

PROCEEDINGS OF THE 130TH ANNUAL MEETING OF THE IOWA ACADEMY OF SCIENCE



April 20—21, 2018
Buena Vista University
Storm Lake, Iowa

Committees and Sections

Committee on Committees and Elections

Chair: Paul Bartelt
Thad Sheldon (2018)
Nicole Palenski (2018)
Tyrone Genade (2019)
Qun Wang (2019)
Marcy Seavey (2020)
OPEN (2020)

Conservation and Preserves

Chair: Paul Frese (2018)
Katherine Megivern (2018)
Ryan Rehmeier (2019)
Andy McCollum (2019)
Paul Mayes (2020)
Vacant (2020)

Finance

Chair: Andrew Brittingham (2018)
OPEN (2018)
OPEN (2018)
John Dawson (2019)
Leslie Flynn (2019)
Gary Coombs, (2020)
Vacant (2020)

Iowa Science Foundation

Chair: Dawn Reding (2018)
Ken DeNault (2018)
Thomas Bonagura (2019)
Joseph Tiffany (2019)
Bonnie Hall (2020)
Jeffrey Willkerson (2020)

Membership

Chair: Donald Beitz (2019)
Gary Fulton (2018)
Chris O'Connell (2018)
Michael LaGier (2019)
Vacant (2020, 2020)

Recognition and Awards

Chair: Carol Boyce (2018)
Lisa Chizek (2018)
Michael Carruthers (2019)
Elitsa Ananieva-Stoyanova (2019)
Leslie Flynn (2020)
Tom Ervin (2020)

Societal Issues

Chair: Jim Pease (2020)
Sherman Lundy (2018)
Sara Coleman (2018)
Joseph Nguyen (2019)
Jonnie Becker (2019)
Vacant (2020)

Student Programs Committee

Chair: Gail Kunch (2018)
Felicita Avendano (2018)
Mike Goudy (2019)
Barbara Lemmer (2019)
Holly Showalter (2020)
Rasika Muddalige-Jayawickrama (2020)
Ex-officio, Kris Kilibarda

Excellence in Science Teaching Awards (ESTA)

Chair: Tom Ervin
Members appointed by the Chair:
Ernie Schiller
Mike Zeller
Doug Herman
Gale Vermeulen
Mike Clough
Morgan Masters
Mary Lestina

Myrle Burk Scholarship

Neil Bernstein
Lynn Countryman

Dennis Schlicht

Section Chair/Vice Chair

Anthropology
Mark Anderson/ Vacant

Cell, Molecular, & Microbiology

Kelly Grussendorf/Stephanie Toering-Peters

Chemistry

Joseph Nguyen/Mark Sinton

Community College Biologists

Amber Ruskell-Lamar/Paul Pistek

Ecology & Conservation

Deborah Lewis/John Pearson

Engineering

Mark Wright/Al Ratner

Environmental Science & Health

Nicole Palenske/Thomas Bonagura

Geology

Chad Heinzel/Ryan Clark

Iowa Science Teaching

Lisa Chizek/Ken Turner

Organismal Biology

Sara Sheeley, Kaitlyn Holden

Physics, Atmospheric & Space Sciences

Elizabeth Golovatski, Jeff Willkerson

Physiology & Health Sciences

Rasna Sabharwal, Vacant

Thank you for participating in the 130th
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.

Iowa Academy of Science
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IAS FRIDAY SCHEDULE

Estelle Siebens Science Center (ESSC), Forum, Schaller Chapel

Registration Desk Hours

7:30 a.m. - 6:00 p.m.

Book Store Hours

7:30 a.m. to 6:00 p.m., ESSC Lobby

Time	Events	Location
7:30 - 10:30 a.m.	IJAS Registration Open	ESSC Lobby
8:00 a.m.- 6:00 p.m.	IAS Registration Open	ESSC Lobby
8:00 a.m.	IAS Book Store Opens	ESSC Lobby
8:00 - 10:00 a.m.	Breakfast	ESSC Lobby
8:30 - 11:15 a.m.	IJAS Student Poster Session	ESSC Hallways
11:30 a.m. - 12:15 p.m.	IJAS/IAS Luncheon	Siebens Forum—Dows Ballroom
12:30 - 1:30 p.m.	General Session I	Schaller Auditorium, See page 6
1:30 - 1:45 p.m.	IJAS Awards Ceremony	Schaller Auditorium
1:50 - 2:20 p.m.	IAS Business Meeting	Schaller Auditorium
2:00 - 2:30 p.m.	IJAS Mastodon Tusk Seminar	Siebens Forum - Hansen 8
2:00 - 4:30 p.m.	IAS Poster Set-up	ESSC Hallways
2:45 - 4:45 p.m.	IAS Symposiums A,B,C	Siebens Forum— See page 7.
4:30 - 6:00 p.m.	IAS Poster Session/Social	ESSC Hallways
6:15 - 7:45 pm	President's Banquet/Awards	Siebens Forum—Dows Ballroom
8:00 - 9:00 p.m.	General Session II	Schaller Auditorium, See page 9

IJAS FRIDAY SCHEDULE

Events located in the Estelle Siebens Science Center (ESSC), Forum, Schaller Chapel

Time	Event	Location
7:30 - 10:30 a.m.	IJAS Registration	ESSC Lobby
7:30 - 10:30 a.m.	Poster set up	ESSA Hallways
8:00 - 8:25 a.m.	Judges Meeting	ESSA 125
8:30 - 11:15 a.m.	IJAS Poster Presentations/Judging	ESSA Hallways
8:30 - 11:30 a.m.	IJAS Oral Presentation/Judging	See Room Schedule on Page 5.
11:30 - 12:15 p.m.	IJAS Luncheon	Siebens Forum—Dows Ballroom
Noon - 12:30 p.m.	IJAS Poster Removal	ESSC Hallways
12:30 - 1:30 p.m.	General Session I	Schaller Chapel Auditorium
1:30 - 1:45 p.m.	IJAS Awards Ceremony	Schaller Chapel Auditorium
2:00—2:30 p.m.	Mastodon Tusk Seminar	Siebens Forum—Hansen 8

IJAS concludes at 2:30 p.m. Attendees are invited to attend IAS Symposiums. See page 7.

IJAS PRESENTATIONS

IJAS Science Symposium ends at 2:30 p.m.

Use the abstract numbers to find a poster location in the ESSC hallways and the oral presentation room.

IJAS students must pick up instructions for mounting posters and their oral presentation schedules at the registration desk. Oral presentation room assignments are available in the table below. Students should remain in their room until all presentations are complete.

Abstract Numbers	Room Assignment	Presentation Time
1 - 6	ESSC 125	9:00 - 10:30
7 - 12	ESSC 128	9:00 - 10:30
13 - 17	ESSC 136	9:00 - 10:15
18 - 24	ESSC 137	9:45 - 11:30
25 - 31	ESSC 218	9:45 - 11:30
32 - 28	ESSC 222	9:45 - 11:30
39 - 45	ESSC 224	9:45 - 11:30
46 - 52	ESSC 226	9:45 - 11:30
53 - 59	ESSC 227	9:45 - 11:30
60 - 67	ESSC 229	9:45 - 11:45

IAS SATURDAY SCHEDULE

Oral Presentation Room Assignments

Registration Desk Hours

7:30 a.m. - 3:00 p.m.

Book Store Hours

8:00 to 3:00 p.m. in the ESSC Lobby

Time	Events	Location
7:30 a.m.- 3:00 p.m.	Registration Desk Open	ESSC Lobby
7:30 a.m.- 3:00 p.m.	IAS Bookstore Open	ESSC Lobby
8:00a.m.- 10:30 a.m.	Breakfast and Beverages	ESSC Lobby
8:00 a.m. - 2:30 p.m.	Section Meetings	See pages 33—37
11:00 a.m. - Noon	General Session III	Forum: Hansen 8
Noon -12:30 pm	Luncheon	Siebens Forum—Dows Ballroom
12:40 - 2:30 p.m.	Section Meetings Continue	See pages 33—37
1:30 - 3:30 p.m.	Mill Creek Archaeology Site Tour	Directions available at registration
3:00 p.m.	Bookstore Closes	ESSC Lobby
3:00 p.m.	Registration Desk Closes	ESSC Lobby

FRIDAY EVENT DESCRIPTIONS

See pages 4 and 5 for IJAS poster and oral presentations

IJAS Poster Viewing
IJAS Oral Presentations
ESSC Hallways and Rooms
See pages 4 and 5



IJAS Luncheon **11:30 a.m.—12:15 p.m.** **Forum - Dows Ballroom**

Enjoy lunch with IJAS students, teachers, and faculty.
IJAS Awards Ceremony will be held at 1:30 in Schaller Auditorium
after IAS General Session I.

General Session I **Friday, 12:30 - 1:30 p.m.** **Schaller Chapel Auditorium**

Gregory Jeff Barord, Ph.D.
Marine Biology Instructor
Central Campus
Des Moines, Iowa



Deep Sea Conservation: **The Secret Life of Nautiluses**



Dr. Gregory Jeff Barord completed his B.S. in Marine Biology with a minor in Chemistry at Texas A&M University at Galveston from 2001-2005. While in Galveston, Dr. Barord also worked at the National Resource Center for Cephalopods (NRCC) from 2003-2008 and in the quarantine facility at the Aquarium at Moody Gardens from 2006-2008. In an entirely different direction, Greg worked on fishing boats in the Bering Sea from 2008-2010. He completed his dissertation at the City University of New York – Brooklyn College and Graduate Center, obtaining his Master of Philosophy in Biology (2014) and Doctor of Philosophy in Biology (2015).

FRIDAY EVENTS CONTINUED

IAS Symposiums A, B, C

Gene Editing in Eukaryotes and Prokaryotes

Symposium A

Friday, 2:45—4:45 p.m.

Siebens Forum: Room 2



Melissa M. Harrison Ph.D.
University of



Eric B. Taylor, Ph.D.



Dipali Sashital, Ph.D.

- From Mutation to Mechanism:: Cas9-Mediated Engineering of Model Organisms
- Use of CRISPR/Cas9 Systems to Decipher Mechanisms Underlying In-born Errors in Metabolism
- CRISPR-Cas systems: From Adaptive Immunity to Biotechnology

Symposium B

Friday, 2:45—4:45 p.m.

Siebens Forum:

Room: Hansen 8

Ecological Site Development and Application in Iowa



Thomas Rosburg, Ph.D.
Drake University



Stacey Clark, Regional Ecologist
USDA - NRCS



Lisa Kluesner, Ecologist
USDA - NRCS

- Ecological Sites in Iowa: Methods and Data
- The Ecological Site Program in the Natural Resources Conservation Service: Developing a Tool for Conservation and Resource Management
- The State-and-Transition Model: Interpreting Ecological Dynamics of the Ecological Site

Symposium C

Friday, 2:45—4:45 p.m.

Siebens Forum: Room 4

Recent Iowa Excavations from the Late Prehistoric Era



Mark Anderson
Research Archaeologist
Office of State Archaeologist



Dale R. Henning, Retired
Dir. Contract Archaeology
Illinois State Museum



Joseph A. Tiffany
Former Director, Missis-
sippi Valley Archaeology

- The Mill Creek Culture, Chan-ya-ta Revisited
- The Dixon Site, 13WD8: A Frontier Oneota Village on the Little Sioux River
- Blood Run, The End of the Oneota Tradition?

FRIDAY EVENTS CONTINUED

IJAS Awards, IAS Business Meeting, IJAS Mastodon Tusk Seminar open to all attendees

IJAS Awards
Friday, 1:30—1:45 p.m.
Schaller Chapel Auditorium

Iowa Junior Academy of Science

Awards Ceremony

De Anna Tibben, Ames High School

Introduction of Iowa's 2018 National Youth Science Camp Delegates

Announcement of IJAS Competition Awards

Most Promising Young Scientist

Iowa Delegates to the American Junior Academy of Science, 2017

Iowa Alternates to the American Junior Academy of Science, 2017

IJAS \$500 Senior Scholarships

Recognition of all IJAS Members, Judges, and Sponsors



Agenda

Call Meeting to Order

Welcome

Approval of Agenda

Recognition of Deceased Members/Moment of Silence

Introduction of Board Members, Honor outgoing Board members

Executive Director Annual Report

New Business

Adjourn

IAS Business Meeting
Friday, 1:50—2:20 p.m.
Schaller Chapel Auditorium

IJAS Seminar
Friday, 2:00—2:30 p.m.
Schaller Chapel Auditorium

**Engaged Learning: Student Involvement
in the Restoration of the UNI Mastodon Tusk**

Nathan Arndt, Chief
Curator, UNI Museum

Joshua Sebree, Ph.D.
Assistant Professor
Department of Chemistry and
Biochemistry
University of Northern Iowa



In the fall of 2016, the University of Northern Iowa Museum was awarded a \$306,258 heritage grant from the Carver Charitable Trust for the "Scientific Study, Conservation, and Interpretation" of a mastodon tusk held by the museum. Over the course of the following three years, the tusk will be cleaned, analyzed, and preserved along with records of the process for eventual permanent display at UNI. To engage UNI students across campus in the conservation process, the museum has established partnerships with the Department of Chemistry and Biochemistry, the Rod Library, the Department of Earth and Environmental Science, and the Department of Sociology, Anthropology, and Criminology.

FRIDAY EVENTS CONTINUED

Saturday Refreshments in the ESSC Lobby

Senior Poster Session and Social Time 4:30 to 6:00 p.m.



IAS Senior Poster Session

- Meet your colleagues
- View more than 70 research posters
- Discuss events of the day

President's Banquet

Seibens Forum, Dows Ballroom, 6:15 p.m. to 7:45 p.m.

Welcome and Introductions

Executive Director Remarks

Election Results

Presentation of the ESTA and Distinguished Awards

President's Address by Paul Bartelt

Passing of the Gavel

Incoming President's Address by Mary Skopec

Close

General Session II

Friday, 7:45 p.m.

Schaller Chapel Auditorium

Low Altitude Remote Sensing

James T. Dietrich, Ph.D.

Assistant Professor of

Geography

University of Northern Iowa

Cedar Falls, Iowa

James T. Dietrich currently works at the Department of Geography, University of Northern Iowa. James does re-

JUNIOR ACADEMY OF SCIENCE

Promoting the study of and participation in science by elementary, middle, and high school students.



IJAS Science Symposium

2018 IJAS Delegates to the American Junior Academy of Science Annual Meeting

Austin, Texas

Helen Hu, Ames High School

David Kim, Ames High School

Chaperone: Gail Kunch
Danville Community School District

The Academy, with the support of the Iowa Space Grant Consortium, sends two Iowa high school students and a chaperone to serve as delegates to the American Junior Academy of Science Annual Meeting.

IOWA JUNIOR ACADEMY OF SCIENCE RESEARCH

2017—2018 STARR Student Research Grants

IAS Member Frank Starr established the STARR Student Research Grants to support science fair research. IJAS Members submit grant proposals to the IAS Student Programs Committee. The committee grants awards of up to \$200 per project to assist students in gaining access to items not normally available in their science classrooms. The committee also provides feedback and suggestions for improving their project plans. This year the Student Program Committee awarded grants to the following 32 student researchers:

Tharindu Jayawickrama
Aaron Wills
Maddox Grafton
Karissa Moeller
Macy Watkins
Emmy Liu
Olivia Tennant
Madison Meixner
Reese Kracht
Jaelyn Boley
Lukas Mcentee
Emma Charbonne
Zoe Best
Faith Neeley
Bruce Claman
Avary Bartholomew

Mckenna Caviness
Chase Krug
Shannon Garrels
Jolie Harryman
Brooklynn Cormier
Anna Beebe
Rebecca Pilcher
Kamryn Banks
Kayla Livesay
Meghana Yellepeddi
Tyler Hill
Bailey Beckman
Style Haeffner
Isabella Steffensmeier
Jennifer Stueve
Kashish Patel

ESTA & DISTINGUISHED AWARDS

Awards are presented at the President's Banquet.

Excellence in Science Teaching Awards (ESTA)

The Iowa Academy of Science awarded the first Excellence in Science Teaching Awards in 1969. Outstanding teachers of all grade levels and areas of science have been recognized for their work and innovations in science education. Nominations are encouraged from administrators, colleagues, or a teacher may self-nominate. Selections are made by the ESTA and the Awards and Recognition Committees.



Scott Black

**Earth,
Space,
Environmental
Science**



Phil Lala

**General or
Multiple
Science**



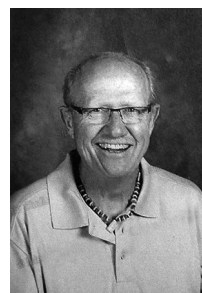
Linda Peitz

**Elementary
Science**



Collin Reichert

**STEM
Science**



Ernest Schiller

**Science
Supervisory**

Distinguished Awards

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. Distinguished Awards are the Academy's highest honor. Nominators and nominees are not required to be IAS members.

Distinguished Iowa Scientist



Thomas Rosburg

Distinguished Iowa Science Teaching



Debora Christensen

Estelle Siebens Science Center, Buena Vista University, Storm Lake, Iowa, April 20–21, 2018

SATURDAY EVENTS

Section meeting room assignments: Page 33

Section meeting schedules: Pages 34—37

IAS Abstracts: Pages 39 to 65

More than a Decade of Research Leading to Recovery of an Endangered Watersnake

General Session III
Saturday, 11:00 a.m. - Noon
Forum: Hansen 8

Robert Brodman, Ph.D.
Associate Professor, Biology
Buena Vista University
Storm Lake, Iowa



Robert Brodman's research focuses on conservation of amphibian and reptiles with questions ranging from ecology to animal behavior. Dr. Brodman developed an undergraduate research program centered on ecotoxicology studies investigating the impacts herbicides, habitat restoration, farming practices, and disease ecology on biodiversity and population abundance. While he has never considered himself in the 'publish or perish' world, he has published 50+ peer-reviewed research articles and book chapters plus another 50+ technical reports and editorials. More importantly 18 of the peer-reviews and 13 of the technical reports were co-authored with undergraduate students. He has received several awards for teaching and scholarship. Courses taught include Biological Principles I; Evolution; Zoology; Mammalogy; Herpetology; Biology of Bats; Conservation Ecology; Research Experience I & II and Research Capstone; Island Ecology (travel course to US Virgin Islands).

Mill Creek Archaeology Site Tour

1:30 - 3:30 p.m.

**Tour the Wittrock Site with Dale Henning then caravan to Chan-Ya-Ta and
learn more from Joe Tiffany.**

Get travel details at the Registration Desk

Meet at the Prairie Heritage Center in Peterson

IJAS RESEARCH PRESENTATIONS

Posters and Oral Presentations in the Estelle Siebens Science Center (ESSC) - See pages 4 and 5

Abstract number identifiers indicate the poster locations. Use the abstract numbers to locate oral presentation rooms on page 5.

GRADE 7

1. The Butterfly's Effect: How Soil Quality Affects Pollinators

Katie Gu & Leslie Kim
Ames Middle School

Pollinators and plants have developed a mutual relationship, where both pollinators and plants benefit from each other. This is because pollinators use the pollen and nectar from a plant's reproductive base for feeding and providing the building block materials for life that can benefit the pollinators. While the plants also benefit by the continuation and spread of their reproductive seeds, as pollinators take nectar from the reproductive plant, pollen will catch on the hairs on their body, allowing the plant's seeds or pollen to be spread to other areas. These plants attract pollinators by appealing to the color ranges that pollinators are able to see, their scent, and the structure of plants has to accommodate for specific pollinators. With fertilizers in most people's gardens and fields, our research studies how organic and chemical fertilizer can improve zinnia elegans growth and how the usage of these different additives can appeal to pollinators. In our hypothesis, we assumed that the chemical fertilizer would be more effective and attractive than the organic fertilizer. The organic was an average of 1.67 cm taller than the chemical. Although we were unable to get the flowers to bloom in time. It was quite obvious that the organic fertilizer had surpassed the control and chemical. Since we were unable to inquire which was more appealing. We were unable to have a conclusion for our hypothesis, but we were able to deduct that the organic fertilizer was more effective than the chemical fertilizer.

2. Alien Garlic Mustard Takes Over Ames, Iowa

John Higgins & Jackson Hufford
Ames Middle School

Garlic Mustard is an invasive species taking over forests throughout the United States. It was introduced from Europe in 1868 for medicinal and culinary purposes and has been spreading through woodland areas at an alarming rate. Garlic mustard plants are hard to control

because they are self-fertile and each plant can produce thousands of seeds per year. Additionally, some invasive plants have allelopathic effects-meaning they can suppress growth of other plant species by releasing toxic substances. Garlic mustard is thought to have allelopathic effects that help it stifle surrounding plants, dominate the environment, and interrupt native plant growth. We generated the hypothesis that garlic mustard will kill or stunt the growth of surrounding plants. Originally, the effects were to be tested on plant species native to the Ames area, but they failed to sprout. Instead, the garlic mustard was tested on a crop-lettuce. Garlic mustard plants were collected and planted in containers. Lettuce was planted from seed with the garlic mustard and in a control box. All of the plants were observed as the seeds grew, monitoring leaf growth and height. After one month the sprouts were removed and their above ground biomass was measured and compared. The results showed the garlic mustard adversely affected the growth of the lettuce as the biomass was larger for the control than the garlic mustard exposed plants. A t-test was done revealing a p value of <0.05 (2.2×10^{-16}). This confirmed the results were statistically significant and suggested allelopathic effects of garlic mustard affected the lettuce plants.

3. Lakes and Ponds Water Quality in Ames, Iowa

Alina Markutsay
Ames Middle School

There are multiple possible sources of contamination in water that can affect aquatic life due to the large number of sewage and fertilizer drained into lakes and ponds. In my project, I investigated whether or not there will be a difference in water quality between lakes and ponds in Ames, Iowa. I hypothesized that the lakes will be cleaner and have better water quality than ponds because of larger size, more access to fresh water, greater depth, and amount of ice. I tested the water quality of different lakes and ponds by measuring the temperature of water, turbidity, pH, nitrate, and dissolved oxygen concentration. The lakes I tested were Ada Hayden Lake, McFarland Lake, and Peterson Pits Lake. The ponds I

IJAS RESEARCH PRESENTATIONS

Posters and Oral Presentations in the Estelle Siebens Science Center (ESSC) - See pages 4 and 5

Abstract number identifiers indicate the poster locations. Use the abstract numbers to locate oral presentation rooms on page 5.

tested were Moore Park pond, East of Northridge Heights Park pond, and Lake Laverne. My results didn't support my hypothesis and I found that the lakes and ponds had mostly the same results. In conclusion, to identify the difference in water quality between lakes and ponds, further research needs to be done and more parameters need to be measured, such as, fecal coliform, conductivity, salinity, and more. Water quality in aquatic life is important and I found that Ames, Iowa has good conditions to grow healthy, prosperous, aquatic life.

4. Solar Water Heater: Material Efficiency

Grant Anderson

Central Lee Middle School

The purpose of this project was to determine which solar water heater material performed the best in heat transfer. Finding which solar water heater material is the best can help consumers lower their energy cost and conserve energy, which is better for the earth. I constructed a passive thermosiphon solar water heater by building a wooden box that contained three individual solar collectors. Each box was lined with foam board and painted black to retain the heat. I then placed sheet metal on top of the foam board and attached the copper, clear and black tubing in place. I created three water reservoirs and attached them to each individual solar collector via black tubing. I predicted that the copper tubing would transfer more heat due to the material. My hypothesis was upheld as the copper tubing overall performed the best. I am going to continue this project with more days of data collection.

5. Purifying H2O - What's Best?

Keating Fuger & Payton Stevens

Central Lee Middle School

Have you ever been in a situation where you did not have access to drinkable water? Research states that water needs to have a PPM (parts per million) level of 600 or less in order for it to be safe to drink. We chose this project because we are both involved into sports and consume several ounces of water. We wanted to test which filter technique purified water the best. First, we

selected 4 filtering systems: Sand, Commercial, Solar, and Boil. Next, we collected a sample of pond water to complete 3 trials. For each filter, we set up a procedure and tested 3 water samples and repeated for 3 different trials. Lastly, we took our data and compiled it into a graph and analyzed the results. This data proved to us that the boil method was the most effective. You never know when you could be in a situation where you did not have access to drinkable water; Therefore, we wanted to have the knowledge to know how to filter water. Furthermore, from the data we have collected it has proven to us that if we need to have a water filtering system we should boil our water for the safest, drinkable water. To accomplish this we can either use a stove, campfire, or other type of heat source.

6. The Effects of Produce Sanitizing Washes on Apples and Strawberries

Jacob Hohl

Central Lee Middle School

My problem was that some fruits even after being washed, can be dirty, unhealthy, and make people sick. I wanted to see if washing the fruit with difference produce sanitizing washes would eliminate bacteria off of the surface of the fruit. I experimented with apples and strawberries because these two fruits are on the top of the "Dirty Dozen" list of most contaminated produce. I chose to experiment using regular tap water, Fit Organic™ Fruit and Vegetable Wash, a water and vinegar mix, and a water and bleach mixture. I hypothesized that the Fit Organic™ Fruit and Vegetable Wash would eliminate the most bacteria. Each fruit was swabbed before and after each wash and placed in a petri dish. Bacteria was allowed to grow for 3 days at 32 degrees Celsius. After the 3rd day, bacteria colonies were counted and recorded. After 8 trials, my hypothesis was not upheld. The mixture of bleach and water removed the most bacteria while the Fit Organic™ Fruit and Vegetable wash removed the least amount of bacteria.

7. Reducing Fluoride In Water Using Phytoremediation

IJAS RESEARCH PRESENTATIONS

Posters and Oral Presentations in the Estelle Siebens Science Center (ESSC) - See pages 4 and 5

Abstract number identifiers indicate the poster locations. Use the abstract numbers to locate oral presentation rooms on page 5.

