in the control of germination and in hypocotyl elongation in the dark and suggest that abp1-c1 may be important in the control of root growth.

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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Clark
Undergraduate
Talk

DETERMINATION OF THE MECHANISM OF FORMATION OF SYNTHETIC BROWNMILLERITE BY X-RAY DIFFRACTION

Paige A. Clark (1), Naomi Winburn (1), and Ryan S. Winburn (2)

(1) Chemistry, Minot State University, Minot, ND and (2) Rare Earth Salts, Beatrice, NE

Brownmillerite is a major component in many coal combustion by-products and used to strengthen cement. This study focuses on determining the ideal conditions to effectively synthesize synthetic brownmillerite with various solid solution compositions. The synthesis was done using an uncomplicated method of thoroughly mixing the reactants, heating the reaction mixture and then taking samples to follow the progression of the solid state reaction via analysis using X-ray diffraction . The conditions varied included the ratio of reactant materials, temperature of heating, and total reactant mass. Additional experiments were done to determine if the introduction of mixing the samples throughout the heating process had any effect on the reaction rate. The results showed that at lower reaction temperatures, the reaction occurs at a much slower rate and that increasing the size of the reactant mixture also resulted in a slower rate of reaction. Results also showed that the ideal conditions to synthesis brownmillerite were a 1.5 g reaction mixture with a 25% iron and 75% aluminum ratio with intermittent mixing for 120 hours at 1150 ºC. The conclusion was by allowing the 25% iron and 75% aluminum ratio sample to react for longer than 120 hours may push the peak further to the synthetic brownmillerite reference peaks.

Support: No financial support was provided for this work.

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Clark
Undergraduate
Talk

TIME INTERVAL ANALYSIS OF CAFFEINE CONCENTRATION IN HUMAN SALIVA UTILIZING GC/MS

Paige A. Clark (1), Annika Kraft (1,2), Shirley Cole-Harding (1), and Naomi Winburn (2)

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

Saliva caffeine concentrations of human subjects who participated in a two day study were determined. On one day subjects were given decaffeinated coffee and on the other day were given a decaffeinated coffee that had been dosed with 2 mg/kg of caffeine for every kg of their body weight. Subjects were asked to give a baseline saliva sample before either study began, and then at 15, 30, 45, 60, 90, and 120 minute intervals after the coffee had been consumed. The caffeine was then extracted from these samples using ethyl acetate in a liquid-liquid extraction. An internal standard of 30 mg/L of salicylic acid was added to each sample, which was then analyzed by gas chromatography/mass spectrometry. It was determined that for all 10 subjects the concentration of caffeine was found to have a maximum value at fifteen minutes with a range of 5.6-82.6 mg/L. Caffeine concentrations of individual subjects did not vary significantly during the placebo days of the study.

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

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Germann
Undergraduate
Talk

CLASSIFICATION OF A CHONDRITIC METEORITE FOUND NEAR COLGATE, NORTH DAKOTA

Justin T. Germann and Nels Forsman

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

Meteorites are classified by multiple criteria including; chemistry, mineral structure and mineral abundance. The meteorite studied was found in 1999 in Colgate, ND during a home construction, it weighs 39 kg and is the largest yet found in ND. The meteorite is a chondritic stone, the most common type of meteorite making up 86% of falls. This study determines the class, clan, and the petrological type, which measures the aqueous alteration or metamorphism experienced by the meteorite. Whole rock geochemical analysis of the meteorite was determined by x-ray fluorescence, and x-ray diffraction. The chemical composition of individual mineral grains was determined with a scanning electron microscope and energy dispersive x-ray spectroscopy. The petrologic structure and optical properties were determined with a polarizing microscope using three thin sections. The meteorite has a SiO2/MgO ratio of 1.5, a FeO/SiO2 ratio of 0.71, and a Fe(metallic)/FeO ratio of 0.72. Total metallic Fe is 19.8%, and the olivine Fa (fayalite) composition is 20.27 mol%. The meteorite has good olivine grain homogeneity with less than 5% average deviation. The meteorite's matrix contains crystalline properties with mostly well segregated chondrules with an average diameter of 0.3mm, and a little igneous glass. With these measurements the meteorite was determined to be H clan meteorite within the ordinary chondrite class, and a petrologic type of 4. Commonly denoted as an H4 Chondrite.

Support: Thin Section Production paid for by Dr. Nels Forsman of UND.

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Ghimire
Undergraduate
Talk

TAAR1 MEDIATES THE AVERSIVE EFFECTS OF METHAMPHETAMINE

Bikalpa Ghimire and Zeni Shabani

Biology, Minot State University, Minot, ND

Individual differences in sensitivity to rewarding and aversive effects likely influence risk for methamphetamine (MA) addiction. A genetic mouse model created to assess the relevant genetic risk factors for binge MA consumption shows that the trace amine-associated receptor 1 (TAAR1) gene on chromosome 10 is one important gene associated with regulating MA consumption. MA is an agonist to TAAR1. TAAR1 is known to regulate monoamine release. Stimulation of TAAR1 receptor by MA in our mouse model for low MA consumption seems to induce aversion to MA, however direct pharmacological manipulation of TAAR1 receptor are lacking. A TAAR1 full agonist (RO-5256390) was studied for its ability to induce conditioned taste aversion (CTA), conditioned place aversion (CPA), and hypothermia. The ability of RO-5256390 to induce a CTA and CPA was examined. At the end of each of these procedures, mice were tested with the same RO-5256390 doses for hypothermic effects. TAAR1 agonist induced robust CTA compared to vehicle treatment at both doses with robust hypothermic effects at 60 min post injection. In the conditioned place procedure, even the lowest dose of 0.05 mg/kg RO-5256390 induced robust CPA and doses >0.05 mg/kg had larger hypothermic effects. In conclusion, our results suggest that TAAR1 stimulation is largely responsible for the aversive effects of MA. High sensitivity to aversive actions of TAAR1 receptor curbs MA intake and reduces chances of future MA use.

Support: INBRE NIH P20GM103442.

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Heimdal
Undergraduate
Talk

NEW APPROACHES TO TREATING CANCER: EPIGENETIC MODIFIERS CAN HELP LEUKEMIA CELLS RESPOND TO THERAPY

Kalsi Heimdal, Edjay Ralph Hernandez, and Heidi Super

Biology, Minot State University, Minot, ND

Acute myeloid leukemia (AML) has approximately eight subtypes, many of which have poor prognosis. Most of these subtypes are associated with specific, recurrent chromosome translocations that result in fusion genes, which encode oncoproteins that block differentiation and promote proliferation of immature cells. The Myeloid Lymphoid Leukemia gene (MLL) is frequently involved in these translocations, and is considered a driver of the AML. Differentiation promoting drugs, such as all-trans-retinoic acid (ATRA) are an attractive alternative to chemotherapy, but few types of AML respond to ATRA. Our initial studies have focused on two AML cell lines, MV4;11 and THP-1 and one non-MLL related AML cell line, U937. We hypothesize that changes in epigenetic modifications due to treatment with epigenetic inhibitors could sensitize more types of AML to differentiation treatments such as ATRA, and that gene activation or inhibition may be manipulated by epigenetic modification. In this study, MV4;11, THP-1, and U937 were treated with two epigenetic modifiers, CI-994 and TCP. Differentiation will be noted indirectly and directly as reduced cell proliferation and metabolic activity, as well as by changes in the morphology of the cells/nuclei, upregulation of CD11b, and downregulation of HOXA9. Our studies suggest that in MLL-driven leukemia, the MLL fusion protein may override genetic manipulation resulting from treatment with epigenetic inhibitors, preventing full differentiation by ATRA.

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

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Hernandez
Undergraduate
Talk

EFFECTS OF RFA2 N-TERMINAL PHOSPHORYLATION ON ADAPTATION-DEFICIENT YEAST

Cristian Hernandez, Trevor Baumgartner, and Stuart Haring

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

Determining the role of the Replication Factor A2 (Rfa2) N-terminus on cell cycle regulation and DNA damage checkpoint progression is crucial for studying how cells prevent genetic defects. Cells must be able to efficiently and accurately repair DNA damage in a temporally-controlled manner. If cells are unable to do so, they are at a very high risk of developing permanent DNA mutations, which are directly correlated with cancer and other cellular diseases.

To prevent mutations, it is especially important for cells to be able to address DNA damage before they replicate their DNA or segregate their chromosomes by mitosis. Before the phases of the cell cycle that involve DNA metabolism (i.e., DNA synthesis and mitosis), checkpoints are elicited to provide the necessary time to do one last check to ensure that the genome is intact. The N-terminus of the single-stranded DNA-binding protein Rfa2 plays a crucial role in the response to DNA damage, especially in regulating checkpoint function.

Checkpoints are utilized by all eukaryotic cells and require precise coordination of many proteins. Using yeast as a model eukaryotic organism, gene deletions of checkpoint machinery required for checkpoint exit (adaptation) were generated to assess the ability of cells to progress through cell cycle checkpoints. We show here how Rfa2 modification affects adaptation when these genes are deleted, to determine the pathway through which Rfa2 mediates checkpoint exit and the return to cell growth.

Support: Support: This work was supported by a National Science Foundation grant (NSF-CAREER-1253723) awarded to SJH.

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OF MICE AND METH: A MOUSE MODEL FOR ACUTE METHAMPHETAMINE WITHDRAWAL AND DEPRESSION-LIKE SYMPTOMS

Sydney Houlton and Zeni Shabani

Biology, Minot State University, Minot, ND

Binge methamphetamine (MA) users have a high MA intake, approximately 10 mg/kg/day, and amplified acute withdrawal symptoms; genetic components are thought to contribute substantially to this phenotype (Shabani et al., 2016). A mouse model has been successfully created and tested to assess the behavioral and genetic characteristics for binge MA consumption (Wheeler et al., 2009). This model assesses measures that are comparable to human-like patterns. We subjected a selectively bred strain of MA high drinking (MAHDR) mice and their progenitor (DBA/2J) to long periods of chronic MA intake. Following the period of intake, mice were subject to specific periods of withdrawal. Depression-like symptoms were assessed using tail suspension and forced swim tests after acute withdrawal (6h and 30h) and prolonged abstention (1 week and 2 weeks). Results showed greatest depression like symptoms in the MAHDR mice after acute withdrawal compared to that of the DBA/2J mice, highlighting a genetic component to the phenotype.

Support: INBRE NIH P20GM103442.

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Jacob
Undergraduate
Talk

HILLSLOPE-CHANNEL INTERACTIONS IN FIRST- AND SECOND-ORDER TRIBUTARIES OF THE DES LACS RIVER VALLEY

Chandler W. Jacob and Nathan R. Hopkins

Geosciences, Minot State University, Minot, ND

Hillslope evolution is driven by fluvial processes and incision rates. Examination of the Des Lacs River valley in north-central North Dakota revealed numerous large slumps within coulees incised into the Missouri Escarpment. This study explored the use of digital elevation models (DEMs) to evaluate controlling factors over the slumps. Using Lidar-derived DEMs, this study explored the spatial relationships between the local drainage network and the slumps. Hydrological analysis tools were used to delineate stream channels and extract longitudinal profiles for the principle stream within 12 coulees. All streams evaluated in this study possessed at least one over-steepened reach, referred to as a knickzone. Each of the slumps lie within a knickzone, indicating stream incision is the primary driver of the slumping. The location and geometry of the slump is controlled by properties of the local stream network. Channel slopes within the knickzones are inversely proportional to drainage area, which controls the aerial extent of the slump. Additionally, the upstream position of the knickzone is dependent on the size of the drainage area. In conclusion, drainage area controls knickzone location and steepness, which in turn dictates location and size of the slump. Thus, stream incision drives the evolution of hillslope morphology in the Missouri Escarpment of North Dakota.

Support: Minot State Division of Science.

