

PROCEEDINGS OF THE 131ST
ANNUAL MEETING
OF THE
IOWA ACADEMY OF SCIENCE



April 26 - 27, 2019
University of Northern Iowa
Cedar Falls, Iowa

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Special Recognition

Thank you to the following organizations & individuals for contributions to the meeting:

University of Northern Iowa

Mark A. Nook, President
Angie Sadler, Catering Manager
Marcy Seavey, STEM Coordinator, Academic Affairs
Joshua Sebree, Asst Professor, Chemistry & Biochemistry
UNI Catering Staff
UNI Facilities Staff

Basic Materials Company

Sherm Lundy, Geology Field Trip

IJAS Symposium & Other Special Recognition

Sponsor: Iowa Space Grant Consortium/NASA

Bob Watson, Water Quality Symposium
Cedar Falls Utilities
Geological Society of Iowa
Iowa Public Television
Larry Stone, IAS Bookstore

Thank you to all section chairs, vice chairs and IAS members who provided speaker suggestions, volunteered to put up posters, and who volunteered throughout the year to help the Academy promote science in Iowa.

UNI Buildings used for this conference.

Schindler Education Center (SEC)
All sessions except those in Curris below.

Curris Business Building (CBB)

General Session I
IJAS Awards
IJAS Seminar
IAS Awards
General Session II



Welcome from the Iowa Academy of Science President

Welcome to the 131st meeting of the Iowa Academy of Science! We are excited to bring you a program that focuses on the contributions of our young scientists, topics of global importance, and the crucial debate on the future of Iowa's water quality. The program reflects the goal of the IAS to engage the public and increase scientific literacy. It also reflects the need for scientists to lend their voices and expertise to the public discourse on issues that affect Iowans. During your time at the annual meeting, we invite you to think about your role in helping the Academy achieve its mission. The Iowa Academy of Science is at a critical crossroads. Since 1875, the Academy has sought to support scientific exploration and the dissemination of this new knowledge. One of the most significant achievements of IAS is in the active participation of the Iowa Junior Academy of Science and the exceptional quality of their research. In the coming months, the Board of Directors will be working to expand the number of IJAS students attending the national meeting and will be asking for your assistance. For now, be sure to stop by their sessions and be amazed by our talented young scientists.

Dr. Mary Skopec, President

Committees and Sections

Committee on Committees and Elections

Chair: Kata McCarville
Tyrone Genade (2019)
Qun Wang (2019)
Marcy Seavey (2020)
Open (2020)
Open (2021)
Open (2021)

Conservation and Preserves

Chair: Open (2019)
Brenda Peters (2019)
Andy McCollum (2019)
Open (2020)
Open (2020)
Open (2021)
Open (2021)

Finance

Chair: Open (2019)
John Dawson (2019)
Leslie Flynn (2019)
Open (2020)
Open (2020)
Open (2021)
Open (2021)

Iowa Science Foundation

Chair: Jeff Wilkerson (2019)
Thomas Bonagura (2019)
Joseph Tiffany (2019)
Open (2020)
Open (2020)
Open (2021)
Open (2021)

Membership

Chair: Open
Donald Beitz (2019)
Michael LaGier (2019)
Open (2020)
Open (2020)

Membership continued...

Open (2021)

Open (2022)

Recognition and Awards

Chair: Carol Boyce (2019)
Elitsa Ananieva-Stoyanova (2019)
Michael Carruthers (2019)
Tom Ervin (2020)
Leslie Flynn (2020)
Open (2021)
Open (2021)

Societal Issues

Chair Open
Joseph Nguyen (2019)
Jonnie Becker (2019)
James Pease (2020)
Open (2020)
Open (2021)
Open (2021)

Student Programs Committee

Chair: Gail Kunch (2019)
Mike Goudy (2019)
Barbara Lemmer (2019)
Holly Showalter (2020)
Rasika_Mudalige-Jayawickrama (2020)
Ex-officio non-voting: Kris Kilibarda

Section Chairs, Vice Chairs

Anthropology

Mark Anderson, Vacant

Cell, Molecular, & Microbiology

Stephanie Toering Peters, Gary Coombs

Chemistry

Mark Sinton, Karissa Carlson

Community College Biologists

Tony Goodrich, Vacant

Ecology & Conservation

John Pearson, Michaeleen Golay

Engineering

Mark Mba-Wright, Al Ratner

Environmental Science & Health

Nicole Palenske, Thomas Bonagura

Geology

Ryan Clark, Chad Heinzl

Iowa Science Teaching

Organismal Biology

Kaitlyn Holden, Jessica Judson

Physics, Atmospheric &

Space Sciences

Elizabeth Golovatski, Vacant

Physiology & Health Sciences

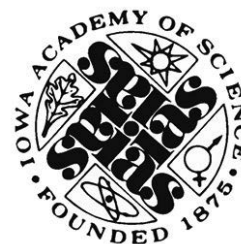
Vacant, Vacant

Thank you for participating in the 131st Annual Meeting of the Iowa Academy of Science.

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

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Iowa Academy of Science



www.scienceiniowa.org

FRIDAY SCHEDULE

SEC = Schindler CBB = Curris Business Building

Registration Desk Hours

Friday - 7:30 a.m. - Noon and 1:15 p.m. to 5:00 p.m.
Saturday - 8:00 a.m. to Noon and 1:00 p.m.-4:00 p.m.

Time	Events	Location
7:30-8:00 a.m.	IJAS Registration Open	Registration Desk/Great Room, 2nd Floor
8:00-8:20 a.m.	Judges Meeting	SEC 144
8:00-5:45 p.m.	IAS Registration Opens	Registration Desk, Great Room, 2nd Floor
8:00-10:45 a.m.	IJAS Oral Presentations	Rooms See page 13
8:00-11:00 a.m.	IAS Book Store Open	SEC Great Room, 2nd Floor
8:00-10:30 a.m.	Breakfast	SEC Great Room, 2nd Floor
10:45-11:45 a.m.	IJAS Student Poster	SEC Great Room, Da Vinci Room (217-218)
11:00-11:45 a.m.	IJAS Luncheon— visit posters	SEC Great Room, Da Vinci Room (217-218)
12:00 - 12:55 a.m.	General Session I	CBB Auditorium (109), see page 6
1:00 - 1:15 p.m.	IJAS Awards Ceremony	CBB Auditorium (109)
1:30 - 2:15 p.m.	IJAS Seminar	CBB Auditorium (109)
1:30 - 2:15 p.m.	IJAS Poster Removal	SEC Da Vinci Room (217,218)
2:00 - 2:25 p.m.	Nepal Education Seminar	SEC 309, See page 7
1:30-2:15 p.m.	IAS Business Meeting	SEC 409
3:00-4:30 p.m.	Senior Poster Set-up	SEC Da Vinci Room (217-218)
2:30-4:30 p.m.	Symposiums A, B	See page 8
4:30-5:45 p.m.	Senior Poster Session/Social	Da Vinci Room, Great Room, 2nd Floor
6:00-7:30 p.m.	President's Banquet & Awards	CAT (216), Great Room, CBB Auditorium
7:45 p.m. - 8:45 p.m.	General Session II	CBB Auditorium (109)

SATURDAY SCHEDULE

Refreshments are in the Great Room

Book Store: **Friday** 7:30—5:45; **Saturday** 8:00—3:30
 Schindler Commons, 2nd Floor
CBB = Curris Business Building
SEC = Schindler Education Center

Time	Events	Location
7:30-4:00 p.m.	Registration Desk Opens	SEC Commons, 2nd Floor
7:30-3:00 p.m.	IAS Bookstore Open	SEC Commons, 2nd Floor
8:00-10:30 a.m.	Breakfast	SEC, 2nd Floor
9:00-10:30 a.m.	Beverages	SEC Commons
8:30 am-2:20 p.m.	Section Meetings	See Schedule on page 5
11:00 a.m. - 11:55 a.m.	General Session III	SEC Auditorium (220)
Noon-12:30 p.m.	UNI Catering-Box Lunch	SEC Commons
12:40-4:00 p.m.	Section Meetings Continue	See Section Schedules page 31
3:00 p.m.	Bookstore Closes	SEC Commons
3:30 p.m.	Registration Desk Closes	SEC Commons

IAS PROGRAM SCHEDULE

Saturday Refreshments in the Great Room

IAS Oral Presentations

8:30 a.m.— 4:00 p.m.

Schindler Education Center

See the oral presentation schedule below

Section Meeting Room Assignments

See detailed schedules beginning on page 31

Section	Time*	Location
Anthropology		See Geology
Cellular, Molecular, and Microbiology	8:50 - 2:10 p.m.	Room 303
Chemistry	8:50 - 10:45 a.m.	Room 304
Community College Biologists	Business Meeting	Room 408
Ecology & Conservation — Zoology	9:10 - 2:20 p.m.	Room 403
Ecology & Conservation — Botany	8:30 - 10:45 a.m.	Room 404
Engineering		See Physics, Atmospheric & Space
Environmental Science & Health	Business Meeting	Room 404
Geology		Room 144
Iowa Science Teaching		See Chemistry
Organismal Biology		See Physiology & Health Sciences
Physics, Atmospheric and Space Sciences	9:10 - 10:45 a.m.	Room 308
Physiology & Health Sciences	8:50 - 10:45 a.m.	Room 406

Section Meeting schedules begin on Page 31

IAS FRIDAY GENERAL SESSION I

General Session I Iowans for Everest

Friday, April 26, 2019, Noon
Curris Business Building
John Deere Auditorium (Room 109)



Andy (John) Anderson, Assistant Professor of Management, University of Northern Iowa

Cousins John and Andy Anderson reached the summit of Mount Everest on May 22, 2017. In doing so, they became the first Iowans to summit Everest via the north (China) side of the mountain. They did this climb for two distinct reasons: 1) to raise awareness of and take tangible steps to alleviate post-traumatic stress disorder (PTSD); and 2) because they love the mountains and Everest is the pinnacle of mountaineering.

The presentation first takes you through the training leading up to the Everest expedition. It then relays the most important aspects of the climb itself – including insight into mental, physical and environmental aspects of the 52-day expedition.

General Session II IPTV, Iowa Land and Sky

Friday, April 26, 2019, 7:45 p.m.
Curris Business Building
John Deere Auditorium (Room 109)



Patrick Boberg is a Producer/Director at Iowa Public Television. His primary role is researching, shooting, editing, and publishing stories for the program Iowa Outdoors and other programs. He holds a degree in Communications from Iowa State University and a master's degree from University of Denver in Project Management and Database Administration.



Patrick Boberg and Tiffany Morgan will share insights into the production process for Iowa Land and Sky, from selecting and capturing these unique landforms and features to the impact this project is having in science classrooms. They will describe how this program explored new ways of storytelling, media acquisition and audience engagement as well as share highlights from the documentary.

Tiffany Morgan is an instructional media designer and educational consultant at Iowa Public Television. She is a graduate of Iowa State University with degrees in History and Curriculum and Instructional Technology. Tiffany has been a graduate lecturer for Iowa State University School of Education, teaching on the principles and practices of distance education.

IAS/IJAS FRIDAY AFTERNOON SEMINARS

IJAS Seminar

Experiences in Classroom Undergraduate Research

Friday, April 26, 2019, 1:30 - 2:15 p.m.

Curriss Business Building

John Deere Auditorium (Room 109)



The Instrumental Analysis course at University of Northern Iowa in the Department of Chemistry and Biochemistry provides a unique opportunity for undergraduate students to not only learn how instruments work, but also to actively use them in a research project to help a partnering organization. In this session, students from the UNI Instrumental Analysis course will be discussing the work they have carried out on a variety of research topics during the Fall 2018 course. At the conclusion of the panel discussion, IJAS attendees will be encouraged to join in on a hands-on activity and build their own instrument to take home with them.

IAS Seminar

Nepal Education Foundation Project

Friday, April 26, 2019, 2:00 - 2:25 p.m.

Room 309

Schindler Education Center



Ernest (Ernie) Schiller, a retired science teacher from Central Lee Schools in Donnellson, Iowa received his B.S. and Education Degree from Iowa State University and his M.S and PhD work from the University of Iowa Science Education Department. He has received numerous awards including the Presidential Award in Science and Mathematics Teaching, Board Certification from the National Board for Professional Teaching Practices and was selected as Iowa Teacher of the Year. He is a long time ISTS Member and has served as Officer in many roles for ISTS. While his interest is in improving Science Education here in Iowa and across the nation his love for science education has spilled across to distant country of Nepal. He heads up a Non-Profit aimed at improving the education/science education in this remote and land-locked country.

IAS FRIDAY SYMPOSIUMS

2:30 - 4:30 p.m.

Symposium A

Iowa's Water Quality - Today into the Future

Friday, April 26, 2019, 2:30 - 4:30 p.m.
Schindler Education Center
Room 409



Christopher Jones, PhD



Mary Skopec, PhD



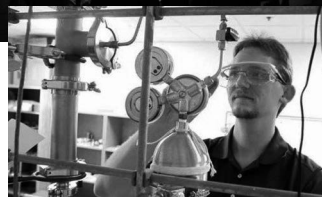
Keith Schilling, PhD

This session will continue a series of IAS Annual Meeting symposiums about one of the most important issues facing Iowa: water quality. Christopher Jones, Research Engineer, IIHR Hydroscience and Engineering, University of Iowa will discuss the current situation in Iowa. Keith Schilling, Adjunct Assistant Professor, Earth and Environmental Sciences, University of Iowa, will talk about opportunities for natural processing in the environment. Mary Skopec, Executive Director of Iowa Lakeside Laboratory, will conclude with a perspective on Iowa water quality in the future.

Symposium B

To Boldly Go Where No Lego Has Gone Before

Friday, April 26, 2019, 2:30 - 4:30 p.m.
Schindler Education Center
Room 309



Brennan Haag



Nicole Bishop



Warren Rouse

Dr. Joshua Sebree is an assistant professor at the University of Northern Iowa in the Department of Chemistry and Biochemistry. Dr. Sebree came to UNI after a postdoctoral position at NASA Goddard Spaceflight Center. In his six years at UNI, he has established multidisciplinary research programs in Astrobiology and Astrochemistry that allow student researchers to work both in a laboratory setting and in the field.

In the Spring of 2019, a group of chemistry, biochemistry, and biology students from UNI embarked on a 5 day excursion to South Dakota to explore portions of Wind Cave cavern as part of a field astrobiology research trip. Among the objectives for the trip was to use new/traditional equipment to answer questions about the formations and water in the cavern. In addition to the familiar instruments (XRF, microscopes, spectrometers, Geiger counters), The team also brought several Lego® Mindstorms® kits that had been customized to record various environmental conditions including: pH, electrical conductivity, and temperature. Dr. Sebree and several student participants will share their story about the trip and discuss the advantages/disadvantages of using Lego® Mindstorms® kits as cheaper alternatives to field instruments.

FRIDAY AFTERNOON IAS POSTER SESSION

4:40 - 5:45 p.m.

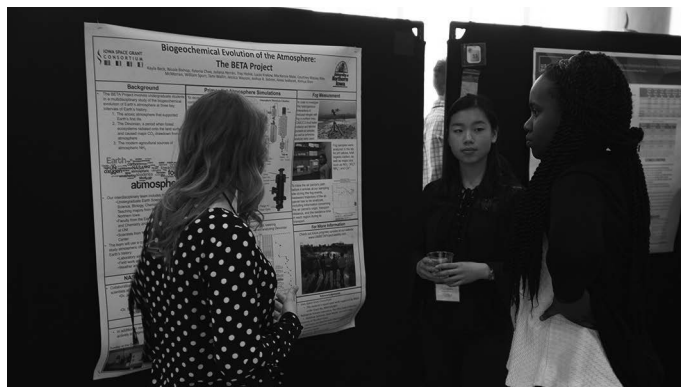
Senior posters may be set-up between 3:00 - 4:30 p.m.

IAS Poster Session

Friday, April 26, 2019, 4:30 - 5:45 p.m.
Schindler Education Center
DaVinci (217-218) and Great Room

Appetizers

Barbecue Meatballs
Cheese and Cracker Tray
Hummus Tray with Celery and Pita Chips
Water & Purple Panther Punch



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

PRESIDENT'S BANQUET AND AWARDS

Dinner 6:00 - 6:45 p.m.

Program, ESTA and Distinguished Awards 7:00 - 7:45 p.m., CBB Auditorium

President's Banquet Program

*Dinner in Schindler Room 216 & The Great Room
Program in John Deere Auditorium, Curris Business Building (109)*

Welcome and Introductions, Craig Johnson, Executive Director
Executive Director Remarks
Presentation of ESTA and Distinguished Awards
President's Address by Mary Skopec
Passing of the Gavel
Incoming President's Address, Kata McCarville
Closing Remarks

Excellence in Science Teaching Awards

Anne Turner, Elementary Education
Connie Courbat, Elementary Education
Cheryl Kluesner, General Science
Mike Skopec, Life Science
Julie Crozier, Middle/Junior High Science
Jayme Smith, Physical Science
Amanda Sanderman, Science Supervisory
Alicia Schiller-Haynes, STEM Science

Distinguished Awards

Mahdi Al-Kaisi, Distinguished Iowa Scientist
Donald Beitz, Distinguished Fellow
Muir Eaton, Distinguished Iowa Science Teaching
Jimmie Thompson, Distinguished Iowa Citizen Scientist
Jesse Wilcox, Distinguished Iowa Science Teaching

FRIDAY GENERAL SESSION II - IOWA LAND AND SKY

7:45 p.m

John Deere Auditorium, Curris Business Building (109)

General Session II IPTV, Iowa Land and Sky

Friday, April 26, 2019, 7:45 p.m.
Curris Business Building
John Deere Auditorium (Room 109)



Patrick Boberg is a Producer/Director at Iowa Public Television. His primary role is researching, shooting, editing, and publishing stories for the program Iowa Outdoors and other programs. He holds a degree in Communications from Iowa State University and a master's degree from University of Denver in Project Management and Database Administration.

Patrick Boberg and Tiffany Morgan will share insights into the production process for Iowa Land and Sky, from selecting and capturing these unique landforms and features to the impact this project is having in science classrooms. They will describe how this program explored new ways of storytelling, media acquisition and audience engagement as well as share highlights from the documentary.

Tiffany Morgan is an instructional media designer and educational consultant at Iowa Public Television. She is a graduate of Iowa State University with degrees in History and Curriculum and Instructional Technology. Tiffany has been a graduate lecturer for Iowa State University School of Education, teaching on the principles and practices of distance education.

SATURDAY GENERAL SESSION III

Schindler Education Center Auditorium (220)

General Session III The Evolution of the Modern Electric Grid and How it Operates Today

Saturday, April 27, 2019, 11:00 - 11:55 a.m.
Schindler Education Center Auditorium
Room 220



Bill Skubal
Director of Electric, Gas and Water Operations
Cedar Falls Utilities



Reliable electricity generation, transmission, and distribution has been a cornerstone of human progress. Today electricity powers many critical devices and machines used in business, industry, and at home. New technology is changing the way we live, work, and communicate and much of it is powered by electricity. Join this general session and learn how the electric grid developed and changed over the years, including milestones that determined where the grid is today. Learn about grid reliability, the planning needed before new generation is approved, what influences electric rates, and how competitive electric markets affect pricing and reliability.

SATURDAY GEOLOGY FIELD TRIP

Meet at the Quarry at 12:30 p.m.

Geology Field Trip

Saturday, April 26, 2019, 12:30 p.m.
Morgan Quarry, 4618 East Donald Street
Waterloo

Field Trip Description

Please join us for a field trip to the Morgan quarry at 4618 East Donald Street, Waterloo, for an afternoon of geology, geomorphology, and more!

Thanks to the cooperation of Basic Materials Company and their resident geologist, Sherman Lundy, for allowing us to explore the geological wonders of the Morgan quarry. Participants can expect to see exposures of Pre-Illinoian glacial sediments overlying Middle Devonian age bedrock of the Wapsipinicon Group.

Field trip leaders will highlight aspects of the Iowan Surface landform region, marine deposition in the Devonian Iowa Basin, and implications of groundwater and surface water quality.



All participants will arrange their own transportation to the quarry. If you ordered a box lunch pick it up after General Session III. Travel time to the quarry is approximately 25 minutes. The field trip will begin at approximately 12:30 p.m. Maps will be available at the Registration Desk. Please wear weather appropriate clothing and sturdy walking shoes or boots.

IAS 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 Awards and Recognition Committee. Winners are honored at the President's Banquet during the Iowa Academy of Science Annual Meeting. Awardees receive a plaque and a \$100 award.

IJAS PROGRAM SCHEDULE

Time	Event	Location*
7:30 - 8:30 a.m.	IJAS Registration	Great Room, 2nd Level
7:30 — 8:30 a.m.	Poster set up	DaVinci Room (217-218)
8:00 — 8:20 a.m.	Judges Meeting	144
8:30 — 11:00 a.m.	IJAS Poster Presentations/Judging	DaVinci Room (217-218)
8:30 — 11:00 a.m.	IJAS Oral Presentation/Judging	See Room Schedule on page 13
11:00 - 11:45 a.m.	Lunch and IJAS Poster Viewing	DaVinci Room (217-218)
Noon - 12:55 p.m.	IAS General Session I	CBB Auditorium (109)
1:00 - 1:15 p.m.	IJAS Awards Ceremony	CBB Auditorium (109)
1:30 - 2:15 p.m.	IJAS Seminar: Experiences in Classroom Undergraduate Research	CBB Auditorium (109)

* Unless otherwise indicated all rooms are in Schindler Education Center

Building Abbreviations: Schindler Education Center (SEC) Curris Business Building (CBB)

IJAS LUNCHEON, POSTER VIEWING, AWARDS CEREMONY

11:00 a.m. - 1:15 p.m.

Honoring the Accomplishments of IJAS Students

Time	Event	Location*
11:00—11:45 a.m.	IJAS Lunch and Poster viewing at your leisure Lunch in the CAT Lab or the Great Room	DaVinci Rooms, Great Room, CAT Lab (216)
Noon—12:55 p.m.	General Session I — Iowans for Everest	CBB —John Deere Auditorium (109)
1:00—1:15 p.m.	IJAS Awards Ceremony	144
1:30—2:15 p.m.	IJAS Seminar: Experiences in Classroom Undergraduate Research	CBB—John Deere Auditorium
IJAS students remove posters by 3:00 p.m.		

IJAS AWARDS

Honoring the Accomplishments of IJAS Students

Most Promising Young Scientist
Iowa Delegates and Alternates to the American Junior Academy of Science, 2020
IJAS \$500 Senior Scholarships

IJAS ORAL PRESENTATION ROOMS

Presentation schedules are in the room.

Room Number	Oral Presentations listed by poster number
144	1, 2, 3, 4, 5, 6, 8, 12
306	7, 9, 10, 11, 13, 14, 15, 17
309	18, 19, 20, 21, 22, 24, 33, 50
403	28, 29, 30, 31, 32, 38, 39, 40, 51
404	25, 26, 27, 34, 35, 36, 37, 46, 53
406	42, 43, 44, 45, 47, 48, 58, 62, 63, 64
409	49, 52, 54, 55, 56, 57, 59, 60, 61

Oral presentations begin at 8:30.

NOTES

IJAS RECOGNITION

Honoring Iowa delegates representing Iowa nationally

National Youth Science Camp

For more than forty years, two seniors from every state have been selected to attend the National Youth Science Camp in West Virginia. The Iowa Academy of Science assists the Iowa Governor's Office by selecting Iowa's Delegates to NYSC. Delegates spend a month at the camp attending guest lectures, developing their own research projects and meeting scientists from many fields. Congratulations!

2019 Iowa Delegates to NYSC

Laura Stowater

Algona High School
Algona

Sydney Ann Ringold

Dubuque Senior High School
Dubuque

2019 IJAS Delegates to the American Junior Academy of Science Annual Meeting

Pooja Kasiviswanathan

Ames High School
Ames

Arunadee Fernando

Ames High School
Ames

Serenity Haynes

Central Lee High School
Donnellson

Chaperone: Gail Kunch

Student Programs Committee Chair
Danville Community School

IJAS Competition

The IJAS Competition takes place from 8:00 until 10:45 on Friday morning. Please feel free to browse the IJAS posters and attend IJAS presentations.