Karissa Moeller

Central Lee Middle School

Long term exposure to high fluoride levels can be seen as dental fluorosis (white spots in teeth) to more harmful effects such as arthritic joint pain, respiratory disease, or cancer. The purpose of this project was to determine if the *Tradescantia pallida* and the *Phalaris arundinacea* would reduce the amount of fluoride levels in water runoff at the end of nine weeks. Initially, I took a sample of my tap water to the Fort Madison Water Department to test and obtain a baseline fluoride level. The result was 3.06 ppm. I then collected two buckets of water to use throughout my project. I started with four red tubs, drilled holes and added spouts, then filled them $\frac{3}{4}$ full of dirt. Three tubs were planted with *Tradescantia pallida* and one tub was left with only dirt to be used as a control. This process was repeated with four white tubs, and three tubs were planted with *Phalaris arundinacea* and one tub left with only dirt as a control. Initially, all tubs were watered with 2.13 L of tap water. Additional waterings kept the soil saturated with standing water for nine weeks. Each plant received the same amount of sunlight. At the end of the project, the runoff water collected was tested at the Fort Madison Water Department. All tubs had decreased levels of fluoride. The *Tradescantia pallida* average decrease was 1.47 ppm, the control 1.43 ppm. The *Phalaris arundinacea* average was 0.56 ppm, with the control 1.40 ppm.

8. Effect of cooking and microwaving on antibacterial properties of herbs and spices

Tharindu Jayawickrama & Logan Barton

George Washington Middle School

Main aim of our research was to find out whether the antibacterial properties of herbs and spices get destroyed by cooking or heating in a microwave oven. We decided to do this experiment because we read a paper that listed many herbs and spices with antibacterial properties. We know most antibiotics go bad when exposed to high temperatures or kept at room temperature for too long. We wanted to know whether cooking and microwaving destroy the good antibacterial properties in food. We

were also curious to know which herbs and spices will work best against bacteria. Our hypothesis was cooking/microwaving reduce the antibacterial properties of spices and herbs. The negative control was water without any herbs or spices while the positive control was ampicillin. We tested ten different herbs and spices against two different bacteria, *Escherichia coli* and *Bacillus cereus*. We spread bacteria on nutrient agar plates. We made spice extracts, dipped small filter paper discs until they are saturated and placed the discs on bacterial plates. This procedure was repeated for boiled and microwaved spice extracts. We measured the size of the clear zone (zone of inhibition) after incubating overnight. Our results showed that garlic has the best antibiotic properties against both bacteria. Cumin and cinnamon also showed some antibacterial properties. Boiling for 5 minutes or heating in a microwave for 1.00 minute did not reduce the antibacterial property of the spices and herbs tested in our first set of experiments.. We are currently repeating our experiments to make sure our data is accurate. When we get all the data analyzed we will come to a proper conclusion.

GRADE 8

9. Tinted Memory: How Does Color Affect Memory Retention?

Sivani Manimaran & Preksha Sarda & Ling Bai

Ames Middle School

Color affects the human mind in many different ways, for example, our memory. Our experiment focuses on how the color of ink on a test affects the score a student receives on a memory test. Our test looks into how red and blue ink colors may cause students to have different scores. Knowing this information can help schools administer tests and the elderly or those with Alzheimer's disease retain information. We think that if the color of the ink is red than the student will end up receiving a higher score on the test because red is a color that is known to get people's attention (is used in stop signs, fire alarms, traffic lights, correction ink etc.) To remember things, the brain needs a stimulus. Many studies have found that red is the stimulus. We have

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tested a number of students on how well they can retain information by randomly giving them 3 tests that are have either red, blue, or black ink. These 3 tests have reading passages with a time limit given to read them. Students will then answer questions about the test, without the passages available to them. These students will come in to take two more tests on the remaining two colors (randomly distributed colors given to random students). From our data, no valid conclusions can be drawn about how ink color affects memory retention. We think that this happened because the difficulty of the passage and questions were not all the same, so this would be an uncontrolled variable, which results in us not efficiently testing the effects of colored ink. For this reason our hypothesis was disproved by the data as well.

10. Up, Up, and Away!

Xandra Abel

Central Lee Middle School

The purpose of this engineering process is to design a table for my grandfather. I researched several different materials for my tabletop and decided on plastic. I chose plastic because it was FDA food grade approved, lightweight, and inexpensive. I purchased a table and removed the existing legs. I chose lift hinges, so the table would lift and extend to the height of my design criteria. I attached the hinges to the table top with the screws that held the table legs on. I used bar clamps to secure the hinges to the table. The hinges kept coming open and posed a risk to the user. I used a Jbolt into the hole at the end of the hinge and added a spring and washer to it. The Jbolt can be twisted into the parallel hole to keep the hinge closed when not in use. My preliminary design had to be altered a little bit to get a working prototype. This table fit all my design criteria and solved the need. There are a few things I could change about the table based on feedback. I would like to have a table top that has a groove to contain spills. I would like to make a table with an adjusting cup holder. In the future I would like to patent my table design.

11. Preserving a Georgia Hot - Phase II

Zepha Abel

Central Lee Middle School

The purpose of this experiment is to see which method mummifies a hotdog the fastest. I used 3 different methods to mummify hotdogs. I measured the length, weight and circumference of each hotdog. I filled 10 airtight containers with 650.618ml of water and placed them in freezer overnight. I then placed a hotdog on top of the ice in each container. I placed 946.35ml of crushed ice on top of each hotdog making sure they were covered. I secured the lid on 5 of the containers and placed them in the freezer. I then added 473.18ml of water to the remaining 5 containers, secured the lid and placed them in the freezer. I poured 1.42L of water into an airtight container and placed a hotdog in the water. I secured the lid and placed the container in the freezer. I repeated those steps with 4 more hotdogs. I put 5 hotdogs in separate containers with air tight lids and placed them in the freezer for my controls. The hotdogs remained in the freezer for 4 consecutive weeks. After 4 weeks I removed the hotdogs from the freezer and remeasured the length, weight and circumference. My controls mummified the hotdogs the fastest, but the ice without water came in second. The control hotdogs decreased in weight, and length the fastest. The hotdogs in water had the least amount of circumference gain. All the methods increased the hotdog circumference. Hotdog length increased with the ice without water and the ice with water methods. Hotdog weight increased with the ice with water and the water methods.

12. What Is the Effect of Different Types of Rocks on Water Hardness?

Emmy Liu

Central Lee Middle School

I wanted to do this project because the town where my school gets its water from the Cambrian-Ordovician aquifer. I wanted to test the hardness of water in total dissolved solids (TDS). I predicted that the sandstone would have the most TDS because it was the most porous and that the distilled water would have the least

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amount of TDS because it didn't have any rocks in it. I took a total of 12 0.95 Liter mason jars and filled them all with 473.18 mL (2 cups). I added .91 kilograms (1.6 lbs) to of each rock to the mason jars. I was testing limestone and sandstone while using distilled water as my control. I took data for 19 days. My data showed that the limestone had the most TDS while the distilled water had the least amount of TDS.

GRADE 9

13. Sudoku Solver

Kashish Patel

Adair-Casey/Guthrie Center

The purpose to this program is to help people solve Sudoku puzzles in an easy and efficient way. I think that I will be able to easily program and solve Sudoku puzzles with the programming that I complete. To create this program you have to first arrange a 9x9 matrix with all the needed numbers in all of the 9 rows and columns, and no number can be used more than once in any row or column. After you have done that you have 9 3x3 matrixes that you make sure have an unique number. This the procedure that I followed to create this unique program. I applied same logic in my html code. My game load with all value and then randomly I made some value invisible using java script and when someone wanted the result I again made those values visible. During the project I understood lots things like categories under user experience, technical and not technical requirement gathering and find solution for those problems. Apart from my learning the project gave output in form of working game in Website.

14. Can You Go Green if You "MEAT" The Bacteria?

Arunadee Fernando

Ames High

In many households, chopping boards are staple item in their kitchen. Many of us are concerned about cleaning these items especially after using them with meat products. The fact stands that meat products including fish are sterile to begin with. Contamination happens via the process to the market, even may be at home.

Without proper cleaning, the amount of bacteria will grow, causing serious food-borne illnesses. In phase one of this study, the goal was to investigate how the amount of bacteria was influenced after different cleaning methods. And, also whether plastic or wooden chopping boards are better for everyday use. The results showed that wood has fewer bacteria than plastic and dishwashing as the best cleaning method. This year, my goal was to further investigate whether the bacteria on different food sources left on wood chopping boards are necessarily bad i.e. pathogenic. Since the wood chopping boards are not compatible with dishwashing, I wanted to explore an alternative cleaning method i.e., hand wash cleaning. I wanted to further investigate whether handwashing with hot or soapy water has an effect on the bacteria left on chopping boards. The experiment was carried with a red pigmented non-pathogenic *E. coli* as a positive control along with beef, chicken, fish and potato as food sources. Each food source was thoroughly smeared onto the chopping boards. Smears were scraped and subjected into a serial dilution followed by plating. Immediately after, chopping boards were washed smears were taken and plated. Plates were subjected to overnight incubation at room temperature to resemble the kitchen environment. Clear signs showed that hot water was more effective for cleaning than soapy water. The swabs that followed serial dilution were also observed for morphology and put into a series of biochemical tests for the identification of the types of bacteria. Results showed that there are a substantial amount of gram negative compared to gram positive bacteria and the nature of bacteria are not pathogenic to humans. This finding helps to ease the consumption of water and electricity in any household, as dishwashing does not have to be done to get rid of "dangerous" bacteria, as there is none. Hand washing with hot water is suffice to remove bacteria eft on chopping boards.

15. A Quantitative and Qualitative Study of Toilet Spray Contaminants

Shaelyn Hansen & Emma Upah

Center Point Urbana High School

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Abstract When you flush the toilet, the swirling water in the toilet bowl mixes with the small particles of the waste, shooting aerosolized feces into the air. Low flow toilets and flushing with the toilet seat down help decrease this risk. Studies show that the particles can shoot up to 15 feet and they go far enough to settle on other bathroom surfaces. In this study, the quantity and types of bacteria were examined from toilet spray behind, on the side, and in front of school toilets. Data showed that very little bacteria came out of the toilets. These data are important for anyone who is concerned about contamination from the use of public toilets.

16. The Effect of UV Light Sterilization of Bacteria Cultures

Serenity Haynes

Central Lee High School

The purpose of this project was to see how much Ultraviolet (UV) light exposure is required to kill bacteria cultures. I took 5 different bacteria that can either be found on menus or that can be transferred to the menus. I used E coli- mm294, E coli- DHS5 alpha, Bacillus cereus, Bacillus brevis, and Staphylococcus epidemidis. I would get an inoculating loop and make a line through the test tube with it and then transfer that bacteria with the loop by doing a zig zag motion onto a petri plate. Once I got through all the 188 plates I would set up the UV light. I would set the plates under the UV light for the certain time period that plate was assigned to, either 5 minutes, 10 minutes, 20 minutes, or 30 minutes. Then I would take the plates out and wait for all the plates to be done before I put them in the incubator. Once I put it in the incubator, I set the temperature to 32°C and recorded percent coverage for 5 days. For my control, I had two of them, a positive and a negative. For my positive control I had bacteria on the plate and put them under the UV lights and for my negative I had no bacteria but then put them under the UV lights.

GRADE 10

17. Left or Right Brain Dominance

Mackenzie Campbell

Adair-Casey/Guthrie Center

We all know a majority of the world is right handed, but have you ever thought about if you are right handed are you right eye or foot dominant? If you use the right side of your body do you use your left or right side of your brain for everything? These are some of the questions that lead me to research further into the subject. From my prior knowledge I know that the left side of our brains control the right side of our bodies. I started to develop a hypothesis from these questions I was accumulating. My hypothesis was; people that use their right hand to write, are left brain side dominant overall and vise-versa. My next step was to collect the data below by using my procedure. With these results I was greeted with even more questions to why people prefer to use each side of their brains for different parts of their bodies. Some of the results that I have found is that there is no one straightforward answer. There is of course a link between hand dominance shown through heredity, but this is not the case for any of the other body parts. Another conclusion is that whichever body part out of the two that you developed first in the womb will be your dominant side because it was connected to your brain first. Other than external factors some people believe it's because of the neurons in your brain.

18. Kick Knowledge

Claire Chesnut

Adair-Casey/Guthrie Center

Soccer is a sport that is played by kicking a ball from one end of a field to the other, with the purpose of getting the ball in the goal, while the opposing team attempts to take the ball from you and score in their own goal that you are defending. I have played soccer since kindergarten and noticed that in my class there was a wide range of knowledge of the game and the proper dynamic used in it. Therefore my question was 'Does the knowledge of how to properly kick a soccer ball affect the distance traveled?'. The reason why I asked this question is that I know many people in my class have kicked a soccer ball, but by what I have viewed of them kicking the soccer ball, many of them are doing it in the

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wrong fashion. My experiment was based on these thoughts. In my experiment I placed the ball in the grass and gave the simple instructions of kick the ball as hard as you can, to get the farthest distance. From this, we recorded the data of how far the ball traveled from its starting position. We then compared that data to data that was gathered through a quiz on the basic knowledge on how to correctly kick a soccer ball. Through this experiment, I learned that the knowledge of how to properly kick a soccer ball has no effect on the distance that it travels. Most of the people who kicked the ball the farthest were in a fall sport at the time, such as football or cross country. I think that this might have helped them kick the ball farther, not that they knew how to properly kick the ball.

19. Farming on Mars

Pooja Kasiviswanathan

Ames High School

The rise of human population indicates the need to make humans a multiplanetary species. Exploration of Mars by physically present scientists will lead to a critical requirement for food. The nature of the Martian soil renders the planet unfit for farming. As there is an urgent need to identify potential strategies to farm on Mars, the objective is to study plant growth in a mimicked-Martian soil and devise a strategy for efficient farming in the Martian soil. Crushed basalt-type volcanic rocks were used as mimicked-Martian soil. Turnip seeds germinated in the mimicked-Martian soil, however the Turnip plant growth was poor as compared to growth in yard soil (control). Treatment of the mimicked-Martian soil with a chemical fertilizer significantly improved the plant growth. As application of chemical fertilizer in the Martian soil is unsustainable, an alternate strategy was explored. Through a web search, Alfalfa plant was identified to contain high levels of macronutrients and micronutrients. Interestingly, Alfalfa plants grew healthy in the mimicked-Martian soil without any fertilizer. When those Alfalfa plants were powdered and used to treat the mimicked-Martian soil, it lead to significant boost in the growth and biomass of Turnip, Lettuce, and Radish plants.

Statistically analyzed data confirmed that the Alfalfa plants can grow normally in the basalt-type volcanic soil without any fertilizer and these plant product can be used as a potent biofertilizer for sustainable plant growth in the basalt-type volcanic soil. Thus, a potent strategy for efficient farming in basalt-type Martian soil was identified.

20. Are people able to recognize those of the same race over another race more consistently or correctly? Secondary question: Is one race more efficient at this?

Abigail Tibben

Ames High School

According to Anthony Muhammad in his book, *Overcoming the Achievement Gap Trap*, stereotyping is a natural and necessary function of the human mind. Being able to quickly make decisions helps us to understand a complex world in simple terms. Stereotyping, though, can also cause us to oversimplify or to generalize too much. How deep rooted is our ability to stereotype? How much do we stereotype of the world and not even realize it? I found this topic to be very interesting. The more information I gathered, the more I wondered, "are people naturally more partial to others of the same race?" I wanted to know not to point out racism, but to try to understand human nature, and to raise awareness of something we may be naturally doing without realizing it. For this study a Google Form was made for people to test whether they were able to recognize one race more correctly, specifically their race. Eighteen subjects responded to the online survey during the month of February. There was not enough data collected at this time to make a full conclusion, but there does seem to be a trend where people have difficulty recognizing female versions over male versions. I also found that there was no one specific race that consistently got a question wrong and that of the questions that were missed, both male and female, there were multiple races that got them wrong. The next step is to make other tests based on gender due to the data I found. I will also continue this to collect more data.

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21. Determining Decision Making Capability in Polycephalum Physarum - The Mechanism

David Kim

Ames High School

Peristaltic motion is the decision making mechanism of Polycephalum Physarum in strategic decision making situations. In the experiment, 70% of correct decisions made left behind residue, confirming the presence of peristaltic pumping and strategic decision making.

22. A Survey of Contaminants in Iowa Well Water

Jacob Kelty

Center Point Urbana High School

Abstract Nearly 60% of Iowa's waters are designated by the Department of Natural Resources as impaired (DNR, 2016). Some of these have contamination from farm fertilizers, soil erosion, and livestock manure. Knowing if drinking water is safe from nitrates, arsenic, and E. coli is thus of critical importance to Iowans. In this project, well water from five locations in Linn County was sampled for these contaminants. Data showed that most water was free of contaminants, but two samples had E. coli and one had high nitrate levels. These data can help educate consumers about the health effects of these contaminants and the importance of testing well water on a regular basis.

23. Bacteria and Mold in Wind and Brass Mouthpieces: A Quantitative Study

Abby Hawken & Natalie Kongable

Center Point Urbana High School

Playing an instrument may be more dangerous than most people - even musicians - might think. Multiple studies have shown that wood and brass instruments carry large amounts of bacteria, yeasts, fungi, and mold, many of which can be attributed to various allergic and infectious diseases, and may contribute to the development of asthma in children (Academy of General Dentistry, 2011). Since mouthpieces vary in shape and material, saliva and bacteria may remain on them even after being cleaned. In this study, the amount of bacteria present in three types of mouthpieces (reed, flute, and brass) was

determined before and after playing, as well as after sitting uncleaned for a 24 hour period. Data showed that the mouthpieces of reed instruments such as saxophones and clarinets retain more bacteria than others. Contrary to the hypothesis, the number of bacteria was shown to decrease after a 24 hour period on other mouthpieces. These data indicate that reed instrument players may be more impacted by the infectious and disease-causing bacteria found in mouthpieces than non-reed players.

24. Stress Reactions in Sheltered and Non-sheltered Dogs: A Quantitative and Qualitative Study

Taylor Kastli & Haley Walker

Center Point Urbana High School

Shelter dogs have been known to show stress reactions which influence their ability to interact socially (Lind et al., 2017). Reactions such as lip licking, biting, and jumping can inhibit the likelihood that they will be adopted. The purpose of this experiment was to assess stress in dogs sheltered in the Linn County Humane Society in Cedar Rapids, Iowa. Both dogs that were sheltered and dogs that were home pets were observed individually while researchers recorded the number of stress behaviors observed over 15 minutes. Data showed that shelter dogs had more stress reactions and reactions of greater intensity than non-sheltered dogs. These data are important because stress can influence health and, ultimately, the likelihood that these dogs will be adopted.

25. A Study of the Efficacy of Makeup Applicator Cleaning Products

Lauren Whitney & Madyson LeVelle

Center Point Urbana High School

There are reports of people getting infections from dirty makeup brushes (CBS News, 2015). Cleaning products for applicators are sold to remove these bacteria. However, the extent to which bacteria grows and the effect of these products is not known. The purpose of this experiment was to see how much bacteria was on and in dirty and cleaned makeup brushes. Makeup sponges and brushes were swabbed for bacteria both

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before and after cleaning with a cleaning shampoo and cleaning mat. Data showed that the cleaned applicators had more bacteria overall than the dirty ones. It is possible that these bacteria were transferred during the cleaning process. This hypothesis was tested and found to be supported. The hypothesis that the cleaning process makes applicators cleaner was not supported. In fact, the cleaning mat appeared to transfer bacteria to the applicators. This data raises concern about the ability of cleaners to remove bacteria.

GRADE 11

26. Fingerprints: Distinguishing Age and Gender

Hana Lee

Ames High School

Ridge patterns of fingerprints have been used in forensic investigations for over one hundred years, but when fingerprints fail to appear in the FBI's database, the owner's cannot be targeted. However, fingerprints are made of endogenous chemical compounds from sweat glands, and exogenous chemical contaminants, meaning that chemical analysis of these compounds may find clues about the individuals who left the fingerprint. Mass spectrometry is one of the advanced analytical techniques that can identify these compounds by measuring their exact masses. Triglyceride (TG) is a common, abundant chemical compound in fingerprint, made of three fatty acids attached to glycerol. It is hypothesized that fatty acid distributions could be affected by gender, age, diet, and disease state of individuals. As a proof of concept experiment to test this hypothesis, last year I used mass spectrometry to analyze the complex patterns of TGs from the fingerprints of four family members with the same diet and ethnicity. It was found that fatty acyl distributions of TGs show distinct patterns between family members. In this current study, to further confirm the significance of the previously found differences in TG distributions, statistical analysis was performed using a web-based tool, MetaboAnalyst, on three new sets of fingerprints from the original four family members. Principal component analysis (PCA) clearly distinguishes the four

data sets in its 2D and 3D plots, and analysis of variation (ANOVA) and correlation analysis could find most distinguishable TGs and their significance.

27. Using Greywater to Increase Power Output of a Photovoltaic Panel

Chiara Travesset

Ames High School

Infrared rays reduce the power output of photovoltaic (PV) panels. Water, however, is able to absorb infrared rays (Chaplin). Greywater is defined as "all waste water generated in the home, except toilet water" (Brain et al.). Hence, greywater has the potential to increase the power output of PV panels. This project intended to test this possibility. Testing took place in my (Chiara Travesset) driveway during the morning. Various types of water were placed on top of a PV panel using a plexiglass box. Trials testing the power output of a PV panel with three different types of artificial greywater (kitchen, laundry, and bathroom) on top, along with a control trial of distilled water, were performed. Each trial lasted ten minutes. The power output of each trial was compared to the power output of the PV panel with no water to find the change in power output. This experiment found that water decreased the power output of a PV panel. Every trial, including the control trial, demonstrated a drop in power output of at least 20%. The kitchen trial demonstrated the largest drop in efficiency (42.92%), while the laundry trial had the smallest drop in efficiency (20.55%). These results may be due to how the experiment was conducted, however. The trials may have been too short for adequate data collection, and the plexiglass may have not allowed enough light to reach the PV panel. Nevertheless, the experiment still demonstrates that for short periods of time, water decrease the power output of a PV panel.

28. An Innovative Approach to the Detection of Ringworm.

Sara Dodge & Abby Wittkamp

Burlington Community Highschool

Using distilled water and a dye called Fluorescent

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Brightener 28, we tested the hypothesis that if ringworm is exposed to a solution that contains Fluorescent Brightener 28 and an ultraviolet light is later shone on the ringworm, then the ringworm will exhibit a visible fluorescence. The solution was made by mixing .2 grams of Fluorescent Brightener 28 with 2550 milliliters of distilled water. Once made, the solution was sprayed on Epidermophyton stockdaleae, which had been spread onto a piece of material similar to that of wrestling mats. The lights were turned off, and ultraviolet light was shone onto the fungus, causing it to exhibit a visible green fluorescence. The minimal number of cells needed to see the fluorescence was also found. Being able to make ringworm fluoresce would allow people to see if certain surfaces are housing ringworm before cleaning and see if the fungus is still there after the surface has been cleaned. This could help in making sure surfaces are clean, which could ultimately lead to fewer cases of ringworm.

29. Bacteria on Computer Keyboards in School

Megan Sherman & Brady Pfeifer

Center Point Urbana High School

How much bacteria can be found on a keyboard? Many people use their laptops and keyboards every day without ever considering what's growing, or how much bacteria is growing on their keyboard's surface. A study by the International Business Times in the UK in 2013, showed that keyboards are dirtier than our toilet seats. Surprisingly, they found that keyboards contained 7,500 bacteria per swab, which is more than 2,000 more than toilet seats. However, depending on the strain and the usage of the keyboard, the lifespan of these bacteria can vary. In our study, the quantity and types of bacteria on the home row and F row of commonly accessed school keyboards were examined. Bacteria seemed to have little to no growth within the first 48 hours of incubation. However, when the growth media were checked 144 hours later, a number of bacteria were found including Staphylococcus aureus, E. Coli, and Streptomyces Griseus. Out of all 3 types, E. Coli was the most prevalent and fastest growing. There was little to no

difference between the number of colonies on the home row and the F row keys. Since common bacteria such as those found on the keyboards can transmit infectious diseases and cause illness, these data can be used to help students and teachers implement infection control on a regular basis.

30. Killing Teeth Bacteria with Mouthwash and Essential Oils

Helena Anderson

Central Campus

In this experiment, mouthwash and essential oils (peppermint oil and tea tree oil) were being tested to see which one would successfully kill the subjects teeth bacteria the best. Through using TSA petri dishes this research was conducted. Both mouthwash and the essential oils were 100% effective in killing colony one (Staphylococcus epidermidis). The mouthwash had a clear zone of .70mm for killing colony two and the essential oils had a clear zone of .30mm for killing colony two. The reason the mouthwash had a bigger clear zone for colony two because it has more chemicals in it to specifically kill mouth/teeth bacteria.

31. Antibacterial Properties of Different Face Washes

Emma Buchacker

Central Campus

This experiment was to test which face wash kills bacteria in acne the best. The face washes used were Up and Up acne spot treatment with Benzoyl Peroxide, Neutrogena Oil- Free Acne Wash with Salicylic Acid, Biore Baking Soda Cleanser with Baking Soda, and Dickinson's Witch Hazel. The bacteria was obtained from the subject's acne on the face and grown on a Trypticase Soy Agar plate. The different colonies were streaked for isolation and killed by the washes. The bacteria are most susceptible to Baking Soda then Salicylic Acid, and then Benzoyl Peroxide. The bacteria are resistant to Witch Hazel. The results showed that Baking Soda eliminated Staphylococcus aureus, Staphylococcus epidermidis, and

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Sarcina lutea the best.

32. Effectiveness of Chemical vs. Natural Cleaners at Eliminating Kitchen Bacteria

Janna Cook

Central Campus

Natural cleaners can eliminate bacteria without using potentially harmful harsh chemicals, but are they as effective as chemical cleaners? After swabbing a cutting board and isolating *Staphylococcus aureus*, filter paper disks soaked in hydrogen peroxide, bleach, lemon juice, and a mixture of essential oils and vinegar were used to test the chemicals ability to eliminate the bacteria. The natural cleaners had an average clear zone measurement of 1.3 cm and the chemical cleaners had an average clear zone measurement of 2 cm, meaning that chemical cleaners were more effective at eliminating *Staphylococcus aureus*.