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Kraft
Undergraduate
Talk

EFFECTS OF CARBONATION AND SWEETENER ON CAFFEINE CONCENTRATIONS OF HUMAN SALIVA WITH GC/MS ANALYSIS

Annika Kraft (1,2), Shirley Cole-Harding (1), and Naomi Winburn (2)

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

Human saliva caffeine concentrations (SCC) were compared in subjects that were given the same dosage of caffeine (2mg of caffeine/kg body mass) in different carbonated and non-carbonated beverages as well as coffee. The variables of this study were carbonation and sweetener type. Subjects were given 300 mL of prepared beverage, and their saliva was collected before ingestion and at 15, 30, 45, 60, 90 and 120 minutes after ingestion. Caffeine was extracted from the saliva using an extraction with ethyl acetate. Previous extraction methods were optimized replacing acetaminophen with 15 mg/L of salicylic acid as the internal standard. Samples were analyzed using GC/MS. In carbonated and non-carbonated sugared sodas, all subjects showed a significant increase in SCC at 15 min. which was maintained until 60 min. In non-carbonated diet sodas, all subjects displayed an initial increase in SCC between 15 and 30 min. which held until 120 min. In carbonated diet sodas, all subjects exhibited an increase in SCC between 15 and 30 min. with no significant decrease to 120 min. In the coffee study, three subjects showed an increase in SCC at 15 min. and a rapid decrease thereafter. There was no significant change between carbonated and non-carbonated saliva caffeine concentration curve shape. There was a significant difference between sugared and diet soda saliva caffeine concentration curve shape. Diet soda showed a higher average saliva caffeine concentration than the regular soda types.

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Limke
Undergraduate
Talk

WHAT WILL I BE WHEN I GROW UP?: NEURAL STEM CELL DETERMINATION AND THE VASCULAR MICROENVIRONMENT

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Cortical neural stem cells (NSC) differentiate in response to microenvironmental cues to generate diverse brain cell types. Our goal is to determine how the vascular microenvironment influences early cortical NSC lineage decisions and to determine the role of the Polycomb repressive complex 2 (PRC2). PRC2 methylates lysine 27 on Histone H3 (H3K27me3) to repress gene transcription. Our hypothesis is that NSC respond to blood-vessel derived cues and PRC2 downregulates expression of NSC-specific genes during cell lineage decisions. To address this hypothesis, we use embryonic cortical forebrain-derived NSC cultured in the presence or absence of vascular cell-conditioned medium. To test PRC2's role in cell fate determination, we use a small molecular inhibitor of Ezh2, the PRC2 component that methylates H3K27. We observe nestin-positive cells in our NSC-neurospheres. In contrast, the NSC exposed to vascular cell conditioned medium express Glial fibrillary acidic protein (Gfap) that is normally found in glial lineages such as radial glia and astrocytes. Inhibition of Ezh2 results in Gfap-positive neurospheres whether or not the NSC were treated with vascular cell-conditioned medium. One interpretation is that PRC2 function is required to suppress Gfap expression in NSC and that Ezh2 inhibition induces gliogenesis. By altering the microenvironment, a link may be established between NSC cell fate and PRC2-based nucleosome modification during cortical cell lineage decisions.

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EFFECTS OF CREAM AND SUGAR ON CAFFEINE ABSORPTION

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The purpose of this research was to determine the amount of caffeine present in human saliva after coffee ingestion. The study was divided in four separate sessions in which subjects were given caffeinated coffee only, caffeinated coffee with sugar, caffeinated coffee with cream, and caffeinated coffee with sugar and cream. The volume of caffeine added for each subject was determined from their body weight (2 mg/kg). The saliva was collected at 15 min interval during the first hour and 30 min interval during the second hour. Caffeine was extracted from the saliva samples using ethyl acetate and sodium dodecyl sulfate. The liquid from the extraction was analyzed with the GC/MS using salicylic acid (15 mg/L) as an internal standard. For coffee only, all subjects showed a peak at 15 min with a range of 2.3 to 16.9 mg/L which then drop quickly. With sugar in the coffee, all subjects showed a maximum caffeine concentration between 15 and 30 min (1.4 to 3.3 mg/L), with then drop much slower with an additional increase at 60 min (0.5 to 1.1 mg/L). When cream was added, the subjects showed an increase at 15 min (1.3 to 4.3 mg/L), with also a slower drop and another one by 60 min (0.4 to 1.2 mg/L) then drop. When sugar and cream were both added, the subjects showed an increase at 15 min (2.4 to 5.4 mg/L) with another increase at 60 min (1.1 to 2.5 mg/L). The results showed that sugar and cream have an impact on the caffeine absorption.

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Richards
Undergraduate
Talk

REPLICATION FACTOR A (RFA) MAINTAINS GENOME INTEGRITY THROUGH REGULATION OF CHECKPOINT EXIT

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Because DNA lesions can lead to cellular disease, cells closely monitor their DNA for damage. Cellular first responders recognize DNA damage and recruit repair machinery, which requires time to restore the DNA. Checkpoints, or “stop signs” in the cell cycle, ensure that adequate time is provided. Premature checkpoint exit, called adaptation, leads to permanent changes and/or loss of genetic information (i.e. mutations). Genome integrity requires proper timing of checkpoint entry and exit; however, little is known about the reversal of checkpoint signaling to exit a checkpoint. Replication Factor A (RFA) is an essential three-protein complex with crucial roles during DNA replication and repair. RFA binds and stabilizes single-stranded DNA and acts as a first responder to recruit necessary regulatory and repair proteins. Research is beginning to explore the role of RFA, especially Rfa2 phosphorylation, in checkpoint adaptation. A series of SDS-PAGE and Western blot analyses of Rfa2-S122 and Rfa2 N-terminal (NT) phospho-mutants showed that Rfa2 is phosphorylated in two stages in response to DNA damage: early at S122, as previously reported, and later within the NT. Checkpoint adaptation studies demonstrated that phosphorylation of Rfa2-NT increases checkpoint adaptation, while the Rfa2-S122 phospho-state has no detectable role. Ultimately, understanding how cells regulate checkpoints to prevent mutations may lead to novel treatments for cancer and other cellular diseases.

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Skinner
Undergraduate
Talk

SYNTHESIS OF N-FLUOROBENZYL-N-METHYLFORMAMIDES

Tess A. Skinner, Shin Young Park, Lioudmila I. Bobyleva, and Mikhail M. Bobylev

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Recently, we developed a rapid procedure for the synthesis of substituted N-benzyl-N-methylformamides. Interestingly, in the reactions conducted on 3- and 4-chlorobenzaldehydes, large amounts of N,N-di-(3-chlorobenzyl)- and N,N-di-(4-chlorobenzyl)- N-methylamines were produced with the isolated yields of 32.6% and 31.3%. N-(3-chlorobenzyl)- and N-(4-chlorobenzyl)-N-methylformamides were produced with the isolated yields of 41.8% and 52.0%.

Based on the higher electronegativity of the fluoro group, we hypothesized that the reaction with 3- and 4-fluorobenzaldehydes may produce lower yields of the respective dibenzyl products and higher yield of the respective monobenzyl products.

The reactions were conducted on 10 mmol scale at 188 and 184 degrees Celsius, respectively. Column chromatography was used for the isolation of the products. NMR-spectroscopy and elemental analysis were used to determine the structures of the products.

The isolated yields of N,N-di-(3-fluorobenzyl)- and N,N-di-(4-fluorobenzyl)-N-methylamines were 32.2% and 21.4%. The isolated yields of N-(3-fluorobenzyl)- and N-(4-fluorobenzyl)-N-methylformamides were 62.5% and 69.4%. The ratio of the yields shifted from 1:1.28 to 1:1.94 and 1:1.66 to 1:3.25.

The results of the reaction support the initial hypothesis. The reaction provides a new method for the synthesis of N-(3-fluorobenzyl)- and N-(4-fluorobenzyl)-N-methylformamides, as well as N,N-di-(3-fluorobenzyl)- and N,N-di-(4-fluorobenzyl)-N-methylamines.

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Sundhagen
Undergraduate
Talk

SYNTHESIS OF N-ALKYL-N-(4-ISOPROPYLBENZYL)FORMAMIDES

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Chemistry, Minot State University, Minot, ND

Recently, we developed a rapid procedure for the Leuckart reaction and successfully applied it for the synthesis of substituted N-benzyl-N-methylformamides. Interestingly, in the reaction conducted on 4-chlorobenzaldehyde, a large amount of a by-product, N,N-di-(4-chlorobenzyl)-N-methylamine was produced with an isolated yield of 31.3%. N-(4-chlorobenzyl)-N-methylformamide was produced with an isolated yield of 52.0%. We hypothesized that the reaction conducted on benzaldehydes with electron-donating groups will produce higher yields of the respective dibenzylamines and lower yields of the respective benzylformamides. In this work, the hypothesis was tested by conducting the reaction on 4-isopropylbenzaldehyde with N-methyl- and N-ethylformamides. The reactions were conducted on 10 mmol scale at 189 degrees Celsius. Column chromatography was used for the isolation of the products. NMR-spectroscopy and elemental analysis were used to confirm the structures of the products. The isolated yields of N,N-di-(4-isopropylbenzyl)-N-methylamine and N-(4-isopropylbenzyl)-N-methylformamide were 44.0% and 42.0%, respectively. The isolated yields of N-ethyl-N,N-di-(4-isopropylbenzyl)amine and N-ethyl-N-(4-isopropylbenzyl)formamide were 47.2 % and 39.5 %. The ratio of the yields shifted from 1:1.66 to 1.05:1 and 1.19:1, respectively. The results of the reactions support the initial hypothesis.

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GRADUATE COMMUNICATIONS

IN THE

A. RODGER DENISON COMPETITION

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

Adsero
Graduate
Talk

THE REPLICATION FACTOR A2 N-TERMINUS IS REQUIRED FOR PROPER PROGRESSION THROUGH MEIOTIC DIVISIONS

Angela M. Adsero (2), Timothy M. Wilson (1), Stuart J. Haring (1,2)

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

Meiosis is essential for generating haploid gametes. In humans, defects in meiosis can lead to an abortive pregnancy or cellular diseases (such as Down Syndrome) in offspring. Due to the conservation of many meiotic proteins and the ability to study all four gametes, budding yeast provides a model system for the induction and study of meiosis. Replication Factor A (RFA) is an essential single-stranded DNA (ssDNA) binding complex whose major role is to protect ssDNA. The RFA complex is composed of three subunits: Rfa1 (70 kDa), Rfa2 (32 kDa), and Rfa3 (14 kDa). In mitotic cells, the N-terminus (NT) of Rfa2 is phosphorylated in response to DNA damage. During meiosis, phosphorylation of Rfa2 is also shown to occur in a programmed manner; however, the contribution of the Rfa2 NT in meiosis has yet to be clearly determined. To study the role of Rfa2 in meiosis, Rfa2 NT diploid mutants were generated that either mimic hyper-phosphorylation (rfa2-Dx) or are not phosphorylatable on their N-terminus (rfa2-Ax and rfa2-Nx). The only mutant that exhibits drastically reduced sporulation efficiency and spore viability is the mutant lacking the NT, rfa2-Nx. This reduction is not due to defective homologous recombination (HR); however, Rfa2-Nx mutants display an inability to complete both reductional (MI) and equational (MII) divisions. Thus, Rfa2 NT may have a role in proper exit from the pachytene checkpoint during MI and/or a direct role in meiotic chromosomal division(s).

