

PROCEEDINGS OF THE 133RD
ANNUAL MEETING
OF THE
IOWA ACADEMY OF SCIENCE



April 21—22, 2023
University of Northern Iowa
Cedar Falls, Iowa

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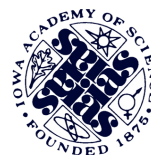
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Basic Materials Company (Geology Field Trip)

IJAS Symposium & Other Special Recognition

Ernie Schiller, IJAS Science Symposium Coordinator
Larry Stone, IAS Bookstore



The Iowa Academy of Science is supported by its members, volunteers, sponsors, donors, event participation, and the University of Northern Iowa. Please thank UNI for providing office space, access to facilities, services, and other benefits IAS receives from our partnership with UNI. IAS offers

Welcome to the 133rd Iowa Academy of Science Annual Meeting. The Academy is excited to welcome you back after a three year hiatus during the COVID pandemic. We hope you enjoy getting back together with your colleagues and friends from across Iowa.

The Iowa Academy of Science has supported science research, science education, the public understanding of science, and awarded excellence in these endeavors since its founding in 1875. As you can see, this meeting is smaller than usual but it is time to move forward. The Academy is devoted to bringing together scientists, science educators, and science students through the only general science organization of its kind in the Iowa. Please attend the business meeting Friday afternoon to learn more about the Academy and its challenges and opportunities.

There are numerous opportunities for everyone interested in science to participate in science building activities through IAS. If you would like to get involved contact the IAS office or any member of the Board of Directors.



Committees and Sections

<p>Committee on Committees and Elections Chair Open Open Open Open Open Open</p> <p>Conservation and Preserves Chair Open Open Open Open Open Open</p> <p>Finance Chair Open Open Open Open Open</p> <p>Iowa Science Foundation Chair Open Open Open Open Open</p> <p>Membership Chair Open Open Open Open Open</p>

<p>Membership continued... Open</p> <p>Recognition and Awards Chair Open Open Open Open Open Open</p> <p>Societal Issues Chair Open Open Open Open Open Open</p> <p>Student Programs Committee Chair: Open Open Open Open Open Ex-officio non-voting:</p> <p>Section Chairs, Vice Chairs</p> <p>Anthropology Open</p> <p>Cell, Molecular, & Microbiology Open</p> <p>Chemistry Open</p> <p>Community College Biologists Open</p>
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<p>Ecology & Conservation Open</p> <p>Engineering Open</p> <p>Environmental Science & Health Open</p> <p>Geology Open</p> <p>Iowa Science Teaching Chair: Alicia D. Schiller Haynes Vice Chair: Past Chair: Jacqueline Easter Secretary: De Etta Anderson</p> <p>Organismal Biology Open</p> <p>Physics, Atmospheric & Space Sciences Open</p> <p>Physiology & Health Sciences Open</p> <p>Excellence in Science Teaching Awards (ESTA) Chair: Tom Ervin Chair appointed members: DeEtta Anderson Janet Dunkel Doug Herman Mary Lestina Morgan Masters Trai Maxted Kathy Megivern Ernie Schiller Gale Vermeulen Jeff Weld Mike Zeller</p> <p>Myrle Burk Scholarship Committee Neil Bernstein Lyn Countryman Dennis Schlicht</p>
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Thank you for participating in the 133rd Annual Meeting of the Iowa Academy of Science.

The Iowa Academy of Science is established to further scientific research and its dissemination, education in the sciences, public understanding of science, and recognition of excellence in these endeavors.

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Iowa Academy of Science



www.scienceiniowa.org

FRIDAY SCHEDULE

Registration Desk

The registration desk is located in West Towers Lounge which is in the Towers Center.

Time	Events	Location
7:30-8:30 a.m.	IJAS Registration Open	West Towers Lounge, Towers Center
8:00-8:30 a.m.	Judges Meeting	Maucker Union: University Room
8:00-5:45 p.m.	IAS Registration Open	West Towers Lounge, Towers Center
8:30-10:45 a.m.	IJAS Oral Presentations	See Section Meeting Rooms
8:30—10:45 a.m.	IJAS Poster Viewing	West Towers Lounge, Towers Center
10:45—11:00 a.m.	Break	
11:00– Noon	Lunch	Rialto Dining Center, Towers Center
Noon—12:55 p.m.	General Session I	West Towers Lounge, Towers Center
1:00 - 1:30 p.m.	IJAS Awards Ceremony	West Towers Lounge, Towers Center
1:30 - 2:15 p.m.	Business Meeting	West Towers Lounge, Towers Center
1:30 - 2:15 p.m.	IJAS Poster Removal	West Towers Lounge, Towers Center
2:30—4:00 p.m.	Symposium A	West Towers Lounge, Towers Center
2:30—4:00 p.m.	Symposium B	Seerley 115
2:30—3:30 p.m.	Senior Poster Set-up	East Towers Lounge, Towers Center
4:00—5:30 p.m.	Senior Poster Session/Social	East Towers Lounge, Towers Center
5:15—6:15 p.m.	Dinner	Rialto Dining Center, Towers Center
6:30—8:00 p.m.	General Session II	West Towers Lounge, Towers Center
8:00—8:30 p.m.	ESTA Awards	West Towers Lounge, Towers Center

SATURDAY SCHEDULE

West Towers Lounge, Towers Lounge
McCullum Science Hall
Tour and Field Trip

Time	Events	Location
7:30— 2:30 p.m.	Registration Desk Open	West Towers Lounge, Towers Center
8:30 —11:00 a.m.	Oral Presentations	See Addendum
9:00 -10:00 a.m.	Dementia House Tour	Pre-registration Required
10:00 —11:00 a.m.	Dementia House Tour	Pre-registration Required
10:00—11:00 a.m.	General Session III	West Towers Lounge, Towers Center
Noon — 2:30 p.m.	Geology Field Trip	West Towers Lounge, Towers Center
11:00—12:30 p.m.	Lunch	Rialto Dining Center
12:45—2:00 p.m.	Section Meetings if needed	See Addendum
2:00 p.m.	Section meetings end conference	

IAS GENERAL SESSIONS

General Session I, Noon — 12:55 p.m., West Towers Lounge, Towers Center



Astrobiology Underground

With Dr. Joshua Sebree
Associate Professor, Astrochemistry
University of Northern Iowa



Learn more at www.scienceiniowa.org/invited-speakers.

General Session II, 6:30 p.m. — 8:00 p.m., West Towers Lounge

UNI Aldo Leopold Distinguished Lecture Tending Iowa's Land: An Evening of Discussion about Iowa's Lost Biodiver-



Dr. Thomas
Rosburg
Drake University



Dr. Jim Pease
Emeritus - Iowa
State University



Dr. Elizabeth Lynch
Luther College



Pauline Drobney
U.S. Fish & Wildlife
Service—Retired

Learn more at www.scienceiniowa.org/invited-speakers.

General Session III, 10:00 a.m. — 11:00 a.m. West Towers Lounge



Santos and Sophia the Virtual Soldiers

with
Dr. Kareem Abdel Malek
Director, Iowa Technology Institute
University of Iowa
Iowa City



Learn more at www.scienceiniowa.org/invited-speakers.

IAS FRIDAY AFTERNOON SYMPOSIA

Friday Evening, ESTA Awards will be presented following General Session II

Symposium A, Friday 2:30—4:00 p.m. , West Towers Lounge, Towers Center

Working Toward Sustainable Campuses

Alicia Rosburg - UNI Associate Prof. of Economics
Gowri Betrabet Gulwadi - UNI Professor of Interior Design
Eric O'Brien - UNI Sustainability Coordinator
Chad Heinzl - Speaker and Coordinator

Universities and communities across our planet are working to address sustainability concerns while continuing to maximize our civilization's potential. Sustainability is a comprehensive word representing how interdisciplinary complex systems react to one another. This symposium provides an opportunity to engage our community's evolving efforts toward sustainability. We will begin with short talks that provide historical, economic, social, environmental, design and infrastructure perspectives. The second half of the symposium will launch into a collaborative/best-practices discussion for an effective pathway forward.

Symposium B, Friday 2:30—4:00 p.m. , Seerley Hall 115

The Use of Syndavers in A&P Labs at UNI



Dr. William Henninger
Director, School of Applied
Human Sciences
University of Northern Iowa

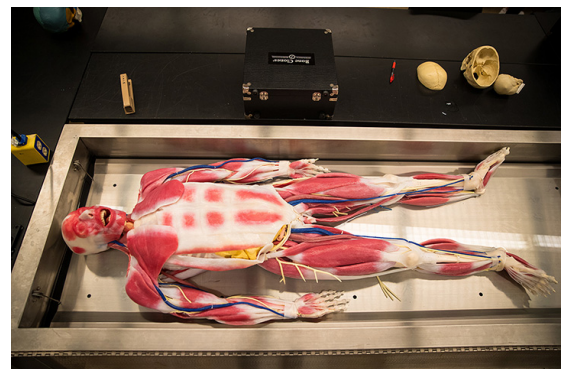


Dr. Nathan Bird
Associate Professor, Biology
University of Northern Iowa

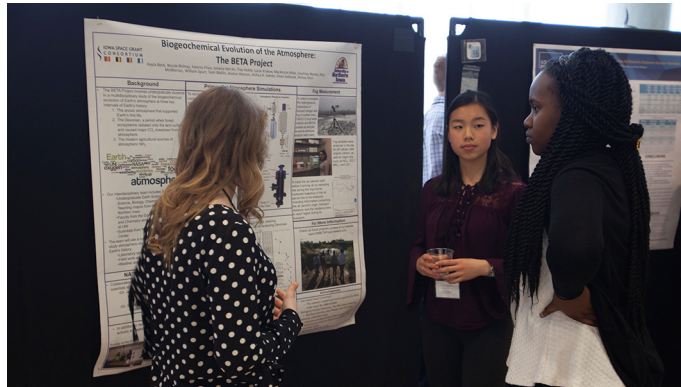


Dr. Laura Pitts
Speech-Language Pathology
University of Northern Iowa

In this presentation, I will discuss the history and use of Syndavers at UNI Biology. Our Syndavers are a cutting-edge addition that bridges the needs for hands-on learning, realism, ease of maintenance, and limited waste. Since their arrival in 2015, we have embraced our Syndavers as a critical and indispensable component to both how we structure Anatomy and Physiology 1 (BIOL 3101) laboratories and how we approach teaching anatomy to our students. Optimal for undergraduate-level anatomy across many majors, Syndavers have helped us maintain hands-on learning without the drawbacks or complications of virtual or cadaver-based alternative approaches. Assessment scores have increased relative to cat-based dissection, and the students love using them to learn!



FRIDAY AFTERNOON IAS POSTER SESSION



Join fellow attendees and review poster presentations by faculty, graduate, and undergraduate students. Discuss the events of the day with science enthusiasts from across the state of Iowa.

CONFERENCE MEALS

If you pre-purchased meals on the IAS registration form your badge will be your meal ticket. You may also purchase meal with a Credit or Debit card. Cash will not be accepted.

2023 EXCELLENCE IN SCIENCE TEACHING AWARDS

Kean Roberts, Ames Middle School, for Earth/Space/Environmental Science

Andrea Harms, Iowa City West High School, Life Science

Isaiah Kent-Schneider, Carlisle Middle School, STEM Middle School Science

Dr. Jesse Wilcox, University of Northern Iowa, Science Supervisory

IAS OPPORTUNITIES

Iowa Academy of Science Distinguished Awards

Nominations are due the first Friday in February

The contributions of Iowa's Scientific Community have transformed our world view, protected our natural heritage and fostered succeeding generations of eager science researchers. In recognition of the best contributions of Iowans to science research, science education, and service to science, the Iowa Academy of Science established the Distinguished Science Awards Program in 1980. Nominators and nominees do not need to be members of the Iowa Academy of Science. Visit www.scienceiniowa.org/awards to make your nominations.