Seniors compete for one of two \$500 college scholarships. Two 9th-11th graders are selected to represent Iowa at the American Junior Academy of Science/American Association for the Advancement of Science National Conference.

Middle school students compete for the Most Promising Young Scientist Award, which is a certificate. All of these awards are made possible through support from the Iowa Space Grant Consortium, the Iowa Science Teaching Section of IAS, the IJAS Silent Auction, and Board allocated funds.

Thank you to the Iowa Space Grant Consortium for supporting the Iowa Junior Academy of Science including the IJAS Symposium and the IJAS student trip to the American Junior Academy of Science Annual Meeting in February. Students are chosen today for the February 2020 trip.

2018-2019 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 student researchers:

Sidney Gruntmeir
Maycie Bartholomew
Josie Johnson
Austin Franklin
Bailey Page
Emma Phelps
Grant Lilley
Keagan Winslow
Ryan Baker
Paisley Grafton
Gracey Genkinger
Emily Barnhardt
Carlea Beckman
Lukas McEntee

Mya Batten
Anna Beebe
Emily Smith
Style Haeffner
Kamryn Banks
Madeline Hakala
Drake Smith
Lauren Beckman
Alyssa Parker
Faith Diephuis
Abby Wittkamp
Madison Barnhardt
Brooklyn Pardall
Brooke Finney

IJAS RESEARCH PRESENTATIONS

Posters—217, 218, & Great Room

Presentations by Iowa Junior Academy of Science students are listed below. The number identifiers indicate the poster location for each presentation.

1. Community of Bats

Maren Doty & Kodi Moeller
Central Lee MS

Our problem is that we wanted to find out which bat species are found in/around Lee County. The nine bat species that are regularly found in Iowa are the Hoary Bat, the Big Brown Bat, Silver Haired Bat, Eastern Red Bat, Little Brown Bat, Indiana Bat, Evening Bat, Tricolored Bat, and the Northern Bat. Knowing what bat species are found in Iowa is crucial because bats eat insects like beetles and mosquitoes and help keep our ecosystem balanced. Also, because bats eat insects, farmers are saving billions of dollars on pesticides. The two of us used the Echolocation Meter, and we brought it home and set it outside for about an hour or more after 7:00 p.m. It picked up sound waves from the different bat species. Our classmates also took the Echo Meter Touch 2 Pro home. Then, we studied the results and graphed the information: what location the bats were found, what different bat species were located, etc. The two of us working together ended up finding all nine of the bat species in Iowa.

2. Talk Dirt To Me

Sidney Gruntmeir

In order to determine if animal and chemical run-off is causing pollution, I tested different soils and their contaminants. I tested the soil near Pollmiller Park, Geode Lake, Wilson Lake, and Indian Lake. Then I ran the samples through a machine at our local NRCS office to get their nitrate levels. Next I put the samples in a test tubes to run their pH levels with pH strips. I tested different levels of each soil for different varieties of contamination. All lakes and ponds had at least a small contamination except Wilson Lake.

3. The Effects of Wavelength on Solar Efficiency

Grant Anderson

The purpose of my project was to determine which solar filter provided the best thermal transfer. I was able to see the effects of changing the light wavelength on solar efficiency. This was done to determine which filter can help consumers lower their energy cost and conserve energy, which is better for the earth. My wooden box contained three individual solar collectors with different color filters that transferred heat to a reservoir of water via a passive thermosiphon technique. Each solar collector contained u-shaped copper tubing that was connected to a individual water reservoir. I predicted that the solar collector with the clear filter will have the greatest thermal transfer. My hypothesis was upheld as the clear filter overall performed the best.

4. Invisible Fencing for Cattle

Carlea Beckman

Abstract I wanted to create an invisible fence system for our cows at home. I wanted to attach a shock device to the inside of the nose of a cow that would give it a shock when reaching the invisible fence line. Because it got cold too early and it snowed, I wasn't able to bury it in the field of our house, rather I experimenting with the voltage and made sure that this was a safe alternative to traditional fencing. The attachment would eventually be placed inside the cows nose like that as you see in a bull. The inside of the nose is one of the most sensitive parts of the cow. My goal this year was to prove that this method was safe for my cow. I used chicken as tissue to simulate the inside of the nose. This type of fencing is safe for dogs and as I proved it is safe for cows.

5. The Effects of Salicylic Acid and Benzoyl Peroxide on Escherichia coli

Gracey Genkinger

Acne is a common skin condition that adolescents and even adults suffer from around the world. Due to acne being such a widespread cosmetic as well as an impacting condition, finding a successful treatment will bring benefits to individuals in our society. This experiment was to determine which acne antiseptic (benzoyl peroxide and salicylic) would be the most effective in killing and preventing the growth of Escherichia coli. The investigation was conducted over a 5-day period where Petri dishes were filled with agar while acne treatments were placed onto E. coli. Salicylic acid is proposed as an alternative biocide-free agent suitable for prevention in acne causing bacteria. Benzoyl peroxide is one of the most widely used topical agents for acne as well. It helps with antibacterial infections, mild anti-inflammatory, and comedolytic effects. Salicylic acid and Benzoyl peroxide are both meant to treat mild to moderate acne. Part of the reason E. coli is commonly used in scientific research is that it is easy to grow in a lab. My hypotheses stated that 10% Benzoyl peroxide would destroy E. coli while the 2% salicylic acid will simply delay its proliferation. The experimental results supported my hypotheses by showing that the Benzoyl peroxide had the greatest zone of inhibitions. The experiment also showed that the salicylic acid slowed the proliferation of E. coli, but not as much as the Benzoyl peroxide did.

6. Ice, Ice, Baby - Phase III

Paisley Grafton

The purpose of my project was to analyze the effects of ex-

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treme cold temperatures on blood sugar levels. My hypothesis stated that stress on the body, more specifically the pancreas will cause blood sugar to increase. Blood glucose levels of 20 participants were measured under two conditions: before and after a three minute ice bath. Additionally, I had two participants who did not participate in the ice bath. Changes in blood glucose levels occurred for all people. I have found that 8/20 results showed an increase after exercise, and 12/20 glucose levels decreased. The average increase was 20 mg/dL. The largest decrease was 48 mg/dL. 75% of those participants whose blood glucose decreased ate before the experiment. The two resting participants represented the control in my experiment. My dependent variable was the blood glucose levels and my independent variable was the three minute ice bath. Overall, the analyzed data did not confirm the conclusion that when the body is submerged to temperatures anywhere from 40-46 degrees that blood glucose increases.

7. The Effects of Colored LED Lights on the Plant Growth of *Eruca sativa*

Jacob Hohl

Leafy greens are one of the most consumed vegetables at our farm but we currently only grow them outside during the spring. I wanted to see if leafy greens grown indoors using different shades of purple lights would affect the plant growth. I experimented with Arugula because it is one of the more popular and profitable leafy greens and can be easily grown in 35 to 40 days. I chose to compare 3 different shades of HUE® LED Light Bulbs to the FEIT® Electric LED Plant Grow Light because the HUE® are some of the best color-changing light bulbs and the FEIT® is one of the top-rated budget grow lights. I hypothesized that the HUE® LED Light Bulbs would show similar growth to the FEIT® Electric LED Plant Grow Light. Over 2400 seeds were planted for this study. 10 plants were randomly sampled from each trial at 10 day intervals until 40 days. Plants were then cleaned, and stems, roots, and masses were measured. In conclusion, my hypothesis was partially upheld. The stem length, root length and plant mass under the HUE® LED Lights and the FEIT® Electric LED Plant Grow Light were consistent through the first 20 days. The arugula increased the most in plant mass under the FEIT® Electric LED Plant Grow Light at day 40. An ANOVA test was completed to support these conclusions.

8. Heat Transfer in Different Types of Windows

Alina Markutsya

Having energy efficient windows in your home is important because it will lower costs of heating/cooling, provide a greater

level of comfort for the occupants, and will help maintain a more uniform temperature throughout your house. I investigated whether or not there will be a difference in heat loss between different types of windows, such as, casement windows, single-hung windows, fixed windows, and sliding windows. I hypothesized that fixed windows and casement windows will have the lowest heat loss because there is little to no movement and no intense wear out of the insulation. On the other hand, I hypothesized that sliding windows and single-hung windows will have the highest heat loss because of their flexible frame, and large opening. I tested the heat conduction of the different types of windows by measuring the inside and outside surface temperature of the windows, inside and outside air temperature, and the area of the windows. All the windows were less than fifteen years old and they were located in Story, Boone, and Polk counties. My results supported my hypothesis and I found that fixed and casement windows had the lowest heat loss and single-hung and sliding windows had the highest. Based on my results, I would recommend casement and fixed windows because they are about 10% more energy efficient than single-hung and sliding windows.

9. Meditation in the Classroom

Olivia Tennant

This experiment will focus on meditation and how it can be used in the classroom. I tested students from 4th-12th grade to see if they were affected by meditation methods. I made up 2 tests from the standards for each grade that they were learning in class. I then gave them all 10 minutes to take the test as well as a two 30 second spelling word test. I came back the next day and had them watch a 5 minute meditation video. Next I had them take a test with the same standards for another 10 minutes with a spelling word test. My hypothesis was upheld because mediation did improve the test scores by over 30%. I have invented a mediation station that can be used in the classrooms for any student.

10. Going On a Counting Spree: Phase II

Jordan Vorwaldt

The purpose of this project was to determine how bottled water affected *Chilomonas* population. For this project, the water was tested to see what type of water affected the re-population over the course of 30 days. The deciding of this project was based on the creature. I wanted to work with living microscopic creatures and teach people like you about them. During the experiments, the initial thought was the purified water will have the highest population because the *Chilomonas* live in clean water at all times, just like purified. At the beginning, 74 milliliters of

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the correct waster was added to the corresponding labeled jar, also adding three equal drops of the Chilomonas. The creature was fed two flakes of wheat seed every 4 days. Aeration of the creature is a necessity to be able to keep these creatures alive. The microscope was set at the smallest power and the water was tested. I tested the water by putting a small drop of Chilomonas onto a slide and covering it with a clear slip. All waters were counted as many as possible in a 45 second time limit. The initial thought was not upheld. After all tests (30 days) the vitamin water had the highest population. Chilomonas creatures love sugar and of all the waters I tested, the vitamin water had the most sugar.

11. Slime Under Stress

Annie Yu

Slime and oobleck are fluids that have shear thickening non-Newtonian behavior. This experiment investigates the variations in shear thickening responses to stress in combinations of different proportions of oobleck to slime. Our hypothesis was that the higher the percentage of oobleck in the solution, the more dramatic the shear thickening response would be. These shear thickening properties were measured by measuring the flow rate through a syringe under forces of 5N, 6N, 7.5N, 8N, and 10N applied over an area of 0.1262 cm². Shear strain is how fast the layers are crossing each other. The shear strain is proportional to the flow rate. For testing we set up a ring stand, then, we loaded the slime into a syringe. We put the weight on the plunger of the syringe and let it drop. We recorded the flow rate on video. Our results did not support our hypothesis and showed no correlation between mixture and flow rate or stress response. Our testing results showed that mixtures with higher percentages of oobleck did not flow as easily under higher pressures as mixtures that were mostly slime. The result also showed the 90-60 oobleck to slime has a Newtonian behavior, the 0-150 and 20-130 had shown no flow. The pure slime has a non-newtonian behavior; when it is under a lot of pressure the slime stops moving. Our results also showed that mixtures with more slime had more variability in flow rates with different amounts of pressure.

12. Iron Absorption in the Stomach; Phase II

Emily Barnhardt & Shane Barnhardt

Central Lee MS

Iron deficiency anemia is a common ailment in humans. Those diagnosed with this must take iron supplements in order to raise their hemoglobin to normal levels. Our goal is to show what conditions will allow for the best absorption. In phase 1 of our project, we concluded that iron was best absorbed with a full

stomach. We will use our method from phase 1 to demonstrate empty and full stomachs but we will add vitamin C and then vitamin D as an independent variable. We chose vitamin C since research shows that foods and drink which are enriched with vitamin C will improve the absorption of iron. We found research that shows milk decreases the absorption of iron in the stomach, so we chose to test vitamin D in order to see if this is the component of milk causing this phenomenon. We found that vitamin C enhances the absorption of iron in the stomach. We discovered that vitamin D will also enhance iron absorption in humans but under specific conditions. The environmental pH played a role in these results and will need further evaluation. We would like to test other substances that may effect iron absorption.

13. Does Cover Crop Affect Nitrate Levels in Farm Run-Off?

Payton Stevens & Keating Fuger

Central Lee MS

Farm runoff can play a big part in nitrate levels in groundwater. High nitrate levels can be linked to higher bacteria levels in nearby water sources. We are gathering evidence that the cover crop affects the amount of nitrates in the runoff water. We chose this project because we both live in a rural community surrounded by farmland. We wanted to test the nitrate levels at farms in our area. We hypothesized that corn cover crop would have higher amounts of nitrates than other crops. We first used a tile map to locate the tiles. Then we marked our area with flags. After determining the site at different farms, we measured the flow and nitrate levels. During the flow procedure, we placed a bucket below the tile and timed how long it took the bucket to fill. We calculated the flow, and recorded it into our chart. Lastly, we tested the water sample for nitrates using Hach Strips. For accuracy we repeated our testing multiple times. This experiment is ongoing. One farm covered with corn showed less nitrates in the water sample than the other corn field. The weather has not been good for us to test this winter. We plan to move forward with sampling from more farms of varying crop covers to see if it changes our conclusion. Ultimately, we hope to learn more about nitrates found in groundwater so that we can invent a device to filter nitrates out so they stay out of our water sources.

14. Mimosas In Action

Leslie Kim & Katie Gu

Ames Middle School

The Mimosa Pudica will send out an action potential to close its pinnules immediately when touched and in darkness, mak-

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ing it a prime subject to test plant behavior. Previous studies have shown that the plant will ignore stimuli and keep its leaves open if it is not receiving enough light. We had previously seen plant to plant communication through electrical wiring on a TedED video (Gage, 2017). We want to test how a *Mimosa Pudica* in the light will interpret an action potential sent over an electrical wire by another *Mimosa Pudica* in the dark. We believe that the plant in the light will close its pinnules. We planned to electrically wire the branch of two *Mimosa Pudica*'s and use a ground wire to connect their dirt. Using this setup, we planned to place one plant in the dark and the receiving plant in light. We planned to record whether the the plant in the light will close its pinnules. We needed to ensure that plant to plant communication was occurring. We tried several configuration of wiring and found no response from one plant when we touched another when both in light. We tried to stimulate the plant using a 3-volt battery. We attempted to record the action potential on an oscilloscope, but we were unable to detect any signal. To continue our experiment we plan to add an amplifier into our setup and also research why we are not seeing an electrical signal transmission.

15. Ratios In Artwork: Spiraling For Appeal

Jackson Hufford & Adrian Guan

Ames

The Fibonacci spiral is found in nature and the human body making it a pattern people see on a daily basis. The spiral is formed when a tiling is created and lines are drawn to connect the opposite corners of the squares whose lengths are successive Fibonacci numbers. Our hypothesis is: people are able to recognize the difference between an image with and without the Fibonacci spiral. Furthermore, the images with the Fibonacci spiral are more appealing than the images without the Fibonacci spiral. Using the triangle test, a survey was created which included 5 groups of similar images, some of that contained the Fibonacci spirals. People were asked to choose which image was different, which appealed to them, and which features were appealing. 38 people responded to the survey. Results were evaluated using a Chi squared analysis. People were able to detect the images with the Fibonacci sequence as different ($P < 0.05$) and overall preferred these images based on pattern and texture over the similar non-Fibonacci images.

16. A Dandy Struggle: The Effect of Fertilizers and Natural Herbicides on the Plant Growth of Dandelions

Angelina Chen & Jessica Lee

Ames Middle School

Fertilizers and herbicides have opposing purposes: fertilizers

are used to boost plant growth while herbicides are meant to deter plant growth. This experiment was conducted to identify how the growth of dandelions was affected when varied amounts of fertilizers and a controlled amount of herbicide was applied to them.

We planted our germinated seeds and decided to vary two factors: vinegar herbicide or no vinegar herbicide and the amount of fertilizer used on the plant: 0g, 25g, or 50g. We tested two plants for each treatment. We then randomly assigned two plants to each treatment. Once the plants sprouted their third leaves, we applied the specified amount of fertilizer, Miracle-Gro Shake 'n' Feed. After allowing the plants to sit for a week, we applied 5 milliliters of white distilled vinegar to the designated plants. Six days following the vinegar application, we determined each plant's root length, leaf area, and height. We plotted the raw data and the measurement averages for each treatment onto separate line graphs. We also graphed the difference of the plant height before and after the vinegar application. Our results demonstrated that without applying vinegar, the fertilizer enhanced plant growth. After applying vinegar to the herbicide group, their height and health declined. The plants that did not have any vinegar applied continued to grow well. We found that the vinegar is suppressing the benefits of fertilizer; the fertilizer did not help the plants against the effects of the vinegar.

17. Effect of extraction method on extraction method on antibacterial properties of herbs and spices

Tharu Jayawickrama, Maddie Hoffman, & Claire Hoyer
Washington MS

Our hypothesis: When we extract the spices and herbs with different chemical methods, their antibacterial properties will change. We selected this project because last year we tested the effect of boiling and microwaving on antibacterial properties of 10 herbs and spices. We expected boiling and microwaving would reduce the antibacterial properties of herbs and spices because some chemicals could be broken down by heat. To our surprise, we found that boiling and microwaving the spice/herb extract increased the antibacterial activity of most of the spices except garlic. We realized some organic chemicals dissolve better in boiling water compared to cold water. We decided to retest the antibacterial properties of some of the herbs and spices by extracting those using different methods. We chose cold water, boiling water, rubbing alcohol (isopropanol) and alcohol (ethanol) to extract cinnamon, cloves, cumin, rosemary and turmeric. We tested each spice extract by putting 100 microliters of the spice extract on filter paper discs and placing them in liquid LB media containing the bacterial inoculations of *Escherichia coli* or *Bacillus cereus*. Our results show all spice

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extracts worked better against the *B. cereus* (gram positive bacteria) compared to *E. coli* (gram negative bacteria). The best method to extract the spices is to grind and soak in isopropanol. All of the spices inhibited bacterial growth over 70% when extracted in isopropanol. Although boiling for a short time (5 minutes) increased the antibacterial properties of all 5 spices (last year results), boiling for one hour reduced the antibacterial spices of the spice extracts. Based on our results, we recommend cooking these spices in oil, or boiling for a short time in order to get the best antibacterial properties. We hope to continue this experiments with different spices.

18. Safe Hands

Xandra Abel & Emmy Liu
Central Lee

Abstract Abel, Xandra J. Liu, Emmy 2019 Science Fair Abstract 2642 US-218 Donnellson, IA 25625 Central Lee Community Schools It is common practice for many healthcare providers to wear gloves during various medical procedures. This is because they do not want to infect their patients. However, what people may not always think about are the bacteria already present on the gloves. These bacteria are then transferred to the patients. This allows the bacteria to spread faster and easier. We designed a glove box and used a patented folding technique to see which method prevented the spread of bacteria the best. We thought that the folding technique would most effectively prevent the spread of bacteria. We also thought that the control would prevent the least amount of bacteria. We had 12 subjects take gloves from each box. We then swabbed the remaining gloves in the box. We let the bacteria incubate at room temperature for three days, and recorded data every 24 hours. We found that the control prevented the spread of the bacteria the least. The glove box that we designed prevented the spread of bacteria the most, and the folding technique prevented neither the most nor the least.

19. How Do Artificial Sweeteners Effect The Weight Of Muscle muscles

Brianna Gruntmeir

In order to determine what kind of artificial sweetener had the largest affect on human health, I tested it on lab mice. I tested five different types of additives, sucralose, acesulfame potassium, stevia, High Fructose Corn Syrup, and sugar. Each cage was given a 30 ml water bottle, and then another 30 ml water bottle with 4 grams of additives. Each cage was fed Mazuri Rodent Breeder and was changed out every two weeks when the cages were cleaned out. I weighed the mice once a week and recorded their data and gave them 3 grams of chocolate to

see how they reacted to real sugar in their diet. I tested the sweeteners on the mice for three months at a time for two trials.

20. Using Carbon Emissions as an Indicator for Determining Soil Nitrogen Content through Temperature and Infra-red Technology

Style Haeffner

Soil represents one of the most important storehouses for carbon on earth and accounts for fifteen percent of carbon emissions related to greenhouse gasses. Soil carbon levels vary dependent on the type of agricultural and land use systems. Nitrogen is an important nutrient found in soil that aids in growth of crops. Nitrogen as a fertilizer is known to end up in rivers and streams as it runs off fields during rain and floods causing disruption in aquatic biomes. Farmers today can use a variety of techniques to determine nitrogen quantities in soil and have them means to plant and fertilizer with geospatial equipment making it easier to determine where and how to plant. Currently there are no direct ways to measure nitrogen levels on fields from the air – only through direct sampling of soil. My project is to determine a way to measure nitrogen in soil in directly through the measurement of carbon in soil. We can determine carbon emissions form the air through thermo-temperature reading. I want to prove that organic carbon found in soil is directly correlated to the about of nitrogen levels. If I can prove this then I can use thermos imaging of carbon from the air using my drone to determine the amount of nitrogen and therefore help farmers reduce fertilizer waste by making more accurate deposits of nitrogen.

21. Using Bacteria and Protozoa as a Bioremediation Method to Clean up Organic Pollutants

Serenity Haynes

The purpose of this project was to use an organic and natural method of cleaning up oil spills opposed to current chemical procedures. I used a total of 9 test tubes for each of the subjects. I used an aquatic bacterium, *Geobacillus stearothermophilus*, and two types of protozoans which are *Amoeba* and *Euglena*. First for my controls I put 8 mL of either of the bacterium or protozoa into the test tube. Next, I would add 4 mL of spring water into the tubes. Then I would add 1 mL of the designated organism for the trials. Finally, I would add either 1, 2, or 3 drops of oil depending on the tubes that is in that group. To incubate my bacterium, I would put them in an incubator at 55°C (108°F) to gather data for 4 months. The protozoa, amoeba, stayed at room temperature (which is about 70°F) and my *Euglena* was placed under a grow light. The data was analyzed and the conclusions were drawn that *Geobacillus stearother-*

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mophilus degraded oil most effectively. Amoeba is the best protozoa to use for breaking down in freshwater environment. Euglena breaks down oil but not as effective as Amoeba

22. Sorbitol Comes to Town

Shaelyn Hansen & Zachary Zimmer

Center Point Urbana High School

Plant communication has been studied in recent years to understand how plants respond to stimuli in the environment. In times of drought, plants respond by closing their stomata to retain moisture. In this study, plants connected only by root systems were subjected to desiccation stress and the number of open and closed stomata were measured over time. While the stomata in the control plants remained primarily open, those in the desiccated plant and its connected neighboring plants began to close. This study confirms other studies that plants do indeed communicate via root systems.

23. Effectiveness of Facial Cleansers

Candy Alvarez

Bacteria is in human body that is dangerous but can also be beneficial. Acne is a disease that is so common that it's considered a normal part of growing from a kid to an adult it is caused by the irregular hormonal changes during puberty. A cotton swab was swabbed from participant; Candy Alvarez face was taken then spread the bacteria onto a trypticase soy agar plate donated by Iowa State University. Colony type 4 was tested, Staphylococcus aureus onto trypticase soy agar. Using 4 different facial cleansers. The best way to eliminate bacteria from the participant's face is to use, Bioré don't be dirty Baking Soda Pore.