33. Antibacterial Properties of Two Iowan Honey

Ian Hollingworth

Central Campus

Honey has been a remedy for wounds and infections for thousands of years. Honey from St. Charles, Iowa and honey from Lynnvile, Iowa were used to try and prevent growth of an isolated bacteria colony from two different water sources. One sample was taken from the Raccoon River and the other sample was taken from a sink in Central Campus. The St. Charles honey and the Lynnvile honey did not prevent the growth of bacteria in either isolated colony. Both the isolated bacteria which were *Alcaligenes faecalis* and *Bacillus megaterium* were resistant to the St. Charles honey and the Lynnvile honey.

34. The Effectiveness of Hydrogen Peroxide and 409 in Killing Bacteria on Wrestling Mat

Ethan James

Central Campus

The bacteria *Staphylococcus aureus* is a cause of skin infections, which is a large problem within the sports community. To find out if hydrogen peroxide and 409

were effective in preventing these skin infections, a wrestling mat and wrestling shirt were swabbed and cultured. Isolated bacteria were gram stained, and samples of the isolated bacteria were cultured with discs of 409 and hydrogen peroxide. The two colonies were isolated and both were identified as *Staphylococcus aureus* strains. Hydrogen peroxide was more effective in eliminating strain 1 of *Staphylococcus aureus*, but the effectiveness of hydrogen peroxide and 409 in eliminating strain 2 of *Staphylococcus aureus* was the same.

35. Active Antibiotics for Bacteria Underneath Fingernails

Nayeli Martinez - Soto

Central Campus

Bacteria was taken from a fingernail and swabbed onto a Trypticase Soy Agar petri dish to determine the bacteria underneath a fingernail. *Staphylococcus aureus* was the bacteria discovered in this experiment, from the original petri dish and streaked for isolation. Three different cleansers were tested using antibacterial paper discs. Hand sanitizer had clear zones of 1.7cm. Antibacterial hand soap and water did not create a zone of inhibition for *Staphylococcus aureus*. Hand sanitizer was the most effective in eliminating *Staphylococcus aureus*.

36. Overexpression of WRKY and MYB Transcription Factors for Disease Resistant Soybean

Aracelyn Miro-Ocampo

Central Campus

Bean Pod Mottle Virus (BPMV) is spread by the bean leaf beetle, *Cerotoma trifurcata*, and it is one of the most common viruses affecting the yield and quality of soybeans. Transcription factors are used by soybeans to express numerous genes which help in the regulation of the plants defenses. When attacked by pathogens the soybeans defense is activated and transcription factors such as WRKY and MYB increase the expression of pathogen fighting genes. This experiment involves transgenic soybeans which have increased expression of WRKY36, WRKY55, and MYB184 transcription factors,

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allowing the soybeans to have the possibility of improved resistance against pathogens. Transgenic soybean lines as well as the positive control soybeans were tested for the presence of bar protein 14 days after germination by using leaf tissue, buffer and indicator strips. 14 days after germination the soybeans were also inoculated with a mixture of freeze dried infected leaf and buffer. Screening of WRKY36 transgene displayed infected soybeans had brighter GFP compared to the positive control, suggesting WRKY36 may be more susceptible to BPMV. Screening for WRKY55 transgenic soybeans, line 189-5-1A had a significant amount of BPMV-GFP compared to the positive control, and appeared more susceptible to the virus. Line 189-9-1C had a smaller amount of BPMV-GFP compared the positive control, suggesting it was less susceptible to the virus. Screening of transgene MYB184 showed both transgenic lines displayed a larger amount of BPMV compared to the positive control. Results suggested most transgenic soybeans were more susceptible to BPMV than W-83 due to the GFP being brighter in most transgenic lines than the control. Transgenic line 189-9-1C from transgene WRKY55 was an exception, as it showed less BPMV-GFP compared to the control, suggesting it was more resistant towards the virus. The overexpression of transgenes (WRKY36, WRKY55, and MYB184) suggest having a positive impact on BPMV infection; however, these transgenes could provide a solution to other soybean pathogens such as fungi, bacteria, or viruses.

37. The effects of mouthwashes on oral bacteria

Jennifer Nguyen

Central Campus

This experiment will test the effect of three different kind of mouthwashes on oral bacteria. By swabbing inside the subjects mouth with a cotton tipped applicator and onto a Trypticase soy agar (TSA) sterile plate, then observe the bacteria. Each mouthwash (Listerine, Act, and Crest) was tested on each colony of bacteria and resulted in crest being the most effective, follow by ACT and then Listerine, based on the clearzones. In conclusion, Crest was most effective towards eliminating bacteria because

the clear zones was the biggest, average 1.9 cm.

38. The Effectiveness of Oregano and Cinnamon Essential Oils (as Antimicrobials)

Amber Ray

Central Campus

The purpose of the experiment was to determine the effectiveness of essential oils as antimicrobials. Airborne bacteria was collected by exposing an agar petri dish to a populated environment for an hour and a half, then allowing the bacteria to grow at room temperature. Once obtained, bacterial samples were taken from the most common colony and identified as *Bacillus subtilis*. The bacteria was then tested separately against cinnamon and oregano essential oil, using the disc diffusion method. Results showed that both essential oils are effective as antimicrobials, but oregano had larger clear zones when compared to cinnamon, against *Bacillus subtilis* bacteria.

39. Salivary Bacteria in Five Quarter Horses Tested With Four Essential Oils

Katie Wilson

Central Campus

The plan is to swab all 5 of my horses for bacteria then look at each agar and find common bacteria among them. Once I find a common bacteria, I will test it in the lab to confirm that the bacteria is the same in all 5 agars. This similar bacteria then will be the only type of bacteria that will be tested via gram staining and identification tests. This single bacteria will be the focal point of my laboratory presentation. There have been thousands of research studies and laboratories on equine studies and horses. There are some odds and ends videos on YouTube, but I have no way of verifying the info on those videos. Many different types of oils have been used in different types of labs, but I have not found any yet in which swabs of bacteria from the mouth of a quarter horse have been tested and attempted to be killed by essential oils. The only lab that I found is ESSENTIAL OILS AS COMPONENTS OF A DIET BASED APPROACH TO MANAGEMENT OF *HELICOBACTER* INFECTION. This lab

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used over 60 different essential oils to attempt to kill the infection bacteria. The link was very long so I could not read it all but the link looked very interesting an in-depth about the information and claims it presented and proved.

40. The Bacterial Diversity in the Mouth

Ellen Harrington

Central Campus

The diversity of bacteria in the mouth is vast and intriguing. The purpose of this science experiment was to compare and contrast how diet affects the bacteria microbiome in the mouth. Healthy and junk food were the two diet types used in the experiment. The healthy food consisted of: apple, yogurt, chicken sandwich, string cheese, grapes, milk and cheerios. The unhealthy diet included turkey sandwich, pizza, salad, and chips. A catalyst test was conducted to determine whether the bacteria from healthy and unhealthy was Staph or Strep. Staphylococcus aureus was present in the healthy diet, because in the catalyst test bubbles appeared; Streptococcus faecalis was present in the unhealthy diet, because no bubbles appeared. Colony1 from Staphylococcus aureus and Streptococcus faecalis was streaked for isolation because it appeared the most in the petri dish. Afterwards Listerine Cool Mint Antiseptic mouthwash was used to test if Staphylococcus aureus and Streptococcus faecalis were susceptible or resistant. The clear zone results for Staphylococcus aureus was 1.5mm. Streptococcus faecalis from the unhealthy diet had clear zones, but in comparison to Staphylococcus aureus the zones were very small in diameter. The measurement of the clear zone from Streptococcus faecalis was 1mm.

41. What All the Buzz is About: Contained Production and Increased Yield of Glycine Max and Other Crops with the Aid of Apis Mellifera and Natural Fertilizers (Phase II)

Brooklyn Pardall

Central Lee High School

Every year, the honeybee population seems to decline

more dramatically. With this being said, it also means crucial pollination is being lost all over America. "Crucial" is merely an understatement, as almost every bite of food we eat is contributed thanks to the bee population. The overall purpose of the project is to simulate what bees truly do for us in the real world, and showing how we benefit. Without the bees, as they continuously decline due to various diseases, our crop yield will go down. Farmers across America would lose money due to the lack of bee production. A method I used was containing the bees in a large screening where they pollinated the plants inside. This left the others to no pollination whatsoever. Another consisted of bringing in layers of topsoil in order to grow efficient crops. In addition to this, we brought in potash (a type of fertilizer) to again benefit the plants and also to simulate a general process a farmer would go through every year. In my project, I have come to find that pollination by Apis Mellifera had caused the soybeans to be larger and more abundant than those without. Actually, I found that after my experiment if there was an entire plot, one would receive 65 bushels per acre. Therefore, this continues my drive to a far larger experiment. Along with this, various vegetables planted along with the Glycine Max prospered with the aid of Apis Mellifera compared to those without. These also prospered, again reining in the overall importance of the bee population and their importance to local Iowa crops.

42. Anti-Microbial Efficacy of a Contact Solution

Phuoc Phu

Des Moines Central Campus

Contact lens hygiene is an extremely important aspect of owning and utilizing contact lenses. However, not many people are compliant with the proper care of contacts. Improper hygiene of contacts may lead to a higher chance of infection. This study tested the efficacy of Opti-Free Pure Moist under poor hygienic conditions. The poor condition was simulated by rubbing a finger on a petri dish after lunch without proper hand washing. Three different bacteria were obtained from the finger: Bacillus megaterium, Corynebacterium xerosis, and

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Staphylococcus epidermidis. All three were isolated separately on a Trypticase Soy Agar petri dish and tested for susceptibility against Opti-Free Pure Moist. All of them proved resistant. The Anti-Microbial efficacy of Opti-Free is questionable and should be studied further.

Introduction: In the United States alone, more than 30 million people wear contact lenses. Of those 30 million, between 40%-90% of contact lens wearers do not properly follow the care instructions (Bui, T H, et al). Improper cleaning and irregular replacement of contact lenses and lens cases, as well as other behaviors relating to contact lens hygiene and care, have been linked to a higher risk of complications (Dumbleton, K A, et al). With this information, an experiment was performed to test the anti-microbial efficacy of contact solutions against bacteria that was found on a finger. The aim of this study was to simulate the effects of poor hygiene while utilizing contact lenses and how effective contact solutions were against poor hygiene conditions.

43. Determining effectiveness of natural vs chemical cleaning products to rid *Staphylococcus aureus* bacterium

Jayda Anaya-Negrete

Des Moines Central Campus

Staphylococcus aureus is gram-positive cocci that is found generally anywhere. In this experiment, the chemical cleaning products Clorox bleach spray, Simply Done disinfecting wipes, and Lysol All-purpose cleaning spray along with the natural cleaning products Method naturally derived cleaning spray, Mrs. Meyers cleaning product, and ECOS natural cleaning spray were used to determine effectiveness against the specific bacteria *S. aureus*. Several samples were collected by swabbing the throat and transferring the sample to trypticase soy agar to grow. Microscope examination under oil immersion was used to analyze bacterial slides and cleaning products were used to determine effect on said bacteria. Chemical products had more effectiveness against *S. aureus* than natural products.

44. Does the future present a possible cure for

Alzheimer's Disease?

Arundhati Soni

Johnston

Every 66 seconds, someone in the United States develops Alzheimer's Disease. Alzheimer's is a progressive disease that impairs the ability of nerve cells to efficiently communicate with each other, leading to cognitive malfunction. Recent studies show, however, that there is a possibility for further research that could not only prevent but also reverse this degenerative decline. Scientists at the Cleveland Clinic reasoned that the reduction of the enzyme BACE1, a natural protein that helps form beta-amyloid peptide, would reduce the fatal plaque formation that leads to Alzheimer's Disease. They examined mice bred to develop Alzheimer's disease, but with a gradual decline of BACE1 as they age. Although the mice should have developed Alzheimer's disease, they did not and remained healthy. These results are promising and support the theory that BACE1 inhibitors could possibly treat Alzheimer's Disease. Though not revolutionary, these findings could be a step closer to discovering a cure for Alzheimer's if pursued and found to be working in humans.

GRADE 12

45. Ambient Light vs. Natural Light vs. LED Light

Alexis Anderson

Central Campus

The end goal of this experience is that we will be able to sustainably grow Algae in our lab. Algae is a group of aquatic eukaryotic organisms that consist of more commonly known names like seaweed, harry algae, zooxanthellae, etc. Being the bases of life in the ocean I saw it as important that we tried to integrate it in our lab. In the end, hopefully we will be able to sustainably grow the seaweed to the point where we can use it as food and habitat for our smaller fish in the lab. This will not only better simulate the ecosystem in our lab but also help with the educational aspect as well by better illustrating how algae is the bases for all life in the ocean. On top of all this, the algae will also act as a great natural filter for our systems. After this is all finished this will be an overall positive addition to our program.

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46. A Study of the Inhibitory Effect of Trace Minerals on the Growth of *Staphylococcus epidermidis*

Angela Graf
Center Point

Antimicrobial resistance has become an increasingly evident problem in modern public health, and it is projected that most modern antibiotics will soon become ineffective. The shortage of available treatment options has become a primary focus of medical experts and scientists alike. The purpose of this experiment was to determine if metals might be potential alternatives to antibiotics. *Staphylococcus epidermidis* was selected for study because it has produced multiple antibiotic-resistant strains in recent years. The growth of *S. epidermidis* was compared in different concentrations of copper sulfate, silver nitrate, and sodium acetate. The molarity of each substance was varied at intervals of 1M, .5M, .25M, and .125M in 12 plates of nutrient soy agar. The copper sulfate and silver nitrate agars were successful in inhibiting the growth of *S. epidermidis* at all concentrations. Conversely, the sodium acetate agar appeared to have little to no effect on the bacterial counts as all were too numerous to count. Because the counts of *S. epidermidis* on these plates were so high, the optical density was measured at each concentration (in the fourth quadrant) to locate any growth patterns. No trends or significant differences were observed in optical density.

47. A proteinaceous comparison of common cystic fibrosis research model organisms and *Homo sapiens*

Rabsa Naseer
Central Academy

This study researched and compared the cystic fibrosis transmembrane conductance regulator in humans (*Homo sapiens*) and four common research model organisms used for cystic fibrosis research (mice, rats, chimpanzees, and sheep) using the CFTR to identify the best research model. Cystic fibrosis is one of the most common genetic disorders in the United States. Bioinformatic data bases allowed for identification of the CFTR protein sequences of different organisms and multiple sequence alignment programs were used to compare CFTR protein sequences of the different organisms. *Macaca mulatta*, and other

primates, have the most similar CFTR sequence to *Homo sapiens* with 98.18% identical residues, making it the most genetically effective research model for cystic fibrosis research. To further determine their effectiveness as models, comparison of *Macaca mulatta* availability and care to other models would be needed.

48. To Thaw or Not to Thaw: How Mysid Feeding Techniques Affect Nitrate Concentration

Mary Beth Armstrong
Central Campus

The nitrogen cycle occurs naturally in both marine and freshwater ecosystems, as well as saltwater aquariums. Aquarists sometimes struggle to maintain nitrates at a level that is considered safe for all organisms. Although there are many methods to reducing nitrates, this experiment examines a more proactive approach to reduce the nitrogenous wastes introduced into the aquarium. The central campus marine biology laboratory feeds frozen mysid shrimp every other day to nearly every organism in the lab. During feeding, the frozen mysid is rubbed between fingers directly into the aquarium being fed. While doing so, an oily substance also comes off, that could potentially increase nitrogenous waste products. Here, we examine different methods of feeding frozen mysid using the current method versus rinsing thawed mysid. Three systems were set up, each with a sponge filter and no living organisms. Every day for three weeks, mysid was put into two of the systems, one frozen and one thawed and rinsed, while the other system was not fed any. The mysid sat for thirty minutes then was net out. After each week the nitrate levels were tested using Hach nitrate strips. Initially, the difference between the two was negligible, but after the second week the difference became more apparent. The thawed and rinsed mysid had reduced the levels of nitrates in the system. This must be due to the lack of oil that remains in the system post-feeding. Not only does thawing reduce the nitrates, but it was also found that thawing the mysid allows for bigger pieces of shrimp to be fed out, rather than the small pieces that break off when using the frozen

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method. This is beneficial to organisms that eat mysid because it is going to be more visible which makes it more accessible.

49. Effectiveness of Bleach, Lysol and Mrs. Meyers against *Staphylococcus aureus*

Nirjan Bhattarai

Central Campus

There have been numerous experiments conducted about bacteria lifeforms, ranging from growing bacteria to discovering ways to terminate them most effectively. This experiment focused on which solvents (Bleach, Lysol and Mrs. Meyers) is most effective in eliminating bacteria. The experiment was performed by sampling bacteria from the right palm and testing the elimination by the solvents. The results showed that Lysol was most effective in killing the bacteria, as it had the biggest clear zone, Bleach was a close second and Mrs. Meyers had no effect on the bacteria, there was no measurable clear zone.

50. Doggy Dentist

Camryn Drummond-Croy

Central Campus

What is the best natural solution to for eliminating oral bacteria in a dogs mouth? Two Doberman dogs oral bacteria was tested using Echinacea and lemon juice. The dogs had individual petri dishes, each had an original dish and one used for isolation. Both of the subjects bacteria, *Micrococcus luteus* and *Staphylococcus aureus* were present after the antibacterial solutions were applied.

51. A Taphonomic Analysis of Carnivoran Fossils from Natural Trap Cave, Wyoming

Cecilia Hodson

Central Campus

Specimens identified from Natural Trap Cave are analyzed so that minimum animal unit values could be used to compare the relative distribution of skeletal elements between *Canis lupus* and *Miracinonyx trumani*. The aim of this analysis was to identify patterns of distribution if any exist to determine the method by

which specimens were deposited at the bottom of Natural Trap Cave, specifically if scavenging behavior was a factor.

52. Bacterial rate of resistance to household cleaning products

Aditi Jithendra

Central Campus

The susceptibility of bacteria to antibacterial agents after repeated exposure is important to understand in a world with increasing antibiotic resistance. Bacteria collected from the environment were grown in the presence of three common household cleaning products. The surviving bacteria were collected and regrown twice with additional cleaning product treatment. A 17.3% decrease in average clear zone diameter was observed over the course of the experiment. Although some bacterial contamination occurred, similar results were observed with the unknown contaminating bacteria. The quick adaptability of the bacteria to the antibacterial cleaning products demonstrates the importance of using cleaning products at a high enough concentration to destroy harmful bacteria before antibiotic resistance has a chance to develop.

53. Comparing the Effectiveness of Alcoholic Mouthwash and Non-Alcohol Mouthwash When Applied to *Staphylococcus aureus*.

Chase Johnston

Central Campus

Abstract Samples were taken from both a dog's tooth and a human's tooth. *Staphylococcus aureus* was found. The *Staphylococcus aureus* samples from either species were placed into two separate petri-dishes with antibacterial discs coated with two different kinds of mouthwashes: alcohol containing and non-alcohol containing. It was found that after incubation, with the mouthwashes having had their effect on the bacteria, that non-alcoholic mouthwash was much more effective at killing off *Staphylococcus aureus* than alcohol containing mouthwashes were.

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54. Taphonomic analysis of Equidae fossils from Natural Trap Cave, Wyoming

Seth Kallestad

Central Campus

Natural Trap Cave in Wyoming is a 26 m-deep sinkhole that preserves thousands of vertebrate fossils from the last ~30,000 years [1] (source 1) Understanding how bones accumulated in the cave is important. Scientists have long assumed that the fossils belong to animals that accidentally fell into the cave and died there but it is possible carnivores contributed to the accumulation of bones. Looking specifically at *Equus* sp, (horse) what bones from what part of the horse's body was best preserved. Theoretically, denser limb bones would hold up much better than a skull or vertebra bone. These denser bones should match closely with the highest minimum animal unit (MAU). Limbs would also be overrepresented if carnivores dragged them down to the cave as opposed to previous assumptions that animals merely fell down the cave without carnivorous influence. Previous studies have shown analyses of other mammals, but not for equidae (sources 2,3,4,5). The results of said study showed that limb bones preserved at a higher rate than skull and vertebra bones. Further direction for this experiment would include finding a larger data set to solidify any trends and expanding the study to other fossilized animals.

55. Microbial Gut Biome of *Acheta domesticus*

Hao Le

Central Campus

Arthropods, throughout history have serve to be a prominent vector of pathogenic agents for disease in humans. The study of these insect pests and their biological control is an attracted topic in science due to new advancement in microbiology that allows used of environmental friendly alternatives of chemical pesticides. *Acheta domesticus*, the house cricket, is a common arthropod in the Insecta class containing a similar gut morphology and feeding behaviors to most other insects. The main objective of this experiment is to examine the gut flora of the common household cricket. Gut bacteria

in insects have been shown to regulate the immune response of the pathogenic organism (source 1). The mechanism that insects utilizes to control their own ecology could be useful In helping prevent diseases caused by insect vectors. The inoculating of bacteria in *Acheta domesticus*, showed a simple micro-biome that shows a low resistance to household antibiotics such as 409.

56. Using Science Kits To Bring Project Based Active Learning Into High School Anatomy and Physiology Class

Sandy Le & Tiffany LeMaster

Central Campus

High school anatomy and physiology courses are traditionally centered around a series of instructor-directed lectures with limited dissection opportunities and very little active learning. Here we describe the use of two in-class experiments that could be used to enhance student learning about neuroscience and help facilitate the construction of science projects for high school juniors and seniors. Using a project-based learning approach, students were asked to work in teams and design an experiment which uses components of the Backyard Brains toolkit (i.e., Roboroach and/or SpikerBox) to help educate the public about the nervous system and anatomy. High school students participating in this program were drawn from an existing collaboration with Des Moines Public Schools Central Campus and worked over a three-week period on the design and implementation of the experiments. We demonstrate that the use of hands-on science kits is a cost-effective way to help build active learning components into the high school anatomy and physiology classroom.

57. Antibacterial Properties of Tea and Coffee

Sandy Le

Central Campus

In this experiment, the antibacterial properties of Lipton caffeinated and decaffeinated tea and Hy-Vee dark roast and medium roast breakfast blend coffee were tested.

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Three common bacteria were selected from an oral sample and streaked for isolation as well as gram stained. Only caffeinated coffee inhibit bacterial growth around the antibacterial disk after streaking for isolation whereas caffeinated tea promoted bacterial growth. Results show that the caffeinated tea promoted gram positive diplococcus bacteria which could be *Staphylococcus aureus*, a common bacteria found in human oral flora.

58. A Taphonomic Analysis of Artiodactyl Fossils from Natural Trap Cave, Wyoming

Rabsa Naseer & David Turner

Central Campus

This study analyzed the presence and frequency of various artiodactyl fossils in Natural Trap Cave, Wyoming through graphical analysis based on three artiodactyl species and their fossil records possessed by Des Moines University to determine fossil elements that are better preserved than others. Taphonomy represents the different processes that affect fossilization. Records of artiodactyl fossils from locality V-99036 (Natural Trap Cave 1) for three species, *Antilocapra americana*, *Ovis canadensis*, and *Bison* sp. were sorted into anatomical categories. Then the MNE (minimum number of element), MAU (minimum animal unit), and percent MAU (MNE/MAU) values were calculated for each fossil element. The data was then put into charts for more accurate analysis. All three artiodactyl species had a 100% preservation rate for their tarsals. This may be due to the strength of the tarsal bones, which remained intact after the initial fall into Natural Trap Cave as well as taphonomic processes.

59. The Wonders of Tea Tree Oil

Nyamal Toang

central campus

This is an experiment tested tea tree oil on post-harvest tomato fungus. The fungus from a tomato purchased from a local Hy-Vee was sampled, streaked onto Trypticase Soy Agar petri dishes and tested to identify what kind of fungi by shape. Exactly what type of fungi

on the tomato was not possible to identify with this experiment. The samples were gram stained, and tested for antimicrobial resistance, also observed under the microscope. 10 samples in total were taken from the tomato. There were two different original dishes because the samples were taken from two different places on the tomato. Then the isolates of the most common fungus from both dishes were put on their own TSA dishes and tested against the tea tree oil, to figure out how effective it would be against the isolates. Under the microscope colony 1 dish 1 was gram + endospore forming bacillus. Colony 2 dish 1 was gram + endospore forming coccobacillus. Colony 3 dish 1 was gram + coccobacillus. Colony 4 dish 1 was gram + bacillus. Colony 5 dish 1 was gram +. Colony 6 dish 1 was gram+ endospore forming bacillus. Colony 1 dish 2 was gram + coccobacillus. Colony 2 dish 2 was gram positive bacillus. The isolates colony 2 dish 1 and colony 1 dish 2 were the same as their originals.

60. False Advertisement Exposed

Kevin Truong

Central Campus

The purpose of this experiment was to identify which mouthwash was the most effective in killing oral bacteria. The mouthwashes used were Listerine, ACT, and Colgate. The subjects mouth was swabbed and the three most common bacteria were being tested. The three bacterial colonies were identified and the first colony may be *Pseudomonas fluorescens*, the second colony may be *Brevibacterium linens*, the third colony may be *Corynebacterium xerosis*. The average clear zone for Listerine was 6.6 mm in diameter while there was no clear zone for ACT and Colgate for all three colonies. This indicates that *Pseudomonas fluorescens*, *Brevibacterium linens*, and *Corynebacterium xerosis* was susceptible to Listerine while it was resistant to ACT and Colgate.

61. Which Cleanser Most Effectively Kills Bacteria in Healing Piercings

Michaela Verwers

Central Campus

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This experiment tested how effective different cleaning methods were in killing bacteria on a healing piercing. This was accomplished by taking a sample from a belly button piercing and using the disc diffusion method to test the five different anti-bacterial solutions to see which was most effective in killing the bacteria. Claire's piercing solution and tea tree oil had clear zones of 17mm and 8mm. Salt water, chamomile tea, and antibacterial soap did not create a zone of inhibition for *Staphylococcus aureus*. Claire's piercing solution was most effective.