Volunteer to Advance Science in Iowa

Here are a few examples of how the Iowa Academy of Science provides opportunities for members to advance science in Iowa.

- Volunteer on committees
- Seeking elected office on the Board of Directors
- Volunteering to review Iowa Science Foundation proposals
- Volunteering to review Junior Academy STARR Grant Research submissions
- Serving as a reviewer or Associate Editor for the Journal of the Iowa Academy of Science
- Speaking to the public as part of the IAS Speaker Series at Saylorville
- Volunteering to lend expertise to IAS programs
- Serving as a Junior Academy judge
- Volunteering as IAS sponsored conferences
- Serving as a mentor to Iowa students
- Submitting an article to the Journal of the Iowa Academy of Science
- Promoting membership in the Academy to colleagues, institutions, and businesses

Learn about more...

www.scienceiniowa.org

or contact the IAS office

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The Iowa Academy of Science promotes science research, science education, the public understanding of science, and recognizes excellence in these endeavors.

Publish in the Journal of the Iowa Academy of Science

- Accepting research manuscripts for peer-review, general interest articles, and perspectives
- Articles with minimal changes are published within approximately four months of submission
- Visible through EBSCO and cross-referenced by CrossRef

Current and past issues included in your IAS membership

Learn more at: www.scienceiniowa.org/iasjournal

IJAS PROGRAM SCHEDULE - FRIDAY

IJAS students should remove posters by 3:00 p.m.

Time	Event	Location
7:30 - 8:30 a.m.	IJAS Registration	West Towers Lounge, Towers Center
7:30 — 8:30 a.m.	Poster set up	West Towers Lounge, Towers Center
8:00 a.m.	Judges Meeting	Maucker Union University Room
8:30 — 10:45 a.m.	IJAS Poster Viewing	West Towers Lounge, Towers Center
8:30 — 10:45 a.m.	IJAS Oral Presentation/Judging	See Room Schedule below
11:00—Noon	Lunch	Rialto Dining Center, Towers Center
Noon—12:55 p.m.	General Session I	West Towers Lounge, Towers Center
1:00—1:30 p.m.	IJAS Awards Ceremony	West Towers Lounge, Towers Center
1:30—2:15 p.m.	IAS Business Meeting	West Towers Lounge, Towers Center
2:30 p.m.	IJAS students may attend IAS Symposiums	See schedule on page

Room-Maucher Union: College Eye IJAS Oral Presentations

8:00	Halle	Hoefing
8:15	Emma	Bell
8:30	Nick	Menke
8:45	Jack	Ragar
9:00	Break	
9:15	Zane	Houtz
9:30	Madisyn	Griffin
9:45	Brooklyn	Forsythe
	Room-Maucher Union: Oak	
8:00	Morgan	Krogmeier
8:15	Kevin	Du
8:30	Elizabeth	Griffin
8:45	Chase	Menke
9:00	Break	
9:15	Emma	Menke
9:30	Ellie	Hellman
9:45	Brooklyn	Todd
	Room-Maucher Union: Presidential	
8:00	Louis Dew	
8:15	Cedric Liu	Team member: Philip John Even
8:30	Maysa	Hamilton
8:45	Alivia Cook	Team member?: Emma Bell (10)?
9:00	Break	
9:15	Mallory	Team member? Wills-Howe
9:45	Sidney	Gruntmeir
9:45	Khlee	Bechman

IJAS RESEARCH PRESENTATIONS

2023 IJAS Research Projects

1. Sporting Your Drink

Jack Ragar

Grade 6

Through the use of the hydrometer, I measured the density of each liquid. When compared to water, a liquid that is more dense shows there are molecules dissolved in the liquid. In my experiment, 7up was the most dense, when compared to water. This was followed by Gatorade. The increased density in these cases shows these liquids have more sugar present than water. The Alkaline Water, from Body Armor and Propel, did not show much of a difference when compared to water. The minimal difference in density shows there is not much sugar added to the Alkaline Water nor the Propel.

2. Studies of the Heartbeat of Daphnia magna

Zane Houtz

Grade 6

I tested Daphnia magna and the changing heart rate by testing it with different substances and different pH of rain to see how the heart rate might be affected. It was a very interesting set of data I collected and it will be interesting if we can use this to relate to larger animals and maybe even humans.

3. Growing Plants vs Acid Rain

Madisyn Griffin

Grade 6

My project is to see if seeds and plants will grow with acid rain instead of water. The seeds that I used were corn and soybeans. I had 2 parts to my project, one growing seeds in Petri plates and one where I grew a different set of seeds and grew them in pots with potting soil. I had six tests, three of corn and three of soybeans. Each of the tests had five seeds in each pot, I water one pot of each with distilled water, acid rain 5.2, and acid rain 6.0. I tested to see if plants would react to the different types of acid rain. My results were that the corn grew more than the soybeans. The soybeans that were watered with acid rain started to die.

4. Sight vs Sound

Brooklyn Forsythe

Grade 6

My project is about testing memory. In my project I tested 12 people to see if they remembered more words by seeing them or hearing them. I had 6 lists of 10 words, 3 were sound lists and the other 3 were sight lists. Each person had 30 seconds to

hear or see the list. I recorded the sound words on voice memos and they are 30 seconds long so the times are even. After 30 seconds I next set a timer for 1 minute and the test subject said any words they remembered. As they were saying the words they remembered, I recorded which ones they remembered. I repeated this for each list on all of the people. Last, I took my data and made my graphs to see if my hypothesis was correct.

5. Comparing the Growth Rates of Algae

Chase Menke

Grade 7

Comparing the Growth Rates of Algae This is my project The Growth Of Algae. My hypothesis was I thought the test tubes with the most fertilizer will grow the most algae. I think there will be a direct correlation between the amount of algae growth compared to the amount of fertilizer introduced into the tubes and (LGC). My procedure included growing algae in experimental test tubes and then adding different amounts of fertilizer to simulate fertilizer run-off from agricultural fields into waterways and into ponds and lakes. I repeated the tests 5 different times using a Spectrophotometer to calculate how many algae were growing under each tested condition. Yes, my hypothesis was proven correct. The more fertilizer available the algae, the faster the algae. My project was very fun to do and I learned a lot from it. I hope to utilize this information to calculate exactly how much fertilizer run-off will create an algal bloom.

6. A Green Energy Resource - Using Water

Emma Menke

Grade 7

I store and create energy during this project. I wanted to do this because I heard of countries struggling with their CO2 emissions. I first got the idea of doing this through my dad who helped me throughout the project. My hypothesis is I believe green energy and energy storage is the future of energy. I believe I will be able to power a light bulb and furthermore prove that I can store energy using water. Some of the materials I used were 10 feet pvc pipe, tape, a hose, generator, and so much more. I first started by building the base which consisted of a valve, generator, and a place to connect the hose. I tested how long we would have power and for 50 feet of water I got 100 seconds of power and for 25 feet of water I got 50 seconds of power which proves in this experiment height matters not width. Finally, I was able to conclude that I can create and Store Energy using water. I hope that we could put these on water towers and provide power to hospitals during bad black-outs and prevent episodes like the Texas power outage of 2021.

7. Water pH

Morgan Krogmeier

Grade 7

I have been working on this project to prove or disprove whether companies are honest in the way they market the pH on the waters. I did this because I wondered how the pH is determined and why it matters. In all of my charts they are ordered from the lowest marketed pH to the highest marketed pH. Ph matters because it is unhealthy to drink water that has a pH high pH 12.5-14 and low pH 6.5-4. I tested and found out few companies are honest about the pH in their waters. The companies that actually have very alkaline or base water actually don't advertise them as alkaline. They are all safe so it is not necessary to test it on your own but it is a fun and easy experiment. This is important to the public because it is unhealthy to consume water above or below a certain pH. The pH has to be above 6.5 and below 12.5. The brands I used were common brands like core and Fiji. This means it is likely that you have drunk them before. I tested them using the test strips pictured in other places on my board. This is a safe project that you could do for a small sum of money. I hope you enjoy it.

Effectiveness of Cleaners on Bacterial Growth

Elizabeth Griffin

Grade 8

My project investigates which cleaning wipes will eliminate germs and bacteria the most effectively. I used Clorox wipes, Hand sanitizer wipes and Citrus disinfectant wipes on a paper towel. I predict that the Clorox wipes will work the best because Clorox is an extremely effective, and trusted brand of wipes for people to use. I first started with swabbing table 1 with no cleaning wipes or anything. After I swabbed table 1 once I wiped the table with hand sanitizer on a paper towel and swabbed it again. After table 1 was done, I started with table 2. For this table, I started by swabbing the table without any cleaning supplies, and then I wiped it down with Clorox wipes and swabbed it again. I did the same thing for table 3 only this time I used the other wipes My prediction was wrong. I had some very interesting results after 3 separate trials, each trial having multiple Petri plates.

9. Acidic Precipitation on Crops

Brooklyn Todd

Grade 8

also did a project in germination on the same crops my Procedure I used 18 3.5x 3.5 inch Petri dishes then I Place a paper towel cut to fit inside the dish next I laid down 10 of the same seeds in each Petri dish, wheat, corn and soybeans, respectively after that I filled each Petri dish with 20 ml of each acid, respectively, & the control Petri dish with Distilled Water. I labeled each Petri dish with a Sharpie. I measured the seeds before and after the seeds were exposed to the acids and the distilled water. I then wrote down my data. I then took a look

11. Protein Powder Pastries

Ellie Hellman

Grade 8

In this project I tested to see if whey protein powder could be a sufficient substitute for egg protein in choux pastry. I tested trials with water and protein powder, protein powder and oil and water, oil and water, and a control with eggs. I measured the weight, width, and height of the choux pastry before and after baking and compared the size difference between them along with a few other things like taste and the air gap between the trails. By the end of my experiment I saw that yes protein powder does prove to be a sufficient substitute for eggs in pastry but it is not nearly as effective for pastry growth as regular eggs.

12. Understand cloud formation

Kevin Du

Grade 8

In this project, I used a balloon, air pumps, and a water bottle to understand how air pressure, temperature, humidity, and cloud formation are related. My first hypothesis was that when more air was pumped into the balloon, air was compressed and temperature increased, when air was released from the balloon, air expanded, and temperature decreased. My second hypothesis was that when air in the clear bottle expanded, temperature decreased, which made the air in the clear bottle reach saturation and therefore cloud formed. To test my hypothesis, I used a PocketLab weather device to record the related elements during our experiments. The results verified my hypothesis and improved my understanding of the cloud formation process.

15. The Effect of Time and Temperature on the Nutritional Value of Tea

Maysa Hamilton

When I hear people saying they only steep their tea for about five minutes I start to question. Question if they are wanting a better tasting tea or if they are oblivious to how bitter tea that is steeped longer is more nutritious. Can two tablespoons of tea produce a more nutrient rich tea, even if it is bitter? Therefore I'm collecting data where temperature and time meet abundance. So far I'm collecting an understanding that the type of tea does play a huge factor as well. I tested four different types of tea. Using two tablespoons of each I tested temperature and time to see if it has an effect on pH, mineral content, and other macromolecules found in liquids. From my findings, results start to appear in five minutes. But the concentration stays consistent over the course of my overall 30 minutes. Really the mineral amounts did not advance after those five minutes. The amount of time affects the tea slightly but the biggest impact on the nutrients is the temperature.