24. Using Radiant Technology as a Temperature Regulator in the Artificial Insemination Process for Cattle

Lauren Beckman

Last year my sister developed a shirt using radiant technology that held the temperature of the semen constant during the artificial insemination process. The material used as an insulator was made of scrap radiant technology. Both my sister and I have looked at a similar product used in the AI process but none contain the radiant material she chose to use last year in her experiment. For my project, I plan to test the radiant technology materials against three other materials used to keep semen at constant temperature. My hypothesis is that by using a radiant material to insulate the thawed sperm during the artificial insemination process. The importance of this information is to provide better conception rates during the AI process by hopefully eliminating multiple AI sessions and having success-

ful AI attempts on the first try, which ultimately will save both time and money. I think that the local everyday farmer as well as larger producers would use this information in the future, if my hypothesis is correct, giving the animals a better conception rate. Once I prove that the radiant material gives the best results, I want to test the shirt/technology during the actual AI process and look at the conception rates to show that they will be improved over the traditional method.

25. Not So Essential Oils - A Preliminary Study

Megan Biondi

Holistic and natural methods of fighting disease and infection has become increasingly popular in American society, however little critical analysis has been made on some of these claims. A popular method that has been claimed to have antibacterial effectiveness is the use of essential oils as a cleaning solution. A bathroom sink and a bathroom doorknob were swabbed for culture. The bacteria identified from both were Streptococcus pneumoniae, and underwent sensitivity testing. The sensitivity test showed that the essential oils tested did not kill or decrease the bacteria in either population. Essential oils may not have very strong antibacterial properties despite popular claims and beliefs.

26. Origin Of Bacteria In Tap Water

Michelle Dang

Tap water affects many humans including animals. Bacteria in tap water has been found to be from the filter of a faucet that the water runs through and not the water itself. This ultimately leads to the water being contaminated. Samples were taken from the tap water before and after the filter was cleaned along with the bacteria on the faucet. The samples were grown on trypticase soy agar in petri dishes, tested, and identified. Gram +Bacilli and fungi were present. Water, distilled water, bleach, iodine, and lysol were used to kill the bacteria. The products were shown to have illuminated all the bacteria with new fungal growth appearing. All products were effective in killing the antibacterial colonies, but lysol would be considered the most effective option that is also the most affordable.

27. Nature vs Nature

Tiembra Dantzler

Hygienic products are a worldwide essential, and in America alone, are of high demand. Common necessities are not as easily accessible to those in need of them. As an alternative, natural oils could be used to cater to those, eager to keep their body balanced on a budget. Natural oils have a long history of habitually being used for healing and medicinal properties. Because

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oils obtained from nature contain anti-pathogenic compounds, it is hypothesized that this makes them fit to be used as an everyday hygienic product. A bacterial experiment was carried out using Jamaican Black Castor oil, Tea Tree oil, and Coconut oil as antibacterial substances to test their effectiveness at killing bacteria, native to three different areas of the body. Samples were collected from the mouth before and after any form of treatment, the underarm, and acne discharge. All samples were smeared onto their own individual trypticase soy agar petri dish and labeled. Petri dishes were then placed in the classroom incubator. All bacteria that were identified were native to the area of the body they were taken from. All bacteria were gram-positive and non-pathogenic. In the sensitivity test, Tea Tree oil was the only oil that produced a clear zone, which was 2mm. Tea Tree oil was also the only essential oil used. Essential oils contain better preserved natural compounds compared to the non-essential oils used. In conclusion, essential oils' higher concentration of anti-pathogenic properties makes them more efficient at being used as a daily hygiene product.

28. Bacteria in Commonly Used Products

Angelia Gallardo

Bacteria affects humans and animal's lives in several ways. Metal and plastic containers are used not only as reusable bottles for humans but also for pets and livestock holding food and water. One sample was taken from a reusable metal cup and another from a plastic cup. Both were grown on agar plates provided by ISU and the bacteria was identified. Gram positive cocci, gram positive bacilli, gram positive coccobacilli, and a possible mold spore along with endospore forming bacteria were all present. There was a clear difference in bacterial growth as the metal grew significantly less than the plastic but a possibility of mold in the metal and endospore forming bacteria in plastic. Metal was found to be better used as a product.

29. The effect of bioreactor medium on the quantity and rate of nitrate removal

Jacob Kelty

Bioreactors are used to remove nitrates from farm fields so that streams and groundwater are less polluted. In this study, a nitrate solution was poured into three different bioreactor media in column style bioreactors; most at a depth of 12 inches and one at a depth of 6 inches. The concentration of nitrates was measured from the reactor outflow daily for a week. All bioreactors showed a decrease in nitrate levels except the pine chips. The potting soil substrate reduced nitrate levels the fastest, bringing the levels down to zero. The fir chips at both 12 and six inches reduced the nitrates to zero at slower rates. These

data are important for researchers designing bioreactors for field applications.

30. Observing the Efficiency of Genetic Algorithm at Different Scales

David Kim

In this project, I investigated the efficacy of a genetic algorithm approximating the shape of a human cochlear at different scales. The base model that I worked with used a 3x scale, so I set the scale factor to 2x and 1.5x and compared the % error between the models. I found that at the 1.5x scale, the eccentricity is not properly taken into account by the algorithm. This is also the case at the 2.0x level, although not to the same degree.

31. Biodegradable Backlash

Hailey Kintz

The purpose of my project is to reduce the use of polyethylene plastics throughout the world and create a safer alternative. Creating a different type of plastic with the same features, but one that is safer for the Earth is something we can all appreciate. I believe that through doing this, the marine life will live longer and happier, and we will not have near as much plastic pollution in the oceans. I used three different recipes off of the internet, and tested them thoroughly to fix the percentages. One was made from agar powder, glycerol, and hot distilled water. Another was made from corn starch, white vinegar, distilled water, and glycerol. Finally, the third was made from tapioca flour, hot distilled water, white vinegar, and glycerol. This made each of the outcomes have much more advanced consistencies and durability. After finding a combination of ingredients that produced the strongest, most flexible type of plastic from each base recipe, I made 15 samples and ran tests over each. These tests include acidity, flexibility, strength/durability, biodegradation, and contamination tests.

32. Facial Acne vs. Acne Products

Alejandra Marquez-Varela

Acne alongside its facial bacteria can be such a pain. Simple treatments and products can be bought for the purpose of attempting to resolve the problem. But are such products successful? Four areas of the face were used to test out whether Grapefruit Scrub, Rapid Gel, or Cetaphil® Pro, three store-bought products, would be the most effective at killing off the facial bacteria. The bacteria identified was that of Cutibacterium acnes, common on the face. The bacteria that had been successfully growing on an agar plate were then attempted to be killed by three different acne removal products through sensitivity

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tests. Out of the three products, the product “Grapefruit Scrub” was the most effective for its sensitivity tests showed a larger clear zone than the other two products with the test.

33. Efficacy of disinfectants at different temperatures

abullahi mohamed

With temperature decreasing people are moving back inside for the winter. In close quarters bacteria strive in growing and multiplying quickly, and the spread of bacteria increases dramatically under the cold seasons. With an increase of bacteria, we need to find ways to increase the effectiveness of disinfectant on surface area to protect our young children. By testing the efficacy to Lysol at two different temperatures 10 degree Celsius and 19 degree respectfully. Two agar plates were used to test the effectiveness of temperature in killing bacteria using the Kirby Bauer Test. The result concluded that the colder Lysol was the most effective anti-bacterial to kill the bacterial colonies of gram positive by .85cm.

34. An Analysis of Bathroom Cleaning Products on Bacteria

Kristy Nguyen

A majority of people use the bathroom/restroom at least once daily. Bathrooms and restrooms are a breeding ground for bacteria, which flourish not only on the obvious toilets, but on nearby surfaces such as mirrors. Gram positive cocci was present in each bacteria sample taken from the bathroom. The results showed that the bacteria found in the toilet was found on the mirror and that vinegar was shown to be the most effective antibacterial substance out of Lysol, bleach, Mr. Clean, vinegar, and alcohol.

35. The Effectiveness of Dog Shampoos and Wipes

Jennifer Robles

Dogs pick up many different bacteria from their environment and can directly affect human health. Effective shampoo and cleaners prevent harmful bacteria from spreading onto people. A sample was taken from a female five-year-old Chihuahua and the bacteria were grown on a trypticase soy agar petri dish, tested, gram stained, and identified. Gram positive cocci were found. Wahl’s Four In One Shampoo and Conditioner, Burt’s Bees Oatmeal Dog Shampoo, Nature’s Miracle Dog Bath Wipes, Burt’s Bees Multipurpose Wipes for Dogs, and water were tested for effectiveness in killing the bacteria. The two effective substances were Burt’s Bees Oatmeal Dog Shampoo and Nature’s Miracle Dog Bath Wipes. The clear zone around the shampoo antibacterial disc averaged 12.5 mm and the clear zone around the wipe antibacterial disc averaged 9.88 mm.

Both substances contained honey.

36. Harnessing Artificial Selection to Develop Antibiotic Resistant Probiotics

Katharina Schmidt

The natural environment of microorganisms that exists in the intestines of many organisms is important for many aspects of the host organism’s health. Gut flora help to prevent such effects as cancer and asthma and the depletion of one’s gut flora can increase one’s chances of getting sick. These microorganisms are diminished upon the introduction of antibiotics, usually introduced in order to fight infections. In this experiment, probiotics from a kombucha SCOBY were put in contact with 409 cleaner, used as an exemplary antibiotic substance, in order to discern if probiotics could develop antibiotic resistance. The experiment utilized 409 cleaner soaked antibiotic discs on two colonies grown from the kombucha SCOBY sample. The first colony exposed to 409 cleaner soaked antibiotic discs consisted of *Saccharomyces cerevisiae*, a yeast. The second generation of *Saccharomyces cerevisiae* exposed to 409 cleaner demonstrated an increase on average of 1.6 mm in the diameter of the clear zone from the first generation. The second colony exposed to 409 cleaner soaked antibiotic discs consisted of *Lactobacillus acidophilus*. There was an average of 3.08 mm decrease in the diameter of the clear zone created by the antibiotic discs on the plate containing the second generation of *Lactobacillus acidophilus* that had been exposed to 409. The results demonstrated that artificial selection can successfully develop antibiotic resistance in probiotics.

37. Developing Antibiotic Resistant Probiotics Using Kombucha Cultures

Katharina Schmidt

The natural environment of microorganisms that exists in the intestines of many organisms is important for many aspects of the host organism’s health. Gut flora help to prevent such effects as cancer and asthma and the depletion of one’s gut flora can increase one’s chances of getting sick. These microorganisms are diminished upon the introduction of antibiotics, usually introduced in order to fight infections. In this experiment, probiotics from a kombucha SCOBY were put in contact with 409 cleaner, used as an exemplary antibiotic substance, in order to discern if probiotics could develop antibiotic resistance. The experiment utilized 409 cleaner soaked antibiotic discs on two colonies grown from the kombucha SCOBY sample. The first colony exposed to 409 cleaner soaked antibiotic discs consisted of *Saccharomyces cerevisiae*, a yeast. The second generation of *Saccharomyces cerevisiae* exposed to 409 cleaner

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38. A Comparison Study of Bio remediated Bacteria, Biochar, and Silver Nanoparticles as a Tool to Restore Polluted Water

Drake Smith

Abstract The purpose of this study is to find out how effective iron nanoparticles, biochar, and genetically modified bacteria are at cleaning polluted water. Also, I plan to test the speed at which each one cleans the contaminated water. In the end, my research could be used to more effectively clean up oil spills in the ocean. My hypothesis is that nanoparticles will work the fastest because of their extremely small size and ability to neutralize the oil particles. Also, I believe that the genetically modified bacteria will be the most effective because they will eat away at the oil. I plan to test each cleaning agent against a few different concentrations of pollution in a set amount of water. I will also time how fast it takes for the water to return to a normal state of abnormalities in the water. I have thought about testing the cleaning ability of each agent in saltwater as well as freshwater to see if the salt makes a difference. From my research, I hope to learn if biochar or nanoparticles are more effective at cleaning the water than the current genetically modified bacteria that is used today. All in all, I hope to use my research to clean up pollution in the ocean.

39. The Effects of Different "Cleansers" on Scalp Bacteria

Esther Ubadigbo

Hair product manufacturers have caught on to the natural hair trend, and many have begun to market towards black and African American people with kinky/curly hair. However, not all products are created equal. There are a variety of cleansers that have been popularized by people with natural hair; from DIY apple cider vinegar rinses to name brand shampoos. A bacteria sample was taken from the scalp of Esther Ubadigbo, grown on a trypticase soy agar plate, and three antibiotic disk tests were performed using the most common bacteria found, *Staphylococcus epidermidis*. Four different types of bacteria were identified using gram-staining techniques and oil immersion. The experiment tested apple cider vinegar (ACV), Crème of Nature

Sulfate-free shampoo, TRESemme conditioner, Suave Clarifying shampoo (sulfate shampoo), and water as a control to see which substance best cleansed the scalp. Only the Suave sulfate shampoo was successful in killing the *Staphylococcus epidermidis*, with an average clear zone of 16.3 mm. No other substance had a clear zone. The sulfate shampoo was the most effective cleanser.

40. Bacteria found on Packaged vs Unpackaged bacteria

Emilie Youngwirth

Many people touch multiple unpacked produce items while grocery shopping which is an easy way to spread different types of bacteria. A sample was taken from an unpackaged head of lettuce and one from a packaged head of lettuce. These samples were grown in a trypticase Soy agar plates and identified. The packaged bacteria colony used was identified as *Brevibacterium linens* and the unpackaged colony identified was a fungus. They were then sensitivity tested. Heinz All Natural Distilled White Vinegar was most successful killing bacteria, having a clear zone of 19mm on average. Prepara produce wash was also successful with an average clear zone of 14mm, but water alone was not effective and had no clear zone. The packaged sample had 10 different colony types while the unpackaged has 8 different colony types and more bacteria overall.

41. Bacterial Contamination in Make Up Testers: A Quantitative Study

Natalie Kongable & Madyson LeVelle

Center Point Urbana High School

Many people are afraid to use make up testers in stores because they fear that they are contaminated with bacteria from previous users. In this study, make up testers in stores for foundation, lipstick and eye shadow were swabbed, and those samples were incubated on nutrient agar. New make up of the same types were also swabbed, plated, and incubated. Bacterial colony counts were taken for three days for all samples. Surprisingly, data showed that make up testers were as clean as new makeup.

42. The Effect of Household Item-Based Fertilizer on Corn Seed Germination Rates

Madeline Hakala & Emina Oglecevac

Waukee High School

The Effect of Household Item-Based Fertilizer on Corn Seed Germination Rates Madeline Hakala and Emina Oglecevac Today, a multitude of individuals are electing to grow their own vegetables at home to avoid store-bought produce laced

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with chemicals; therefore, many are looking for safe, home-made fertilizer alternatives. The purpose of this experiment was to test the effectiveness of various household item-based fertilizers that are commonly used. Lemon juice, grapefruit juice, and epsom salt were determined to be commonly used through the internet and word of mouth. Then, they were tested through studying the germination of corn seeds, which germinate quickly and are not easily killed by fertilizer. 54 corn seeds were planted to test each treatment group (1% lemon juice, 5% lemon juice, 1% grapefruit juice, 5% grapefruit juice, 1 tablespoon epsom salt, and 2 tablespoons epsom salt). The fruit juice concentrations were applied through daily watering; the epsom salt was inserted as a solid into the soil during planting. Germination rates were determined after 1 week, which is shorter than the typical speed of germination, and after 2 weeks, which is longer than the typical speed of germination. Ultimately, all 6 treatment groups resulted in p-values higher than the chosen 0.05 significance level through a two-proportion z-test. We failed to reject the null hypothesis that there is no difference in the germination rate of corn seeds with or without fertilizer after 1 week and 2 weeks. This means that the fertilizers had neither a positive nor a negative impact on the germination of corn seeds in the experiment.

43. Seasonal Lighting as a Determinant of Periodic Weight Gain

Kennedy Schuff & Alyssa Parker

Danville Community Schools

The purpose for this experiment is to see if seasonal lighting effects the mice's weight gain and how they react. We are trying to relate that back to humans and the stress level in different seasons and how SAD(seasonal affective disorder), can affect how you live in winter versus summer and can cause weight gain in humans, among other elements. Our hypothesis is that the more darkness and less light you have will cause the mice to gain weight. We chose this as our hypothesis because with less light you could potentially sink into a depression and become overly stressed and as a comfort, "stress-eat." We think that the public would be able to use this research in the future to answer their questions as to why they tend to consume more food in some seasons rather than others.

44. Antibacterial Properties of Suave Shampoo

Naomi Adams

Ocean Breeze Suave shampoo has been shown to eliminate bacteria effectively. Bacteria was collected from a human arm, human hair, and a lab table. Six types of gram-positive cocci were tested: Staphylococcus epidermas, Staphylococcus lutea,

Staphylococcus aureus, Micrococcus luteus, and Micrococcus roseus as they were the most common. None of the bacteria were resistant to suave shampoo when exposed to it in Trypti-case Soy Agar plates.

45. How to save a cell

Jayda Anaya-Negrete

With new advancements in the biology field and the need to enhance cryopreservation and preservation techniques for processes like in vitro or bringing back extinct animals, how would simple household items like salt improve these techniques? This project takes salts of different charges and tests how well they preserve red onion cells upon being frozen and thawed. Data was analyzed using Ph strips. My hypothesis being the higher the charge and concentration, the less damage to cells there will be. The results displayed that higher concentrations did supplement more cell preservation than ones of lower percentage.

46. Are they lying? Political identity and personal experience influence believability of rape accusations.

Karli Benson

This study was designed to find a variable that identifies why individuals choose whether to believe a rape accusation or not. Although there are many qualitative studies examining this issue, little empirical research has been done regarding this question. We were not able to find any studies that manipulate a variable to better understand which factors influence the likelihood someone is more or less likely to belief a rape accusation. A survey was developed where subjects read three separate rape accusations from a pool of six accusations. Using random sampling, subjects read a combination of both true and false stories. There were additional questions regarding demographics, political identity and personal experience with sexual assault. From this study we were able to conclude a number of things that may affect why one would believe a rape accusation. Factors such as gender, education level, age, political affiliations, and whether or not someone was a victim or knew a victim of sexual assault were examined.

47. Effect of Temperature on the Incubation Period and Chick Weight of Gallus gallus domesticus.

Cade Cameron

Abstract Much research has been done on the correct temperature in which to hatch eggs in an incubator. Optimal temperature is 99.5oF+/- 3o. What I wanted to determine is with the variation in temperature, is the birthweight effected? I live on a farm and collected my own fertilized eggs – I could assume

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they were fertilized. I placed the eggs in three different temperatures with the same humidity in the incubators. I allowed the eggs to gestate for 21 days and chicks hatched. Chicks were weighed within a 12-hour period from the hatch time to allow the chicks to dry off from the hatch. Weights were recorded and averaged over each of the temperatures. The reason I am working on this project is that I want heavier chickens for sales.

48. Kitchen Sink vs. Toilet

Alexis Crewse

Samples from the kitchen sink and from the toilet were taken from a home in Des Moines, IA. These samples were grown on trypticase soy agar plates, tested and identified. *Corynebacterium pseudodiphtheriticum* was present in the sample taken from the kitchen sink and *Bacillus subtilis* was present in the sample taken from the toilet. According to the sensitivity tests, Mr. Clean was the most successful in killing both bacteria. Mr. Clean had the largest clear zone in both samples.

49. The Effects of Copper (II) Sulfate, Silver (I) Nitrate, and Sodium Acetate on the Growth of *Staphylococcus epidermidis*: A follow-up study.

Angela Graf

Finding alternatives to antibiotics has become increasingly important as resistant strains of bacteria have developed recently. Metals are known to be antimicrobial. In this study, *S. epidermidis* was incubated on agar in 1 micromolar and .001 micromolar concentrations of three metal compounds: copper (II) sulfate, silver (I) nitrate, and sodium acetate. Sodium acetate had very little inhibitory effect on the growth of *Staphylococcus epidermidis*. Silver (I) nitrate inhibited growth at concentrations as low as $1.0 \times 10^3 \mu\text{M}$ but not as low as $1 \mu\text{M}$. Therefore, it can be hypothesized that there is an inverse relationship between bacterial growth and concentration of silver (I) nitrate; as the concentration of silver (I) nitrate increases, the number of countable colonies of *Staphylococcus epidermidis* decreases. These data are important for researchers who are designing alternatives to antibiotics.

50. Exploring the Effectiveness of Different Hand Sanitizing Solutions

Kailee Keongam

Clean hands are the single most important thing everyone can do to keep from getting sick, or to keep from infecting others. The hand sample was taken from a female high-school student in the afternoon of a regular school day traveling from Lincoln High School to Central Academy on October 10, 2018. In the environmental hand sample one, *Micrococcus luteus* was pre-

sent and derives from soil, dust, water, skin of humans and other animals. Bath and Body Works brand hand sanitizers work the best as they contain alcohol which kills most germs on contact without harming the skin.

51. So your feet stink?

justin louis

The bacteria responsible for these are *Brevibacterium linens* and *Staphylococcus epidermidis* in the study *Staphylococcus epidermidis* was taken and identified them giving a sensitivity test to find out which non-corrosive antibacterial could get rid of the sample the study found that dish soap was the best solution.

52. What Kind of Bacteria Grows at Your Gym?

Hannah Marshall

People are not aware how much bacteria surround them while they are trying to work out at a local gym. Four samples were taken from a treadmill, a free weight, a body mat, and a medicine ball. The samples were grown in a trypticase soy agar plate, identified, and tested. The bacteria that were present included, gram+bacilli, gram+cocci, and endospore forming gram+bacilli. Two cleaners were tested. The Planet Fitness cleaner provided at the gym, and Lysol multi-surface cleaner. The clear zone around the Planet Fitness antibacterial discs was, on average, a 14 mm. The clear zone around the Lysol antibacterial discs was, on average, a 11.13 mm. The Planet Fitness cleaner provided was the most effective antibacterial to kill the bacteria found on the gym equipment.

53. Potential Pathogens Inside A Hose Faucet

Lanchi Nguyen

Bacteria is present everywhere in the environment and may contaminate the water people consume leading to diseases, directly or indirectly. Many bacteria can live inside biofilms created by rust and flow out with running water. Two samples were taken from the hose faucet at the Lincoln high school pool, which provides a dark, moist, and rusted environment: perfect for harboring bacteria. One sample was taken from the running water of the hose faucet and the second sample from the inside mouth of the hose. The samples were grown on soy agar plates and a gram-negative bacillus, *Pseudomonas fluorescens*, which may cause infections, and a fungus were found. Bleach, iodine, vinegar, Lysol, tea tree oil, and alcohol were all found as effective disinfecting treatments against the bacteria and fungus. The most effective treatment against the fungus cannot be determined because the zones overlapped, but the most effective treatment against the bacteria was alcohol with a

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clear area diameter of 43mm and the least effective treatment was bleach with a clear area diameter of 12mm. There were no directly harmful bacterial colonies found in the running water most likely due to the colder fall temperature, since these bacteria need hot temperatures to produce effectively.

54. Testing the Effectiveness of Antibacterial Car Products

Edwin Rojas

Cars are a daily utility for most people around the world. People are not aware of how much bacteria can be infested in their dashboards if they do not take the proper precautions. A sample was taken from a Camry 2007 dashboard and grown on a Trypticase Soy Agar in petri dishes donated by Iowa State University. A bacteria colony that was the most unique was collected and tested. Gram positive cocci was present. ArmorAll, AutoArmor, water and soap, and Lysol were tested to see which one would be more effective to killing the Gram Positive Cocci. The clear zone around the Lysol was greater with a 1.65cm compared to water and soap which had .43cm and AutoArmor which had .242cm and ArmorAll which had no clear zone around it. Lysol was proven to be more effective to kill the bacterium.