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Amjaour
Graduate
Talk

FACILE AND SCALABLE PREPARATION OF A CYCLOBUTANE-1,2-DIACID (CBDA) BUILDING BLOCK VIA PHOTOREACTION

Houssein Amjaour, Zhihan Wang, Jenna Puttkammer, and Qianli R. Chu

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Dicarboxylic acids (e.g., terephthalic acid) have a wide array of applications in both materials and pharmaceuticals. The surfacing of cyclobutane-diacid (CBDA) has recently attracted increasing attention from researchers of different fields. The unique, semi-rigid cyclobutane rings are different from flexible aliphatic and rigid aromatic building blocks that have been commonly used. Herein, a scalable preparation of a cis-3,4-diphenylcyclobutane-1,2-dicarboxylic acid (CBDA-4) was developed by capturing and photodimerizing a metastable crystalline solid of trans-cinnamic acid. This approach enables us to explore the properties of this novel diacid building block. It was discovered that the cyclobutane of CBDA-4 can be cleaved upon heating at 300 oC, which offers a simple way to recover the biomass-derived starting materials from CBDA-4 at the end of its life as a polymer building block.

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QUANTITATIVE CARBON NANOTUBE-BASED LATERAL FLOW STRIP FOR PROTEIN DETECTION IN HUMAN PLASMA

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

Detecting proteins in physiological fluids is of enormous interest in clinical diagnostics. Traditional techniques used to quantify protein concentrations in physiological fluids involve complex methods (eg. radioimmunoassay, western blot, gel electrophoresis, ELISA) which are limited to the laboratory setting. These methods rely on complex sample purification steps and sophisticated equipment, are time and labor intensive, expensive, and require highly trained personnel. To this end, we designed a carbon nanotube (CNT)-based lateral flow strip biosensor (LFSB) for the rapid and quantitative detection of proteins in human plasma. The assay involved the capture of target antigen in a sandwich-type assay between an immobilized capture antibody and a CNT-labelled-detection antibody. The buildup of CNTs on the test zone of LFSB gave a black colored line which enabled visual detection of the target antigen. The intensity of the test line was read with a portable strip reader for quantitative data. Rabbit IgG was used as a model target to demonstrate the proof-of-concept. The detection limit of the assay was determined to be 1.32 pg mL (S/N=3), with two linear dynamic ranges of 5 to 100 pg/mL and 0.5 to 20 ng/mL. The assay was successfully applied to detect Rabbit IgG spiked into human plasma samples. The CNT-based LFSB provides a rapid and low-cost approach for detecting proteins in human plasma and thus, shows great promise for clinical application and diagnosis.

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Baumgartner
Graduate
Talk

RFA2 N-TERMINAL PHOSPHORYLATION MEDIATES CHECKPOINT EXIT THROUGH PHOSPHATASE ACTIVITY

Trevor Baumgartner and Stuart Haring

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DNA is the template that encodes for all cellular factors, and as such, preserving this template is of the utmost importance for cell survival and function. DNA breaks and lesions can lead to permanent mutations in the DNA, resulting in defective gene function or misregulation responsible for several cellular diseases, including cancer. Therefore, cells take great measures to maintain their DNA.

When DNA breaks occur, a host of cellular machinery is recruited to the site of the break. One category of machinery is that used for break repair. A second category, of equivalent importance, is that which works to halt the cell cycle to prevent catastrophic events while DNA repair is occurring. This stoppage is known as a cell cycle checkpoint. For example, the G2/M checkpoint occurs prior to mitosis to allow the repair proteins time to fix broken DNA before chromosomes are separated and allocated to the daughter cell. While entering checkpoints is necessary, exiting from them is equally important for cells to continue growing.

It has previously been shown that Replication Factor A2 (Rfa2) phosphorylation drives checkpoint exit in all mutants tested that are defective for exit. In these studies, we show that Rfa2 N-terminal phosphorylation promotes checkpoint exit through the activity of phosphatase genes (PPH3, PSY2, PTC2, and PTC3), as removal of the phosphatases previously identified to be required for checkpoint exit prevents phospho-Rfa2 from driving exit from a checkpoint.

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E. Biggane
Graduate
Talk

SPARC IN A CELL CULTURE MODEL OF HEAVY METAL INDUCED BLADDER TRANSITIONAL CELL CARCINOMA

Emily Biggane (1), Seema Somji (2), Scott H. Garrett (2), Don A. Sens (2), Xu Dong Zhou (2), Andrea Nore (2), and Jane R. Dunlevy (1)

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Our lab studies biomarkers using a bladder cancer model based on environmental exposure to cadmium in a cell culture system that can also be used to generate heterotransplant tumors in immunocompromised mice. The biomarker SPARC is the most repressed gene in all of the independent malignantly transformed UROtsa cell lines. It has been shown to play a role in many contradictory cell biological functions and has been described as both an oncogene and a tumor suppressor dependent upon which cancer is being studied. Its role in bladder cancer is yet to be determined. This study focuses on the matrix-associated protein SPARC and its role in cell attachment and spreading using cell culture assays and microscopy techniques as well as its role in tumor initiation using mouse studies and immunohistochemistry. Results show that cell spreading of non-SPARC expressing cadmium transformed cells was decreased compared to SPARC expressing cells. Immunohistochemical analysis shows that with successive tumor inoculations SPARC expression within the tumor is not maintained nor does it increase; however, stromal SPARC expression does increase. These results support the literature in regards to SPARC playing a role in multiple cell biological processes. SPARC may promote cell spreading once a cell has attached in a distant site ultimately supporting cell survival and tumor metastasis. SPARC may also play a role in cellular communication between the tumor and stroma promoting tumor progression.

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J. Biggane
Graduate
Talk

IMPORTANCE OF THE ALPHA1A-ADRENERGIC RECEPTOR IN THE ANTIEPILEPTIC PROPERTIES OF NOREPINEPHRINE

Joseph P. Biggane (1), Zachary O. Dent (1), Jason A. Power (1), Theda P. Knauth (1), Dianne M. Perez (2), and Van A. Doze (1)

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This study aimed to elucidate the complex antiepileptic effects of the neurotransmitter norepinephrine. Our experiments used knockout (KO) mice as a novel method to investigate subtype-specific effects of the adrenergic receptors, which facilitate norepinephrine action. Specifically, we were interested in the role of the alpha1A-Adrenergic Receptor (alpha1A-AR) subtype. We hypothesized that the alpha1A-AR is important for maintaining normal seizure threshold receptor activation would reduce epileptiform event frequency. We tested this hypothesis using behavioral observation and electrophysiological recordings. Wild-type control (WT) or KO mice lacking alpha1A-ARs or alpha1B-ARs were used in this study. Experiments included observation of spontaneous seizure activity and electrophysiological recordings of epileptiform events in hippocampal slices. Results from behavioral observations showed that alpha1A-AR KO mice were vulnerable to spontaneous seizures. Electrophysiological recordings revealed that alpha1A-AR expression is requisite for phenylephrine antiepileptic effects. Further, we found that slices from alpha1A-AR KO mice exhibited significantly higher baseline frequencies than other strains. From our results, we can conclude that the alpha1A-AR is important for maintaining seizure threshold and is important for AR mediated antiepileptic effects.

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Davis
Graduate
Talk

THE EFFECT OF COMBINED EXPOSURE OF HYPERGLYCEMIA AND CADMIUM ON HUMAN PROXIMAL TUBULE CELLS

Bethany A. Davis, Seema Somji, Donald A. Sens, and Scott H. Garrett

Pathology, University of North Dakota, Grand Forks, ND

Diabetic nephropathy (DN) is a complicated microvascular disease, where prolong exposure to hyperglycemia induces damage to proximal tubule (PT) cells of the kidney. Ultimately, this disease will progress to an end-stage renal disease as the severity of toxic insult is increased. Hyperglycemia has been shown to induce the expression of aldose reductase (AR) enzymes to assist with the extra glucose metabolism. Global microarray analysis indicated an AR isoform, AKR1B10, has also been shown to be induced upon cadmium (Cd2+) exposure. Since both glucose and Cd2+ have similar effects on the PT cells, which is also a target of Cd2+ toxicity, their co-exposure may increase the disease severity. Results from a global gene array analysis conducted on primary PT cells exposed to hyperglycemia showed an induction of thioredoxin-interacting protein (TXNIP) which may be a downstream target of both toxicants. The goal of this project was to investigate the effects of dual exposure of glucose and Cd2+ toxicity on PT cells. For this purpose, PT cells were exposed to 0, 4.5, 9 uM Cd2+ for 48 hours alone then 5.5, 7.75, 11, or 16 mM glucose was added for a dual exposure of 72 hours. TXNIP is significantly induced by hyperglycemia and the combined toxicant exposure at the mRNA and protein levels. Since both toxicants induced AKR1B10, sorbitol accumulation and glucose utilization was measured. These results suggest prolonged Cd2+ exposure may contribute to DN disease progression.

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Han
Graduate
Talk

ULTRASENSITIVE DETECTION OF HG2+ USING SINGLE PARTICLE INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY

Juan Han, Yuqian Xing, Xu Wu, Julia Xiaojun Zhao, and David T. Pierce

Chemistry, University of North Dakota, Grand Forks, ND

Mercury (Hg) and its compounds make their way into the environment through the soil, water and air. Even though the mercury concentrations in these matrices are usually very low, the action of bacteria generates organomercury compounds which bioaccumulate through the food chain and can cause damage to the nervous and immune systems of humans. The US Environmental Protection Agency (EPA) has studied the effects of mercury in the environment and established maximum contaminant levels (MCL) of mercury for human consumption, which for drinking water is 2.0 parts-per-billion (μg/L). Accordingly, it is important to develop both sensitive and selective methods for determination mercury and various spectroscopy techniques have proven useful, including fluorescence, atomic absorption, and surface-enhanced Raman. This work relies on a very different approach through a novel, rapid, and ultrasensitive detection of modified gold nanoparticles using single particle inductively coupled mass spectrometry (sp-ICP-MS). The gold nanoparticles are modified with a single-stranded DNA (AuNPs-ssDNA) with strategically positioned thiamine (T) groups. Hg2+ ions in solution bridge and thereby aggregate the modified gold nanoparticles by “T-Hg-T” interactions. This mercury-induced aggregation has been quantified by sp-ICP-MS for Hg2+ concentrations ranging from parts-per-trillion (ng/L) to parts-per million (mg/L). Currently, this method can detect mercury down to 10 ng/L.

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ANGIOTENSIN CONVERTING ENZYME 2: A PROMISING TARGET FOR REVERSING DIABETIC COMPLICATIONS

Shrinidh Joshi and Yagna PR Jarajapu

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Diabetes increases risk for cardiovascular diseases mainly due to damage to the blood vessels resulting in lack of blood supply. Bone marrow stem cells have the propensity of repairing and regenerating damaged blood vessels. Stem cells are mobilized in response to ischemic vascular injury and home to the areas of injury and carry out the repair and restore the blood flow. In diabetic individuals these reparative functions are impaired therefore this approach is currently not feasible. We have discovered that loss of cardiovascular protective enzyme, Angiotensin converting enzyme 2 (ACE2), in stem cells is closely correlated with the severity of diabetes. This led us to hypothesize that enhancing the ACE2 in diabetic stem cells would restore the reparative functions.

We have tested this using ACE2 gene transfer in the dysfunctional cells from diabetic individuals. The reparative function of the cells was tested in athymic mouse model of diabetes undergoing ischemic vascular disease. Mice receiving cells from nondiabetic individuals recovered normally following vascular injury that was attenuated by diabetic cells. This dysfunction was reversed by ACE2 gene-transfer. Diabetic mice experienced amputations following vascular injury. ACE2 gene-transfer enhanced the vasoreparative potential of dysfunctional cells and prevented amputations in diabetes.

Transplantation of ACE2 ‘designer stem cells’ is a promising approach for the treatment of diabetic vascular complications.