16. Bacteria in a Hospital

Emma Bell, Alivia Cook?

Grade 10

I chose this project because when I am older I want to work in the healthcare field. Specifically an OB nurse. So I thought about doing something related to what I want to do when I am older. Then, that is when I came up with testing how much bacteria would be left on medical tools when sterilized. My project will help the hospital personnel know what metal of the surgical tools they use will get the most sterilized. I predicted that when cleaned with the 70% isopropyl alcohol, the stainless steel will prevent the most bacterial growth. I also predicted that when not being sterilized with the isopropyl alcohol, titanium will have the most bacteria growth. First, I gathered all of my materials that I needed. Second, I labeled four of the petri plates with the specific contents which were stainless steel control, stainless steel sterilized, titanium control, and titanium sterilized. After I labeled the Petri plates, I filled them with the nutrient agar. Then, I set out two of each of the metals to contaminate (one for the control and one to sterilize). After that, I sterilized one of each of the metals with the 70 isopropyl alcohol and then sterilized both pieces of each metal and swabbed them with a sterile swab and swiped it on a labeled petri plate. After 48 hours I wrote down what percentages of the petri plate was covered. Then I recorded that information into a graph then I repeated the procedure five more times. My first hypothesis was not upheld. When sterilized with the 70% isopropyl alcohol, the stainless steel samples had less bacterial growth on

IJAS RESEARCH PRESENTATIONS

it compared to the titanium samples. My second hypothesis was upheld. When not sterilized, the titanium samples had more bacterial growth than the stainless steel samples.

17. Bridge Structure Optimization Using SkyCiv Analysis

Cedric Liu, Philip John Even, Trevor Lin

Grade 11

There are about 600,000 bridges in the US and more than one-third needing repairs. How to repair them with the right quality and cost has been a challenge. This project is an attempt to shed some light on possible solutions. People sometimes tend to add more materials to strengthen a bridge and that drives up structural weight and cost. This project goal is to optimize a bridge structure that has the minimal weight while still supporting a certain load. The main bridge structure was developed from a simple concept and then improved by adding stable and efficient triangle frames. SkyCiv was used to evaluate eight various concepts to simulate their structural soundness and estimated weight. Minimizing the bridge weight while holding a defined weight and reducing the construction complexity are the key focus points, but risks and uncertainties are also considered in the decision analysis. The winning concept was the one next to the lightest when the human errors in the construction were factored in. The team built a few wooden bridges to validate that SkyCiv simulation accurately reflects the real world performance before building the final design for the Science Olympiad competition.

18. Home Remedies of the *Apis Mellifera* kind vs. *Streptococcus*

Sidney Gruntmeir

Grade 11

In order to determine the amount of E. Coli levels that a muscle can filter I tested the E.coli levels in the water after having samples of E.coli added to a 5 gallon tank of water. I placed 1 muscle in a sanitary 5 gallon tank of water with sand and no E.Coli for a control. I then added 0.004 mL of E.Coli to the water and added another muscle to the tank after 30 minutes. I tested the water for E.coli every 30 minutes. I started by adding 1 muscle to a sanitary 5 gallon tank of water and adding the other 2 after 30 minute intervals. After 30 minutes I added 0.004 mL per gallon of E.coli to the tank and tested the water's E.coli levels. My research will determine if muscles can be an effective source of filtration for E.coli.

19. Ape Initiative Social Media Analysis

Halle Hoefing, Seth Breeding

Grade 12

Social media can be used as a powerful tool. Recent studies have shown that the type of imagery portrayed can have both negative and positive impacts on people's views of the conservation status of an animal or its overall welfare; however, the extent to which these images can be used to positively influence engagement by viewers with a particular organization has not been extensively studied. The current investigation aimed to monitor social media engagement on Instagram for the Ape Cognition & Conservation Initiative to determine which types of animal pictures or videos promoted the most engagement from viewers. Data were collected for the number of "likes" each Instagram post gathered from January 1 through February 28 2023. Data were classified into five different categories of pictures or videos: half, portrait, medical, side, and action. Portrait posts are a closeup of a bonobo's face. Half posts are an image of the top half of a bonobo's body. Side posts are images of the bonobos from the side profile. Medical posts are clips of the apes interacting with the caretakers during voluntary veterinary procedures. Action posts are videos of the bonobos moving and interacting with one another. Data was analyzed for the total number of likes received on each post and the average number of likes per category of post. An ANOVA was run to test for overall effect of category of photo as well as post hoc Tukey tests between conditions to analyze if the overall effect of condition was significant.

20. Pre-Columbian Animal Exploitation in the Lower Illinois River Valley

Emma Bell

Grade 12

Through analyzing faunal exploitation in the Lower Illinois River Valley, effects of human cultural shifts on animals and the effects of domestication on animals can be ascertained. In the Archaic period, *Canis familiaris*, domestic dogs, were bred to haul goods and catch small game, leading to a high level of injuries. Through studying vertebral disfigurements, it was viewed that an increase in agriculture in the Woodland period led to a decrease of physical ailments in domesticated *Canis familiaris*. Concurrently, there was an increase in non-canid burials, indicating that an increase in agriculture allowed for a religious exploitation of animals. Overall, while animal exploitation has remained omnipresent in the Lower Illinois River Valley, the manners in which animals have been exploited have changed as cultures have changed.

ACADEMY OPPORTUNITIES

Volunteer to Advance Science in Iowa

Here are a few examples of how the Iowa Academy of Science provides opportunities for members to advance science in Iowa.

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- Serving as a Junior Academy judge
- Volunteering as IAS sponsored conferences
- Serving as a mentor to Iowa students
- Submitting an article to the Journal of the Iowa Academy of Science
- Promoting membership in the Academy to colleagues, institutions, and businesses

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ABSTRACTS BY SECTION

Poster locations are labeled by the poster number as indicated below.

CELLULAR AND MOLECULAR & MICROBIOLOGY POSTER PRESENTATIONS

1. Investigating Differences in IgA Antibody Response against *Aspergillus fumigatus* in wild type and TLR7 protein deficient mice.

Courtney Folk

Minnesota State University Moorhead

Aspergillus fumigatus is a commonly inhaled, respiratory fungal pathogen and an allergen found in flooded indoor environments, household dust, soil, and plant matter. While a competent immune system effectively clears the inhaled fungus, this same fungus poses a significant threat to weakened immune systems due to its potential to invade the lungs, bloodstream and brain tissue. The mouse genome is 99% similar to the human genome and can serve effectively model the effects of inhaled *A. fumigatus* (Guénet, 2005). Antibodies play a crucial role in neutralizing pathogens and in mediating an allergic response. In this study, we will investigate the IgA response against *A. fumigatus*. In particular, we are investigating if TLR7 enzyme deficiency in mice can influence IgA production after inhalational exposure to *A. fumigatus*, in a gender specific manner. Based on preliminary studies, we hypothesize that TLR7 presence is critical for enhanced IgA production against *A. fumigatus*, in female but not the male mice. Results from such studies will inform the design of treatment and diagnostic options for humans, against *A. fumigatus*.

2. Drivers of Estrogen Induced Invasive Lobular Carcinoma

Larkin Clem

Saint Mary's University of Minnesota

Breast cancer is the second most common cancer among women. The Invasive Lobular Carcinoma (ILC) classification is a largely estrogen positive subtype. ILC is characterized by loss of E-Cadherin and is typically resistant to hormone therapy such as tamoxifen. Novel models have been developed to better recapitulate and study the progression of ILC tumors and response to estrogen. Preliminary studies from the Ostrander lab showed that estrogen accelerated tumor growth and invasion *in vivo* using mouse mammary intraductal injection model. We aim to identify molecular markers of ILC progression and response to estrogen. Examination of RNAseq data identified several genes as ILC-specific and estrogen-induced in MM134, MM330, and SUM44PE ILC cell lines, including IRS2, ABAT, TFAP2C. Analyzing protein expression through western blot and RNA via q-PCR, as well as tumor burden in response to estrogen will provide information on the driving forces of ILC progression. Estrogen treated, SUM44 engrafted, mice models exhibited significantly higher number of total tumors compared to -E2 mice. Estrogen treatment also increased gene expression *in vitro* of ABAT and IRS2 over 24- and 48-hours, but not TFAP2C. Future studies will determine if ABAT and/or IRS2 are drivers of progression from LCIS to ILC.

3. Characterizing Selected, Durable *Bacillus cereus*/anthracis Bacteriophages

Michael Walter and Walderlande Nicolas

Dept. Biology, UNI

Bacteriophages ('phages') are viruses that parasitize (and often kill) specific bacteria, including the common soil inhabitants *Bacillus cereus* and *B. anthracis*. *B. anthracis* can cause anthrax, a deadly disease of cattle that has been used as a bio-terror weapon. Our lab examines phages with potential as therapeutics or protectants against *B. anthracis*, for which we use the 'Safe' vaccine strain, *B. anthracis Sterne*. Practical applications include 'phage therapy', where phages work against bacterial diseases. Phages suitable for any therapy or protection need to display physical stability under a wide variety of storage, transport and application conditions. Our previous student, Alexis Moore ('AJM-2021') successfully selected a group of *B. cereus* soil phages that with stood exposure to higher temperatures, filtration, aerosolization and exposure to ultraviolet light, blood & perspiration, and sunlight. We now continue that work by characterizing genome and structural proteins of selected & non-selected phages.

4. Extracting RNA from *Hydrophyllum virginianum*

Ashley Bloomquist and Gabby Corday

Wartburg College

Hydrophyllum virginianum (Virginia waterleaf) is a common plant found in the northeastern part of the United States that has differing physiology and morphology through the growing season. To study the gene expression behind these changes, we aim to create a cDNA library of differentially expressed genes from RNA extracted in various seasonal stages. RNA extraction from Virginia waterleaf has been difficult, potentially due to phenolic compounds and polysaccharides. This study involved modification of an RNA extraction protocol effective on plants with many phenolic and polysaccharide compounds. We used the Qiagen RNeasy Plant Mini Kit, Qiagen RNeasy PowerPlant Kit and plan to use the Qiagen RNeasy Plant Mini Kit with a PVP modification. The quality of the RNA was tested using a Nanodrop spectrophotometer to look at the concentration, A260:A280 ratio, and A260:A230 ratio. The concentration needs to be greater than 670 ng/ μ L to proceed with library construction and the A260:A280 and A260:A230 ratios, indicators of RNA purity, need to be 1.8 or above. Both of these Qiagen kits yielded concentration under 670 ng/ μ L and both A260:A280 and A260:A230 ratios under 1.8. The methods utilized have not produced sufficient results to proceed with downstream procedures. Next steps will involve further extraction with Qiagen RNeasy Plant Mini Kit with a PVP modification. The quality of the RNA will be analyzed in the same manner.

5. De Novo Acquisition of Aneuploidy to Sustain Fluconazole Drug Tolerance in *Candida albicans*

Kade Copple and Laura Burrack
Gustavus Adolphus College

Invasive fungal infections caused by *Candida* species, including *Candida albicans*, have high treatment failure rates due to antifungal drug resistance and tolerance development. Tolerance is a distinct subpopulation of slow-growing cells in the presence of a drug. Rapid genomic changes, notably the acquisition of aneuploidy, are a common mechanism for drug resistance and contribute to activating stress response pathways associated with drug tolerance. However, it is unknown whether acquiring aneuploidy prior to fluconazole exposure is sufficient to establish drug tolerance. A diverse putative aneuploid strain library of 989 isolates was constructed from three different starting tetraploid strains by plating on stress conditions known to induce chromosome loss and then screened for fluconazole tolerance. Forty strains were selected for minimum inhibitory concentration analysis. Nine putative aneuploid progeny had a higher level of resistance and tolerance than their parental strain. Ploidy analysis of twenty putative aneuploids using flow cytometry revealed various levels of ploidy ranging from near diploid to near tetraploid among the isolates with increased growth in fluconazole. Nine near-diploid strains were selected for whole genome sequencing to identify chromosomal events associated with fluconazole resistance and/or tolerance. Subsequent experiments will include characterizing the stability and adaptability of the aneuploid strains.

