

# 3<sup>rd</sup> Annual Graduate Student Council Research Symposium

3<sup>rd</sup> April 2019

**NDSU**  
Graduate  
Student Council

YOUR COUNCIL  
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**NDSU** NORTH DAKOTA  
STATE UNIVERSITY

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# Graduate Student Council (GSC), North Dakota State University

2018-19

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<b>Serap Vatansever</b>	Ph.D. candidate Cereal Science
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## **GSC Team 2018-19**



**Swetha Thiyagarajan**



**Seseer Mou-Danha**



**Logeeshan Velmanickam**



**Raquib Hasan**



**Amanda Savitt**



**Kenechukwu Ezekwem**



**Muhabbat Yakuboba**



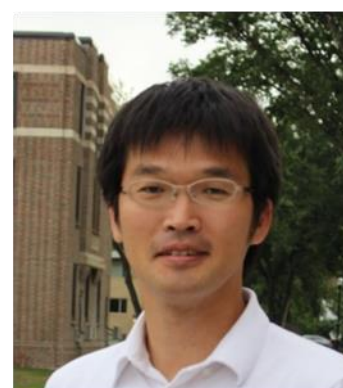
**Curtis Sullivan**



**Dipankar Mitra**



**Md Daulat Hossain**



**Masahiro Toyama**



**Vidura Jayasooriya**



**Serap Vatansever**



**Blessing Okafor**



**Fleming Gudagunti**

## **EDITOR'S NOTES**

Welcome to the 3<sup>rd</sup> Annual Graduate Student Council (GSC), NDSU Research Symposium.

In the abstract booklet, you will find information about the GSC team and the advisory board, and the abstracts to be presented. This is the first attempt to publish an abstract booklet for the GSC Research Symposium. The booklet will also be available online.

I would like to thank all the participants for submitting their abstracts and presenting in the symposium. I believe, this will be a great opportunity for the campus community to come together, and present and discuss their research while building professional networks. The versatile high impact research carried out by the NDSU research community is very impressive. This symposium will showcase the strength of research and its necessity in continuing development of the State of North Dakota and highlight the national importance of the research. I hope, this symposium will make a strong note for the necessity of continuous research funding support at NDSU.

On behalf of the GSC team, I wish to express gratitude to the advisory board for their guidance. Dr. Claudia Tomany, Dean of Graduate School, has been very supportive to enable the GSC to carry out professional development activities geared for graduate students at NDSU.

The GSC team showed their impressive passion to organize the symposium. The abstract screening committee members – Amanda, Msahiro, Dipankar, Md Daulat and Muhabbat – made a committed effort to receive, organize and screen the abstracts. The PR committee worked to publish this booklet. The whole GSC team put their concerted effort to make the symposium a reality and a success.

I hope, that the trend of organizing the GSC Symposium will continue in future and the entire campus research and staff community will keep continuing their support. The symposium will provide a fertile platform for exchange of the research, knowledge and expertise while building collaboration among the NDSU community. This year, 62% more abstracts was received than last year. In future, I hope to see expansion of the symposium to include other regional research universities and beyond. I strongly believe, the research at NDSU is making, and will continue to make important impact regionally, nationally and globally.

Sincerely,

**Raquib Hasan**

Scribe, NDSU Graduate Student Council

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# **SCHEDULE**

<b>Time</b>	<b>Sessions</b>
7:30am	Registration for Poster and Oral Presentations; Breakfast for Participants
8:30am	Opening Remarks by Dr. Claudia Tomany, Dean of the Graduate School
8.50	Presenters go to their presentation location
9.00 am	Poster Session I Display –Plains Side of Great Plains
9.00 am	Oral Presentation: Session I-Great Side of Great Plains
9.00 am	Oral Presentation: Session I-Century Theatre
10:25 am - 10:40 am	Break
10:45am	Poster Session II Display –Plains Side of Great Plains
10:45am	Oral Presentation: Session II-Great Side of Great Plains
10:45am	Oral Presentation: Session II- Century Theatre
12:10 pm - 1:10 pm	Lunch— Great Side of Great Plains
1:15 pm - 2:20 pm	Oral Presentation Championship Round — Great Side of Great Plains
2:25 pm - 2:50 pm	Poster Presentation Championship Round — Plains Side of Great Plains
2:55—3:15 pm	Break and Interaction with Audience
3:15 pm - 4:00 pm	Presentation of Awards/Certificates and Closing Remarks

# **ORAL PRESENTATION**

## **Session I - Great side of Great Plains room, MU 9.00 to 10.15 am**

	<b>First name</b>	<b>Last name</b>	<b>Department</b>	<b>Abstract title</b>
1	Jesse	Puka-Beals	Plant Sciences	Weed response to mulches in carrot
2	Jasmine	Cutter	Range Science	Moo > Ewe: Effects of Livestock Species on Flower Resources and Pollinators
3	Adrienne	Antonsen	Entomology	Determining spatial and temporal distributions of grassland butterflies through statewide monitoring
4	Chyna	Pei	Range Science	Statewide monitoring of bee communities and their associated resources
5	Jane	Snelling	Cereal Science (within Plant Sciences)	Vacuum Steam Pasteurization of Hard Red Spring Wheat

## **Session I – Century Theatre 9.00 to 10.15 am**

	<b>First name</b>	<b>Last name</b>	<b>Department</b>	<b>Abstract title</b>
1	Hizb Ullah	Sajid	Civil and Environmental Engineering	Microstructural Approach Towards Post-fire Investigations in Steel Structures
2	Mohammad Hadi	Bazrkar	Civil and Environmental Engineering	Drought Identification and Categorization in Cold Climate Regions
3	Shree	Paudel	Civil Engineering	Snow-proof roadways through steel fiber reinforced fly ash geopolymers mortar/concrete
4	Phat	Huynh	Industrial and Manufacturing Engineering	A Novel Knowledge-and-data-driven Probabilistic Graphical Model of Acute Disorder Pathogenesis
5	Nathan	Dicks	HNES	Increased Performance Markers and Load Carriage in Army ROTC Cadets

## **Session II - Great side of Great Plains room, MU 10:45am-12:10 pm**

	<b>First name</b>	<b>Last name</b>	<b>Department</b>	<b>Abstract title</b>
1	Sakshi	Taneja	Pharmaceutical Sciences	How does hypoxia affect RAGE behavior in Pancreatic Cancer?
2	Pranothi	Mulinti	Pharmaceutical Sciences	BIO INSPIRED RECOMBINANT SPIDER SILK BUBBLES TO COMBAT ANTIBIOTIC RESISTANCE
3	Jennifer	Longo	Health, Nutrition, and Exercise Science	APFT Scores and Musculoskeletal Injuries among Army ROTC Cadets
4	Divya	Sharma	Pharmaceutical Sciences	Controlled Delivery of Insulin Using Smart Polymer Provides Long-Term Glucose Control and Prevention of Diabetes Complications
5	Rahul Raj	Singh	Biological Sciences	GSTP1 knockdown and inhibition impairs pancreatic ductal adenocarcinoma (PDAC) growth



### Session II - Century Theatre 10:45am-12:10 pm

	First name	Last name	Department	Abstract title
1	Richard	Latterell	Music	The Role of the Chorus Master in Three Contemporary Operas Addressing Social Conflict: A Dramatic Analysis of Poul Ruders' (b. 1949) The Handmaid's Tale (1998), Jake Heggie's (b. 1961) Dead Man Walking (2000), and Kevin Puts' (b. 1972) Silent Night (2011).
2	Michael	Mead	Psychology	24-Hour Health Behavior: Daily Interaction of Sleep and Waking Health Behaviors
3	Nicholas	Birkhimer	Soil Science	Effects of cropping rotations and deep tillage plus manure on the reclamation of pipeline-impacted soils in western North Dakota
4	Anna	Semanko	Psychology	Dating dissonance: Does psychological discomfort influence dating behavior intentions?
5	Brooke	Thiel	School of Education	Making the Jump: What Factors Lead Agricultural Educators to Adopt Innovative Ideas?

**Top presenter from each session will compete at the championship round from 1:15 pm-2:20 pm at the Great Side of the Great Plains room**

### POSTER PRESENTATION

Location	Poster Set-up	Poster Viewing	Poster Presentation	Poster Tear-down
Plains side of Great Plains Room, MU	7:30 am - 8.30 am	9am - 4pm	<p>Poster no 1- 33  <b>Session I</b> - 9:00 am - 10:15 am</p> <p>Poster no 34-66  <b>Session II</b> - 10:45 am to 12.10 pm</p> <p><b>Top 3 presenters</b> from each poster session qualify for the  <b>Championship Round</b> - 2.25 to 2.50 pm</p>	4 pm - 5 pm



## **Poster Session I – 9.00 am to 10.15 am**

<b>Poster#</b>	<b>First name</b>	<b>Last name</b>	<b>Department</b>	<b>Abstract title</b>
<b>1</b>	Sean	Mahoney	Health, Nutrition, and Exercise Sciences	Comparable Metabolic Responses From Blood Flow Restriction Walking And Walking With Load
<b>2</b>	Pradeepika	Chintha	Plant Sciences	Screening Of Phenolic Antioxidant-Linked Bioactive Nutrients Of Sweet Potato Cultivars Targeting Early Stages Of Type 2 Diabetics
<b>3</b>	Minwei	Xu	Cereal Science	Opposite Antioxidative Activity Variation Of Soluble Free And Polar Soluble Bound Phenolic Compounds During Yellow Pea Germination
<b>4</b>	Felicity	Merritt	Plant Sciences	Identification Of Genes Involved In Sugar-End Disorder In Tetraploid Potato (Solanum Tuberosum L.)
<b>5</b>	Eman	Al-Qtiemat	ECE	A Methodology For Synthesizing Formal Specification Models From Requirements For Refinement-Based Verification
<b>6</b>	Matthew	Confeld	Pharmaceutical Sciences	Hypoxia-Responsive Peptide Conjugated Nanoparticles For Delivery Of Chemotherapy
<b>7</b>	Rachael	Poore	Plant Pathology	Pythium Pathogens Of Common Bean In North Dakota And Minnesota
<b>8</b>	Dakota	Goodhouse	History	Makhóche Wašté, The Beautiful County
<b>9</b>	Sangeeta	Bhallamudi	Pharmaceutical Sciences	Estrogen Receptor Signaling And Intracellular Calcium Regulation In Human Airway Smooth Muscle
<b>10</b>	Bhavana	Bhardwaj	Computer Science & Upper Great Plains Transportation Institute	Railroad Track Irregularities Position Accuracy Assessments Using Low-Cost Sensors On A Hi-Rail
<b>11</b>	Alison	Long	Biological Sciences	Importance Of Phosphorus And AM Fungi In Performance Of Blanketflower, Gaillardia Aristata, Across The Northern Tier
<b>12</b>	AliReza	Rahimi	Coatings and Polymeric Materials	Design Of Additives To Modify Properties Of Marine Coatings To Combat Biofouling
<b>13</b>	Tanzina	Afrin	Industrial and Manufacturing Engineering	Assessment Of Resilient Infrastructure Networks Under Cascading Failure
<b>14</b>	Sara	Moayed	Plant Sciences	How Does Protein Molecular Weight Distribution Affect Dough Strength And Pasta Firmness?
<b>15</b>	Zhenyang	Luo	Communication	The More Role-Playing, The More Real? How Player-Avatar Interaction/Relationships Influence Presence

16	Aaron	Forde	Materials and Nanotechnology	Colloidal Stability And Photo-Physics Of Lead Halide Perovskite Nanocrystals: Using Density Gradient Ultra-Centrifugation To Probe Size-Dependent Surface Chemistry And Photo-Physical Properties
17	Andrej	Svyantek	Plant Science	Quantifying Grapevine Dormancy Acclimation Responses: A Breeding Objective For North Dakota
18	Subhashree	Navaneetha Srinivasagan	Agricultural and Biosystems Engineering	Development Of User-Coded Plugin And Web Application For Classification And Quantification Of Flowers For Pollinators Interaction
19	Jiyan	Mohammad	Biological Sciences	Genome-Scale CRISPR-Cas9 Screening To Identify Molecular Mechanisms Of Piperlongumine In Pancreatic Ductal Adenocarcinoma Cells
20	Krishna	Kambhampaty	Computer Science	Identifying Malicious Users Through Behavior
21	Nik	Snyder	Biological Sciences	Seasonal Trends In Nesting Physiology Of Adult Laughing Gulls ( <i>Leucophaeus atricilla</i> )
22	Thanya	Bunma	Animal Sciences	Placental Progesterone Receptors (PGR) Expression From Early To Late Pregnancy In Sheep
23	Alexander	Rischette	Range Science	An Exploratory Application Of Unmanned Aerial Vehicles For Wildlife Surveys
24	Santo	Kalathingal Anto	Pharmaceutical Sciences	Effect Of Cigarette Smoke Extract On Apelin-APJ System In Rat Coronary Arteries
25	Abhishek	Banerjee	Electrical and Computer Engineering	Towards BLACKOUT Free Power Grids - Using Energy Functions For Supervisory Protection
26	Fangzheng	Yuan	Management	Measuring Nursing Home Efficiency Using Pca-Dea Approach
27	Haneesh	Jasuja	Civil and Environmental Engineering	Bone Metastasis Of Prostate Cancer Evaluated Using An In Vitro Model With A Perfusion Bioreactor
28	Rebecca	Bradley	Biological Sciences	How Can Citizen Scientist Participation Influence Herpetological Species Distribution Models In Conjunction With Researcher Surveys?
29	Jayani	Maddakandage Dona	Plant Sciences (Cereal science)	Do Ancient Wheat Species Differ From Modern Bread Wheat?
30	Beth	Ringwelski	Electrical and Computer Engineering	Label-Free Cell Purification After Electroporation
31	Ian	zeng	Department of Civil and Environmental Engineering	A Modified SWAT Model For Hydrologic Modeling In Depression-Dominated Areas
32	Anuj	Ghimire	Biological Sciences	Effect Of Stress On Body Size And Telomere Of House Sparrow ( <i>Passer domesticus</i> )
33	Babak	Mamnoon	Pharmaceutical Sciences	Targeted Drug Delivery To Triple Negative Breast Cancer Cells

## **Poster Session II - 10:45 am to 12.10 pm**

<b>Poster#</b>	<b>First name</b>	<b>Last name</b>	<b>Department</b>	<b>Abstract title</b>
34	Zeyad	Al-Odat	Electrical and Computer Engineering	A Modification To The SHA-1 To Circumvent Collision Attacks
35	Gwendorlene	Chea	Coating and Polymeric Material	The Effect Of Accelerated Weathering On Flexibility, Adhesion, And Barrier Property On Epoxy Primer
36	Harshit	Shah	Pharmaceutical Sciences	Development Of A Novel Omega-6 Fatty Acid Based Treatment Strategy For Skin Cancer By Inhibiting Delta-5-Desaturase
37	Jesse	Puka-Beals	Plant Sciences	Surface And Living Mulches In Carrot Production
38	Doreen	Odera	Sociology and Anthropology	Sexuality Through Art : Body Mapping As A Research Tool
39	Jing	Wan	Plant Sciences	Enhancement Of Antifungal And Mycotoxin Inhibitory Activities Of Food-Grade Thyme Oil Nanoemulsions With Natural Emulsifiers
40	Matthew	Kruger	Soil Science	Can Soil Microbial Activity Be Improved With The Use Of Amendments?
41	Sanjay	Arora	Pharmaceutical Sciences	Targeted Nano Gene Delivery To Brain For The Treatment Of Alzheimer's Disease
42	Sakshi	Taneja	Pharmaceutical Sciences	How Does Hypoxia Affect RAGE Behavior In Pancreatic Cancer?
43	Asif	Arshid	Civil Engineering	Probabilistic Finite Element Based Reliability Structural Analysis Of Railways Trackbed Subgrade
44	Arup	Dey	Industrial and Manufacturing Engineering	Optimizing Process Parameters Of Fused Deposition Modeling Process Using A Multi-Objective Optimization Approach
45	Parvina	Yakubova	Sociology and Anthropology	Economic, Cultural Beliefs And The Fate Of Girls' Education In Tajikistan
46	Joseph	Fehrenbach	Mechanical Engineering	Development Of Novel Biocomposite Body Armor
47	Mohammed A	Jabed	Chemistry and Biochemistry	Modeling Charge Carrier Dynamics In Semiconductor Nanomaterials And Hetero-Nanoclusters
48	Mal	Jason	Communication	The Waco Siege As Case Study Of Contested Public Spheres In Religio-Secular Communication
49	Bikash	Poudel	Plant Pathology	Genome-Wide Association Study Of Aggressiveness, DON Production And Spore Productivity In A Population Of Fusarium Graminearum Collected From North Dakota
50	Ana	Magallanes Lopez	Plant Sciences	Can We Remove Vomitoxin From Wheat By Wet Milling?