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Koney
Graduate
Talk

POST-TRANSCRIPTIONAL PROCESSING AT THE PROMOTER-PROXIMAL RNA POLYMERASE II PAUSING

Nii Koney-Kwaku Koney, Kai Guo, Adam Scheidegger, and Sergei Nechaev

Biomedical Sciences, University of North Dakota, Grand Forks, ND

Promoter-proximal RNA Polymerase II pausing, which occurs within the first 100 nucleotides of a gene, refers to a property of the Polymerase II to halt transcription temporarily but remain transcriptionally competent. Knowledge of proximally paused Polymerase II dynamics is important in understanding the regulation of mRNA production. At the paused site, Polymerase II can either elongate to resume mRNA synthesis or terminate to release a short RNA. We hypothesize that both events occur on genes and, furthermore, suggest that the equilibrium between elongation rate and termination rate at the pause site reflects regulatory inputs at the promoter. There is dearth of knowledge regarding the role of premature transcription termination in modulating promoter proximal Polymerase II pausing in the field.

We adopted the MicroRNA sequencing approach to detect short RNA generated by paused Pol II genome-wide on chromatin. By detecting short RNA in subcellular fractions, we observed that a fraction of genes exhibited post initiation processing on chromatin which coincided with paused Polymerase II and some of these processed transcripts were seen in the cytoplasm and nucleoplasm indicative of premature termination. These short RNAs generated by Paused Pol II may represent a novel class of small RNAs. Future experiments would focus on the functional role of these transcripts.

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Larson
Graduate
Talk

POST-TRANSLATIONAL MODIFICATION OF REPLICATION FACTOR A (RFA) DIRECTS CHECKPOINT EXIT

Wendy A. Larson and Stuart J. Haring

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Replication Factor A (RFA) is a complex that binds to single-stranded DNA (ssDNA) to maintain the fidelity of genomic information during cellular replication and in the event of DNA damage. When breaks occur in the DNA of yeast cells, RFA will bind to ssDNA and recruit proteins needed to carry out the DNA damage response. The repair of damaged DNA requires the establishment of a checkpoint to ensure that cellular division is delayed until DNA lesions have been repaired. To study the importance of how post-translational modifications of RFA affect its function, the Rfa2 subunit of the RFA complex was mutated, such that arginine residues replace all of its lysine residues. This lysine-less Rfa2 influences the ability of yeast to adapt, or exit a checkpoint and resume the cell cycle, in response to irreversible DNA damage. Adaptation-deficient cells could be induced to undergo checkpoint adaptation more readily when transformed with a vector containing the lysine-less Rfa2 mutant gene. Protein samples were also collected at various time points from cells with DNA damage to observe the timing and intensity of Rfa2 phosphorylation, previously implicated to drive adaptation. Cells containing the lysine-less rfa2 gene demonstrated more extensive Rfa2 phosphorylation and greater incidence of adaptation compared to wild-type cells, supporting that post-translational modification of lysines within Rfa2 may regulate its phosphorylation, which in turn, regulates checkpoint exit.

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Liu
Graduate
Talk

TWO READOUTS SENSOR USING EUROPIUM-COMPLEX DOPED MEH-PPV POLYMER DOTS FOR COPPER IONS DETECTION

Xiao Liu, Juan Han, Xu Wu, and Julia Xiaojun Zhao

Chemistry, University of North Dakota, Grand Forks, ND

Copper, a pivotal transition metal element, plays essential role on a various of physiological activities, such as cell generation and enzymatic processes. However, over digesting copper triggers dreadful neurodegenerative diseases. As a matter of fact, it can accumulate in the body throughout the food chain and is hardly to be degraded to remove, consequently causing serious neurodegenerative diseases, such as Wilson and Parkinson's diseases. Therefore, copper level has been considered as a significant health parameter to monitor. The U.S. Environmental Protection Agency clearly claimed the Cu2+ levels in drinking water are limited by 20 uM. Many techniques have been applied, such as AAS. Here in this project, a two-readouts sensor for copper ions has been developed by doping europium complex into MEH-PPV polymer dots. The polymer dots utilize carboxylic acid as surface modification groups, which bond with copper ions and induce aggregation. Fluorescence quenching occurs and can be used to set up a concentration-dependent relationship to detect copper ions. Except that, this aggregation can also be quantitated from Europium signal by single-particle inductively coupled plasma mass spectrometry (ICP-MS). Comparing one read-out sensor, this sensor shows better privileges, fluorescence-based detection shows simple and fast detection process. ICP-MS will substantially improve the detection limit.

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Mohammad
Graduate
Talk

PIPERLONGUMINE ACTIVATES THE JNK SIGNALING PATHWAY IN PANCREATIC DUCTAL ADENOCARCINOMA CELLS

Jiyan M. Mohammad and Katie M. Reindl

Biological Sciences, North Dakota State University, Fargo, ND

Piperlongumine (PL) is a novel cancer cell-specific cytotoxic agent obtained from the Piper longum plant. In an earlier study, we reported that PL causes cell death in human pancreatic ductal adenocarcinoma (PDAC) cells in vitro and in vivo. The proposed cytotoxic mechanism of action for PL is through disruption of cellular redox homeostasis. c-Jun N-terminal kinases (JNKs) belong to the MAPK family of signaling proteins, and regulate cellular processes such as growth, survival, and cell death. Oxidative stress conditions activate JNK signaling, and previous reports have shown PL activates JNK signaling in other cancer types. Here we investigated the effect of PL on the JNK pathway in two different PDAC cell lines. Our results show PL reduced viability of PDAC cells in concentration and time-dependent manners. PL treatment resulted in robust JNK activation in PDAC cells. Downstream effectors of JNK, c-Jun and ATF-2, were also activated by PL treatment in PDAC cells, and showed sustained activation in PANC-1 compared to MIA PaCa-2 cells. The JNK inhibitor, SP600125, inhibited the activation of c-Jun in cells treated with PL. Our results suggest that PL-induced oxidative stress results in activation of JNK signaling including c-Jun and ATF-2, which leads to PDAC cell death.

Support: This work is supported by NIH Grant Number 1P20GM109024 from the National Center for Research Resources.

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Rodriquez
Graduate
Talk

NEONATE ESCITALOPRAM EXPOSURE SIGNIFICANTLY ALTERS MIDBRAIN EXPRESSION OF EPIGENETIC GENES

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Biomedical Sciences, University of North Dakota, Grand Forks, ND

Perinatal depression is a common disorder often treated with selective serotonin (5-HT) reuptake inhibitors (SSRIs) during pregnancy. SSRIs act by increasing serotonergic tone via binding and inhibiting 5-HT reuptake by the serotonin transporter. Considering 5-HT is a trophic factor and regulates some aspects of brain development, studies in humans and rodents have linked SSRI exposure during development to increased mood disorder-like behaviors later in life. Early-life challenge by SSRIs and long-term behavioral consequences implicates the involvement of epigenetic mechanisms. To investigate this possibility RNA-Seq analysis was performed on the midbrain of neonate mice challenged with the SSRIs fluoxetine or escitalopram. Results show significant alterations in gene expression profiles of SSRI-exposed mice. Moreover, several key genes associated with epigenetic modifications of RNA and histones were differentially expressed in escitalopram-treated mice, supporting an epigenetic link. Collectively, these data provide candidate genes which can be evaluated for a role in SSRI-mediated developmental changes in the brain leading to persistent behavioral changes in adult animals.

Support: This work was supported by the National Institute of General Medical Sciences of NIH award NIH-NIGMS P20 CM104360 to LKH and UND Bioinformatics COBRE Core and by an Institutional Development Award NIH-NIGMS P20GM103442 to LKH and UND Behavioral Research Core Facility.

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Singh
Graduate
Talk

GSTP1 KNOCKDOWN AND INHIBITION IMPAIRS PANCREATIC DUCTAL ADENOCARCINOMA (PDAC) GROWTH

Rahul R. Singh and Katie M. Reindl

Biological Sciences, North Dakota State University, Fargo, ND

Pancreatic ductal adenocarcinoma (PDAC) is the third-leading cause of cancer-related deaths in the US. Resistance to the available treatment options has led to development of new approaches, such as personalized medicine and immunotherapy. However, new therapeutic strategies based on the unique molecular biology and physiology of PDAC hold the greatest promise. Glutathione S-transferase pi 1 (GSTP1) is a detoxification enzyme which metabolizes xenobiotic compounds and byproducts of metabolism. GSTP1 is overexpressed in tumors and in drug-resistant cancer cell lines. The reasons for increased expression ratios compared to normal tissues or wild-type cell lines are not well understood. To elucidate the role of GSTP1 in PDAC pathogenicity, we generated two knockdown lines of GSTP1 in metabolically diverse PDAC cells. We show that GSTP1 knockdown impairs the growth and proliferation of PDAC cells, elevates the ROS levels, and extends G0/G1 phase of the cell cycle. Pharmacological inhibition of GSTP1 using Ezatiostat (TLK199) impaired the proliferation of PDAC cells. Orthotopic implantation of GSTP1 knockdown cells in athymic mice resulted in reduced tumor weight and volume compared to the control. Tumor growth was monitored via Vevo3100 ultrasound system. These data suggest that GSTP1 knockdown and inhibition impairs the growth and survival of phenotypically diverse PDAC cells in vitro and in vivo. With these data, we propose that GSTP1 is a novel therapeutic target for PDAC.

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Smith
Graduate
Talk

MILK ALLERGY INDUCES BEHAVIORAL CHANGES ASSOCIATED WITH NEUROINFLAMMATION AND GENE REGULATION

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Pathology, University of North Dakota, Grand Forks, ND

Allergic hypersensitivity is often found comorbid with neuropsychiatric disorders. Cow's milk allergy has been suspected to elicit or exacerbate behavioral symptoms in patients with behavioral disorders such as attention deficit hyperactivity and autism. To define the underlying mechanism of milk-allergy-mediated behavioral manifestations, we investigated gut and brain pathology associated with behavioral abnormality in a mouse model of milk allergy. Male C57BL/6 mice were orally given an adjuvant solution without or with a milk protein, beta-lactoglobulin (BLG), for 5 weeks. In Week 6 and 7, all mice were challenged with BLG and their behavior were analyzed the next day. BLG-sensitized mice presented with increased repetitive and anxiety-like behaviors that were associated with elevated BLG-specific serum IgE levels. Furthermore, the expression of a tight junction protein, occludin, was decreased in the gut and brain of BLG mice, indicating potential degradation of intestinal and blood-brain-barrier permeability, respectively. Additionally, the expression of a cytokine, TNFa, was induced in the hippocampus of BLG mice, suggesting an inflammatory response in the brain. Other genes thought to be important for neural and neurovascular development were also differentially regulated in the brains of BLG-sensitized mice. These results suggest that milk allergy induces behavioral changes via brain inflammation and regulation of the genes that affect brain structures and function.

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POSTDOCTORAL, FACULTY, AND PROFESSIONAL COMMUNICATIONS

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

Best
Professional
Talk

LEUKOCYTE EXPRESSION OF C-REACTIVE PROTEIN IS MINIMAL AND NOT DEPENDENT ON RS1205 GENOTYPE

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(2) Science, Cankdeska Cikana Community College, Fort Totten, ND

PURPOSE: C-reactive protein (CRP) is a prominent component of the innate immune system. We sought to determine if the rs1205 SNP in the CRP 3' UTR influences leukocyte expression.

METHODS: Leukocytes were obtained from 19 women without pre-eclampsia, 10 with rs1205 CC genotype and the remainder with TT genotype. RNA was extracted, cDNA produced, "pre-amplified" with BioRad primers and serum CRP measured; genotypes were determined using TaqMan assays. Quantitative, real-time PCR using BioRad primers for CRP and a "housekeeping" gene (GAPDH). Leukocyte expression is represented as the CRP (Cq) to GAPDH (Cq) ratio. Each expression run measured SYBR fluorescence in 10 fold replicates for each sample and Cq values were determined against a standard curve derived from BioRad standards of known concentration. Student's t test examined possible differences of mean expression ratios between genotype groups.