6. MICROTUBULE-ASSOCIATED PROTEIN TAU AMPLIFIES STRESS-INDUCED p38 SIGNALING IN NEURONAL CELLS

Sydney Price and Hannah Harris
Morningside University

Over-activation of ERK and other MAPK pathways such as p38 in response to chronic inflammation and oxidative stress can lead to significant neuronal atrophy and cell death in Alzheimer's Disease. Tau protein enhances abnormal ERK signaling in disease, but its role in abnormal p38 signaling remains unclear. To investigate this question, we studied the effects of tau on arsenic-induced apoptosis mediated by the p38 pathway. We also investigated the formation of tau-containing extracellular ectosomes under apoptotic conditions to better understand how tau from dying neurons is spread to distant locations in the diseased brain. Our results indicate tau has a marginal effect on the generation of stress neurites and cell viability after arsenic exposure, and that similar apoptotic conditions can generate ectosomes containing fragments of tau protein. Together, these findings shed new light on the nature of tau's effects on abnormal p38 signaling, and on the mechanisms of neurodegenerative disease.

7. Comparison of the Microbiomes of Urban and Rural Eastern Gray Squirrels (*Sciurus carolinensis*) and Eastern Fox Squirrels (*S. niger*).

Rhaegan Kiland, Grace Ivesdal, Andie Kassenborg, Kylie Mitchell Lipetzky, Harshana De Silva Feelixge, Ellen Aho, John Flaspohler, Joseph C. Whittaker,
Concordia College Moorhead

A microbiome consists of a diverse array of microorganisms living within a host organism. Gastrointestinal microbiomes are associated with digestion, metabolism, immunity, and processes related to development and behavior. Previous research with other organisms has found that those with a strictly plant-based diet have more diverse gut microbiota than those who include meat in their diet. Due to the expected differences in diets among rural and urban squirrels, we expect to find consistent differences in their microbial biomes. Our goal in this project is to identify the types of bacteria in the ceca of Eastern Gray (*Sciurus carolinensis*) and Eastern Fox Squirrels (*S. niger*) and hypothesize diets of rural squirrels, having a more natural, plant-based diet, will have a more diverse microbiome than urban squirrels, with their increased access to processed (human) food sources. We cultured bacteria from squirrels salvaged opportunistically. Ceca contents were extracted, diluted, and plated. Bacteria were cultured and grown on master plates and Gram stained. Distinct colonies will be used in Colony PCR to determine genetic composition. Remaining samples were added into a glycerol broth to be preserved for future use. Diversity of bacteria will be used to classify microbiome diversity between urban and rural squirrels.

8. The effects of Fluoride on Interleukin-1 cellular functions

Kaitlyn Hamlett and David McClenahan
University of Northern Iowa

Fluoride is a naturally occurring mineral that is often added to dental care products and municipal water to strengthen tooth enamel. It has been well demonstrated that fluoride reduces tooth decay. Unfortunately, there is some concern that high concentrations of fluoride can have potentially detrimental health effects by impairing physiological functions of various body systems. Research examining the effects of fluoride on other body systems is limited, thus our research to determine if fluoride has any effect on the immune system is new and still advancing. THP-1 cells, a macrophage cell line, were exposed to various concentrations of fluoride under various incubation times (2, 24, and 48 hours) to determine if Interleukin-1 (IL-1) production was decreased or increased. This research was done utilizing a commercial Enzyme-Linked Immunosorbent Assay (ELISA). Currently, the emphasis was on getting the assay working and making sure the standards were reading appropriately and accurately via the plate reader. It is expected that the fluoride exposure will increase IL-1 production because of the fluoride stimulating a pro-inflammatory response in the cells, but the opposite could happen as well as fluoride may be inhibitory or toxic to the cells thus decreasing their production of cytokines.

9. The effect of fluoride exposure on CD11b expression in THP-1 human monocytes

Caitlin Sanderman and Dr. David McClenahan
University of Northern Iowa

Fluoride is an extremely prevalent additive in municipal water supplies and is commonly used in dental treatments to strengthen enamel. Although fluoride has proven benefits in the field of dentistry, its effects on the immune system are not well understood. In order to begin to gain insight into how fluoride may alter the expression of inflammatory markers on immune cells, a human monocyte line of (THP-1 cells) were exposed to various concentrations of fluoride; 1000ppm, 1250ppm, 1500ppm, and 2000ppm. These samples were then incubated with a primary fluorescent antibody directed against the molecule CD11b – which modulates cell adhesion and migration – and examined using flow cytometry to assess any changes in expression of CD11b. Fluoride exposure consistently decreased expression of CD11b in a bimodal distribution, with peak depressions at 1250ppm and 2000ppm. However, with the addition of lipopolysaccharide (LPS) following fluoride exposure, a negative linear relationship was observed, with CD11b expression decreasing as fluoride concentration increased. Decreased adhesion molecule expression would likely result in decreased ability of these cells to migrate, thus potentially inhibiting certain immune responses.

10. Isolation and characterization of Late Embryogenesis Abundant (LEA) proteins from the freezing-tolerant orchid, *Aplectrum hyemale*.

Sharon Moscoso and Rasika Mudalige-Jayawickrama
University of Dubuque

In our quest to find native orchids in Dubuque area, we came across an unusual orchid, *Aplectrum hyemale* (putty root), which show exactly the opposite of normal winter response. This unusual orchid produces a functional green leaf in mid-October and keeps this leaf viable until the next spring. Our main objective was to monitor the metabolomic and transcriptomic profiles of putty root orchid in order to elucidate the freezing-tolerant mechanism. We monitored metabolic profiles via Liquid Chromatography-Mass Spectroscopy (LC-MS) and RNA sequence profiles of leaves before and after freezing. The results indicate that Late Embryogenesis Abundant (LEA) proteins may play an important role in freezing tolerance. Differential Expression profile show 9 LEA proteins are upregulated after freezing conditions. The metabolic profiles suggest high concentrations of antioxidants (anthocyanin) and antifreeze compounds like glycerol accumulate during freezing conditions. The RNA differential expression data suggests glyceraldehyde-3 phosphate dehydrogenase (GA3PD), C2domain/GRAM domain containing protein, chalcone synthase (CHS) are predominantly expressed under freezing conditions. We have cloned the full open reading frame of the LEA gene (AhLEA1) into an expression vector. We will transform the model plant *Arabidopsis thaliana* with the AhLEA1 gene to investigate whether it can confer freezing-tolerance to the host plant.

11. Elucidating the role of WD40 repeat containing proteins in freezing-tolerance mechanism of the native orchid *Aplectrum hyemale* (Muhl. ex Willd.) Torr

Emily Gross and Rasika Mudalige-Jayawickrama
University of Dubuque

In Iowa, as the day-length decreases and temperatures falls, most plants prepare themselves for cold winter by shedding leaves and maintaining a minimal metabolism. However, one native orchid of Iowa, the putty-root orchid (*Aplectrum hyemale*), does not follow the normal winter response. It produces a functional green leaf in mid-October and keeps this leaf viable until the next spring. Our main objective was to monitor the transcriptomic and metabolomic changes of the putty root orchid via Gas Chromatography-Mass Spectroscopy (GC-MS) and the expression profile of freezing induced genes in Putty-root leaves. Our results indicate a group of proteins containing WD40 repeat containing domain is upregulated during freezing conditions. WD40repeat containing genes are involved in histone modifications during abiotic stress. We have isolated one full clone and five partial clones containing of WD40-like genes which are induced by freezing conditions. The full clone (AhWD40-1) is being cloned into an expression vector to characterize its efficacy in freezing tolerance in the model plant *Arabidopsis thaliana*. In addition, many antioxidants (flavonoids), apoptosis inhibitors (Ginsenoside) and DNA replication inhibitors (Aphidicolin) and osmotic regulators.

12. mRNA Production of Gene 50 in JacoRen57

Harms Kaytlyn and Elizabeth Heeg
Northwestern College

Bacteriophage, JacoRen57 was discovered and sequenced as a result of the SEA-Phages research program at Northwestern College. JacoRen57 is a mycobacteriophage which selectively infects bacteria within the genus *Mycobacterium* – specifically, *Mycobacterium smegmatis* mc²155. Sequencing revealed JacoRen57's double stranded DNA genome is 70,300 bp long and consists of 73 genes: 57 forward genes and 16 reverse genes. We observed that one of the gap regions (40,644 - 40,975 bp) between reverse and forward genes possessed minimal coding potential (Almail et al., 2019) (Phagesdb, 2021). From in vitro investigations, we have identified this area as a regulatory region for Gene 50 (Almail et al., 2019). The product of this gene appears to be an ATP-dependent recombinase. It exhibits homology with known proteins including RecA-like recombinase and DnaB (Leipe et al., 2000).

Additional investigation of the RNA and protein expression of Gene 50 is needed. We sought to examine Gene 50 mRNA production during an active infection of *M. smegmatis* utilizing qRT-PCR. To do this we first established a timeline of infection and replication, designed primers to measure Gene 50 expression, and carried out qRT-PCR.

13. Metabolic Characterization of Porcine Hepatocytes

Sophie Swart and Kip Cullinan
Northwestern College

Abstract: We partnered with Cytotheryx, Inc in developing a porcine model system that is metabolically similar to humans without the ethical concerns for use in drug trials. In our research, we developed techniques to characterize porcine liver cell metabolism.

CELLULAR & MOLECULAR & MICROBIOLOGY

ORAL PRESENTATIONS

14. The Effect of Creatine Monohydrate on Myosin Heavy Chain - Prenatal (MyHC-pn) and Adult Myosin Heavy Chain-IIa (MyHC-IIa) expression in *Mus musculus*

Mandy Schmidt
Saint Mary's University of Minnesota

Creatine monohydrate is a widely used muscle enhancement supplement. It works in the body by regenerating ATP in muscles during strenuous physical activity. While it is naturally produced, additional supplementation can lead to an increase in muscle contraction efficiency. Previous research has indicated that creatine in conjunction with exercise influences gene expression particularly in myosin heavy chains. This gene expression is essential to increasing muscle function and has shown increases in gene expression in mice both with and without exercise. This research aimed to determine if creatine, in conjunction with exercise, affected MyHC-pn and MyHC-IIa RNA expression. There were four treatment groups of *Mus musculus* used: no creatine or exercise, creatine but no exercise, exercise but no creatine, and creatine and exercise. The mice requiring exercise were placed in hamster balls and encouraged to run around for 15 minutes daily over a six-week period. Creatine was provided in the water supply of mice requiring creatine supplementation. After a two-week creatine pretreatment followed by a six-week exercise and creatine regimen, MyHC-IIa and MyHC-pn expression was measured using qRT-PCR. A one-way ANOVA determined that although there was a noticeable trend there was not a significant change in MyHC-IIA ($p=0.154$) or MyHC-pn ($p=0.402$) expression in mice treated with creatine.

