2019 Faculty and Students Research Poster Session

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Book of Abstracts

2019 Minot State Research Poster Session – Book of Abstracts

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Difficult Mathematical Problems

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When speaking about a difficult mathematical problem people often refer to two very different things. While at times difficulty refers to the sheer computational power required to arrive at a number. At other times it is perceived almost philosophically, as something requiring a imaginative breakthrough never before reached. This paper is a survey of some well-known problems in mathematics which seem very easy to understand, but pose a great challenge to the mathematical community in their underlying complexity. We will try to analyze these problems in somewhat of a new light and try to understand their applications and implications. The goal of the research is to look at somewhat simple mathematical problems in a deeper, more complex light.

Learning the Larynx: A Comparison of Two Student-Made Models on Learning and Retention

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No known study has compared similar types of student-made models to isolate the factors that make one tool more effective for learning and retention or preferred by students than another. The current study compared the effectiveness of two types of functional, student-made laryngeal models, which differed in how accurate they were to the size and shape of a human larynx and how complex they were to assemble. Twenty-five anatomy and physiology students were divided into two groups who completed a pre-test and received identical instruction in laryngeal anatomy. Each group assembled, labeled, and turned in a different model larynx (folded or 3D printed). Participants then completed a post-test. Four months later, a retention-test was given. Students were given a survey to analyze their perceptions of their model's effectiveness on learning. No significant differences between the groups were noted in learning or retention in anatomy or physiology, or in the students' perceptions of the usefulness of assembly. Significant differences were noted in the amount of time students spent assembling the models, whether they studied from their model, and whether they would recommend the model to future classes. Qualitative analysis showed frustration with assembly impacted students' perceptions of learning. While academic benefits may be similar despite type of model, students completing the 3D printed model had less frustration which increased their perception of learning. Decreased assembly time may have contributed to increased study time, as students had more time to study after assembly.

Nanopore Real-time Sequencing of 16S rRNA for Species Identification

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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. However, 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. We have analyzed over 80,000 bacterial 16S rDNA sequences from both tick species using a high through-put, real-time, Nanopore sequencing system and compared these results with traditional sequencing methods. As a new technology the limitations of the nanopore sequencing system have not been adequately circumscribed. We are concurrently elucidating the limitations of system in the context of ribosomal rRNA gene sequencing.

Deletion of Auxin Binding Protein-1 Increases Stratification and Decreases Lateral Root Initiation

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Auxin (indole-3-acetic acid) controls aspects of development in plants. Binding of auxin to the TIR1 family of nuclear receptors alters 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, reportedly 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 dark development. We compared time to germination, hypocotyl and primary root growth, and lateral root initiation in wild type (Col-0) Arabidopsis with that of the abp1-c1 null mutant. Wild type and abp1-c1 seeds were planted on agar with both seed types planted in each petri dish for identical growth conditions. Abp1-c1 null mutants displayed an increased stratification (cold pre-treatment) requirement. For example, after 48 hours, germination was 88.4% +/- 5.4 for wild versus 8.3% +/- 2.2 for abp1-c1 with zero stratification, 81.4% +/- 0.87 for wild type versus 39.3% +/- 1.7 for abp1-c1 with four days stratification, and 95.9% +/- 0.87 for wild type versus 98.4% +/- 3.0 for abp1-c1 with eight days stratification. Wild type hypocotyl length and primary root length were similar but wild type plants initiated more lateral roots sooner. These results show a role for abp1-c1 plays a previously unrecognised role in mediating stratification as well as lateral root initiation.

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.