RESULTS: There were a total of 22 runs (10 replicates each) of CRP/GAPDH expression. Intra-run CV's averaged 8.33%. The mean (SD) CRP/GAPDH ratio was 4.09E-4 (2.68E-4) and 3.45E-4 (1.54E-4) for CC and TT genotypes respectively, $p<0.54$. Serum CRP was not significantly different between genotypes and was not correlated with leukocyte expression.

CONCLUSION: We show that CRP is minimally expressed in leukocytes and that expression is not likely influenced by rs1205 genotype, nor correlated with serum CRP levels.

Support: Research reported in this publication was supported by an Institutional Development Award from the National Institute of General Medical Sciences of the National Institutes of Health under grant number P20GM12345.

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Super
Faculty
Talk

WHOLE EXOME SEQUENCING FOR CHARACTERIZATION OF COOPERATING MUTATIONS IN MURINE ACUTE LEUKEMIAS

Rhea Desai, Sarvenaz Taghavi, Heidi J. Gill Super, Jenny Chien, Purvi M. Kakadia, and Stefan K. Bohlander

Biology, Minot State University, MInot ND and Molecular Medicine and Pathology, University of Auckland, Auckland, New Zealand

Acute leukemia is caused by heterogenous genetic alterations including gene fusions and point mutations. We established a murine bone marrow transplantation leukemia model using two human leukemia-associated fusion oncogenes, abbreviated CA-MF and AML1-ETO. Both leukemias were transplantable into recipient mice, which showed the same leukemia phenotypes but with shorter latency. We hypothesized that the difference in latencies was due to cooperating spontaneous mutations. To identify these mutations, we performed whole exome sequencing on leukemia cells and the corresponding germline DNA of donor mice. We analyzed 32 leukemia exomes. In both CA-MF and AML1-ETO leukemias, we found mutations in genes known to be mutated in human leukemia, including genes involved in growth factor signalling, nuclear export, cohesins, and polycomb complex. A single gene mutation was noted in both the CA-MF and AML1-ETO leukemia. Our results strongly suggest that CA-MF and AML1-ETO require additional cooperating events to cause leukemia. These genomically well-characterized mouse leukemias provide more realistic models for human disease and can also lead to the discovery of potentially important novel pathways in leukemogenesis. Our mouse models will be a unique resource for the in depth study of leukemias with multiple driver mutations in defined cellular pathways and should facilitate development of treatment strategies targeting these pathways and combinations of pathways.

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Webster
Faculty
Talk

HEAVY MINERAL ANALYSIS AND DEPOSITIONAL HISTORY OF THE CHADRON FORMATION OF NORTH DAKOTA

John R. Webster (1) and Clint A. Boyd (2)

(1) Geosciences, Minot State University, Minot, ND and (2) Paleontology, North Dakota Geological Survey, Bismarck, ND

The depositional history of the late Eocene Chadron Formation (Chalky Buttes Member and overlying South Heart Member) has been re-evaluated based in part on heavy mineral analyses of samples from southwestern North Dakota and adjacent areas in South Dakota and Montana. Heavy minerals (> 2.85 g/cc) separated from 14 samples from 11 localities were identified using optical microscopy and SEM-EDS microanalysis. Combined with published analyses of 33 samples, cluster analysis revealed four types of heavy mineral assemblages: (A) zircon > staurolite > aluminosilicates, tourmaline; (B) epidote > garnet > zircon; (C) biotite > epidote; and (D) amphiboles > diopside > epidote. Stratigraphic relationships show that deposition started with group A rocks, which were followed by group B rocks. At two localities, group B rocks are overlain by group C (similar to group B plus biotite). A second phase of deposition followed a period of soil development, evidenced by newly recognized paleosols, and local downcutting of stream channels. Channel-fill deposits with group D heavy minerals are found at the Medicine Pole Hills (MPH) and Stover Site (SS). Vertebrate fossils indicate the MPH deposit is older than the SS deposit. South Heart Member samples cluster with group A. South Heart Member and group D deposits are not found together, but similarity between group D and heavy minerals in the younger Brule Formation suggests that group D deposits may be younger than the South Heart Member.

Support: No financial support was provided to JRW or CAB for this work.

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POSTER COMMUNICATIONS

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

Bechelli
Graduate
Poster

INFLUENCE OF COMPOSITION ON THE NUCLEATION PROCESS IN CUNI SYSTEMS

Solene Bechelli, Brittany Gonzalez, Caroline Desgranges, and Jerome Delhommelle

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Metal nanocrystals and nanostructures are currently the focus of intense research because of their applications in a wide variety of fields including e.g. as DNA/protein markers, drug carriers and in catalysis. In this work, using the quantum corrected Sutton-Chen potential to model the interactions in bimetallic systems, we carry out molecular simulations to shed light on the interplay between crystallization and glass transition during the nucleation process in bimetallic nanoalloys.

Support: Partial funding for this research was provided by NSF through CAREER award DMR #1052808.

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Brown
Undergraduate
Poster

ANALYSIS OF TICK ASSOCIATED BACTERIAL DIVERSITY USING NANOPORE REAL-TIME SEQUENCING

Sam Huether, Dakota Brown, Ron Royer, and Paul Lepp

Biology, Minot State University, Minot, ND

Beyond a few individual bacterial species known to be associated with human and animal diseases little is known about the microbiota associated with hard-bodied tick species. What little is known has come primarily from culture based identification methods. We used PCR-amplified ribosomal RNA genes (rDNA) to identify bacterial species associated with these two hard-bodied tick species. Ixodes scapularis, also known as the black-legged or deer tick, is the vector primarily responsible for the transmission of the bacterium Borrelia burgdorferi, the etiological agent of Lyme disease. Dermacentor varibilis, also known as the wood tick or American dog tick, harbors the bacterial pathogens responsible for Rocky Mountain spotted fever and tularemia. We have analyzed over 80,000 bacterial 16S rDNA sequences from both tick species using a high throughput, real-time, Nanopore sequencing system. We have used these results to analyze the bacterial species richness and evenness among and between these two tick species. Bacterial populations are dominated primarily by small number of closely related bacterial species from the genera Francisella believed to be endosymbionts of ticks. Our methods have not revealed the presence of Borrelia burgdorferi in any of the individual ticks examined to date.

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Danes
Undergraduate
Poster

TOX21 ENRICHER: ENRICHMENT ANALYSIS OF CHEMICAL ANNOTATIONS FROM TOX21 TOXICITY SCREENING PLATFORM

Larson Danes, Brett McGregor, Dakota Krout, Jui-Hua Hsieh, Scott Auerbach, and Junguk Hur

Biomedical Sciences, University of North Dakota, Grand Forks, ND

Humans are exposed to tens of thousands of chemicals that are used in our daily life, some at levels that may pose a health risk. For many of these chemicals, there limited toxicological information which makes risk assessment impossible. The US Toxicology Testing in the 21st Century (Tox21) program was established to develop more efficient and human-relevant toxicity assessment methods.

The Tox21 program screens >10,000 chemicals using quantitative high-throughput screening (qHTS) of assays that measure effects on toxicity pathways. To date, more than 70 assays have yielded >12 million concentration-response curves. The patterns of activity across assays can be used to define similarity between chemicals.

Assuming chemicals with similar activity profiles have similar toxicological properties, we may infer toxicological properties based on its neighborhood. One approach to this is chemical annotation enrichment analysis.

Tox21 Enricher is a web-based chemical annotation enrichment tool for Tox21 assay data. It identifies over-represented chemical annotations among lists of chemicals, facilitating the identification of the toxicological properties and mechanisms in the chemical set.

Tox21 Enricher, with its features like network visualization and structure-based queries, affords researchers the ability to efficiently identify toxicity of chemicals through the Tox21 library as a valuable research tool.

Support: The work was partially supported by the University of North Dakota, Department of Biomedical Sciences.

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Dostert-Azzarello
Undergraduate
Poster

RAPID SYNTHESIS OF N-METHYL-N-(2-TRIFLUOROMETHYLBENZYL)FORMAMIDE

Tiffany A. Dostert-Azzarello, Lioudmila I. Bobyleva, and Mikhail M. Bobylev

Chemistry, Minot State University, Minot, ND

Recently, we developed a rapid procedure for the Leuckart reaction and successfully applied it for the synthesis of substituted N-benzyl-N-methylformamides. Interestingly, in the reaction conducted on 3-(trifluoromethyl)benzaldehyde, a large amount of a by-product, N-methyl-N,N-di-(3-trifluoromethylbenzyl)amine was produced with an isolated yield of 33.1 %. N-methyl-N-(3-trifluoromethylbenzyl)formamide was produced with an isolated yield of 47.6%.

Based on the higher electron-withdrawing action of trifluoromethyl group in the 2-position compared to the 3-position, we hypothesized that the reaction with 2-trifluoromethyl-benzaldehyde should produce more of the monobenzyl product and less of the dibenzyl product.

The reaction was conducted on 10 mmol scale at 188 degrees Celsius. Column chromatography was used for the isolation of the products. NMR-spectroscopy and elemental analysis were used to determine the structures of the products.

The reaction was completed in 10 minutes. The isolated yields of N-methyl-N,N-di-(2-trifluoromethylbenzyl)amine and of N-methyl-N-(2-trifluoromethylbenzyl)formamide were 28.0% and 59.5%, respectively. The ratio of the yields shifted from 1:1.44 to 1:2.13.

The results of the reaction support the initial hypothesis. The reaction provides a new method for the synthesis of N-methyl-N-(2-trifluoromethylbenzyl)formamide and N-methyl-N,N-di-(2-trifluoromethylbenzyl)amine. Both products are new compounds.

Support: The project was supported by NIH grant 8 P20 GM103442-12 from the National Institute of General Medical Sciences to MB.

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Gonzalez
Graduate
Poster

COMPETITION BETWEEN CRYSTALLINE AND ICOSAHEDRAL ORDER DURING CRYSTAL GROWTH IN BIMETALLIC SYSTEMS

Brittany Gonzalez, Solene Bechelli, Ilham Essafri, Vincent Piquet, Caroline Desgranges, and Jerome Delhommelle

Chemistry, University of North Dakota, Grand Forks, ND

Using molecular dynamics simulations, we study the crystallization process in Ag6Cu4 and CuAu alloys. By changing the amount of supercooling, we are able to identify the role played by icosahedral order in the crystal growth kinetics. Specifically, the Ag6Cu4 alloy exhibits a slowing down of the growth rate when
temperature decreases, as a result of the greater amount of icosahedral order in the liquid. On the other hand, there is much less icosahedral order in the CuAu alloy and, as a result, this system displays the expected behavior of increased growth rates for greater supercooling. Furthermore, by varying the metal
used as a substrate for the crystal growth process, we are able to show the major role played by the size mismatch between the atoms of the substrate and the alloy during the polymorph selection process.

Support: Partial funding for this research was provided by the National Science Foundation through CAREER award DMR-1052808.

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Gooding
Undergraduate
Poster

RAPID SYNTHESIS OF N-(10-CHLORO-9-ANTHRYLMETHYL)-N-METHYLFORMAMIDE

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Chemistry, Minot State University, Minot, ND

Recently, we developed a rapid procedure for the Leuckart reaction and successfully applied it for the synthesis of substituted N-benzyl-N-methylformamides. Interestingly, in the reaction conducted on 4-chlorobenzaldehyde, a large amount of a by-product, N,N-di-(4-chlorobenzyl)-N-methylamine was produced with an isolated yield of 31.3%. N-(4-chlorobenzyl)-N-methylformamide was produced with an isolated yield of 52.0%.

We hypothesized that the reaction conducted on electron-rich 10-chloro-9-anthracene-carboxaldehyde may produce a higher yield of the respective dibenzyl product and a lower yield of the respective monobenzyl product.