15. Genetic, Biochemical, and Biophysical Investigation into the Role of TGF- β Signaling in Pathology of Emery Dreifuss Muscular Dystrophy

Rakshya Thapa and Araneg Leon
Waldorf University

Emery Dreifuss muscular dystrophy (EDMD) is a rare muscular dystrophy caused by mutations in the LMNA gene, which encodes intermediate filaments (Lamins A and C) that are components of the nuclear lamina. TGF- β signaling plays a role in fibrosis and can exacerbate MD symptoms. We examined TGF- β signaling effects on muscle physical properties in a fruit fly model of EDMD. We have examined *Drosophila* larval muscle expressing wild type or mutant (R564P) Lamin C treated with vehicle or pirfenidone using atomic force microscopy. This data shows Ca²⁺-responsive

atomic force microscopy. This data shows Ca²⁺-responsive muscle contraction and a significant effect of the R564P mutation on elasticity. We also prepared larvae for histological sectioning and performed histology and electron microscopy. Ultrastructural elements in muscle fibers, including myofilament configuration, mitochondria, and sarcoplasmic reticulum, can be seen with electron microscopy. As Emery Dreifuss muscular dystrophy also causes dilated cardiomyopathy, we investigated TGF- β signaling in the heart by expressing wild type and R564P Lamin C in cardiac muscle and assessing the effect of Losartan on survival. Losartan has been reported to suppress TGF- β signaling and is used off-label to treat Marfan syndrome patients, who often have SMAD7 mutations that deregulate TGF- β signaling. We compared survival between groups using Kaplan-Meier plots.

16. Using a Genetic Screen to Discover Gene Functions in Mycobacteriophages Sbash and Island3

Sara Tolsma and Abigail Bastian
Abigail M. Bastian,* Sadie A. Gilmeister,* Keziah J. Knudson,* Erika J. McKenney,* Garrett Raymon,* Anneka E. Sterk,* Alaena L. Trevino,* April S. Van Tol,* Emily Schmidt, Byron Noordewier, Sara S. Tolsma
Northwestern College

Sbash is a temperate bacteriophage that infects *Mycobacterium smegmatis*. It was assigned to cluster I2 based on gene-content similarity of 35% or higher to sequenced bacteriophages present in the Actinobacteriophage database, phagesDB. Its genome was annotated in 2014 and found to include 89 protein-coding genes, only 22 of which were assigned functions based on bioinformatic analysis. We are using a genetic screen to identify functions of phage genes for which no function is currently known. We cloned 40 of the genes in Sbash's genome with sizes ranging from 90 bp to 3,666 bp. We screened each gene for cytotoxicity and identified six genes that reduced growth of the host cells when expressed. We also screened for defense, the ability of each gene product to protect the host cell from infection by another phage. We identified eight Sbash gene products that defend host cells from infection by other mycobacteriophages. We have also analyzed genes in Mycobacteriophage Island3, a cluster II phage, for cytotoxicity and defense to complete the screen of this phage started by students in previous research groups.

17. Discovery and Annotation of Six Iowa Actinobacteriophages

Jayron Klinghagen and Grace Anderson
Grace Anderson, Olivia Anderson, Clayton Bosma, Erin Brouwer, [Kleyton DeGroot](#), [Owen Hede](#), [Daiki Jonouchi](#), [Dylan Kirkeby](#), [Jayron Klinghagen](#), [Kate Kralik](#), [Julia Kutz](#), [Olivia Lott](#), [Maegan Olsen](#), [Victoria Pavik](#), [Cayli Penner](#), [Leah Rozeboom](#), [Jett Skrien](#), [Jessica Slight](#), [Jonas Tiensvold](#), [Kyra Wajer](#), [Abigail Bastian](#), [Marcus Blankespoor](#), [Gideon Fynaardt](#), [Sadie Gilmeister](#), [Emily Hurley](#), [Madison Jones](#), [Erika McKenney](#), [Alexa Olguin](#), [Micah Rens](#), [Garrett Snyder](#), [Anneka Sterk](#), [Sophie Swart](#), [Alaena Trevino](#), [Ashley Van Egdom](#), [Morgan Veach](#), [Byron Noordewier](#), and [Sara S. Tolsma](#)
Northwestern College

We isolated and purified actinobacteriophages Gshelby23, Clayda5, Tedro, and BAjuniper, which infect *Microbacterium foliorum* and Santhid and Wrigley, which infect *Gordonia terrae*. Tedro is a lytic, cluster EF phage isolated from soil collected in Hawarden. Its genome is 56,197 bp long, circularly permuted, and includes 83 protein-coding genes. Clayda5 is a lytic, cluster EB phage. It has 70 protein-coding genes and two tRNA genes in its 39,894 bp genome. Clayda5 was purified

from soil collected in Hull. GShelby23 was isolated from soil collected in Storm Lake. It is a cluster EM phage with a circularly permuted, 53,603 bp genome. Santhid is a cluster DY phage isolated from soil collected in Orange City. Its genome is 39,295 bp long and includes 60 protein-coding genes. Wrigley, a cluster CY phage, was isolated from soil collected in Johnston. It is a temperate phage whose genome is 51,878 bp long and includes 81 protein-coding genes. BAjuniper was isolated from soil collected in a garden in Orange City. Its genome is 41,985 bp long. It was assigned to cluster EB. BAjuniper's genome includes on tRNA gene and we will finalize the number of protein-coding genes shortly.

18. Understanding the Antiproliferative Activity of Plant Extracts

Blake Johnson and Abigail Bastian

Abigail Bastian, Parker Fryar, Sadie Gilmeister, Jackson Hofland, Blake Johnson, Lauren Jurrens, Keziah Knudson, Erika McKenney, Abigail Noonan, Alexa Olguin, Emily Schmidt, Martha Stein, Anneka Sterk, Sophie Swart, Alaena Trevino, and Sara S. Tolsma

Northwestern College

Many plants possess medicinal properties. Some, such as the Pacific yew, have yielded chemotherapeutic drugs (taxanes). Scientists report that other extracts such as the leaves of *Calendula officinalis* (marigold), *Vinca rosea* (periwinkle), *Viscum cruciatum* (mistletoe), and *Rosmarinus officinalis* (rosemary) have anti-tumor activity. In most cases, the chemical components responsible for antiproliferative activity have not been identified and it is unclear if any individual components are as effective in isolation as they are in the context of the whole extract. Furthermore, in most cases, there are no data indicating whether these extracts have synergistic effects or cause negative reactions when used with other drugs. We are using HeLa (adenocarcinoma), RAW 264.7 (leukemia), HepG2 (hepatoma), MDA-MB-231 (adenocarcinoma), and human foreskin fibroblasts (HFF, non-tumorigenic) to test the antiproliferative activity of several plant extracts. We identified five extracts, grapeseed, guava, yew, juniper berry, and *Vinca*, that slow the growth of all five cell lines in a dose-dependent manner. We are using a variety of methods to understand the mechanism by which these extracts are blocking cell growth.

Ecology & Conservation **Poster Presentations**

19. Fine-scale patterns in microclimate and vegetation on algalic slopes in northeastern Iowa

Meyer

Meyer, A., Richards, J., and Lynch E.A.
Luther College

We described fine-scale patterns in soil temperature and vegetation on two algalic slopes in the Driftless Area National Wildlife Refuge of northeastern Iowa. Our objectives were to describe current conditions to provide a baseline for future changes and to determine whether some plant species are currently restricted to the coolest microsites. We measured soil temperature 7 cm below the surface at 1-m intervals along five 10-30 m transects at each site. We measured the abundance of plant species in 40 0.25 x 0.25 m² quadrats at each site; half were at sites with soil temperature (< 10°C), and half at sites with temperatures (>10 °C). In mid-June, the range of soil temperatures was 1.8-19.8 °C at Turkey River, and 2.7-16.0 °C at Finch Memorial Hardwoods. Soil temperature were lowest near the base of the slopes. Several plant species had a high

frequency of occurrence, including *Cystopteris bulbifera*, *Impatiens pallida*, *Ageratina altissima*, and *Hydrophyllum virginianum*. Most species were not restricted to the coolest microsites; the exceptions were *Cerastium arvense*, *Chrysosplenium iowensis*, and *Plagiomnium medium*.

20. Evaluating Siouland Areas for Barn Owl Habitat Suitability

Michael Griffen, Hayden Stephenson, Alex Valdez
Morningside University

The Barn Owl (*Tyto alba*) is an iconic species with a worldwide distribution. This species has seen a recent population decrease across Iowa likely resulting from increased farming and habitat degradation. Researchers have worked to identify factors correlating to Barn Owl presence in a given area, but few have applied this knowledge to identify areas of importance using assessment models. Using methods of habitat suitability index modeling to construct an idealized version of habitat capable of sustaining an owl population as collected from current literature, nine different Siouland locations were selected for evaluation. Our results suggest that the surveyed areas are currently not optimal, but climate change projections could alter this in the next few decades. Future directions could include applicational studies to identify areas of focus for conservation efforts.

21. DIFFERENTIATION OF *Peromyscus leucopus* FROM *Peromyscus maniculatus* USING SALIVARY AMYLASE AND CELLULOSE ACETATE ELECTROPHORESIS

Kelly Harris and Vanessa Petrich

Kelly M. L. Harris, Lauryn P. Petrich, Vanessa D. Petrich,
Taylor M. Devine, Amelia F. Landsverk,
Cole R. Nowacki, and Joseph C. Whittaker (Advisor) Biology
Department
Concordia College

White-footed (*Peromyscus leucopus*) and deer mice (*Peromyscus maniculatus*) are two distinct species and are physiologically differentiable. Their morphology overlaps to the extent that they cannot be reliably differentiated in the field. Historically, biologists have attempted to use physical characteristics, such as ear and tail length and the distinctiveness of tail coloration. These measurements have always overlapped or were subject to observer bias. A result of climate change, the deer mouse range has been constricted as the white-footed mouse range has increased, resulting in greater overlap of the two species ranges. Previous research has indicated that these morphological traits can only identify between 55% and 66% of these species correctly. Unlike morphological comparisons, cellulose acetate electrophoresis of

allozymes of salivary amylase provides reliable differentiation. Saliva samples were collected from restored and remnant prairies, and woodlands in Minnesota from 2004 to 2019. We analyzed 1,262 saliva samples from 2004 to present and compared morphological data that were collected in the field. Accurate identification is possible through salivary amylase electrophoresis and is crucial to further understand romyscus ecology in general, particularly in light of climate change, and also important as they are reservoirs for Lyme disease (white-footed mice) and hantavirus (deer mice).

22. Assessing the diet of gray foxes using DNA metabarcoding of stomach contents

Ashley Karas and Shannon Schultz
Luther College

Gray fox populations have been declining in the Midwest. Causes of the decline are unknown but may be linked to anthropogenic disturbances, habitat loss, changing meso-carnivore community structure, and disease. Diet can influence and be influenced by each of these factors, so a better understanding of diet composition could give insight into gray fox declines. We used DNA metabarcoding of stomach contents to assess the food items consumed by 53 gray foxes collected primarily in the fall/winter from Indiana in 2019-2022. We detected plant items in nearly all (49; 92%) stomachs and vertebrate prey in most (33; 62%), but arthropods were less common (13; 25%). Plants with the highest frequency of occurrence included American persimmon (*Diospyros virginiana*) and members of the Poaceae family (grasses). Mice (*Peromyscus* sp.) and voles (*Microtus* sp.) were the most common vertebrate prey items, and members of the Noctuidae family (moths) were the most common arthropod prey detected. Several individuals showed evidence of consuming anthropogenic food items such as pet food. Ongoing analyses will provide a detailed understanding of the diverse food resources of this species and how diet varies with season, sex, and site-specific characteristics.