51	Aaron	Forde	Materials and Nanotechnology	When Life Gives You Localized Charge Carriers, Make Light: Computational Modeling Of Polaron Spectra And Photoluminescence Quantum Yield In A Lead Halide Perovskite Nanocrystal
52	Kutay	Yilmaz	Plant Sciences	Seeding Date Effects On Grain Sorghum Performance In North Dakota
53	ning	wang	Civil and Environmental Engineering	A New Daily Semi-Distributed Hydrologic Model For Depression Dominated Areas
54	Sunoj	Shajahan	Agricultural and Biosystems Engineering	UAV-Based Plant-Stand Count, Plant Vigor, And Spatial Distribution Mapping Using Imagej
55	Yuxiang	Yuan	Biological Sciences	Hydrological, Chemical And Biological Connectivity Between Wetlands
56	Abdul Aziz	Alanazi	Computer Science	Cube Satellite Systems: Innovative Tools For STEM Education
57	Md Razuan	Hossain	Electrical and Computer Engineering	Low Cost Diabetes Breath Sensor Device Based On Nanostructured K <sub>2</sub> W <sub>7</sub> O <sub>22</sub>
58	Hanaa	Mansour	Animal Science Departments	Melatonin Supplementation And Restricted Nutrition Do Not Affect Placental Lactogen Expression In Ovine Placenta
59	Minwei	Xu	Cereal Science	How Do Beany Flavor Of Chickpea, Lentil, And Yellow Pea Change Following Germination?
60	Supun	Fernando	Department Of Plant Sciences	Effect Of Soaking On Cooked Quality Of Commercial Semolina And Whole-Wheat Spaghetti
61	Hannah	Ohm	School Of Natural Resource Science	Urban Soil Taxonomy As It Relates To A Recreational Stormwater Detention Basin
62	Niyati	Borkar	Pharmaceutical Sciences	Effect Of Kisspeptin On The Intracellular Calcium Regulation In Asthmatic Human Airway Smooth Muscle Cells
63	Rounak	Pokharel	Electrical and Computer Engineering	Label Free Microrna Biomarker Detection In Serum Samples For Potential Diagnosis Applications At Point-Of Care
64	Patricia	Cabas-Lühmann	Cereal Science	Factors Affecting Hydration And Bleaching Of Durum Wheat Grain
65	Krishna	Kundu	Civil and Environmental Engineering	Tissue-Engineered Interlocking Scaffold Blocks For Regeneration Of Bone Defects
66	Margaret	Githua	Communication	Impact Of Social Media On Health

**Top 3 presenters from each session will compete at the championship round from 2:25 pm - 2:50 pm at the Plains Side of the Great Plains Room**

# **ABSTRACTS**

## **ORAL PRESENTATION ABSTRACTS**

### **Weed Response to Mulches in Carrot**

Jesse Puka-Beals

Department of Plant Sciences, North Dakota State University

**Abstract:** Direct seeding into strip tilled zones (STZ) of living mulches may require weed suppression tactics for soil within the STZ. Biodegradable mulches (BM) applied in the STZ could suppress weeds and improve crop performance. Three BM treatments [hydromulch (HM), compost blanket (CB), control (NO)] were applied on STZs seeded to carrot (*Daucus carota* L.) in five living mulches [red clover (RC), white clover (WC), perennial ryegrass (PR), weed-free check (WF) and weedy check (WK)] to evaluate weed response, crop emergence and crop yield. Weed counts and biomass were significantly lower in surface mulch treatments than control, but no significant differences between HM and CB were observed for in-row weed suppression. Differences in carrot emergence were site specific, with significantly greater emergence in CB (16 ct m<sup>-1</sup>) than control (6 ct m<sup>-1</sup>) in Fargo ND and significantly lesser emergence than control in Absaraka ND. There were no simple effects in carrot yield by surface mulch, but living mulch treatment WK average carrot weight (96 g carrot<sup>-1</sup>) was approximately triple of RC, WC, and PR (31,34 and 35 g carrot<sup>-1</sup> respectively). The HM and CB were effective at weed suppression and CB significantly improved carrot germination compared to control at one location. Average carrot weight was significantly reduced when grown in STZ of a living mulch compared to control, but no yield differences were associated with the BM or type of LM specie. Different in-season management of living mulches may reduce yield loss and further development of BM may improve crop performance.

Keywords: agriculture, weed suppression, organic, carrot, mulch

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### **Effects of Livestock Species on Flower Resources and Pollinators**

Jasmine Cutter, Torre Hovick, Benjamin Geaumont, Devan McGranahan, Jason Harmon

Department of Range Science, North Dakota State University

**Abstract:** Grazing lands promote biodiversity in agroecosystems. Consequently, livestock management can influence the extent to which grazing lands provide quality habitat for native species. Management decisions on grazing lands typically focus on stocking rate, grazing duration, and grazing season, but choices about livestock species are also important. We compared how sheep versus cattle, both under moderate stocking, affected floral resources and butterfly and bee communities in low-diversity, post-Conservation Reserve Program pastures managed with patch-burning. We sampled bees and butterflies three times per season in 2017 and 2018 and counted flowering stems within 1 m of transects. During our 2017 field season—which coincided with a severe drought (14 cm below-average rainfall)—there were notable differences in floral resources between pastures grazed by different herbivores. In 2017, we detected 34 forb species and 28,468 flowering stems in cattle pastures, but only 12 species and 3,567 flowering stems in sheep pastures. These trends persisted in our 2018 season, which had near-normal rainfall. In 2018, we detected 43,117 flowering stems and 47 forb species in cattle pastures, while sheep pastures had 2,470 flowering stems and 17 forb species. Furthermore, native bees were 9-16 times more abundant in cattle pastures than sheep pastures over both years. Butterfly responses were mixed, with species richness and abundance similar across grazer treatments. Continued monitoring of how different herbivores in a patch-burn grazing framework affect butterflies, bees, and floral resources will inform range management decisions to better support pollinators, especially in low-diversity grasslands where sheep are the dominant herbivore.

Keywords: pollinators, grazing, bees, butterflies, patch-burn grazing

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## **Determining Spatial and Temporal Distributions of Grassland Butterflies through Statewide Monitoring**

Adrienne Antonsen, Jason Harmon

Department of Entomology, North Dakota State University

**Abstract:** Over 30 species of butterflies in the United States are currently listed as either endangered or threatened by the Fish and Wildlife Service, with even more currently proposed for listing. This includes multiple species of concern in North Dakota. To direct conservation efforts for these species, and to proactively increase our understanding of all grassland butterflies, we need comprehensive information on their current distributions through space and time. The goal of our project is to develop these distributions for the grassland butterflies of North Dakota through four years of statewide monitoring. Since 2017 we have been surveying butterflies at three grassland sites in each of ND's 53 counties, visiting each site twice per summer. During each visit we perform visual encounter surveys and line transect distance surveys. We also record the floral resources available for pollination using belt transects and the overall vegetative community using cover quadrats. Over two summers we have already collected tens of thousands of butterfly detections, over 50 species which we are using to create spatial and temporal distributions. These population metrics, in conjunction with associated vegetation characteristics, provide vital baseline information on North Dakota's butterfly communities that can help inform future conservation efforts across the state and beyond.

Keywords: Butterflies, Pollinators, Community Ecology

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## **Statewide Monitoring of Bee Communities and Their Associated Resources**

Chyna Pei, Torre Hovick, Ryan Limb, Jason Harmon, Ben Geaumont, Adrienne Antonsen

Department of Range Science, North Dakota State University

**Abstract:** Native pollinator services are essential to the stability of native prairie ecosystems. Increasing pressures from human activities threaten their contributions to both agricultural and natural systems. These pressures are the drivers behind the global bee population declines that have spurred an increase in pollinator-monitoring studies. Monitoring studies have allowed researchers to detect rapidly declining populations by comparing historical to present data. However, the status of pollinator populations is still relatively unknown in many regions due to a lack of baseline data. The Northern Great Plains (NGP) is among such regions that would undoubtedly benefit from increased native pollinator monitoring as the diversity and distribution of pollinator species across the region is relatively undetermined. Several species considered for federal listing also have distributions that may intersect the region giving further demand for spatially robust information regarding the status of pollinator species in the NGP region. We implement a four-year survey of North Dakota to address the lack of current data on bee species across the state. We conduct 636 surveys of bee communities within each of North Dakota's 53 counties annually. Our survey sites are managed by both public and private entities and our bee survey methods incorporate a complement of both active and passive sampling. Survey results from our first two seasons yielded 257 bee species thus far. Our spatially extensive survey will represent the diverse assemblage of grasslands within the region and will provide a baseline of information on the distribution of bee species required for future conservation planning.

Keywords: bee communities, monitoring, native pollinators

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## Vacuum Steam Pasteurization of Hard Red Spring Wheat

Jane Snelling, Sahar Malekmohammadi, Teresa Bergholz, and Senay Simsek

Cereal Science under Department of Plant Sciences, North Dakota State University

**Abstract:** Recent outbreaks traced to contaminated flour, a low moisture food, have created demand in the milling industry for a method that effectively reduces pathogens in wheat. Traditional pasteurization methods can compromise wheat functionality, thus maintaining functional quality of wheat protein was critical for this research. Vacuum steam pasteurization (VSP) is a promising technology for pasteurization of low moisture foods that can achieve lower processing temperatures that may aid in quality preservation. The objective of this study was to evaluate the efficacy of VSP on Hard Red Spring (HRS) wheat. HRS wheat kernel samples were pasteurized at 65, 70, 75, and 85°C for 4 or 8 minutes. Analysis of the flour after milling showed significant ( $p < 0.05$ ) changes to gluten functionality in treatments  $\geq 70^\circ\text{C}$ . Bread loaf volumes decreased significantly ( $p < 0.05$ ) as VSP treatment temperature increased. However, bread quality for 65°C VSP treatment was determined to be within acceptable limits. Changes in starch were minimal, and not meaningful for product quality. Treatment time did not have any important effect for any of the parameters measured. After determining that product quality was best preserved at 65°C, HRS wheat kernels were inoculated with *Escherichia coli* O121, and processed at 65°C for 0, 2, 4, 6, or 8 min periods. The treatments achieved a maximum reduction of  $\sim 3.5$  log CFU/g. VSP shows potential as an effective pasteurization method as functional characteristics of wheat flours can be maintained while mitigating risks associated with pathogens in flour products, thus making flour a safer ingredient for consumers.

Keywords: Food safety, wheat, milling, pathogens.

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## Microstructural Approach Towards Post-fire Investigations in Steel Structures

Hizb Ullah Sajid and Ravi Kiran Yellavajjala

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**Abstract:** Extensive research on post-fire mechanical properties of structural steels has made it possible to predict mechanical properties of fire affected structural steels as a function of temperature. However, temperatures developed during a fire accident are seldom known. In the absence of fire temperatures, tracking post-fire microstructure of steels provides a convenient alternative to quantify post-fire mechanical properties of structural steels. With this in mind, the current study aims to investigate the microstructural changes and their influence on post-fire mechanical properties of different structural steels. Post-fire mechanical properties are obtained by conducting uniaxial tension tests on steel specimens that are air-cooled from temperatures up to 1000°C. Microstructural analysis is conducted to determine the volume fractions of ferrite and pearlite phases, ferrite grain size and pearlite colony size corresponding to different target temperatures. It is observed that increase in ferrite phase volume and ferrite grain size, in general, lead to reduction in post-fire yield strength and tensile strength of structural steels. Ductility of post-fire specimens is observed to increase with increase in ferrite grain size. Using experimental, multivariate regression equations are proposed in this study that can be used to predict post-fire yield strength of structural steels as a function of volume fraction and average grain size of ferrite and average pearlite colony size. The results obtained in this study can be used by forensic structural engineers to evaluate the residual strength of fire affected steel structures.

Keywords: Post-fire; microstructure, ferrite, pearlite, structural steels

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## **Drought Identification and Categorization in Cold Climate Regions**

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**Abstract:** As one of the most destructive natural disasters, drought inflicts billions of losses in the world. The available drought indices that are currently used for identification of drought have not taken into account dominant hydroclimatic processes in cold climate regions (CCRs). The objectives of this research are to develop a new hydroclimatic aggregate drought index (HADI) for identification of droughts in CCRs and to further customize drought categorization. To derive this new index, precipitation, surface runoff, snow water equivalent, and soil moisture from a grid-based hydrologic model (GHM) were integrated by applying principal component analysis (PCA). To customize drought categorization with consideration of both spatial and temporal distributions of drought, joint probability distribution function (JPDF) and conditional probability were used. Finally, the HADI was compared with the widely accepted standardized runoff index (SRI) in an application to the Red River Basin of the North (RRB) in 2003-2007. The results indicated that the HADI outperformed the SRI in identification of drought in CCRs. According to the HADI, RRB experienced a dry condition for a long period from 2003 to 2006, while 2007 was the wettest year. The new drought index can be used for water resources planning and management, especially in CCRs.

**Keywords:** Drought index, Cold climate, Drought categorization, Grid-based hydrologic model

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## **Snow-proof Roadways through Steel Fiber Reinforced Fly Ash Geopolymer Mortar/Concrete**

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**Abstract:** Geopolymer composite is an innovative and ecofriendly construction material and an alternative to Portland cement. Moreover, geopolymer concrete is also a multifunction material that could be used for different purposes. One of the applications that recently catches people's attention is to be used as a snow-proof roadway. Polymer concrete exhibits brittle behavior due to its low tensile strength but with addition of fibers its behavior can be changed into ductile or quasi-ductile, while simultaneously its electrical conductivity could be much enhanced. In this paper, compressive strength and stiffness of fly ash based geopolymer with reinforcement of different volume percentage 0.5 inch long steel fiber at different curing conditions have been studied. The formed geopolymer concrete has been analyzed through MTS microstructural analysis as well as measurement of electrical conductivity. The result shows that the fly ash based geopolymer mortar can achieve a great improvement on the compressive strength and its electrical conductivity by using a small amount of steel fibers. Curing at elevated temperatures for the first 24 hours also helps. With improved mechanical properties and electrical conductivity, the developed geopolymer concrete could be used as a pavement material for snow-proof roadways, after validating its freeze and thaw resistance.

**Keywords:** Geopolymer, Fly ash, Microstructure, Snow-proof, Freeze-thaw

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# **A Novel Knowledge-and-data-driven Probabilistic Graphical Model of Acute Disorder Pathogenesis**

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**Abstract:** Domain-specialized knowledge as disease pathogenesis has not been properly encoded in a machine-learning-applicable representation due to its complex temporal dependencies, inter-patient variability, the traditional models' incapability of expert knowledge elicitation, and the model's non-transparency for doctors' comprehension. Hence, this paper proposes a theoretical knowledge-and-data-driven probabilistic graphical model that embeds the domain knowledge of predisposing factors, causal temporal dependencies, and behavioral coupling patterns of pathogenesis for capturing the mechanism dynamics triggering the disease onset. The model consists of two sub-models: a static Bayesian network of pathological factors and patient characteristics; and a dynamic pathogenic mechanism model. The first sub-model performed Bayesian inference on the probability queries about patient vulnerability relative to the disease and served the parametrization for the second sub-model, then the parameterized sub-model probabilistically tracked the pathogenic state transition of various pathogenic mechanisms over time and simultaneously estimated the predictive onset distribution to forecasting its occurrence k-step in advance. The model was evaluated by two case studies: Obstructive Sleep Apnea (OSA) – a pseudo-real-world problem – using simulated data and Paroxysmal Atrial fibrillation (PAF) utilizing PAF prediction challenge database. The OSA case study yielded high accuracy in Bayesian parameter estimates measured by Kullback-Leibler divergence between the true parameter distribution and the estimated one ( $KLD=0.0242$ ), while the k-step-ahead prediction results in the PAF investigation highlighted the dramatic increase in the onset probability as time approached the actual incidence. The method potentially has great implications for the development of acute disorders' onset forecasting model, physician workload's reduction, and preventive treatments' enhancement.

**Keywords:** Acute disorders, Bayesian network, dynamic probabilistic model, disease pathogenesis, domain knowledge-driven

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## **Increased Performance Markers and Load Carriage in Army ROTC Cadets**

Nathan Dicks, Sean Mahoney, Vanessa Anderson, and Kyle Hackney

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**Abstract:** Load carriage (LC) is an inherent part of the military and the mass required to be carried can be dependent on the range and length of the operation. Critical velocity has been associated with technical and combat-specific performance measures in tactical populations. The running 3-min all-out exercise test (3MT) provides estimates of critical velocity (CV) or the maximal aerobic steady-state. The purpose of this study was to evaluate the effects of using the CV model to prescribe high-intensity interval training (HIT) regiments aimed at enhancing CV and LC performance. **Methods:** Twenty young adult participants (male = 15, female = 5, age = 21.8 +/- 1.5 yrs) underwent a 4-week training period where they trained 2 d·wk<sup>-1</sup>. The participants were randomly assigned to two groups: 1) HIT or 2) LCHIT. Pre-post training assessments were body composition, running 3MT, and load carriage tasks (400 m and 3200 m). **Results:** There were significant increases in CV ( $p = .005$ ) and velocity at VO<sub>2</sub>max (vVO<sub>2</sub>max) ( $p = .037$ ) among the sample but there was no statistical difference between the training groups. Load carriage improvements were also observed for the 3200 m LC task ( $p < .001$ ) with a 9.8% decrease in the LCHIT group compared to 5.4% decrease in completion times with the HIT group. Fat mass decreased significantly ( $p = .037$ ) in both groups. **Conclusion:** The CV model used to prescribe exercise over four weeks of 2 d·wk<sup>-1</sup> HIT showed improvements in CV and vVO<sub>2</sub>max and LC performances.

**Keywords:** Critical Velocity, 3-min all-out Test, Load Carriage, High-Intensity Interval Training

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## How does hypoxia affect RAGE behavior in Pancreatic Cancer?

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**Abstract:** Pancreatic cancer grows at enormous speed, leading to overcrowding of cells. At this stage where cancer cells don't receive enough oxygen is known as hypoxia. The craving for oxygen triggers them to move away from the pancreas tumor. They migrate and spread to other body parts, ultimately proceeding to metastasis. Of the 55000 cases that will be diagnosed with pancreatic cancer in 2019, around 45000 patients will die, according to a report by the American Cancer Society. What is causing the massive spread of pancreatic cancer cells? Our research on finding the role of RAGE (Receptor for Advanced Glycation Endproducts) in pancreatic cancer would help to address this question. RAGE, a receptor present on the cell surface has a huge role in signaling many cancer promoting proteins. We have mimicked the patient's hypoxic condition in our lab by experimenting with human pancreatic cancer cells under low oxygen environment. Interestingly, our results show an increased level of RAGE and other cancer promoting proteins that have strengthened our hypothesis to make a connection between RAGE and metastasis. Since RAGE helps tumor to perpetuate, we believe that blocking RAGE receptor would slow down uncontrolled division of cancer cells and metastasis. Results from this study will aid in improving the current therapeutic options available and would also increase patient's survival.