The reaction was conducted on 10 mmol scale at 192-193 degrees Celsius. Column chromatography was used for the isolation of the products. NMR-spectroscopy and elemental analysis were used to determine the structures of the products.

The reaction was completed in 10 minutes. The isolated yields of N,N-di-(10-chloro-9-anthrylmethyl)-N-methylamine and N-(10-chloro-9-anthrylmethyl)-N-methylformamide were 38.9% and 60.1%, respectively. The ratio of the yields shifted from 1:1.66 to 1:1.55.

The results of the reaction tend to support the initial hypothesis. The reaction provides a new method for the synthesis of N-(10-chloro-9-anthrylmethyl)-N-methylformamide and N,N-di-(10-chloro-9-anthrylmethyl)-N-methylamine. Both products of the reaction are new compounds.

Support: The project was supported by NIH grant 8 P20 GM103442-12 from the National Institute of General Medical Sciences of the National Institutes of Health to MB.

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Groven
Graduate
Poster

COARSE-GRAINED MODEL FOR SIMULATING THE BOILING POINT OF ASPHALTENES

Steve Groven, Caroline Desgranges, and Jerome Delhommelle

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The reason behind computational chemistry is to use simulations to calculate the physical properties of substances in order to refine experimentation. For instance, a common problem in oil fields are Asphaltenes, a large hydrocarbon that has a tendency to clog the pipes and flowlines in oil wells. Determination of physical properties, such as the vapor-liquid equilibrium, would aid in also determining the necessary conditions for the aggregation of these compounds. An effective method using Wang-Landau approach combined with hybrid Monte Carlo simulations to calculate the boiling point and heat of enthalpy in the isothermal-isobaric ensemble. The method, HMC-WL simulation, was performed on a coarse-grained model of a simple asphaltene structure made of two pyrene groups linked by an alkyl chain of lengths from a chain of four methylene groups up to 16. Through the simulation a quasi-linear relationship was determined between the boiling point and the length of the chain.

Support: Exxon Mobil, Schlumberger, and Chevron.

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Gudejko
Undergraduate
Poster

RAPID SYNTHESIS OF N-METHYL-N-(4-PHENYLBENZYL)FORMAMIDE

Michal Gudejko, Lioudmila I. Bobyleva, and Mikhail M. Bobylev

Chemistry, Minot State University, Minot, ND

Recently, we developed a rapid procedure for the Leuckart reaction and successfully applied it for the synthesis of substituted N-benzyl-N-methylformamides. Interestingly, in the reaction conducted on 4-chlorobenzaldehyde, a large amount of a by-product, N,N-di-(4-chlorobenzyl)-N-methylamine was produced with an isolated yield of 31.3 percent. N-(4-chlorobenzyl)-N-methylformamide was produced with an isolated yield of 52.0 percent.

We hypothesize that the reaction conducted with electron-rich 4-phenylbenzaldehyde may produce a higher yield of the respective dibenzyl product and a lower yield of the respective monobenzyl product.

The reaction was conducted on 10 mmol scale at 190-194 degrees Celsius. Column chromatography was used for the isolation of the products. NMR-spectroscopy and elemental analysis were used to determine the structures of the products.

The reaction was completed in 10 minutes. The isolated yields of N-methyl-N,N-di-(4-phenylbenzyl)amine and N-methyl-N-(4-phenylbenzyl)formamide were 41.2 percent and 44.5 percent, respectively. The ratio of the yields shifted from 1:1.66 to 1:1.08.

The results of the reaction support the initial hypothesis. The reaction provides a new method for the synthesis of N-methyl-N-(4-phenylbenzyl)formamide and N-methyl-N,N-di-(4-phenylbenzyl)amine. Both products of the reaction are new compounds.

Support: The project was supported by NIH grant 8 P20 GM103442-12 from the National Institute of General Medical Sciences of the National Institutes of Health to MB.

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Guo
Postdoc
Poster

GLOBAL DNA METHYLATION PROFILING OF HUMAN DIABETIC PERIPHERAL NEUROPATHY IN SUBJECTS WITH T2DM

Kai Guo (1), Sarah Elzinga (2), Stephanie Eid (2), Guillermo de Anda-Jauregui (1), Claudia Figueroa-Romero (2), Brett A. McGregor (1), Carey Backus (2), Crystal Pacut (2), Eva L. Feldman (2), and Junguk Hur (1).

(1) Biomedical Sciences, University of North Dakota, Grand Forks, ND and (2) Neurology, University of Michigan, Ann Arbor, MI

Diabetic peripheral neuropathy (DPN) is the most common complication of diabetes. Emerging evidence suggests that aberrant DNA methylation may play a critical role in the pathogenesis of diabetic complications. Yet, its involvement in DPN is not fully characterized. In this study, we performed a global DNA methylation profiles of 12 patients with DPN. Examination of sural nerve biopsies from these individuals revealed that six patient biopsies had significant nerve regeneration whereas the other six had significant nerve degeneration over a period of 52 weeks. These samples underwent reduced representation bisulfite sequencing (RRBS) for analysis of DNA methylation between patients who exhibited sural nerve regeneration and those who exhibited degeneration. A total of 3,460 differentially methylated CpGs (DMCs) and 246 differentially methylated regions (DMRs) between the two patient cohorts were identified. Functional enrichment analysis shows genes associated with the DMCs were highly enriched in neuron development and differentiation, as well as pathways associated with cancer. These results suggest that DNA methylation has an important role in regulating nervous system development and cellular proliferation in the progression or regression of DPN. Additionally, these novel results provide insights into possible epigenetic regulation of DPN and offer useful information for future DPN research.

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Hanna
Undergraduate
Poster

REANALYSIS OF GLACIAL LANDFORMS IN THE SOURIS BASIN, ND, USING HIGH-RESOLUTION TOPOGRAPHIC DATA

Haley D. Hanna and Nathan R. Hopkins

Geosciences, Minot State University, Minot, ND

Large parts of the North Dakota landscape have been sculpted by repeated Pleistocene glaciation. These landscapes represent an archive of the processes and dynamics of the ice bodies that shaped them. Through the use of glaciological inversion models, knowledge of the type and distribution of glacial landforms can shed light of these dynamics. The purpose of this research was to assess, characterize, and map the glacial landforms in the Souris Basin of north-central North Dakota utilizing newly available high-resolution LiDAR-derived elevation models. Using a geographic information system (GIS), landforms were manually mapped and their topographic expressions characterized. The inventoried landform assemblage is largely typical of continental systems, including lineations, eskers, washboard moraine, recessional moraines, hill-hole pairs, and supraglacial features. Within a landform category, there is variation of morphology along the ice margin. The resulting maps will be compiled with future maps of adjacent localities and provide the framework for paleoglaciologic interpretations of the late-glacial Souris Lobe.

Support: Minot State University Division of Science.

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Hansen
Undergraduate
Poster

THE EFFECT OF MAGNESIUM ION ON ALDEHYDE DEHYDROGENASE (ALDH) INHIBITOR EFFICIENCY AND SELECTIVITY

Miah L. Hansen, Katelyn S. Ogburn, and Thomas P. Gonnella

Chemistry, Mayville State University, Mayville, ND

Aldehyde dehydrogenases (ALDHs) consists of a superfamily of NAD(P)+-dependent enzymes help to reduce aldehyde concentrations in the cell by oxidizing the aldehydes to carboxylic acids. Unfortunately ALDH participates in multiple metabolic pathways and have been shown to play a role in several cancerous disease states.

The presence of magnesium ion has been shown to inhibit NADH dissociation, the rate limiting step for cytosolic ALDH1, and increase the rate of deacylation, the rate limiting step for mitochondrial ALDH2. Since magnesium ion also inhibits NADH dissociation in ALDH2, these combined effects lead to biphasic behavior of the enzyme activity as a function of magnesium ion concentration.

Selective inhibitors for some of the aldehyde dehydrogenases (ALDHs) have recently been developed in order to determine the relative contribution of the ALDH1 and ALDH2 isozymes to certain biological functions. Our goal was to examine the selectivity and efficiency of the most selective ALDH inhibitors over a range of magnesium ion concentrations. Our results indicate that most of the EC50 values remain relatively consistent with increasing magnesium levels. Significantly changes in inhibitor behavior were observed with inhibitor-enzyme mismatches that were not reported previously.

Support: This work is supported by an Institutional Development Award (IDeA) from the NIH National Institute of General Medical Sciences (NIGMS) under grant number P20GM103442.

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Heick
Undergraduate
Poster

RAPID SYNTHESIS OF N-(9-ANTHRYLMETHYL)-N-METHYLFORMAMIDE

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Chemistry, Minot State University, Minot, ND

Recently, we developed a rapid procedure for the Leuckart reaction and successfully applied it for the synthesis of substituted N-benzyl-N-methylformamides. Interestingly, in the reaction conducted on 4-chlorobenzaldehyde, a large amount of a by-product, N,N-di-(4-chlorobenzyl)-N-methylamine was produced with an isolated yield of 31.3%. N-(4-chlorobenzyl)-N-methylformamide was produced with an isolated yield of 52.0%.

We hypothesized that the reaction conducted on electron-rich 9-anthracenecarboxaldehyde may produce a higher yield of the respective dibenzyl product and a lower yield of the respective monobenzyl product.

The reaction was conducted on 10 mmol scale at 186 degrees Celsius. Column chromatography was used for the isolation of the products. NMR-spectroscopy and elemental analysis were used to determine the structures of the products.

The reaction was completed in 10 minutes. The isolated yields of N,N-di-(9-anthrylmethyl)-N-methylamine and N-(9-anthrylmethyl)-N-methylformamide were 30.1% and 43.3%, respectively. The ratio of the yields shifted from 1:1.66 to 1:1.44.

The results of the reaction tend to support the initial hypothesis. The reaction provides a new method for the synthesis of N-(9-anthrylmethyl)-N-methylformamide and N,N-di-(9-anthrylmethyl)-N-methylamine. Both products of the reaction are new compounds.

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Hernandez
Undergraduate
Poster

NEW APPROACHES TO TREATING CANCER: EPIGENETIC MODIFIERS CAN HELP LEUKEMIA CELLS RESPOND TO THERAPY

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Acute myeloid leukemia (AML) has approximately eight subtypes, many of which have poor prognosis. Most of these subtypes are associated with specific, recurrent chromosome translocations that result in fusion genes, which encode oncoproteins that block differentiation and promote proliferation of immature cells. The Myeloid Lymphoid Leukemia gene (MLL) is frequently involved in these translocations, and is considered a driver of the AML. Differentiation promoting drugs, such as all-trans-retinoic acid (ATRA) are an attractive alternative to chemotherapy, but few types of AML respond to ATRA. Our initial studies have focused on two AML cell lines, MV4;11 and THP-1 and one non-MLL related AML cell line, U937. We hypothesize that changes in epigenetic modifications due to treatment with epigenetic inhibitors could sensitize more types of AML to differentiation treatments such as ATRA, and that gene activation or inhibition may be manipulated by epigenetic modification. In this study, MV4;11, THP-1, and U937 were treated with two epigenetic modifiers, CI-994 and TCP. Differentiation will be noted indirectly and directly as reduced cell proliferation and metabolic activity, as well as by changes in the morphology of the cells/nuclei, upregulation of CD11b, and downregulation of HOXA9. Our studies suggest that in MLL-driven leukemia, the MLL fusion protein may override genetic manipulation resulting from treatment with epigenetic inhibitors, preventing full differentiation by ATRA.