23. Effect of canine distemper virus on gray fox gut microbiome

Nathan Anderson and Peter Edlund
Luther College

The gut microbiome contains a variety of microorganisms that help the host with digestion, immune function, and other processes, but the breakdown (dysbiosis) of this microbial community can negatively impact overall health. Canine distemper virus (CDV), a potential driver of gray fox population declines, suppresses the host immune system and therefore potentially disrupts the gut microbiome, allowing for fatal secondary infections from opportunistic, pathogenic bacteria. To better understand the potential role of host-microbiome relationships in gray fox declines, we aimed to establish a baseline understanding of the gray fox gut microbiome and determine whether CDV infection alters this composition. We collected 22 stomach samples from uninfected and CDV-positive gray foxes in Indiana from 2019-2022. Using DNA metabarcoding of the 16S rRNA gene, we found the most abundant bacteria phyla were Firmicutes and Proteobacteria. Samples from CDV-positive foxes showed reduced taxonomic diversity. At the genus level, healthy samples were dominated by *Lactobacillus* and *Lactococcus*, which are often recognized as beneficial bacteria. In contrast, CDV-positive samples were dominated by potentially pathogenic bacteria such as *Fusobacterium* and *Helicobacter*. These data provide baseline information on the gut microbiome composition of the gray fox and indicate that CDV infection is associated with dysbiosis.

24. Macroinvertebrate Colonization in the Floyd River

April Van Tol and Garrett Raymon
Northwestern College

Watershed characteristics impact water quality, habitat heterogeneity, and allochthonous inputs. Lotic macroinvertebrates are dependent upon and can be used as indicators of these conditions. Macroinvertebrates tolerant of degraded environments dominate impaired sites, resulting in low benthic macroinvertebrate index (BMI) scores. We explored the relative importance of habitat characteristics and allochthonous inputs by examining how macroinvertebrate colonization of leaf bags varied with leaf species, water quality, and landscape disturbance. Leaf bags were submerged in the Floyd River at seven locations. After four or eight weeks, we collected the bags for analysis. We hypothesized that colonizer richness, abundance, and BMI scores would be highest in bags downstream from intact riparian habitats and in reaches with higher water quality. We also hypothesized that leaf species with lower lignin content would support higher abundances of colonizers. Midge larvae (*Chironomus*) and scuds (*Hyallela*) were the dominant colonizers in all bags, resulting in low BMI scores at all locations. Richness and abundance did not differ significantly with leaf type, but did differ significantly with location. Although our results were limited by low water flow and lost bags, we found these initial results interesting and plan to expand the scope of this study in the future.

Ecology and Conservation Oral Presentations

25. Using DNA Barcoding to Study the Bee Diversity of Big Rock Park

Layken Byntar and Lauren Wall
Central College

Bees are well known for their pollination services in natural ecosystems and crop production. They are a diverse taxon with estimates of over 20,000 species worldwide. However, only a small number of species have been studied and there are many documented declines in bee populations. Therefore, it has become imperative that we expand the research to other bee species to assess the conservation status of these important pollinators. Since native bees are poorly studied, the diversity is unknown in many areas. This research consists in determining the bee diversity of Big Rock Park, located within the city limits of Pella, IA. This park consists of savanna, one of the most endangered ecosystems in the world. Collections were done in 2021 and 2022. Initially, species identification was done using dichotomous keys. However, we later also used DNA barcoding, a novel way to distinguish species. This technique allows for quick and accurate species identification using minimal amounts of tissue. In addition to providing species identification, our use of DNA barcoding has revealed some interesting patterns that have practical implications for how biologists define a species.

26. Assessing Gravimetric Soil Moisture Content of the Neppel Fen Restoration

Rebecca Kauten and Ashley Kleve
Iowa Lakeside Laboratory Regents Resource Center

From 2020 to 2021, the Iowa Natural Resource Conservation Service (NRCS) conducted a large-scale reconstruction of what was historically considered the largest known fen in Iowa. Considered “essentially destroyed” since the mid-1960s, drainage ditches and tile once installed to facilitate agricultural utility were removed and the natural hydrology was encouraged to reestablish. An undergraduate field researcher with Iowa Lakeside Laboratory actively monitored soil gravimetric moisture content throughout the extent of the site immediately following reconstruction and over the course of two subsequent growing seasons. Results indicate hydrologic recovery in key areas of the reconstructed area.

27. Updating the Iowa list of endangered, threatened and special concern plant species

John Pearson and
Iowa Dept Natural Resources

Over 400 plant species were evaluated for statewide rarity during the current effort to update the official state list of endangered, threatened and special concern species. Drawing upon the DNR Natural Areas Inventory (NAI) database of records derived from field surveys, herbarium specimens, and natural history literature, a committee of expert botanists with extensive experience in Iowa examined potential species based primarily on their number of extant occurrences. Special effort was applied to update the scientific names of all species, a challenging task due to many changes in taxonomic concepts over the past 25 years.

28. BOTANICAL STUDY OF IOWA IN THE 21st CENTURY: MAKING THE CASE FOR THE “COUNTY INVENTORY”

William Norris and Thomas Rosburg
Western New Mexico University

The vascular flora of Story County, Iowa has long been of interest to botanists associated with Iowa State University (ISU). Three published floras by Bessey (1871), Hitchcock (1890), and Pammel (1898) and hundreds of plant specimens collected in this county prior to 1900 and deposited in the Ada Hayden Herbarium (ISC) at ISU document the late 19th century flora of Story Co. Floristic study of the county, especially by Pammel, Ada Hayden, and J.P. Anderson, continued through the mid-20th century but waned dramatically in the latter half of the century. However, numerous plant inventories conducted in Story Co. since 1991 (Municipality of Ames, Doolittle Prairie State Preserve, Ames High School Prairie/Richard W. Pohl Memorial State Preserve, Story County Sensitive Area Inventory) have resulted in the preparation of a recent (1991-2020) county flora containing 1,230 vascular plant taxa, *100+ more than are known from any of Iowa’s other 98 counties and including almost 100 taxa not included in the checklist of Iowa vascular plants* (Eilers & Roosa 1994).

In this paper, we summarize botanical studies conducted in Story Co., Iowa since 1991, including goals, methodology, and analysis of the flora. We also discuss the significance of basic plant inventory work in the 21st century.

29. Engaging a Citizen Scientist in Floristic Research: Jimmie D. Thompson (1939-2021)

Deborah Lewis and William Norris and Iowa State University
Jimmie Thompson’s collaboration with the authors of this presentation and two additional researchers began in 1997 with a study of the flora of Ames, Iowa, which resulted in two publications. His learning and success in this first project led to his studies of the flora of Hamilton and Boone counties and his two single-authored publications. His survey of the Ledges State Park flora added hundreds of additional species to previous studies. He was first author of the study’s results, published in a national journal, and it won the journal’s annual award for best paper. He was author or coauthor of six journal publications, and he was part of a team of five researchers engaged in a study of the flora of Story County at the time of his death.

Our interactions with Jimmie Thompson evolved through the 24 years of collaboration, and our engagement included encouragement, training, collaboration, learning from him, sharing the credit and celebrating accomplishments. In 2019, he received the IAS Distinguished Citizen Scientist Award. With the loss of activity and expertise in floristics in our state universities, and with much yet to be learned, we encourage other researchers to engage citizen scientists in similar projects.

30. Landscape ecology and floristics on the Armstrong site in Harrison County, Iowa

Thomas Rosburg and
Drake University

The Loess Hills landform is arguably Iowa’s most important region for prairie conservation. Based on data from the Loess Hills Alliance, upwards of 22,000 acres of prairie occur in the Loess Hills, an amount that may account for over 70% of the remaining prairie in Iowa. Field research was completed in 2021 on the Armstrong site, a 155-acre tract recently acquired by the Iowa Natural Heritage Foundation, to delineate the extant ecosystems and plant communities, perform a floristic inventory, and conduct an assessment of its quality. There were 170 vascular plant species observed; 150 native and 20 non-native. Landscape heterogeneity and community diversity is high with 59 plant communities mapped and 24 plant associations identified. Prairie associations (4 types) account for 46 acres, or 29.7% of the site. Other associations include 2 agricultural types, 4 grasslands, 4 shrublands, 4 woodlands and 4 forests. One Special Concern species, *Spiranthes magnicamporum*, was observed. Among the 150 native species, 108 were prairie indicator species (72.0%). There were 19 Loess Hill indicator species observed out of a potential number of 40. The vegetation was assessed with 73 community variables. The conservation quality of the Armstrong site will be discussed.

31. Conservation for the 21st Century: Sensitive Areas Inventory, Story County, IA

Thomas Rosburg
Drake University

It is imperative for a successful conservation strategy to have an understanding of the ecosystems and species that occur on a conservation landscape. The Sensitive Areas Inventory was a 4-year project that investigated the conservation value of private land in Story County. A total of 140 study sites comprising 11,700 acres were investigated, which amounts to 46.6% of the estimated 25,100 acres of semi-natural habitats present. Nearly

half (5,228 acres, 44.7%) of the 11,700 acres was considered conservation land (supportive of native biodiversity). The extant ecosystems and plant communities were mapped and inventoried on 83.4% of conservation land (4,360 acres). The total vascular plant richness was 801 species; 24.9% were non-native to Story County. Among the 602 native species, 156 were high conservative species (25.9%). There were 15 listed plant species observed. The study found 49 species that are not included in the Vascular Plants of Iowa. New Story County records were established for 24 plant species. Nine historic species only known for Story County from vouchers collected prior to 1950 were documented. Over 60 vegetation variables were used to assess the quality of 719 plant communities. Many high-quality ecosystem remnants supporting prairies, sedge meadows and forests were discovered.

ASSORTED ABSTRACTS

POSTER PRESENTATIONS:

32. Chemistry

Poster

Identification of Microorganisms from the Depths of Wind Cave

Abigail Bangs and Justin Peters

University Of Northern Iowa

Department of Chemistry and Biochemistry, University of Northern Iowa

In 2022 samples were collected at Wind Cave National Park on three different trips. As the team goes deeper and deeper into the cave, the goal is to actively trace the types of microorganisms (fungi, bacteria, and archaea) throughout the cave. The process to obtain genus- and species-level identification of these samples utilizes PCR amplification of different sections of their genomic DNA followed by sequencing analysis. The objective of this project is to make a genetic map of the Wind Cave microbial system that includes public tour routes as well as deep wild cave regions, including previously reported lake extremophiles. This effort will determine how genetically unique/isolated the lake system is and what influence surface microbes and anthropogenic contamination from cave explorers may have had on the subterranean microbiome. An initial phylogenetic tree showing relatedness of the identified microorganisms is presented.

This project is based upon work supported by the Iowa Space Grant Consortium under **NASA Award No. 80NSSC20M0107**

33. Chemistry

Poster

Development of a Deep Learning-based classification method for cancer

Nalin Goonesekere

University of Northern Iowa

Despite considerable efforts at curbing deaths from cancer, it still remains a major threat to public health. Early detection significantly improves prognosis. For example, a major reason for the dismal prognosis of pancreatic cancer patients (5-year survival rate of 10%) is that there is neither an associated family history nor specific symptoms at the early stages of the disease, when the disease can be effectively treated by surgical resection.

Omics data, such as gene expression, copy number variation and methylation status can be used for classification and subtype analysis of cancers. These methods, however, ignore the fact that genes are part of biological pathways, and

therefore do not act independently of each other. We aim to address this issue by explicitly incorporating biological pathway information into omics data.

Initially, we chose gene expression data, which is the most commonly used omics data type, and the biological pathways database REACTOME, which is a manually curated database. We created algorithms to combine gene expression data with biological pathway information. This modified omics data can then be input into one of the standard Deep Learning algorithms. Even using the simplest classifier, logistic regression, our preliminary results have been encouraging.