Keywords: Pancreatic Cancer, Hypoxia, RAGE, Metastasis

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## Bio-inspired recombinant spider silk bubbles to combat antibiotic resistance

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**Abstract:** Frequent usage of antibiotics for trivial infections has changed the bacterial evolution by increasing resistance towards antibacterial agents. Thus, the development of an infection-responsive drug delivery system may prove an important tool in the fight against multidrug resistant bacteria. The present work describes the development of infection-responsive, silk-based nanospheres using a unique peptide thrombin sensitive peptide (TSP) for use as an antibiotic delivery vehicle. Initially susceptibility of both the peptides (TSP) and recombinant silk peptide to bacteria was analyzed by HPLC which showed cleavage of TSP while silk peptide was stable. Subsequently, these two peptides were coupled to create a conjugate in order to make silk bubbles/nanospheres. The antibiotic vancomycin was encapsulated into these silk bubbles and were then analyzed for their size, encapsulation efficiency and antibacterial activity. The size was 180 nm and the encapsulation of the drug was above its therapeutic concentration and these bubbles showed antibacterial activity that is comparable to the free drug. This study proves that the peptide was infection-responsive and by combining silk protein with the thrombin-sensitive peptide, a self-assembling material can be created to not only encapsulate a drug but also to release it only in the presence of an infection. Production of this infection-responsive drug delivery system will constitute a significant, quantifiable improvement in our technical capabilities to address antibiotic resistant bacteria. A similar mechanism can foreseeably be extended to other disease conditions.

Keywords: Antibiotic resistance, silk, nanospheres, infection-responsive

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## **APFT Scores and Musculoskeletal Injuries among Army ROTC Cadets**

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**Abstract:** Athletic trainers have been recently employed by the Armed Forces because of their scope of practice in musculoskeletal injuries. Previous research suggests those with lower muscular endurance, as measured by the Army Physical Fitness Test (APFT), are at greater risk of injury. The APFT consists of two minutes of the following exercises: push-ups, sit-ups, and two-mile run. Objective: The goal of this research was to identify relationships between previous musculoskeletal injuries and APFT scores. Participants: 49 Army Reserve Officers' Training Corps (ROTC) Cadets (35 males, 15 females) participated in this study. Inclusion criteria included healthy cadets who were cleared by the ATC to complete all three components of the APFT. Outcome Measures: The Extended Nordic Musculoskeletal Questionnaire and an injury details form including information about specific diagnoses were completed. Results: Scores on the APFT were: push-ups  $88.76 \pm 13.14$ , sit-ups  $83.20 \pm 11.91$ , 2-mile run  $82.08 \pm 13.03$ . Reported injuries per body region included: 10 neck, 15 shoulder, 5 upper back, 1 elbow, 5 wrist, 20 lower back, 7 hip, 15 ankle, and 6 lower leg. Linear regression models were estimated with the test scores as the dependent variables and injuries to body parts as independent predictors yielding no statistical significance. Conclusions: Although no statistical significance is reported, only those who were currently healthy completed the APFT. ROTC cadets are at the earliest phase of Army training; thus, they are in an ideal position to begin focusing on injury prevention, which could prevent musculoskeletal injuries in the future.

Keywords: Military, Pain, Performance

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## **Controlled Delivery of Insulin Using Smart Polymer Provides Long-Term Glucose Control and Prevention of Diabetes Complications**

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**Abstract:** Type 1 diabetes is an autoimmune disorder in which the body's immune system destroys insulin producing pancreatic  $\beta$ -cells. Insulin is a peptide hormone which helps liver, muscle and fat cells take in glucose from blood for producing energy. Human body needs basal insulin (constant low level, 0.5 – 1 U/h) throughout the day for cerebral energy production and maintaining bodily functions. Basal insulin requirement is currently approached using insulin pump therapy or once daily disposable devices which are very expensive with low patient compliance. Furthermore, ineffective blood glucose management by current therapies causes serious damage to nerves, blood vessels and organs throughout the body resulting in blindness, stroke, heart attacks, limb amputations, and considerable premature mortalities. In this study biodegradable and biocompatible thermosensitive triblock copolymer (poly(lactic acid)-poly(ethylene glycol)-poly(lactic acid) (PLA-PEG-PLA)) loaded with chitosan-zinc-insulin complex was designed for continuous delivery of insulin at basal level for a prolonged period following a single subcutaneous injection. Type 1 diabetic rats injected with single dose of the optimized formulation resulted in glycemic control up to 3 months with no signs of diabetes complications. On the other hand, control group of diabetic rats injected with traditional daily insulin injections demonstrated higher blood glucose levels, development of partial/total blindness and high blood ketone levels which are serious complications of diabetes. The results exemplify optimized thermosensitive injectable depot system as a better and effective alternative to the conventional daily basal insulin therapy.

Keywords: Thermosensitive smart polymer; diabetes; insulin; controlled release; prevention of complications

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## **GSTP1 Knockdown and Inhibition Impairs Pancreatic Ductal Adenocarcinoma (PDAC) Growth**

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**Abstract:** 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.

Keywords: GSTP1, Pancreatic ductal adenocarcinoma (PDAC), oxidative-stress, JNK, therapeutic targets

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## **The Role of the Chorus Master in Three Contemporary Operas Addressing Social Conflict: A Dramatic Analysis of Poul Ruders' (b. 1949) *The Handmaid's Tale* (1998), Jake Heggie's (b. 1961) *Dead Man Walking* (2000), and Kevin Puts' (b. 1972) *Silent Night* (2011)**

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**Abstract:** As the voice of the people, the opera chorus allows audiences to easily connect to the unfolding drama. But to realize its dramatic potential, an opera chorus must have a resonant, vibrant sound that is more "soloistic" than other genres of choral music. Indeed, studies confirm there are quantifiable acoustic differences between solo and choral singing (Reid, Davis, Oates, Carbrera, Ternström, Black, and Chapman, 2007). Yet there is only minimal research, to date, describing a systematic approach to rehearsing the opera chorus and applying those techniques to specific musical examples. In this disquisition, I summarize existing research regarding the role of the chorus master (Draper, 1995; Duffie, 2001; Henderson, 2018; Kaiser, 2018; Lundquist, 2000; McClatchy, 1989) and effective strategies for leading general choral rehearsals. (Atkinson, 2006; Draper, 1995; Olson, 2010; Weiss 2001). I then synthesize and apply this research in the form of a chorus master's analysis of choral excerpts from three contemporary operas recently produced by The Minnesota Opera: Norwegian composer Poul Ruders' (b. 1949) *The Handmaid's Tale* (1998), Jake Heggie's (b. 1961) *Dead Man Walking* (2000), and American composer Kevin Puts' (b. 1972) *Silent Night* (2011). The composers of these operas hoped to engage audiences about specific social issues. But social learning requires dialogue. If the choruses in these operas do not fulfill their dramatic functions, the audience's connection to the chorus, and by extension, to the greater social lessons in these operas, will be severed. Thus, for the chorus master, there is much at stake.

Keywords: Opera chorus, drama, dialogue, operatic sound, social learning

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## 24-Hour Health Behavior: Daily Interaction of Sleep and Waking Health Behaviors

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**Abstract:** The consideration of health behaviors within a 24-hour context provides an important model for health promotion and intervention efforts. Although research suggests sleep associated with waking health behaviors (WHBs), studies investigating the directional influence of night and day is scant and inconsistent. The current study sought to extend the literature by examining the daily, bidirectional relationships between sleep and WHBs. Participants (N=384) were college students who completed two weeks of a baseline assessment in which their objective sleep was assessed via Actigraphy, and their WHBs via bedtime sleep diary. Multilevel modeling was used to test the daily, bidirectional associations between WHBs and sleep. Alcohol consumption was associated with greater total sleep time (TST) and sleep onset latency (SOL), but predicted fewer awakenings ( $p$ 's  $<.05$ ). Drinking caffeine after 2PM predicted less TST and longer SOL ( $p$ 's  $<.001$ ). Napping longer than 30 minutes was associated with greater SOL, wake after sleep onset (WASO), and number of awakenings ( $p$ 's  $<.05$ ). Longer TST predicted less alcohol and caffeine consumption the following day ( $p$ 's  $<.001$ ). Contrary to expectation, more nighttime awakenings predicted less alcohol and caffeine consumption the following day ( $p$ 's  $<.001$ ). Lastly, greater sleep efficiency predicted less time spent napping the following day ( $p=.036$ ). These results indicate that sleep and WHBs hold a significant, bidirectional influence on one another and provide evidence for a 24-hour model of health behavior. Greater understanding of the temporal relationships between sleep and WHBs can help identify targets for intervention and improve effective allocation of public health resources.

Keywords: Sleep; health behavior; multilevel modeling

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## Effects of Cropping Rotations and Deep Tillage Plus Manure on The Reclamation of Pipeline-Impacted Soils in Western North Dakota

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**Abstract:** This study aims to develop effective strategies to restore cropland soils following pipeline installation in the Bakken and Three Forks oil reserves. Restoring affected soils to a level of ecological function and productivity similar to what they were prior to disturbance is critical to the agricultural sustainability in this region. Cost-effective restoration and reclamation plans allow for stakeholders to retain land productivity while also allowing for continued pipeline infrastructure development. While studies have been conducted on soil reclamation following pipeline installation, further research focusing on cropping rotations or perennial plants is necessary to aid stakeholders in developing efficient land management solutions. The installation of a 3-ft diameter water pipeline along the eastern edge of the Williston Research Extension Center provided the perfect opportunity to study this problem. A six-year study was initiated in 2015 that tested planting five annual crop rotations and two perennial crop covers on soils above the pipeline, on the roadway developed during pipeline installation, and on adjacent, undisturbed soils. A subplot has also been established where the effects of deep tillage and beef cattle manure on compaction and concentrations of organic matter are also being investigated. At present time, results indicate that soil compaction and crop yields vary significantly between disturbed and undisturbed areas, and are inconclusive in regards to the effects of deep tillage and beef cattle manure on the subplots. Data will continue to be collected as this study enters its final years.

Keywords: pipeline, reclamation, tillage, manure

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## **Dating dissonance: Does Psychological Discomfort Influence Dating Behavior Intentions?**

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**Abstract:** Previous research indicates that undergraduate students often have misperceptions about healthy dating behaviors. Although many interventions attempt to decrease unhealthy dating behaviors, little research has the specific intent of altering dating behavior expectations. This study used the theory of cognitive dissonance to understand how discomfort may influence dating behavior expectations. We predicted that 1) participants experiencing dating dissonance would have higher levels of psychological discomfort, and 2) that higher discomfort would motivate them to have intentions toward engaging in healthy dating behaviors. Undergraduate students (N=274) were randomly assigned to either a dissonance or no-dissonance condition. Participants in the dissonance condition were prompted to think about inconsistencies between their past dating behaviors and stated dating behavior expectations, whereas those in the no-dissonance condition were prompted to think about general dating concepts. All participants then completed measures assessing psychological discomfort and indicated their dating behavior intentions toward engaging in respect, trust, communication and helping with a future dating partner. Our first hypothesis was supported, with participants in the dissonance condition having higher levels of psychological discomfort. Despite the higher levels of psychological discomfort, there was no positive effect of dissonance on dating behavior intentions. Overall, the dating behavior intentions across both conditions were in a healthy direction. These findings contribute to our theoretical knowledge, our understanding of undergraduate dating behavior expectations and intentions for four dating behaviors imperative to healthy relationships – respect, trust, communication and helping.

Keywords: dating, dissonance, psychological discomfort, intentions

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## **Making the Jump: What Factors Lead Agricultural Educators to Adopt Innovative Ideas?**

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**Abstract:** Agriscience research projects are an emerging experiential learning activity within school-based agricultural education programs. The purpose of this study was to explore what factors impact high school agricultural education teachers' motivation to utilize agriscience research projects as part of their programs. A basic qualitative design was implemented to interview nine North Dakota agricultural education instructors about their current and prior experiences with agriscience research projects and their motivations for involvement. Analysis and interpretation was guided by Roger's (2003) Diffusion of Innovation theory. The interviews were then coded and emerging ideas were grouped into themes. Initial findings based upon those emerging themes indicate that teachers who utilize agriscience research projects in their programs are open to change and failure, are motivated to provide opportunities for all students to succeed, and are driven by overall program quality. Further, it was noted that teachers relied upon professional development or mentors to succeed in the initial implementation of agriscience research projects into their programs. Consequently, the findings suggest teachers who are determined to be successful innovators should serve as mentors to their peers in an effort to increase student engagement in agriscience research, which may lead to the development of necessary 21st Century Skills. The findings of this research will be most meaningful within secondary agricultural education by developing a greater understanding of the motivations behind how teachers incorporate new educational options into their programs. However, the findings may be transferrable to other teaching disciplines, such as science, regarding the adoption innovative ideas.

Keywords: 21<sup>st</sup> Century Skills, Agricultural Education, Agriscience, Diffusion of Innovation

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## **POSTER PRESENTATION ABSTRACTS**

### **Comparable Metabolic Responses from Blood Flow Restriction Walking and Walking with Load**

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**Abstract:** Load carriage (LC) is an inherent part of the military and other tactical occupations (e.g., law enforcement, firefighters). Variation in LC can range from 10- 60 kg and leads to a higher risk for back and leg injuries. Exercise with blood flow restriction is a form of low-intensity exercise that can elicit gains in muscular strength and aerobic endurance capacity. The purpose of this study was to compare the acute metabolic and perceptual responses from low-intensity blood flow restriction walking with walking with LC. Methods: Twelve young male participants (21.8  $\pm$  1.5 yrs) underwent five bouts of 3-min treadmill walking at 4.8 km·h<sup>-1</sup> with 1-min rest interval either as a blood flow restriction walking (BFR), loaded with 15% of their body mass (LOAD) and loaded walking with blood flow restriction (BFR-LOAD). Results:  $\dot{V}O_2$  was increased 7% during the BFR-LOAD ( $p = .001$ ) compared with BFR or LOAD alone. There were no differences in  $\dot{V}O_2$  between BFR and LOAD. BFR ( $p = .202$ ). BFR-LOAD showed significantly lower muscle oxygen saturation (SmO<sub>2</sub>) ( $p = .044$ ) and deoxygenated hemoglobin (DeOxyHb) ( $p = .047$ ) compared to LOAD. There was no condition effect for feeling scale ( $p = .459$ ) but there was a time effect ( $p = .004$ ). Conclusion: There was an increased metabolic response with the addition of BFR-LOAD. There was no significant difference between walking with BFR and LOAD. There is potential for BFR to limit the use of LC for individuals engaging in rehabilitation and reconditioning programs due to injury.

Keywords: blood flow restriction, load carriage, ischemia, muscle oxygenation, reconditioning

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### **Screening of Phenolic Antioxidant-Linked Bioactive Nutrients of Sweet Potato Cultivars targeting early stages of Type 2 diabetics**

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**Abstract:** Sweet potatoes are increasingly recognized as a healthy food option, recent research studies described sweet potatoes as a vegetable-rich in dietary antioxidants such as beta carotene, high dietary fiber, vitamin C, anthocyanins, xanthophylls and range of other functional phenolic metabolites. Being a storehouse of potential antioxidants, it helps in neutralizing the free radicals which are resultant of aerobic respiration in human body. Due to their diverse bioactive profiles and associated health relevant functionalities, sweet potato can be targeted in ethnic and functional food design to address chronic disease challenges such as type 2 diabetes and its associated health risks. In this study seven sweet potato cultivars were screened for phenolic-linked functionalities targeting antioxidant and anti-hyperglycemic properties using in vitro assay models such as total soluble phenolics (TSP), free radical scavenging activity using DPPH and ABTS assays,  $\alpha$ -amylase, and  $\alpha$ -glucosidase activity studies. The TSP content of sweet potato varied between 0.38 and 2.85 mg/g gallic acid equivalent (GAE) on a fresh weight basis across cultivars and extraction types. The purple-fleshed cultivar (NIC 413) showed significantly higher antioxidant activity in both cold water and ethanol extractions in terms of free radical scavenging properties. Cold water and ethanol extracts of sweet potato cultivars showed significantly moderate to high  $\alpha$ -amylase and  $\alpha$ -glucosidase inhibitory action by showing slow postprandial glucose rise. Therefore, different flesh colored sweet potato cultivars (white, orange, and purple) were investigated for antioxidant properties/potential health benefits targeting type 2 diabetes and associated complications using different in vitro assays.

Keywords: Sweet potato, Antioxidants, Anti-diabetic, Anti-hypertension, Phenolics

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## Opposite antioxidative activity variation of soluble free and polar soluble bound phenolic compounds during yellow pea germination

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**Abstract:** Germination is an effective process to improve the antioxidative activity of phenolic compounds in pulse seeds. This research aims to study the dynamic change of antioxidative activity of polar solvent extractable phenolic compounds during yellow pea germination and unveil the mechanism based on phenolic composition and molar mass. After germination, soluble free and polar soluble bound phenolic compounds were extracted and their antioxidative activities were evaluated in both in vitro and in stripped soybean oil (SSO)-in-water emulsion system. Liquid chromatography coupled with electrospray ionization quadrupole time-of-flight mass spectrometry (LC-ESI-QTOF-MS) and size-exclusion chromatography with multiangle-light-scattering and refractive-index detection (SEC-MALS-RI) were employed to analyze the phenolic composition and molar mass, respectively. Antioxidative activity of soluble free phenolic compounds increased in both oxygen radical absorbance capacity (ORAC) and SSO-in-water emulsion system, while that of polar soluble bound phenolic compounds decreased with germination. Coupled with the chemometric analysis, phloridzin (4), quercetin (9), hesperetin (14), glyzaglabrin (15), and pinocembrin (16) were speculated as the pivotal phenolic compounds responsible for the hydrogen donating capacity. In addition, decreased molecular weight accompanied with the decrease of antioxidative activity in SSO-in-water emulsion system that testified steric hindrance theory: moieties of polar soluble bound phenolic compounds have protective and dual antioxidative effect.

Keywords: yellow pea, germination, phenolic compounds, emulsion, molar mass

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## Identification of Genes Involved in Sugar-End Disorder in Tetraploid Potato (*Solanum tuberosum* L.)