62. A Multi-Faceted Approach to Containment, Treatment, and Prevention of the Ciliated Parasite, *Cryptocaryon irritans*, in Marine Aquariums

Julie Warburton & Mercadees Johnson-Stewart
Central Campus

The Marine Sciences program at Central Campus in Des Moines, Iowa is a student-run laboratory and aquarium that provides career-based training and experiences for high school students. The 10,000 square foot facility includes over 15,000 gallons of saltwater divided between 130 aquariums from 10-2500 gallons. At any given time, approximately 125 species of marine organisms are in the collection. Maintaining these species in aquariums, though, requires acute observations, daily husbandry and feedings, and excellent water quality. Even with everything seemingly in place, health concerns can pop up, necessitating quick action to prevent mortality. Here, we describe an infestation of the ciliated parasite, *Cryptocaryon irritans*, in multiple species of bony fishes across different aquariums. *Cryptocaryon irritans*, also called marine ich, is usually diagnosed from external symptoms of cloudy eyes and white spots on the fish epidermis and confirmed with microscopy. Common treatments include hyposalinity and copper-based additives. In these cases, a combination of hyposalinity in conjunction with copper-based medications was administered to the water as a "bath". Rather than treating individual fish, treating the water the fish are in is much more effective. Although we did experience some mortality, more than 90% of the fishes responded positively to the treatments and are either fully recovered

or in the process of recovering at this time. We are also reviewing our current protocols to reduce any potential cross-contamination as well as improve our preventative methodologies.

63. Bacterial Colonies on Aluminum Soft Drink Cans

Samuel Knoshaug
Central Campus

Abstract- 1) Allegations against many soft drinks corporations have been made from people suffering from life-threatening complications due to substances found on aluminum soft drink cans. 2) Six differing bacterial colonies collected from an 8 oz. Pepsi™ can were grown on a Trypticase soy agar. One displayed a light red pigmentation and was then collected to be identified. The bacterium was identified as *Micrococcus roseus*. 3) The bacterium was tested against four antibacterial agents to identify which one the bacterium was most susceptible to. 4) 409™ cleaning agent was observed to be the most effective in ridding of the bacterium, while tap water was found to be the least effective.

64. The Effectiveness of Summer's Eve Vaginal Cleanser as an Antibacterial Solution

Dayanna Martinez-Soto
Central Campus

This experiment tested if the most common vaginal cleanser (Summer's Eve) was healthy, or if it actually worked. The experiment proved that Summer's Eve killed good bacteria. This experiment tested how effective different cleansers were killing bacteria derived from the outer labia of the vagina. There are annual debates about whether or not vaginal cleansers actually work. Summer's Eve, the most commonly used, was not as effective as people thought. This experiment was a lot different than the experiments of other peers.

65. Drought Tolerance of Glycine max When Watered with Acetic Acid Solution

Chase Krug
Linn-Mar High School

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Drought stress is a major factor in crop production worldwide, as climate change increases weather volatility, crops will need to cope with irregular rainfall. The addition of acetic acid to crops might allow Glycine max to cope with longer periods of time without water. There were four trials conducted with 72 seeds planted in each trial. The two-week-old Glycine max seedlings were divided into 4 groups and were either exposed to 2%, 1%, 0.01% of acetic acid solution or distilled water as the control. The Glycine max plants were subjected to two weeks without water, then watered with distilled water to determine if the plant would survive from wilting. Measurements were made by counting the number of soybean plants that survived the drought stress test. The data was analyzed by determining the survival rate of Glycine max. This experiment contributes to crop production in drought-stricken environments.

SATURDAY SECTION MEETINGS

All Oral Presentations are in the Estelle Siebens Science Center

IAS Oral Presentations

Saturday 8:00 a.m.— 2:30 p.m.

ESSC Rooms

See the oral presentation schedule below and the section meeting schedules.

Section Meeting Room Assignments

Section	Time*	Location
Anthropology	8:40 a.m. - Noon	ESSC 128
Cellular, Molecular, and Microbiology	9:00 a.m. - 10:40 a.m.	ESSC 226
Chemistry	8:20 a.m. - 10:50 a.m.	ESSC 224
Community College Biologists	TBD	ESSC 218
Ecology & Conservation	8:20 a.m. - 2:15 p.m.	ESSC 125
Engineering	9:20 a.m. - 10:40 a.m.	ESSC 227, with Physics
Environmental Science & Health	9:40 a.m. - 10:40 a.m.	ESSC 136
Geology	8:40 a.m. - 10:00 a.m.	ESSC 137
Iowa Science Teaching	9:20 a.m. - 10:40 a.m.	ESSC 227, with Physics
Organismal Biology	9:20 a.m. - 10:40 a.m.	ESSC 229
Physics, Atmospheric and Space Sciences, Engineering, ISTS	9:20 a.m. - 10:40 a.m.	ESSC 227
Physiology & Health Sciences	9:40 a.m. - 10:40 a.m.	ESSC 136, See Environ Sci & Health

* The time listed is the total time the section meetings are scheduled to run. The meetings will break for the 11:00 a.m. General Session III which ends at Noon. The IAS Luncheon is at Noon - tickets required. Sections that continue into the afternoon will begin after lunch. Start times may vary. Please see the oral schedules on pages 30- 33 for specific times.

Specific Section Meeting schedules are on pages 34 - 37.

SATURDAY SECTION MEETINGS

See individual sections for room locations and schedule.

Anthropology Section

Room: ESSC 128

- 8:40** WALKING A MILE IN HIS SHOES: PRESERVING CHARLES KEYES' LEGACY THROUGH TRANSCRIPTION OF HIS LETTERS AND NOTES
- 9:00** A PREVIEW OF FAUNA FROM THE 2017 EXCAVATIONS AT THE DIXON SITE
- 9:20** OLD COLLECTIONS, NEW INSIGHTS: A LITHIC ANALYSIS OF THE LUNGREN SITE (13ML224)
- 9:40** A PROPOSAL FOR ARCHAEOLOGICAL INTERPRETATION AND EDUCATIONAL OUTREACH: THE CORRECTIONVILLE PROJECT
- 10:00-10:40** Section Business Meeting: **Election of New Officers, New Business**

SESSION 2

- 10:40** THE SWALLOW-TAILED KITE: SYMBOLISM AND BUNDLING IN NATIVE AMERICAN TRIBES OF THE MIDWEST
- 11:00** AERIAL RECONNAISSANCE FOR HERITAGE RESOURCE MANAGEMENT
- 11:20** SACRED PLACES: A BRIEF INTRODUCTION TO NORTHEAST IOWA'S NATIVE AMERICAN ROCK ART LEGACY
- 11:40** OSBORNE'S GATEWAY TO EARLY DAIRYING: THE MCDERMOTT-BYRNES CREAMERY CELLAR, CLAYTON COUNTY, IOWA
- 12:00-1:30** BREAK FOR LUNCH (IAS Luncheon - tickets required - or lunch on your own)

1:30-3:30 Mill Creek Archaeology Site Tour (Stop at registration for information.)

Meet in the parking lot of the Prairie Heritage Center at 2 p.m.

4931 Yellow Ave, Peterson, IA 51047

(712) 295-7200

We will first tour the Wittrock Site with Dale Henning then we will caravan to Chan-Ya-Ta and learn more from Joe Tiffany.

SATURDAY SECTION MEETINGS

See individual sections for room locations and schedule.

Cellular, Molecular & Microbiology Section

Room: ESSC 226

- 9:00** ROLE OF EFG1 IN MANAGEMENT OF GLYCOGEN STORAGE AND STARVATION IN CANDIDA ALBICANS
- 9:20** EFFICACY OF DIFFERENT PLANT TRANSFORMATION METHODS IN DELIVERING TRANSGENES INTO DENDROBIUM ORCHIDS
- 10:20** Section Business Meeting: **Election of New Officers, New Business**
- 10:40** Travel to General Session
- 11:00** General Session - III
- 12:00** Lunch

Chemistry Section

Room: ESSC 224

- 8:20** PREVENTING THE DECOMPOSITION OF WINE
- 8:40** CHEMICAL COMPOSITION OF PM2.5 IN ZION, IL DURING THE 2017 LAKE MICHIGAN OZONE STUDY
- 9:00** FURTHER INVESTIGATIONS INTO THE GREENING OF THE SUZUKI REACTION
- 9:20** THE EFFECT OF CO-FIRING BIOMASS ON EMISSIONS FROM COAL COMBUSTION
- 9:40** A STOP-FLOW AND SUBSTRATE ANALOG ANALYSIS OF TYROSINASE'S MECHANISM
- 10:00** AN AFFINITY LABELING STUDY OF POTATO AND MUSHROOM TYROSINASE
- 10:20** EXPLORING THE POTENTIAL FOR RESEARCH-EMBEDDED COURSES
- 10:40** Section Business Meeting: **Election of New Officers, New Business**
- 11:00** General Session - III
- 12:00** Lunch

Community College Biologists

Room: ESSC 218

Ecology & Conservation Section

Room: ESSC 125

- 8:20** THE LANDSCAPE ECOLOGY AND FLORISTIC COMPOSITION OF SPRING HILL PRAIRIE IN MARSHALL COUNTY
- 8:40** HERPETOFAUNA SURVEYS ON THREE PUBLIC PROPERTIES IN CHICKASAW COUNTY, IOWA

SATURDAY SECTION MEETINGS

See individual sections for room locations and schedule.

- 9:00** CONSERVATION ASSESSMENTS OF THREE PALEOZOIC PLATEAU NATURAL AREAS
- 9:20** RESOLVING ODDBALL REPORTS OF RARE IOWA PLANTS
- 9:40** AN UPDATE ON THE CURRENT STATUS OF THE REVISION OF THE IOWA COEFFICIENTS OF CONSERVATISM AND THE FLORA
- 10:00** SOIL N AVAILABILITY CAN PROMOTE COPIOTROPHIC OVER OLIGOTROPHIC GROWTH IN TALLGRASS PRAIRIE: RESULTS
- 10:20** Section Business Meeting: **Election of New Officers, New Business**
- 10:40** Travel to General Session
- 11:00** General Session - III
- 12:00** Lunch
- 1:15** URBAN SURVEYS FOR COMMON NIGHTHAWKS IN SOUTHEAST IOWA
- 1:35** SURVEY OF NATIVE BEES OF IOWA: PRELIMINARY RESULTS FROM A REMNANT TALLGRASS PRAIRIE IN CENTRAL IOWA
- 1:55** RESPONSES OF THE VEGETATION AT ROBISON WILDLIFE ACRES, STORY COUNTY, TO SEVEN YEARS OF RESTORATION

Engineering Section

*See Physics, Atmospheric, and Space Sciences Section

Environmental Science & Health Section

Room: ESSC 136

- 9:40** PRIMARY AND SECONDARY SOURCES OF AMBIENT PARTICULATE MATTER IN THE KATHMANDU VALLEY, NEPAL
- 10:00** WHAT CAN WE LEARN FROM RAPID PARTICLE MEASUREMENTS DURING THE LAKE MICHIGAN OZONE STUDY 2017 (LMOS 2017)
- 10:20** Section Business Meeting: **Election of New Officers, New Business**
- 10:40** Travel to General Session
- 11:00** General Session - III
- 12:00** Lunch

Geology Section

Room: ESSC 137

- 8:40** ARCHEOMETRIC ANALYSIS OF IRON AGE CERAMICS
- 9:00** IMPLICATIONS OF A DEEP RESEARCH BOREHOLE IN NORTHEAST IOWA

SATURDAY SECTION MEETINGS

See individual sections for room locations and schedule.

- 9:20** CRINOID; IOWA'S STATE FOSSIL
- 9:40** Section Business Meeting: **Election of New Officers, New Business**
- 10:40** Travel to General Session
- 11:00** General Session - III
- 12:00** Lunch

Iowa Science Teaching Section

*See Physics, Atmospheric, and Space Science Section

Organismal Biology Section

Room: ESSC 229

- 9:20** MORE THAN A DECADE OF RESEARCH LEADING TO RECOVERY OF AN ENDANGERED WATERSNAKE
- 10:00** POPULATION GENOMIC STRUCTURE IN A WIDESPREAD REPTILE, THE PAINTED TURTLE (*CHRYSEMYD PICTA*)
- 10:20** Section Business Meeting: **Election of New Officers, New Business**
- 10:40** Travel to General Session
- 11:00** General Session - III
- 12:00** Lunch

Physics Section

Room: ESSC 227

- 9:20:** ONLINE PREDICTION USING DATA-DRIVEN PROGNOSIS: LATERAL WORKPIECE INSTABILITY ON SKEWED ROLLING MILL
- 9:40:** EVALUATING THE SCIENCE GENDER GAP IN LOCAL ELEMENTARY STUDENTS
- 10:00:** PROFESSIONAL DEVELOPMENT, ASTRONOMY EDUCATION, AND TRAFFIC: REFLECTIONS ON EXPERIENCING THE GREAT AMERICAN ECLIPSE
- 10:20:** Section Business Meeting: **Election of New Officers, New Business**
- 10:40:** Travel to General Session
- 11:00:** General Session - III
- 12:00:** Lunch

Physiology & Health Section

*See Environmental Science and Health

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ABSTRACTS BY SECTION

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

Anthropology Poster Presentations

1. OVERLAPS AMONG SEXISM, HOMOPHOBIA, AND VICTIM BLAMING IN VIOLENT RELATIONSHIPS

Gage Grutz, Abby Ross, Katie Puls, Lani Brown, Marquelle Graham, Justin Belstene, Dr. Wind Goodfriend

Buena Vista University

Previous research on domestic violence has established patterns of stigma and victim blaming (for a review, see Harrison & Esqueda, 1999). For example, victim blaming increases if participants believe (1) victims “provoked” a husband first and (2) if she was Black [compared to White]. Our study extended research by exploring how individual differences in participants predict victim blaming as well. Approximately 200 participants (both college students and a community sample) will complete an online survey including a brief fictional vignette describing a domestic dispute. After reading the vignette, participants will complete several items regarding how much each partner is to blame, then several self-report scales including (1) four types of religiosity, global acceptance of relationship violence, and personal experience with relationship conflict. We hypothesize that victim blaming will be positively correlated with fundamentalist religiosity and with global acceptance of relationship violence, but negatively correlated with age, quest religiosity, and personal experience of violence (which may increase empathy toward victims). Stereotypes about and blaming of domestic violence victims is a poignant problem in society today that warrants more research attention.

2. SHE DESERVED IT: INDIVIDUAL DIFFERENCES IN VICTIM BLAMING

Kyle Wiebers, Tiffany Hull, Andrea Almanza, McKenna Whitehill, Brittini Thomas, Dr. Wind Goodfriend

Buena Vista University

Previous studies on domestic violence, stigma, and victim blaming focused on violence perpetrated by a man toward a woman. This study explores other forms of relationship violence, including female-to-male and within same-sex couples. Approximately 200 participants (both college students and a community sample) will complete an online survey including a brief fictional vignette (modified from Esqueda & Harrison, 2005; Harrison & Esqueda, 2000). The vignette describes one partner hitting another, creating a 2 [sex of participant] X 2 [sex of victim] factorial design. Participants each read only one scenario (via random assignment), then

complete items regarding how much each partner is to blame for the physical violence. We hypothesize that there will be a main effect of participant sex such that male victims will be blamed more than female victims, as previous research established high levels of stigma for male, heterosexual victims (Arnocky & Vaillancourt, 2014). In addition, we expect a main effect such that victims of same-sex relationships will be blamed more than heterosexual victims, due to homophobia (Cruz, 2003). Past research has neglected the needs of both male victims of relationship violence and of victims within same-sex couples, both of which are controversial populations in this context.

3. EFFECT OF VOLUNTARY ALCOHOL CONSUMPTION ON BEHAVIORAL FLEXIBILITY

Kyle Wiebers, Gage Grutz, Dr. Wesley Beckwith

Buena Vista University

PURPOSE: Alcoholism has been associated with impaired behavioral flexibility. Rodents that have been forcibly exposed to alcohol vapor show behavioral flexibility impairments. However, forced, compared to voluntary exposure, have different effects. We will provide voluntary access to ethanol; behavioral flexibility will then be assessed using an operant reversal learning and set-shifting task. **PROCEDURE:** 24 Long Evans rats will be allowed to voluntarily consume (20% v/v) or a control solution every other day using an intermittent access protocol (IAP). The animals will complete a reversal learning and set-shifting task. The reversal learning/set-shifting task is designed to assess how long it takes subjects to learn a new strategy when an old one no longer works. **EXPECTED RESULTS:** We hypothesize the animals who voluntarily consume alcohol during the IAP will have an increased number of errors and trials to criteria on both intra-dimensional and extra-dimensional set-shifts. **CONCLUSIONS:** Previous research has not been able to identify if behavioral flexibility is a cause or consequence of alcoholism. Our research will focus on impaired behavioral flexibility as a consequence of alcoholism. This research can provide further understanding in how alcohol effects behavioral flexibility in rodents, and which may provide insight into human subjects as well

4. LYING AND THE ILLUSION OF TRANSPARENCY. HANNAH APPLESETH BUENA VISTA UNIVERSITY (ROBERT BLODGETT & WIND GOODFRIEND, FACULTY SPONSORS)

Hannah Appleseth

Buena Vista University

This study experimentally manipulated knowledge of the illusion of transparency and measured whether that knowledge affected perceived ability to tell and detect lies. Participants rated on a scale of one to five how well they know their partner prior to the experiment, one being not at all and five being very well. One partner was in the control group, uninformed about the illusion of transparency, and the other was in the informed, experimental group. Participants told their partner a series of false and true statements, and their partner guessed whether the statement was true or false. The experimental hypothesis was not supported, no knowledge controls ($M=2.78$, $SD=.943$, $n=18$), knowledge experimental ($M=2.83$, $SD=1.04$, $n=18$), $F(1, 34)=.028$, $p<.87$. An exploratory correlational analysis revealed that detection and acquaintance between partners were positively correlated, $r(36)=.403$, $p=.015$. Participants in the experimental group ($M=3.61$, $SD=.85$, $n=18$) believed that they could conceal their emotions better than the participants in the control group, ($M=2.94$, $SD=.938$, $n=18$). $F(1, 34)=4.99$, $p=.032$. When the level of acquaintance was statistically controlled, the difference was only marginally significant, $F(2, 33)=2.45$, $P=.10$.

Cellular, Molecular, & Microbiology

Poster Presentations

5. ANNOTATION OF THREE NOVEL SOIL MYCOBACTERIOPHAGES: SIBS6, ROOTS515, AND CBORCH11

Sara Sybesma Tolsma, Christopher Borchers, Nathan Eide, Emily Geraets Colton Hage, Jacob Jenness, Hannah Jorgensen, Shay Kamstra, Megan Kingsriter, Sidney Martin, Courtney Mithelman, Bethany Muyskens, Lily Peschau, Peace Preston, David Rowley, Sabrina Tarchione, Shelby Van Den Berg, Michaela Van Riesen, Byron Noordewier

Northwestern College

We isolated, purified, characterized, and sequenced three novel Mycobacteriophages from soil bacteria. Sibs6 is a member of the A1 cluster, Roots515 is a C1 cluster phage, and CBorch11 is a member of the rare H1 cluster. Sibs6 and CBorch11 are siphoviridae phages with double-stranded DNA genomes and long, flexible, non-contractile tails. Roots515 is a podoviridae phage with a double-stranded DNA genome and a short, non-contractile tail. The 50,210 base-pair genome of Sibs6 has a 63.8 % GC content and includes genes that suggest this phage is lysogenic, consistent with its plaque morphology and other A1 phages. Its left arm contains 38 forward genes and its right arm contains 58 reverse genes. Using bioinformatics, we assigned functions to 41 of its 96 genes. The genome of Roots515 is 156,288 base pairs in size and has a 64.7% GC

content. Its 271 genes are mostly forward and include 33 tRNA genes. We assigned functions to 50 of the protein-coding genes in Roots515. CBorch11's genome is 68,508 base pairs in size and has a 57.6% GC content. CBorch11's 93 genes are all forward genes and we assigned functions to 22 of them.

6. TARGETING LEUCINE AND ITS METABOLISM FOR THE TREATMENT OF BONE SARCOMAS

Elitsa Ananieva, Shailer Martin, William Reiche, Alexander Schultz, Nickolas Fifelski, Michael Boyer

Des Moines University

Osteosarcoma and chondrosarcoma are devastating bone sarcomas with low survival rates. The prognosis for individuals with bone sarcomas depends upon the patient's response to chemotherapy and surgical intervention. A novel approach to treat bone sarcomas is to target leucine, an essential amino acid that supports tumor growth. Our objective was to investigate how a pharmacological inhibition of leucine uptake and metabolism by N-acetyl-leucine amide (NALA) and gabapentin, respectively, would affect the ability of osteosarcoma and chondrosarcoma cells to use leucine for energy and biosynthetic needs. To achieve this objective, we treated osteosarcoma and chondrosarcoma cells with NALA (0-25mM) and gabapentin (0-10mM) for 24-48 hours and measured: cell growth, leucine transamination, lactate secretion, the energy sensor AMPK-regulated protein kinase (AMPK) and the S6 ribosomal protein. Results showed that NALA stimulated AMPK but inhibited leucine transamination, lactate secretion, the activity of S6, and the growth of both cell lines. Gabapentin affected the osteosarcoma cells only. Activated AMPK indicated low energy status, while inhibition of lactate secretion and S6 suggested low biosynthesis potential of the cells upon inhibition of leucine uptake by NALA or leucine metabolism by gabapentin. Targeting leucine is thus a promising new solution to combat bone sarcoma

7. PRODUCTION OF ANTI-MYCOBACTERIOPHAGE PROTEIN ANTIBODIES IN BALB/C MICE

Sara Tolsma, Jeanna Becker, Chris Borchers, Kelsey Dorhout Hans Epp, Emily Geraets, Courtney Mithelman, Hannah Powell, Peace Preston, Renju Pun, Sabrina Tarchione, Michaela Van Riesen, Byron Noordewier

Northwestern College

We annotated three novel mycobacteriophages: Sibs6 (Cluster A1), Roots515 (Cluster C1), and CBorch11 (Cluster H1). We used 12% SDS-PAGE to visualize high titer lysates from the three phages. Our gels revealed a major Sibs6 protein at 65 kDa, two major Roots515 proteins at 64 kDa and 30 kDa, and four CBorch11 bands at 65 kDa, 42 kDa, 30 kDa, and 23 kDa.

We eluted the 64/65 kDa bands from each phage sample, concentrated, and used these eluted proteins to immunize Balb/c mice. We are characterizing these polyclonal anti-phage protein antibodies and plan to determine if they cross react with proteins produced by mycobacteriophages from other clusters. We also hope to use the antibodies to understand the production of these proteins in the context of phage life cycles. In addition, we immunized Balb/c mice with whole CBorch11 mycobacteriophage and are developing monoclonal antibodies to proteins produced by this rare cluster H1 mycobacteriophage.

8. USING PCR TO CONFIRM AND REVISE MYCOBACTERIOPHAGE GENOME ANNOTATIONS

Sara Tolsma, Jeanna Becker, Chris Borchers, Kelsey Dorhout Hans Epp, Emily Geraets, Courtney Mithelman, Hannah Powell, Peace Preston, Renju Pun, Sabrina Tarchione, Michaela Van Riesen, Byron Noordewier

Northwestern College

We annotated three novel mycobacteriophages: Sibs6 (Cluster A1), Roots515 (Cluster C1), and CBorch11 (Cluster H1). We used 12% SDS-PAGE to visualize high titer lysates from the three phages. Our gels revealed a major Sibs6 protein at 65 kDa, two major Roots515 proteins at 64 kDa and 30 kDa, and four CBorch11 bands at 65 kDa, 42 kDa, 30 kDa, and 23 kDa. We eluted the 64/65 kDa bands from each phage sample, concentrated, and used these eluted proteins to immunize Balb/c mice. We are characterizing these polyclonal anti-phage protein antibodies and plan to determine if they cross react with proteins produced by mycobacteriophages from other clusters. We also hope to use the antibodies to understand the production of these proteins in the context of phage life cycles. In addition, we immunized Balb/c mice with whole CBorch11 mycobacteriophage and are developing monoclonal antibodies to proteins produced by this rare cluster H1 mycobacteriophage.

9. PROGESTERONE IS A POTENT INDUCER OF INDOLEAMINE DIOXYGENASE (IDO) IN HUMAN MACROPHAGES

Kristin Twedt, Sydney Beals, Daniel Jung,

Briar Cliff University

Successful human pregnancy depends on the initiation and maintenance of local immunological tolerance at the fetal-maternal interface. This immunosuppressive microenvironment also regulates the fetal immune system and may be partially responsible for deficiencies in the neonatal immune system. Fetal immune system deficiencies result in a greater susceptibility to microbial infection, a major cause of mortality

early in life. Previous researchers have shown that human cord blood-derived macrophages express a higher level of IDO compared to adult macrophages. It is known improper functioning and abnormal expression of IDO can cause atypical pregnancy conditions. Furthermore, IL-27, a regulatory cytokine, is known to regulate IDO expression in human neonatal macrophages.

Since progesterone is produced by the placenta during pregnancy and induces many transcription factors, progesterone may be an inducer of IDO.

Current research showed that IDO is expressed by the treatment of progesterone in a dose-dependent manner. This gene upregulation may be due to the production of IL-27. The elevated expression of IL-27 in human neonatal macrophages positively regulates IDO expression. IDO has been shown to negatively regulate T-cell proliferation and activity. Thus, the ability to mount protective immune responses in newborns and infants may be improved by blocking IL-27.

10. MOLECULAR MECHANISM OF INDOLEAMINE DIOXYGENASE GENE EXPRESSION IN PRAIRIE TURNIP (PSORALEA ESCULENTA) EXTRACT TREATED HUMAN MACROPHAGES

Jessica Welter, Jacob Hindman, Paul Weber, Daniel Jung

Briar Cliff University

The enzyme indoleamine 2, 3-dioxygenase (IDO) is present in many cells, including macrophages and is important in the modulation of immune response. The catabolites of tryptophan are involved in immune tolerance, and IDO is a rate-limiting enzyme that catabolizes tryptophan.

IDO is normally upregulated by cytokines, with interferon gamma (IFN- γ) being the primary source of upregulation. Tumor necrosis factor alpha (TNF- α) synergistically enhances IDO when IFN- γ is present.

Psoralea esculenta, found in the prairies of Iowa, contains the flavonoids genistein and daidzein. The flavonoids are known to be an inducer of IDO.