34. Chemistry

Poster

Spectroscopic Characterization of Wind Cave National Park as a Model for Extraterrestrial Environments

Jenna Heinen and Joshua Sebree

University of Northern Iowa

In order to better understand the possible life in the Solar System, it is important to understand the extreme limits where it can thrive. Because of the necessary cost and time of space exploration, it is vital that mission planners understand the environments and data they could encounter prior to sending spacecraft. Knowing this, scientists have been searching for places on Earth to help model these environments. In particular, Wind Cave National Park is used in my research as an analog for other planetary bodies, specifically the icy moons of Saturn and Jupiter. Using novel in situ spectroscopy techniques, we are able to study this cave, including its mineral makeup, organic flow, and microbial systems without damaging or removing precious cave formations. From this, our team can create methods and foundational understandings from the cavern to help in planning future missions to these Icy Moons.

35. Chemistry

Poster

Determination of the Elemental Composition of 'Druzy' in Crystalline Quartz using UV & X-Ray Fluorescence

Margaret Ierien

University of Northern Iowa

Architect Father Paul Dobberstein used a variety of natural and synthetic minerals from different regions throughout the world to create what is now known as the Shrine of the Grotto of the Redemption. Scientists are exploring the renewed interest of what natural and synthetic minerals were used to construct the shrine. This experiment detected and identified the elemental composition of the new term 'druzy' in quartz minerals and was compared to other crystalline minerals, including other forms of quartz, calcite, and fluorite. The six types of crystalline minerals incorporated into this experiment, including 'druzy' quartz, were analyzed using two methods of UV fluorescence and X-ray fluorescence spectroscopy. The fluorescence of the 'druzy' quartz mineral was undetermined, therefore exhibited no comparison between the other crystalline minerals. However, the elemental composition of 'druzy' quartz had detected a higher quantity of trace elements that were absent in the other crystalline minerals.

36. Chemistry

Poster

Detecting Temperature, pH, and Potential in the Waters of Coldwater Cave

Raquel Wilhelm

University of Northern Iowa

Coldwater Cave is a 17-mile-long cave system in Winneshiek County, Iowa. The water that runs through the caves is a tributary of the Upper Iowa River and has largely gone untested. Vernier Go bluetooth probes were brought into the cave to test the temperature, pH, and potential of the water at different spots in the cave. The values were recorded and compared to those taken at North Snake Passage which is considered to be the baseline for the cave.

37. Engineering

Poster

Bridge Structure Optimization Using SkyCiv Analysis

Cedric Liu and Philip John Even

Cedar Falls High School

There are about 600,000 bridges in the US and more than one-third needing repairs. How to repair them with the right quality and cost has been a challenge. This project is an attempt to shed some light on possible solutions. People sometimes tend to add more materials to strengthen a bridge and that drives up structural weight and cost. This project goal is to optimize a bridge structure that has the minimal weight while still supporting a certain load. The main bridge structure was developed from a simple concept and then improved by adding stable and efficient triangle frames. SkyCiv was used to evaluate eight various concepts to simulate their structural soundness and estimated weight. Minimizing the bridge weight while holding a defined weight and reducing the construction complexity are the key focus points, but risks and uncertainties are also considered in the decision analysis. The winning concept was the one next to the lightest when the human errors in the construction were factored in. The team built a few wooden bridges to validate that SkyCiv simulation accurately reflects the real world performance before building the final design for the Science Olympiad competition.

38. Environmental Science & Health

Poster

Observational Analysis of Siouxland Lung Diseases and Air Quality

Jacob DePauw and Lauryn Bonar

Morningside University

The characteristic odor of Sioux City led us to question Siouxland's air quality. While diseases including Asthma, COPD, and Cancer have declined in recent years, the incident rates in the Siouxland area have lagged behind compared to the state of Iowa. We hypothesized that Siouxland factories produced poor air quality and increased rates of lung diseases. We first found elevated levels of PM2.5 and PM10 particles in several locations near factories in the Siouxland area. Exposure to these particles has been known to cause lung and throat irritation. This led us to utilize Organic Vapor Monitors to extract specific compounds in the air and run Gas Chromatography-Mass Spectrometry to identify specific molecules obtained from the monitors. Correlation studies dealing with similar compounds and their effects on the lungs allow us to conclude that there are potential risks for lung illnesses in Sioux City.

39. Environmental Science & Health

Poster

Analysis of Toxic Selenium Levels in Siouxland Waterways

Nick Philthilath and Alex Godfredsen

Morningside University

The Floyd River is an impaired waterway on the Environmental Protection Agency Impaired Waters List due to elevated concentrations of selenium. Selenium accumulates quickly in ecosystems and can originate from multiple sources such as runoff or naturally from the environment. This can cause reproductive problems and/or heart failure in some animals and is toxic to plants. To further investigate the prevalence of selenium in Siouxland waterways, water samples were collected on a weekly basis and tested with a Microwave Plasma Generator (MPG). Our results indicated elevated selenium levels in several locations, and widespread lower selenium levels on a regular basis. We concluded that levels of selenium vary depending on seasonal effects such as farming routines and precipitation. With this knowledge, we can put information out to the public to encourage safer farming and homeowner practices.

40. Environmental Science & Health

Poster

Digested Styrofoam—The Next Fertilizer?

Allison Franks and Timothy Sesterhenn

Morningside University Dept. of Natural and Mathematical Sciences

Polystyrene, more commonly known as Styrofoam, is a known non-biodegradable plastic that is a large source of pollution. Currently, there is not an effective way to degrade the plastic, nor a method to recycle it. However, it has been discovered that Superworms (*Zophobas morio*) are able to break down polystyrene into a biodegradable substance, but little is known about the substance that is produced. In order to gain a better understanding of the properties of the Superworm waste from the polystyrene-only diet, an experiment was conducted that isolated the excretions, or frass, from Superworms. The frass was placed on rye grass seed (*Lolium* sp) to determine if the frass from the polystyrene fed Superworms could be used as an effective fertilizer. It was hypothesized that the frass collected from the Superworms only consuming polystyrene would increase the growth of the grass. The data suggest that the grass did benefit from the polystyrene frass compared to the unfertilized group. The results indicate that this method of degradation could be a sustainable solution to eliminate polystyrene.

41. Environmental Science & Health

Poster

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Allison Franks and Timothy Sesterhenn

Morningside University

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42. Environmental Science & Health

Poster

A Comparison of Microplastic Content in the Gastrointestinal Tracts versus Feces of Urban and Rural Tree and Ground Squirrels (Sciuridae)

Alissa Edjacin and Alexa Smith, Concordia College, Alissa Edjacin, Concordia College, Alexa Smith, Concordia College, Harshana De Silva Feelixge, Jennifer Sweatman, Concordia College, Joseph C. Whittaker, Concordia College

Anthropogenic plastic pollution threatens both human and ecosystem health. Plastic waste can be directly consumed by wildlife or broken down into microplastics (MPs, <5mm) that pollute the water, air, and soil. The prevalence of MPs is becoming increasingly recognized as a threat to public health and environmental conservation. Previous lab studies have observed MP distribution and accumulation in mammalian liver, kidney, and gastrointestinal tract (GIT) samples. The purpose of this study seeks to determine if the feeding behavior of the mammals influences the number of MPs existing in the GIT, using feces as a representative subset for the GITs of living squirrels. We hypothesize that all specimens sampled will contain MPs and that urban-dwelling squirrels will contain a greater number of MPs than rural squirrels.

Specimens were obtained as salvages or incidental mortalities. All GIT organs and existing feces were collected and frozen until the time of tissue digestion. Each sample was chemically digested using a 10% KOH solution. Samples were vacuum filtered and examined using a dissection microscope. For standardization, we will calculate the number of MPs per gram (g-1) organ mass, or feces mass. We will be presenting preliminary results.

43. Iowa Science Teaching

Poster

Undergrads Understanding RNR Using 3D Modeling

Ngui Dodo and Jaren Obia

Grand View University

Dodo, N., Snetselaar, E. M., Obia, J. C., Ward, C. P., Joe, E. N., Berry, J. E., Costansi, S., Rusch-Salazar, L. A., Hall, B. L.

Ribonucleotide reductase (RNR) is a key enzyme to prepare for DNA synthesis, catalyzing the production of deoxyribonucleotides from ribonucleotides. As part of an undergraduate course, we focused on the RNR enzyme and studied how it functions. Our chemistry backgrounds range from no college chemistry to Organic Chemistry I and it was a challenge for us to comprehend how an enzyme as complex as RNR worked. Ultimately, we chose to use 3D modeling to help us understand the primary literature we studied. We learned how ATP binding drives the formation of an $\alpha_2\beta_2$ complex, which is then capable of catalyzing the necessary radical chemistry. Binding by dATP allosterically inhibits RNR by shifting its form to a stable α_6 ring structure that excludes the

β_2 complex. Utilizing a cryoEM structure from the Drennan lab we built two models: one of the active $\alpha_2\beta_2$ RNR complex and another of the inactive α_6 ring form. Throughout this project we explored topics ranging from introductory chemistry through biochemistry. Discussions were driven entirely by our requests to know more about specific concepts. Based on our experiences in this course, we highly recommend using 3D modeling to help students learn and understand topics in chemistry and biochemistry.

44. Organismal Biology

Poster

A CURE for the cookbook lab—*Tigriopus californicus* as a model for realistic research experiences in undergraduate lab courses

Eric Emmons, Michaelen Golay, Eric Berns
Wartburg College

In a Course-based Undergraduate Research Experience (CURE), students engage in the full spectrum of the scientific process over the course of a semester. At Wartburg College, our second semester of introductory biology gives students the chance to create novel research projects using the model organism *Tigriopus californicus*. These marine invertebrates—known as copepods—are an important part of many marine ecosystems along the Western coast of the United States. Copepods are zooplankton that spend most of their lives in tide pools, volatile environments that are susceptible to a wide range of temperature and salinity conditions. In the *Tigriopus* CURE, a modified version of a curriculum originally created by the University of Northern Colorado, teams of students design experiments to assess how different conditions affect aspects of copepod lifestyle. These projects assess changes in temperature, salinity, diet, and/or mating opportunities. Dependent variables include survival rate, reproduction, and development. This CURE provides a straightforward system to give undergraduate students a distilled scientific experience. Along with regular written and oral communication of their findings, students get a preview of life as a researcher. Long-term, student-driven research programs like this CURE are a valuable way to give undergraduates in STEM realistic experiences as working scientists.

45. Organismal Biology

Poster

Analysis of Macro and Microplastics Present in Sri Lankan Elephant Feces

Emerson Wilson and University of Dubuque

Sri Lankan elephant (*Elephas maximus maximus*) is the largest of four sub species of Asian elephants. Current wild population is est. 7,500 whereas 22 million people also live in the small island. There has been conflicts for sharing resources such as, water and land between the two populations. Rapid urbanization left with poor waste management, so an open landfill was created adjacent to national parks. Wild elephants migrated out from the national park forest to feed on these plastic wrapped urban-food waste. Elephants are herbivores and most of the energy derived by fermenting plant food in the hindgut. Their molar-teeth can't separate food from plastics. Therefore, indigestible plastics are excreted in dung while some can obstruct the colon causing distress or death. This study examined the presence of macro and microplastics in elephant dung. Samples were collected from Diganpathana Waste Recycling Plant and Minneriya National Park. Macro plastics were present in

all samples from Recycling plant ($\bar{x}=6$) none in National park samples. Microplastics were present in dung collected from all locations. These results imply that presence of microplastics is not confined to elephants who eat from the open dump but has reached elephants inside the national parks as well.