Indians into Disability Studies Project

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The goal of the Indians into Disability Studies Project was to create a mutually beneficial planning partnership between the North Dakota Center for Persons with Disabilities (NDCPD) at Minot State University and the Turtle Mountain Community College (TMCC) at the Turtle Mountain Band of Chippewa Indian (TMBCI) reservation. The outcome was to improve community awareness and education of disabilities across the lifespan, particularly in a rural, underserved area of the state. The outcome was measured through feedback harvested during the World Café Method (2018) where community members participated in small group discussion and answered the following questions regarding people of all ages with disabilities in the TMBCI community: 1) Where are we presently as a community, 2) What does our community need, and 3) What needs to be done to get there? The themes of the answers included the need for increased inclusion across community settings, various specialized services for people with disabilities, and education and awareness of the community in supporting their fellow tribal members with disabilities. A lesson learned from the Indians into Disability Studies Project was to focus on alternative and more assertive participant recruitment methods such as social media. Future plans for sustainability include continuing to build the partnership between NDCPD and TMCC into an implementation phase utilizing lessons learned to overcome barriers and challenges faced.

Reference: World Café Method (2018). Retrieved from: http://www.theworldcafe.com

Support: This project is supported by a grant funded by the U.S. Department of Health and Human Services, Administration for Community Living.

Vascular Flora of Western North Dakota

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North Dakota is among a few North American regions which have not been studied in full for plant diversity. Before 2011, only 55% of state territory was covered with botanical research. From 2011, the team under my supervision is surveying these botanical "white spots" using 30×30 miles virtual grid. Every plant was photographed, geo-referenced (with precise GPS coordinates) and collected. To date, almost 6, 000 plant samples were taken across the state. These samples, along with other sources, became a basement 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) and in 2019, largely updated again. It contains now more then 1,600 species of vascular plants.

Western North Dakota is one of the botanical hot spots where botanical survey should significantly increase the amount of information about North Dakota plants. In 2017–2018, we researched multiple spots in this region and found species of plants which are completely new to North Dakota. One of the most remarkable finding is a grass (collected in Bullion Butte, Billings county) with *Agropyron desertorum* affinities. All in all, our 2018 summer research was highly productive and demonstrated the potential of the future botanical investigations in the state.

First and Second Order Trace Formula for Pair of Self Adjoint Matrices

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The first order spectral shift function and the associated trace formula for self-adjoint perturbations of self-adjoint operators originated from Lifshits's work in theoretical physics. He was looking for efficient formulas to compute the change in the free energy of oscillations of the crystal lattice upon introduction of small impurities into the crystal. The first mathematical result of this formula was proven by M.G. Krein and plays a very important role in the perturbation theory of self-adjoint operators. Our research has made an attempt to demonstrate the first and second order trace formula in the case of a pair of self-adjoint matrices. Our method is purely computational and does not directly rely on the proofs provided in the current literature. Being able to use our demonstration for theoretical physics problems involving self-adjoint matrices and self-adjoint operators would enhance the effectiveness and speed of problem-solving.

Rapid synthesis of N,N-di-(2-methoxybenzyl)-N-methylamine

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Background: Recently, we developed a rapid procedure 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%.

Hypothesis: The reaction conducted on benzaldehydes with electron-donating substituents may produce higher yields of the respective N,N-dibenzyl-N-methylamines and lower yields of the respective N-benzyl-N-methylformamides. In this work the hypothesis was tested by conducting the reaction on 2-methoxybenzaldehyde.

Methods: The reaction was conducted on 10 mmol scale at 186-190ºC. Column chromatography was used for the isolation of the products. NMR-spectroscopy and elemental analysis were used to determine the structures of the products.

Results: The reaction was completed in 10 minutes. The isolated yields of N,N-di-(2-methoxybenzyl)-N-methylamine and N-(2-methoxybenzyl)-N-methylformamide were 64.9% and 34.6%, respectively. The ratio of the yield of the dibenzyl product to the yield of the monobenzyl product shifted from 1.14:1 to 1.88:1.

Conclusions: The results of the reaction support the initial hypothesis. The reaction provides a new method for the synthesis of N,N-di-(2-methoxybenzyl)-N-methylamine and N-(2-methoxybenzyl)-N-methylformamide.

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

Rapid Synthesis of N-(4-isobutylbenzyl)-N-methylformamide

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Background: 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%. The ratio of the yield of the dibenzyl product to the yield of the monobenzyl product was 1:1.66.