In this research, prairie turnip rind extract was found to upregulate IDO mRNA to an extent similar to IFN- γ and TNF- α . The mechanism of upregulation was further investigated.

11. ANTIOXIDANT COMPOUND M11 ISOLATED FROM PSORALEA ESCULENTA INHIBITS THE GROWTH OF TWO PATHOGENIC BACTERIA; STREPTOCOCCUS PYOGENES AND STAPHYLOCOCCUS AUREUS

Olivia Matz, Abigail Gerhardt, Jacob Hindman, Paul Weber Daniel Jung,

Briar Cliff University

Psoralea esculenta, found in the prairies of Iowa, contains the flavonoids genistein and daidzein. These compounds are known to exhibit high antioxidant activity. Previous research by colleagues at this institution have shown that a previously unreported component, M-11, isolated from this plant also exhibited potent antioxidant activity.

Previous research in this lab revealed that the extracts from *Psoralea esculenta* inhibits the growth of *Staphylococcus aureus* significantly. Current research revealed the same pattern of inhibition on the growth of *Streptococcus pyogenes* and these inhibition were partially due to the potent antioxidant M-

12. USING PCR TO CONFIRM AND REVISE MYCOBACTERIOPHAGE GENOME ANNOTATIONS

Sara Tolsma, Bethany Muyskens, Chris Borchers, Byron Noordewier

Northwestern College

We discovered CBorch11, a novel cluster H1 mycobacteriophage, and annotated its 68,508 base pair genome. CBorch11 is the sixth H1 phage to be discovered, which makes comparative genomics difficult. Autoannotation software suggested gene 90 began at nucleotide 64331 and ended at 64456 and gene 91 began at nucleotide 64411 and ended at 64803. This created an 81 base pair overlap, which is uncommon in mycobacteriophage genomes. We compared these genes to similar H1 phages and found that some annotations deleted gene 90, but others did not. When gene 90 was deleted, some annotations extended the start site of gene 91, but others did not. We isolated RNA from an *M. smegmatis* culture actively infected with CBorch11 and prepared cDNA from the RNA transcripts. We designed primers to distinguish gene 90 from gene 91 and an extended version of gene 91. We are using PCR to determine which products are present in our cDNA preparation. We will use these results to definitively confirm or revise our genome annotation.

13. INVESTIGATING LISTERIA P60 PROTEIN ENZYMATIC ACTIVITY ON VARIOUS BIOLOGICAL SUBSTRATES

Brett Cornforth, Rebecca Schmidt

Upper Iowa University

Listeria monocytogenes (Lm) is an intracellular bacterial pathogen which causes the food-borne illness listeriosis in humans. Listeriosis is the cause of 400-600 deaths each year. During a *Listeria* infection, the most highly secreted protein is p60, which is currently categorized as an Lm endolysin. Based on the knowledge that p60 is highly expressed in *Listeria*

infections, along with the research showing that p60 is very ineffective at hydrolyzing Lm peptidoglycan, the purpose of this study is to investigate the biological substrates upon which p60 is active, including the mammalian phospholipid lecithin as a possible substrate. This hypothesis is based upon LRAT (lecithin retinol acyltransferase), a p60 homolog found in mammals, which acts as a phospholipase. Previous preliminary results suggested possible p60 lecithinase activity on egg agar plates. This study aims to replicate those results using freshly purified p60 protein that was collected from transfected *E. coli*. In the future, peptidoglycan from other bacterial sources may be examined as p60 substrates in order to determine if p60 aids in *Listeria* microbial antagonism. A better understanding of p60 enzyme activity and its various roles, such as during infection, could be used to minimize health risks associated with *Listeria*-related food-borne illness.

14. PROPERTIES OF ANTIBACTERIAL EXTRACTS AND ISOLATED COMPONENTS FROM THE PRAIRIE TURNIP (PSORALEA ESCULENTA)

Jacob Hindman, Emily Joines, Carlye Polacek, Cristhian Trujillo Paul Weber, Daniel Jung

Briar Cliff University

Native Americans of the prairie regions have employed the prairie turnip (*Psoralea esculenta*) as both a dietary staple and a medical remedy for generations. Previous work at this institution has demonstrated that extracts from the rind skin of this plant and a fraction isolated by preparative chromatography possess selective and potent antibacterial activity. Reported herein are the results of studies on the effect of light, heat and exposure to oxygen on extract stability. Also determined are features of chemical structure important for antibacterial activity of extracts.

15. GENERATION OF TAU OVER-EXPRESSING CELL LINES TO STUDY ABNORMAL MAPK SIGNALING IN NEURODEGENERATIVE TAUOPATHIES

Elvis Castro, Hayley Lange, Jessy Huff, Ellie Freebern, Destiny Boettger

Morningside College

Tau, a neuronal microtubule-associated protein, has been shown to enhance MAPK signaling through the ERK pathway. Over-activation of ERK and other MAPK pathways such as JNK and p38 in response to chronic inflammation can lead to significant neuronal atrophy and cell death in neurodegenerative diseases such as Alzheimer's disease. Since the role of tau in JNK and p38 activation due to chronic inflammation remains unclear, we aimed to further investigate tau's impact on these pathways downstream of inflammatory

stressors such as Tumor Necrosis Factor Alpha (TNF α). We have previously shown that over-expression of the 3R isoform of human tau enhances TNF α -induced cell death, but the effects of 4R tau isoforms on MAPK signaling remains unclear. To better understand the impact of 4R tau isoforms, we have generated several 4R tau over-expressing neuronal cell lines to be used in future studies. Three clonal cell lines and one pooled polyclonal cell line were established and screened to verify the over-expression of 4R tau. TNF α -induced MAPK signaling will be compared in the 4R and 3R tau over-expressing cell lines. The findings from these experiments will increase our understanding of tau's interactions with the abnormal MAPK signaling that occurs in neurodegenerative diseases.

16. DOMESTICATION EFFECTS OF TB1 GENE (TEOSINTE BRANCHED 1) ON TEOSINTE AND MAIZE

Kimberly Hults, Destiny Einerwold, Noah Schmitt, James Hampton

Buena Vista University

Modern corn is derived from a Mesoamerican wild grass called teosinte and the result of selection for a surprisingly small number of mutant alleles. One of the most important genes in this domestication process was in alterations of the tb1 gene, present in both teosinte and maize. Previous research has found that the tb1 gene has effects on inflorescence sex and number and length of internodes in the lateral branches and inflorescences. Tb1 has major phenotypic effects in teosinte, but these are not seen in maize. This sequence comparison may help elucidate the unique role that the tb1 gene played in the domestication of the Heartland's most valuable crop. We will report our research on tb1 in teosinte and maize.

17. THE ROLE OF FEA3 IN COB DEVELOPMENT IN TEOSINTE

Devin Wagenman, Rebecca Peters, Ryan Exline, James Hampton

Buena Vista University

Our research group investigates the arrangement of cells in the production of the ear of corn. as it is produce by organizing center in the apical meristem. In particular, we are looking at the role of the FEA 3 gene, which is involved in the proliferation of stem cells in the ear. We have compared the DNA sequence of this gene between teosinte, the earliest progenitor of corn, and modern maize. We will report the results of our investigation.

18. MICROTUBULE-ASSOCIATED PROTEIN TAU IS ABNORMALLY UPREGULATED IN EWING'S SARCOMA

Christian Burford, Chad Leugers

Morningside College

Ewing's sarcoma is characterized by a chromosomal translocation involving the EWS gene and a member of the ETS family of transcription factors. This translocation causes a series of genes to be upregulated and downregulated as a result of abnormal transcription factor activity. Recent studies have shown one particular gene known as Microtubule-Associated Protein Tau (MAPT) has elevated mRNA expression levels in Ewing's sarcoma. However, no one has verified whether this increased mRNA expression corresponds with increased tau protein production. Tau has been reported to enhance abnormal cell signaling that can occur in cancer, and tau expression has also been correlated with resistance to certain chemotherapeutic drugs, such as taxols, in some breast cancers. Ewing's sarcoma treatment typically consists of non-taxol drugs, but the survival rate for metastatic cases is less than 30%. This poor prognosis highlights the need for new therapeutic drug targets, which may include tau. In order to confirm the upregulation of tau in Ewing's sarcoma, we have performed Western blots that demonstrate tau protein is present in these cancer cells. We have also found evidence of a possible cleaved tau isoform, which may increase the effects of tau on signaling pathways responsible for abnormal cell division.

19. PRAIRIE TURNIP (PSORALEA ESCULENTA) EXTRACTS INHIBIT THE GROWTH OF PATHOGENIC BACTERIA; STREPTOCOCCUS PNEUMONIA AND ENTEROBACTER AEROGENES.

Abigail Furlich, Elizabeth Havenridge, Mishell Garcia, Tracietaylor Turner, Ikram Omar, Grace Whitlaw, Nicole Wiles, Jacob Hindman, Paul Weber, Daniel Jung

Briar Cliff University

Research in this lab revealed anti-bacterial activity of the extracts from Psoralea esculenta. Bacterial survival test (percent survival of bacteria) showed the inhibition of bacterial growth on following pathogenic and non-pathogenic bacteria. Percent survival levels of tested bacteria were dose dependent. Furthermore, of the organisms studied, Mycobacterium and Staphylococcus are known invasive human pathogens while Pseudomonas and Klebsiella are opportunistic pathogens. The results showed that the survival rates of invasive pathogens are quite low (~10%), whereas those of opportunistic pathogen are considerably higher (35%).

To further investigate if this inhibition pattern is a general trend, we tested the effects of extracts on *Streptococcus pneumoniae* (invasive pathogen) and *Enterobacter aerogenes* (opportunistic pathogen). The results showed the unique pattern of growth inhibition.

20. INVESTIGATION OF LACTOCOCCUS LACTIS CHAIN LENGTH UNDER VARYING GROWTH CONDITIONS

Leah Davenport, Rebecca Schmidt

Upper Iowa University

Lactococcus lactis is a well-studied bacterium used historically in the food industry as in cheese, yogurt, and fermented vegetables. Now *Lactococcus lactis* is an emerging model organism in health for expression, secretion of proteins, and metabolites in live vaccine delivery. *Lactococcus lactis* typically grows in streptococcal form, in chains of spherical cells. Depending on the application, variations in morphology could influence efficiency of bacterial behaviors such as attachment to surfaces in vitro and in vivo, or secretion and production of desired compounds. This study investigated two hypotheses regarding whether cell size and cell chain length varies depending on growth conditions. The first hypothesis predicts that *Lactococcus lactis* chain length is influenced by the environment and could therefore be manipulated based on the needs of the investigator. Alternatively, the chain length of *Lactococcus lactis* is genetically determined and therefore resistant to the influence of growth conditions. Preliminary findings indicate that there is a difference in the chain length between cultures grown under shaking vs still conditions. This suggests that researchers could alter growth conditions to influence morphology in *Lactococcus* sp. and possibly other organisms in future experiments.

21. STAPHYLOCOCCUS AUREUS BIOFILM FORMATION

Jordyn Ostrowski, Rebecca Schmidt

Upper Iowa University

Many bacteria can exist as surface-attached accumulations known as biofilms. Biofilms assemble from surface-associated microbial cells that are enclosed in an extracellular polymeric substance matrix secreted by the microbial community. Biofilms can lead to many infectious diseases and can play a role in medical device-related infections. This study examines the early stages of biofilm creation using static biofilm assays, measuring matrix production after initial bacterial adherence to the surface and microcolony formation. Biofilm production was assayed by crystal violet staining of the matrix, with readouts based on analysis of optical density and microscopy.

Staphylococcus aureus, a significant biofilm-forming microbe in medical device-related infections, was the main bacterial strain of bacteria investigated and compared to *Staphylococcus epidermidis* and other species. Preliminary observations indicate that *S. aureus* produces more robust biofilm than *S. epidermidis* when both strains are inoculated using cultures at equivalent optical densities. These studies

22. INHIBITION OF MALIC ENZYME ENHANCES SURVIVAL IN A FRUIT FLY MODEL OF EMERY DREIFUSS MUSCULAR DYSTROPHY

Hannah Apolinar, Maria Valdes, Lori Walrath, Gary Coombs

Waldorf University

Previous studies have shown that mutations in *Drosophila Melanogaster* Lamin C that are homologous to LMNA mutations found in human Emery Dreifuss muscular dystrophy (EDMD) patients impair larval locomotion and survival of pupae to adulthood. These mutant Lamin C variants also activate the CncC transcription factor homologous to human Nrf2. Activation of CncC leads to reductive stress in the body wall muscle cells of larvae. RNAi mediated knockdown of the enzymes glucose 6 phosphate dehydrogenase, 6 phosphogluconate dehydrogenase, and malic enzyme, which increase reducing equivalents in the cell, increases survival to adulthood, suggesting that the redox stress caused by expression of mutated Lamin C underlies organism level symptoms of muscular dystrophy. To further test this conclusion, we searched the literature for small molecule inhibitors of malic enzyme and found a report of inhibition of human maleate dehydrogenase 2 by pamoic acid with an IC50 of $1.4 \pm 0.4 \mu\text{M}$. We show here that low millimolar concentrations of pamoic acid significantly increase survival to adulthood of flies expressing muscular dystrophy associated mutant Lamin C at 22°C and 25°C. We also evaluated the effect of pamoic acid on larval locomotion, but the results are inconclusive.

23. SINGLE NUCLEOTIDE POLYMORPHISMS AND MICROSATELLITES IN THE CANINE GLUTATHIONE S-TRANSFERASE P1 1 (GSTP1) GENE PROMOTER

Sarah Mann, Anastasia Yablochkin, James Sacco

Drake University

Background: Genetic polymorphisms within the Glutathione S-transferase P1 (GSTP1) gene affect detoxification activity of the GSTP1 enzyme and may be associated with canine cancer. This study aimed to identify polymorphisms in the GSTP1 promoter of 278 purebred dogs and several canids, compare polymorphism prevalence between breed groups and select

breeds, and predict their effects on gene expression. Results: Of the 15 single nucleotide polymorphisms (SNPs) and two microsatellites discovered, three were unique to dogs and three were unique to canids. The microsatellite located in the 5' untranslated region (5'UTR) was a GCC tandem repeat, consisting of alleles ranging from 10 to 22-repeat units, with 16 and 17 repeat-alleles most commonly-seen. The microsatellites may arise from unequal recombination. Twenty-eight haplotypes were constructed in dogs and eight in canids. The most common haplotype was the wild-type *1A(17). In Siberian Huskies and Boxers, there was minimal diversity. The compound 16*2 allele may interfere with transcription factor binding and/or stability of the transcript. Conclusions: Dogs and other canids exhibit variation in the GSTP1 promoter. Distinct haplotypes were prevalent in certain breeds. Unequal crossing-over explains most of the microsatellites observed. Certain variants may affect gene expression and are currently being investigated via promoter characterization studies.

24. TOXICOLOGY STUDIES OF ALUMINUM ON THE MODEL ORGANISM, CAENORHABDITIS ELEGANS, AND THE MOLECULAR ANALYSIS OF EXPRESSION CHANGES IN GENES LINKED TO BREAST CANCER.

Samantha Redmond, Kyleigh McLaughlin, Adam Hoffman, Rasika Mudalige-Jayawickrama, Kelly Grussendorf,

University of Dubuque

Many deodorants that are commonly used contain aluminum, specifically aluminum chloride. Studies have shown that aluminum chloride could be linked to cases of breast cancer, altering levels of gene expression of various genes, as well as interfering with the function of estrogen receptors. To study the effect of aluminum and its link to breast cancer we used the model organism *Caenorhabditis elegans*. *C. elegans* serves as an ideal organism in this type of study due to ease of use, transparency, invariance, and uncomplicated manner of subjecting them to various elements. Lastly, homologous genes that have been linked to breast cancer in humans have been found to carry out similar cellular roles in *C. elegans*. We subjected *C. elegans* to various concentrations of aluminum chloride in a wild-type background and strains with the following genetic mutations: *cep-1* (homolog p53), *brc-1* (homolog BRCA1), and *brc-2* (homolog BRCA2). After treatment, worms were analyzed for reproductive rates, behavioral change, as well as expression analysis of the genes of interest. Past and current studies show reproductive rates decrease as the concentration of aluminum chloride is increased. Lastly, current studies are addressing observed behavioral changes as well as initial testing and verification of expression levels of breast cancer linked genes.

25. ASSAY DEVELOPMENT OF THE INNATE IMD PATHWAY IN DROSOPHILA MELANOGASTER

Tara Hicks, William Jones

Upper Iowa University

The purpose of this project was to determine the kinetics of *Drosophila melanogaster*'s IMD pathway. The *D. melanogaster* mutant 55707 has a modified dipterin gene, an antimicrobial peptide (AMP), containing a β -Galactosidase reporter gene (Dipt2.2-LacZ). Dipterin, and thus the β -Galactosidase protein, is induced by the IMD pathway in response to infection by gram negative bacteria. An assay for the β -Galactosidase activity was developed using the ortho-nitrophenyl- β -galactoside (ONPG) substrate. This ONPG assay was used to measure the expression of β -Galactosidase activity in *E. coli* infected 55707 *D. melanogaster*. At various times post infection, the infected flies were frozen then homogenized. The homogenate was cleared by centrifugation and the supernatant assayed for β -Galactosidase activity. An increase in β -Galactosidase activity was first detected at four hours after infection and increased thereafter. This system will allow for future studies testing factors affecting the innate immune system's response to various environmental factors or testing of in vivo activities of antibiotics.

26. ANALYZING THE EFFECTS OF ENDOCRINE DISRUPTOR EXPOSURE ON CD - 1 MICE

Makky Mousa-Makky, Gerald Zuercher, Adam Hoffman, Kelly Grussendorf

University of Dubuque

Hormones are essential signaling molecules that are necessary for many cellular and organismal properties, particularly homeostatic processes. Regulation of these hormones is an intricate and necessary process that, unfortunately can be challenged by many external and environmental molecules. Our study looked at a chemical compound, formononetin, which is believed to be endocrine disruptor, particularly affecting estrogen. Due to the structural similarities to estrogen, formononetin is believed to mimic estrogens effect and is considered a phytoestrogen (derived by plants). To study the effects of formononetin we subjected CD-1 mice to various concentrations of formononetin over a four week period. During and at the completion of the study, mice were analyzed by many different means. Of phenotypic traits that were observed, there were changes weight as well as changes in levels of food and water consumption. Current work is being carried out to determine the correlation of these phenotypic changes with other known mimicking molecules of estrogen. Also, as this was the first study of this type at the University of Dubuque, many experimental approaches and techniques have

now been analyzed and hope to be incorporated into future studies of hormone disruptors at the University of Dubuque

27. FUNCTIONAL CHARACTERIZATION OF ANTHURIUM ANDRAEANUM DFR GENE IN PETUNIA W80 MUTANT LINE

Janaan Fink, Stephanie Pfab, Makky Mousa-Makky, Rasika Mudalige-Jayawickrama Teresita Amore

University of Dubuque

Anthocyanins are colored flavonoid glycosides which accumulate in vacuoles giving characteristic colors such as red, purple and blue to flowers, fruits and other specialized plant organs. The main objective of this study is to express dihydroflavonol 4-reductase (DFR) gene of *Anthurium andraeanum* in a petunia mutant line that lacks DFR enzyme. The DFR enzyme is one of the key enzymes that determine the color and the type of anthocyanin produced in different plants due to its substrate specificity. The full open reading frame of the *Anthurium* DFR gene was cloned into an expression vector, pORE-E2, under the CaMV 35S promoter and nopalene synthase terminator. The petunia W80 mutant was transformed with the pORE-E2-DFR plasmid via *Agrobacterium*-mediated method. We have selected 8 individual transformed lines and tested the expression of the transgene via reverse transcription-PCR (RT-PCR). Our results indicate 6/8 lines express DFR in leaves. Once the transformants produce flowers, we will determine the type of anthocyanin produced via thin layer chromatography. These results will help us to understand the substrate specificity of the *Anthurium* DFR enzyme and its potential value as a genetic tool in manipulating flower color in other floricultural commodities such as *Dendrobium* orchids, which lack red flowers.

28. UNDERSTANDING THE FUNCTION OF SH3PXD2B BY IDENTIFYING INTERACTING PROTEINS USING DEEPN: DYNAMIC ENRICHMENT FOR EVALUATION OF PROTEIN NETWORKS.

Zachariah Steffen, Whitney Christiansen, Tabitha Peterson, Robert Piper Alesia Hruska

Mount Mercy University

The SH3PXD2B protein is an important component of podosomes, actin-based membrane protrusions that help with adhesion to and degradation of the extracellular matrix. This protein is made of several domains: a PX domain, four SH3 domains, PXXP motifs and tyrosine phosphorylation sites. These domains can act as binding sites for protein-protein interactions. A one base pair deletion of the SH3PXD2b gene found in patients with Frank Ter Haar syndrome and inbred

nee mice leads to truncation of the protein in the third SH3 domain. Glaucoma amongst other symptoms develops due to this mutation. The focus of this research was to produce bait constructs to be used in a modified Yeast two-hybrid screen: DEEPN, Dynamic Enrichment for Evaluation of Protein Networks, to discover novel proteins that interact with SH3PXD2B. Various bait constructs were constructed including full length and individual wild type and mutant SH3 domains, using the pTEF-GBD plasmid by Gibson Assembly. Once baits are validated (testing for protein production, auto-activation, growth defects, and stringency requirements) multiple baits will be used in DEEPN allowing the evolution of interacting proteins in batch. Analysis of next-generation sequencing from these matings will ultimately identify novel proteins that interact with SH3PXD2B.

29. HEAVY METAL RESISTANCE AND METAL CONCENTRATIONS AMONG GLACIAL AND RIVERINE WETLANDS BACTERIA ACROSS UPPER MIDWEST

Matthew Nieland, Brittany Gill, Miyu Okada, Taylor Hixson Anni Moore

Morningside College

The purpose of this study was to determine levels of heavy metal resistance of microbial communities in glacial and riverine wetlands in Iowa, South Dakota, and Minnesota. Soil/sediment samples were collected from permanent, temporary, and former wetlands (now agricultural land) from each site. Bacteria were extracted from the soil/sediment and grown in the presence of increasing concentrations of arsenic, cobalt, copper, mercury, zinc, determining the minimal inhibitory concentration (MIC) for each metal. The preliminary results show mercury and zinc resistance more variable in riverine wetlands than glacial wetlands. Agricultural soils (former wetlands) had higher mercury resistance (up to 250 µg/ml HgCl₂) than permanent wetland soil (up to 50 µg/ml HgCl₂) among both glacial and riverine wetlands. Arsenic, copper, and zinc resistance was relatively even across the permanent, temporary, and former wetland soils in all wetlands (600 µg/ml Na₃AsO₄, 500 µg/ml ZnSO₄, 500 µg/ml CuSO₄). Cobalt resistance was low (2 mM CoCl₂), and there appears to be no significant difference between the sites.

30. USING PCR TO IMPROVE THE CHANCES OF IDENTIFYING A NOVEL SEA-PHAGE

Elizabeth Heeg, Perkins Aiyegbeni, Madison Beaver, Rebecca Gritters, Peter Hollinger, Inge, Katie Marie Nwaelugo, Nnenna Stephanie Powell, Hannah Elizabeth Preston, Peace Antonia Pun, Renju Sevcik, Kristina Marie Sitzmann, Haley

Lynn Van Den Berg, Shelby Elizabeth Van Der Werff, Brenden Scott Van Riesen, Michaela Rae

Northwestern College

We will present a diagnostic protocol to utilize in order to increase the likelihood of choosing a novel SEA-PHAGE to sequence and characterize. The HHMI SEA-PHAGES project at Northwestern College involves culturing bacteriophages and deciding which isolated phage a student should continue working with. Ideally, a student will culture, purify and analyze an undocumented phage in order to contribute novel data to the growing SEA-PHAGES database. By designing primers to annotated SEA-PHAGES we were able to explore the feasibility of a PCR diagnostic step to help students identify which viruses they should select to further characterize.

Cellular, Molecular, & Microbiology Oral Presentations

101. ROLE OF EFG1 IN MANAGEMENT OF GLYCOGEN STORAGE AND STARVATION IN CANDIDA ALBICANS

Zainab Tanveer, Martin Schmidt

Des Moines University

Candida albicans is a dimorphic fungus that is common to the human digestive tract. In response to host factors like temperature, CO₂ or serum, the fungus transitions from the commensal yeast form to a virulent hyphal morphology. In its virulent form, *C. albicans* can establish painful infections of the mouth and the vagina that can progress to life-threatening systemic infections in immunocompromised patients. The present study examines the effects of a key *C. albicans* virulence factor, Efg1, on the fungus' ability to store carbohydrates and to survive periods of starvation. Efg1 is a transcription factor that effects broad morphological and metabolic adaptations in response to protein kinase A signaling. We found that mutants lacking Efg1 have low carbohydrate (glycogen) stores and do not maintain viability on solid media well. These findings implicate Efg1 in control of glycogen synthesis and suggest that the reduced virulence of an efg1 mutant might be due to poor management of carbohydrate storage. The results suggest that glycogen synthesis is a virulence factor for *C. albicans* as it allows the pathogen to persist through periods of starvation within the host.

102. EFFICACY OF DIFFERENT PLANT TRANSFORMATION METHODS IN DELIVERING TRANSGENES INTO DENDROBIUM ORCHIDS

Fink Janaan, Rasika Mudalige-Jayawickrama, Teresita Amore

University of Dubuque

The ability to introduce new genes that precisely target a single biosynthetic pathway for modification of nutritional quality, flower color, vase life or productivity is an important breakthrough in understanding and manipulating gene function. Genetic transformation by adding a single gene has already facilitated functional genomics, discovery of new gene functions through complementation of mutants, production of knockout mutants to study gene functions and opened the explosive new field of functional RNA and gene regulation. We have isolated many commercially important anthocyanin biosynthetic genes that can potentially be used to create novel colors for the orchid cut-flower industry. Our objective is to find an efficient, inexpensive method to introduce these genes into orchid protocorms (undifferentiated seedlings). We have tested biolistic bombardment (gene gun), *Agrobacterium*-mediated plant transformation, and silicon carbide (SiC) whisker mediated transformation in delivering β -glucuronidase (GUS) reporter gene and antibiotic selectable marker gene into *Dendrobium* orchids. We successfully produced transformed seedlings through biolistic bombardment and *Agrobacterium*-mediated transformation. However, SiC whisker method alone has not been successful in delivering the transgene into orchid protocorms. We are currently testing the combination of SiC whiskers and *Agrobacterium*-transformation in delivering the transgene into orchids. Comparison of all the methods used and their success rate will be presented.