55. Bacteria Under the Armpit

Paige Sensouk

Armpits are the perfect place for bacteria to grow. Because there is an odor that can come from the armpits, people use deodorants or antiperspirants. In order to test the interactions between bacteria and the different products, three samples were taken from the armpit of a human subject after exercise. Samples were grown on trypticase soy agar in petri dishes, gram stained, and identified. Gram positive bacilli and cocci were present. The bacteria tested were resistant to Degree antiperspirant spray, Dove deodorant, and Secret deodorant. Because different factors were tested that did not relate with the use of the products, the results of the experiment were not successful

56. Uniform stylishness and college football recruitment.

Brigid Toothman

My project used public opinion to rate the stylishness of college football uniforms and then compare that to how good their recruiting class was for the 2018 year. I found that the uniforms of teams with better recruiting classes according to ESPN were rated higher than teams with worse recruiting classes. This means that teams with more stylish uniforms did better with recruiting than teams with not as stylish uniforms. This research is important because while there is a lot of speculation to the role of uniforms in the recruitment process there is not a

lot of scientific data to prove or disprove it.

57. Examining the Effects of Water, Acrylic Glass, and Soda-Lime Glass on the Power Output of a Photovoltaic Panel

Chiara Travesset

Soda-lime glass, acrylic glass, and distilled water all have low transmission of infrared rays. Infrared rays reduce the efficiency of photovoltaic (PV) panels by heating the panels. This experiment aimed to determine how effective soda-lime glass, acrylic glass, and distilled water are in increasing the efficiency of PV panels. Higher efficiency was defined as an increase in power output. For each material, three 8 hour trials under fluorescent lights were conducted. The voltage, current, and surface temperature of two PV panels, one with the material on top and the other bare, was measured every five minutes in each trial. The results of the experiment showed an increase in the power output and the surface temperature for soda-lime glass, and no change in the power output and the surface temperature for distilled water and acrylic glass.

58. Bacteria Growth In Various Methods of Thawing Frozen Shrimp

Nou Vue

People are often in a rush to thaw food out, and have left it out at room temperature to speed up the process without realizing the dangers of it. One sample was taken from a frozen shrimp right out of the bag and placed inside a zip-lock bag. With gloves on, one shrimp was placed on the counter in a bowl and another shrimp was put in a bowl then placed in the refrigerator. Both shrimps were left for two hours. Both shrimps were then swabbed with a sterile cotton swab, and placed individually in zip-lock bags. Table one had seven different bacteria with 140 colony counts after it was left out at room temperature for two hours. Table two had five different bacteria with 15 colony counts after it was left in the fridge for two hours. Table three had nine different bacteria with 12 colony counts right out of the bag. The bacteria had time to multiply after it was left out, even more when it was left out at room temperature.

59. What Mouthwash Kills the Most Mouthwash in a Human's Mouth?

Zoey Weber

Bacteria affect everyone every day because it's almost everywhere including human mouths. Not all mouthwashes kill the bacteria in a human's mouth. A human subject's mouth was swabbed and three mouthwashes were tested ACT, Crest and Listerine. By using trypticase soy agar plates and sensitivity discs *Bacillus subtilis* was found and eliminated by rinsing

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mouth with ACT. The clear zones around ACT and Crest were both an average of 16 mm around while the Listerine had no clear zone. ACT and Crest were the most effective mouthwash to eliminate the bacterial colonies.

60. Microorganisms on Retail Pin Pads

Abby Wiedmann

Microbes are on everything touched by humans, especially cash and credit cards. Because of this, microbes also get onto credit card readers and the pin pads. Three samples were taken from a retail store- one from a rarely used register, one from a busy register, and one from the busy register after being cleaned with the store's method of cleaning. The bacteria were then grown, tested with antibacterial agents, as well as identified. Hand sanitizer, Lysol, lens cleaner, alcohol, and soap and water were used to try and kill the microbes. The most effective of these treatments was Lysol, with an average of 2.6 cm diameter of killed microbes. The least effective method is the recommended method by others on how to clean the pin pads- using soap and water. All but one microbe was resistant to the soap and water cleaning method.

61. Exploring the effect of electron sharing on the bond length and excitation energy of molecular iodine using computational chemistry.

Ian Hollingworth & Robert Bodiroga
Hoover High School

Molecular iodine (I₂) is known to exhibit solvatochromism (the variation of solution color with solvent), but the precise mechanism remains somewhat unclear. Experimental evidence suggests that iodine solvatochromism arises from the donation of electron density from solvent to a σ^* orbital of I₂. Quantum chemical calculations were used to investigate the bond length and excitation energy of I₂ associated with single explicit molecules of with water, methanol, cyclohexane, carbon tetrachloride, dimethylformamide, and acetonitrile in various orientations relative to I₂. The bond length and excitation energy for I₂ was greatest when a solvent atom showing Lewis base character was aligned with the I₂ bond axis, supporting the notion that electron donation of the solvent to the σ^* orbital of I₂ is at least partially responsible for the solvatochromism of iodine. We further compared results from PBE0, CCSD, and double-hybrid density functional theory calculations to each other and to experiment and conclude that PBE0 is a reliable and computationally economical method for exploring the solvatochromism of iodine in silico.

62. Increasing the Population of *Danaus plexippus* by Ma-

nipulating Food Choice Behavior

Abby Wittkamp & Sara Dodge
Burlington Community High School

For the past twenty years, the population of *Danaus plexippus* (monarch butterflies) has been on the decline. The dwindling number of monarchs has to do with the increasing eradication of monarchs' singular food source and breeding ground: milkweed (*Asclepias syriaca*). Since monarchs use olfactory senses to detect milkweed, it was hypothesized that if milkweed extract were to be placed on a plant other than milkweed, thinking that the plant is milkweed, monarch butterflies may be willing to lay eggs on the plant and monarch caterpillars may eat the plant. For the experiment, 55 monarch caterpillars were fed dogbane (*Apocynum cannabinum*) that had been sprayed with milkweed extract, 20 caterpillars were fed dogbane, 10 caterpillars were fed milkweed, 20 caterpillars were fed spinach that had been sprayed with milkweed extract, and 20 caterpillars were fed spinach. The results showed that the monarch caterpillars were willing to eat milkweed and dogbane that had been sprayed with milkweed extract. Dogbane can be found in every continental state of the United States and eight Canadian provinces, making it a readily available resource for monarchs. By giving monarchs another food source, the monarch population may be able to rebound.

63. The Effect of Dandelion Root Extract on the Enhancement of Mouse Lymphoma Cell Growth

Meghana Yellepeddi & Geetika Kanaparti
Waukee high school

The goal of this experiment was to determine if dandelion root extract (DRE) enhances or inhibits the growth of EL-4 mouse lymphoma cells. There have been many experiments conducted on the idea that dandelion extract can kill cancer cells -- the intent of our research was to help develop natural remedies for cancer. To start our procedure, we seeded four flasks, added media, EL-4 cells, dandelion root extract (100, 1000, and 2000 μ g DRE/ml media) and 1% DMSO to the flasks. We incubated our cells and then counted them every day using trypan blue for a span of four days. To determine cell viability, we performed the MTT assay. Although our cells grew very slowly, the MTT showed a significant increase in cell viability at the high dose vs. control -- the trypan blue counts also mimicked the results of the MTT assay. The significant inhibition of the growth of the low and medium dose flasks was interesting, but could partly be due to a tight cap error which resulted in the lack of CO₂ from day 0 to day 1. The other two flasks had loose caps in the incubator. Overall, our cells in all four flasks were mostly dead on day 4. We conclude that the high dosage flask of DRE had

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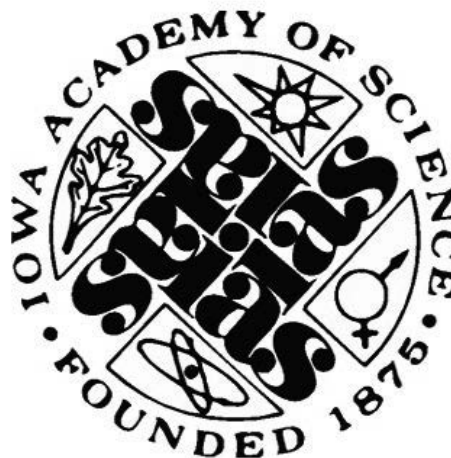
significantly higher cell viability vs control on day 4. It appears that cell growth was statistically enhanced with the high dose of dandelion root extract, although the number of cells in each flask was lower than expected.

64. INVESTIGATING CILIA PHENOTYPES IN TETRAHYMENA THERMOPHILA CELLS WITH MUTATIONS IN GENES RIB72, CEN2, and DISA

Olivia Proctor & Sofia Lopez

Hoover High School

Tetrahymena thermophila is a single-celled eukaryotic organism commonly found in pond water. The oval-shaped cells are covered with rows of hundreds of cilia that are needed for mobility, feeding, mating, and cell division. Each cilium consists of a ring of microtubules that extends from the surface of the cell. In humans, defects in cilia cause genetic disorders called ciliopathies such as Bardet Biedl Syndrome. Cilia present in human cells are similar to those found in *Tetrahymena*. Therefore, *Tetrahymena* is a great model organism for understanding proteins important for cilia structure and function. Mutations in multiple *Tetrahymena* genes have been found to have an effect within cilia. In this study, we are examining phenotypes associated with cilia in cells having mutations in genes RIB72, CEN2, and DISA. Specifically, we are comparing wild-type and mutant cells for mating, mobility, cell morphology, cilia synthesis, as well as cilia length, number, and organization.



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SECTION MEETINGS

Saturday, See individual sections for room and schedule.

Anthropology Section

See Geology

Cellular, Molecular & Microbiology Section

Room 303

- 8:50 – 9:10 **107.** SULFORAPHANE INDUCED CHEMOTHERAPEUTIC EFFECTS ON JURKAT T LYMPHOCYTE
- 9:10 – 9:30 **108.** PREVALENCE OF ANTIBIOTIC RESISTANCE GENES CHICKEN MICROBIOTA
- 9:30 – 9:50 **109.** EXAMINING THE PRESENCE OF ANTIBIOTIC-RESISTANT BACTERIA IN COW MILK & MEAT IN RELATION TO DIFFERENT FARMING METHODS: CONVENTIONAL VS ORGANIC
- 9:50 – 10:10 **104.** THE EFFECT OF EPIREGULIN AND TBX2 ON ACTIVATION OF THE EGFR FAMILY IN THE MCF10A CELL LINE
- 10:10 – 10:30 **106.** INHIBITION OF BACTERIAL GROWTH BY ESSENTIAL OILS
- 10:30 – 10:45 **Section Business Meeting – Select Section Chair and Vice Chair**
- 11:00 – 11:55 **General Session III**
- Noon – 12:30 **Lunch**
- 12:50 – 1:10 **105.** QUANTIFYING PATHOGENS AND POTENTIAL SOURCES IN RECREATIONAL WATERS IN NE IOWA
- 1:10 – 1:30 **110.** THE EFFECTS OF SEPSIS ON SKELETAL MUSCLE MITOCHONDRIA OVER DIFFERENT PERIODS OF TIME
- 1:30 – 1:50 **111.** LONG-TERM SURVIVAL OF CANDIDA ALBICANS ON SOLID MEDIA DOES NOT DEPEND ON GLYCOGEN

Chemistry Section

Room 304

- 8:50 – 9:10 **113.** CONTAMINANTS AREN'T THE BOMB: A SURVEY OF BATH BOMBS FOR POTENTIAL TOXINS
- 9:10 – 9:30 **112.** COMPUTATIONAL STUDY OF THE EFFECT OF ELECTRON DONATING AND ELECTRON WITHDRAWING GROUPS ON A NAPHTHAQUINONE MECHANISM
- 9:30 – 9:50 **132.** WATER CONNECTS US ALL: 3D LEARNING AND ENVIRONMENTAL EDUCATION
- 9:50 – 10:10 **114.** DEVELOPMENT OF FINGERPRINTS ON PAPER FOR AN INTRODUCTORY FORENSIC SCIENCE COURSE
- 10:10 – 10:30 **115.** A MOLECULAR DYNAMICS SIMULATION AND SUBSTRATE DOCKING STUDY OF MUSHROOM TYROSINASE
- 10:30 – 10:45 **Section Business Meeting – Select Section Chair and Vice Chair**
- 11:00 – 11:55 **General Session III**
- Noon – 12:30 **Lunch**

Community College Biologists, Business Meeting

Room 408

SECTION MEETINGS

Saturday, See individual sections for room and schedule.

Ecology and Conservation Section: Botany

Room 403

- 8:30 – 8:50 **119.** OVERVIEW AND ANALYSIS OF THE WORK OF A.P AND LAURA MORGAN
- 8:50 – 9:10 **117.** RESOLVING PHYLOGENETIC RELATIONSHIPS BETWEEN STEREUM FUNGI SPECIES
- 9:10 – 9:30 **128.** DECIDUOUS FOREST COMMUNITIES OF FINCH MEMORIAL HARDWOODS, DRIFTLESS AREA NWR
- 9:30 – 9:50 **123.** CONSERVATION ASSESSMENT OF WHITE PINE HOLLOW
- 9:50 – 10:10 **122.** UPDATE ON IOWA'S OLDEST OAKS
- 10:10 – 10:30 **125.** THE EFFECTS OF NATURAL HERBICIDES ON INVASIVE ALLIARIA PETIOLATE AND NATIVE WOODLAND SEEDLING GERMINATION
- 10:30 – 10:45 **Section Business Meeting – Select Section Chair and Vice Chair**
- 11:00 – 11:55 **General Session III**
- Noon – 12:30 **Lunch**

Ecology and Conservation Section: Zoology

Room 404

- 9:10 – 9:30 **124.** ECOLOGICAL FACTORS CONTROLLING THE PREVALENCE OF LYME DISEASE-CAUSING BACTERIA, BORRELIA BURGDORFERI, ALONG THE MISSISSIPPI RIVER
- 9:30 – 9:50 **120.** IMPACTS OF SUNFLOWER DOMESTICATION ON THE EVOLUTION OF ITS SPECIALIST INSECT HERBIVORES
- 9:50 – 10:10 **127.** CITRIC ACID AS A POTENTIAL MOLLUSCICIDE AND DETERRENT FOR THE INVASIVE SLUG SPECIES ARION SUBFUSCUS
- 10:10 – 10:30 **116.** RESPONSE OF EASTERN TIGER SALAMANDERS TO RESTORED WETLANDS ON AN AGRICULTURAL LANDSCAPE IN NORTH CENTRAL IOWA
- 10:30 – 10:45 **Section Business Meeting – Select Section Chair and Vice Chair**
- 11:00 – 11:55 **General Session III**
- Noon – 12:30 **Lunch**
- 12:50 – 1:10 **118.** FERAL CAT HOME RANGE AND SURVIVAL RATES IN FAYETTE, IOWA
- 1:10 – 1:30 **121.** NATIVE BEES AND OTHER INSECTS OF A HABITAT DIVERSE SUBURBAN YARD
- 1:30 – 1:50 **126.** COMMUNICATING KNOWLEDGE AND RESPECT FOR SPIDERS AND THEIR FUNCTIONS IN ECOSYSTEMS FOR AUDIENCES SUCH AS ELEMENTARY STUDENTS

Engineering Section

See Physics, Atmospheric and Space Sciences

Environmental Science and Health Section, Business Meeting

Room 408

Geology Section (continued on page 33)

SECTION MEETINGS

Saturday, See individual sections for room and schedule.

Geology Room 144

- 8:30 – 8:50 **101.** UPDATE ON THE DIXON SITE, 13WD8: A FRONTIER ONEOTA VILLAGE ON THE LITTLE SIOUX RIVER.
- 8:50 – 9:10 **129.** AN UPDATE ON THE NORTHEAST IOWA INTRUSIVE COMPLEX (NEIIC)
- 9:10 – 9:30 **102.** FROM BIRD TO BONE: ADDING TO AN ARCHAEOLOGIST'S COMPARATIVE COLLECTION
- 9:30 – 9:50 **130.** CHARACTERIZATION OF DRY RUN CREEK SEDIMENTS
- 9:50 – 10:10 **103.** PRESERVATION OF THE JOHN AND PHIL PALMQUIST COLLECTION FROM SOUTHWESTERN IOWA
- 10:10 – 10:30 **131.** THE PRODUCTION OF ALKALIC MAGMAS IN NORTHEAST NEW MEXICO: A CALL TO OLD, FAILED RIFTING
- 10:30 – 10:45 **Section Business Meeting – Select Section Chair and Vice Chair**
- 11:00 – 11:55 **General Session III**
- Noon – 12:30 **Lunch**

Iowa Science Teaching Section

See Chemistry

Organismal Biology Section

See Physiology and Health Sciences

Physics, Atmospheric and Space Sciences

Room 308

- 9:10 – 9:30 **136.** MAGIC SIZED AU ISLANDS ON MOS2
- 9:30 – 9:50 **137.** QUANTITATIVE TECHNIQUES FOR MODELING AND ANALYZING IMAGES AND TIME SERIES DATA FROM INTRACELLULAR TRANSPORT AND SINGLE MOLECULE MICROSCOPY
- 9:50 – 10:10 **135.** STATE SELECTIVE SINGLE ELECTRON CAPTURE FROM MOLECULES BY HIGHLY CHARGED IONS
- 10:10 – 10:30 **138.** QUASI-CONTINUOUS STELLAR PHOTOMETRIC MONITORING FROM AN IOWA SITE
- 10:30 – 10:45 **Section Business Meeting – Select Section Chair and Vice Chair**
- 11:00 – 11:55 **General Session III**
- Noon – 12:30 **Lunch**

Physiology and Health Sciences Section

Room 406

- 8:50 – 9:10 **139.** INVESTIGATION INTO THE USE OF A CNM HERBAL INDUCER CONTAINING ACTAEA RACEMOSA, LEONURUS CARDIACA, MITCHELLA REPENS, AND VIBURNUM OPULUS AS APPLIED TO ISOLATED MUS MUSCULUS UTERINE STRIPS
- 9:10 – 9:30 **134.** THE ROLE OF MORPHOLOGY, PHYSIOLOGY, AND DENSITY IN MALE REPRODUCTIVE SUCCESS IN A FRESHWATER TURTLE
- 9:30 – 9:50 **141.** IMPLANTATION SPACING OF EMBRYOS IN MUS MUSCULUS EXPOSED TO ATRAZINE

SECTION MEETINGS

Saturday, See individual sections for room and schedule.

Physiology and Health Sciences Section continued

- 9:50 – 10:10 **133. MISSISSIPPI RIVER TURTLE TRAP SUCCESS BASED ON BAITING**
- 10:10 – 10:30 **140. THE CONTRACTILE EFFECTS OF VARIOUS SPECIES OF THE ANGELICA GENUS ON ISOLATED UTERINE TISSUE OF MUS MUSCULUS**
- 10:30 – 10:45 **Section Business Meeting – Select Section Chair and Vice Chair**
- 11:00 – 11:55 **General Session III**
- Noon – 12:30 **Lunch**

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NOTES

ABSTRACTS BY SECTION

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

Anthropology: Poster Presentations

1. PRESERVATION OF THE JOHN AND PHIL PALMQUIST COLLECTION FROM SOUTHWESTERN IOWA

Keely Kinsella, Maizy Fulgate, and Jacqueline O'Neill
University of Iowa Office of the State Archaeologist

In Fall 2018, John Palmquist, a longtime member of the Iowa Archeological Society, transferred care of his collection of archaeological artifacts into the hands of the Office of the State Archaeologist for inclusion in the State Archaeological Repository. The John and Phil Palmquist Collection, rare for most private collections, consists of well documented and responsibly collected artifacts acquired across southwestern Iowa over many years, and includes uncommon projectile point types as well as other rare artifacts. The diligence of the Palmquists in carefully and ethically collecting archaeological materials while preserving the scientific information associated with them will serve to enhance our understanding of southwestern Iowa's archaeological history. It also serves to illustrate an example of the merits of cultivating relationships between responsible avocational archaeologists and professionals. This presentation will summarize the findings of research in progress on the collection, as well as highlight future avenues of potential study.

Anthropology: Oral Presentations

101. UPDATE ON THE DIXON SITE, 13WD8: A FRONTIER ONEOTA VILLAGE ON THE LITTLE SIOUX RIVER.

Mark Anderson
University of Iowa Office of the State Archaeologist

The Dixon Site, 13WD8, is a village occupied by the Oneota, archaeologically recognized in the early 1950s, with excavations conducted in 1964 and 1994. These studies documented a slice of the life-ways of these agricultural peoples. Continued monitoring of the site indicated that the Little Sioux channel was eroding the remaining site area between the channel and Highway 31. Because of this, the Iowa DOT planned a bank stabilization project triggering the data recovery excavations that took place during the 2016-2017 seasons. These investigations documented the remains of structures, numerous pit features, hearths, work areas, and occupation debris including ceramic vessels, lithic tools and manufacturing waste, shell, worked and unworked bone and antler, canine remains, a copper artifact, and large quantities of fire cracked rock. With the draft report completed, this presentation will cover our understandings of the Dixon site and discuss the Oneota occupations in northwest Iowa.

102. FROM BIRD TO BONE: ADDING TO AN ARCHAEOLOGIST'S COMPARATIVE COLLECTION

Seraphina Carey
Iowa Office of the State Archaeologist

An archaeologist's wide array of tools doesn't just include shovels or microscopes. A comparative collection, whether it be pottery or lithics, helps with identifying materials during analysis and can change the course of an investigation. Compiling a detailed comparative collection takes a lot of specialized work, however, especially when it comes to bone. This presentation details the steps needed to turn a whole specimen into a valuable asset of an archaeologist's toolkit and shows how this side of archaeology is far messier than anyone going into the field could've anticipated. Oral (Saturday, April 27, 2019)

103. PRESERVATION OF THE JOHN AND PHIL PALMQUIST COLLECTION FROM SOUTHWESTERN IOWA

Warren Davis
University of Iowa Office of the State Archaeologist

In Fall 2018, John Palmquist, a longtime member of the Iowa Archeological Society, transferred care of his collection of archaeological artifacts into the hands of the Office of the State Archaeologist for inclusion in the State Archaeological Repository. The John and Phil Palmquist Collection, rare for most private collections, consists of well documented and responsibly collected artifacts acquired across southwestern Iowa over many years, and includes uncommon projectile point types as well as other rare artifacts. The diligence of the Palmquists in carefully and ethically collecting archaeological materials while preserving the scientific information associated with them will serve to enhance our understanding of southwestern Iowa's archaeological history. It also serves to illustrate an example of the merits of cultivating relationships between responsible avocational archaeologists and professionals. This presentation will summarize the findings of research in progress on the collection, as well as highlight future avenues of potential study.

Cellular, Molecular, & Microbiology: Poster Presentations

2. ANNOTATION OF TWO SOIL MYCOBACTERIOPHAGES: JACOREN57 AND DRLUPO

Ali Almail, Kelsey Dorhout, Jackson Johnson, and Hannah Jorgensen
Northwestern College

We discovered two novel Mycobacteriophages from soil samples. JacoRen57 is a singleton, most closely related to

cluster AB phages. DrLupo is a member of the rare H2 sub-cluster containing only one other member. Both phages exhibit a siphoviridae morphotype, double-stranded DNA genome, and a non-contractile tail. The genome of JacoRen57 is composed of 52,411 base pairs with a 56.7% GC content and includes genes and plaque morphologies that suggest a lytic life cycle. The genome is organized according to the following order from the left to right arm: 33 forward genes followed by 16 reverse genes and 24 forward genes. We identified functions for 33 of the 73 protein coding genes using bioinformatics software. The 70,030 base-pair genome of DrLupo has a 57.5% GC content and contains genes that support a lytic life cycle. We identified 110 forward genes and assigned functions to 25 of them.