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

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Hoggarth
Graduate
Poster

UROTSA AS A MODEL TO STUDY DEVELOPMENT OF HEAVY METAL INDUCED BASAL MUSCLE INVASIVE BLADDER CANCER

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Arsenic and cadmium are environmental carcinogens that promote the development of bladder cancer. Classification of muscle invasive bladder cancer (MIBC) into basal and luminal subtypes is achieved based on the expression patterns of specific biomarkers. Previous studies from our laboratory have shown that both arsenic and cadmium can malignantly transform the immortalized urothelial cell line, UROtsa. These transformed cells form tumors that resemble urothelial carcinoma with focal areas of squamous differentiation. The goal is to determine if the transformed UROtsa cells and the cancer-initiating cells (CIC) generated from them reflect the basal subtype of MIBC. RT-qPCR analysis utilized to determine gene expression, along with immunohistochemistry to analyze protein expression in tumor heterotransplants. Our results demonstrate that the transformed cell lines, as well as the CICs and tumor heterotransplants, express high levels of the basal markers CD44, KRT5, KRT6, KRT17 and TP63. In contrast, there is low or absent expression of the consensus luminal markers FOXA1, GATA3, KRT20 and PPARG. Heterotransplant tumors exhibited positive staining for basal markers. In conclusion, the UROtsa model system to study the molecular changes that occur during the development of arsenic and cadmium-induced basal MIBC.

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Howard
Undergraduate
Poster

COYOTE FOOD HABITS IN THE NORTH DAKOTA MIXED-GRASS PRAIRIE

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The North American native coyote, Canis latrans has an extraordinary adaptability to its surroundings and eats anything that is available. My original question was to assess if season and location affected the coyote's diet. I hypothesized that the coyote's diet would be dominated by plants and insects during the summer and that the location of my preliminary study would have more insect prey.
My preliminary study took place in a bison pasture managed by Sitting Bull College in June and July 2017. I surveyed for coyote scat by walking through a large percent of the pasture. The evidence that coyotes were utilizing this area was very scarce. A total of 4 scat samples were collected through a 2 month period. The data did not support my hypothesis that the coyotes diet was plant and insect based.

Support: Support: All research reported was supported by an award from the IHS under grant number U261IHS0087-03-00 and by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences of the NIH under grant number P20GM103442.

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Lee
Undergraduate
Poster

RAPID SYNTHESIS OF N-(2-FLUOROBENZYL)-N-METHYLFORMAMIDE

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Recently, we developed a rapid procedure for the Leuckart reaction and successfully applied it for the synthesis of substituted N-benzyl-N-methylformamides. Interestingly, in the reaction conducted on 2-chlorobenzaldehyde, a large amount of a by-product, N,N-di-(2-chlorobenzyl)-N-methylamine was produced with an isolated yield of 42.5%. N-(2-chlorobenzyl)-N-methylformamide was produced with an isolated yield of 37.3%.

Based on the higher electronegativity of the fluoro group, we hypothesized that the reaction with 2-fluorobenzaldehyde may produce a lower yield of the respective dibenzyl product and a higher yield of the respective monobenzyl product.

The reaction was conducted on 10 mmol scale at 186-187 degrees Celsius. Column chromatography was used for the isolation of the products. NMR-spectroscopy and elemental analysis were used to determine the structures of the products.

The reaction was completed in 10 minutes. The isolated yields of N,N-di-(2-fluorobenzyl)-N-methylamine and N-(2-fluorobenzyl)-N-methylformamide were 43.4% and 49.7%, respectively. The ratio of the yields shifted from 1.14:1 to 1:1.14.

The results of the reaction support the initial hypothesis. The reaction provides a new method for the synthesis of N-(2-fluorobenzyl)-N-methylformamide and N,N-di-(2-fluorobenzyl)-N-methyamine. Both products of the reaction are new compounds.

Support: The project was supported by NIH grant 8 P20 GM103442-12 from the National Institute of General Medical Sciences to MB.

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Michelson
Graduate
Poster

VASCULAR CELL INFLUENCE ON CORTICAL NEURAL STEM CELL FATE DECISIONS

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During brain development, cortical neural stem cells (NSCs) divide and differentiate in concert with blood vessel ingression into primitive cortex to vascularize the neuroepithelium. Our hypothesis is that NSCs require vascular cells to differentiate into neurons or glia in a Polycomb repressive complex 2 (PRC2)-dependent mechanism. We utilize a Transwell system containing primary mouse brain cultures including enriched NSC, brain-derived perivascular/fibroblast, and endothelial cells to recapitulate the early cortical neuroepithelium.

Analysis of NSCs grown in solo culture or coculture with vascular cells (contacting or non-contacting conditions) revealed increased Glial fibrillary acidic protein (Gfap) expression at the RNA and protein levels when the NSCs are grown in coculture with vascular cells compared to their growth in solo culture. Inhibition of the PRC2 component, Ezh2, with a small molecule inhibitor results in further increased expression of Gfap, suggesting that PRC2 functions to suppress gliogenesis in NSCs. Transcriptome-level analysis of NSCs in solo or vascular coculture revealed co-regulated genes modified by vascular cells in contacting (juxtacrine) or non-contacting (paracrine) conditions including: Gfap, Notch1, Fabp7/Blbp, Cspg4, and Cxcr4. Our long-term goal is to define the mechanism of action whereby developing vasculature influences neural stem cell fate choice decisions in the early cortex.

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Miner
Undergraduate
Poster

THE EFFECTS OF BISON GRAZING ON SOIL PROPERTIES IN A MIXED-GRASS PRAIRIE

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Sitting Bull College, Fort Yates, ND

Bison grazing is a problem in the mixed-grass prairie as it affects soil properties, plant growth, and food availability for wildlife. Overgrazing by bison has negative effects like compaction, nutrient deficiencies, and low moisture. This study investigated the effects of bison grazing on soil properties. It was hypothesized that as bison grazing intensity increased, soil moisture and nutrient levels will decline due to higher compaction and low plant cover.

The study was conducted in a mixed-grass prairie pasture located south of Selfridge ND managed by Sitting Bull College. It was split into five sub-pastures, then further subdivided based on grazing intensity characteristics identified as: ungrazed, moderately grazed, and heavily grazed. Sixty soil core samples were collected, 12 from each sub-pasture. Samples were analyzed for percent soil moisture, texture, nutrient content (total N and NO3), and mineral content (P, Cu, Se).

Initial findings show percent soil moisture was significantly lower with increased grazing. Soil texture was sandy across the pasture which contributes to low water retention. Mineral and nutrient content have an effect because they were lower than required for a healthy bison pasture.

Minerals such as copper are essential for bison productivity and wellbeing. Instituting programs that manage bison grazing, increase mineral and nutrient supplementation, improve soil water retention and structure to encourage plant growth are recommended.

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Munski
Faculty
Poster

PERSISTENCE OF GERMANS FROM RUSSIA TRADITIONAL FOODWAYS IN NORTH DAKOTA

Dana McVeigh, Douglas C. Munski, and Christopher Atkinson

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Persistence of immigrant culture includes foodways being among the last aspects of "the old country" to be lost. North Dakota's Germans from Russia are no exception. Foodways is defined as the selection, preparation techniques, consumption, symbolism, and preservation techniques of food. The research questions were: 1) is important ethnic foodways knowledge being transmitted between generations; 2) what techniques are used to transfer these foodways; and 3) does persistence of traditional foodways help preserve ethnic diversity? This mixed methods study began with archival investigations. The research emphasized analyzing community cookbooks and a survey of Germans from Russia in south-central North Dakota. Participant-Observer data was acquired at local museums, ethnic celebrations, and the International Germans from Russia Heritage Society 2017 convention in Bismarck. The study conclusions are as follows. First, many traditional foodways have been retained by this ethnic group. Second, learning to cook goes more so from mother to daughter than from grandmother to granddaughter. Gardens remain significant even if specific produce had to be changed because of local conditions. Commercial availability of traditional specific foods has helped promote these foodways with the German from Russia Triangle being a key production area. Thus, it appears that there is persistence of Germans from Russia traditional foodways in North Dakota.

Support: Virginia George Inheritance Fund.

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Osowski
Graduate
Poster

KERATIN GENE EXPRESSION IN A SERUM-FREE AS3+- AND CD2+-TRANSFORMED UROTHELIAL CELL MODEL SYSTEM

Danyelle B. Osowski, Scott H. Garrett, Don A. Sens, and Seema Somji

Pathology, University of North Dakota, Grand Forks, ND

The framework of the cell contains three types of cytoskeletal filaments, namely microtubules, microfilaments, and intermediate filaments. The latter is comprised of a large family of genes, which are expressed in tissue- and differentiation-specific manners. In epithelial cells, keratins are the major type of filament and are separated into two types: type I and type II, both of which combine to include 20 members. Since the expression of keratins is associated with the differentiation state of a cell, their expression patterns have been used to investigate the mechanisms involved in epithelia differentiation. To do this, UROtsa cells were exposed to either arsenite or cadmium which caused a malignant transformation and subsequent growth in soft agar and tumor formation in athymic mice. Cells were grown in serum-free media and spheroids were generated by seeding cells in ultra-low attachment flasks. Following passage, cells were replaced in confluent flasks and allowed to be passaged. RNA was isolated from cell lines, spheroids, and passaged cells and subjected to RT-qPCR to evaluate keratin gene expression levels. Digital droplet PCR and western blot analysis was used to confirm keratin expression. There was found to be increased levels of keratins in many of the spheroids and passage following replacement in confluent flasks. These results suggest that the absence of serum on urothelial cells allows them to become more differentiated, marked by the expression of keratins.

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Rogers
Undergraduate
Poster

RAPID SYNTHESIS OF N-METHYL-N-(3-NITROBENZYL)FORMAMIDE

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Chemistry, Minot State University, Minot, ND

Recently, we developed a rapid procedure for the Leuckart reaction and successfully applied it for the synthesis of substituted N-benzyl-N-methylformamides. Interestingly, in the reaction conducted on 3-chlorobenzaldehyde, a large amount of a by-product, N,N-di-(3-chlorobenzyl)-N-methylamine was produced with an isolated yield of 32.6%. N-(3-chlorobenzyl)-N-methylformamide was produced with an isolated yield of 41.8%.

Based on the higher electron-withdrawing action of nitro group, we hypothesized that the reaction with 3-nitrobenzaldehyde may produce a lower yield of the respective dibenzyl product and a higher yield of the respective monobenzyl product.

The reaction was conducted on 10 mmol scale at 188 degrees Celsius. Column chromatography was used for the isolation of the products. NMR-spectroscopy and elemental analysis were used to determine the structures of the products.

The reaction was completed in 10 minutes. The isolated yields of N-methyl-N,N-di-(3-nitrobenzyl)amine and N-methyl-N-(3-nitrobenzyl)formamide were 30.5% and 42.6%, respectively. The ratio of the yields shifted from 1:1.28 to 1:1.40.

The results of the reaction support the initial hypothesis. The reaction provides a new method for the synthesis of N-methyl-N-(3-nitrobenzyl)formamide and N-methyl-N,N-di-(3-nitrobenzyl)amine. Both products of the reaction are new compounds.

Support: The project was supported by NIH grant 8 P20 GM103442-12 from the National Institute of General Medical Sciences to MB.

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Shipunov
Faculty
Poster

FIVE NEW PLANTS FOR NORTH DAKOTA

Alexey Shipunov and Kyle Pay

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Western North Dakota and especially locations close to the three corners of Montana, South Dakota and Wyoming belong to botanical hotspots where surveys should significantly increase the amount of information about our plants. In 2017, we researched multiple spots mostly in Slope, Billings and Bowman counties and found several species of plants which are completely new to North Dakota! There are two species (Logfia arvensis and Cirsium palustre) which represent the ongoing process of invasion, and two (Chrysothamnus viscidiflorus and Lemna minuta) which were never registered in North Dakota before. Another remarkable finding is a grass with Agropyron desertorum affinities. In addition, we checked the easternmost, only one known in North Dakota (Slope county) population of Pinus flexilis, limber pine, and also found the westernmost location of Selaginella rupestris (McHenry county). All in all, our 2017 summer research was exceedingly productive and demonstrated the high potential of the future botanical investigations in the state. All collected samples, along with other sources, became a source of our North Dakota Plant Checklist. In 2017, the checklist was completely re-organized and updated under supervision of BONAP (Biota of North America Program). It contains now about 1,600 species of vascular plants.