Hypothesis: The reaction conducted on benzaldehydes with electron-donating substituents may produce higher yields of the respective N,N-dibenzyl-N-methylamines and lower yields of the respective N-benzyl-N-methylformamides. In this work the hypothesis was tested by conducting the reaction on 4-isobutylbenzaldehyde.

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

Results: The reaction was completed in 10 minutes. The isolated yields of N,N-di-(4-isobutylbenzyl)-N-methylamine (43.2%) and N-(4-isobutylbenzyl)-N-methylformamide (40.6%) appeared to be approximately 12% higher and 11% lower than the yields of the respective products in the previous reaction. The ratio of the yield of the dibenzyl product to the yield of the monobenzyl product shifted from 1:1.66 to 1:0.94.

Conclusion: The results of the reaction support the initial hypothesis. A new rapid method for the synthesis of N-(4-isobutylbenzyl)-N-methyl-formamide and N,N-di-(4-isobutylbenzyl)-N-methylamine was developed. 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.

Rapid Synthesis of N-(4-methoxybenzyl)-N-methylformamide

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Background: Recently, we developed a rapid procedure 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%.

Hypothesis: The reaction conducted on benzaldehydes with electron-donating substituents may produce higher yields of the respective N,N-dibenzyl-N-methylamines and lower yields of the respective N-benzyl-N-methylformamides. In this work the hypothesis was tested by conducting the reaction on 4-methoxybenzaldehyde.

Methods: The reaction was conducted on 10 mmol scale at 187-189ºC. Column chromatography was used for the isolation of the products. NMR-spectroscopy and elemental analysis were used to determine the structures of the products.

Results: The reaction was completed in 10 minutes. The isolated yields of N,N-di-(4-methoxybenzyl)-N-methylamine and N-(4-methoxybenzyl)-N-methylformamide were 31.3% and 49.3%, respectively. The ratio of the yields shifted from 1:1.66 to 1:1.58.

Conclusions: The results of the first trial reaction tentatively support 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-methoxybenzyl)-N-methylformamide and N,N-di-(4-methoxybenzyl)-N-methylamine.

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

New Approaches to Treating Cancer: Epigenetic Modifiers Can Help Leukemia Cells to Respond to Therapy

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Human acute myeloid leukemia (AML) is associated with specific, recurrent gene alterations, which create leukemogenic oncoproteins. These oncoproteins block differentiation and promote proliferation of myeloid cells. Differentiation promoting drugs, such as all-trans-retinoic acid (ATRA or vitamin A) are an attractive alternative to cytotoxic chemotherapy but few types of AML, other than acute promyelocytic leukemia (APL), respond to ATRA. We hypothesize that specific genes must be activated or inhibited in AML for drugs like ATRA to induce differentiation, and that activation or inhibition may be manipulated by epigenetic inhibiting drugs. To test our hypothesis, we used three genetically unique non-APL, AML cell lines (U937, MV4;11, and THP-1) treated with ATRA and three different epigenetic drugs (CI-994, TCP, and DZNep). We measured differentiation of the AML cells by four different indicators: decreased cell proliferation, expression of the myeloid maturation marker CD11b, morphological cell changes, and decreased AML-associated gene expression. All three drugs seemed to sensitize U937 and THP-1 cells to differentiate when treated with ATRA. MV4;11 cells were sensitized to differentiation by CI-994 and DZNep with or without ATRA, although there was no indication of CD11b upregulation. However, MV4;11 was not sensitized by TCP to differentiate with or without ATRA. These experiments suggest epigenetic inhibitors may increase sensitivity to ATRA differentiation therapy, but that the response may still be dependent on the specific genetic alterations driving the AML.

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

Energy on Demand: A Brief History of the Development of the Battery

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Portable, readily available electrical energy provided by batteries is ubiquitous in modern society and can easily be taken for granted. From the early Voltaic piles to modern lithium ion cells, batteries have been powering scientific and technological advancement for over two centuries. A survey of the development of the battery will be presented, with emphasis on early technologies and advancements made within the last several decades. A brief discussion of the chemistry utilized by battery technology will also be included.