46. Other

Poster

Effects of Compound M on Parkinsonian-Like Behavior in LRRK and Park Mutant Flies

Anna Paca and Danielle Dircks

Anna Paca, Danielle Dircks, Darshika Desai, Pramod

Mahajan, Christopher L Kliethermes

Drake University

Parkinson's disease is a progressive neurodegenerative disease caused by loss of dopaminergic transmission. FDA-approved treatments for this disease reduce symptom severity by increasing the bioavailability of the dopamine. Our laboratory has been exploring in fly models of Parkinson's disease the efficacy of Compound M, a bioactive compound isolated from a plant used in Ayurvedic medicine for the treatment of Parkinson's disease. We fed varying concentrations of Compound M to wild-type flies and to two fly lines that carry mutations in genes associated with familial Parkinson's disease, LRRK and Park. These flies were then observed in assays of negative geotaxis, horizontal locomotion, feeding, and longevity. We found genotype, sex, and concentration dependent effects of Compound M in most assays, with the clearest beneficial effect found in the climbing assay. However, the effects of the LRRK and Park mutations varied across assays, which complicates the interpretation its effects. Overall, our results suggest that Compound M might be effective at treating some aspects of Parkinson's disease, and highlight the importance of using multiple behavioral and genetic models in pharmaceutical development.

47. Other

Poster

Life of Learning: Re-energizing the Role of Mathematics and Science in University General Education

Katherine McCarville and Nigel George

Upper Iowa University

A university education should be transformational, propelling each student to a new higher level of personal and professional development. An integrated general education program that strengthens and supports a student's major program can contribute significantly to achieving these outcomes. The underlying philosophy for any general education program is to 1) build foundational skills; and 2) promote disciplinary diversification and breadth. These two components are intended to develop transferable skills and adaptability in a rapidly changing world.

The Life of Learning philosophy specifically rejects the common model of an arbitrary list of courses from various disciplines or curricular areas, and instead seeks to provide a robust rationale for inclusion of courses or disciplines, and framework was developed by the authors during a process of reimagining general education at Upper Iowa University. The framework has been proposed, but not yet adopted.

The role of Mathematics and Science coursework in the context of skills focuses on Evidence-Based Decision Making,

and can include courses such as Elementary Statistics, Data Science, and science courses with a focus on decision-making. The role of Mathematics and Science coursework in the context of disciplinary breadth may include Mathematics for Liberal Arts, or "beauty of math" courses.

48. Physics, Atmospheric & Space Sciences

Poster

Newtonian particle dynamics alone can result in wide-ranging oscillations in the eccentricity of a simulated binary stellar system due to the perturbation of a distant, orbiting third body

Kenneth McLaughlin and Loras College

As a test for the minimum perturbation required to explain recently observed variations in the orbital parameters of the spectroscopic binary *57 Cygni*, we have pursued the numerical integration of particle dynamics under non-relativistic conditions. We show that wide-ranging oscillations in the eccentricity of an inner-binary can be induced, over mere decadal timeframes, by the pure Newtonian gravitational influence of a more distant, orbiting third body without the need to incorporate tidal effects. These oscillations were observed over a restricted range of distances for the third body where the specific range depended upon its mass: too close disrupts the inner-binary stable periodicity while, at far enough distances, variations in the orbital motions of all three bodies are negligible. The oscillations were more pronounced with the third body orbiting at high inclination to the inner-orbital plane where the perturbing torque has a significant vector component perpendicular to the inner-orbital angular momentum akin to the mechanism for the precession of a spinning top, which is the observed orbiting-like motion about a vertical axis.

49. Physiology & Health Sciences

Poster

One-to-One vs. Simultaneous Manual Comparisons of the Relative Masses of Running or Basketball Shoes Yield Equivocal Accuracy Percentages

Josh Doolittle and Meg Wightman, Doolittle *et al.*

Drake University

During multiple previous experiments where subjects blindly hefted five different athletic shoe models, relative mass ranking accuracy was ~90% when they hefted the shoes simultaneously or ~70% when they hefted the shoes individually/serially, regardless of the subject's sex, whether women's or men's shoes were tested, and whether running or basketball shoes were tested. In this experiment, a third (new) protocol was developed wherein subjects blindly hefted ten pairs of two different shoes (all possible pairwise comparisons of five shoes) and then reported which was heavier; overall accuracy percentage was computed from the ten individual comparisons. The previously described simultaneous test was also repeated. Fifteen subjects (ten male, five female) participated using men's shoes. In the new protocol, overall accuracy was $93\% \pm 9\%$ for running shoes and $86\% \pm 12\%$ for basketball shoes. In the repeated simultaneous protocol, overall accuracy was $91\% \pm 10\%$ for running shoes and $84\% \pm 20\%$ for basketball shoes (consistent with earlier studies). Results indicated accuracy scores were equivocal regardless of which protocol or shoe type was used.

50. Physiology & Health Sciences

Poster

Interarm Blood Pressure in Males and Females During Upper Body Aerobic Exercise

Megan Keller and Steven Ange

Morningside University

Studies have shown that interarm blood pressure (BP) differences exist in older, diseased populations. Few studies have examined whether interarm BP differences exist in young healthy populations while exercising. The purpose of this study was to examine whether there were interarm BP differences in male and female subjects during upper body exercise. Male and female subjects all served as their own control in the sense that their right arm was compared to their own left arm. Subjects performed arm crank exercise at 60 revolutions per minute for 3-minute intervals on a cycle ergometer. At the end of each 3-minute interval, subjects stopped exercising for 1 minute to allow for recording of blood pressure and heart rate. This continued two more times for a total of three bouts of exercising. Results showed that there were no interarm blood pressure differences, independent of sex and arm, at rest or during exercise. The exercise itself did significantly raise systolic BP and heart rate in the females, independent of arm. Males had a significant increase in heart rate during exercise, but not systolic BP. Future studies should consider using a variety of exercise intensities to investigate interarm blood pressure differences.

51. Physiology & Health Sciences

Poster

Acrylamide and Perfluorooctanoic Acid Induce Transformation of NIH3T3 Cells

Rachel Hewitt

Saint Mary's University of Minnesota

Acrylamide and perfluorooctanoic acid (PFOA) are potential carcinogens that are found in many of the foods people consume, including microwave popcorn and coffee. Because of this, more research needs to be done to look at the chemicals in food that people are putting in their bodies. To analyze the potential danger of these chemicals, NIH3T3 cells were exposed to zero, low, intermediate, or high concentrations of acrylamide or PFOA. The cells were exposed to the chemicals for about two weeks, the plates were fixed and stained with crystal violet, and the number of foci that grew on each set of plates was counted. The groups were analyzed together to determine the minimum dose of each chemical that causes a significant amount of transformation to occur. From this experiment, acrylamide and PFOA were found to consistently cause significantly more instances of transformation at 3.33×10^{-5} mM and 3.33×10^{-4} mM respectively. This is about a 10-fold smaller concentration of acrylamide and a 10^7 -fold higher concentration of PFOA, than what is typically found in food. Even though there was a significant amount of transformation of NIH3T3 cells, acrylamide is the only chemical that may increase one's chance of developing cancer.

Assorted Abstracts

Oral Presentations

52. Anthropology

Oral

A Total Eclipse of the Sun as Seen by Americans Native to the Great Plains

Thomas Hockey and University of Northern Iowa

Inspired by two central eclipses of the Sun to take place within the next year, I examine the history of the Native American experience with a total solar eclipse. Of course, such a history—and that of any astronomical and geophysical phenomena—is shrouded in pre-literacy. That which is documented is filtered through the mindsets of biased authors from largely European culture. Moreover, as western scientific knowledge proliferated, much indigenous knowledge became lost.

I contend that an inflection point occurred at the total solar eclipse of August 7, 1869, the path of which spanned North America. In most of its geographical area, the dominant population was Native American, before these lands became annexed to the United States. Autochthonous interaction with those of European descent was new, but common enough that literate informants recorded Native American reaction—still largely untainted by knowledge of western science.

Coincidentally, the path of the 1869 eclipse followed the Missouri River for two thousand kilometers. First peoples of the Great Plains were provided with a good view under mainly good weather conditions. I provide examples of the event as experienced by the Dakhóta-speaking and Lakhóta-speaking (incorrectly labeled Sioux) Sisseton, Yanktonai, Oglála, Mnikhówožu, Sihásapa, and Brulé.

53. Chemistry

Oral

Hunting Zebra Calcite

Jenna Heinen and Joshua Sebree

University of Northern Iowa

Wind Cave National Park is an extreme cavern environment whose origins remain widely unknown. Because of this, my research focuses on studying the molecular makeup and mineral flow throughout the cave to create possible conclusions on both its genesis and applicability to the icy moons of the solar system. One target formation is Zebra Calcite, a crystalline calcite formation trapped between paleo fill layers. This formation is quite rare and its makeup unknown, however its uniqueness and relative location could provide insight into the cave's formation. Due to the delicate and pristine conditions of the cave, methods such as UV-VIS and XRF spectroscopy are used to study the makeup of the formation without removing it. This data is then used to synthetically create replicate crystals of the feature in the lab. Through this, further investigation of the mineral can be done, allowing us to garner information about its molecular makeup. Using this information, hypotheses about the contents of Zebra Calcite and more broadly the cave makeup itself can be made, leading to a better understanding of the cave itself and its possible origins.

54. Organismal Biology

Oral

The effect of atrazine on the learning ability in mice

Catherine Pierpont and

Saint Mary's University of Minnesota

Atrazine (ATZ) is one of the most used herbicides across the United States and is commonly used on crops like corn and sugarcane. ATZ contaminates water sources because of its topical application. The EPA has implemented a 3ppb maximum contaminant level in drinking water, but concentrations measured in ground water often exceed that amount. Exposure to ATZ has been found to influence spatial learning in mice specifically in association with the hippocampus. The goal of this study was to determine if in utero exposure to ATZ affected spatial learning. Female pregnant mice were treated with 0ppb, 3ppb, 30ppb, and 300ppb in their drinking water. A Morris water maze was performed on pups at 4 weeks post-natal for 5 days and there was no significant statistical difference in the mice exposed to ATZ.

55. Physiology & Health Sciences

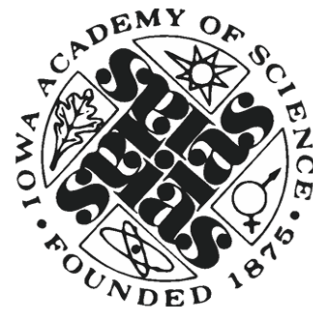
Oral

Salivary cortisol and DHEA sulfate levels as markers of stress and resilience

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Cortisol is a hormone that tends to increase with increasing stress in serum and saliva in mammalian species. DHEA sulfate, also found in serum and saliva, exhibits relatively stable levels over short time periods and is thought to correlate with resilience and wellbeing. This study addresses correlations between emotional health and environmental factors including relationships, athletic participation, and academic pursuits. We will assay for correlations between emotional health and genetic factors including resilience. Environmental factor information will be collected from participants and recorded in Excel. Saliva samples will also be obtained and used to perform ELISA assays for levels of DHEA sulfate and cortisol. As cortisol levels display diurnal variation, samples will all be collected during the same hour of the day. Samples from participants will be assayed in duplicate, setting an upper limit of 38 on the total number of participants. Statistical analyses will be performed using PRISM software to assess correlations between ELISA results and environmental factor data. I am predicting positive correlations between emotional health and relationships and athletic participation. I also predict that perceived rigor of academic pursuits will inversely correlate with emotional wellbeing, and resilience will display a strong positive correlation independently of environmental factors.



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