Chemistry Poster Presentations

31. THE ADDITION OF METHYLAMINE TO DICHLORONAPHTHAQUINONE

Samantha Aguilar, Ashley Garr

Central College

The mechanism for the addition of methylamine to dichloronaphthaquinone in DMSO was modeled computationally at the M06/6-311+G(d,p) level of theory. Based on this model, a concerted mechanism for the addition of methylamine and dissociation of a chloride was proposed. The reaction was modified to determine how different levels of theory, solvent, and leaving groups would affect the reaction. Levels of theory utilized were the M062x, B3LYP, PBE1PBE, and mPW1PW91 density functionals. Solvation was modeled using the implicit solvation model, IEFPCM, at the M06/6-311+G(d,p) level of theory and included the solvents THF, acetonitrile, chloroform, and DMF. Difluoronaphthaquinone and dibromonaphthaquinone were employed to study the effect of leaving group. The difluoronaphthaquinone reaction showed a step-wise addition-elimination mechanism as opposed to the

concerted mechanism for dichloro- and dibromonaphthaquinone.

32. A SURVEY OF THE ACTIVITY OF TYROSINASE ISOLATED FROM A VARIETY OF SOURCES

Whylder Moore, Anthony Coltson, Brian Gramajo, Tsveta Valcheva, Mark Sinton

University of Dubuque

Previous work in the Sinton lab has demonstrated that tyrosinase (polyphenyl oxidase) isolated from a variety of plants have varied properties. When isolated from Russet potatoes, for example, the enzyme is active at 80°C, which is not observed in the common mushroom form of the enzyme. Here, we report on a survey of the high temperature activity of tyrosinase isolated from a variety of other sources, including several other members of the Solanaceae (Nightshade) family.

33. A COMPARISON OF ELECTRODES FOR DIELECTRIC ELASTOMER ACTUATOR FABRICATION

Anthony Coltson,, Freddie Santiago Silvia Matt, David Bonanno, Blerta Bajramaj, Brian Hicks, Weilin Hou, Sergio Restaino

University of Dubuque & U.S Naval Research Lab

Dielectric Elastomer Actuators (DEAs) are composed of a soft elastomer between two electrodes that deforms when an electrical current is applied. Compliant electrodes can range from ionic compounds, metal flakes, or electro active polymers. The goal of this study is to find the optimal electrode that is low cost, simple to pattern and fabricate and with electrical properties that will result in low power consumption.. The compliant electrodes investigated are Carbon Grease, Graphite Powder, Graphite Spray, and Poly(3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS). We present preliminary measurements of the conductivity of the electrodes for different electrodes dimensions and description of how the initial DEAs were fabricated. Future work for DEA fabrication is looking into maximum displacement as well as understanding the thickness variation of the DEA's membrane, when an electric current is applied.

SCHIFF-BASE VANADIUM(V) COMPOUNDS AS CATALYSTS FOR ALKENE OXIDATION

Taylor McGowan, James Dunne

Central College

We are investigating the reactivity of a new oxovanadium Schiff base compound, phenalV(O)(O-i-Pr). H□phenal (2-

[(2-hydroxyphenyl)imino]methyl]phenol) is readily ligated to V(O)(O-i-Pr)₃ to give the target VV compound. The tridentate binding mode of the ligand is confirmed via both IR and ¹H NMR spectroscopy. Oxovanadium compounds have been reported as good oxidation catalysts in the literature. Given this, the catalytic activity of phenalV(O)(O-i-Pr) as an oxidant of alkenes with H□O□ is being explored. Additionally, the use of O□ as the terminal oxidant with phenalV(O)(O-i-Pr) in catalytic alkene oxidations is also under investigation.

34. BIOGEOCHEMICAL EVOLUTION OF THE ATMOSPHERE: THE BETA PROJECT

Joshua Seabee, Tray Hickie, Lucas Krakow,, Kayla Beck Nicole Bishop, Astoria Chao, Juliana Herran, Mackenzie Male, Courtney Massey, Riley McMorran, William Spurr, Jessica M. Wayson, Alexa Sedlacek, Xinhua Shen

University of Northern Iowa

The interactions between the atmosphere and biosphere throughout Earth's history play an important role in the dynamic climate system. The BETA Project involves undergraduate students in a multidisciplinary study of the biogeochemical evolution of Earth's atmosphere at three key intervals of Earth's history. (1) The anoxic atmosphere that supported Earth's first life, (2) the Devonian, a period when forest ecosystems radiated onto the land surface and caused major CO₂ drawdown from the atmosphere and (3) the modern agricultural sources of atmospheric NH₃. Our interdisciplinary team includes undergraduate Earth Science, Environmental Science, Biology, Biochemistry, Computer Science, and All Science Teaching majors from the University of Northern Iowa. The team is led by faculty from the Earth Science Department and Chemistry and Biochemistry Department at UNI in collaboration with scientists from NASA Goddard Space Flight Center. 22 undergraduate students and one high school student have used a combination of laboratory simulations, field work and analysis, and weather and climate modeling to study atmospheric changes at these intervals of Earth's history over the past three years.

35. UNCOVERING THE EVOLUTIONARY MECHANISM OF ENZYME CATALYSIS

Gabriel Fortunato, Priyanka Singh, Amnon Kohen

University of Iowa

The design of effective artificial enzymes for desired industrial or biomedical purposes is limited by our current understanding of the evolution of enzyme catalysis. Specifically, how do the dynamics of enzymes evolve to optimally perturb the substrates and activate them for bond breaking and formation? In this project, we evolve a circular permuted mutant of

dihydrofolate reductase (cpDHFR), which mimics the slow and nonspecific enzymes of early life. We observe how the fast protein motions of the chemical step, as well as overall catalytic efficiency and substrate affinity, change at each generation along the enzyme's evolutionary trajectory. We use the kinetic isotope effect as a tool to study the chemical step in enzyme catalysis. Previous analyses of wild-type enzymes across species have found a strong preservation of the fast dynamics that organize the tunnelling ready state, despite the transient and non-rate limiting nature of the chemical step within the overall catalytic cycle. Our work aims to investigate the evolution of DHFR and the role of fast protein motions in catalysis.

36. SYNTHESIS OF IONIC LIQUID MONOMERS FOR USE IN FREE-RADICAL POLYMERIZATIONS

Brook Boyd, Brian McFarland

Morningside College

In this research, we investigated methods of synthesizing new ionic liquid monomers that could be used in free-radical polymerizations. Our focus was primarily of synthesizing crosslinkable monomers containing multiple vinyl groups. Ionic liquid monomers were prepared using acid-base neutralization, structurally analyzed using infrared and ¹H NMR spectroscopy, and radically polymerized. Synthesized polymers were tested in potential adhesive applications, keeping in line with recent previous research. This included direct mechanical testing of adhesive properties, as well as environmental toxicity testing.

37. USING FLUORESCENCE QUENCHING TO OBSERVE CONFORMATION CHANGES IN NITRIC OXIDE SYNTHASE

Alexandria Yoerger, Jeffrey Jeltema, William Browning, Hannah Powell, Peace Preston, Renju Pun Nnenna Nwaelugo, David Arnett

Northwestern College

The Nitric-Oxide-Synthases (NOS) are a family of enzymes that plays important physiological roles in the regulation of blood circulation and neuronal activity, amongst other things. These enzymes are activated by the signaling protein calmodulin (CaM) and enzyme function is regulated through a series of conformational equilibria. We have been exploring these conformational equilibria through the quenching that occurs when fluorescence-labeled CaM binds and activates NOS. Since fluorescence quenching is a distance-dependent phenomenon, the degree of quenching experienced by the fluorescence label is sensitive to the conformation of the CaM-NOS complex, and changes in fluorescence reflect changes in

conformation. Conformations that place the label close to natural quenching centers in NOS will appear dark with the fluorescent label exhibiting a very short fluorescence lifetime. Other conformations that place the label further from the quencher will appear brighter and have longer fluorescence lifetimes. In this poster, we report on how the fluorescence quenching in CaM-NOS complexes changes as the conformational equilibria respond to (1) additional calcium ions in solution or (2) mutations to either the CaM or the NOS.

38. UNDERSTANDING THE PHASE STATE OF INDIVIDUAL SUBSTRATE DEPOSITED AEROSOL PARTICLES

Kamal Ray, Hansol Lee, Alexei Tivanski

University of Iowa

Understanding the impact of aerosols' phase state (liquid, semisolid and solid) on climate is important to better understand the cloud condensation nuclei, ice nuclei and heterogeneous gas phase reactions. The phase state, mechanical and morphological properties are influenced by relative humidity (RH) and hygroscopic nature of the aerosols. However, mechanical properties and phase state variation of different aerosol particles in fixed and varying RH have not been reported yet for submicrometer sized aerosol particles. Herein, we present a technique where we use nanoindentation and nano-Wilhelmy methodologies as a function of RH for sucrose particles to understand the phase state at varying RH condition. We report that this technique can be used for sucrose particles as well as other atmospheric relevant particles. Afterwards, we expand our study to other model sea spray aerosols (SSA) and secondary organic aerosols (SOA) systems under fixed RH condition. Here, we utilized AFM 3D morphology and nanoindentation techniques to distinguish the phase state of the model aerosols. Thus, we show here that the AFM nanoindentation techniques and 3D morphology can be utilized to distinguish between the phase state of aerosols.

Chemistry Oral Presentations

103. FURTHER INVESTIGATIONS INTO THE GREENING OF THE SUZUKI REACTION

Katrina Pagel, Mark Sinton

University of Dubuque

The Suzuki reaction is an important synthetic reaction used in the pharmaceutical, herbicide, and natural product industries due to its ability to form a biphenyl functional group. Recent work by Satterlee, as well as our group, to design a safer and more environmentally sound Suzuki reaction showed that it

was possible to achieve good biphenyl yield and purity using dimethyl carbonate and palladium (II) acetate instead of the benzene and traditional tetrakis(triphenyl-phosphine)palladium (0) solvent and catalyst, respectively. Here, we report on an extension of this research in which we used absolute ethanol as the solvent coupled with a 10% unreduced palladium on carbon catalyst. Our results show that ethanol and palladium on carbon produce biphenyl with yields and purity as good as those observed with dimethyl carbonate and palladium (II) acetate, and that the palladium on carbon can be reused a number of times. As an added benefit towards the use of ethanol and palladium on carbon, the reflux period has been significantly reduced from the 24 hours required by Satterlee to as little as 30 minutes.

104. A STOP-FLOW AND SUBSTRATE ANALOG ANALYSIS OF TYROSINASE'S MECHANISM

Mark Sinton, Abigail Fabris

University of Dubuque

Work in our lab has previously shown that tyrosinase (or polyphenyl oxidase) isolated from Russet potatoes has significant activity at high temperature. Similar temperature dependent activity profiles have not been observed when the enzyme has been isolated from other sources. In light of this observed difference, we probed the mechanism of tyrosinase isolated from Russet potatoes, D'anjou pears, and common mushrooms in two ways: a stop flow analysis of their kinetics to see if the potato enzyme has different fast kinetic intermediates, and an analog substrate activity study to better understand each enzyme's catalytic mechanism. Our stop flow analysis suggests that at high temperature, potato tyrosinase appears to have a very slow mechanistic first step, that then transitions into a much faster subsequent step. The mushroom and pear varieties of the enzyme seem to get stuck in this slow first step at high temperature by failing to make the transition into the next step that would lead to product formation. This conclusion is supported by our substrate analog observations: when presented with a substrate analog, all three enzymes are blocked from making product, suggesting each enzyme employs the same first mechanistic first step.

105. AN AFFINITY LABELING STUDY OF POTATO AND MUSHROOM TYROSINASE

Mitchell Pope, Mark Sinton

University of Dubuque

Tyrosinase isolated Russet potatoes has unusual temperature dependent activities and kinetics, which are not observed in the versions isolated from other sources such as common mushrooms. In order to better understand this observation, we

have used eosin isothiocyanate (EITC) affinity labeling of lysine and arginine residues to probe differences active site differences in the potato and mushroom versions of the enzyme. Upon EITC labeling, potato tyrosinase has one reactive lysine or arginine residue, which reduces the activity of the enzyme by 10 fold. When EITC labeled, the mushroom form of tyrosinase has about 10 reactive lysine or arginine residue, but its activity is only reduced by a factor of 2. These data suggests that potato tyrosinase has a different active site structure when compared to the mushroom enzyme, and may explain the previously observed temperature dependent activity differences.

106. EXPLORING THE POTENTIAL FOR RESEARCH-EMBEDDED COURSES: A BIOCHEMISTRY CASE STUDY

Karissa Carlson

Northwestern College

There is indisputable evidence that research experiences are extremely valuable for undergraduate science students. Such opportunities are instrumental in developing important skills needed in scientific careers and are often pivotal in attracting and retaining students to these careers. Undergraduates often seek research opportunities through research programs at their institution or larger educational research universities. These programs are limited in the numbers and types of students they serve. Research-embedded courses, in contrast, have the potential to overcome some of those limitations and provide research opportunities for a wider variety of students by incorporating research experiences into the laboratory components of undergraduate courses. This study describes an undergraduate research-embedded Biochemistry course at a private liberal arts college in which students worked on a project with nitric oxide synthase (NOS) enzymes. The value of this research experience is evaluated from both the faculty and student perspectives. Learning gains in key scientific skills for this research-embedded lab are compared with student reported learning gains for traditional verification-style laboratory experiments. Furthermore, the value of teaching this research-embedded course is described. Results suggest that research-embedded courses at smaller colleges and universities may benefit both students and faculty.

108. THE EFFECT OF CO-FIRING BIOMASS ON EMISSIONS FROM COAL COMBUSTION

Gavin Parker, Ibrahim Al-Naiema, Elizabeth A. Stone

University of Iowa

The University of Iowa aims to achieve 40% renewable energy consumption by 2020. The University is working towards this

goal by co-firing coal with biomass in existing coal boilers. This process has benefits such as reductions in greenhouse gases like sulfur dioxide, nitrogen oxides, and fossil fuel CO₂ emission. Prior work has shown that co-firing 50% oat hulls with 50% coal in a circulating fluidized bed boiler has benefits to air quality compared to a 100% coal baseline. These benefits include reductions important to human health such as particulate matter by 90%, polycyclic aromatic hydrocarbons by 40%, metals by 65%, and fossil fuel CO₂ by 40%. Promising results from co-firing biomass and coal led to this investigation of maximizing biomass use in the boilers. Two boilers with different fuel mass ratios were studied: a stoker boiler firing 100% energy pellets, and a circulating fluidized bed boiler firing 78% oat hulls, 17% coal, and 5% energy pellets. Energy pellets were chosen as a cost-effective, renewable alternative to coal with a similar energy density. Emission factors with respect to energy input for particulate matter, metals, organic species, and CO₂ were calculated for both boilers and compared to the 100% coal baseline.

109. CHEMICAL COMPOSITION OF PM_{2.5} IN ZION, IL DURING THE 2017 LAKE MICHIGAN OZONE STUDY (LMOS)

Dagen Hughes, Alissia Milani, Megan Christiansen, Dylan Millet, Timothy Bertram, Charles Stanier, Elizabeth Stone

University of Iowa

The Lake Michigan Ozone Study 2017 combined airborne, ship, mobile, and ground based measurements to investigate the elevated ozone concentrations along the coast of Lake Michigan and to examine how coastal meteorology affects ozone production. Here, we focus on characterizing the chemical composition of fine particulate matter (PM_{2.5}) in Zion, Illinois and identifying its sources. The most significant contributor to PM_{2.5} was organic matter (averaging 57.9%), followed by sulfate (16.4%), ammonium (6.3%), nitrate (3.5%), and elemental carbon (3.3%). The average organic carbon-to-elemental carbon ratio was 12.25, suggesting a large contribution from secondary organic aerosol. Ozone concentrations exceeded the primary standard to protect human health (70 ppb) during a high-ozone event on June 02 and during a high-ozone period occurring from June 10 to June 16. PM_{2.5} concentrations were elevated during these two episodes relative to non-event periods. Moreover, the organic carbon-to-elemental carbon ratio on June 02 was 7.0—substantially lower than the ratios for the high-ozone period (13.8) and non-event periods (12.0)—indicating a larger contribution from primary combustion emissions. Additional organic species and metals will be quantified for use in source apportionment modeling to evaluate sources contributing to PM_{2.5} in Zion, Illinois.

110. PREVENTING THE DECOMPOSITION OF WINE

Jordyn Lehman, Joseph Nguyen

Mount Mercy University

Oxygen has a rather interesting role in wine, both in its taste as well as its longevity. Oxygen is initially important as it helps intensify the smell of wine, which additionally contributes to adding a robust taste to it. However, as most wine drinkers know, wine does not last longer than a week before its taste degrades to the level that it needs to be disposed, which is partially contributed by the oxidation of ethanol to acetic acid. While the science and research behind the production and tastes of wine is abundant, the role of oxygen, especially regarding the decomposition of wine, is unknown. The presentation will discuss the efforts towards understanding the role oxygen plays in wine, both with the decomposition as well as its taste.

Ecology & Conservation Poster Presentations

39. ASSOCIATION OF CLUTCH SIZE AND SEX DETERMINATION IN TURTLES

Sarah Hill

Iowa State University

This research project aims to identify any relationships between the clutch size and sex-determining mechanisms (genotypic and temperature-dependent) in turtles. This study incorporates all species of turtles for which both clutch size and sex determination information is available based on prior research. Once the information is gathered, it will be evaluated in order to find possible correlations between these two traits. Existing research examining the relationship between turtle sex determination and chromosome number has shown that these two traits coevolved, and that climate change is potentially related to turtle evolutionary movements. Finding a link between turtle clutch size and sex determination will potentially shed light on how the number of eggs a species typically lays per nest is related to how they may evolve in the future. Few past studies have examined this relationship specifically but finding a connection between these two traits in turtles may provide better understanding of how turtles evolved in the past and how they may continue to do so in the future.

40. RESPONSE OF BEE SPECIES TO HABITAT TRANSITION FROM PRAIRIE TO TEMPERATE DECIDUOUS FOREST

Alec Rutherford Adam Hoffman Stephen Hendrix Gerald Zuercher

University of Dubuque

Bees play valuable roles in both natural and agricultural lands as they positively impact ecosystem biodiversity and provide economic benefits. Little is known about native Iowa bee communities and if adjacent habitats, such as forests and prairies, have fundamentally similar or different communities. Using fluorescent pan traps, 120 meters transects were established in three separate prairies, and the surrounding temperate deciduous forests. Over 20 genera were represented in the 809 specimens that were collected in the summer of 2017. The most common genus captured overall was *Lasioglossum* (Halictidae), with 37% of all bees captured, representing nearly 300 individual specimens. Statistically significant differences ($p < 0.05$; $t = 1.94$) in the number of bees captured in the prairie versus bees captured from the forest environment were noted, as bees captured in prairie habitats outnumbered bees captured in forest habitats during our sampling by a 4:1 margin. *Lasioglossum* was associated most commonly with prairie habitat as only 5% of the individuals were captured in the forest. The most common genus captured in the forest was *Ceratina* (Apidae), 57 of the 128 total individuals were captured within the forest. Some Genera commonly occurred in both habitats as both *Ceratina* and *Nomada* (Apidae) were found in similar proportions at each habitat.

41. COMPARISON OF AQUATIC CALL PLAYBACK SURVEYS FOR OWLS

Nicholas Engelhardt Paul Skrade

Upper Iowa University

Population surveys for nocturnal species are primarily conducted using call playback, i.e. broadcasting a recording of the species' and listening for their response. Eastern Screech-Owls (EASO, *Megascops asio*), Barred Owls (BADO, *Strix varia*), and Great Horned Owls (GHOW, *Bubo virginianus*) in Iowa are associated with forested areas and in northeast Iowa this is usually near water. Sound carries more easily over water than through forest so we compared the effectiveness of call playback surveys conducted from watercraft to surveys conducted from land. These were performed from flowing (Turkey River) and still (Volga Lake) water over a period of several nights to compare activity during a full and new moon. BADO were the most responsive with 48 individuals detected. This averaged out to 1.8 owls per point at Volga Lake and 1.6 on the Turkey River, which was similar to the number of BADO detected from land. Activity was also similar during the moon phases. Only one GHOW was detected from land near the river with the new moon. EASO were more active during

the full moon with seven detected from land and one from the river.

Ecology & Conservation Oral Presentations

111. SURVIVORSHIP AND HABITAT USE VARIANCE BETWEEN TWO COHORTS OF TRANSLOCATED WESTERN RINGTAIL POSSUMS (*PSEUDOCHEIRUS OCCIDENTALIS*).

Gerald Quinlan

Buena Vista University

The Department of Parks and Wildlife of Western Australia was asked to identify factors that could result in more successful translocations of medium-sized mammals. The task was given out to ensure the growth and maintenance of insurance populations for endangered animals within the state. This research looked at the maintenance of two different possum cohorts that were introduced to a predator free sanctuary within the Upper Warren region of south-western Australia. By looking at the two different cohorts of western ringtail possums translocated into the Perup Sanctuary, survivorship and habitat use were examined with respect to sex and where the cohorts were sourced from. It was found that there is a significant difference in the habitat use of the different cohorts; the population from the similar habitat type survived notably longer compared to the population of a different habitat type. There are also differences in same sex occupancy amongst the different cohorts between the six habitat types found in Perup. Further factors such as timing of release and stress of breeding could also cause variance between the two translocated populations.

112. HERPETOFAUNA SURVEYS ON THREE PUBLIC PROPERTIES IN CHICKASAW COUNTY, IOWA

Katy Cantin, Paul Skrade

Upper Iowa University

Amphibians and reptiles are in a steep decline globally, including species in the midwestern United States. In Iowa, habitat loss is the main cause for this decline, primarily deforestation and wetland drainage for agriculture. Chickasaw County exemplifies this, with over 90% of acreage in crop production. Remaining suitable habitat is often in private ownership; however small parcels are managed by the state and county for wildlife. We surveyed three of these public properties for herpetofauna in the fall of 2017 using coverboards and visual encounter surveys (VES) and

additional surveys will be conducted in spring of 2018 including call surveys to increase detections of amphibians. Our initial surveys in 2017 yielded a total of 10 different species, with the majority found at the Upper Wapsi Wildlife Management Area. One species of garter snake (*Thamnophis* sp.) was found DOR (dead on road) about a ½ mile from the Nelson Wildlife Management Area. No species were found at Wapsi Junction. Across all three management areas, no species of reptiles or amphibians were found under any coverboards and were located through VES, the most surprising being *Storeria occipitomaculata* and a large number of *Notophthalmus viridescens louisianensis*, (threatened in Iowa).

113. THE LANDSCAPE ECOLOGY AND FLORISTIC COMPOSITION OF SPRING HILL PRAIRIE IN MARSHALL COUNTY

Thomas Rosburg

Drake University

Spring Hill Prairie is located northeastern Marshall County and contains about 78 acres of mostly grassland habitat. Five plant associations were delineated and mapped – upland prairie is the largest association with 51.5 acres (66%), alluvial grassland is the second largest with 17.8 acres (22.8%), a lowland grass/ forb community occupies 8.1 acres (10.3%), the lowland grove, dominated by box elder and white mulberry, is 0.50 acres (0.6%), and a wet seep occupies 0.2 acres (0.3%). There were 211 vascular plant species identified on Spring Hill, of which 178 were native and 33 were non-native, resulting in a non-native percentage of 15.4%, a relatively low measure of non-native presence among Iowa's natural and semi-natural areas. Saw-tooth sunflower, Virginia mountain mint, and hairy fruited sedge were the most widespread native species, and white mulberry and reed canary grass were the most widespread non-native species. No species were observed that are on the list of priority plant species in Iowa (endangered, threatened, or special concern). However, there were 33 high conservative species found. The ecology and flora of this prairie pasture will be discussed in detail.

114. URBAN SURVEYS FOR COMMON NIGHTHAWKS IN SOUTHEAST IOWA

Erik Murry, Paul Skrade

Upper Iowa University

The Common Nighthawk (*Chordeiles minor*) is an aerial insectivore in the night-jar family that has been in a population decline for over a decade. This species has adapted to living around humans and frequently nests on gravel roofs in urban areas. We conducted nocturnal surveys for this species in cities of varying sizes in southeast Iowa during the summer of 2017.

The urban populations ranged in size from Gladwin (unincorporated) to Iowa City (~74,000), which was so large it had to be subdivided into four quadrants for adequate coverage. There appeared to be a correlation between human population/buildings and the number of Common Nighthawks, with the numbers of birds detected increasing with the urban areas surveyed. However, it was not a linear correlation as three birds were detected in Gladwin with sixty-five detected in the entire Iowa City area. These birds are likely attracted to the available nesting areas and feeding opportunities associated with urban structures and extensive lighting.

115. CONSERVATION ASSESSMENTS OF THREE PALEOZOIC PLATEAU NATURAL AREAS

Wayne Schennum, John Pearson

Iowa Department of Natural Resources

The Driftless Area at the juncture of 4 Midwestern States is a unique island of deeply dissected unglaciated terrain where narrow stream valleys are bordered by steep ridges and rolling plateaus on dolomitic bedrock. Here native vegetation is best represented in mesic forests and algific talus slopes on steep north-facing slopes and dry limestone (dolomite) hill prairies on west- and south-facing slopes. Three Iowa Preserves were studied here in 2017. Solitaire Ridge is a 35 to 40 acre very high quality dry dolomite prairie above the Upper Iowa River owned by the Iowa Natural Heritage Foundation. A total of 102 native plants were observed here, one listed as threatened and 5 as special concern. Two special concern skippers occur here also. Malanaphy Springs (64 ac.) is a very rich, little-disturbed mesic forest with several seeps and dolomite cliffs. A total of 102 native species, many of which are conservative, were found here. At Bixby Springs, only a 2 to 3 acre algific talus slope imbedded in mesic forest was studied. This very high quality community has 64 native species, 56% of which are conservative, including the threatened Northern Monkshood and several northern relics.