University & P-12 Education Partnerships: A Pilot Project to Develop a Model Program for Early and Mid-Program Clinicals in Teacher Education

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The purpose of this project was to create, implement, and evaluate a professional development model focused on mentoring of pre-service teacher education students during early and mid-level clinical experiences. This model provided teachers with needed time for mentoring, built shared visions of effective teaching, and also addressed the practical difficulties teacher preparation programs have in developing sufficient placements for teacher candidates particularly when there are a significant number of clinical experiences in the program. The core of this program was reflective conversation regarding mentoring, which occurred twice during the semester. During these conversations participants shared challenges encountered while working with pre-service teachers who are early in their program as well as solutions to those difficulties. We also explored what effective teaching is and ways to move our practice at the university and in the schools more towards that ideal, particularly in relation to pre-service teachers. A pre- and post-assessment tool was administered to measure self-perceptions of mentoring efficacy. We found that time for mentoring was a significant issue, particularly at the point of early and mid-level clinicals. In addition, communication between everyone (K-12 teachers, university faculty, and teacher candidates) was an area for improvement. We also made plans for changes to the assessment process that will more adequately focus assessment on our shared vision of effective teaching. Final results of the pre- and post-assessment are not yet calculated. K-12 teachers were extremely positive about the experience and would like to see it offered in the future.

Survey of Bacterial Diversity Associated with Tick Blood Meals

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Department of Biology, Minot State University

The hard-bodied tick *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. Both *Ixodes scapularis* and the accompanying bacterial pathogen *Borrelia burgdorferi* have been slowly and steadily moving westward from the east coast of North America towards the interior plains region, reaching as far west as the Red River Valley where there have been sporadic reports over the past decade. The white-footed mouse, *Peromyscus leucopus* is believed to be the most common reservoir for *Borrelia burgdorferi* and host for *Ixodes scapularis* in the eastern U.S.. Due to differences in landscape ecology the population density and distribution of *Peromyscus leucopus* on the Great Plains is much smaller than in the east which may impact the distribution of both *Borrelia burgdorferi* and host for *Ixodes scapularis*. In an attempt to determine the most common host for *Ixodes scapularis* on the plains we used PCR to survey hundreds of individual ticks in order to identify the mammalian host blood meal. In addition, we used nanopore, real-time sequencing to determine the bacterial diversity harbored by these same individual ticks.

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.

Are you ready to transform your mindset? Traditional vs Innovative

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Various stakeholders are demanding changes in higher education. As stakeholders' needs change faculty must shift their mindset from traditional to innovative. The paper is an evaluation of literature to better understand how faculty can be responsive to the changing demands in the higher education system. The literature supports there are three areas helpful to faculty as institutions are re-evaluating what is necessary to meet stakeholders' needs.

According to the review of literature, researchers support the requirement for higher education systems and faculty to develop creative approaches to cope with the changing requirements of 21st century stakeholders. As students' needs change faculty must innovate to thrive in a constantly evolving environment. Such an environment is ripe for entrepreneurialism. A shift to an entrepreneurial mindset can help faculty to better recognize opportunities and develop innovative solutions to the changing higher education system.

The literature revealed faculty report of growing expectations for quicker and increased responsiveness to students and other stakeholders. Greater demads intensify the pressure on instructors to spend more time on work activities in areas such as teaching, advising and research with reduced resources. This turbulent environment creates a multitude of stresses. The literature suggests faculty employ creative strategies to be more intentional with their time to obtain balance. One solution is for faculty to use technology to provide balance and opportunities for engagement.

The literature reveals instructor adoption of an entrepreneurial mindset and modern technology can enhance faculty performance and increase responsiveness to the rapidly changing environment of higher education.