Support: We thank Minot State University for the financial support.

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Shrestha
Graduate
Poster

EFFECT OF CADMIUM ON THE STEM/PROGENITOR CELL POPULATIONS IN OF RENAL PROXIMAL TUBULAR CULTURES.

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The proximal tubules cells are common site of toxic insult, cell death and regeneration and a major site for the development of renal tubular diseases. Toxic insult results from heavy metals, pharmaceuticals, diabetic induced nephropathy or from ischemia. Recent studies suggest that tubular regeneration after toxic insult may involve progenitor/stem like cells that are residing among the renal tubular cells. Our previous study showed that renal tubular cells cultures contain 25-30% of the CD24+ cells whereas 70-75% of the CD133+CD24+ cells. The CD133+CD24+ cells are considered as stem cells whereas the function of the CD24+ cells is unknown. The goal of this study was to determine the response of these cell population after exposure to cadmium. These cells population were sorted from the RPTEC/TERT1 cells and then stably cultured and treated with 4.5μM and 9μM Cd2+ for an approximately 30 days. The results demonstrate that the CD133+24+ cells are more resistant to cadmium exposure as there was no change in the number of CD133+CD24+ cell-population post-treatment, whereas the number of CD24+ cells significantly decreased. Both of the cell population form domes in culture indicative of vectorial active transport. In addition, the CD133+CD24+ cells grow a lot faster when compared to the CD24+ cells. In conclusion, our data suggests that the CD133+CD24+ cells show characteristics of progenitor cells that may be involved in tubular regeneration.

Support: National Institute of General Medical Sciences (P20GM103442-14).

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Swor
Undergraduate
Poster

GEOMETRY OF A CAMBRIAN INTERTIDAL ZONE, BLACKBERRY HILLS, WISCONSIN

Ana Swor and Joseph Collette

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One of the most significant events in the history of life was the transition of animals from marine environments onto dry land as early as the Cambrian (Series 3 – Furongian, 497–485Ma). Unfortunately, little is known about this transition – including such basic information as the slope of seafloor across which the first subaerial forays were made. It has been hypothesized that low nearshore slopes during the Cambrian drained vast, extremely wide intertidal zones, and that high selection pressures in these areas may have driven development of novel strategies or structures pre-adapting animals to move ashore. To help answer these questions, a detailed survey of five Cambrian-age quarries in central Wisconsin that preserve nearshore sandstones was undertaken. Forty-four bedding plane surfaces were surveyed, with geometric data collected in one- or two-meter intervals (n=264 intervals). Mean bedding plane dips were calculated for each quarry using 1) Fisher Statistics and 2) marker bed elevations and distances. Fisher results indicate a mean nearshore slope of 0.27° and an intertidal zone width of 0.42km for the study area. Marker bed calculations indicate an average slope of 0.24°, and an intertidal zone width 0.48km. Although the calculated results of this study were considerably narrower than suggested by previous studies (up to 50km), an intertidal zone 0.42–0.48km wide is still a wide horizontal distance for nearshore animals to evacuate during the ebb of each tidal cycle.

Support: NASA, AAPG, MSU.

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Wilson
Undergraduate
Poster

RAPID SYNTHESIS OF N-(4-CYANOBENZYL)-N-METHYLFORMAMIDE

Benjamin S. Wilson, Lioudmila I. Bobyleva, and Mikhail M. Bobylev

Chemistry, Minot State University, Minot, ND

Recently, we developed a rapid procedure for the Leuckart reaction and successfully applied it for the synthesis of substituted N-benzyl-N-methylformamides. Interestingly, in the reaction conducted on 4-chlorobenzaldehyde, a large amount of a by-product, N,N-di-(4-chlorobenzyl)-N-methylamine was produced with an isolated yield of 31.3 percent. N-(4-chlorobenzyl)-N-methylformamide was produced with an isolated yield of 52.0 percent.

Based on the higher electronegativity of the cyano group, we hypothesized that the reaction with 4-cyanobenzaldehyde may produce a lower yield of the respective dibenzyl product and a higher yield of the respective monobenzyl product.

The reaction was conducted on 10 mmol scale at 189-190 degrees Celsius. Column chromatography was used for the isolation of the products. NMR-spectroscopy and elemental analysis were used to determine the structures of the products.

The reaction was completed in 10 minutes. The isolated yield of N,N-di-(4-cyanobenzyl)-N-methylamine and N-(4-cyanobenzyl)-N-methylformamide were 37.5 percent and 46.5 percent, respectively. The ratio of the yields shifted 1:1.66 from to 1:1.24.

The results of the reaction do not agree with the initial hypothesis. Further conclusions will be made after the reaction is replicated. The reaction provides a new method for the synthesis of N-(4-cyanobenzyl)-N-methylformamide and N,N-di-(4-cyanobenzyl)-N-methylamine.

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JU: Jamestown University
LRSC: Lake Region State College
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NDSCS: North Dakota State College of Science
NDSU: North Dakota State University
SBC: Sitting Bull College
TMCC: Turtle Mountain Community College
UND: University of North Dakota
VCSU: Valley City State University
WSC: Williston State College

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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 OF THE NORTH DAKOTA ACADEMY OF SCIENCE

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 (non-member 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 managing editor.

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.

BYLAW 12. *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.

BYLAW 13. *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)

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COMMITTEES OF THE NORTH DAKOTA ACADEMY OF SCIENCE

Executive Committee	Zeni Shabani, Minot State University Diane Darland, University of North Dakota Julia Xiaojun Zhao, University of North Dakota Stuart J. Haring, North Dakota State University Bryan Schmidt, Minot 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 Darland, 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

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

Year	President	Location
1909	M. A. Bannon	Grand Forks
1910	M. A. Bannon	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

Year	President	Location
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
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	Bismarck
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
2018	Zeni Shabani	Minot

MINUTES OF THE NORTH DAKOTA ACADEMY OF SCIENCE

ANNUAL BUSINESS MEETING 2017

Secretary Haring called the meeting to order at 1:45 PM on Saturday, April 29, 2017. Motion to approve the minutes of the 2016 Business Meeting was made by Ron Jyring and seconded by Kathryn Kilroy. Motion carried.

Secretary Haring thanked the UND Provost, Dr. Thomas DiLorenzo, for his support of this year's meeting, particularly his funding of a second set of graduate talk awards and a set of awards for the best talks by post-doctoral researchers. As well, Dr. Haring thanked Dr. Julia Xhao for hosting the meeting and the faculty members of the Academy for judging the talks and chairing the sessions.

Dr. Haring described his development of the NDAS listserv which he established through entering all available member email addresses. A motion by Ron Jyring and seconded by Julia Xhao to use the listserv exclusively for NDAS communications was passed. Dr. Haring will continue as moderator.

Chris Keller submitted a report pursuant to a motion at last year's meeting requesting an investigation into the origin of the A. Rodger Denison Awards. Keller reported that the Denison awards first appear, without explanation, in Volume XVIII (1964) of the *Proceedings of the North Dakota Academy of Science*. A search of the net yielded an obituary (see Bulletin of the American Association of Petroleum Geologists Vol 48[2]: 239-243) for Albert Rodger Denison, a petroleum engineer, one-time President of the American Association of Petroleum Geologists, and Vice-President of Amerada Petroleum (now Hess Corporation) who died in a plane crash in July of 1962. Denison was originally from Oklahoma and no North Dakota connections are apparent, but he did have an interest in geology-related philanthropy. Given the time of his death relative to the first appearance of the Denison Award and the unusual spelling of his name, it is assumed likely that his estate provided funds to the Academy to initiate the award. In discussion, it was agreed that Secretary Haring would ask long-time Academy members if more is known.

The following executive positions were voted on and filled: Dr. Diane Darland of UND was elected President-elect. Dr. Douglas Munski was elected Councilor. Pursuant to last-years' vote to separate the Secretary-Treasurer into two separate positions a motion was made by Ron Jyring and seconded by Kathryn Kilroy to request Secretary Haring to draft appropriate language for the NDAS bylaws to effect this change. Additionally, with the departure of Dr. Daniel Clayton, Dr. Bryan Schmidt was recommissioned as the Treasurer of the Academy. Dr. Haring also undertook to correct the location of the 2012 annual meeting as listed in future *Proceedings* to "Bismarck" to reflect reality.

A motion to set the 2018 meeting (which will be in Minot) as a one-day meeting on Friday, April 27 was made by Julia Xhao and seconded by Kathryn Kilroy. Motion passed.

A discussion of registration and membership fees followed. In order to avoid room fees at some North Dakota institutions charged to organizations that charge meeting registration fees, as well as to avoid a restriction some members encounter with prohibitions against paying for

professional memberships with university accounts, it was proposed that NDAS charge a publication fee to all meeting attendees in lieu of any registration or membership fee. It was decided to investigate this possibility. There was also some discussion of the need to decide how to manage the resources of the Academy long-term following eventual repossession of the stock accounts (see last year's minutes). We may be in a position to consider giving regular research or travel grants or establishing an endowment of some sort.

Abstract submission for the *Proceedings* was discussed. It was agreed to make no changes to the current abstract format at this time, and the current practice of a deadline set by the Secretary for submissions with late submissions published online was confirmed. A motion was made by Doug Munski and seconded by Ron Jyring to ask the Secretary to poll the membership as to the desirability of the Academy maintaining an online publication for full-length unreviewed manuscripts submitted by members. Motion carried.

Discussion of Academy finances began with a submission by Secretary Haring of the costs of the 2017 NDAS Meeting:

UND Catering (Fri – breakfast/dinner; Sat – breakfast)	$2,241.38
UND Parking	$300.00
UND Printing	$269.70
UND Poster Boards/Setup	TBD
Jimmy John's Catering (Sat – lunch)	$868
China Garden (Fri – lunch)	$260
Awards (Undergraduate)	$450
Awards (Graduate)	$450
Registration Fees	$255
Awards (Undergraduate)	$550
Awards (Graduate)	$550
Awards (Postdoc)	$1,000
Registration Fees	$1,155
Speaker Reimbursement/Honorarium	$1,000
Total	$9,349.08

These costs were underwritten in part by the UND Provost's contribution of $4,000.

Bryan Schmidt reported that PayPal account currently contains $8-9K.

At the 2017 Annual Meeting, there were 5 faculty (F) talks, 9 postdoctoral (P) talks, 27 graduate (G) student talks, and 6 undergraduate (U) talks. Due to the generosity of the UND Provost, this year for the Denison Graduate Completion two awards were presented at each level. The support of the UND Provost also made possible awards for the best post-doctoral presentations. The award winners were:

Undergraduate A. Rodger Denison Competition

1st – Danielle Germundson (UND) $500
2nd – Alex Buchholz (MiSU) $300

3rd – Michael Storandt (UND)$200

Graduate A. Rodger Denison / University of North Dakota Provost Competition

1st – Jiyan Mohammed (NDSU) $500
1st – Joshua Kulas (UND) $500
2nd – Ramnarin Ramakrishna (NDSU) $300
2nd – Adam Edwinson (NDSU) $300
3rd – Gagandeep Singh (NDSU) $200
3rd – Ashrifa Ali (UND) $299

UND Provost Postdoctoral Competition (Four individuals received Outstanding Presentation awards)

Soumya Banerjee (UND) $250
Guillermo de Anda-Jauregui (UND) $250
Janani Kumar (UND) $250
Ying Zhang (UND) $250

The meeting adjourned at 3:00 PM.

Respectfully submitted,
Christopher Keller

LIFETIME MEMBERS

F. D. “Bud” Holland
Ron Jyring
Allen Kihm
Bonnie Heidel