3. ANALYSIS OF MAFB POLYMORPHISMS ASSOCIATED WITH RISK OF NON-SYNDROMIC OROFACIAL CLEFTING

Hannah Ashley
Waldorf University

Orofacial clefting (OFC) is a birth defect affecting 1 of 700 live births in the U.S., causing physical deformities that lead to difficulty breathing, feeding, and speaking. Syndromic cases (30%) arise from single gene mutations. Nonsyndromic cases (70%) are more complex, with many contributing elements, including multiple “partially defective” genes caused by single base-pair DNA changes (single nucleotide polymorphisms, SNPs). SNPs contribute to many human diseases, often by altering transcription levels; however, specific causative alleles are difficult to pinpoint because they tend to travel in haplotype blocks. We study the effects of individual polymorphisms on transcription levels within the MAFB locus. Three alleles from one haplotype block associated with OFC were chosen based on histone acetylation data from a previous study. We used single base-pair substitutions to create alternate alleles (normal and risk-associated) for each SNP, which were inserted into reporter vectors and transfected into epithelial cells for examination of their transcriptional effect using a luciferase reporter system. Functional SNPs will have quantitative allele-specific effects on oral epithelium enhancer activity, suggesting a causal relationship between that SNP and development of OFC. Based on preliminary results, we expect to find at least one functional SNP with quantitative allele-specific enhancer activity.

4. IDENTIFICATION OF POLYMORPHISMS WITHIN THE KERATIN 8/18 LOCUS THAT DIRECTLY INFLUENCE RISK FOR NON-SYNDROMIC OROFACIAL CLEFTING ^{βββ}

Sydney Beasley and Carol Fischer
Waldorf University

Orofacial clefting (OFC) defects, including cleft lip, cleft palate, and cleft lip/palate, are the most common craniofacial birth defects in humans, affecting 1 in 700 live births in the

United States and approximately 1 in 833 live births worldwide. OFC defects cause a range of disorders related to feeding, breathing, speech, obstructive sleep apnea, and hearing. Several independent genome-wide association studies (GWAS) implicate a number of SNPs in nonsyndromic OFC but GWAS studies cannot distinguish between risk-associated and nonrisk-associated SNPs because they are in linkage disequilibrium during meiotic segregation thus, all the SNPs in one haplotype block carry similar risk for OFC. Previous studies indicate a group of SNPs in the keratin 8/18 gene locus as strongly associated with risk for OFC. We will create alternate alleles (normal and disease-associated) for SNPs chosen based on published histone acetylation data, insert them into reporter vectors, and transfect those vectors into human epithelial cells to test whether they affect the translation using luciferase reporter methods. Because the identified group of SNPs are associated with OFC risk, we expect to find at least one SNP within this group with quantifiable allele-specific effects on enhancer function within the regulatory region.

5. KILLER CATS ON THE LOOSE: PREVALENCE OF TOXOPLASMA GONDII

Natalie Brewer, Kathryn Keller, Kayanna Wibben, and Brittany Williams
Buena Vista University

Toxoplasma gondii is an intracellular protozoan whose definitive host is the Felis catus (domestic cat) and has a range of intermediate hosts including rodents and humans. Behavioral changes in the host have been correlated with the T. gondii infection. Our research includes blood samples from house cats, stray cats, Bos taurus (cattle), and Canis lupus familiaris (dogs who have never been exposed to cats). We used PCR and gel electrophoresis to determine the current infection rates of T. gondii for 50 animals in the local area. We also conducted an ELISA test to determine if the subjects had ever been exposed to T. gondii in the area at any period of time.

6. A GENOMICS-INFORMED INVESTIGATION OF THE EFFECT OF TGFB SIGNALING IN EMERY-DREYFUS MUSCULAR DYSTROPHY ^{βββ}

Grace Engelman¹, Tanner Schimtz¹, Jennet Hojanazarova¹, Gary Coombs¹, and Lori Wallrath²
Waldorf University¹, University of Iowa²

Autosomal dominant Emery-Dreifuss Muscular Dystrophy, EDMD, is caused by a mutation in the LMNA gene, and causes muscle atrophy and dilated cardiomyopathy. In a family in which 5 members carry the LMNA mutation R527P, whole exome sequencing revealed a mutant allele of SMAD7, an inhibitor of TGF-β signaling, unique to 2 strongly affected family members. We hypothesized that this mutant SMAD7 allele is a modifier of the EDMD phenotype. Therefore, the TGF-β signaling pathway may be a therapeutic target in

muscular dystrophy. Pirfenidone, Tranalast, and Repsox were studied in fruit flies due to their established inhibition of TGF- β signaling and their relative water solubility. We used fruit flies expressing an EDMD-associated lamin C mutation (G489V) to model human EDMD. Fly symptoms include impaired larval locomotion and strongly reduced survival of pupation. 562 mM pirfenidone increased survival through pupation by 61%, and c2 analysis indicated significance ($p = 0.013$). Pirfenidone also increased larval locomotion by 67%, but did not achieve statistical significance ($p = 0.064$). 182 mM Repsox did not improve locomotion or survival. 280 mM Tranalast produced a 4.65 fold significant increase in survival of pupation ($p = 0.00003$), but no benefit to larval locomotion.

7. AN IN VITRO ASSAY TO IDENTIFY POLYMORPHISMS THAT DIRECTLY INFLUENCE RISK FOR NON-SYNDROMIC OROFACIAL CLEFTING ^{BBP}

Jennet Hojanazarova
Waldorf University

Orofacial cleft (OFC) is a craniofacial birth defect that affects 1 in 700 live births in the United States annually¹. About 30% of all OFC are syndromic and inherited in Mendelian fashion from parents to children. However, 70% of OFC cases are non-syndromic (NS) and affected by a combination of multiple defective alleles and probably influenced by environmental factors. The majority of disease-causing alleles are in non-coding regions. Genome-wide association studies (GWAS) provide a link between single nucleotide polymorphism (SNP) markers and risk for NS OFC; they identified risk-associated blocks of linkage disequilibrium—non-random association of alleles at different loci—each containing functional and non-functional SNPs². We hypothesize that risk-associated allele will have a quantitative effect on the enhancer's activity level in an oral epithelium cell line, relative to the non-risk associated allele. We will select candidate SNPs at 12q13 locus based on H3K27ac chromatin marks and effects on the enhancer's activity level. We will amplify chromatin elements harboring candidate SNPs, amplify chromatin elements with risk alleles for site-directed mutagenesis. We will transfect the candidate SNPs with risk and non-risk alleles into GSM-K to test for enhancer activity. We expect enhancer activities to be affected resulting in OFC.

8. MICROTUBULE-ASSOCIATED PROTEIN TAU AMPLIFIES STRESS-INDUCED p38 SIGNALING IN NEURONAL CELL

Merle Bublitz, Elvis Castro, Jacob Katzer, Joel Katzer, Ons Souissi, and Chad Leugers
Morningside College

The neuronal microtubule-associated protein tau 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 hypoxia and hyperglycemia have been shown to cause significant neuronal atrophy and cell death in neurodegenerative diseases such as Alzheimer's disease. As the role of tau in the p38 pathway is still unknown, we aim to investigate its role in cellular response to stressors such as hyperglycemia and simulated hypoxia. Our preliminary evidence suggests tau increases MAPK signaling in response to simulated hypoxia. However, the specific mechanism for the amplification of the MAPK pathway remains unclear. Here, we have used immunoprecipitations to further understand the impact of tau on MAPK signaling by measuring p38 activation in PC6-3 neuronal cell lines. Furthermore, we have used cell viability assays to study the impact of tau overexpression on hyperglycemic cell death. Our data shows that tau also increases cell death under hyperglycemic conditions. The findings from these experiments will increase our understanding of tau's interactions with the abnormal MAPK signaling that occurs in neurodegenerative diseases.

9. RELATIONSHIPS BETWEEN THE POLYMORPHISMS OF BETA-3 ADRENERGIC RECEPTOR GENE AND DEIODINASE GENE IN THE DEVELOPMENT OF TYPE 2 DIABETES MELLITUS

Rasika Mudalige-Jayawickrama
University of Dubuque

The development of type 2 diabetes mellitus (DM) is dependent on many genetic, hormonal, and nutritional factors. Impaired energy metabolism and thermogenesis, along with visceral fat deposition are key factors in the development of obesity and DM. One of the key genes directly involved in lipid metabolism and thermogenesis encodes the beta 3-adrenergic receptor gene (ADRB3) while deiodinase gene (DIO2) indirectly affects the energy metabolism via regulation of active thyroxin production. A single nucleotide polymorphism (SNP) Trp64Arg of ADRB3 gene and Thr92Ala of DIO2 gene was shown to be associated with impaired sugar metabolism in some populations. The objective of this study is to find whether there is any relationship between the presence of Trp64Arg polymorphism of ADRB3 and Thr92Ala polymorphism of DIO2 and the occurrence of DM in two distinct pedigrees. We isolated human DNA from 18 individuals belonging to 2 distinct pedigrees and amplified parts of ADRB3 and DIO2 genes by PCR. The PCR fragments were digested with BstNI and BsgI enzymes respectively. The genotype of each sample was identified. Our results do not indicate a strong association of DM with the Trp64Arg polymorphism. However, we see most of the individuals in 1 pedigree with DM carries at least one Thr92Ala variant for DIO2.

10. EVALUATING THE EFFICACY OF FREEZING-INDUCED GENES OF APLECTRUM HYEMALE BY HETEROLOGOUS EXPRESSION

Stephanie Pfab, Rasika Mudalige-Jayawickrama, and Lalith Jayawickrama
University of Dubuque

A unique Iowa orchid known as putty-root orchid (*Aplectrum hyemale*) produces a functional green leaf in mid-October and keeps this leaf viable until the next spring. We isolated partial clones of 16 freezing-induced genes from putty-root orchid via cDNA suppressive-subtractive hybridization. We chose four key genes encoding Glyceraldehyde 3-phosphate dehydrogenase (GAPDH), C2 domain/containing protein (AHC2GR), W80 repeat-containing protein (AHW80) and late embryogenesis abundant protein (LEA-1) for further study. Their annotated functions suggest they are involved in accumulation of osmoticum (GAPDH), membrane repair after freezing damage (AHC2GR), transcription factors that enhance freezing tolerant gene expression (AHW80) and prevent protein aggregation under water stress (LEA-1). In order to test their efficacy, we isolated full open reading frame of each gene and cloned them into a binary vector pORE-E4. We are in the process of transforming *Arabidopsis thaliana* plants with the four key genes via *Agrobacterium*-mediated transformation. Once transformed we will evaluate the efficacy of each transformant by challenging them with sub-zero temperatures. This research gives us an important opportunity to show how native plants can pave the path towards a better understanding of stress tolerance and supplement the genetic tools to improve our crops in a rapidly changing environment.

11. BEELZEBUB, RAELA, REDRAIDER11, AND ANTONIA: THREE CLUSTER S MYCOBACTERIOPHAGES AND A B1 CLUSTER PHAGE

Kristina Sevcik, Peace Preston, and Michaela Aulner
Northwestern College

We isolated, purified, and characterized four novel Mycobacteriophages: Raela, Beelzebub, RedRaider77, and Antonia from soil samples collected from South Dakota, Colorado, and Nebraska. Raela, Beelzebub, and RedRaider77 are among the first cluster S phages sequenced to date, and Antonia was found to be a member of cluster B1. All four phages are lytic, siphoviridae in morphotype, contain double-stranded DNA genomes, and have long, flexible non-contractile tails. The genomes of Raela, Beelzebub, and RedRaider77 consist of 65,380 base pairs, 65,529 base pairs, and 64,827 respectively. Antonia's genome contains 68,573 base pairs. Raela, Beelzebub, and RedRaider77 have a 63.4% GC content, while Antonia has a 66.5% GC content. Using bioinformatics software, we assigned functions to 34 of 117 genes in Raela, 36 of 118 in Beelzebub, and 31 of 115 in RedRaider77. The three cluster S phages contain minor tail proteins in the far right arm of the phage, a characteristic unique to cluster S mycobacteriophages. We assigned functions to 30 of 101 of Antonia's genes and found that its genome resembled other cluster B1 phages. None of the four

phages contained tRNA genes and all contained both forward and reverse genes.

12. INDUCTION OF LIPID BODIES IN LEISHMANIA INFANTUM-INFECTED C57BL/6 MACROPHAGES OF MALE VERSUS FEMALE ORIGIN

Victor Soupene¹, Ryan Lockard¹, Mary Wilson², and Nilda Rodriguez¹
University of Northern Iowa¹, University of Iowa²

Worldwide, 12 million people are infected with the parasitic protozoa *Leishmania* spp. The parasite has two stages: promastigote and amastigote. Promastigotes are carried by sand fly vectors, inoculated in animal hosts, and internalized by macrophages where they convert into amastigotes and cause disease. *L. infantum* is the causative agent of visceral leishmaniasis, a potentially fatal disease. Epidemiological data has shown that males are more likely to develop visceral leishmaniasis. In addition, we have shown that parasite survival is increased within macrophages of male-origin. We have also reported that *L. infantum*-infected macrophages accumulate lipid bodies. Lipid bodies are organelles that metabolize lipids and modulate immune responses. Furthermore, lipid bodies could also provide nutrients for the parasite. Preliminary data of *L. infantum*-infected macrophages showed increased number of lipid bodies in macrophages of male- versus female-origin. Specifically, upon *L. infantum* infection the number of lipid bodies increased from 89 to 317 in female-derived macrophages, whereas in male-derived macrophages the increase was from from 158 to 527. We hypothesize that increased lipid body expression in macrophages of male-origin facilitate parasite survival and provide a basis for the increased male susceptibility in *L. infantum* infection.

13. AROMATASE MRNA EXPRESSION IN GONADS OF MICE (*MUS MUSCULUS*) EXPOSED TO ATRAZINE IN UTERO. ^{PPP}

Erika Thiel
Saint Mary's University of MN

In the 1960s, atrazine became a widely used triazine herbicide in America. The Corn Belt region of the Midwest contains the most prominent areas of atrazine usage. In order to kill unwanted vegetation, atrazine inhibits electron transport of photosynthesis. When atrazine washes out of the soil, it may contaminate the water sources of those living near areas of atrazine usage and cause harm to animals as well as plants. Prior research has shown that atrazine works as an endocrine disruptor. By stimulating aromatase, atrazine converts testosterone into estradiol. Elevated aromatase activity has been linked to a variety of health problems, such as the feminization of males and possibly cancer. The mechanism for the elevated aromatase activity is unknown and could be

activation of the enzyme or increase expression of the aromatase gene. The purpose of the present study was to determine whether atrazine increases aromatase mRNA expression in the gonads of *Mus musculus* exposed in utero to 3, 30 and 300 ppb atrazine.

14. NOVEL DATA ANALYSIS METHODS IN MULTI-CHANNEL AND MULTI-STATE BINDING EXPERIMENTS

Joseph Tibbs
University of Northern Iowa

Single-Molecule studies use advanced microscopy techniques to view biomolecules, such as proteins and DNA, individually. On a slide, fluorescently-labeled molecules are immobilized and imaged using lasers, and the patterns of fluorescence can give important information about the interactions of multiple molecules. However, if multiple proteins bind at the same location, or if proteins labeled with different colors bind, the possibilities for more complicated binding combinations and dynamics are almost endless. Which combinations are most common, the binding duration of each protein, or the probable binding/dissociation order of each subunit are all data which can inform on the underlying mechanism behind the interaction. The first goal of this project is to create a method to robustly normalize (correct for brightness) single-channel fluorescence data. The second goal is to extend pattern recognition of binding order to multi-state and multi-channel binding patterns. The KERA 3.0 suite links creative pattern-recognition and normalization techniques with the abilities of existing idealization software to extract this information from previously intractable data. This allows researchers to study protein complexes, their inhibitors, and their mechanisms, more holistically and more efficiently.

15. ANTI-PROLIFERATIVE EFFECTS OF GRAPESEED, JUNIPER BERRY, AND TURMERIC EXTRACTS ON CELLS IN VITRO

Joseph Kelly, Christopher Borchers, Perkins Aiyegbeni, Paige Boote, Brittany Buren, Katie DeKruyff, Emily Geraets, Chau Le, Rachel Mercer, Courtney Mithelman, Haley Muyskens, Renju Pun, and Zachery Rossen
Northwestern College

In 2018, the World Health Organization identified cancer as responsible for 1 in 6 deaths globally, encouraging the exploration of creative forms of cancer treatment. Our research interests include identifying anti-proliferative plant extracts and illuminating mechanisms of growth inhibition. In this study we measured the effects of *Vitis vinifera* (grape seed), *Juniperus communis* (juniper berry), and *Curcuma longa* (turmeric) extracts on the proliferation of several normal and tumorigenic cell strains and lines (HFF-S2, HeLa, HepG2, and MDA MB 231). We performed dose response CyQUANT

assays to analyze the effects on cell growth. We are using DNA analysis, recovery experiments, and DAPI staining to investigate whether our extracts induce apoptosis in these cells. Our results showed dose-dependent inhibition of cell growth in vitro with all three extracts but not with extracts from other plants. The results of this study suggest the potential for further study of components of grape seed, juniper berry, and turmeric extracts as potential chemo preventive agents.

16. IDENTIFICATION OF PROTEINS INTERACTING WITH THE ALPHA SUBUNITS OF ACTIN CAPPING PROTEIN

Ryan Bennett
Minnesota State University, Mankato

Capping protein (CP) is an actin binding protein composed of an alpha and a beta subunit, which is important for actin assembly and cell motility. Whereas lower organisms have one gene and one isoform of each subunit, higher organisms have multiple alpha isoforms ($\alpha 1$, $\alpha 2$ and $\alpha 3$) with conserved sequences defining highly conserved subfamilies. CP $\alpha 1$ and CP $\alpha 2$ share >90% sequence identity and the regions of divergence are highly conserved among the subunits across vertebrate. Endothelial cells contain only CP $\alpha 2$, and erythrocytes contain almost exclusively CP $\alpha 1$. Most tissues have both isoforms but the ratio of $\alpha 1$: $\alpha 2$ varies widely. The highly conserved sequence conservation and distinct expression patterns of CP $\alpha 1$ and CP $\alpha 2$ support our hypothesis that the CP alpha isoforms have conserved, unique and essential roles in vertebrates and will therefore, interact with unique proteins. We executed a yeast two-hybrid screen to identify proteins that interact with CP $\alpha 1$ and CP $\alpha 2$. To date, approximately 100 clones have been identified for both CP $\alpha 1$ and CP $\alpha 2$. We are currently using a liquid culture B-Galactosidase assay for quantitative analysis of the protein interactions. The clones with the strongest interactions, correlating with the highest B-Galactosidase activity, will be sequenced and analyzed using a Bioinformatic approach.

Cellular, Molecular, & Microbiology: **Oral Presentations**

104. THE EFFECT OF EPIREGULIN AND TBX2 ON ACTIVATION OF THE EGFR FAMILY IN THE MCF10A CELL LINE ^{BBB}

Lucas Campbell
Saint Mary's University of Minnesota

Breast cancer is not only the most common form of cancer in the world, affecting about 3 million women worldwide, but it is also the most prevalent form of cancer diagnosed in females in the United States. The amplification and overexpression of the TBX2 transcription factor has been strongly associated with 40% of breast cancers. Yet, the specific function of TBX2 in cancer remains unknown. Nonetheless, there is evidence that the overexpression TBX2 can result in a cell's ability to bypass

senescence and promote tumorigenesis by inhibiting anti-cell growth factors p19ARF and p21WAF1/CIP1 and downregulating the p53 tumor suppressor. Recent studies have also suggested that TBX2 activates epiregulin expression. Previous data epiregulin's binding to EGFR and HER4, not HER2 or HER3. The interplay between epiregulin and the epidermal growth factor receptors (EGFR) – EGFR, HER2, HER3, and HER4 – remains somewhat controversial. As such, the objective of this study is to elucidate activation of EGFRs in MCF10A human, mammary epithelial cells either expressing or not expressing TBX2. Transfections will be carried out using a lentiviral-based system, and expression of activated receptors in response to TBX2 expression will be determined via western blot analysis of the EGFR family of receptors' phosphorylation. The results from this study will provide further insight regarding epiregulin's activation of the EGFR family in the presence of overexpressed TBX2, ultimately providing additional information regarding the complexities of breast cancer.

105. QUANTIFYING PATHOGENS AND POTENTIAL SOURCES IN RECREATIONAL WATERS IN NE IOWA

Jorge Chavez¹, Shau Khadka¹, Mitch Kaleso¹, Claire Hamilton¹, Becca Mullenbach¹, Rachel Penningroth¹, Josh Tank¹, Fadzai Teramayi¹, Aaron Firnstahl², Mark Borchardt³, Jodi Enos-Berlage¹, and Eric Baack¹
Luther College¹, Upper Midwest Water Science Center, USGS, Marshfield, WI², Environmentally Integrated Dairy Management Research Unit, USDA-ARS, Marshfield, WI³

The springs, streams, and rivers of NE Iowa are widely used for recreation, but prior research has shown that they can have high levels of fecal bacteria. We sampled surface and well water in Winneshiek county in the summer of 2018, pumping samples through ultrafilters to trap pathogens as well as microbes that could indicate sources of contamination. Pathogen and tracer DNA was quantified using qPCR. Two-thirds of the surface water samples contained pathogens, with *Cryptosporidium* being present most frequently. Pathogen levels varied dramatically between sites and sample dates. Source markers revealed the presence of human and cow feces as potential sources of contaminants, but pig-specific markers were not detected. We are working to develop a risk assessment for recreational contact with these pathogens.

106. INHIBITION OF BACTERIAL GROWTH BY ESSENTIAL OILS

Julia Hanacek and Shannon Mackey
St. Ambrose University

Each year, over 2 million people in the United States are infected with an antibiotic-resistant bacterium, such as methicillin-resistant *Staphylococcus aureus*. The rise in antibiotic resistance has made it much more difficult to treat infectious disease, and antibiotic alternatives are needed. Natural therapies, such as essential oils, may enhance treatments for MRSA by stopping its growth. In this study, disc diffusion and minimum inhibitory concentration (MIC) assays

will be performed to evaluate the efficacy of essential oils isolated from geranium, parsley, lavender, and cedarwood against the growth of the bacterium, *Staphylococcus epidermidis*. If the oils are not able to inhibit the growth of *Staphylococcus epidermidis*, there is strong reason to conclude that the oils are not able to kill methicillin-resistant *Staphylococcus aureus*. If, however, the oils are effective at inhibiting the growth of *Staphylococcus epidermidis*, then there is evidence to suggest that the oils may be able to inhibit the growth of methicillin-resistant *Staphylococcus aureus*. The inhibition of *Staphylococcus epidermidis* may also indicated that essential oils could be the future for treating antibiotic-resistant bacterial infections.

107. SULFORAPHANE INDUCED CHEMOTHERAPEUTIC EFFECTS ON JURKAT T LYMPHOCYTE

Rebecca Hoerres and Karli Smith
Graceland University

Sulforaphane is a naturally occurring compound found in broccoli seeds and has been shown to be a promising chemotherapy agent for a variety of cancer cell lines. Human Jurkat cells were incubated with various concentrations of sulforaphane for 24 h. Cell viability assay was used to determine the drug's effectiveness in killing the cells. Western Blot and DNA Fragmentation assays will be used to determine if sulforaphane induced death via an apoptotic pathway.

108. PREVALENCE OF ANTIBIOTIC RESISTANCE GENES CHICKEN MICROBIOTA

Savea Hull and Sydney Dorrance
Graceland University

Salmonella spp. was isolated from Amish and non-Amish chicken farms. The *Salmonella* spp. was tested for antibiotic resistance against ampicillin, tetracycline, trimethoprim sulfamethoxazole, and streptomycin using a zone of inhibition assays. The DNA of the antibiotic resistant *Salmonella* spp. was isolated and a PCR was run with the primers against blaCMY2, tetA, sulI, and aadD antibiotic resistance genes. Antibiotic resistance genes present in Amish and non-Amish farms were compared.