Effects of Methamphetamine on Adrenal Cells

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Methamphetamine is a known central nervous system stimulant and widely abused illicit drug. Despite the well-described effect of methamphetamine on brain activity, the classic side effects of methamphetamine abuse suggest a role in peripheral tissue as well. These side effects include vasoconstriction, tachycardia, appetite suppression and weight loss, all of which are also results of epinephrine stimulation. To test the correlation between exogenous methamphetamine and epinephrine production, cultured adrenal cells were treated with either acetylcholine, cortisol, methamphetamine or a combination of acetylcholine, cortisol and methamphetamine. Epinephrine excreted from the cells was quantified with ELISA of the cell culture media. Cell growth rates and cell viability were both measured for ten days following treatment. Stimulation with methamphetamine, alone or in combination with acetylcholine and cortisol, decreased the cell viability. These data suggest an interaction between methamphetamine and epinephrine-producing adrenal cells, though the exact nature of this interaction still needs to be determined.

Support: This work was supported by an Institutional Development Award (IdeA) from the National Institute of General Medical Sciences of the National Institutes of Health grant number P20GM13442.

Locality in Morphological Theory: Two Cases from Breton

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The idea that a trigger must be local to its target has long been a guiding principle in linguistic theory as an attempt to curtail overgenerating grammars. Through the decades locality has been shown to be applicable at the phonemic, subphonemic, morphemic, and morphosyntactic levels. Two cases from Breton appear to violate locality, however: the spirantization of a noun by a possessive adjective across an intervening word, and the failure of lenition to occur in plural masculine animate nouns whose desinence is *–où*. A local solution taking full advantage of the arsenal provided by Distributed Morphology is proposed.

Method Optimization for GC/MS Analysis of Catecholamines

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The purpose of this research is to optimize the analysis of catecholamines through gas chromatography-mass spectrometry (GC-MS). The optimized parameters from previous research on the analysis of caffeine in saliva are being used as a starting point for this research, including internal standards, selective ion monitoring (SIM) and liquid-liquid extraction using ethyl acetate to extract the analyte from the biological milieu. The parameters will be fully optimized when the extraction procedure is determined. Currently optimization is being done on a model solvent system that should mimic the final extraction system. Parameter adjustments include changing of the solvent for the liquid-liquid extraction and increasing the injector temp from 220°C to 400°C, while simultaneously minimizing the injector heating time due to issues with the rubber septum melting at the 400°C. The GC/MS analysis for this study is performed on a Thermo Scientific Trace GC Ultra gas chromatograph in tandem with a Polaris Q mass spectrometer. Current instrument parameters include a constant 1.00 mL/min. helium flow rate, and a 1 µL sample injection in spitless mode. The initial temperature parameters include a 200°C ion source, 400°C injector temperature and 300°C transfer line temperature. The GC oven is initially held at 70°C for 1.00 minute, followed by a ramp to 250°C with a ramp speed of 20°C/min. After reaching 250°C, the oven temperature is held at 250°C.

Support: Research 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.

University & P-12 Education Partnerships: A Pilot Project to Develop a Model Program for Senior Clinicals in Teacher Education

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The purpose of this project was to create, implement, and evaluate a professional development model focused on mentoring of pre-service teacher education students during early and mid-level clinical experiences. This model provided teachers with needed time for mentoring, built shared visions of effective teaching, and also addressed the practical difficulties teacher preparation programs have in developing sufficient placements for teacher candidates particularly when there are a significant number of clinical experiences in the program. The core of this program was reflective conversation regarding mentoring, which occurred twice during the semester. During these conversations participants shared challenges encountered while working with pre-service teachers in student teaching as well as solutions to those difficulties. We also explored what effective teaching is and ways to move our practice at the university and in the schools more towards that ideal, particularly in relation to pre-service teachers. A pre- and post-assessment tool was administered to measure self-perceptions of mentoring efficacy. We found that time for mentoring was a significant issue, particularly at the point of early and mid-level clinicals. In addition, communication between everyone (K-12 teachers, university faculty, and teacher candidates) was an area for improvement. For this group of teachers, who are involved with teacher candidates at the exit point (student teaching) approaches to remediation when there are concerns was also a focus of discussion. We also made plans for changes to the assessment process that will more adequately focus assessment on our shared vision of effective teaching. Final results of the pre- and post-assessment are not yet calculated. K-12 teachers were extremely positive about the experience and would like to see it offered in the future.