116. RESOLVING ODDBALL REPORTS OF RARE IOWA PLANTS

John Pearson

Iowa Dept of Natural Resources

During an effort to update the list of Endangered, Threatened, and Special Concern plants in Iowa, I investigated reports of rare species whose sources were unclear or whose occurrences appeared out of range. Herbarium searches revealed that all specimens for *Alisma gramineum* had been annotated to *A. subcordatum* after publication of the state checklist (Eilers & Roosa 1994); likewise, all specimens of *Asclepias engelmanniana* had been recently annotated to *A. stenophylla*.

Melica mutica lacked a voucher specimen for its lone literature report, but had been recorded in 1898, prior to that taxon being split in 1905 into two species with all Iowa specimens subsequently updated to M. nitens. The historic specimen for a fourth species, Lechea racemulosa, was correctly identified, but reexamination of its label revealed that it had been collected in Tennessee, not Iowa. Based on national range maps or historic records, seven species formerly considered native were determined to be adventive or introduced: Rosa palustris, Carex douglasii, Acalypha ostryifolia, Baptisia tinctoria, Trichostema dichotomum, Helenium amarum, and Cimifuga [Actaea] racemosa. Conversely, two species formerly considered non-native are now regarded as native: Crepis runcinata and Adlumia fungosa. This study underscores the importance of herbaria as sources of verifiable data.

117. RESPONSES OF THE VEGETATION AT ROBISON WILDLIFE ACRES, STORY COUNTY, TO SEVEN YEARS OF RESTORATION MANAGEMENT

Thomas Rosburg

Drake University

Robison Wildlife Acres is a 78-acre park located in southeast Story county managed by Story County Conservation. Upland soils occupy approximately 80% of the park; alluvial soils comprise 20%. Extant plant communities include oak-dominated forests, shrubland and grassland. In 2010, four 20x50 m permanent plots were established on four sites throughout the park to record baseline data on plant community composition. Management efforts over the next seven years were aimed at restoring woodland, savanna and prairie. Mechanical woody removal, prescribed fire and goat herbivory were used in various portions of the park. Plant community composition was recorded in 2017 on the plots and analyses completed to evaluate changes in the vegetation. Significant patterns exhibited across all sites included 1) an increase in the richness of native forbs, 2) an increase in the total density of low conservative native herbaceous species, 3) an increase in the total frequency of native graminoids, 4) a decrease in the total frequency of native woody species in the herb layer, 5) an increase in the diversity index for native herbs, and 6) a decrease in the diversity index of native woody species. Additional patterns of vegetation dynamics among and within sites will be discussed.

118. AN UPDATE ON THE CURRENT STATUS OF THE REVISION OF THE IOWA COEFFICIENTS OF CONSERVATISM AND THE FLORA OF IOWA

Thomas Rosburg, Pauline Drobney,, Deborah Lewis John Pearson, Dean Roosa, Daryl Smith, Mark Widrlechner

119. Drake University, US Fish & Wildlife Service, Iowa State University, Iowa Department of Natural Resources, & University of Northern Iowa

The application of coefficients of conservatism for native plant species to evaluate the quality of vegetation has been in use since 1979 following the publication of “Plants of the Chicago Region” by Floyd Swink and Gerould Wilhelm. The concept of plant conservatism is based on the precept that plant responses to modern anthropogenic disturbances occur along a gradient. Species that respond favorably to human disturbance are less conservative species, while highly conservative species require natural, pristine habitats. A draft list of coefficients for Iowa plant species was completed and made available to users in 1999. Over the last four years, we have been working to revise the coefficients to make them more accurate. Adjustments have been made for about 51% of the native species in Iowa. In most cases of adjustment, the coefficient either increased or decreased by 1 or 2 on a 1-10 scale. In a few cases, the modification decreased the coefficient by 5 or increased it by 7. A new field describing our confidence level in the coefficient’s accuracy has been added to the list. The status of this ongoing work and its consequences for the Flora of Iowa will be discussed.

120. SURVEY OF NATIVE BEES OF IOWA: PRELIMINARY RESULTS FROM A REMNANT TALLGRASS PRAIRIE IN CENTRAL IOWA

Isaiah Smith, Paulina Mena

Central College

Pollinators provide essential ecosystem services to both crops and wild plants. However, recent concerns over the welfare of managed honey bee colonies and wild bees have resulted in calls for the evaluation of bee populations. Studies of the native bees of Iowa are limited, highlighting the importance of assessing the status of the local bee populations. Here we present preliminary results from a survey of native bee populations of Iowa. Collections were done monthly using bowls and aerial nets from July to October. These were done in three different kinds of environment: remnant prairie, planted prairie, and ruderal grassland. Specifically, we present the species richness and abundance of one of the sites surveyed, the Reichelt Unit of Rock Creek State Park in Jasper County.

121. SOIL N AVAILABILITY CAN PROMOTE COPIOTROPHIC OVER OLIGOTROPHIC GROWTH IN TALLGRASS PRAIRIE: RESULTS FROM A CULTURE-FOR-DIVERSITY STUDY

Matthew Nieland, Lydia Zeglin

Morningside College

Anthropogenic alterations to tallgrass prairie ecosystems, such as fire suppression and nitrogen (N) enrichment, alters N availability for soil-dwelling bacteria that have a vital role in supporting plant and other microbial growth by degrading recalcitrant and complex organic materials in the soil. Community composition and microbial biomass change as a result, suggesting shifts in copiotrophic (r-selection) and oligotrophic (k-selection) growth patterns. To determine whether prolonged land management practices have changed soil bacterial growth rates and efficiencies, growth curves and CO₂ respiration were measured from bacterial isolates cultured from soil sampled from a 30-year field experiment of historical burning and N addition, as well as a recent N fertilizer application, from Konza Prairie Biological Station, Kansas, USA. 143 pure cultures representing 13 families within 6 bacterial (sub)phyla were isolated using seven different media types. Growth rates in more concentrated nutrient broth were higher in strains isolated from recently fertilized soils, and growth rates in dilute nutrient broth were higher in strains isolated from soils with the lowest N availability, as predicted. Variability in growth rates also increased in amended N plots.

Engineering Poster Presentations

42. EVOLUTION OF SURFACE ROUGHNESS PARAMETERS DURING MICROPITTING OF CARBURIZED AISI 8620 STEEL

Anvay Pradhan, Sougata Roy, Sriram Sundararajan

Valley High School

Micropitting is a phenomenon whereby small craters or pits appear on the surface of gear teeth, leading to weakening, cracking, or failure of gear teeth. This is one of the most crucial rolling contact fatigue (RCF) failure modes observed in drivetrain components such as on gears and bearings. Observing evolution of different surface roughness parameters during micropitting can help to understand the failure behavior effectively. Retained Austenite (RA) is an important phase in steel which can impact wear and fatigue performance of gears. In this study, three different levels of RA samples were manufactured and RCF tests were conducted. The low RA samples failed due to early crack initiation and rapid crack propagation. Initiation and propagation of micropitting were observed for high and medium RA samples. Average surface roughness (Ra), root mean square roughness (RRMS), skewness (Rsk) and kurtosis (Rku) values were captured by intermittently stopping the tests and observing sample surface using non-contact white light interferometry technique. Significant correlation was observed between propagation of micropitting and above-mentioned surface roughness parameters. Present study shows, this correlation on surface roughness parameters can be used by drivetrain industries to

predict the long-term performance of gears and bearings at their practical application field.

43. A LIFE CYCLE COST ANALYSIS OF A CATTLE-BASED ANAEROBIC DIGESTER OPERATION IN IOWA

Alvina Aui, Mark Mba-Wright

Iowa State University

Anaerobic digestion (AD) is an attractive and beneficial process for converting agricultural, commercial and industrial waste into clean methane-rich biogas, which can be used as heat, power and substitute natural gas. Besides that, anaerobic digestion produces by-products which are also highly rich in nutrients that can be used as fertilizers. Despite these advantages, the development of AD in Iowa is hindered by social, economic and environmental factors, mostly related to commercialization risks. The objective of this study is to analyze the economics of a 2400-head cattle-based AD operation located in Iowa through a life cycle cost analysis. This analysis employs a discounted cash flow rate of return (DCROR) to evaluate the economic feasibility of the AD operation based on a 30-year plant life, and a minimum selling electricity price of 12.0 ¢/kWh. The internal rate of return (IRR) of this project is estimated at 7.10%. The IRR varies based on the different technical, capital and operating cost parameters. The sensitivity analysis suggests that the three main factors contributing to the change in IRR are the operating capacity, waste per cattle and power efficiency. Uncertainty analysis indicates that IRR varies within the range of 0.01 and 0.09.

44. A DYNAMIC TAINT ANALYSIS TOOL FOR ANDROID APP FORENSICS

Chen Shi, Chris Chao-Chun Cheng, Zhen Xu Neil, Zhengqiang Gong, Yong Guan

Iowa State University

The plethora of mobile apps introduce critical challenges to digital forensics practitioners, due to the diversity and the large number of mobile apps available to download from Google play, as well as hundreds of other online app stores. Law enforcement investigators often find themselves in a situation that on the seized mobile phone devices, there are many popular and less-popular apps with interface of different languages and functionalities. Our goal is to develop an automated mobile app analysis tool to analyze an app and discover what types of and where forensic evidentiary data that app generate and store locally on the mobile device. The outcome from this research will help digital forensic practitioners to reduce the complexity of their case

investigations and provide a better completeness guarantee of evidence discovery. For each app, our tool produces the list of evidentiary data that the app could have collected and stored on the devices' local storage in the forms of file or database. We have evaluated our tool using both benchmark apps and real-world apps. Our results demonstrated that the initial success of our tool in accurately discovering the evidentiary data.

Environmental Science & Health

Poster Presentations

45. THE EFFECTS OF URBANIZATION ON BEE SPECIES IN COMPARISON TO RURAL PRAIRIE AND THE AFFECTS IT HAS ON THE BEE BRANCH WATERSHED

Nate Pauli, Alec Rutherford, Adam Hoffman, Gerald Zuercher

University of Dubuque

Pollinators are a keystone species in all terrestrial ecosystems; they help create plant diversity and abundance. Native bees are responsible for eighty percent of all flowering plants and seventy-five percent of all fruits, nuts, and vegetables that grow in this country, yet research examining bee diversity in urban areas is lacking. This project established plots in both prairie and urban areas of Dubuque County to address these differences. We set 1-hectare plots within Dubuque prairies and Dubuque urban areas to determine if 1) urban areas affect the diversity of bee population, and 2) are bee populations healthy enough in the city to help the restoration process of the Bee Branch Watershed. There were population differences between the Dubuque prairie and Dubuque urban areas. Urban captures represented only 11% of the prairie captures. This may be caused by reduced open spaces in urban areas that pollinators need to survive. Over 50% of captures occurred in suburban areas like parks and backyards. Monthly differences also occurred with a greater number of bees captured during July than other months. These numbers are helpful for revitalizing the community's neighborhood and the restoration of the Bee Branch Watershed.

Environmental Science & Health

Oral Presentations

122. THE INVOLVEMENT OF THE ARYL HYDROCARBON RECEPTOR IN THE TOXICITY OF POLYCHLORINATED BIPHENYLS

Nazmin Akter, Eti Susanne Flor, Violet E Klenov, Khursheed Iqbal, James Watt, Walter H Watson, Aileen F. Keating, Katherine N. Gibson-Corley, Martin J Ronis, Michael J. Soares, Gabriele Ludewig, Larry W. Robertson

University of Iowa, University of Louisville, University of Kansas Medical Center, & LSUHSC

The aryl hydrocarbon receptor (AhR) is a ligand-activated transcription factor involved in the regulation of biological responses to planar aromatic hydrocarbons, and regulates xenobiotic-metabolizing enzymes. Our previous results showed that dioxin-like polychlorinated biphenyl (PCB) congeners like PCB126 binds avidly to the AhR. Our hypothesis is that toxic manifestations following exposure to PCB126 are mediated through the AhR. To test this, we created AhR knock out (AhR-KO) model using CRISPR/Cas9 to compare wild type (WT) male and female Holtzman Sprague Dawley rats with AhR-KO rats. After 28 days of injection by a single IP dose of corn oil vehicle or PCB126 in corn oil, organs were collected by necropsy to analyze the expression of genes and changes leading to histopathology. Significant decrease in body-weight, relative thymus, and absolute liver weights were observed in WT rats compared to AhR-KO rats. Unlike AhR-KO rats, the expression of genes encoding enzymes related to xenobiotic and intermediary metabolism, and levels of whole blood glutathione were altered, and serum glucose was decreased in WT rats. Therefore, all adverse manifestations were observed in WT rats, and not in AhR-KO rats, indicating the direct involvement of the AhR in the mediation of toxicity due to PCB 126 exposure.

123. PRIMARY AND SECONDARY SOURCES OF AMBIENT PARTICULATE MATTER IN THE KATHMANDU VALLEY, NEPAL

Md. Robiul Islam, Thilina Jayarathne, Ashley Gilbert, Maheswar Rupakheti, Elizabeth Stone

University of Iowa

Kathmandu Valley, the capital of Nepal, suffers from severe air quality problems, due in part to particulate matter (PM). In this study, we use molecular markers to identify and quantify PM sources in Kathmandu from April 11-24, 2015. The concentration of PM_{2.5} (particles with diameters < 2.5 μm) ranged 30.0-207.4 $\mu\text{g}/\text{m}^3$, all of which exceeded the World Health Organization 24-hour guideline of 25 $\mu\text{g}/\text{m}^3$. PM_{2.5} was comprised in part by water-soluble ions, including sulfate (16%), ammonium (9%), nitrate (4%), indicating secondary inorganic aerosol contribution, as well as calcium (1.2%) and magnesium (0.1%), reflecting airborne soil dust. Major fractions of PM_{2.5} were organic carbon (27%) and elemental carbon (13%) that originate from combustion and secondary processes. To gain further insight to sources of organic carbon, gas chromatography coupled to mass spectrometry was used to quantify molecular markers that are indicative of PM sources such as garbage burning, biomass and dung burning, fossil fuel combustion, biogenic and anthropogenic secondary organic aerosol, etc. Preliminary source apportionment using chemical

mass balance modeling indicated garbage burning (18%), biomass burning (17%), gasoline and diesel engines (18%) as major sources of PM_{2.5} organic carbon.

124. WHAT CAN WE LEARN FROM RAPID PARTICLE MEASUREMENTS DURING THE LAKE MICHIGAN OZONE STUDY 2017 (LMOS 2017)

Megan Christiansen, Charles Stanier, Dagen Hughes, Elizabeth Stone, Nathan Janecek, Nathan Bryngelson

University of Iowa

The field campaign, Lake Michigan Ozone Study 2017, combined ground, mobile, aircraft, and ship measurements to better understand the regional and local summertime ozone episodes. The population of aerosols at the main ground site (Zion, IL) was continuously monitored using electrical particle counters with size measurement capabilities (Scanning Mobility Particle Sizer (SMPS) and Aerodynamic Particle Sizer (APS)).

These continuous measurements are useful because they show how rapid events (smoke, dust, other pollution types, and wind shifts) impact the site. Here we compare them to integrated aerosol filters taken on site, which are more accurate but do not record rapid values.

The 12 hr average of SMPS+APS PM_{2.5} concentrations were well correlated with the filters, the mean concentrations were 5.71 µgm⁻³ and 5.17 µgm⁻³ respectively, and a correlation coefficient (r) of 0.89. High ozone events, exceeding 70 ppb, occurred June 2nd and June 10-16. The PM_{2.5} was averaged over every hour of event and non-event days where the concentrations, and hour, were 11.4 µgm⁻³ (19 UTC) and 5.9 µgm⁻³ (04 UTC) respectively. A significant diurnal variation of PM_{2.5} and total number concentrations were observed during the event periods, peaking in the late afternoon, but not during the non-event periods.

Geology Poster Presentations

46. INTEGRATING DIVERSE TECHNOLOGY PLATFORMS INTO GEOLOGIC FIELD AND LABORATORY COURSES

Chad Heinzel Elizabeth Kelly Morgan Streff Rachel Beck Ryan Butcher Blake Borchers, Mike Barron, Noah Brockshus, Evan Eades, Clifton Foy, James Janssen, Pierce Matt all from the

University of Northern Iowa

Diverse technological platforms are capable of enhancing learning opportunities, but they may also quickly become a distraction to core education objectives. For the past 10 years, the University of Northern (UNI) Iowa's Dept. of Earth and

Environmental Sciences has sought effective means of increasing its students' geospatial reasoning and 21st century skills. Geographic Information Systems (GIS) thinking and applied skills are continuing to be a powerful tool for learning and research. GIS has been embedded into a variety of, Earth and Environmental Sciences, classes: grades 6-12th (summer workshops), Intro. to Geology, upper-level Geology and teacher professional development. Successes have ranged from enhanced topographic perceptions, ability to accurately collect field samples to a greater understanding of the importance of effectively communicating geologic data. Recent University of Northern Iowa geochemistry/laboratory upgrades (XRD, XRF and ICP-MS), now provide opportunities for the second line of technological/education inquiry. These new analytical machines offer new pathways of discovery towards understanding minerals, rocks, water and ceramics; as well as opportunities to explore the inter-relationships between environmental and cultural material. A new geologic laboratory methods course guides students through proper safety measures, physical and chemical laboratory techniques, identifying technique advantages and disadvantages and effective communication of scientific research

47. PARTICLE SIZE AND HEAVY MINERAL ANALYSIS OF IOWA SANDSTONE: A COMPARISON OF THE ORDOVICIAN ST. PETER AND PENNSYLVANIAN FORMATIONS

Elizabeth Kelly Chad Heinzel

University of Northern Iowa

The sedimentology (e.g. particle size, heavy mineral content) of two Iowa sandstone formations are under investigation. The two sampling locations are the Ordovician St. Peter Sandstone from northeastern Iowa and the Pennsylvanian sandstone from Fallen Rock State Preserve. Previous research has found the St. Peter to be mature (very well-sorted, well-rounded, and containing very few heavy minerals), which has been verified by this research project. The current investigation intends to expand these data as well as identify the characteristics of the sandstone found at Fallen Rock State Preserve. For particle size analysis, sand sizes are separated by sieving. Heavy mineral analysis will be conducted by separating dense minerals from the medium sized sands (.5-.25mm) with LST. Then, these minerals are identified using a petrographic microscope. Ultimately, the purpose of this research is to determine the sources of both sandstone formations and compare their characteristics.

Geology Oral Presentations

125. CRINOID; IOWA'S STATE FOSSIL ??

Raymond Anderson

Cedar Valley Rocks and Minerals Society

Iowa is one of 10 states that does not have an official State Fossil. This year the Cedar Valley Rocks and Minerals Society and other “friends of Iowa fossils” are working to convince the Iowa legislature to designate the crinoid as Iowa's State Fossil. The crinoid is a marine animal with the general body shape of a flower, so it is often publicly referred to as a “sea lily.” Crinoids live in marine environments and were among the Earth's earliest animals, having been around for at least 508 million years (450 million years in Iowa). Although they still live in today's oceans, they flourished during the Paleozoic (550-250 million years ago) when most of the rocks that underlie Iowa were deposited, and they are common fossils in these rocks. Spectacular crinoid collections from Le Grand, Burlington, and Gilmore City are known to paleontologists world-wide, and samples are prominently displayed in museums around the world. The University of Iowa Museum houses about 50,000 crinoid specimens, many from Iowa, gathered by numerous collectors over the past 150 years. Senate Joint Resolution 2001 “a joint resolution recognizing the fossil crinoid as the state fossil” will soon be debated in the Iowa Legislature.

126. IMPLICATIONS OF A DEEP RESEARCH BOREHOLE IN NORTHEAST IOWA

Ryan Clark

Iowa Geological Survey

The U.S. Geological Survey has been investigating the deep bedrock geology of northeastern Iowa and southeastern Minnesota for several years. The purpose of their investigation is to better characterize the Precambrian geology of the region. The goal is to correlate geologic features in northeastern Iowa with features in the Lake Superior region that host economic mineral deposits. Utilizing airborne and ground-based geophysical techniques has revealed a great deal of information however much more work is needed. The next step in the process is to drill a research borehole to collect rock core samples for further analyses.

It has been proposed that the borehole should be converted to a monitoring well nest after the core sampling has been completed. This part of the project is still in the initial planning phase and is struggling to achieve funding support. This talk will provide some background on the project and discuss the potential impacts that a research boring and monitoring well nest such as this could have on the scientific community in Iowa.

127. AN ARCHAEOMETRIC ANALYSIS OF IRON AGE CERAMICS, WESTERN SICILY

Chad Heinzl, Paige LePlant

University of Northern Iowa

Selinunte, an important archaeological site, is located on the south-western coast of Sicily about 25m above sea level. It was built over three hills (Marinella, Manuzza, and Gaggera) and is 1500m long by 1000m wide, with the Acropolis taking up 500m by 300m. The site rests on top of lower Pleistocene sedimentary rocks made mostly of sand and clay (calcarenite). The purpose of this study is to analyze the chemical properties of Mediterranean pottery collected from western Sicily (e.g. Selinunte, Salemi and Partanna) and Lipari. These data are being used to learn about potential Iron Age ceramic technologies and as an attempt to delineate the relationships between natural resources (clay) and ceramic artefacts. In total, 91 samples were tested, 65 of which are approximately 6th century BC pottery pieces collected from Selinunte while twelve are plaster samples taken from Selinunte's remaining architecture. Buildings at Selinunte were built primarily with locally quarried Tufa. The remaining samples include: 5 sediment samples from the island of Lipari along the Cave di Caolino Trail, 3 Partanna artefacts, and 6 Greek ceramics from a site near Selinunte. Samples were geochemically ‘fingerprinted’ through petrography, X-ray fluorescence and inductively coupled plasma mass spectrometry.

Iowa Science Teaching Poster Presentations

48. THE DEVELOPMENT OF A STEM LEARNING COMMUNITY AT A SMALL, PRIVATE, LIBERAL ARTS UNIVERSITY: EARLY FINDINGS

Theodore A. Bryan, Regan L. Murray, Paul Weber, Brian T. Hazlett

Briar Cliff University

Briar Cliff University is 3.5 years into a 5-year NSF S-STEM grant to establish a STEM Living Learning Community. The goal of this program is to increase the number of STEM graduates at BCU. To date, 37 students have participated in STEM, with a retention rate of approximately 73%. Students who stayed in STEM had significantly higher GPAs compared to those who left, $U = 197.00$, $p = 0.34$. Additionally, when compared to non-completers, STEM completers were significantly more likely to report feeling engaged in the program ($X^2(4) = 11.07$, $p < .05$), attended more STEM activities ($X^2(4) = 18.38$, $p < .001$), and were happier with the STEM program as a whole ($X^2(4) = 19.48$, $p < .001$). We also compare our STEM cohort to a matched cohort of students

who are majoring in one of our four STEM majors, but are not in the STEM LLC.

Iowa Science Teaching Oral Presentations

128. EVALUATING THE SCIENCE GENDER GAP IN LOCAL ELEMENTARY STUDENTS

Ashley Brock, Jeffrey Butikofer

Upper Iowa University

Participation in science has a gap between men and women, which begins as early as elementary school. Girls begin to display more negative thoughts and lessening interest in most scientific fields. Girls have less exposure and direct interaction with science projects, which limits their confidence in pursuing science in the future. The goal of this study was to evaluate the gender gap in elementary school students. A pre-test was given to local fifth and sixth-grade students to assess any existing biases and identify the gender gap severity. Science experiments were performed to allow students to directly interact with different areas of science, which has been shown to increase confidence in scientific ability. The experiments related to the Iowa Core Curriculum so the students were applying information they learned in class. Application of knowledge also allows allowed students to build confidence. Following the experiments, the students completed a post-test. The post-test allowed comparison to see if the student's attitude toward science had changed. Results from the pre-and post-test analyses will be presented and discussed.

129. ENGAGING YOUNG FEMALES IN STEM WITH THE STEM PRINCESS

Ashley Delaney

Iowa State University

Nine out of the ten fastest growing occupations require mathematics and science (Hill, Corbett, & St. Rose, 2010). However, many students lack interest and proficiency in mathematics and science by eighth grade (Holdren, Lander, & Varmus, 2010). Thusly, most STEM initiatives focus on secondary students. A proactive approach is capturing students' interest in STEM at an earlier age (DeJarnette, 2012). Early exposure to STEM content shapes children's perceptions and dispositions toward STEM (Bybee & Fuchs, 2006). Programs incorporating community members are particularly effective with girls (Swift & Watkins, 2004). More classroom-based initiatives and curriculum are emerging for young children (Bagiati, Yoon, Evangelou & Ngambeki, 2010), yet few specifically target young females.

The STEM Princess provides events for girls three through seven with the goal of increasing interest and engagement in STEM by connecting girls to female STEM professionals and exposing them to STEM experiences related to princesses. Activities are play-based inquiry stations led by women in STEM. Findings show a positive impact on participants' interest in science and mathematics as well as shifts in their perceptions of STEM.

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Organismal Biology Poster Presentations

49. MEASURING STRESS LEVELS OF JUVENILE MICE USING SOCIAL DEFEAT ASSESSMENTS

Kristina Campbell

Buena Vista University

Behavioral and chemical assessments were conducted on male and female juvenile mice to determine potential differences in their stress levels after undergoing social defeat tests. This research consisted of using a social defeat test to be the initial stress inducer, followed by weight assessments over the 10-day experiment, sucrose versus water consumption levels, and a final corticosterone blood assay. The purpose of the tests was to look at juvenile stress levels and specifically whether females have a higher likelihood of showing measurably higher levels of stress than males, as has been shown in past research on humans. Results showed the experimental male and female juvenile mice consumed less sucrose and massed in at a lower level when compared to the control mice, with no correlation being observed between mass and sucrose consumption.