109. EXAMINING THE PRESENCE OF ANTIBIOTIC-RESISTANT BACTERIA IN COW MILK & MEAT IN RELATION TO DIFFERENT FARMING METHODS: CONVENTIONAL VS ORGANIC ^{βPP}

Jocy Magana and Michael Vitalini
St. Ambrose University

The World Health Organization (WHO) categorizes antibiotic resistance as one of the biggest threats to society. Although antibiotic resistance is a natural process that occurs over time, the misuse by humans in healthcare and agriculture exacerbates the problem. Antibiotics are used therapeutically in agriculture, however, conventionally-raised livestock are often prophylactically treated for diseases and growth promotion.

Conversely, to be certified “USDA Organic” the organic food sector does not allow for livestock to be treated with antibiotics. With the use of antibiotics, the microbiome of the livestock is predicted to change, as antibiotic-resistant bacteria (ARB) out-compete antibiotic-sensitive bacteria. The consumption of conventionally raised cattle products may increase the risk of contraction of ARB in humans. Although this link has not been fully established, prior studies have isolated ARB from produce and meats sold to consumers. This research will examine the hypothesis: Conventionally raised cattle will result in food products with a higher incidence of antibiotic-resistant bacteria than organically raised cattle. This study will be conducted by examining total bacterial load and ARB load for meat and milk from conventional and organic farms. Results of this ongoing study will be presented.

110. THE EFFECTS OF SEPSIS ON SKELETAL MUSCLE MITOCHONDRIA OVER DIFFERENT PERIODS OF TIME^{βββ}

Bailey Matthaidess and Paul Bartelt
Waldorf University

When infection causing microorganisms reach the bloodstream of their host, they release endotoxins, causing sepsis. Sepsis is the body’s response to the endotoxins that triggers cytokine release, leading to inflammation throughout the body. The body needs cytokines to regulate inflammation, but with sepsis the body overproduces cytokines, leading to tissue damage, organ dysfunction, and mortality. People who survive sepsis suffer from muscle wasting and weakness caused by damage to cristae and matrices of skeletal muscle mitochondria. Currently, we know little about how and when mitochondrial muscle damage occurs during the sepsis process. To better understand this process, we are injecting mice with *E. coli* lipopolysaccharides (LPS) to induce sepsis. After euthanizing the mice at different time intervals (12, 24, 36, etc. hours), we will dissect muscle tissue and prepare it for microscope examination. Using electron microscopy, we will examine muscle mitochondria cristae and matrices, and quantity amounts of cristae misfolding and other damages. We expect to see increasing amounts of damage with increasing amounts of time for sepsis development. If we can identify when muscle damage first appears and its increasing severity, this may help us better understand the onset and progression of sepsis and its damage to muscles.

111. LONG-TERM SURVIVAL OF CANDIDA ALBICANS ON SOLID MEDIA DOES NOT DEPEND ON GLYCOGEN

Martin Schmidt, Anatole Openshaw, and Marcus Zeitz
Des Moines University

The human pathogenic yeast *Candida albicans* stores carbohydrates in the form of glycogen. The expression of the glycogen synthase gene *GSY1* is controlled by PKA signaling through the transcription factor *Efg1*. *Efg1*-deficient mutants have low *GSY1* expression and low glycogen content – but also poor survival on solid surfaces. We hypothesized that low glycogen content is responsible for poor long-term survival of

C. albicans - which would suggest glycogen synthesis as a potential target for antifungal drug development. To establish a link between glycogen content and survival we screened *C. albicans* mutant libraries for strains with low glycogen content and determined those mutant’s survival on solid medium over 10 weeks. The glycogen/survival analysis included strains with defects in PKA/*Efg1* signaling and newly constructed *gsy1/gsy1* mutant strain. Library screening identified 21 strains with low glycogen content, of which only one showed short survival. Deletion of *GSY1* produced a glycogen-free strain but did not affect survival. The role of PKA signaling was ambiguous, with only 2 out of 11 examined strains showing a correlation between glycogen and survival. We conclude that survival of *C. albicans* on solid media does not depend on glycogen content but instead on an as-yet unidentified target of *Efg1*.

Chemistry: Poster Presentations

17. REVISITING PROJECT ON MOLECULAR GASTRONOMY OF COFFEE: EXPLORING THE SCIENCE OF FLAVOR

Kayla Breunig, Emily Griggs, Ray Harrington, and Amandeep Arora
University of Dubuque

Coffee is one of the most popular and complex foods that humans ingest. Several studies have tried to investigate the chemistry behind the flavor of coffee and tried to build instrumental approaches to quantify it. However, exploring the relationship between flavor components of coffee with instruments at molecular level is not clear yet. In this study, the relationship between the level of different flavor components and in variables such as temperature and storage conditions has been studied using gas chromatography-mass spectrometry.

18. MEASURING THE ENERGY DIFFERENCE BETWEEN CIS AND TRANS ALKENES USING BOMB CALORIMETRY

Julia Rodewald
University of Dubuque

In 2013, the Weaver group explored a method of accessing less stable geometrical *cis* styrenes from their thermodynamically more stable *trans* isomers via visible light mediated isomerization using a tris *Ir(ppy)₃* photocatalyst. An energy transfer mechanism is responsible for this unusual reactivity. In order to build deeper understanding of the project, both *cis* and *trans* isomers were synthesized as described by Weaver (JACS, 2014) using substrates which would give the maximum *E/Z* selectivity. The energy associated with each isomer was then measured using bomb calorimetry.

Chemistry: Oral Presentations

112. COMPUTATIONAL STUDY OF THE EFFECT OF ELECTRON DONATING AND ELECTRON WITHDRAWING GROUPS ON A NAPHTHAQUINONE MECHANISM

Samantha Aguilar and Ashley Garr
Central College

The mechanism for the addition of methylamine to a substituted naphthaquinone in DMSO was examined computationally at the M062x/6-311+G(d,p) level of theory. Previous calculations showed a concerted substitution mechanism for dichloro- and dibromonaphthaquinone, while difloronaphthaquinone underwent a stepwise substitution. In this study, the mechanistic effects of electron donating and electron withdrawing substituents on the quinone ring were examined. Substituents included methyl, methoxy, nitrogen dioxide, cyanide, amine, chlorine, bromine, and fluorine. The effects observed with non-halogen substituents showed correlations with electron withdrawing groups following a stepwise pathway and a concerted pathway for electron donating.

113. CONTAMINANTS AREN'T THE BOMB: A SURVEY OF BATH BOMBS FOR POTENTIAL TOXINS

Gabrielle Marchese and Mark Sinton
University of Dubuque

Cosmetics do not need FDA approval before being marketed unless they claim to have drug properties. As a result, cosmetics can contain substances that could be harmful to the consumer. While a variety of cosmetics have been tested for toxic substances by both the FDA and independent researchers, bath bombs have not been studied. As such, a survey for the presence of potential harmful contaminants in luxury, mid-range, and economy bath bombs was conducted. Our results indicate that none of the bath bombs surveyed contained detectable ppm levels of lead, chromium, cadmium, nickel, arsenic, or cobalt. Our analysis of the bombs for organic contaminants revealed that while no FDA banned substances were found, several contained compounds banned either in certain states, in the European Union, in Canada, by the International Fragrance Association, or were known possible carcinogens. Our data also showed that there was no difference as to whether a particular bath bomb was considered a luxury, mid-range, or economy brand.

114. DEVELOPMENT OF FINGERPRINTS ON PAPER FOR AN INTRODUCTORY FORENSIC SCIENCE COURSE

Madelaine Quistgaard and Jeffrey Butikofer
Upper Iowa University

Upper Iowa University has an introductory forensic science laboratory course that involves processing a mock crime scene with ongoing analysis of collected evidence. The crime scene scenario involves white office paper on which a suspect has written a note and left behind latent fingerprints. A commercially available ninhydrin spray has been used to develop the prints. Ninhydrin reacts with amino acids in the oils left behind on the paper to produce a colored compound known as Ruhemann's purple. The spray has produced inconsistent results over the lab scenarios in which it has been used and there is also interest in reducing the cost associated with the laboratory. A systematic study had been undertaken to find a suitable alternative that produces better results. A standardized method for depositing and assessing fingerprints on paper was developed. Two common ninhydrin solution formulations have been explored as alternatives to the spray. Additionally, control of the variables associated with color development in the reaction such as darkness, relative humidity, and temperature has been attempted. Relative humidity seems to be one of the more important factors in producing a successful outcome.

115. A MOLECULAR DYNAMICS SIMULATION AND SUBSTRATE DOCKING STUDY OF MUSHROOM TYROSINASE

Victor Zaki and Mark Sinton
University of Dubuque

The enzyme tyrosinase has a unique temperature activity profile that depends on its source. For example, the common mushroom form of the enzyme has maximal activity at 50°C, but no activity beyond 70°C, while the Russet potato form is active all the way up to 80°C. In order to understand these differences, we have been attempting to crystallize Russet potato tyrosinase in order to generate an X-ray structure that we could analyze for structural differences that may contribute to these observations. Unfortunately, this has proven difficult, so while we continue to work on getting potato tyrosinase crystals, we wondered if we couldn't do something similar on the "back end" by using the published common mushroom tyrosinase crystal structure to simulate it's structure at high temperature in order to understand why this version of the enzyme doesn't have activity beyond 70°C. Our results to date suggest that mushroom tyrosinase substrate binding is very weak at low temperatures, indicating that the enzyme loses the ability to bind substrate at high temperature.

Community College Biologists: Poster Presentations

19. DAPHNIA MAGNA EXPOSED TO HIGH LEVELS OF NITROGEN-RICH UREA FOR A SHORT PERIOD OF TIME HAVE AN INCREASED FATALITY RATE THAN THAT OF DAPHNIA MAGNA EXPOSED TO LOW

LEVELS OF NITROGEN-RICH UREA FOR A PROLONGED PERIOD OF TIME

Deaven Denis
Kirkwood Community College

Because *Daphnia magna* have often been used as an indicator species for freshwater quality, and because Iowa's industrial farming practices have negatively impacted freshwater quality and greatly contributed to the 'dead zone' in the Gulf of Mexico, the impact of nitrates from industrial fertilizer runoff on the mortality rate of the crustacean *Daphnia magna* was the focus of this study. Six cultures of *Daphnia magna* were used for this experiment to evaluate the impact of nitrogen rich urea on their mortality rates. Containers 1 and 4 contained exclusively spring water and served as controls. *Daphnia magna* in containers 2 and 5 experienced short term, high-intensity exposure to a 10.0g/L solution of dry urea for 20 minutes. *Daphnia magna* in containers 3 and 6 experienced long term, low-intensity exposure to a 0.5g/L solution of dry urea throughout the course of this experiment. Their mortality rates were recorded throughout the course of this study. I rejected my hypothesis that the long term, low-intensity experimental group would have an decreased mortality rate compared with the short term, high intensity experimental group because the results presented a trend which was the reverse of this expected outcome.

Ecology and Conservation: Poster Presentations

20. MULTIPLE PATERNITY IN WILD WHITE-TAILED DEER DETECTED USING HIGH-THROUGHPUT SEQUENCING ^{aaa}

Gabrielle Blair¹, Thomas Litchfield², and Dawn Reding¹
Luther College¹, Iowa Department of Natural Resources²

Effective management of white-tailed deer (*Odocoileus virginianus*) requires understanding of social behavior and breeding structure. Recent genetic studies in captive deer exhibiting multiple paternity within litters have challenged the view that deer exhibit a strict dominance-based breeding hierarchy with few males siring most offspring. To identify whether multiple paternity is occurring in wild populations, we performed genetic analyses on tissue from 63 road-killed does and their fetuses (n=199) collected 2013-2017 in Iowa. We used 2bRAD-sequencing, a novel approach for SNP identification and allele scoring that is potentially suitable for degraded samples. After successfully genotyping individuals from 49 litters at approximately 3000 SNPs, we calculated pairwise relatedness values to identify full- and half-siblings. Preliminary results show evidence of multiple paternity in 2 of 10 sets of triplets and 8 of 40 sets of twins (overall 20% of litters). 2bRAD was a viable and cost-effective option for genotyping degraded DNA samples from large mammals.

Multiple paternity appears to be prevalent in wild white-tailed deer, indicating that mating opportunities are more widespread for males than previously assumed. Management policies should take into account this new information on the mating system, and additional research should investigate variables influencing rates of multiple paternity.

21. OWL RESPONSE TO CALL PLAYBACK AT THE VOLGA RIVER STATE RECREATION AREA

Emily Frank and Paul Skrade
Upper Iowa University

Population surveys for nocturnal species are primarily conducted using call playback, i.e. broadcasting a recording of the species' calls and listening for their response. Northern Saw-whet Owls (NSWO, *Aegolius acadicus*), Eastern Screech-Owls (EASO, *Megascops asio*), Long-eared Owls (LEOW, *Asio otus*), Barred Owls (BADO, *Strix varia*), and Great Horned Owls (GHOW, *Bubo virginianus*) all either breed and/or overwinter in Iowa and are associated with forested areas. These surveys are typically performed from roadsides, but forest can affect detection distance. We compared the effectiveness of winter call playback surveys conducted from roadside parking to surveys 200m adjacent to the road. These were performed at five paired locations at the Volga River State Recreation Area (VRSRA) that were dispersed over the 5,700 acre property. We also compared activity in relation to moon phase. There was no significant difference in the number of owl detections at roadside points compared to road-adjacent points. GHOW were the most responsive during the full moon, whereas BADO were detected more frequently during the last quarter of the moon. NSWO and LEOW overwinter in Iowa in low numbers and were not detected at any points. EASO are present in the VRSRA but were not detected at any points.

22. PHENOLOGY AND CLIMATE CHANGE: USE OF DIGITIZED DATA TO UNDERSTAND PLANT RESPONSE ^{aaa}

Michaeleen Gerken Golay and Jacob Buchheim
Wartburg College

In the past century, climate change has had unparalleled adverse effects on plants and animals. Phenological research offers a mechanism to monitor these effects. In the past decade, methods for obtaining phenological data from herbaria specimens have been digitized and searchable. This study examined *Hydrophyllum virginianum*, which undergoes unique seasonal changes in leaf morphology, to identify long-term effects of climate change on phenology. We recorded data relevant to phenology (collection location and collection date) from the information cards of over 2,000 digitized samples, which are available online through IDigBio. We assigned each specimen a phenological score corresponding to flowering/fruitlet stage as well as leaf characteristics. We obtained

temperature data for the study period (1895-2017) from the National Oceanic Atmospheric Administration. We linked phenology data to monthly standardized temperature data. We created divisional April-June temperature averages for each year and then assigned to samples with corresponding locations and dates. We used multiple regression to analyze the relationships between temperature and the timing of phenological events. Previous studies have shown that phenological events occur earlier in the year as the climate warms, and we note insights on reproductive and vegetative shifts that occur in *Hydrophyllum virginianum*.

23. MULTIYEAR STUDY TO DETERMINE TICK-BORNE PATHOGENS ALONG THE MISSISSIPPI RIVER IN RODENTS AND TICKS

Taline Holman, Thomas Scroggs, Brianna Finnegan, Alec Rutherford, David Koch, Gerald Zuercher, and Kelly Grussendorf
University of Dubuque

Though Lyme disease is primarily known as a disease of the northeast, it continues to increase throughout the Midwest. There has been a significant increase in the number of reported cases in recent years in the state of Iowa, particularly eastern Iowa. To get a better understanding of the prevalence and transmission of *B. burgdorferi* we carried out trapping and sample collections from reservoir hosts, primarily small rodents. A pilot study was conducted in 2016 where 84% of captured rodents carried *B. burgdorferi*. During 2017, 91 rodents were captured from four different locations. The prevalence of *B. burgdorferi* varied at these different locations, ranging from very low (4%) to very high prevalence rates (86%). During summer of 2018 we expanded the study to eight different sites in hopes to determine correlating factors of the previous year's prevalence rates. We trapped a total of 260 small rodents. Molecular analysis is currently being carried out to determine the prevalence of *B. burgdorferi* from these collected samples. Each year's results will be compared to the first year as a basis and analysis will be done to correlate ecological factors influencing the habitat of captured rodents and ticks and prevalence of *B. burgdorferi*.

24. THE BIRDS OF GREEN WING ENVIRONMENTAL LABORATORY NORTHCENTRAL ILLINOIS

Kelly J. McKay¹ and Stephen B. Hager²
BioEco Research and Monitoring Center¹, Augustana College²

Green Wing Environmental Laboratory (GWEL), a biological field station in the Prairie Peninsula Physiographic Area of northcentral Illinois contains 170 hectares of forest fragments, edge, wetlands, and grasslands. Our objective was to assemble a cumulative list and summarize baseline ecological information for the avifauna of GWEL based on field studies from 2001-2007. During this time, we observed 188 species

within 17 orders and 47 families. Abundant summer breeders included: Red-winged Blackbird (*Agelaius phoeniceus*), Song Sparrow (*Melospiza melodia*), and Gray Catbird (*Dumetella carolinensis*). During fall and spring migration, Lesser Yellowlegs (*Tringa flavipes*), Golden-crowned Kinglet (*Regulus satrapa*), and Yellow-rumped Warbler (*Setophaga coronata*) were abundant. In winter, abundant species included the American Crow (*Corvus brachyrhynchos*), Dark-eyed Junco (*Junco hyemalis*), and Blue Jay (*Cyanocitta cristata*). We observed many species of conservation concern, such as Golden-winged Warbler (*Vermivora chrysoptera*), Common Yellowthroat (*Geothlypis trichas*), Wood Thrush (*Hylocichla mustelina*), and Eastern Whip-poor-will (*Antrostomus vociferus*). Edge nesting species, such as Red-winged Blackbird and Gray Catbird, experienced high reproductive success. However, limited observations of breeders in interior-edge habitat suggest that these birds, e.g., Red-eyed Vireo (*Vireo olivaceus*) and Veery (*Catharus fuscescens*), may suffer from high rates of nest depredation and parasitism by the Brown-headed Cowbird (*Molothrus ater*).

25. PERSISTENCE OF BIRD CARCASSES RESULTING FROM WINDOW COLLISIONS IN AN URBAN LANDSCAPE

Kelly J. McKay¹, Stephen B. Hager², and Bradley J. Cosentino³
BioEco Research and Monitoring Center¹, Augustana College², Hobart and William Smith Colleges³

Estimating the magnitude of avian-window mortality is difficult and may be influenced by scavenging activities. Failure to account for removal of carcasses by scavengers has the potential to bias estimates of window mortality. We tested the hypothesis that carcass persistence depends on local habitat factors related to scavenger behavior and the timing of carcass deposition. Scavenger activity on bird carcasses was documented within an urban landscape in northwestern Illinois. Daily carcass persistence was greater in winter than non-winter (spring, summer, and fall). Persistence was negatively related to canopy cover and window area and positively related to pavement cover. Using an exponential model of persistence time, estimated mean persistence of carcasses ($t \pm 1$ SE) was 82.9 ± 11.7 days for winter and 11.8 ± 7.2 days for non-winter. Motion-triggered cameras revealed that raccoons (*Procyon lotor*) scavenged more carcasses than other species and 63% of carcasses were removed at night. Overall, our results suggest that local habitat structure creates variation in the persistence of avian victims from window collisions by mediating scavenger behavior and carcass deposition at buildings. Bias associated with carcass persistence may be reduced if building surveys for collision victims were conducted at time intervals of ≤ 3 days.

26. SUMMARY AND RESULTS OF THE 2005-2008 MILAN BOTTOMS BALD EAGLE NIGHT ROOST SURVEY PROJECT

Kelly J. McKay¹, Cathleen D. Monson¹, Robert R. Bryant¹, Walter M. Zuurdeeg¹, Jennifer A. Rothe¹, Mark J. Bolinger¹, Brian P. Ritter², Jason L. Monson¹, Albert J. Frohlich³, and Brian L. Blevins¹

BioEco Research and Monitoring Center¹, Nahant Marsh Education Center², U.S. Army Corps of Engineers, Rock Island District³

The Upper Mississippi River (UMR) represents one of the largest wintering concentrations of Bald Eagles (*Haliaeetus leucocephalus*) in North America. However, human development activities continue to encroach on the floodplain habitats of the UMR. For example, economic development (i.e. casino) is occurring immediately adjacent to the Milan Bottoms Complex in Rock Island County, Illinois. Evidence suggests that this area functions as a major night roost location for wintering Bald Eagles. Therefore we conducted a standardized night roost survey here over three winters (2005-2008), in order to document the importance of this site to wintering eagles. Surveys were conducted weekly from early December through late March. In 2005-2006, 10,386 observations of night roosting eagles were recorded. In contrast, only 2,553 observations were reported in 2006-2007. Eagle numbers increased in 2007-2008 to 6,957 observations. The majority of eagle observations occurred in December and January, with steadily decreasing numbers in February and March, respectively. The upstream end of Milan Bottoms (i.e. the widest tract of floodplain forest habitat) appears to be the most heavily utilized portion of the study area for night roosting purposes. This project documented Milan Bottoms as one of the largest wintering Bald Eagle night roosts along the UMR.

27. EVALUATING THE DRIVERS OF BIRD-WINDOW COLLISIONS AT THE UNIVERSITY OF WISCONSIN - PLATTEVILLE

Kelly J. McKay¹, Ryan T. Schmitz², Elizabeth E. Tanner², and James L. Nooyen Jr.²

BioEco Research and Monitoring Center¹, University of Wisconsin – Platteville²

Urbanization throughout North America appears to be resulting in greater amounts of avian mortality due to bird-window collisions (BWCs). Current estimates suggest 500 million to 1 billion birds may be perishing annually. This project assessed how building size, window area, and the amount of vegetation near buildings were influencing BWCs on the University of Wisconsin – Platteville campus during the 2013 fall migration season. Six study buildings were selected and stratified by size and the percent vegetation occurring near the building. We examined the influence of structural variables such as total window area, number of building stories, and total building

floor area, as well as the environmental variable (percent vegetation near a building) on BWC mortality. Seven carcasses were documented among 7 species. No significant relationship existed between the number of carcasses and any of the variables analyzed ($P > 0.05$). Nevertheless, higher R² values for total window area and building floor area suggest these two structural factors may be potentially driving BWCs. The lack of significant results may be due to small sample sizes ($n = 6$ buildings; $n = 7$ carcasses; $n = 1$ year), as well as relatively similar amounts of vegetation occurring near each building.

28. EFFECTS OF STRUCTURAL FACTORS ON BIRD-WINDOW COLLISIONS WITHIN URBAN SETTINGS

Kelly J. McKay¹, Ryan T. Schmitz², Erikajo Johnson², Lindsay Maas², Jake Manning², Marissa A. Martin², and Michael Unser²

BioEco Research and Monitoring Center¹, University of Wisconsin – Platteville²

Current estimates assert that as many as one billion birds in North America are killed annually due to collisions with windows. We assessed the potential effects of building area as well as window area, reflectivity, and transmittance on the frequency of bird-window collisions (BWCs) on the University of Wisconsin – Platteville campus. We measured total building floor space, total window area, as well as window transmittance and reflectivity at each of six study buildings. Eleven carcasses of BWC victims were recovered, representing 7 species and 1 unidentified species. All carcasses occurred at the three buildings with the greatest amount of floor space (ranging from 5,139 to 15,788 m²), as well as the largest amount of window area (ranging from 180 to 729 m²). Consequently, both building floor space and the amount of window area significantly influenced the number of fatalities resulting from BWCs ($P < 0.05$). Visible light reflectance (VLR) averaged 83.7%, while the average visible light transmittance (VLT) was 64.1%. Neither VLR nor VLT significantly influenced the number of BWC fatalities. Results suggested that larger buildings with greater amounts of window area created a higher risk for BWC mortality, while smaller buildings with less window area reduced this risk.