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**Abstract:** As worldwide potato production increases, fried potato products have become more prevalent. With this increase, it is important that the quality of these products is maintained and improved. The sugar end disorder is a common affliction in production of processing potatoes. Sugar ends occur when sucrose accumulates in the stem end of the tuber, rather than starch. When fried, the stem end of the tuber displays a dark color impacting appearance, flavor, and smell, making them unfit for marketing and consumption. Due to the widespread production of processing potatoes for fried potato products in the United States, this disorder often has damaging effects on the potato industry.

Tetraploid potato (*Solanum tuberosum* L.) is genetically complex, thus most approaches to handling sugar ends have been practical management solutions. However, these management strategies are only a temporary fix as the industry attempts to avoid sugar end defects. By using a genetic approach, resistance can be identified, and resistant cultivars could be more quickly developed. Using Genome-Wide Association Studies, this work aims to identify the genes involved in resistance to the sugar end disorder. Fifty-four genotypes were selected in order to build a diverse and varied population. Field trials were conducted in Inkster, ND in 2018, and will be repeated in 2019. Using a controlled irrigation system, drought stress was imposed on the trial during early tuber bulking to induce sugar end formation. "

Keywords: GWAS, plant breeding, genetics

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## **A Methodology for Synthesizing Formal Specification Models from Requirements for Refinement-based Verification**

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**Abstract:** Formal verification has become the bedrock for ensuring software correctness when dealing with safety-critical systems. One of the biggest obstacles in applying formal techniques to commercial systems is the lack of formal specifications. Software requirements are expressed only in natural language. We present a structured approach for synthesizing formal models from natural language requirements.

Our approach is structured in that, while our procedures do most of the work in the synthesis process, it allows for structured input from the domain expert. The uniqueness of this work is the novel approach that can synthesize requirements to formal specifications that are useful for refinement-based verification, a formal verification technique that is very effective for the safety-critical Internet of Things (IoT) embedded systems. Several safety requirements for insulin pumps have been used to demonstrate the effectiveness of the approach. Ensuring the correctness of control software used in safety-critical embedded devices is still an ongoing challenge. The Food and Drug Administration (FDA) has issued 54 Class-1 recalls on infusion pumps which are applied to medical device models whose use can cause serious adverse health consequences or death. Such safety-critical embedded devices incorporate a whole slew of additional functionality to interface with the other components, in addition to their core control functions that exacerbate the challenge of ensuring that the core functionality of the control software is correct and intact. Our goal is transforming these functions into formal form and verify that they can be appended to build a new safe insulin pump model."

**Keywords:** natural language requirements, safety-critical IoT embedded devices, formal model, formal verification, system specifications.

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## **Hypoxia-Responsive Peptide Conjugated Nanoparticles for Delivery of Chemotherapy**

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**Abstract:** The success of a chemotherapy drug depends on efficient delivery to the tumor site. A drug given intravenously will concentrate in areas with the best blood supply. In regards to solid tumors, the best blood supply are at the peripheral walls of the tumor and 90% of the tumor receives little or no drug. Furthermore, the lack of oxygen, hypoxia, further adds to the conundrum of solid tumors. Tumors with poor oxygenation have an increased risk of metastasis and mortality. While the tumor's microenvironment plays a crucial role in treating the disease, the cells within the tumor are not homogenous. Cancer stem cells (CSCs) have been identified in a large number of human malignancies. Stem cells are theorized to be responsible for resistance to chemotherapy, metastasis, and relapse. We synthesized hypoxia-responsive peptide conjugated nanoparticles. These nanoparticles are able to selectively and rapidly release their chemotherapeutic payload under low oxygen concentrations. The addition of a cyclic peptide (iRGD) allows for greatly increased cellular uptake and penetration of multiple millimeters into the tumor tissue. In-vitro monolayer and spheroidal assays showed improved efficacy of the drug-encapsulated nanoparticles over the free drug. Our in-vivo studies showcase extended circulation times >72 hours and high accumulation at the tumor site and suppression of tumor growth. In an inside-out approach, we hope to effectively eliminate cancer cells residing in the most chemo resistant areas of the hypoxic tumor core.

**Keywords:** nanoparticles, drug delivery, hypoxia

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## Pythium Pathogens of Common Bean in North Dakota and Minnesota

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**Abstract:** North Dakota and Minnesota rank number one and four in US common bean (*Phaseolus vulgaris* L.) production. Root rot is a destructive disease to common beans production worldwide. To effectively manage root rot, it is vital to know what pathogens are most damaging. *Pythium* spp., *Fusarium* spp., and *Rhizoctonia solani* Kühn are known to cause root rot in common beans. A root rot survey conducted about a decade ago, established *Fusarium* and *Rhizoctonia* pathogen populations in the region, but *Pythium* spp. were not included in this survey. Metalaxyl/mefenoxam are commonly used as seed treatments to manage *Pythium* spp. in many crops. Metalaxyl/mefenoxam resistance has been observed in some *Pythium* populations in the US in numerous crops. To date, metalaxyl/mefenoxam resistant *Pythium* spp. have not been observed infecting common beans. The goals of this research are to establish which *Pythium* species are important pathogens in common beans in this region by determining the pathogenicity and aggressiveness of isolates collected and to evaluate metalaxyl/mefenoxam sensitivity in the *Pythium* population. To date, 16 *Pythium* spp. have been morphologically identified from 13 of 33 fields sampled in 2018. Preliminary results indicate that varying levels of aggressiveness exist among the *Pythium* spp. isolated. Metalaxyl/mefenoxam sensitivity levels for the *Pythium* spp. identified also will be reported.

Keywords: *Pythium*, common bean, root rot

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## Makǰóche Wašté, The Beautiful County

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**Abstract:** The Očhéthi Šakówiŋ (Seven Council Fires; “Great Sioux Nation”) call their homeland and by extension North America many names, but one of the most meaningful names is “Makǰóche Wašté,” which means “The Beautiful Country.” The original homeland of the Očhéthi Šakówiŋ includes lands in western Wisconsin, northern Iowa, Minnesota, North Dakota, South Dakota, northern Nebraska, eastern Montana, and eastern Wisconsin. The Očhéthi Šakówiŋ are composed of seven main divisions and three major dialects across this landscape. Their homes reflected a relationship with the landscape too. The Isáŋyathi (Santee) speak Dakhóta and reside east of Wakpá Tǰánka (The Big River; Red River) and Wakpá Ipákšankšanj (The River That Bends Back Upon Itself; Big Sioux River). The Middle Dakhóta, commonly referred to as “Nakota,” reside between the Wakpá Tǰánka and the Wakpá Ipákšankšanj to the east and the Mnišóše (The Water-Astir; Missouri River) to the west. The Middle Dakhóta variously identify with speaking “Nakota,” but the Upper Yanktonai who reside on the Standing Rock Sioux Indian Reservation call their language Wičhíyena. The Thítǰunwanj (Dwellers On The Plains; Teton) reside west of the Mnišóše and ranged as far west as Heská (White Mountains; Rocky Mountains), as far north as Mdé Thawákhanj (One’s Spirit Lake; Great Slave Lake) and as far south as Wahíŋ Wakpá (Flint River; Arkansas River). This division is the most numerous and speaks Lakǰóta. This people’s name for themselves is testament to a long occupation and unique relationship to the landscape. Let’s explore these places together.

Keywords: Plains Indians Sioux Landscape Territory

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## Estrogen Receptor Signaling and Intracellular Calcium Regulation in Human Airway Smooth Muscle

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**Abstract:** Asthma incidence has been shown to be higher in pre-menopausal women and aging men, strongly indicating that estrogen may be involved in both sexes. Recent studies demonstrated that airway smooth muscle (ASM) cells from both male and female express estrogen receptors (ER) - ER $\alpha$  and ER $\beta$  and these receptor expressions are upregulated during asthma or inflammation. We hypothesize that these receptors have differential roles in intracellular calcium ([Ca<sup>2+</sup>]<sub>i</sub>) regulation in ASM cells. Human ASM cells were enzymatically dissociated from tissue obtained incidental to lung surgery. Cells were plated onto 8-well glass plates, grown to 70% confluence, and exposed to pro-inflammatory cytokines TNF $\alpha$  (20ng/ml) and/or IL-13(50ng/ml) in the presence or absence of non-selective ER agonist 17 $\beta$ -estradiol (E2, 1nM), 10nM PPT (ER $\alpha$  agonist) or WAY (ER $\beta$  agonist) for 24h. These were then loaded with 4 $\mu$ M Fura-2, AM in HBSS for 1h and subsequently washed. The [Ca<sup>2+</sup>]<sub>i</sub> level was measured from the intensity change observed following exposure to 10 $\mu$ M histamine, 10nM bradykinin and 1 $\mu$ M acetylcholine under Olympus confocal microscope. The cytokines significantly increased [Ca<sup>2+</sup>]<sub>i</sub> compared to vehicle. ER $\beta$  agonist WAY was effective in reducing [Ca<sup>2+</sup>]<sub>i</sub> levels in ASM cells compared to control. In combination with cytokines, WAY significantly reduced [Ca<sup>2+</sup>]<sub>i</sub> in ASM cells, while ER $\alpha$  agonist PPT did not elicit any notable changes compared to cytokines alone. We further examined mechanism of estrogen signaling via several calcium channels and pumps. It was found that ER $\beta$  signals primarily through L-type calcium channels and Sarcoplasmic Reticulum Calcium Reuptake pump (SERCA).

Keywords: Asthma, Inflammation, Sex Steroids, Calcium Handling, SERCA

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## Railroad Track Irregularities Position Accuracy Assessments Using Low-Cost Sensors on a Hi-Rail

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**Abstract:** Regular maintenance of railroad tracks is not only essential for the proper functioning of the railway, but also significantly improves ride quality, reduces track damage, and increases track life. Deviations from the designed track geometry can result in poor ride quality and possible derailments. Railroad companies currently cannot afford to monitor the geometry of their entire networks as frequently as necessary because of the high cost of deploying the required specialized equipment and trained professionals. All the previous research sought to evaluate irregular track geometry by focusing on the use of more complex and expensive sensor systems. Conversely, this study combines the inertial and geospatial position data from low-cost sensors aboard hi-rail. The use of low-cost sensors aboard railcars could screen the infrastructure for irregularities automatically and continuously to save railroad companies billions of dollars by focusing follow-up manual inspections on high-risk locations. In lieu of a dedicated low-cost device to sense and record multi-directional inertial responses, this research uses smartphone because they have all the capabilities needed to develop and test the proposed low-cost condition monitoring system. However, the GPS receivers of low-cost sensors do not always provide reliable position information, mostly due to signal occlusion, multipath interference, and low update rates. This study introduces a signal processing and statistical method to estimate the position of peak inertial events from multiple traversals and furthermore, characterizes the position accuracy of the method by comparing the estimated position of PIEs with the actual positions of irregularities that the railroad inspector observed.

Keywords: Railroad, irregularities, Low-cost sensors, Signal processing

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## **Importance of phosphorus and AM fungi in performance of blanketflower, *Gaillardia aristata*, across the northern tier**

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**Abstract:** Arbuscular mycorrhizal (AM) fungi form a symbiotic relationship within plant roots and provide nutrients such as phosphorus (P) to the plant in exchange for sugars and lipids. Previous work showed the native prairie wildflower *Gaillardia aristata* to display a negative growth response when colonized by AM fungi. We measured plant biomass, plant and soil nutrients, hyphal length in the soil and root colonization by AM fungi for 10 *G. aristata* individuals at each of 12 sites along an east-west gradient in soil P availability from western Montana to northwestern Minnesota. We also grew this species in the greenhouse with and without AM fungi to determine mycorrhizal responsiveness. Plants from soils with higher P availability were larger and had greater P content in their aboveground tissues. Greater plant P content was associated with greater hyphal length in the soil. In the greenhouse, mycorrhizal plants were several times larger than non-mycorrhizal plants. These results together suggest that P may limit growth in this plant species and that AM fungi are important for the performance of this plant.

Keywords: arbuscular mycorrhizal fungi, phosphorus

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## **Design of additives to modify properties of marine coatings to combat biofouling**

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**Abstract:** Biofouling, settlement of marine organisms in seawater on sea vehicles/submerged structures, can result in a series of drawbacks such as increased fuel consumption, decreased maneuverability, shortened service-life, and transportation of invasive species. Tin-containing paints were promising candidates for decades to address biofouling. These tin-based formulations were banned worldwide due to their toxicity on marine environments. Therefore, the focus to solve this problem has shifted to a non-toxic coating. To this effect, NDSU developed a hydrophobic fouling-release self-stratifying siloxane-polyurethane coating that offers durability, can be applied on a substrate via one step, and experiences low adherence of many organisms due to its low surface energy. The coating exhibited a performance comparable or better than the commercial products while withstanding deformations under a higher force load. However, all marine organisms cannot be deterred with a hydrophobic system, so there is a necessity to modify the surface properties of the coating by introducing chemical moieties to reach a balance of hydrophilicity and hydrophobicity. Thus, this presentation will discuss how a series of polymeric additives were designed, synthesized, and characterized to attain an amphiphilic balance for a coating system. The formulated coatings were characterized by surface analysis techniques such as contact angle and surface energy measurements and atomic force microscopy. Furthermore, coatings were pre-leached in water tanks to ensure residual impurities are removed and then were assessed via biological assays including *C. Lytica* (marine bacterium), *N. incerta* (diatoms), and *A. amphitrite* (Barnacle). The Office of Naval Research supported this research under grant N00014-16-1-3064.

Keywords: Fouling-release, Paint, Biofouling, Coatings, Polymers

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## Assessment of Resilient Infrastructure Networks under Cascading Failure

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**Abstract:** The critical infrastructure networks are often vulnerable to unexpected failures that have immense devastating effects on network functionality. The reason behind such vulnerability could be due to the interdependency among several infrastructure networks. The failure in one network component might cause the diffusion of failure among the dependent components and other dependent networks. These failures are often modeled as a cascading effect where the failure propagates from one network to another and eventually resulting in the breakdown of the total system. The likelihood of such failures occurring has urged the development of a disaster-resilient infrastructure system, which requires an effective restoration planning. This study mainly focuses on cascading failures and restoration strategies against them in interdependent networks. Among various existing restoration strategies, selecting the one that is most competent in achieving high resilient performance is still a great challenge. In this study, a comparison framework for assessing different restoration strategies is proposed. The overall system performance, recovery time, recovery cost, and system resilience are selected as the evaluation criterion. Additionally, a case study for evaluating restoration strategies against cascading failures is presented to validate the effectiveness of the proposed framework. The implementation of the proposed framework does not only help in decision-making processes but also provides directions for further improvements of the existing restoration strategies against cascading failures.

Keywords: cascading failure, restoration, resilient, infrastructure system, interdependent networks

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## How Does Protein Molecular Weight Distribution Affect Dough Strength and Pasta Firmness?

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**Abstract:** Although storage protein fractions are known to have dominant impacts on dough strength and pasta cooking quality the detailed information is still lacking on associations between these factors in durum wheat. This research was conducted to assess associations of protein molecular weight distribution (MWD) parameters with dough strength and cooked pasta firmness for six durum wheat genotypes grown at locations in North Dakota and Montana across five years (2013-2017). Quality determinations consisted of protein content, gluten index, mixograph, and pasta cooking traits. Size exclusion HPLC (SE-HPLC) was also performed to quantify MWD for SDS buffer extractable and unextractable protein fractions.

The results indicated protein fractions that identified through SE-HPLC, specifically had a dominant impact on variation in gluten index and cooked pasta firmness. Variation in gluten index was positively associated with unextractable glutenin macro-polymers. However, a negative correlation was found between gluten index and extractable polymeric proteins and gliadins. Grain and semolina protein had a strong positive correlation with firmness of cooked pasta in all genotypes. Our results showed non-significant or weak correlations between gluten index and firmness in majority of genotypes. Conversely, unextractable polymeric proteins had a strong positive correlation with pasta firmness. However, the higher percentage of extractable polymeric protein as well as albumins and globulins in total protein was observed to cause the lower pasta firmness. The SE-HPLC of protein appeared to be very helpful to identify protein components that played dominant roles in determining dough strength and pasta firmness in durum wheat.

Keywords: Unextractable polymeric protein, gluten, firmness

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## **The more role-playing, the more real? How player-avatar interaction/relationships influence presence**

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**Abstract:** This paper reports on research examining the relationships between player-avatar interaction and player-avatar relationship variables and the three types of presence in video games. Specifically, hypotheses predicted positive relationships between emotional investment and three types of presence, negative relationships between sense of control and three types of presence, negative relationships between critical concern and three types of presence, positive relationships between anthropomorphic autonomy and spatial presence and social presence, and a negative relationship between anthropomorphic autonomy and self presence. Also, hypotheses predicted that avatar-as-me would generate the strongest spatial presence, social presence and self presence among the four types of player-avatar relationships. The data indicated that emotional investment was positively related to spatial presence and self presence, sense of control was positively related to self presence, critical concern was positively related to spatial presence and self presence, and anthropomorphic autonomy was positively related to spatial presence and self presence. In addition, the results showed that avatar-as-me and avatar-as-symbiote both generated the strongest feeling of presence in video games. These results are discussed, as are limitations and directions for future research.

**Keywords:** video games, player-avatar relationship, presence

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## **Colloidal Stability and Photo-Physics of Lead Halide Perovskite Nanocrystals: Using Density Gradient Ultra-Centrifugation to Probe Size-Dependent Surface Chemistry and Photo-Physical Properties**

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**Abstract:** Fully-inorganic CsPbX<sub>3</sub> (X=I,Br,Cl) lead-halide perovskite (LHP) nanocrystals (NCs) have become promising materials for opto-electronic applications such as light-emitting diodes (LEDs) and photovoltaics (PVs). In part, this is due to broadly tunable visible photoluminescence (PL) and high PL quantum yields. LHP NCs are synthesized using wet-chemistry methodologies and require surface passivating ligands for colloidal stability and bright emission. Currently, the surface chemistry of LHP NCs is an active area of research due to 'dynamic binding' at the NC surface using conventional surface passivation with oleic acid and oleylamine ligands. Implications of the dynamic binding include: 1) ligand desorption from the surface which reduces colloidal stability and reduces PLQY due to the formation of surface trap states, and 2) it makes the NCs difficult to process into high-purity solutions and films using conventional wet-chemistry methods, such as anti-solvents. Here, we use density gradient ultra-centrifugation (DGU) to process an ensemble of CsPbBr<sub>3</sub> LHP NCs into size-resolved colloidal fractions for detailed photo-physical characterization, including PLQY, PL lifetime, and optical absorption spectroscopy. In agreement with a crossover from weak to strong quantum confinement, we find tunable PL spanning 460 nm to 515 nm for size ranges from 6 nm to 15 nm NCs. For colloidal stability, we observe that within a week the samples display Ostwald ripening and we explore various approaches to stabilizing the NCs. Our findings have implications for improving solution processability and colloidal stability of these materials, while providing fundamental insight into photophysical processes that have great relevance to optoelectronic device applications.