Corticosterone results indicated higher averages among experimental males versus control males with a p value of 0.18. Additionally, corticosterone results among experimental males versus experimental females indicated higher averages for males with a p value of 0.10. In conclusion, the induced stress had a greater average effect on the corticosterone levels for the juvenile male mice than female mice, but the difference was not statistically significant.

50. BIOGEOGRAPHY OF SOUTHWESTERN POCKET GOPHERS IN THE GENUS GEOMYS

Courtney Massey, James Demastes

University of Northern Iowa

Species status between interconnected and closely related species can be difficult to discern. The southwest United States is home to several species of pocket gophers (*Geomys*), including the northern species, *G. arenarius* and *G. bursarius* major, and southern *G. bursarius knoxjonesi*. Current biogeographic hypotheses for this assemblage involve a population of *G. bursarius* using one of several potential colonization routes across the arid region between the Pecos River and the Rio Grande Valley, which ultimately led to isolation and the speciation of *G. arenarius*. My project aimed to test 3 likely colonization routes using comprehensive geographic samples of the aforementioned pocket gopher species. Genetic sequences of the COX1 mitochondrial gene offer insight into the evolutionary relationships between the species and, when combined with geographic data, a story of colonization. A clear route has been mapped based on the genetic data, and further support has been compiled in support of the gophers' status as three independent species.

51. ANTIMICROBIAL METABOLITE ANALYSIS OF SUB-ANTARCTIC MOSSES FOUND IN BIRD NESTS

Tanner Cook, Roy MacKenzie, Melinda Coogan

Buena Vista University

Bryophytes have been largely studied in phytochemistry due to their high diversity of secondary metabolites, which play key roles in bryophyte survival under extreme conditions. These metabolites have also displayed antioxidant responses and microbial growth inhibition factors. These properties could be useful for bird nesting, and are found to contribute to the mechanical insulation properties of bryophyte-plant materials. Ornithologists at the Omora Park Long-Term Socio-Ecological Research center, Chile, have observed the presence of bryophytes in bird nests of different species. In a previous ornithological study, most nests surveyed had variable construction material proportions of the mosses *Lepyrodon lagurus* and *Acrocladium auriculatum*. This project analyzed

the presence and diversity of flavonoids and other phenolics in bryophytes used in nest construction. Samples were collected along Wulaia Trail, Navarino Island, Chile, transported back to the United States, and analyzed at BVU using GC/MS applications. Results indicated antimicrobial properties found to be present in both *Lepyrodon* and *Acrocladium*. Future studies will evaluate potential microbial growth inhibition of each bryophyte against the two bird-pathogenic bacterial strains *Staphylococcus* and *Enterococcus*. The expected results will unravel the ecological relationships between birds and bryophytes in these remote regions and set a precedent for potential biotechnological applications

52. ENRICHMENT OF CAPTIVE CANIDS AT FONTANA NATURE CENTER

Aubrey Lasche, Paul Skrade

Upper Iowa University

Captive wildlife are important for many aspects of conservation such as rehabilitation, breeding, and education. However, these captive animals are often restricted in their ability to move or exhibit stress because of changes in their environment, and as a result can act in a self-destructive manner. Enrichment activities can help to alleviate this. We examined different forms of enrichment and their effects on the behavior of two species of captive canids, coyote (*Canis latrans*) and red fox (*Vulpes vulpes*) housed at Fontana Nature Center, Hazleton, Iowa in the spring of 2018. Animals were exposed to four types of enrichment and their responses recorded. The enrichments included a Kong® dog toy with dog treat, cardboard egg carton with food inside (e.g. dry dog food), three different scent items (e.g. lemon) around the enclosure, and a duck wing. The recorded behaviors included stereotypy (e.g. pacing), human or animal interference, inactive/disinterest (e.g. sleeping), active engagement (e.g. sniffing), locomotion (e.g. walking), and fear (e.g. avoidance). The enrichment activities rotated through the week over the course of the study to minimize daily variation in weather. Preliminary results indicated differences in the responses of not only the two species but differences between the two conspecifics.

53. NONLETHAL LONG-TERM EFFECTS OF STYROFOAM CONSUMPTION ON BEETLE LARVAE

Reed Smith, Josh Reed, Timothy Sesterhenn

Morningside College

Previous research has shown that mealworms (beetle larvae) are capable of eating and digesting Styrofoam, creating a biodegradable product. We investigated if a similar and larger beetle species, *Zophobas morio* ("superworms"), was capable

of doing the same thing. Superworms were fed either their typical bran food or Styrofoam, and observed over a 7 week period. Activity of a separate group of worms was recorded over a 10 week period, and the activity of bran fed vs. styrofoam fed worms was compared. At the end of the experiment the condition of the worms was analyzed in g/cm to give an indication of the nutritional value of the Styrofoam compared to bran. Mortality was low across all treatments, and Styrofoam was readily consumed by *Z. morio*. Condition of superworms fed Styrofoam was lower than bran-fed individuals, and activity also decreased. Overall, while beetle larvae are able to survive long-term diets of Styrofoam they exhibit heavy costs to performance.

54. EFFECTS OF DIFFERENT FERTILIZER METHODS ON NITRATE CONCENTRATION IN ROOTS AND LEAVES OF BEETS

Madeline Kemp, Joel Toppin, Michaela Gerken Golay

Wartburg College

Nitrogen is a factor limiting plant growth and various crops require additional fertilizer to ensure efficient growth. Certain plants take up and store nitrogen as nitrate in different tissues. Previous studies have shown differences in nitrate concentration in crops grown with conventional versus organic methods. However, it is not clear whether organic farming practices (compost) or organic fertilizers would lead to nitrate concentrations more similar to conventional fertilizer rates. We studied Detroit Dark Red beets (*Beta vulgaris*) because they are grown for both their leafy tops and their roots and are known to have high nitrate concentrations. We hypothesize that the nitrate concentrations of beets grown with compost will differ from those that have been grown using conventional and organic fertilizers. Beets grown in potting soil amended with conventional Miracle-Gro[®], organic Miracle-Gro[®], and compost fertilizers will be analyzed to compare the biomass and nitrate concentration in roots and in shoots. Finding the optimum growing method could help reduce high levels of nitrates in beet crops.

55. WHEN THE MIDNIGHT SNACK ATTACKS: PREVALENCE OF TOXOPLASMA GONDII

Natalie Brewer, Kayanna Wibben, Kathryn Keller, Matthew Goodman, Brittany Williams

Buena Vista University

Toxoplasma gondii is an intracellular protozoan whose definitive host is the *Felis catus* (domestic cats) and has a range of intermediate host including rodents and humans. Behavioral changes in the host have been correlated with the *T. gondii* infection. Our research includes blood samples from various cat

and rodent species using PCR to determine the infection rates. We report the prevalence of *T. gondii* in the local area.

Organismal Biology Oral Presentations

130. POPULATION GENOMIC STRUCTURE IN A WIDESPREAD REPTILE, THE PAINTED TURTLE (*CHRYSEMYS PICTA*)

Jessica Judson, Anne Bronikowski, Fredric Janzen

Iowa State University

In wide-ranging species, population genomic structure is anticipated due to limits of dispersal, particularly in conjunction with local adaptation. However, turtles evolve slowly relative to other lineages, and the painted turtle expressed little genetic variation across its entire range in a previous study. We tested the hypothesis that painted turtles exhibit population genetic structure across the range west of the Mississippi River, an area encompassing enormous temperature and precipitation gradients, using a GBS approach. We sequenced 164 individuals representing seven populations spanning the western range of the painted turtle (northwestern border of Illinois, northern Minnesota, central Kansas, western Nebraska, southern New Mexico, northern Idaho, and northwestern Oregon) and processed SNPs according to GATK Best Practices. We assessed population genomic structure across the seven focal populations and tested key demographic hypotheses associated with glaciation and aridification during the Pleistocene, such as the extinction and recolonization of painted turtles in the Great Plains region. Analyses of population structure indicate that populations are genetically distinct and that populations are experiencing different selective pressures, contrary to prior results from a single mitochondrial locus study. These population genomic patterns may reflect limited dispersal, different population histories, and local adaptation to varied environmental conditions.

131. MORE THAN A DECADE OF RESEARCH LEADING TO RECOVERY OF AN ENDANGERED WATERSNAKE

Bob Brodman

Buena Vista University

I will tell the story of my involvement in research on the federally threatened Lake Erie Watersnake (*Nerodia sipedon insularum*) that eventually led to the recovery of the population. The research mostly involved an intense two-week survey by a team of field biologists and herpetologist that we affectionately refer to as “Nerodio”. The second chapter of the

presentation will explain how my students and I used this experience to create undergraduate research projects on local snakes that evaluated the effectiveness of two mark-recapture methods by double marking snakes.

Snakes were surveyed periodically from April to September each year using 64 cover boards placed in a 2 ha restored prairie next to a wetland. Three species were marked, Common Gartersnakes (*Thamnophis sirtalis*) Brown Snakes (*Storeria dekayi*) and Western Fox Snakes (*Pantherophis vulpinus*). A total of 355 snakes were captured 562 times, and 17 of these were captured in multiple years. PIT tags were lost in 7 snakes, and cautery marks were unreadable in 3 snakes. This accounts for a loss of just 2% of PIT tags and 1% of cautery marks. The estimates population sizes ranged from 120-140 *Thamnophis sirtalis*, 40-80 *Storeria dekayi*, and 12-17 *Pantherophis vulpinus*.

Physics Poster Presentations

56. EVIDENCE FOR A THIRD BODY PERTURBING THE SPECTROSCOPIC BINARY 57 CYGNI

Kenneth McLaughlin, John Stoppelman

Loras College

Abstract: We present evidence from five observing seasons confirming repetitive Doppler-shifts in the double-line spectroscopic binary 57 Cygni. Our spectroscopy is limited to a range encompassing H-alpha and the helium 667.8 nm line; the Doppler-shifts were well-resolved in the helium line but less so in H-alpha. Although radial velocities derived from both lines were reasonably consistent, we retained only the helium-line derived velocities for sinusoidal curve-fits to the orbital dependence. The fit-amplitudes specify the ratio of the stellar masses as 1.03 ± 0.05 , in agreement with previous assessments. We find an eccentricity of 0.028 ± 0.024 and a longitude of periastron of $163.5 \pm 2.5^\circ$; the former is significantly lower than that previously reported while the latter is in agreement but calls into question the apsidal motion projected from the last published studies four decades ago. Our modeling suggests the presence of an external third body was implicit in the previously observed apsidal motion, as well as the most likely mechanism for our observed variation in eccentricity. Based upon the spectral type, the near-circular orbit and the established mass ratio, we can place restrictions on the orbital inclination from 51.5 -to- 53.0° , in reasonable agreement with previous estimates.

57. AMPLITUDES, PERIODICITIES, AND SECULAR BRIGHTNESS TRENDS OF LONG-PERIOD VARIABLE STARS IN THE FIELD OF OPEN CLUSTER M23

Erik Floden, Jeffrey Wilkerson, Kevin Honz

Luther College

More than 500,000 images of Open Star Cluster M23 have been obtained at Luther College since 2005. Of the approximately 1,600 stars detected in these images, approximately 80 have been identified as long-period variable stars (LPVs) via statistical tests developed at Luther. LPVs pulsate with periods of tens to hundreds of days, and their amplitudes of variation, periodicities, and long-term brightness trends warrant analysis. Recent developments have allowed for an improvement in the analysis of these LPV properties done in the past at Luther. These developments include the discovery of more LPVs allowed by an improved normalization method, the increase in photometric resolution resulting from a modified method of photometry, and the addition of five more years of data to the data set. The advantages and disadvantages of various methods of determining LPV amplitudes of variation will be discussed, and it will be shown how the change to a new telescope in the middle of the data set has complicated the analysis of LPV long-term brightness trends. Efforts made to remedy this instrument-induced artifact via modified photometric methods will be described.

Physics Oral Presentations

132. PROFESSIONAL DEVELOPMENT, ASTRONOMY EDUCATION, AND TRAFFIC: REFLECTIONS ON EXPERIENCING THE GREAT AMERICAN ECLIPSE

Jeffrey Butikofer

Upper Iowa University

On August 21, 2017 all of the contiguous United States had an opportunity to view a solar eclipse: a partial eclipse for most, but a total eclipse for a thin swath of the country from coast-to-coast. I traveled from Fayette, Iowa to just south of Casper, Wyoming so I could experience totality during what has been dubbed the Great American Eclipse. In this presentation, I will reflect on the journey and share photographs from the event. I have incorporated some of these photographs into my Introduction to Astronomy course to demonstrate the ability to obtain relatively high-quality images with modest equipment and experience. The photographic techniques learned are applicable to our Introduction to Astronomy laboratory, which is usually only taken by education majors at Upper Iowa University. Telescope and astrophotography projects during the lab are geared towards providing hands-on experience with the equipment.

Physiology & Health Sciences Poster

Presentations

58. THE EFFECT OF NON-DOMINANT SHOULDER EXERCISES ON DOMINANT SHOULDER RANGE OF MOTION IN COLLEGIATE VOLLEYBALL PLAYERS

Savannah Dinger, Jennifer Rogers, Jeanna Becker, Renee Maneman

Northwestern College

Context: Janda's Upper-Crossed Syndrome (UCS) is characterized by alternating patterns of tightness and weakness, which is indicative of muscle imbalances and movement dysfunction. Objective: Based on the UCS, application of non-dominant shoulder exercises may decrease muscle imbalances and movement dysfunction. We hypothesized that there would be an increase in internal rotation of the dominant shoulder demonstrating increased movement pattern function. Design: Randomized control trial. Setting: Midwest NAIA institution. Participants: Women collegiate volleyball players (n=22), age range of 18-21. Interventions: Participants were randomly assigned into two groups (treatment and control). The treatment group performed 15 overhand serves with their non-dominant arm three times a week for four weeks. Baseline, mid-point, and final measurements were taken. Main Outcome: External (ER) and internal rotation (IR) of the dominant and non-dominant shoulder were measured using a clinometer app on a clinician's smartphone. Results: Repeated measure ANOVA found a significant increase in ER ROM in the non-dominant shoulder from baseline to mid-point and from baseline to final measurement (effect size=.87 and 1.19; mean difference=10° and 14°). Conclusion: The research hypothesis was not statistically supported, however statistical significance was found in the non-dominant shoulder ROM measurements. Muscle imbalances were present between ER of non-dominant and dominant shoulders. Shoulder exercises significantly increased ER of non-dominant shoulder possibly equalizing the muscle imbalance between the shoulders.

59. THE EFFECTIVENESS OF Y-BALANCE TEST AS A CONCUSSION SCREENING TOOL

Jennifer Rogers, Renee Choquette, Jessica Sandbulte, Kayla Tindall

Northwestern College

Context: The Y-balance test is a test used to determine a patient's dynamic balance and functional symmetry in order to evaluate their risk for injury and return to play readiness. However, no literature has been found on the utilization of the Y-balance test as an assessment of balance and coordination post concussion. Currently, the tandem gait test is used to

determine differences in gait, speed, dynamic balance, and coordination following a concussion. Evidence in the research has supported a decrease in performance on the tandem gait test when a patient is concussed. Objective: The objective of this study is to determine the changes in the performance on the Y-balance test compared to the Tandem Gait when a patient is 72-hours post concussion, asymptomatic, and cleared for return to full participation following a concussion. We hypothesize a significant decrease in Y-balance test compared to Tandem Gait performance when a patient is post injury and asymptomatic following a concussion. We expect the Y-balance test and Tandem Gait performance to return to baseline when the patient returns to play. Design: Cohort study. Setting: Athletic Training Clinic at a Midwest NAIA institution. Patient or Other Participants: Female college soccer athletes. Main Outcome Measures: Y-balance test and Tandem Gait test. Results: Study is ongoing. Statistical data will be completed following data collection. Conclusion: Study is ongoing. Word Count: 223

60. A PRELIMINARY MRI AND DTI BRAIN ATLAS OF THE SIBERIAN TIGER (PANTHERA TIGRIS ALTAICA)

Victoria Knauf, June Olds, Rachel Descheid, Johnny, Ng, Victoria Wang, Cheuk Tang, Bridget Wicinski, Patrick Hof, Chet Sherwood, Paul Manger, Muhammad Spocter,

Des Moines University

The Siberian tiger (*Panthera tigris altaica*) is the largest member of the *Panthera* and also one of the most endangered big cats in the world, with recent census data suggesting a wild population of less than 600 individuals. Owing to their protected status and declining numbers in the wild, we know very little about the brain of the Siberian tiger and how it compares with other feline species. Using postmortem brain tissue obtained through collaboration with Iowa State University and the Blank Park Zoo, we derived a preliminary MRI and diffusion tensor brain atlas based on the brain of a 18-year-old female Siberian tiger that was humanely euthanized for age-related quality of life concerns. Using quantitative magnetic resonance imaging, cortical white and grey matter volumes, as well as global gyrification index and cortical thickness maps were derived and compared with available data for other mammals. While preliminary, this study provides the first MRI and DTI map of the Siberian tiger brain and offers much needed comparative data for ongoing studies on felid brain evolution.

61. USING SCIENCE KITS TO BRING PROJECT BASED LEARNING INTO HIGH SCHOOL ANATOMY AND PHYSIOLOGY CLASS

Sandy Le, Tiffany LeMaster, Kacia Cain, Kathleen Bitterman, Muhammad Spocter

Des Moines University

High school anatomy and physiology courses are traditionally centered around a series of instructor-directed lectures with limited dissection opportunities and very little active learning. Here we describe the use of two in-class experiments that could be used to enhance student learning about neuroscience and help facilitate the construction of science projects for high school juniors and seniors. Using a project-based learning approach, students were asked to work in teams and design an experiment which uses components of the Backyard Brains toolkit (i.e., Roboroach and/or SpikerBox) to help educate the public about the nervous system and anatomy. High school students participating in this program were drawn from an existing collaboration with Des Moines Public Schools Central Campus and worked over a three-week period on the design and implementation of the experiments. We demonstrate that the use of hands-on science kits is a cost-effective way to help build active learning components into the high school anatomy and physiology classroom.

62. EXTRACTING 3D SURFACE DATA FROM THE ENDOCASTS OF FOSSIL CANIDS AND FELIDS

Muhammad Spocter, Ian Glidden, Kathleen Bitterman, Paul Manger, Rachel Dunn

Des Moines University

Brain endocasts (both natural and artificial) are traditionally created by casting the internal surface of the cranial vault to provide paleobiologists with a snapshot of the external anatomy of the brain. In conjunction with our understanding of brain morphology in extant species, endocasts allow us to reconstruct the evolutionary history of brain expansion in a particular lineage and generate hypotheses on the behavioral capabilities of now extinct species. In recent years, the use of virtual endocasts and the advent of new imaging techniques have expanded this field to allow for the extraction and reconstruction of surface data in three-dimensional space. In the following study, we undertook a preliminary investigation of the use of virtual 3D surface models created by scanning artificial endocasts of fossil canids and felids (spanning some 30 million years). These endocasts were scanned using the NextEngine 3D scanner and accompanying processing software. Volumetric data on brain volume, surface area and relative sulcal lengths were extracted from each specimen and compared across taxa using standard regression analysis techniques. Here we discuss key sulcal landmarks and the topographical changes in sulcal morphology which accompanied major evolutionary transitions in fossil Canidae and Felidae. Our results demonstrate that three-dimensional

surface models are a useful tool for mining surface features in fossil carnivores.

63. THE BRAIN OF THE AFRICAN PAINTED DOG (LYCAON PICTUS)

Muhammad Spocter, Jonathan Tenley, Samson Chengetanai, Jennifer Niederlander, Megan Duncan Johnny Ng, Victoria Wang, Cheuk Tang, Bridget Wicinski, Patrick Hof, Paul Manger

Des Moines University

The African Painted dog (*Lycaon pictus*) is native to Sub-Saharan Africa and belongs to the family Canidae which includes domestic dogs and a group of their closest living ancestors (i.e., wolves, coyotes, jackals and foxes). This peculiar canid is known for its highly social behavior and vocal repertoire however, very little is known about the brain of the African Painted dog and how this might vary from that of other canids. To address this caveat, we created a preliminary MRI brain atlas using postmortem scan data obtained from the brains of three African Painted dogs. MR sequences were acquired at 7 Tesla and post processing of the MRI scans were undertaken using Analyze 10.0 and DTI-Query. Cortical white and grey matter volumes, as well as the species gyrification index and cortical thickness map was derived and compared across species. While preliminary, this study provides the first MRI and DTI map of the brain of the African Painted dog and offers much needed baseline data for this understudied species.

64. REDUCING HYPOXIA INDUCIBLE FACTOR 1 ALPHA EXPRESSION AMELIORATES CARDIAC DYSFUNCTION IN MITOCHONDRIAL PYRUVATE CARRIER 1 DEFICIENT HEARTS

Jesse Cochran, Yuan Zhang, Paul Taufalele, Kevin Lin, Tom Cassier, Lawrence Gray, Eric Taylor, James Cox, Jared Rutter, E Dale Abel,

Fraternal Order of Eagles Diabetes Research Center, University of Iowa, Metabolomics Core Facility, University of Utah,

Pyruvate represents an essential metabolite for glucose oxidation, linking glycolysis to TCA cycle oxidation and aiding in the preservation of heart function. The mitochondrial pyruvate carrier (MPC) transports pyruvate into the mitochondria matrix for further oxidation. The MPC is a complex composed of two necessary subunits, MPC1 and MPC2 that act in conjunction to maintain normal MPC function. To investigate the role of pyruvate transport in cardiomyocytes, we generated cardiomyocyte-restricted MPC1 knockout mice (cMPC1^{-/-}). cMPC1^{-/-} mice manifested cardiac

hypertrophy and decompensated heart failure at 8 weeks and 18 weeks old respectively. Metabolomics analysis revealed a significant increase in 2-hydroxyglutarate (2-HG) within the cMPC1^{-/-} mice. 2-HG, an oncometabolite, activates hypoxia-inducible factor 1 α (HIF1 α) signaling. Reduced HIF1 α expression in cMPC1^{-/-} mice was accomplished by crossing cMPC1^{-/-} with HIF1 α floxed mice (cHIF1 α ^{+/-}:MPC1^{-/-}). cHIF1 α ^{+/-}:MPC1^{-/-} mice exhibited attenuated cardiac hypertrophy at the age of 8 weeks. Cardiac contractile function was measured by left ventricle catheterization, revealing reduced developed pressure and improved diastolic function in 22-week-old cHIF1 α ^{+/-}: MPC1^{-/-} mice. In whole, the amelioration of cardiac dysfunction achieved by reducing HIF1 α in cMPC1^{-/-} mice suggests that aberrant HIF1 α signaling represents an important mechanism contributing to heart dysfunction consequent of MPC1 loss.

65. FABRICATION OF 3D PRINTED SUPPOSITORIES FOR INDIVIDUALIZED DRUG DELIVERY: EVALUATING POTENTIAL POLYMERS AND SOFTWARE

Andre Do, Abebe Mengesha

Drake University College of Pharmacy and Health Sciences

Three-dimensional printing is continuously expanding upon the development of medicine. This area is important when designing and producing personalized medicine for patients with additional conditions. This work focuses on obtaining potential drug-polymer matrices suitable for 3D printing as well as evaluating software for optimal drug development. Various dosage forms were modeled by computer-aided design software and produced by fused deposition modeling. Each software was evaluated in terms of difficulty and functionality to determine its application in a clinical setting. The benefits found were used towards the creation of a 3D printed model similar to a rectal suppository. To determine 3D printer compatibility, melting points of different polymers were assessed using thermal analysis by differential scanning calorimetry. The temperature dependent phase transition and the heat of fusion were used to evaluate suitable polymer characteristics for 3D printing. Each model used polylactic acid filament and were customized to various shapes and sizes. However, this filament is not pharmaceutically approved for drug development and would require suitable polymers. The ability to change 3D printed samples depict the clinical potential for individualized therapy. This project will supplement current studies in the future development of 3D printed medicine to meet the patient's desired needs.

66. EFFECT OF 17-A-ETHINYLESTRADIOL (EE2) AND ETHANOL ON CORTICOTROPIN RELEASING FACTOR IN ZEBRAFISH

Hailey Dollen, Devin Stane

Buena Vista University

The corticotropin-releasing factor system in fish functions to maintain homeostasis during stress in part by regulating cortisol production via the hypothalamus-pituitary-inter-renal axis. Using the Zebrafish model we are interested in testing the effects of two compounds; 17- β -ethinylestradiol (EE2) and ethanol on corticotropin-releasing factor-levels present in brains and renal tissues. EE2 is a bioactive estrogen that has become a widespread problem due to accumulation in sediment and biota. The effects of EE2 on sexual maturity and differentiation have been examined but it is unclear if this compound influences other hypothalamic-regulated axes. To examine this, fish were placed in seven tanks with one control tank, three tanks with concentrations of EE2 at 0.50, 5.00, and 10.00 ng L⁻¹, and three tanks with concentrations of ethanol at 0.25%, 0.50%, and 1.0% (v/v) ethanol. Fish were exposed to the compounds for one hour, one day, five days, fifteen days, and thirty days. Tissues were collected for semi quantitative reverse transcription-polymerase chain reaction assay. CRF levels will be compared in both groups looking at the effects of dose and exposure time. An increase in CRF could be indicative of changes in the stress axis in fish following exposure to EE2 and ethanol.

67. EFFECTS OF EARLY-LIFE NATURAL AND ARTIFICIAL STRESSORS ON THE ADULT STRESS RESPONSE.

Tyler Kyhl

Buena Vista University

The purpose of this research was to compare the effects of a natural and artificial stressor in early-life on adulthood in mice. My research hypothesis was that the mice exposed to the artificial stressor in infancy would be more significantly different than the mice exposed to the natural stressor when compared to the control group. Three groups of pups were each raised in a different environment. The artificially stressed mice were raised in bedding that was sprayed with weed killer, the naturally stressed mice were raised with reduced bedding, and the control mice were raised in standard conditions. Once the pups had sexually matured, they were submitted to an open field test, a light-dark box test, and a social behavior test. The mice were then sacrificed to look at cortisol levels in the brain. This research is important because it not only highlights the effects of stressors experienced during early-life on adulthood, but it also highlights how influential man-made compounds can be to the neurological development of wild animals.



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