29. INFLUENCE OF LAND COVER ON BIRD-WINDOW COLLISIONS IN AN URBAN LANDSCAPE

Kelly J. McKay¹, Ryan T. Schmitz², Amanda M. Carpenter², Nicole A. Schoefnacker², Kody K. Habeck², Larissa A. Ruchotzke², and Chase W. Tuescher²

BioEco Research and Monitoring Center¹, University of Wisconsin – Platteville²

Estimates suggest up to one billion birds annually die across North America as a result of bird-window collisions (BWCs). Urban landscapes are a mosaic of building structures, impervious surfaces, lawn, and woody vegetation. The

objective of this project was to assess the influence of habitat availability relative to the quantity of fatal BWCs on the University of Wisconsin – Platteville campus. We monitored BWC at six buildings over a 21-day study period. To assess the impact of land cover on BWCs, we categorized land cover composition (i.e. woody vegetation, grass, impervious surfaces, and building structures) occurring near each building using ArcGIS. Daily BWC carcass surveys were conducted around each building. Eleven BWC victims were recorded including 7 identified species and 1 unidentified species (i.e. feather pile). None of the four land cover types measured produced a significant relationship involving BWC mortality ($P > 0.05$). However, our small sample sizes ($n = 6$ buildings; $n = 11$ carcasses) may have been insufficient to detect a relationship between various land cover types occurring around buildings and the risk of BWCs. We suspect that the presence of various land cover types in an extended area around buildings may be influencing BWC mortality.

30. ASSESSING AVIAN SPECIES VULNERABILITY TO BIRD-WINDOW COLLISIONS

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Bird-window collisions (BWCs) are considered to be one of the greatest human-related sources of avian mortality throughout North America. However, previous research has indicated a variety of species which appear to be more highly vulnerable to BWC mortality (e.g. American Robin, Cedar Waxwing, White-throated Sparrow, as well as various thrush and warbler species). The objective of this study was to document which species were vulnerable to BWCs on the University of Wisconsin – Platteville campus during the fall migration season. During this project, six buildings on campus were monitored for the presence of window collision victims. Eleven carcasses representing 7 identified and 1 unidentified species were recovered. Six of these species were Neotropical Migrants, along with a single non-migratory Permanent Resident (i.e. House Sparrow). We collected no carcasses of North American Migrant species. BWC victims recovered during this research included: 3 Ruby-throated Hummingbirds, 2 Tennessee Warblers, and 1 each of Ovenbird, Nashville Warbler, Common Yellowthroat, Chestnut-sided Warbler, House Sparrow, and an unidentified “feather pile.” Although 82% of the carcasses were Neotropical Migrants, this may be the result of the study period occurring near the peak of Neotropical migration and before many North American Migrants had begun their fall migration.

31. A PRELIMINARY ASSESSMENT OF THE BUILDING AND LANDSCAPE FACTORS INFLUENCING BIRD-

WINDOW COLLISIONS IN NORTH AMERICA WITH A FOCUS ON FISH AND WILDLIFE REGION 3 - MIDWEST

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Urban growth throughout North America appears to affect variation in bird-window collisions (BWCs). However, the factors driving this variation remain unexplored. We tested the hypothesis that the magnitude of BWCs reflects landscape structure at local and regional scales. Researchers at 40 sites throughout North America documented (a) collision mortality ($N = 340$ carcasses, 71 species) and (b) building characteristics ($N = 282$ buildings). We also measured land cover at local (< 50 meters) and regional (10 kilometer) scales. Analysis suggested that three factors explained 71% of the building and landscape data. These factors included: “open flight space” in the landscape, building size, and the degree of urban infrastructure. Furthermore, building characteristics and urban infrastructure interact to affect the number of BWC victims. Collisions were positively related to factors associated with building size (i.e. floor space, window area, stories), but the positive relationship was stronger in rural rather than urban landscapes. U.S. Fish and Wildlife Service Region 3 – Midwest contained 10 study sites, which documented mortality in 27 species. Within Region 3, the Hermit Thrush had highest mortality in Bird Conservation Region (BCR) 22, while the Ruby-throated Hummingbird was highest in BCR 23. The Tennessee Warbler was documented in all BCRs.

32. THE EFFECTS OF BUILDING SIZE, WINDOW AREA, AND DEVELOPMENT ON BIRD-WINDOW COLLISIONS IN AN URBAN LANDSCAPE

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Increased urban development throughout the United States has resulted in greater levels of bird-window collision (BWC) mortality. Current estimates of annual BWCs do not account for the influence of various factors such as building size, window area, and the proportion of development or habitat near buildings. We assessed how various building and environmental factors were related to fatal BWCs. In the fall of 2014, we documented the number of bird carcasses resulting from window collisions at six buildings on the University of

Wisconsin – Platteville campus. We conducted daily BWC carcass surveys around each building over 21 consecutive days. Eleven carcasses were recovered, consisting of seven known and one unknown species. The Ruby-throated Hummingbird (*Archilochus colubris*) was the most prevalent species killed. Overall, BWCs had a significant positive relationship to window area and building size ($P < 0.05$). However, the relationship to land cover around buildings was not significant ($P > 0.05$). This project supports and adds to the current understanding regarding the impacts of large buildings with large window areas to BWCs. In order to minimize the risk of BWCs, as well as promoting avian conservation, we offered suggestions which may reduce the number of fatalities that occur due to window collisions.

33. AN EVALUATION OF STUDENT SEARCHER EFFICIENCY IN A BIRD-WINDOW COLLISION STUDY

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Estimates of avian mortality resulting from window collisions vary considerably due to several potential biases inherent in this type of research. One source of possible bias involves the ability of researchers to detect the carcasses of birds killed by collisions with windows. We assessed searcher efficiency at detecting bird carcasses during an ongoing avian-window collision project on the University of Wisconsin – Platteville campus during the fall of 2015. We placed bird carcasses at study buildings and assessed the ability of two groups of student researchers to detect the carcasses. The first group consisted of independent research students (IRS) who volunteered to perform the avian-window collision study, and the second group was biology students (BIOS) working on the project as part of a required course. Test birds were categorized according to the degree of detection probability. Although the IRS were slightly more efficient at detecting carcasses compared to the BIOS, these differences were not significant. There was a significant difference based on the degree of difficulty of test birds ($P < 0.05$). The results of this project suggest that using “citizen scientists” for avian-window collision research may produce a substantial underestimation of the overall avian mortality resulting from window collisions.

34. PRESENCE AND DIVERSITY OF LASIOGLOSSUM BEES IN ADJACENT PRAIRIE AND TEMPERATE DECIDUOUS FOREST IN THE DRIFTLESS REGION OF EASTERN IOWA

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Native bee species are essential to the survival of a variety of prairie plants due to their roles as pollinators and they play a crucial part of Iowa’s wetland, prairie, oak savannah, and

temperate deciduous forest ecosystems. The *Lasioglossum* genus (*Halictidae*) is one of the many bee genera found in Iowa and is one of the largest and highly diverse in the world. The hundreds of *Lasioglossum* species vary in size, color, specialization, ecologically niches, and geographic ranges. The minute differences that distinguish the many *Lasioglossum* species make this genus largely unidentified, and often misidentified. To gain a better understanding of the native *Lasioglossum* diversity in the geologically unique driftless region of Iowa, bee specimens were collected using fluorescent blue, yellow, and white pan traps, set at ground level in parallel 120 meter transects in adjacent prairie and forest environments within the Grant-Little Maquoketa and Apple Plum watersheds. Of 740 collected bees, *Lasioglossum* bees were the most abundant, making up 60% of total prairie and forest specimens. The proportions and significance of *Lasioglossum* (*Dialictus*), *Lasioglossum* (*Lasioglossum*) and *Lasioglossum* (*S.st*) as well as the implications for diversity and health of the ecosystems will be discussed.

35. BASELINE DATA COLLECTION FOR LONG-TERM TERRESTRIAL INSECT BIOMONITORING DURING THE “INSECT APOCALYPSE”

Sarah Meyer, Alyson Eversman, Lily Peschau, Alison Wagner, Sabrina Tarchione, Nathan Eide, Shay Kamstra, David Rowley, Todd Tracy, and Laurie Furlong
Northwestern College

Just as Rachel Carson brought the imperilment of birds to the world’s attention in 1962 with her book *Silent Spring*, we are now hearing alarming news about the global insect biodiversity. The bleak news includes the loss of honeybees and other pollinators potentially threatening millions of people with malnutrition, and starvation being the likely cause of the startling loss of nightingales, turtledoves, bee-eaters, and other insectivorous birds from much of their range in Eurasia. Little baseline data have been collected regarding insect populations and communities, such that the reports of severe insect losses in many area are just anecdotal (e.g., fewer insects splattered on windshields). The rising awareness of threats to avian biodiversity in the 1960s led to the implementation of breeding bird surveys in North America and other parts of the world. Likewise, we propose the use of pitfall cups and “bee bowls” to conduct long-term surveys of terrestrial insect biodiversity. During early fall 2018, we conducted 24-hour pitfall and bee-bowl sampling at two locations in Sioux County. In this poster, we discuss our methods, present our findings, and discuss how these techniques can be used in both long-term biomonitoring and in assessing the success of habitat restoration projects.

36. USING MUSSEL GROWTH CURVES TO DETERMINE ANTHROPOGENIC IMPACTS ON MUSSEL DEVELOPMENT

Addy Schober, Amanda Magana, and Adam Hoffman
University of Dubuque

Freshwater mussels (*Bivalvia*: *Unionoida*), as filter feeders, play an essential role in aquatic ecosystems and are sensitive to changes in water quality. A recent emerging threat to aquatic ecosystems is the presence of microplastics. Threeridge mussels (*Amblema plicata*) were collected by pollywogging around 9-Mile Island in Pool 12 of the Mississippi River. To explore the relationship between potential stress caused by microplastics and mussel growth we collected, dissected, and digested the mussels to allow for quantification of microplastics present in their digestive tissues. Shells were sliced from the umbo up the ventral margin, and the growth rings were counted allowing for the determination of the age for each mussel. Mussel ages were compared to mussels aged in 2011 and 2012 in similar fashion and also compared to the growth rates for mark and recaptured *A. plicata*. Growth rates were compared between the recaptured and collected mussels to allow for a quantitative analysis between methods. The impacts of microplastics in the digestive tissues on the growth rate of *A. plicata*. will be discussed.

37. SEASONAL STORAGE OF CARBON, NITROGEN, AND PHOSPHORUS IN TWO PERENNIAL FOREST HERBACEOUS PLANTS^{aaa}

Paige Shafer, Brooke Klostermann, and Michaeleen Gerken Golay
Wartburg College

Herbaceous perennials in a forest ecosystem play a role in seasonal nutrient cycling. *Hydrophyllum virginianum* L., (Virginia waterleaf) and *Asarum canadense* L. (wild ginger), are perennial herbaceous plants with different seasonal growth patterns native to mesic hardwood forests. Both flower early, but *H. virginianum* senesces and produces a second flush of leaves by late summer, while *A. canadense* leaves persist after flowering. Our specific question of interest was whether there is a difference in nutrient storage in leaves and roots between spring and summer in these two species. We excavated plants in the spring and summer to determine carbon (C), nitrogen (N), and phosphorus (P) concentration and content of each nutrient in two locations (above and below ground). Our findings indicate complex patterns across the growing season in the location of nutrients in *H. virginianum* and *A. canadense*. Biomass is an important driver of nutrient storage, as evidenced by *A. canadense* patterns. We suspect a different strategy for *H. virginianum* related to the second flush of leaves, potentially be linked to photosynthetic capacity.

38. SEQUENCE OF SF1 IN SPINY SOFT-SHELLED TURTLE APALONE SPINIFERA TO TEST ITS POTENTIAL ROLE AS A SEX-DETERMINING GENE

Anthony Sillman, Beatriz Mizoguchi, and Nicole Valenzuela
Iowa State University

Sex determination is the establishment of an individual's sexual fate during development, which in animals include genotypic sex determination (GSD) and environmental sex determination (ESD). GSD may involve two separate chromosomes (e.g. XY and ZW). Sex chromosomes carry the top-most trigger of the male/female developmental pathway, which is unknown in turtles. The steroidogenic growth factor (*Sf1*) gene is critical in testicular development in vertebrates. We studied the turtle *Apalone spinifera* (GSD-ZW). Cytogenetic studies mapped *Sf1* genes to Z and W chromosomes, rendering *Sf1* a candidate sex-determining gene. It is unknown if *Sf1* maintains the same sequence in the Z and the W, or if there are Z- and W- specific alleles, one of which might be 'the' sex determining factor in *Apalone spinifera*. PCR and gene sequencing were used to test for a difference in the DNA sequence or size of *Sf1* between the sexes that would indicate chromosome-specific alleles. Preliminary PCR results show that male and female *Sf1* amplicons yield a single band of same size, which indicate no difference in allele size of the *Sf1* gene in the Z and W chromosomes. Sequencing is ongoing to detect difference at the nucleotide level of chromosome-specific alleles.

39. HUMAN ACTIVITY AND RECREATIONAL LAND USE IN TREMPPEALEAU NATIONAL WILDLIFE REFUGE^{aaa}

Angela Soto
Saint Mary's University of MN

Recreational land use is a popular form of outdoor activity. The impacts humans can have when they invade the natural land can be detrimental to the health of animal and plant populations whose habitats can be found in these areas. Information about how people use the land can be used to find areas with similar characteristics to the areas that people have been found to frequent before, and predict places where there are higher chances of people recreating. Non-conformist behaviors are of interest due to the higher potential for these behaviors to have harmful impacts on the ecosystem. In this study, various spaces within Trempealeau National Wildlife Refuge were explored with the objective of locating certain signs of people participating in non-conformist behaviors. A GPS was used to record wherever these behaviors were observed. This data were statistically analyzed using Maxent modeling software to find predictors that influenced where these behaviors occurred, and these predictors were then used to create a map highlighting areas of interest with these predictors to determine where non-conformist behaviors could occur in the future.

40. ESTIMATION OF THE FREE-RANGING CAT POPULATION IN FAYETTE, IOWA

Rebecca Stramer and Paul Skrade
Upper Iowa University

Fayette is a small town of ~1300 residents in northeast Iowa with small residential university and a large number of free-ranging cats (*Felis catus*; truly feral, partially domesticated – either recently released or provided with shelter and/or food, or indoor/outdoor house pets) within the city limits. Other studies have found that free-ranging cats can have a strong negative impact on native prey species such as rabbits, birds, and squirrels as well as possibly spreading diseases to pets and humans. We attempted to estimate the population of free-ranging cats within the city limits of Fayette by deploying 1-5 motion-activated trail cameras in residential yards and on the Upper Iowa University campus. We documented and identified photographed individuals based on coat characteristics such as fur coloration or length. In three months of observations we documented 16 identifiable cats as well as other mammal species (Eastern Gray Squirrel, *Sciurus carolinensis*; Raccoon, *Procyon lotor*; Virginia Opossum, *Didelphis virginiana*; White-tailed Deer, *Odocoileus virginianus*; Eastern Cottontail Rabbit, *Sylvilagus floridanus*; and domestic dogs, *Canis lupus familiaris*). Preliminary mark-recapture analysis estimates a population size of 24 cats for the city limits, however this is likely biased low, as the study covered extensive periods of extreme winter weather.

41. SUBSTRATE COLONIZATION BY MACROINVERTEBRATES IN A DEGRADED LOW- ORDER STREAM

Sabrina Tarchione, Sarah Meyer, Alyson Eversman, Shay Kamstra, Elison Wagner, Lily Peschau, David Rowley, Todd Tracy, and Laurie Furlong
Northwestern College

Many streams in Northwest Iowa experience degradation by agricultural activities, producing increased sedimentation, low habitat heterogeneity and poor water quality. Only macroinvertebrate taxa tolerant of these conditions persist in impacted streams, resulting in relatively low taxonomic richness. We explored the effects of increasing habitat heterogeneity in a degraded low-order stream by introducing multiple colonization substrata (gravel, concrete stepping-stones and leaf bags). We hypothesized that abundance and richness of colonizing macroinvertebrates would be significantly higher in and on more complex substrata (gravel and leaf bags vs. stepping-stones) and that abundance and richness would increase with increasing colonization time. Overall, macroinvertebrates colonizing the introduced substrata were typical of degraded streams (e.g. oligochaetes, midge larvae and hydropsychid larvae). We found that macroinvertebrate richness and abundance varied significantly with substrate type. Abundance varied with both length of colonization time and colonization month (September vs. October). In addition, we found that some taxa preferentially colonized some substrata (i.e. leaches colonized only leaf bags;

Hydropsyche colonization was significantly higher in gravel and leaf bags than on stepping-stones). We plan to use these baseline data for comparison as land use immediately adjacent to our study sites transitions from agricultural use to residential development.

42. LEAF MORPHOLOGY OF THE FOREST PERENNIAL HYDROPHYLLUM VIRGINIANUM THROUGHOUT THE GROWING SEASON

Kelly Worm-Beneke, Grace Morningstar, and Michaelleen Gerken Golay
Wartburg College

Hydrophyllum virginianum is a common forest floor plant in the Midwest. The plant emerges before canopy leaf-out in the spring but leaves may be observed persisting late into fall. Therefore, we wondered if leaf morphology or physiology vary in response to changing environmental conditions (light level, temperature, and soil moisture). The goal of this research was to explore relationships between environmental conditions and chlorophyll a/b ratios, stomatal densities, and leaf size. The data is collected by monitoring marked plants throughout the year and taking periodic samples of plants in the same area for laboratory processing. Preliminary data indicate two distinct sets of leaves, those abundant in spring and those that occur sporadically after July. Early leaves and later season leaves differ in stomatal density and chlorophyll ratios, although further exploration into environmental variables is underway.

Ecology and Conservation: Oral Presentations:

116. RESPONSE OF EASTERN TIGER SALAMANDERS TO RESTORED WETLANDS ON AN AGRICULTURAL LANDSCAPE IN NORTH CENTRAL IOWA

Paul Bartelt¹ and Alyse DeVries²
Waldorf University¹, Cerro County Dept. of Public Health²

We measured occupancy and movement patterns of Eastern Tiger Salamanders among recently restored wetlands in Winnebago County, IA. In 2014, we used visual encounter surveys and unbaited minnow traps to estimate occupancy in 45 ponds among 19 restored wetlands, including 14 ponds among 5 wetlands that were restored in 2013. Each pond was surveyed at least twice. Naïve estimates of salamander occupancy was 60% (27/45) of all ponds and 67.7% (21/31) of older ponds (2-20 years old). Occupancy models (\emptyset) showed that salamanders occupied 74+21% of all ponds and 90+26% of older ponds. In 2015 and 2016, we used radio-telemetry, GPS, and a GIS to map movement and habitat use patterns of 35 salamanders. We tracked each salamander for 8-108 days (56+35 SD) and made a total of 313 observations; they made daily movements of 0-135 m and traveled a total of 50-708 m from their breeding ponds. Fourteen (40%) salamanders were eaten by predators; two were killed by agricultural equipment.

We found them in wetlands and the surrounding restored prairie habitats in 35% and 60%, respectively, of our observations; only three salamanders traveled into agricultural fields, accounting for 6% of our observations, occupying burrows during 85% of our observations.

117. RESOLVING PHYLOGENETIC RELATIONSHIPS BETWEEN STEREOUM FUNGI SPECIES

Sarah DeLong-Duhon and Andrew Forbes
University of Iowa

Stereum is a cosmopolitan genus of stereoid, wood-decay fungi characterized by thin leathery brackets with smooth undersides. Several species are common in Iowa's woodlands, and have been implicated to have useful antimicrobial qualities. Although previous research has examined phylogenetic relationships between the phenotypically-similar but genetically disparate stereoid fungi, little is known about the relationships within *Stereum* itself. Further complicating matters, many *Stereum* species are notoriously difficult to identify macroscopically, as few species have reliable associations, and many demonstrate considerable morphological variation. In the literature, *S. hirsutum* has been assumed – based on microscopy – to be in a species complex with *S. complicatum* and *S. subtomentosum* but this has not been verified through genetic work. To address this question and evaluate the reliability of phenotypic characteristics to species designations, we collected *Stereum* specimens from eastern Iowa, identified them based on macromorphology (size, habit, basidiocarp color, presence/absence and color of bruising/bleeding, host tree, etc.), and sequenced each at the internal transcribed spacer (ITS) locus. Using these data, we built phylogenetic trees to determine the phylogenetic relationships between species, and map phenotypic traits onto these trees to assess the congruence between phenotypic traits and taxonomic designation.

118. FERAL CAT HOME RANGE AND SURVIVAL RATES IN FAYETTE, IOWA

Hannah Dotter and Paul Skrade
Upper Iowa University

Feral cats are domesticated felines that live in the wild in a variety of different habitats and limit/avoid contact with humans. They have a strong negative impact on native prey species due to hyperpredation and rapidly increasing numbers. Some communities attempt to limit cat population growth by capturing, sterilizing, and returning to their capture site, a process known as Trap-Neuter-Return (TNR). Fayette is a city of ~1,300 people in rural Iowa with a known population of feral cats; however, nothing is known about the population demographics. We live-trapped and radio-collared four feral cats in Fayette to estimate their home range size and survival rates and to examine possible effects of TNR. These consisted

of an intact male and female and a neutered male and female. We determined the locations of collared cats three times a day from October 23, 2018 to February 22, 2019. All four cats survived the study period, which included record-breaking low temperatures and extensive snow cover. The intact male and neutered female had larger home ranges than the neutered male and intact female. However this was likely due to the availability of food and shelter provided by local residents.

119. OVERVIEW AND ANALYSIS OF THE WORK OF A.P. AND LAURA MORGAN

Graham Hagan and Deborah Lewis
Iowa State University

Andrew Price (A.P.) Morgan (1836-1907) was an American mycologist who primarily studied the fungi of the Miami River Valley in Ohio. He and his wife, Laura Vail Morgan (1844-1936), collected fungal specimens and exchanged specimens with others, building a collection of nearly 3700 specimens. Laura Morgan illustrated specimens that could not be preserved well with the technology of that time, creating over ~630 illustrations. The Morgan Collection of specimens, illustrations, and letters between A.P. Morgan and other botanists and mycologists was donated by Laura Morgan to the University of Iowa Herbarium following the death of A.P. Morgan. This collection came to Iowa State University's Ada Hayden Herbarium with the merger of the two herbaria in 2004. The specimens have been digitized and uploaded to the Mycological Collections Portal. Laura Morgan's illustrations have been scanned and cataloged, with the goal of also uploading the images to the Portal, making them also available online. Analyses are underway of 1) notable correspondence, especially between A.P. Morgan and C.G. Lloyd, 2) the illustrations made by Laura Morgan, concentrating on the medium, techniques, and organizational system used, and 3) typification of names of fungal taxa described and illustrated by the Morgans

120. IMPACTS OF SUNFLOWER DOMESTICATION ON THE EVOLUTION OF ITS SPECIALIST INSECT HERBIVORES

Alaine Hippee¹, Marc Beer¹, Robin Bagley¹, Marty Condon², Allen Norrbom³, and Andrew Forbes¹
University of Iowa¹, Cornell College², National Museum of Natural History³

Many insect species display strong host associations with one or a few host plant species throughout their native ranges. Changes in these interactions can result in host plant shifts, insect divergence events, and subsequent speciation. The sunflower maggot fly (genus *Strauzia*) is a tephritid fruit fly that specializes on sunflowers (genus *Helianthus*) and other Asteraceae. In Iowa, we have identified three genetically distinct *Strauzia* lineages that all associate with a single host

plant, the Jerusalem artichoke (*Helianthus tuberosus*), a rare observation in specialist insects. The history of the Jerusalem artichoke may also contribute to the evolutionary history of *Strauzia*, as the Jerusalem artichoke was domesticated by native peoples and subsequently experienced a large range expansion due to human agricultural practices. Using next-generation sequencing methods, we resolve the *Strauzia* phylogeny and clarify previous taxonomic discrepancies. Then we explore several hypotheses for how human agricultural practices and host plant shifting may have resulted in the currently observed patterns of *Strauzia* host use. This work proposes novel methods for evaluating the impacts of plant domestication and dispersal on specialist insect evolution and will help improve the current understanding of the role of ecological interactions on organismal diversity across multiple trophic levels.