**Keywords:** Nanocrystal, Colloidal Stability, DGU, Photo-physics, Surface Chemistry

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## Quantifying Grapevine Dormancy Acclimation Responses: A Breeding Objective for North Dakota

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**Abstract:** In North Dakota, dormancy acclimation responses of grapevines are essential traits for the breeding of new genotypes with improved winter hardiness. Using a factorial mating scheme, the dormancy acclimation responses of breeding lines within the North Dakota State University Grape Germplasm Enhancement Project (NDSU GGEP) were characterized. Weekly measurements were recorded for seedling populations in conjunction with a 0.5 hr decrease in photoperiod from 16 hr to 10 hr daylight while temperatures were maintained at 27 °C within a regulated growth chamber. Traits monitored included abscission of apical growing tip, periderm development, individual node maturation, lateral shoot abscission, total shoot height, and total node count. Heritability estimates for acclimation responses increased with decreasing photoperiod and heritability of most measured traits reached individual peak estimates between 12.5 and 11.5 hr daylight. Further evaluation of seedling populations identified parents giving rise to progeny with superior acclimation at 12 hr daylight, a photoperiod corresponding to 25 Sept. in Cass County, ND, three days prior to the average first frost date. Progeny of both MHND 011#1 and ND 030#2 performed similar across multiple monitored traits when compared to open-pollinated seedlings of Ekre #55, a wild, native, *V. riparia* utilized as a control population with desirable acclimation traits. Consequently, these genotypes are being further characterized for potential use as cold-hardy substitutes within the NDSU GGEP to avoid the recurring use of *V. riparia* parents, circumventing some of the species' undesirable traits such as unprecedented herbaceous character, high acidity, and negligible fruit size.

Keywords: cold-climate viticulture, cold-hardiness, dormancy, grape breeding

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## Development of user-coded plugin and web application for classification and quantification of flowers for pollinators interaction

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**Abstract:** Floral traits, such as color, shape, size, and shape, influence the pollinators visitation rate that affect plant pollination. Bee pollinator discrimination based on their floral traits among three different flower species (Phacelia, Buckwheat, and Mustard) was studied in a bee visitation study plot containing four main plots, each containing 16 subplots. The flower quantification was performed by using ruler and manual count and a developed image processing technique. A custom designed frame with legs was used in the test plots for capturing the flower images. The images were captured weekly for a duration of about three months (June – August 2017), a total of 192 sample images (4 main plots 16 subplots 3 replications) during one visit, along with simultaneous manual measurements. ImageJ (open source software) user-coded plugin will be developed for classifying the flowers and quantifying the flowers coverage. The plugin will be developed with capabilities to (i) segment the plant area within the frame; (ii) classify the flower species based on the color and shape; and (iii) determine the flowers coverage after classification. In addition, a web application will be developed, compatible and accessible through desktops and mobile phones, using Shiny package in R which will allow the user to upload the images to classify and quantify the flower species. Statistical analysis will be conducted to compare the difference between the manual measurements and the image analysis results; additionally, the relationship between the flower species and coverage with bee visitation rate will be determined.

Keywords: flower classification, image processing, ImageJ, inflorescence, cover crop, bee pollination, web application

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## Genome-scale CRISPR-Cas9 screening to identify molecular mechanisms of piperlongumine in pancreatic ductal adenocarcinoma cells

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**Abstract:** Pancreatic ductal adenocarcinoma (PDAC) is an aggressive malignancy that lacks early detection and diagnosis. Despite recent advances in the field of oncology, less than 9% of PDAC patients survive for five years or more after diagnosis. Conventional treatment approaches such as chemotherapy, radiation therapy, and resection surgeries have been largely ineffective for PDAC. Novel treatment strategies, based on the unique molecular biology and physiology of pancreatic cancer, are now being investigated for their potential use in clinics. We have reported piperlongumine (PL), a novel cancer cell-specific cytotoxic agent, causes cell death in human PDAC cells in vitro and in vivo. PL is a bioactive compound obtained from the roots and fruits of Piper longum. Its primary protein target is glutathione S-transferase Pi 1 (GSTP1), and the proposed mechanism of action by which PL causes cell death is by disrupting the redox homeostasis. To investigate additional molecular mechanisms by which PL kills PDAC cells, we used a CRISPR-Cas9 system to individually knockout expression of 2,500 cancer-associated genes in PDAC cells treated with or without PL. We identified potential sensitizers, which are proteins whose loss enhanced PL-induced cell death. Further, we identified potential antagonizers, which are proteins whose loss prevented PL-induced cell death. Isocitrate dehydrogenase-2 was the top antagonist of PL's cytotoxic effect, suggesting the importance of the citric acid cycle in generating energy for PDAC growth. Altogether, our CRISPR-Cas9 screening data confirmed our previous results indicating PL is involved in cell cycle regulation, the TP53 pathway, and the MAPK signaling pathway.

Keywords: CRISPR-Cas9 screen, piperlongumine, pancreatic cancer

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## Identifying Malicious Users Through Behavior

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**Abstract:** There are many communication mediums for interaction. Users frequently hop from one medium of communication to another. Such as hopping from a computer to a mobile device or to a cloud. Advanced hardware technology has led to cheaper costs and maintenance. However, this also led to security and vulnerabilities issues. Security of these devices is important as provisioning the platform. There has been a considerable research in identifying various attacks in the domain of mobile networks, pervasive and cloud computing. Several researchers have proposed security algorithms. Some of these algorithms either need modification(s) or acquiring new infrastructure. Either of these are an expensive investment. In my research, I present an approach that would not need any infrastructural changes and maintenance. User authentication alone is not enough to ensure the safety of users. The combination of user behavior analysis along with authentication, ensures the genuineness of the user. Malicious users have a tangential behavioral pattern as compared to genuine users. These users are identified from their past and current interaction with the system. This is also known as users' behavior. When a malicious user is identified, the user's reputation value is quickly reduced. This value gets further reduced upon any malicious detection. As the reputation value goes down, user loses access to the system. This will enable the service providers in taking timely action against these users from performing unauthorized or illegal actions. This algorithm can prevent malicious and inside attackers.

Keywords: Cyber Security, Cloud Computing, Network Security

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## Seasonal trends in nesting physiology of adult Laughing Gulls (*Leucophaeus atricilla*)

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**Abstract:** Organisms are inherently complex, with their fitness and persistence tightly tied to the phenotypes that emerge from genetic and environmental influences. Currently, we cannot reliably predict how individuals integrate genetic and environmental cues affecting phenotypes. Suggesting we cannot predict changes in offspring survival and reproductive success, critical for successful seabird conservation. Using a seasonally breeding seagull, we examined three different life stages across the nesting season. We investigated how adult condition and investments in offspring could be used to adjust offspring phenotypes to mitigate seasonal effects on reproductive success. We found female adult condition declined across the nesting season and male offspring laid later in nesting season were smaller. In this gull colony, evidence suggests quality of female partially predicts when during nesting season a female will initiate egg-laying and in late season breeders, male chicks are paying a higher cost for mom's timing of breeding than female chicks.

Keywords: Phenology; Maternal Effects; Seasonal Effects

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## Placental Progesterone Receptors (PGR) Expression from Early to Late Pregnancy in Sheep

Thanya Bunma, Kimberly A Vonnahme, Manuel A Vasquez-Hidalgo, Kendall C Swanson, Sheri T Dorsam, Chainarong Navanukrav, and Anna T Grazul-Bilska

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**Abstract:** To determine the effects of plane of nutrition, nulliparous white face ewes (6 - 8 months) carrying singletons on day 50 of gestation were randomly assigned to two dietary treatments receiving 100% of NRC recommendations (CON) or 60% of CON (RES). CON ewes either remained on CON or RES until day 130, or CON ewes were RES from day 90 to 130, or RES ewes were realimented to CON from day 90 to 130 that resulted in 7 groups (n=5-6 ewes/group): CON (day 50, 90 and 130), RES (day 90 and 130), RES-CON (day 130) and CON-RES (day 130). At these days, maternal (CAR) and fetal (COT) placental tissues were collected for evaluation of expression of PGR protein and mRNA. PGRAB protein expression was greater ( $P<0.05$ ) on day 50 than 90 or 130, and it was not affected by diet. In CAR, PGRAB mRNA expression was greater ( $P<0.04$ ) on day 50 than 90 or 130, and PAQR7 (membrane PGR alpha) was lowest ( $P<0.05$ ) in CON-RES on day 130. In COT, mRNA expression of PAQR8 (membrane PGR beta) was lowest ( $P<0.02$ ) on day 50, and PAQR5 (membrane PGR gamma) was greater ( $P<0.03$ ) in all groups on day 130 than any group on days 50 and 90. Thus, expression of PGR in ovine placenta depends on pregnancy stage, and may be affected by plane of nutrition. Overall, the mechanisms of diet and developmental effects on placental functions needs to be elucidated and warrant further investigation. USDA-AFRI grant 2016-67016-24884 to ATGB and KAV.

Keywords: Placenta, Progesterone, Sheep, Nutrition

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## **An Exploratory Application of Unmanned Aerial Vehicles for Wildlife Surveys**

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**Abstract:** Manned aerial surveys are an important tool for wildlife managers, but they are expensive to conduct, dangerous, and difficult to replicate. In recent years, interest has been expressed in using unmanned aerial vehicles (UAV) to alleviate concerns associated with traditional, manned aerial surveys. To assess the potential of UAV technology in North American avifauna surveys we established a research project studying the behavioral response of sharp-tailed grouse (*Tympanuchus phasianellus*) to two different UAV platforms (fixed-winged and quadcopter) on National Grasslands in North and South Dakota. In addition, we aimed to describe technical requirements with each and identify pitfalls. A total of 13 leks were tested; seven with a fixed-winged vehicle, and six with a quadcopter. Lekking grouse showed a measurable response to UAVs during all flights regardless of UAV platform. Lek observers recorded four of the seven fixed-winged flights and three of the six quadcopter flights flushed all grouse from leks. The level of disturbance we observed inhibits still imagery collected by UAVs to accurately portray bird densities at lek locations in our study. UAVs show promise for improving survey replication and limiting dangers associated with manned, aerial surveys. However, our preliminary findings suggest UAVs are not a worthwhile substitute at this time. Future investigations need to consider variables such as survey elevation and UAV type to identify physiological responses lekking grouse express towards UAV exposure.

Keywords: drone, grouse, survey, *Tympanuchus phasianellus*, unmanned aerial vehicle.

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## **Effect of Cigarette Smoke Extract on Apelin-APJ System in Rat Coronary Arteries**

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**Abstract:** Cardiovascular disease (CVD) is the leading cause of death worldwide. Smoking is the major cause which results in one of every three deaths from CVD. Apelin is an endogenous ligand for APJ receptor and activation of APJ receptors causes endothelium-dependent relaxation in many blood vessels. However, the ability of apelin to regulate vasomotor tone under pathologic conditions is poorly understood. Therefore, in the current study, we investigated the effect of cigarette smoke extract (CSE) on apelin-APJ system in isolated coronary arteries. CSE was freshly prepared from 3R4F reference cigarettes. Rat coronary arterial segments were suspended in wire myograph for isometric tension recording. The presence or absence of endothelium was verified using endothelium-dependent vasodilator acetylcholine (ACh). CSE (1 and 2%) exposure resulted in inhibition of apelin induced, endothelium-dependent, relaxation in rat coronary arteries but had no effect on ACh-induced relaxation. Interestingly, apelin inhibited ACh-induced endothelium-dependent relaxation following incubation with higher concentration (2%) of CSE. The cigarette smoke extract had no effect on relaxation to the NO-donor DEA-NONOate in endothelium-denuded arteries. CSE impaired apelin-induced relaxation in coronary arteries. Moreover, apelin itself inhibited ACh-induced relaxation after exposure to CSE. The observations that apelin had no effect on the response to ACh under normal conditions, nor did it alter responses to an NO-donor (i.e. DEA), suggest that apelin inhibits the production or release of NO from endothelial cells in coronary arteries. Taken together, these data demonstrate that exposure to cigarette smoke may impair endothelial cell function, thereby increasing the risk for coronary vascular disease

Keywords: Coronary, smoking, Nitric-oxide, apelin, Endothelium

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## **Towards BLACKOUT Free Power Grids - using Energy Functions for Supervisory Protection**

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**Abstract:** Relay misoperations in power systems, especially during stressed conditions can initiate a cascade potentially leading towards a blackout. A typical event that aggravates a cascade is a trip decision by distance relays to faults in zone 3. We examine the use of energy functions as a discriminant in such scenarios to supervise the action of distance relays, in particular, to distinguish between load encroachment and zone 3 faults. The scenarios are tested on two individual test beds, the 39 bus New-England Test System (NETS) and a portion of the Western Electricity Coordinating Council (WECC) system. The NE system is used to analyze and assess the choice of energy functions for protection, whereas the WECC system is used for an actual blackout simulation in the South Western United States corridor. Analysis on these test systems shows on how energy functions can help in detecting and potentially avert costly relay misoperations.

Keywords: Supervisory Protection, Relay misoperation, Energy Functions, Cascading Faults, Blackout  
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## **Measuring Nursing Home Efficiency Using PCA-DEA Approach**

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**Abstract:** This study employs a robust approach to measure the efficiency of major nursing homes in Fargo-Moorhead metropolitan area using two stage analysis consisting of principal component analysis (PCA) and data envelopment analysis (DEA). The objective is to improve discriminatory power of the DEA by reducing the dimensionality of data set when there is an excessive number of inputs and outputs compared to the number of decision-making units (DMUs). The performance of each DMUs is ranked and a benchmarking target is provided to improve the efficiency score in this study. The result demonstrates that using PCA can noticeably improve the discrimination of DEA models.

Keywords: PCA-DEA, Efficiency Measuring  
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## **Bone Metastasis of Prostate Cancer Evaluated Using an In Vitro Model with a Perfusion Bioreactor**

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**Abstract:** Prostate cancer is the second leading cause of cancer death among men in the United States. The primary cause of morbidity is the metastasis of prostate cancer to bone. Effects of various biochemical factors have been demonstrated in the disease progression; however, the role of physical factors as shear stress/mechanical cues by the interstitial fluid on tumor progression is poorly explored. It has been established that interstitial flow has a pro-migratory and biomechanical stimulatory effect on cancer cell invasion. To address this issue, we designed a perfusion bioreactor based 3D in-vitro model to show the feasibility of the progression of prostate cancer cells colonizing the bone. The bioreactor uses a tissue engineered bone scaffold to create bone microenvironment on which cancer cells are grown. We cultured human mesenchymal stem cells (hMSCs) on nanoclay-polycaprolactone-based scaffolds under dynamic condition enabled with the perfusion bioreactor to duplicate accurate bone-like microenvironment. Further, we cultured human prostate cancer cells on the newly formed bone to mimic bone metastasis. Flow perfusion not only provided mechanical stimulation but also increased nutrient and oxygen supply throughout the scaffold to enhance cell growth. Preliminary data confirmed the viability and maturation of hMSCs to bone cell lineage, and indicate that bone niche with flow perfusion

promotes cancer cell progression. The perfusion bioreactor based 3D in-vitro model could be utilized to elucidate the mechanisms of prostate cancer metastasis and innovations in drug therapy.

Keywords: perfusion bioreactor, prostate cancer metastasis, 3D in-vitro model

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### **How Can Citizen Scientist Participation Influence Herpetological Species Distribution Models In Conjunction With Researcher Surveys?**

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**Abstract:** Amphibian and reptile populations, which are crucial in maintaining ecosystem function, are declining globally. The decline of these populations is the result of various factors including: disease, habitat loss and alterations. As a result of these declines it is necessary to determine local population trends and distributions over time, to assess population status. Within North Dakota there has been inadequate historic records of amphibian and reptile population trends. Recently the southeastern portion of North Dakota was surveyed from 2014-2016. Data from this State Wildlife Grant (2014-2016) and HerpAtlas (citizen science) were utilized to create distribution maps for species including but not limited to the Northern Leopard Frog (*Lithobates pipiens*), the Canadian Toad (*Bufo hemiophrys*), and the Plains Garter Snake (*Thamnophis radix*). With this additional data provided by citizen scientists it is possible to create distribution models for an increased number of species. These models allow a comparison of amphibian and reptile populations of surveys that researchers conducted and the combination of the survey and citizen science data. This can be useful in assessing species status and influence management decisions.

Keywords: citizen science, amphibian, reptile, distribution

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### **Do Ancient Wheat Species Differ from Modern Bread Wheat?**

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**Abstract:** The increasing popularity of organic agriculture and healthy food products has led to a renewed interest in ancient wheat species. Several studies have suggested that ancient wheat species have health benefits compared with modern wheat. However, there is limited literature about the chemical composition, dietary fiber variation and technological potential of ancient wheat species. Based on this perspective and rationale, goal of this study is to identify the variation in chemical composition and dietary fiber components of ancient wheat species such as emmer (*Triticum dicoccum*), einkorn (*Triticum monococcum*) and spelt (*Triticum spelta* L.) along with selected bread and durum wheat cultivars. In addition, this study will evaluate the potential of utilizing ancient wheat flour in food processing to gain additional health benefits associated with ancient wheat species. Emmer, einkorn, spelt, bread and durum wheat samples were selected from an organic farming trial conducted in Fargo and Carrington. This project will comprise several stages including analysis of dietary fiber components of ancient and modern wheat species and preparation of sourdough bread using ancient wheat flour and analysis of quality characteristics and sensory parameters. At the end of this study, exact chemical composition, dietary fiber components and potential uses in food processing would be known and identified.