Performance Markings in Anglo-Saxon Gospel Manuscripts

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When seventh-century Anglo-Saxon rulers converted to Christianity, they accepted a religion couched in a language understood by only a few religious elites. That changed as bilingual English clergy glossed Latin scriptural texts in Old English and, by the end of the tenth century, produced vernacular sermons and Gospel translations. Moreover, while Christian liturgy was spoken and sung exclusively in Latin, those who did not understand Latin nevertheless understood that liturgy's import, not only through religious teaching but also because of how liturgy was performed.

Paleographic examination of Anglo-Saxon Gospel manuscripts containing the Passion narratives reveals the importance of liturgical performance. These narratives were central to the Passion (Palm) Sunday and Easter Week liturgies, and some of their manuscripts were marked to indicate elements of performance. Scholars have long debated what those marks signify; some claim that they indicate the division of the Passion narrative among multiple liturgists to produce a "dramatized" performance, a practice usually credited to the Benedictine reforms witnessed by the tenth-century *Regularis Concordia*, while others contend that they instead directed performance by a single liturgist. Examination of these manuscripts conclusively reveals the division of narratives into performance parts, a division that served in some manuscripts as the foundation for further annotation to guide liturgical performance and understanding. Both the various marking schemes used, some of which may predate the tenth century, and the modification and elaboration of marks over time demonstrates that meaningful performance was a fundamental concern of those producing and using early Anglo-Saxon liturgical texts.

Support: This research is supported by a Minot State University Office of Sponsored Programs Small Grants for Faculty Research.

Rapid Synthesis of N,N-di-(4-chlorobenzyl)-N-methylamine

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Background: Recently, we developed a rapid procedure 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%.

Hypothesis: Increasing the molar ratio of 4-chlorobenzaldehyde to N-methylformamide (from 1:25 to 1:5) should produce a higher yield of the respective dibenzyl product and a lower yield of the respective monobenzyl product.

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

Results: The reaction was completed in 10 minutes. The isolated yields of N,N-di-(4-chlorobenzyl)-N-methylamine and N-(4-chlorobenzyl)-N-methylformamide were 65.0% and 23.3%, respectively. The ratio of the yield of the dibenzyl product to the yield of the monobenzyl product shifted from 1:1.66 to 2.79:1.

Conclusions: The results of the reaction support the initial hypothesis. The reaction provides a new method for the synthesis of N,N-di-(4-chlorobenzyl)-N-methylamine.

Support: The project was supported by NIH grant 8 P20 GM103442-12 from the National Institute of General Medical Sciences and by NSF RII Track-1 Award #1355466.

Post-Digital Printmaking

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Purpose: Many artists around the world are exploring the use of new technology to create their printmaking matrices including CNC, Laser Cutters, 3D Printing, the hobbist Cricut machine and other digitally driven processes. Today's printmakers cross media and process like no time before creating hybrid prints that obscure one process inside of another. Integration of technology into these older processes of lithography and etching is reinvigorating them again. Post-digital printmaking has connections to social movements called "hacker" and "maker" cultures which are outgrowths of the DIY culture.

Printmakers who work in this work find these bounds fluid, moving in/out/across digital and non-digital techniques. Once fabricated, the print matrices may be printed through a more traditional process of woodcuts, linoleum, copper or zinc plate engraving, and even stone lithography. The grant will help fund faculty and student research to explore these processes through the purchase of a 3D printer, time with makers on a CNC and/or laser cutter, as well as necessary materials for these processes.

Results: Students and faculty worked successfully with a CNC and the Cricut to create a variety of processes and resultant prints. Difficulties included the software learning curve, materials, and pairing the designs to processes. Most successful were efforts on the Cricut for creating vinyl resists for etching, die cut, and engraving on plexi, hard and soft grounds.