Keywords: Ancient wheat, Dietary fiber, Organic, Sourdough, Technological potential

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## Label-Free Cell Purification after Electroporation

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**Abstract:** Cell transfection by electroporation is a biological assay that has been utilized to inject exogenous molecules (e.g.: RNA, DNA and protein) into live cells. Recently, electroporation has been utilized in developing cell therapy for cancer. Moreover, messenger RNA (mRNA) molecules that recognize specific cancer cells surface proteins, were injected into T-cells by electroporation and produce Chimeric Antigen Receptor (CAR) T-Cells for therapy. One of the major problems associated with the use of electroporation in CAR T-cell therapy is that a significant portion (>40%) of T-cells are dying via apoptosis and necrosis. These dying/dead cells have potential harmful effects to the healthy tissue and T-cells and have the possibility to enhance the growth of tumor cells. Current cell filtering methods are unable purify T-cells following electroporation, this is due to the lack of unique biomarkers that target the apoptosis and necrosis of T-cells. To address this issue, we have developed a method using dielectrophoresis and microfluidics, where no prior labeling is needed to isolate dead cells from live cells. Upon electroporation, the cell sample has to be flowed through the microfluidic chip where a selective electric field is applied through specially designed electrodes so that the dead cells are trapped on the electrodes, and the live cells are able to flow through and are collected at the end. Results after purification of the cells using our method reveal that it is possible to achieve ~100% of purity in filtering of the live cells. This method presents a viable solution to a critical concern regarding CAR T-cell manufacturing.

Keywords: cell, purification, electroporation

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## A modified SWAT model for hydrologic modeling in Depression-dominated Areas

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**Abstract:** Surface depressions play important roles in hydrologic modeling. The spatial distributions of depressions and their hierarchical relationships and variable contributing areas make the modeling of hydrologic processes more complicated. The objective of this study is to quantify the influence of spatially distributed depressions on hydrologic processes to improve hydrologic modeling for depression-dominated regions. To achieve this objective, a puddle-based unit (PBU)-oriented SWAT (SWAT-PBU) model is developed by incorporating a new hydrotopographic routing algorithm into the original SWAT. In the hydrotopographic routing algorithm, surface runoff generation processes are simulated separately for depressional area (CBUs: channel-based units) and non-depressional area (PBUs). For depressional areas, a series of PBU-based probability distributed models (PBU-based PDMs) are developed to simulate the dynamic contributing areas and the depression filling-spilling dynamics of PBUs and quantify their depression storage and surface runoff. Particularly, the concept of PBU accounts for the spatial distributions and relationships of depressions and their contributing areas. The SWAT-PBU model was applied to a watershed in North Dakota and the simulated discharges at the watershed outlet were compared with the observed data. The simulation results indicated that the SWAT-PBU and the PBU-based PDMs are able to provide satisfactory simulations of hydrologic processes under the influence of spatially distributed depressions and mimic the filling-spilling overland flow dynamics and the threshold behavior.

Keywords: surface depressions, hydrotopographic routing algorithm, probability distributed model, SWAT, hydrologic modeling

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## **Effect of stress on body size and telomere of house sparrow (*Passer domesticus*)**

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**Abstract:** Environmental and nutritional conditions during early developmental period can affect the morphology and physiology of an organism. Growth and lifespan are inversely correlated, thereby causing a trade-off between them. Telomere dynamics may be one possible way to examine the mechanism behind it. Telomeres are repetitive sequence at the end of our chromosomes, which protect the chromosome from fusion and deterioration. It has been found that the telomeres shorten with reproduction, because of the end replication problem. Therefore telomere length tends to decrease with each cell division. Apart from that, oxidative stress acts as a promoter of telomere attrition. In this study, we hypothesize that stress during early developmental condition affects the body size, as a part of trade-off between growth and energy expenditure in terms of dealing with the stressful condition. And the trade-off caused by that will affect the telomere length to decline in individuals that are stressed. We examined our hypothesis, by experimentally manipulating stress in chicks of house sparrows (*Passer domesticus*). Within each nest (n =33) chicks were either subjected control or treatment. Stressing was done using a standardized bird stressing procedure, whereby the chicks were held in a bag for 30 minutes. Blood was extracted from the chicks at day 2, 6 and 10 after hatching to observe the effect of the treatments on telomere length. Results will be discussed in context of theory of life history.

Keywords: Life History Traits, Physiological Ecology, Evolutionary Ecology, Telomere, Body size

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## **Targeted Drug Delivery to Triple Negative Breast Cancer Cells**

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**Abstract:** Breast cancer is one of the most prevalent cancers and the second leading cause of death among women. The lack of sufficient oxygen (hypoxia) in solid tumors accelerates the progression of tumor growth, resistance to chemotherapy, and contributes to recurrence of disease. Due to the lack of tumor penetration, most of the chemotherapeutics are unable to reach the hypoxic niches of solid tumors. Targeted drug delivery is a promising approach for increasing the therapeutic efficacy of chemotherapeutic drugs. In this study, we synthesized amphiphilic copolymers to deliver and release chemotherapeutic drugs into solid tumors. These nanoparticles (polymersomes) are made out of a hypoxia-responsive azobenzene linker between polylactate and polyethylene glycol and are conjugated with a tissue penetrating peptide. They encapsulate doxorubicin as a chemotherapeutic agent to cancer cell nuclei. The doxorubicin-encapsulated, hypoxia-responsive polymersomes have an encapsulated efficiency of 48%. They substantially decreased the viability of hypoxic triple negative breast cancer cells in both monolayer and spheroidal cultures to 31% and 45% respectively. Due to the presence of hypoxia-responsive unit in these Polymersomes, they can be used to deliver anticancer drugs to the hypoxic regions of tumors. The results of this study will provide new directions in targeting triple negative breast cancer cells for overcoming the recurrence of disease in patients suffering from breast cancer.

Keywords: Drug delivery, Doxorubicin, Polymersome, Breast cancer

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## **A Modification to the SHA-1 to Circumvent Collision Attacks**

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**Abstract:** This work introduces an improved version of the SHA-1 hash algorithm. The proposed work produces a strengthened version of the SHA-1 using the fusion between SHA-1 and SHA-2 hash standards. This design helps to protect the SHA-1 against collision attack, which was exposed by different researchers. The fusion process is incorporated in the early steps of the SHA-1 using the function manipulators of the SHA-2 algorithm. Using the function manipulators of the SHA-2 yields to more randomness to the output hash value of the SHA-1. The proposed design is verified by the official test vectors that were confirmed by the National Institute of Standard and Technology. Moreover, the avalanche effect, hamming distance, and bit-hit properties were studied using different samples that were generated randomly. The fused SHA-1/SHA-2 design gives over 52 percent of avalanche effect and over 84 hamming distance, for all tested samples. The proposed design was tested against collision attack and produced unique hash values for real collided examples.

Keywords: Cryptography, SHA-1, hash algorithms, collision attack.

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## **The Effect of Accelerated Weathering on Flexibility, Adhesion, and Barrier Property On Epoxy Primer**

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**Abstract:** Traditional military vehicle and aircraft has consisted primarily of steel and aluminum alloys which due to their density, has resulted in various logistic problems including transportation, maneuverability, and fuel efficiency. These hinderance has led to a major increase in the incorporation of composites material into military equipment. As the use of these composite increases, multi-substrate coating systems that can provide adequate corrosion protection to metal components as well as superior adhesion and flexibility to the composites are needed. In 2012, the Department of Defense published MIL-DTL-53033E outlining specification of epoxy primer required for all military vehicles. An Experimental Commercial Epoxy (EC) primer, and the current bench mark formula for MIL-DTL-53033E, Approved Commercial Epoxy (AC) primer were weathered per ASTM-B117 and ASTM G-85 Prohesion. The effect of these accelerated weathering test on flexibility, adhesion, and barrier property of both the AC and EC primers were evaluated.

Keywords: Epoxy, Multi-substrate, Accelerated Weathering, Adhesion

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## **Development of a novel omega-6 fatty acid based treatment strategy for skin cancer by inhibiting delta-5-desaturase**

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**Abstract:** Our lab has recently validated that cyclooxygenase-2 (COX-2), overexpressed in majority of the cancers, can metabolize dihomo- $\gamma$ -linolenic acid (DGLA, a precursor of arachidonic acid) to 8-hydroxyoctanoic acid (8-HOA), an anti-cancer byproduct in delta-5-desaturase (D5D) enzyme (responsible for metabolism of DGLA to arachidonic acid) knock down condition. Based on this finding, we hypothesized that the strategy of providing DGLA in presence of D5D inhibitor can also elicit inhibitory effect on cancer growth and metastasis in one of the most commonly occurring cancer, Non Melanoma Skin Cancer (NMSC). Methods: Inhibitory effect of DGLA and SQ-1 (D5D inhibitor) on growth and metastasis was evaluated by colony

formation assay, FITC Annexin V/PI double staining assay by using A431, Human epidermal skin cancer cell line. Animal study was performed by injecting A431 cells in flank of the Nu/Nu mice. Results: Treatment with DGLA and SQ-1 was significantly able to inhibit growth in A431 through 8-HOA generation which produced anticancer effect by inhibiting histone deacetylase and down regulating anti-apoptotic proteins. Similarly, high levels of 8-HOA was observed in animals treated with DGLA and SQ-1, responsible for markedly reduction in tumor size. By western blot analysis, it was confirmed that anti-cancer effect was produced by downregulating anti-apoptotic protein such as caspase 3, 9 and PARP. Based on the result, we concluded that novel strategy of providing DGLA in presence of D5D inhibitor in NMSC is able to reduce tumor growth. The outcome of this research can guide us to develop new anti-cancer strategy and/or to improve current chemotherapy for cancer treatment.

Keywords: Non Melanoma Skin Cancer, Omega-6 unsaturated fatty acid, delta-5-desaturase  
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### **Surface and Living Mulches in Carrot Production**

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**Abstract:** Direct seeding into strip-tilled zones (STZ) of living mulches may require weed suppression tactics within the STZ. Biodegradable mulches (BM) applied in the STZ could suppress weeds and improve crop performance. Three BM treatments [hydromulch (HM), compost blanket (CB), and control (NO)] were applied on STZs seeded to carrot (*Daucus carota* L.) in five living mulches [red clover (*Trifolium pratense* L.), white clover (*Trifolium repens* L.), perennial ryegrass (*Lolium perenne* L.), weed-free check, and weedy check] to evaluate weed response, crop emergence, and crop yield. Weed counts and biomass were lower in surface mulch treatments than control, but no significant differences between HM and CB were observed. Differences in carrot emergence were site specific, with significantly greater emergence in CB (16 plants m<sup>-1</sup>) than in the control (6 plants m<sup>-1</sup>) in Fargo, ND and significantly lesser emergence than in the control in Absaraka, ND (15 plants m<sup>-1</sup> vs 35 plants m<sup>-1</sup> respectively). Surface mulches were not associated with yield differences but living mulch species were associated with a 59% to 98% yield reduction compared to weed-free check. No yield differences were observed among living mulches species. Adjusting living mulch management by mowing more regularly or expanding the width of the STZ may reduce yield loss. Further development of BM formulations, rates, and application techniques may improve crop performance and could be tailored to unique management challenges faced by vegetable growers.

Keywords: Biodegradable, weed suppression, organic, mulches, carrot  
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### **Sexuality Through Art: Body Mapping as a research tool**

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**Abstract:** Female teenagers in the Turkana pastoral community in Northern Kenya are born into a culture that has over the decades been rigged to change despite the efforts of the government and NGOs to intervene. Parents have predominantly decided whether their female infants would have an opportunity to go to school or live a traditional life and be prepared for marriage, a few months after their birth. With two distinct female population; perspectives on sexuality vary diversely. Menstruation was used as an approach to initiate talks into sexual health perspectives of the female adolescents. Incorporating body mapping as part of data collection broke through the communication barrier and taboo topic, making it inclusive for all the females. In groups of

fives each from a distinct group the females 13-18 years of age traced a figure of one of them on a paper, decorated, wrote on and painted it to depict their way of life. This was followed by a discussion centered around the symbols drawn by the females and their meanings. Visually engaging the female adolescents allowed the researcher to better contextualize the sometimes-challenging interviews about sexual issues within the community.

Body mapping provided room to improvise and create a comfortable environment for the teenagers to discuss sexuality a topic that is deemed a private affair in that part of the country. This method proves to be both a powerful complement to conducting traditional ethnographic research and an important method for social action.

Keywords: Sexuality, Body mapping, visual ethnography  
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### **Enhancement of Antifungal and Mycotoxin Inhibitory Activities of Food-grade Thyme Oil Nanoemulsions with Natural Emulsifiers**

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**Abstract:** Thyme oil-in-water nanoemulsions stabilized by three different sources of natural emulsifiers (bovine serum albumin, quillaja saponins, and soy lysolecithin) were prepared as potential natural antifungal agents. The thyme oil nanoemulsion containing bovine serum albumin or quillaja saponins with mean particle diameters < 200 nm showed high physical stability during 28 days' storage. The antifungal and mycotoxin inhibitory activities of thyme oil nanoemulsions stabilized with three natural emulsifiers against *Fusarium graminearum* isolates were then investigated. Mycelial growth, spore germination, and mycotoxin production results indicated that thyme oil prevailed the antifungal activity rather than emulsifier by altering mycelial and spore cell membrane integrity. The mycotoxin inhibitory efficacy of thyme oil was enhanced considerably in nanoemulsion form as compared to bulk oil. Among the three natural emulsifiers, bovine serum albumin stabilized thyme oil nanoemulsion exhibited higher mycotoxin inhibitory activity due to a joint function of thyme oil and emulsifier.

Keywords: Thyme oil, nanoemulsion, *Fusarium graminearum*, mycotoxin production.  
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### **Can Soil Microbial Activity be Improved with the use of Amendments?**

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**Abstract:** Soil microbial activity is crucial due to microbes regulation of biochemical processes and impact on nutrient dynamics. Low microbial activity and associated nutrient cycling are concerns in agricultural problem soils. The objectives of this study were to investigate the potential of soil amendments used for reclamation to elevate soil microbial activity, the influence of drying-rewetting cycles on microbial respiration under problem soils, and the shift in metabolic pulse and flux rate in response to the interaction between soil and amendment through drying-wetting events. Spent lime, propanics, and composted beef manure were applied at rates of 10, 2.5, and 10 tons per acre respectively to both a hydrocarbon contaminated soil treated with thermal desorption and a non-contaminated non-treated soil from Tioga ND as well as saline and non-saline soils from Grand Forks, ND to evaluate microbial response to organic amendments. In this laboratory study, CO<sub>2</sub> flux was measured from soils incubated in biochambers as a measure of microbial activity over three drying-rewetting cycles to simulate natural rainfall. N mineralization rates were determined for each incubation as well as changes in MBC and POXC. It is expected that organic amendments with higher N and labile C concentrations will have a greater

positive impact on microbial activity. Based on the Birch Effect, it is expected that a flush of CO<sub>2</sub> will be seen upon rewetting of dried soils with a smaller burst seen in each consecutive rewetting. Improved microbial activity is crucial to successful reclamation of problem soils and improving agricultural productivity.

Keywords: Microbial Activity, soil Amendments

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## **Targeted Nano Gene Delivery to Brain for the Treatment of Alzheimer's Disease**

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**Abstract:** Alzheimer's disease (AD) is a debilitating neurodegenerative disorder which currently has no cure. Apolipoprotein E4 (ApoE4) isoform has been found to be a major risk factor for AD, whereas ApoE2 isoform was found to have a protective role. Therefore, gene delivery of ApoE2 has enormous potential as a therapeutic strategy against AD. However, it is majorly limited by the presence of blood brain barrier (BBB). Lipid based nanoparticles called liposomes can function as novel gene delivery carriers to brain. These liposomes when surface modified with mannose and penetratin can target GLUT-1 transporter on BBB and aid in cell penetration, respectively. Therefore, liposomes modified with 4-aminophenyl  $\alpha$ -D-Mannopyranoside (MAN) and penetratin were prepared. These dual modified particles were characterized and cell viability assay was performed in bEnd3, primary glial cells and primary neuronal cells. Targeting efficiency of these liposomes was determined in all cell lines via uptake assay. Transfection efficacy was also assessed for pDNA encoding ApoE2 using ELISA. These nanoparticles were also assessed for their transporting and transfection ability through in-vitro BBB model. The conjugation efficiency of MAN and Pen was found to be ~35% and ~70%, respectively with particle size <200nm. Dual modified liposomes formed using 100nmoles of phospholipids were found to be biocompatible with bEnd3, primary glial cells, and primary neuronal cells. These liposomes showed higher uptake and transfection efficiency compared to unmodified, MAN-only and PEN-only modified liposomes in all cell lines and through in-vitro BBB model.

Keywords: Alzheimer's disease, Liposomes, gene delivery, ApolipoproteinE2, GLUT-1

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## **Probabilistic Finite Element Based Reliability Structural Analysis of Railways Trackbed Subgrade**

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**Abstract:** Railroad is very important component for the economic growth in United States. Railroad trackbed performance is generally evaluated using Finite element (FE) based programs. None of these programs consider variations in the variables involved in the calculations. These variations are, however, successfully modelled in probabilistic methods, which are not common to apply in these programs. Therefore, authors developed and validated a 3-dimensional FE and probability based numerical model and in this study, they investigated the performance of subgrade layer due to variations in the stiffness of granular layers (Ballast, Subballast and Subgrade). The influence of these factors is accounted for by changing their coefficients of variation (COV) while keeping their means at constant values. Gaussian normal distribution is assumed for all these variables. Probabilistic analysis results revealed that subgrade performance is most influenced by the variations in the subgrade modulus, followed by ballast and subballast modulus. The findings of this work is of particular significance in studying the subgrade performance due to environmental changes coupled with extreme loading

conditions, which might be caused due to any climatic event like flooding or due to regular rail operations. In addition, it also provides an additional tool to supplement the deterministic analysis procedures and decision making for railroad repair, maintenance and rehabilitation works.