Sponsors: Minot State University Research Grant and Flat Tail Press

Rapid Synthesis of N-ethyl-N-(4-isopropylbenzyl) formamide

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Background: 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-isopropylbenzaldehyde, a large amount of a by-product, N,N-di-(4-isopropylbenzyl)-N-methylamine was produced with an isolated yield of 44.0%. N-(4-isopropylbenzyl)-N-methylformamide was produced with an isolated yield of 42.0%. The ratio of the yield of the dibenzyl product to the yield of the monobenzyl product was 1.04:1.

Hypothesis: Based on the electron-donating properties of the ethyl group, the reaction with N-ethylformaide may produce a higher yield of the respective dibenzyl product, and a lower yield of the respective monobenzyl product compared to the reaction with N-methylformamide.

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

Result: The reaction was completed in 10 minutes. The isolated yields of N-ethyl-N,N-di-(4-isopropylbenzyl)amine (47.2%) and N-ethyl-N-(4-isopropylbenzyl)formamide (39.5%) appeared to be approximately 3.2% higher and 2.5% lower than the yields of the respective products in the previous reaction. The ratio of the yield of the dibenzyl product to the yield of the monobenzyl product was 1.19:1.

Conclusion: The reaction provides a new method for the synthesis of N-ethyl-N-(4-isopropylbenzyl)formamide and N-ethyl-N,N-di-(4-isopropylbenzyl)amine. Both products of the reaction are new compounds.

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Indirect Experience with Hazards: An Influence on Behavior and the Opportunities for Emergency Management

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Direct experience has long been recognized as exerting strong influence on both risk perception and individual behavior. However, the impact of indirect experience on perception and behavior is less documented or understood. This work aims to explore this condition, where despite the lack of direct hazard experience, individuals demonstrate responses typically associated with direct experience. The impact of indirect hazard experience on perception and preparedness was highlighted in a recent survey of residents in both Tornado Alley and Dixie Alley. Specifically, the actions taken by rural residents when tornado warnings are issued and the role that experiences have on those actions was examined. Findings suggest that residents lack direct experience and therefore lack a frame of reference or expectations for the tornado warned condition. The lack of clarity/confidence about how a tornado incident would play out for their community leads residents to fill-in that gap with what they have seen in other communities. Events in a distant community that receives high media coverage and social media attention, helps residents to identify with that community; creating a sense of "experience" with the hazard event themselves. Substituting the experience from other places leaves residents seeking more lead time in warnings; suggesting they may not have an action plan in place prior to receiving a warning. Findings highlight an opportunity for emergency managers to use indirect experience to instigate planning and preparedness actions in communities exposed to tornado risk with limited tornado experience.

Method Optimization for Catecholamine Solvents and Extraction from Cultured Adrenal Cell Media

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The solubility of catecholamines and their subsequent extraction from cultured adrenal cell media were investigated. Because the product of the extraction would be measured with gas chromatography mass spectrometry, a non-aqueous extraction solvent was required. In addition, the extracting solvent must also be immiscible with water to allow partitioning and separation of the extracting solvent. Previous preliminary results suggested that octanol with an ammonium tetraphenylborate (TPB) salt was viable extracting solvent. However, neither TPB nor any catecholamine was soluble in spectral grade octanol. Epinephrine and TPB were used for further solvent testing to find a suitable extracting solvent. Epinephrine is known to be soluble\ in methanol, but the miscibility of water and methanol make it an unsuitable extracting solvent. Other organic solvents with polarities as close to methanol that are immiscible with water were tested. Butanol, t-butyl alcohol, benzyl alcohol, ethyl acetate, 1-propanol, ethanol, and methanol were all tested. TPB was first added to each solution, but it was discovered that TPB is less soluble than epinephrine and has conflicting solubility with epinephrine. Benzyl alcohol without TPB appears to have the highest epinephrine solubility, but the solution changes color to a light pink/orange upon addition of the epinephrine, suggesting a degradation product is being formed. The results show that benzyl alcohol is the most promising solvent for catecholamines and their extraction from cell culture media, but further research is needed to determine if there is a chemical reaction between benzyl alcohol and epinephrine that is degrading either one.