**Keywords:** Finite Element analysis, Numerical modeling, Probabilistic methods, Risk and Reliability analysis, Subgrade

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## **Optimizing Process Parameters of Fused Deposition Modeling Process using a Multi-Objective Optimization Approach**

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**Abstract:** Fused Deposition Modeling (FDM) is an extrusion-based additive manufacturing (AM) technology that is often used to produce geometrically complex shaped parts from different types of thermoplastics. It is becoming popular as it can reduce product development time by producing prototypes within a short period of time. Applications for the FDM process are still limited in various industries due to low part characteristics (e.g. dimensional accuracy and mechanical properties) and build time constraints. Process parameters are known to have significant impacts on part characteristics and build time. Part characteristics can be improved by choosing an optimum combination of process parameters. However, the improvement of one-part characteristic may deteriorate other characteristics because of the combination for one-part characteristic may not be optimum combination for all part characteristics. To overcome this challenge, this work proposes a method to determine a set of combinations that is optimum for multiple part characteristics. The impacts of four (04) process parameters (layer thickness, extrusion temperature, build orientation and infill density) on compressive strength and build time are analyzed. To optimize compressive strength and build time simultaneously, based on experimental results, a multi-objective optimization problem is formulated and solved to assess the impacts of the process parameters on part characteristics. From a set of optimal solutions, a decision maker can make a better decision when multiple conflicting objectives present.

**Keywords:** Fused deposition modeling, process parameters, part characteristics, multi-objective optimization

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## **Economic, Cultural Beliefs and The Fate of Girls' Education in Tajikistan**

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**Abstract:** Tajikistan's economy is developing at a very slow rate, a rate that limits families' financial resources and thus limits the educational opportunities for girls that they can provide. However, the limitations on Tajik girls' education is due to more than economics: culture, religious and gender discrimination are critical factors as well. Therefore, this paper studies the girls' education condition in the period from 1995 to 2015 in the capital city, Dushanbe, which is the post war period. Tajikistan is a small country of 8 million. It is the only country that went through a civil war after the collapse of the Soviet Union, which negatively impacted all aspects of the country. One of those aspects has been education in Tajikistan. First, the condition of the education deteriorated. Second, the children were not involved at school. And third, the girls mostly did not finish the secondary school. The review seeks to answer why girls most likely choose family life (marriage and children) rather than pursuing higher education (gaining knowledge, becoming a field specialist, and an independent person) in their life. The review seeks to answer why girls most likely choose family life (marriage and children) rather than pursuing higher education (gaining knowledge, becoming a field specialist, and an independent person) in their life. In

order to study this issue, the study uses secondary data from the project “Oral History of Tajikistan” collected by the Academy of Organization for Security and Cooperation in Europe (OSCE) and the primary data collected by conducting in-depth interviews with the girls in Dushanbe city. This paper studies the economic, cultural, and religious factors that act as barriers to keep girls out of school while providing the context of the social and political changes that occurred during the mentioned period of time. By the end, it comes with the suggestions for resolving the issue of girls’ education.

Keywords: girls, education, factors, schools, Tajikistan

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## **Development of Novel Biocomposite Body Armor**

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**Abstract:** This novel research will study the effect of impregnating shear thickening fluids (STF) into flax fabric as a method of improved energy absorption from ballistic impact for body armor applications. Numerous studies have reported that impregnating a Kevlar, glass, or nylon fabric with a STF composed of a nanosilica/Polyethylene glycol suspension significantly increases the energy the material can absorb from a ballistic impact, in some cases by more than 600%, when compared to the non-impregnated fabric. STF’s display shear thickening behavior due to a large increases in viscosity at high shear rate loadings like ballistic projectile impacts. This shear thickening effect increases the impact energy absorbed by a fabric material primarily by increasing the inter-friction between yarns of the fabric, due to the high shear rate from impact causing a dramatic increase in the viscosity of the STF. STF suspensions are prepared by sonicating the nanosilica spherical particles (diameter of 15-20nm) in PEG (MW-200) for 30 minutes. The rheological properties of the STF were then measured with a rheometer. The impregnated fabric’s resistance to impact will be studied with both drop-tower impact tests and high velocity ballistic impact tests. The goal of this work is to study the effect of impregnating a woven flax fabric with a nanosilica/PEG suspension on the ballistic impact properties. Potentially a flax fiber impregnated with STF could result in a green body armor with comparable ballistic impact resistance to that of plain Kevlar fabric. The hybridization of flax fabric and Kevlar fabric impregnated with STF will also be investigated.

Keywords: Biocomposite, Shear Thickening Fluid,

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## **Modeling Charge Carrier Dynamics in Semiconductor Nanomaterials and Hetero-nanoclusters**

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**Abstract:** Recently quasi two-dimensional (2D) semiconductor materials composed of ordered arrays of quantum dots (QDs) have attracted special attention due to their better control over photoexcited process important for photovoltaic applications, including carrier multiplication and energy relaxation mediated by phonons. In particular, PbSe 2D nanoplates (NPLs) have been recently synthesized with precisely controllable thickness via halide precursors, where PbCl<sub>2</sub> moieties attached to the (111) and (110) surfaces of QDs form intra-particle bridges, leading to the growth of the (100) face-dominated NPLs.<sup>1</sup> While chlorine passivation is critical to the growth and thickness control of these NPLs, its role in photoexcited dynamics is still unclear. We study phonon-mediated dynamics in these 2 nm PbSe NPLs using DFT based non-adiabatic dynamics combined with simplified trajectory surface hopping method. The energy band gap of NPLs is at L symmetry point (~0.96 eV), where it is 1.36 eV at the  $\Gamma$ -point. Similar as in 2-nm PbSe QDs,<sup>2</sup> NPLs also show roughly symmetric valence and conduction band near the bandgap edge. Orbitals associated with Pb-Cl-Pb bridging contribute only deeper to the valence band. Consequently, bridging has a significant impact on the relaxation of hot holes. Our



calculations show that in the case of hot electron excitation, hole relaxation rate is faster than those of electrons, while both are almost the same in the symmetric excitation.

Keywords: Solar cell, Nanoplatelets, Hot carrier dynamics, computational modeling

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## **The Waco Siege as Case Study of Contested Public Spheres in Religio-Secular Communication**

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**Abstract:** This essay considers the nature of religio-secular discourse: specifically, what occurs when two groups with competing ideological values come into conflict with one another. This essay argues that through the development of a strong internal logical system of beliefs, members of a religious group become hardened in their value system and are rendered ineffective in communicating with individuals outside of the group's value system. This essay argues that the roots of religio-secular conflict can be found in the development of separate religious and secular spheres, and the difficulties in communication across these isolated spheres. The final negotiation transcript between David Koresh and the FBI during the Waco siege in 1993 is used as a case study of this religio-secular conflict. This essay posits an inverse relationship between internal identification and a sense of group culture and the ability of the group to communicate effectively with external groups or individuals.

Keywords: Religion, Communication, Secularism, Koresh, Cult

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## **Genome-Wide Association Study of Aggressiveness, DON Production And Spore Productivity In a Population of *Fusarium Graminearum* Collected From North Dakota**

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**Abstract:** *Fusarium* head blight (FHB) is a destructive disease of small grains caused predominantly by a haploid ascomycete fungus *Fusarium graminearum* in North America. To understand the genetics of quantitative traits in this fungal pathogen, we conducted a genome-wide association study (GWAS) of aggressiveness, DON production, and spore productivity using 251 *F. graminearum* isolates collected between 1981 and 2013 from North Dakota. Aggressiveness of the fungal isolates was evaluated on Alsen (with *Fhb1*) and Wheaton (susceptible) in two greenhouse seasons (2017 and 2018), and the disease severity ranging from 7-85% and 8-100% were recorded, respectively. DON content produced by the isolates on the inoculated spikes of Alsen ranged from 0.7 to 52.6 ppm. Spore productivity on mungbean agar also varied among the isolates. Genotyping of the isolates was done using two-enzyme genotyping-by-sequencing (GBS) method to generate 175311 SNPs among the isolates. SNP markers with more than 20% missing sites and the isolates with >90% identity by state were removed from the association analysis. GWAS indicated that 3 SNPs were significantly associated with mycotoxin production after Bonferroni correction. Two SNPs linked to mycotoxin production were mapped on genes *FGRAMPH1\_01G05859* on chromosome 1 and *FGRAMPH1\_01G12197* on chromosome 2, and third SNP was located upstream of gene *FGRAMPH1\_01G26687* each explaining approximately 31% of phenotypic variance. Identification of these novel genes involved in metabolic pathways of *F. graminearum* could help to develop new strategies for management of the disease.

Keywords: *Fusarium* head blight (FHB), genotyping by sequencing (GBS), GWAS

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## Can We Remove Vomitoxin From Wheat by Wet Milling?

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**Abstract:** Fusarium Head Blight (FHB) disease caused around \$1,554 million in revenue loss for wheat grown in North Dakota from 2000 to 2014. The reduction in wheat value is due to a decrease in quality and accumulation of mycotoxins. Furthermore, the water soluble Fusarium mycotoxin deoxynivalenol (DON), also known as vomitoxin, represents a health threat. Regarding processing, wheat is usually dry milled into flour (or farina), bran, and shorts. In contrast, wheat can be wet milled by using water and shear force to separate starch, protein, and water solubles. The research was conducted to determine the extent of DON removal from wheat dry milled fractions during wet milling. Hard red spring wheat (HRSW) samples contaminated with DON were dry milled. The dry milled fraction farina underwent three different bench-scale wet milling processes, which comprise consecutive gluten washing steps, and centrifugation to separate starch fraction from the water solubles. The residual water from the washings was freeze-dried. Determination of DON levels in every dry and wet milled fraction was performed by Gas Chromatography with Electron Capture Detection (GC-ECD). After wet milling farina, significant ( $P < 0.05$ ) differences were detected from the starch and gluten net yields and recoveries of the three studied wet milling processes. Regarding DON levels, the water soluble fraction contained 90% of the mycotoxin. This study indicates the three wet milling processes did not differ in their effectiveness in reducing or eliminating DON from wheat starch and gluten; thus, increasing the value of a low value raw material.

Keywords: Deoxynivalenol, dry milling, wet milling, starch, gluten

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## When Life Gives You Localized Charge Carriers, Make Light: Computational Modeling of Polaron Spectra and Photoluminescence Quantum Yield in a Lead Halide Perovskite Nanocrystal

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**Abstract:**  $\text{APbX}_3$  ( $\text{A}=\text{Cs}, \text{Methylammonium}\{\text{MA}\}$ ;  $\text{X}=\text{I}, \text{Br}, \text{Cl}$ ) lead halide perovskites (LHPs) of various morphology are of interest for opto-electronic devices, such as light-emitting diodes (LEDs) and PVs, due to the tuneability of photoluminescence (PL) across the visible spectrum and efficient PL quantum yields (PLQYs). An interesting property of these materials is in the photo-excited state the perovskite crystal lattice will reorganize around the photo-excited electron/photo-induced hole to spatially localize the charges (ie polaron formation). Generally, polaron formation reduces the efficiency of PV devices due to charges becoming 'trapped' which reduces PV efficiency. Instead of the 'trapped' charges being dissipated into heat we consider converting the 'trapped' polarons into a light emitter. In the bulk morphology of  $\text{MAPbI}_3$ , polaron formation is observed from time-resolved infrared (IR) absorption. Since absorption and emission are inverse processes it is possible that polarons in LHPs can be used as a source for IR emission with PLQY being determined by the kinetics of radiative ( $k_R$ ) and non-radiative ( $k_{NR}$ ) recombination. Here we use Density Functional Theory (DFT) to computational model polaron formation and electronic structure of polarons in a  $\text{CsPbBr}_3$  nanocrystal using Vienna ab Initio Software (VASP).  $k_R$  is found from calculating the Einstein coefficient for spontaneous emission.  $k_{NR}$  is found from calculating nonadiabatic couplings which allows to describe energy dissipation into heat using Redfield theory. Our calculations show that the lowest energy polaron optical transition is bright and shows promise for efficient PLQY. Implications of this work is towards developing efficient IR devices.

Keywords: Nanocrystals, Polarons, Infrared, Nonadiabatic Coupling, PLQY

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## Seeding Date Effects On Grain Sorghum Performance In North Dakota

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**Abstract:** Successful grain sorghum [*Sorghum bicolor* (L.) Moench] production requires proper selection for variety maturity and seeding date, especially in cooler, northern, short season regions such as North Dakota. The study objective was to evaluate early-maturing, high-yielding open-pollinated sorghum genotypes in seeding date studies at North Dakota locations to determine optimum crop performance. A RCBD split-plot study with seeding date and genotype as main and subplot, respectively, was conducted at Carrington and Prosper, ND, in 2018. Genotypes included two commercial hybrids and four open-pollinated genotypes previously screened from national germplasm sources from 2015 to 2017. Days to 50% anthesis were 9 to 10 and 5 to 8 days earlier for the open-pollinated genotypes than the hybrids at Carrington and Prosper, respectively. At Carrington yield was similar at seeding date 1 for all genotypes, but at seeding dates 2 and 3 yield was lower for the hybrids compared with the open-pollinated genotypes. At Prosper hybrid yield was reduced at seeding date 3 compared to dates 1 and 2 which produced similar yield. Open-pollinated genotype yield was constant across seeding dates at Prosper. Results indicate the open-pollinated genotypes are earlier maturing than the hybrid genotypes and maintain yield at later seeding dates whereas hybrid yield decreased as seeding date advanced especially at the cooler, northern, shorter season Carrington location. As seeding date advanced hybrid yield decrease was less dramatic at the warmer southern Prosper location where the earlier maturing open-pollinated genotypes yield was constant across seeding dates.

Keywords: grain sorghum, seeding date, early-maturing, cold-tolerance, high-yielding

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## A New Daily Semi-distributed Hydrologic Model for Depression Dominated Areas

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**Abstract:** Surface depressions increase the complexity of hydrologic connectivity in a hydrologic system. In traditional semi-distributed hydrologic models, it is commonly assumed that a watershed is well connected, and depressions are simply lumped as a parameter that needs to be calibrated. This simplified method may only be suitable for depressionless areas. The objective of this research is to quantify the impacts of depressions on hydrologic processes by considering the spatial connectivity of depressions and channels. To achieve this objective, a new daily semi-distributed hydrologic model (HYDROL-D) is developed to simulate precipitation-runoff processes in depression dominated areas. Instead of delineating a watershed into subbasins, HYDROL-D further delineates each subbasin into a main channel and a number of puddle-based units (PBUs) and channel-based units (CBUs). In addition, each PBU consists contributing area (CA) and ponding area (PA), and all CBUs are classified into off-stream CBUs (i.e., the CBUs that are not directly connected to the main channel) and on-stream CBUs (i.e., the CBUs that are directly linked to the main channel). HYDROL-D implements simulations for all PBUs, CBUs, and their connections. To test the performance of HYDROL-D, it was applied to a watershed in North Dakota and calibrated and validated by using the observed flow data. The results demonstrated that the new modeling framework was able to effectively account for the dynamic processes associated with surface depressions and the spatial connectivity of different PBUs and CBUs.

Keywords: Daily semi-distributed hydrologic model; Surface depressions; Watershed delineation; Precipitation-runoff

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## UAV-based plant-stand count, plant vigor, and spatial distribution mapping using ImageJ

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**Abstract:** Plant-stand count is one of the important measures to determine whether target plant population can be achieved by the end of growing season, evaluate the planter performance on seed placement and spacing, and obtain emergence characteristics of the planted seeds. Plant spacing variation in the field is also reported to have a significant effect in the final crop yield. Commonly performed method of field scouting for these is time-consuming, painstaking, involves skilled personnel, and only a small portion of the field is covered. Nowadays, unmanned aerial vehicle (UAV) technology is replacing the field scouting through UAV images, as they are quick, easy, and covers the entire field. Rather than counting manually from a UAV image, which is prone to error, automatic plant-stand counting algorithms were developed using image processing and commercial, expensive, proprietary software are available. In this research, an open source system-based, user-coded, customizable, multi-output ImageJ plugin was developed in Java to perform the plant-stand count and spatial distribution mapping from a UAV image using simple profile analysis methodology. The algorithm was developed using a UAV image of a sunflower field (91 m × 40 m). Different planting patterns and orientations were simulated from the UAV images and used for algorithm validation. The algorithm performed well with an overall accuracy of 95.4 % in all the simulated conditions regardless of planting pattern and row orientations. The algorithm can be potentially used for estimating plant-stand count in other crops (e.g., corn, soybean) at different growth stages.

Keywords: Algorithm development, Emergence, ImageJ, Plant-stand count, Profile analysis,

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## Hydrological, Chemical and Biological Connectivity Between Wetlands

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**Abstract:** Hydrological connectivity leads to chemical and biological exchange and migration, resulting in changes of composition of elements and species and consequently influences the biodiversity and stability of interconnected aquatic ecosystems. We investigated biological connectivity among four wetlands in the Xingkai Lake basin in China in 2013/14, and chemical connectivity between prairie pothole wetlands in the US using the multi-element fingerprinting approach in 2017/18. In China, increased nutrient concentrations occurred in those habitats connected to a eutrophic shallow lake, and hydrological connectivity increased phytoplankton community similarity among different waterbodies. In the US, most element (e.g. Na, Mg, As) concentrations of porewater and soil varied significantly by wetland hydrologic type and increased along a recharge to discharge hydrologic gradient. Element compositions in porewater and soil of interconnected wetlands were more similar to each other than to those of wetlands located farther away. Our findings confirmed the importance of hydrological connectivity for biodiversity and chemical composition between connected wetlands, and provide a scientific basis for wetland protection and management at the basin scale.