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Rapid synthesis of N,N-di-(3-methoxybenzyl)-N-methylamine

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Background: 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%. The ratio of the yield of the dibenzyl product to the yield of the monobenzyl product was 1:1.28.

Hypothesis: The reaction conducted on benzaldehydes with electron-donating substituents may produce higher yields of the respective N,N-dibenzyl-N-methylamines and lower yields of the respective N-benzyl-N-methylformamides. In this work the hypothesis was tested by conducting the reaction on 3-methoxybenzaldehyde.

Methods: The reaction was conducted on 10 mmol scale at 191-194ºC. Column chromatography was used for the isolation of the products. NMR-spectroscopy and elemental analysis were used to determine the structures of the products.

Results: The reaction was completed in 10 minutes. Both the isolated yield of N,N-di-(3-methoxyl)-N-methylamine (49.2%) and the isolated yield of N-(3-methoxybenzyl)-N-methylformamide (46.6%) appeared to be higher than the isolated yields of the respective products in the reaction with 3-chlorobenzaldehyde. However, the ratio of the yields shifted slightly from 1:1.28 to 1.06:1.

Conclusions: The results of the first trial reaction seem to support the initial hypothesis. Further conclusions will be made after the reaction is replicated. The reaction provides a new method for the synthesis of N-(3-methoxbenzyl)-N-methylformamide and N,N-di-(3-methoxybenzyl)-N-methylamine.

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The Intrinsic & Extrinsic Motivations of Volunteers in the Lutheran Church

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Purpose: The purpose of this qualitative, phenomenological study was to determine the intrinsic and extrinsic motivations of millennials, Generation X, and baby boomer generational groups to engage in volunteer activities within the Lutheran church. Self Determination Theory on intrinsic and extrinsic motivations was the theoretical foundation for the study. The context of the research for this project will be Lutheran Churches of the ELCA in North Dakota. The researcher analyzed intrinsic and extrinsic motivations of three generational groups to volunteer within the church.

Methods: A qualitative, phenomenological approach was chosen for this study due to the need to obtain data that is given through text and speech. The participants for the study were surveyed or interviewed at Lutheran churches within the city of Minot, ND.

Results: Baby boomers are the generation most likely to volunteer, followed by millennials, and Generation X respectively. All three generations considered themselves to be more intrinsically motivated than extrinsically. Making a difference was the common theme arising as an intrinsic motivation for volunteering. Personal invitations were found to be a source of external motivation across all three generations, while time constraints were considered a factor limiting volunteer behavior.

Conclusions: : Information presented in this study is useful in recruitment of volunteers. Understanding how the generational groups view certain activities such as volunteering with a church can make better informed marketing strategies.

Roles and Training Needs of Special Education Paraprofessionals in P-12 settings

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This survey study addresses special education paraprofessionals' perceptions about their current roles and responsibilities, training needs, and obstacles for them to learn online. A specific interest of the study includes the need for a possible para-to-teacher program, which features staying at current positions, online modules, and onsite mentoring. We designed and distributed a survey to the paraprofessionals through an email survey link in an upper Midwestern state school district after IRB and school district approval. We have received a total of 61 anonymous responses, which represents 20% of all the paraprofessionals in the district. Results show 14% are in their first year of employment. Role confusion manifests in 8.2% of the responses concerning lesson planning. More than half of the participants indicate that behavioral management, student learning, and communication needs are the most needed areas for training, followed by promoting inclusion and knowledge of specific disabilities. 41% of the participants are either very likely or likely to enroll in a para-to-teacher program in the next 5 years and identify that financial support will positively impact the likelihood for them to enroll. Tuition and fees are the most identified obstacles to online learning. The great needs for licensure and associate or bachelor's degrees shown in this survey lead to the necessity of providing an innovative para-to-teacher program.

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