Keywords: wetland, connectivity, hydrology, lake

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## **Cube Satellite Systems: Innovative Tools for STEM Education**

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**Abstract:** In 2020, it is estimated that in the United States, 80% of the jobs will be in STEM fields. Many STEM students however, don't know how to apply the knowledge and skills they have learned from school. A CubeSat is considered a great engineering tool for STEM (Science, Technology, Engineering, and Mathematics) students. This is due to its simple design, low cost, and usage of open-source software and hardware tools. Universities implement different methods and concepts into their CubeSat projects depending on their desired mission. Some universities apply tools and models to enhance the design process of their CubeSats; others may provide workshops to their STEM students before developing the actual CubeSat. In general, university students from different disciplines divide up into small teams to work on designing and developing their CubeSat project. For example, aerospace students work on environmental analysis and control systems, mechanical students can work on the structures and layout mechanisms, Software students can test and develop software for data communication, and electrical students can design and test the electrical power subsystem (EPS). This paper focuses on the importance of CubeSat systems in STEM education, and lessons learned from universities' CubeSat projects designed by STEM students.

Keywords: CubeSats

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## **Low Cost Diabetes Breath Sensor Device Based on Nanostructured K2W7O22**

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**Abstract:** Acetone is an effective biomarker for diabetes, one of the leading diseases causing death in the United States. Comparing to other methods of diagnosis, breath analysis through the detection of acetone in breath has lot of merits such as non-invasive, accurate, convenient and inexpensive. A chemiresistive sensor based on novel nanostructured K2W7O22 has developed which can effectively detect the acetone gas at room temperature. Our preliminary results show an effective detection of acetone based on K2W7O22. The lowest detection limit can be reached up to 0.75 ppm (much lower than the threshold of concentration for diabetes, 1.7 ppm) with fast response only 12 s while relative humidity was around 6 %. Recently, we studied the influence of humidity on K2W7O22 sensing acetone and found high concentration of humidity can cause a fading of the sensing performance to acetone. In this case, with the improvements in material and device, we have solved the moisture problem. The sensor gains a stable sensitivity and much improved compatibility to high humidity. This makes the sensor device closer to being used for analyzing the exhaled breath of diabetics, which usually contains water vapor at a high concentration. Currently our main goal of this research is to make a portable device which can be accurately monitoring diabetic health condition with affordable price.

Keywords: Acetone, biomarker, K2W7O22, Nanostructure

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## **Melatonin Supplementation and Restricted Nutrition Do Not Affect Placental Lactogen Expression in Ovine Placenta**

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**Abstract:** Melatonin plays a role as a vasodilator, and it has been demonstrated to increase umbilical artery blood flow from day 60 to 110 of gestation in sheep. Previous studies have indicated that angiogenic and vasoactive factors are expressed by placental binucleate cells (BNC), and produce a factor, placental lactogen, known to impact fetal growth and mammary gland development. In this study, we hypothesized that melatonin supplementation and restricted nutrition from mid- to late-gestation would alter placental lactogen expression in placenta. At day 50 of gestation, ewes carrying singletons were randomly assigned to 2 × 2 factorial design and were fed either an adequate (ADQ; 100% NRC; n = 15) or restricted (RES; 60% NRC; n = 15) diet supplemented with 0 (CON, n=14) or 5 mg of melatonin (MEL; n = 16). Placental tissues were collected on day 130 of gestation and preserved for histology and western immunoblotting analyses. Melatonin supplementation and restricted nutrition did not affect BNC number ( $P > 0.5$ ), area and diameter ( $P = 0.12$ ), and placental lactogen protein expression ( $P > 0.5$ ). While we reject our hypothesis that melatonin supplementation and nutrient restriction would alter the placental lactogen expression in placentomes, we continue to evaluate if the BNC produce angiogenic or vasoactive factors that may influence placental and mammary gland functions in sheep.

**Keywords:** Binucleate cells, Melatonin, Placental lactogen, Pregnancy, Sheep

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## **How do Beany Flavor of Chickpea, Lentil, and Yellow Pea Change Following Germination?**

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**Abstract:** One of the continuing impediments to popularize pulses as gluten-free food ingredients are the distinct beany flavors. In this study, volatile component changes of germinated chickpea, lentil, and yellow pea flours over the course of 6 days germination were characterized by HS-SPME-GC-MS/O. In total, 124 volatile components were identified involving 19 odor active components being recorded by GC-O exclusively. Principal component analysis (PCA) and hierarchical cluster analysis (HCA) revealed that lentil and yellow pea flours had the similar aromatic attributes, while the decrease of beany flavor compounds along with the occurrence of unpleasant flavors was detected in chickpea flours upon germination. Six beany flavor markers, including hexanal, (E,E)-2,4-nonadienal, (E,E)-2,4-decadienal, 3-methyl-1-butanol, 1-hexanol, and 2-pentyl-furan, were employed to quantify beany flavor formation in the flours over the course of germination. The results suggested that no significant beany flavor formation or mitigation was appeared after 1 day of germination. Our results are crucial to further study the variation of combination between macronutrients and flavor compounds after germination. Easing the combination would make easier remove of beany flavor, which is anticipated to enlarge the application of pulse products

**Keywords:** Germination, pulse, germination, beany flavor

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## Effect of Soaking on Cooked Quality Of Commercial Semolina and Whole-Wheat Spaghetti

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**Abstract:** Sustainability has become an important strategy in food industry. Environmental impact is higher during the cooking phase in pasta life cycle. This experiment was conducted in view of reducing the cooking time and to determine the effect of soaking on cooked quality of commercial semolina and whole-wheat spaghetti. Commercial spaghetti samples were soaked for 15, 30, 45, 60, 75, 90, 105 and 120 min at room temperature. Soaked water was drained and collected. Then the soaked samples were cooked at 100°C for 2, 4 and 6 min. Soaked weight, soaking loss, soaked color, cooked weight, cooking loss, cooked firmness and cooked color was measured. The experimental design was a randomized complete block with a split plot arrangement. Cooking time of semolina spaghetti was reduced from 10 min to 4 min when it was presoaked for 120 min. When whole wheat spaghetti was presoaked for 90 min, the cooking time was reduced from 7 min to 2 min. When the soaking time increased, L\* value increased in semolina spaghetti and whole wheat spaghetti. When the soaked spaghetti samples were cooked, b\* value of semolina spaghetti and a\* value of whole wheat spaghetti increased significantly. After soaking for 45 min, the soaking loss became higher than the cooking loss for all the cooking times. As the soaking time increased, the firmness of the cooked spaghetti decreased for all the cooking times. The findings of this experiment will help greatly to reduce the cooking time of spaghetti at food services and households.

Keywords: Pasta, Sustainability

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## Urban Soil Taxonomy as it Relates to a Recreational Stormwater Detention Basin

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**Abstract:** Urban soils are soils that have been extensively altered through human activities and are unlike their natural counterparts. Currently, there is either minimal or non-existent knowledge on urban soil survey, taxonomy, and characteristics. However, with over 80% of the North America's population living within urban areas, there is a great need for urban soil data. As of 2005, 0.9% of North America was classified as developed land. This relatively low number has great impacts on human health and environmental quality due to its close proximity to the population. Currently, the rate of urbanization for North America is estimated to increase 0.98% between 2015 and 2020. Due to the rapid increase of urbanization and a majority of the population living in these areas, urban soil taxonomy is essential. The objectives of this study were to determine the urban soil taxonomy in an urban, recreational stormwater detention basin within the city of Fargo, ND. Soil cores were obtained inside and outside the basin and described using traditional US soil survey field and laboratory methods and compared to their corresponding taxonomy based on Drs. John Galbraith (Virginia Tech.) and Richard Shaw's (New Jersey State Soil Scientist) urban soil taxonomy proposal. Results show that traditional soil survey descriptions do not fit the urban soil taxonomy. Understanding urban soil taxonomy will give insight for how recreational, stormwater detention basins impact taxonomy in the future and allow for the improvement of urban soil taxonomy.

Keywords: Soil, taxonomy, stormwater

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## Effect of kisspeptin on the intracellular calcium regulation in asthmatic human airway smooth muscle cells

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**Abstract:** The pathophysiology of asthma involves inflammation and altered structure and function of airway smooth muscle (ASM). Notably, prepubertal boys are more likely to have asthma, while post-pubertal women show more asthma that decreases during postmenopausal years. Here, the role of sex steroids especially, estrogen and progesterone in asthma appears paradoxical and still under investigation. Kisspeptins (KISS1) were originally identified as a key protein that regulates GnRH controlling sexual differentiation and puberty onset and bind to their receptor (KISS1R), involved in the inhibition of proliferation and remodeling in multiple cell types. Considering this, we hypothesize a major role of KISS1 and KISS1R signaling in asthma with respect to gender. Primary human ASM cells were cultured in DMEM-F12. Cells serum deprived for 72 hours were followed by western analysis, qPCR and immunofluorescence [Lionheart FX (Biotek Imager)] analysis. KISS1R agonist metastatin treated ASM cells were imaged to assess intracellular calcium ( $[Ca^{2+}]_i$ ) responses using Olympus FV300 Fluorescence microscope. Our novel findings indicate the altered expression and function of KISS1 and KISS1R in human ASM cells. Interestingly, there is a significant difference in the expression levels of KISS1 and KISS1R between the genders with females showing lower expression at a basal level. Furthermore, our studies show decreased expression of KISS1 and increased expression of KISS1R in asthmatic compared to non-asthmatic ASM cells. Our functional studies showed that metastatin was effective in reducing  $[Ca^{2+}]_i$  responses in non-asthmatic and asthmatic ASM cells. This effect was found to be significantly more in asthmatic ASM cells.

Keywords: Kisspeptin, Airway smooth muscle cells, Asthma, Inflammation, Intracellular Calcium

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## Label Free MicroRNA Biomarker Detection in Serum Samples for Potential Diagnosis Applications at Point-Of Care

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**Abstract:** Biomarker testing is the first step toward diagnosis of many diseases including cancer, cardiovascular and infections. Among traditional circulating biomarkers such as protein, DNA and RNA, microRNAs (miRNAs) could be used to accurately map the disease related biological changes at tissue, organ or cellular level. For example, during the tumor development, cell-free miRNA is released into the blood stream by cancer specific cells at the very early stages of the disease, in the concentrations that in the range from femto to atto molar. These miRNA molecules can be used as biomarkers for diagnosis and develop treatments. Quantitative Real-time Polymerase Chain Reaction (qRT-PCR) is the gold-standard when it comes to miRNA detection. Studies have reported that RT-qPCR can detect miRNA molecules up to few pM. However, this limit of detection is generally insufficient for detecting early stage of disease development. In addition, RT-qPCR assays are expensive and time consuming to perform. To accommodate this critical need in diagnosis, we present a novel approach where we have integrated microscale electrode design and dielectrophoresis to accurately detecting miRNAs in human serum or blood at point of care settings. Moreover, we have utilized electrical impedance between interdigitated electrodes as the measure of miRNA quantity in the sample; we have found that electrical impedance is proportional to the miRNA quantity in the sample. This method can be used in clinics with low cost and high throughput to detect the target miRNA levels from patients.

Keywords: Label free, microRNA, biomarker, dielectrophoresis, impedance

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## Factors Affecting Hydration and Bleaching of Durum Wheat Grain

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**Abstract:** Grain bleaching is a bran discoloration that happens when grain is exposed to damp conditions during harvest. Bleaching is a concern for durum producers since grain price declines. This research was conducted to evaluate the hydration of the durum wheat grain (*Triticum turgidum* L. ssp. durum [Desf.] Husn.) as affected by the temperature and consecutive wet/dry cycles and their effect on grain quality parameters related to bleaching. Two experiments were conducted using bulk durum grain samples. The first experiment consisted of two temperatures and twenty soaking times (from 0 to 30 min). The second experiment consisted of four wet/dry cycles and seven soaking times (From 0 to 6 hr). Results showed that grain hydration based on weight gain % was significantly different ( $P < 0.05$ ) between the evaluated interactions of temperature and wet/dry cycles. There was an increase in hydration at 360 seconds which might be related to the responses of some of the quality parameters. A multiple regression analysis showed that most of the changes in water gain were due to soaking time with a small increased corresponded to temperature or cycles ( $R^2 = 0.97$  and  $0.98$ , respectively). Color parameters, CIE  $L^*$ ,  $a^*$ , and  $b^*$ , test weight, vitreousness, and falling number were significantly different for the wet/dry cycles  $\times$  soaking time interaction. Whereas, the temperature did not show any other significant interaction. In conclusion, higher temperature and subsequent wet/dry cycles did cause an increased in the grain absorbed water and a decline in the majority of the tested grain quality parameters.

Keywords: Grain bleaching, grain hydration, grain quality, temperature, wet/dry cycles

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## Tissue-Engineered Interlocking Scaffold Blocks for Regeneration Of Bone Defects

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**Abstract:** Current use of autografts, allografts, or metallic/ceramic-based implantation exhibit limitations with regards to availability, increased risk of infection, donor site morbidity, and insufficient transplant integration. To overcome the drawbacks mentioned above, we developed BMP-2 & 7 coated PCL/in situ HAPclay interlocking scaffold blocks system that can accelerate the healing of the critical size bone defect. In brief, PCL/in situ HAPclay interlocking scaffold blocks were prepared using designed mold and freeze drying. Mesenchymal stem cells and osteoblasts cells were seeded on each interlocking scaffold at 1:1 ratio. Uncoated scaffolds were used as the control throughout the experiment. Cell viability (WST-1), Alkaline Phosphatase (ALP) assay, Alizarin Red S staining, immunocytochemistry, and FTIR spectroscopy were performed on scaffold constructs at days 3, 5 and 7. WST-1 assay results indicated that the addition of BMP-2 and BMP-7 and interlocking structure enhanced cell viability. Alizarin Red S stained scaffold with BMP-2 & -7 showed greater ECM formation compared to uncoated ones. Intracellular ALP levels were found to be increased when scaffolds coated with BMP-2 & -7 seeded with MSCs and osteoblasts, suggesting that BMP-2 & -7 and co-culture stimulated osteogenic differentiation of MSCs. Also, immunocytochemistry results showed the formation of defined fibril-like collagen in BMP-2 & -7 coated scaffolds at days 7. FTIR spectra showed a significant band shift in the range of  $1150$  to  $960\text{ cm}^{-1}$ , suggesting increased RNA expression of bone-related proteins. Taken together, results suggest that a novel BMPs coated interlocking scaffold has developed for bone tissue engineering applications.

Keywords: bone regeneration, critical bone defect, BMPs

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## Impact of Social Media on Health

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**Abstract:** The main objective of the project is to research the effects of social media on health communication on patients in a bid to enhance health promotion and disease prevention. Social media being a huge tool which brings a new dimension to health care as it offers a medium to be used by the general public, patients, and health professionals to communicate health issues, prevention and ways to minimize multiple hospital visits. Social media provides a cheaper means of communication which is easily accessible and easy to use among the users. Social media use in disseminating health information to patients can offer both positive and negative effects hence the need for verification and validity of the data being shared. New technologies can provide patients with general information about health prevention and at the same time achieve health promotion. The main objective of the study is to measure the effects of social media and the intentions of the patients in using social media platforms to curb diseases outbreak and increase. The data collection will be quantitative in the form of a survey. The number of participants will be 100 composed of an equal number of men and women will be recruited from North Dakota State University undergraduate students. Using the quantitative research tool will broaden the research to get a better understanding of the social media impact on the health care industry.

Keywords: Health, Objective Survey, Social Media, Impact

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## **GSC Events 2018-19**

Event: Ice-cream social event  
Date: Tuesday, July 31, 2018

Event: Fall orientation – welcoming incoming graduate students  
Date: Monday, August 20, 2018

Event: Managing Stress and Thriving as a Graduate Student  
Date: Wednesday, September 12, 2018  
Speakers: Amanda Brooks (Assistant Professor, Pharmaceutical Sciences), Benjamin Braaten (Chair, Electrical Engineering), Justin Walden (Assistant Professor, Communications), John Repko (Student, Computer Science), Shrinidh Joshi (Student, Pharmaceutical Sciences)

Event: Advisor-Advisee Relationship: Expectations and Balances  
Date: Thursday, October 11, 2018  
Speakers: Tim Grieves (Assistant Professor, Biological Sciences), Elizabeth Blodgett Salafia (Associate Professor, Human Development and Family Science) and Ashley Bagget (Assistant Professor, Social Science)

Event: Graduate Fellowships and Scholarship: Resources and Pathways  
Date: Wednesday, November 14, 2018  
Speakers: Enrico Sassi (Director, Center for Writers, Scarlet Gray Bernard (Grant Writing Consultant), Marvin Ssemadaali (ND EPSCoR Fellowship Awardee), & Ashleigh Petts (NDSU Doctoral Dissertation Fellowship Awardee)

Event: Photoshoot event towards fundraising for GSC symposium  
Date: Thursday, December 13, 2018

Event: Spring orientation – welcoming incoming graduate students  
Date: Monday, January 7, 2019

Event: En route – Graduates: Academic/ Industrial Job Positions  
Date: Tuesday, January 22, 2019  
Speakers: Angela Bachman (Academic Coordinator, Office of Provost), Kelly Rusch (Director ND EPSCoR), Nicole Askew (NDSU Campus Activities), & Venkata Shravan Kumar (Aldevron)

Event: Networking: How to build professional connections  
Date: Tuesday, February 12, 2019  
Speakers: Olivia Scott (Senior Career Coach at the Career Center), Matt Skoy (Director of Student Activities), Dr. Zoltan Majdik (Director of Graduate Studies in the Department of Communication)

Event: Sharpening Presentation Skills: Poster and Podium  
Date: Wednesday, March 20, 2019  
Speakers: Dr. Carrie Anne Platt (Associate Professor, Department of Communication), Steve Beckerman (Assistant Manager, Learning & Applied Innovation), & Elisabeth Wilson (Master's student, Biological Science, Winner of 3 minutes thesis competition)

Event: 3<sup>rd</sup> Annual GSC Research Symposium  
Date: Wednesday, April 3, 2019

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7. The Office of Teaching and Learning, NDSU
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