121. NATIVE BEES AND OTHER INSECTS OF A HABITAT DIVERSE SUBURBAN YARD

Stephen Johnson
(Independent)

An important tenet in ecology is that high diversity habitat confers high biological diversity. Since establishment of a rocky upland, a sandy clay upland, two small ponds and forest savanna ecotone habitats including approximately 159 plant species, this 0.25 acre yard attracts 44 species of native bees in the families Andrenidae, Apidae, Colletidae, Megachilidae, and Halictidae either residents or frequent visitors including 3-5 species of kleptoparasitic bees and 9 one-time visitors. It has also attracted a microlepidopteran species new to North America. It has also attracted many species of Diptera, Hemiptera and Coleoptera.

122. UPDATE ON IOWA'S OLDEST OAKS

John Pearson
Iowa Dept Natural Resources

Dendrochronological research of old white oaks (*Quercus alba*) for the 300-year period between 1680 and 1980 was presented by Duvick and Blasing in a 1983 article entitled "Iowa Oldest Oaks" (PIAS 90:32-34). They cored nearly 500 trees from 17 public conservation areas in Iowa, primarily state parks and preserves. Nearly 300 were over 200 years old (including 30 over 300 years and 2 over 400 years). In 1986, I collaborated with Duvick to tag and map his ~300 oldest trees. Over subsequent years, I opportunistically revisited many trees to monitor their status. In 2018, I conducted comprehensive surveys of Pammel State Park, Merritt Forest, and White Pine Hollow, which collectively contained a third of all tagged trees. Significant natural mortality was observed at all sites, particularly Pammel State Park (~50%) and Merritt Forest (~90%). Statewide, the four oldest trees originally identified by Duvick and Blasing have died: Red Rock Wildlife Area

(originating in 1573), White Pine Hollow (originating in 1580), and Yellow River State Forest (two trees originating in 1640). Windthrow has been common cause of loss over the past 32 years. The oldest surviving tree (originating in 1634, thus 385 years old in 2019) remains in Pammel State Park.

123. CONSERVATION ASSESSMENT OF WHITE PINE HOLLOW

Wayne Schennum¹ and John Pearson²
(Independent)¹, Iowa Department of Natural Resources²

White Pine Hollow is a 712 acre state preserve on the Paleozoic Plateau landform in northwest DuBuque County, Iowa. The site is best known for several stands and scattered individuals of White Pine (*Pinus strobus*). However, there are several other very notable features of the site, including 8 algific talus slopes; 34 rare plants, including 4 Special Concern and 8 Threatened; rare periglacial snails; limestone cliffs; and dry mesic to mesic forests of variable quality. Four areas were selected for study – one algific talus slope; one white pine/oak forest; and two mesic forests with different exposures. The primary purposes of the work were to determine the species richness and quality of the selected communities, the relative abundances of rare species, and the successional state of the forests. Three of the 4 study sites had high to very high quality ratings (mean C-values) and high proportions of conservative species. Values for the algific talus slope were expectedly the highest. One mesic forest was diverse and not over-dominated by sugar maple. Seedling, but not sapling, white pines, were scarce to absent. Succession has restricted them to very small glades and cliffs.

124. ECOLOGICAL FACTORS CONTROLLING THE PREVALENCE OF LYME DISEASE-CAUSING BACTERIA, BORRELIA BURGDORFERI, ALONG THE MISSISSIPPI RIVER

Thomas Scroggs, Taline Holman, Brianna Finnegan, Alec Rutherford, David Koch, Gerald Zuercher, Adam Hoffman, and Kelly Grussendorf
University of Dubuque

Approximately 300,000 people are diagnosed with Lyme disease each year making it the most commonly reported vector-borne illness in the United States. The bacterium *Borrelia burgdorferi* is the causative agent of Lyme disease and is transferred to humans via black-legged ticks (*Ixodes scapularis*). To get a better understanding of the epidemic trend of Lyme disease we worked to determine the prevalence of *B. burgdorferi* in eastern Iowa, at various ecological locations. During summer 2018, we tested eight different sites throughout Dubuque and Jackson County, collecting ticks and blood samples from reservoir hosts. Our sites included areas of prairie, woodland, and wetland. Soil samples were collected at each trap site, 160 total, to determine soil composition, soil

bulk density, percent moisture, percent organic matter, and soil pH. We determined density of ground coverage and trees in our sampling area, as well as recorded weather conditions for each day. We collected 260 blood samples from reservoir hosts and 124 ticks. Molecular work is being carried out to determine the presence of *B. burgdorferi* from these collected blood samples and ticks, which will then be analyzed with the ecological information that was collected to determine any possible interactions and correlations.

125. THE EFFECTS OF NATURAL HERBICIDES ON INVASIVE *ALLIARIA PETIOLATA* AND NATIVE WOODLAND SEEDLING GERMINATION

Dani Sheddan and Amy Blair
St. Ambrose University

Alliaria petiolata, or garlic mustard, is an invasive plant species that outcompetes native species for nutrients and space in forests across the United States. Management of invasive plant species like garlic mustard is costly and laborious. Usually, such plants are managed using chemical herbicides. However, chemical herbicides can have adverse effects on the environment, such as polluting the ground water and soil. It is important to research alternative natural herbicides, such as vinegar and clove-oil, to find a more eco-friendly treatment. This research aims to discover if natural herbicides can be utilized as an effective alternative treatment to the chemical standard for managing *Alliaria petiolata*. Also, this research will compare the effects of these treatments on the germination of high quality native plant species. Based on previous research, we hypothesized that: (1) Vinegar and clove-oil will significantly reduce the abundance of garlic mustard, similar to the commonly applied chemical herbicide Roundup; and (2) Soil treated with clove oil or vinegar will have less of a negative effect on germination and early growth of native woodland species as compared to soil treated with Roundup. This research will provide important insight into alternative methods of management for garlic mustard.

126. COMMUNICATING KNOWLEDGE AND RESPECT FOR SPIDERS AND THEIR FUNCTIONS IN ECOSYSTEMS FOR AUDIENCES SUCH AS ELEMENTARY STUDENTS

Mary Stark¹, Stephen Johnson¹, and Lisa Zylstra²
Central College¹, Jefferson Elementary Pella²

Ecologist Stephen Johnson joined me to collaborate with literacy coach and fifth-grade language arts teacher, Lisa Zylstra, in teaching a unit on E.B. White's *Charlotte's Web* and literacy about spiders. Since White fosters respect and wonder about his spider protagonist, we wanted to underscore the necessity for spiders and how they fit in ecosystems. Lisa and I created a plan for close reading of the literature and Dr. Johnson presented a close reading of White's information on

spiders and drew the parts of a spider's leg that Charlotte delineates when Wilbur tries to weave a web in chapter nine. Stephen gave a copy of the artwork to each student in the class to accompany White's written description. Stephen described the diversity of spiders found in Pella, Iowa, and the students adopted one of his photographs. The fifth-graders researched information about habitat and hunting styles as well as why spiders should be respected. The students included their own written description of their adopted spider. The fifth graders presented their Power Points to third graders and kindergarteners.

127. CITRIC ACID AS A POTENTIAL MOLLUSCICIDE AND DETERRENT FOR THE INVASIVE SLUG SPECIES *ARION SUBFUSCUS*

Keegan Steele, Amy Blair, and Brenda Peters
St. Ambrose University

Because terrestrial slugs cause significant damage in home gardens and commercial farms, physical barriers and chemical molluscicides are used to limit their impacts, yet constant maintenance and toxicity make the development of a more user friendly and safer slug deterrent appealing. Previous studies found citric acid to be less toxic to non-target species compared to current molluscicides. However, the effects of citric acid on slugs have not been explored. To determine the deterrent capabilities of citric acid, the invasive slug species *Arion subfuscus* was given a choice of Romaine lettuce sprayed with 5% citric acid or DI water. To determine the molluscicide capabilities of citric acid, slugs in no-choice trials were given lettuce sprayed with 5% citric acid or placed directly on a citric acid exposed paper towel. Lastly, Romaine lettuce was grown and sprayed with a 5% citric acid solution to examine the effects of citric acid on plant growth. The possibility of using citric acid to solve the problem of unsafe or costly slug maintenance without negatively impacting surrounding plants will be discussed.

128. DECIDUOUS FOREST COMMUNITIES OF FINCH MEMORIAL HARDWOODS, DRIFTLESS AREA NWR

Savannah Wilson and Elizabeth Lynch
Luther College

Our objectives were to complete a floristic inventory and to identify and describe deciduous forest communities in a 70-ha USFWS preserve located in Winneshiek County, IA. We sampled tree, shrub, and herbaceous understory species in twenty 10 x 10 m plots in mature forest stands. We measured soil depth and organic matter and used slope aspect and steepness to calculate a heat load index for each site. We used a NMS ordination to group plots sharing similar species composition and compared the resulting groups with previously described native forest communities of southern MN. We identified three forest community types in the

preserve: mesic maple-basswood, dry-mesic oak, mesic oak-basswood. The mesic maple-basswood forest occurs on steep north-facing slopes and on rocky slopes at the base of the limestone escarpment. This community is characterized by relatively high abundances of *Adiantum pedatum*, *Anemone acutiloba*, and *Mitella diphylla*. The dry-mesic oak forest plots are on steep slopes near the bluff tops; important understory plant species include *Ageratina altissima*, *Circaea luteiana*, *Laportea canadensis*, and *Osmunda claytoniana*. Southern mesic oak-basswood forest plots are on flatter upland sites; species with relatively high abundance in these sites include *Geranium maculatum* and *Sanicula odorata*.

Engineering: Poster Presentations

43. EXPERIMENTAL INVESTIGATION OF NANOMATERIAL SETTLING IN HYDROCARBON FUEL

Nicholas Hentges¹, Gurjap Singh¹, Elio Lopes², and Albert Ratner¹

University of Iowa¹, Santa Catarina State University²

Abstract: The combustion of hydrocarbon-nanomaterial suspensions has long been of interest to the combustion community. These suspensions usually consist of a small quantity of nanomaterial, usually 5% or less by mass, combined with a common hydrocarbon fuel. These suspensions have the potential to offer enhanced combustion characteristics and better fuel economy, however the practicality of these hydrocarbon-nanomaterial suspensions is dependent on the rate at which these suspensions separate. This research used a new method for tracking the settling of the suspension in a quantitative and objective manner without disturbing the solution. This research studied the stability of hydrocarbon-nanomaterial suspension at different load percentages. It is predicted that this research will be a building block in future analysis of hydrocarbon-nanomaterial suspensions.

Environmental Science and Health: Poster Presentations

44. LYME DISEASE CAUSING BACTERIA IN TICKS ON WHITE-TAILED DEER IN NORTHEAST IOWA

Brianna Finnegan, Taline Holman, Thomas Scroggs, Emily Less, David Koch, and Kelly Grussendorf

University of Dubuque

In Iowa there has been an upward trend in the number of cases of Lyme disease. Due to this increase it is important to understand the transmission pattern and the factors that play a role in the spread of this disease. Lyme disease is caused by the bacterium, *Borrelia burgdorferi*, and is transmitted to organisms by *Ixodes scapularis* (deer ticks). *I. scapularis* has a two-year life cycle that includes three life stages: larva, nymph, and adult, and require a blood meal between each stage. Their

last blood meal usually occurs upon the reproductive host *Odocoileus virginianus*, (white-tailed deer). Since white-tailed deer play such an important role in the life cycle of *I. scapularis*, it is essential to get a better understanding of this relationship. The goal of this study was to determine the presence and prevalence of *I. scapularis* on harvested white-tailed deer and to test these ticks and deer for the presence of *B. burgdorferi*. Ticks and blood samples from the deer were collected during the first weekend of December in northeast Iowa. A total of 60 deer blood samples and 117 deer ticks were collected. These samples are currently being tested for the presence of *B. burgdorferi*.

45. SCREENING THE CEDAR RIVER FOR SELECT PHARMACEUTICALS USING SOLID-PHASE EXTRACTION AND HPLC-MS/MS

Alex Hohensee and Matthew Zart
Wartburg College

A comprehensive method has been developed and validated for the analysis of active pharmaceutical compounds in surface and waste waters using solid phase extraction (SPE). Due to the lack of research in the detection and analysis of active pharmaceutical ingredients (API) in rural areas, selection of pharmaceuticals for analysis was difficult. Treated and untreated samples were collected from the Waverly Waste Water Treatment Plant (WWTP) and Cedar River in the winter season. Water samples were subjected to SPE followed by high performance liquid chromatography (HPLC) with tandem mass spectrometry. Samples underwent analysis for the presence of pharmaceutical compounds in rural Iowa and their respective metabolites including these therapeutic classes: antiasthmatics, ACE inhibitors, diuretics, stimulants, anticholinergics and beta blockers. This study provided additional research into whether APIs exist in surface and waste water of rural Iowa.

46. HISTOLOGICAL EXAMINATION OF BPA EFFECTS ON THE ADULT RAT BRAINS

Kyla Kern
Waldorf University

Bisphenol A (BPA) is an endocrine disrupting chemical that mimics the hormone estrogen within the body, affecting brain function and growth. BPA is released from certain plastics and epoxy resins as they degrade, contaminating food and water. However, we still do not completely understand the neurological effects of BPA absorption. Previous neurological studies have focused mainly on fetal rodents. To understand BPA effects on adult brains, we will histologically examine the tissues of four male rats divided into experimental and control groups. The experimental group will have 0.05% mg/kg/day of BPA administered through drinking water; the control group will have BPA-free drinking water - both administered from glass bottles. After four weeks, the rats will be humanely

sacrificed and the brain removed and processed for immunohistochemistry. We will use anti-Iba1 antibodies to look for differential active microglial counts and a TUNEL assay kit to stain for apoptotic cells. An ANOVA test with Bonferroni multiple comparison corrections will be used to determine statistical significance of immunoreactive cell numbers. Based on preliminary information, we expect to find higher numbers of activated microglial macrophages and more apoptotic cells within the brains of rats exposed to BPA.

47. EXAMINING THE PRESENCE OF MICROPLASTICS IN WATER AND THREE-RIDGE MUSSEL (*AMBLEMA PLICATA*) SAMPLES FROM THE MISSISSIPPI RIVER

Amanda Magana, Addy Schober, and Adan Hoffman
University of Dubuque

Microplastics are a growing problem for the environment and have been found in various aquatic habitats, consumer products, and animals. Research has largely focused on how these pollutants affect the marine environment, but very little focus has been placed on the effects of microplastics in freshwater systems and its organisms. We have tested freshwater systems in two different riverine locations, pool 12 of the Mississippi River and the North Branch of the Chicago River. Our results showed that 94% of the water samples from the Mississippi River (n = 17) contained microplastic particles, while 57% of the water samples from the Chicago River (n = 49) contained microplastic particles. Phosphorus (P) retention by soils, particles, and biota is an important issue relating nutrient fate and transport in the Mississippi River. The P adsorption capacity of various microplastics with P were determined using short-term isotherm batch experiments. Three-Ridge mussels (*Amblema plicata*; n=16) were collected, dissected and digested to quantify the amount of microplastics present in their digestive tissues. The implications of microplastics in these freshwater systems, especially as they impact nutrient transport, will be discussed.

48. THE IMPACTS OF MICROPLASTICS AND TERRESTRIAL AND AQUATIC PLANT GROWTH AND DEVELOPMENT

Julia Rodewald and Adam Hoffman
University of Dubuque

Much of the scholarly focus related to microplastics has centered on marine and aquatic ecosystems, while the impacts of microplastics in the terrestrial environment has been under examined. Microplastics can enter the terrestrial environment from many different sources, including industrially made compost, personal care products, sewage sludge, and degradation from larger pieces of plastic. In any ecosystem microplastics have the potential to move up trophic levels and accumulate in plants and animals. To explore how microplastics affect plants in both terrestrial and aquatic

ecosystems, soybeans and duckweed were exposed to four different known amounts of microplastics. Plant growth and germination success was measured and statistical analysis was performed on the data to test the null hypothesis that there is no difference in germination or growth rates between the soybeans and duckweed grown in the varying concentrations of microplastics. In addition, plant tissue were collected and examined for foreign bodies using Hematoxylin and Eosin regressive staining to visually identify microplastics taken up by the plants. The impacts that microplastics have on plant growth and accumulation of microplastics and their potential impacts on human health will be discussed.

Geology: Poster Presentations

49. STANDING ON THE SHOULDERS OF GIANTS: INTEGRATING OBSERVATIONS, DESCRIPTIONS, AND INTERPRETATIONS OF EARLY WORKERS WITH A NEW INTERPRETATION FOR THE FORMATION OF THE IOWAN EROSION SURFACE LANDFORM REGION

Katherine McCarville
Upper Iowa University

Geologists and geomorphologists working in Iowa have long remarked on the enigmatic characteristics of the Iowan Erosion Surface (IES) of northeast Iowa. Early workers invoked glacial processes, periglacial processes, and most recently, pedogenic processes to explain the genesis of this region, and all of these are without doubt involved to some degree in shaping the landscape, yet none alone has provided a satisfactory explanation. However, the geomorphic features of the IES, including loess distribution and thickness, streamlined paha hills, extensive boulder trains, deeply incised bedrock gorges, and amphitheater-headed canyons suggest formation by a megaflood. This review of previous work on the geology, geomorphology, and soil development of the Iowan Erosion surface integrates several instances of observations, descriptions and interpretations that can be aligned with and may support this new interpretation.

Geology: Oral Presentations

129. AN UPDATE ON THE NORTHEAST IOWA INTRUSIVE COMPLEX (NEIC)

Ryan Clark¹, Ray Anderson¹, David Peate², Allison Kusick², Kenny Horkley², and Anonymous
Iowa Geological Survey¹, University of Iowa²

Copper-nickel sulfide and platinum group element deposits have been identified along the north shore of Lake Superior in Ontario (Coldwell Complex) and the western shore in Minnesota (Duluth Complex). These magmatic deposits are related to the Midcontinent Rift System and are geophysically distinct, with high amplitude magnetic anomalies and

associated gravity highs. The NEIC has an aerial extent of over 6,000 mi² consisting of several large ring/horseshoe shaped geophysical anomalies and associated linear features. Characterizing these features using geophysics has been done, yet with a limited number of boreholes that reach the NEIC, accurate lithologic and geochronologic data has remained elusive. An exploration core drilled in 1963 intersected a dike thought to be related to the NEIC and encountered 722 feet of ultramafic rocks. The Iowa Geological Survey and the University of Iowa are using pXRF and micro probe analyses to isolate datable minerals. Preliminary results show there are distinct zones within the core that have elevated uranium and zirconium, typically in the form of baddeleyite or zirconolite. Obtaining a reliable age date from this core could provide the answer to whether the NEIC is in fact related to other economic mineral deposits in the Lake Superior region.

130. CHARACTERIZATION OF DRY RUN CREEK SEDIMENTS

Chad Heinzl¹, Danika Patten², and Logan Letellier³
University of Northern Iowa¹, Land and Water Stewards
AmeriCorps², Green Iowa Americorps³

The University of Northern Iowa resides within the Dry Run Creek (DRC), 15,177 acre, watershed. This creek is scientifically and socially fascinating because it lies within a dynamic rural to urban landscape. Many students and faculty have investigated the creek's environmental parameters; this study presents new geochemical and geophysical data from the creek's bank sediments. These data compliment on-going inquiries of water quality, sediment provenance, bank stabilization, habitat and efforts to mitigate stream urbanization. Quantitative analyses are being conducted using a Panalytical X-ray Fluorescence (XRF) machine and by sieving Dry Run Creek sediment samples. Geochemically we are recording both concentrations (ppm) and relative percentages of ten oxide compounds (e.g. SiO₂, Al₂O₃, P₂O₅) and twenty elements (As, Ba, Cr, Pb, Sr, Zr). The chosen compounds and elements should aid in characterization of the sediments' origin, weathering profiles and contamination. Sieving and some pipetting is beginning to characterize Dry Run Creek bank sediment size from 32mm to 4.0 μm. The collected clast-size data may aid in the interpretations of stream discharge, potential erosion/sediment yields and geologic history.

131. THE PRODUCTION OF ALKALIC MAGMAS IN NORTHEAST NEW MEXICO: A CALL TO OLD, FAILED RIFTING

Lee Potter
University of Northern Iowa

Alkalic melts were emplaced in Northeastern New Mexico starting at 37 Ma. They fall on an alignment, the Jemez

Lineament, which stretches NE-SW through the region and offsets at the Jemez Mountains and Rio Grande Rift (RGR). Compositions range from older intrusive trachyte-trachyandesite and lamprophyre, to phonolite-carbonatite that ended about 20 Ma. At ~8 Ma, activity resumed as basalt-rhyodacite volcanism. The existential question: why are these magmas here? Workers have viewed the Jemez Lineament as "a leaky transform" on the flank of the RGR. Others suggest weakness along an ancient basement suture, and even stresses in the higher crust. Some call upon the Eastern Rocky Mountains Alkalic Belt; a result of subduction to the West. This author goes on record that another option should be considered: reactivation of an older, failed, extension event: the Southern Oklahoma Aulacogen (SOA). With a WNW-ESE orientation, a distal fragment of the SOA sits under NE New Mexico. The grain of lamprophyre dikes, phonolite intrusions, and some volcanic centers follows the orientation of the SOA. A reactivation of the failed extension by stress reorientation is reasonable. Magmas that were not produced originally, may have formed later as they do in modern rifting analogs.

Iowa Science Teaching (ISTS): Oral Presentations

132. WATER CONNECTS US ALL: 3D LEARNING AND ENVIRONMENTAL EDUCATION

Barb Ehlers¹, Cathryn Carney², Kata McCarville¹, and Jeff Monteith³
Upper Iowa University¹, University of Iowa², New Hampton CSD³

This presentation focuses on the 3D study of water and soil quality issues in Iowa for grades PK-12 through an interactive board game. Participants will experience the 3D learning of inquiry-based lessons and activities showing practices, crosscutting concepts and disciplinary core ideas associated with the environmental issues study of water and soil quality in Iowa. Environmental topics are perfect examples of 3D learning of the Next Generation Science Standards. The disciplinary core ideas encompass understanding the science of water and soil. Examining environmental issues provides a key tool for understanding complex ideas and trying to solve environmental problems. In studying local environmental issues students can relate to interests and life experiences in their local communities and connect to societal problems with water quality. Crosscutting concepts include cause and effect of farming practices, soil and water systems, structure and function of water and soil, and stability and change of the environment. An overview of the study as an example of 3D learning will be given as well as specific lessons and activities for teachers to use in their classrooms.

Organismal Biology: Poster Presentations

50. THE EFFECTS OF ENRICHED ENVIRONMENTS ON MALE AND FEMALE C57BL/6 MICE

Samantha Braundmeier, Adriana Gordon, Brian Hamilton, and Samantha Larimer Bousquet
Wartburg College

A study done by Acklin and Gault in 2015 showed that specific types of bedding and environmental enrichment showed cognitive benefits for laboratory mice. Our research followed methods found in the Acklin and Gault (2015) study, but we continued the research by controlling the age of the mice and the number of mice in each cage. We also compared females to males, as female mice have been shown to be more anxious than male mice. Our animals were pair housed in two conditions, aspen bedding with enrichment materials (enriched condition) or corncob bedding with no enrichment materials (non-enriched condition). We tested the mice's anxiety via an open field maze and spatial memory via T-maze. We predict both females and males in the non-enriched condition will exhibit greater anxiety behaviors and decreased working spatial memory than their counterparts in the enriched environment. Within groups, we predict males' anxiety levels will be less than females'.

51. AS THE SEASONS CHANGE...SO TOO DO THE SMALL MAMMAL RESERVOIRS FOR LYME DISEASE: AN OVERWINTER ASSESSMENT OF PEROMYSCUS MICE AND BORRELIA BURGENDORFERI IN AN EASTERN IOWA NATURAL AREA ALONG THE MISSISSIPPI RIVER

Bryan Gramajo, Kelly Grussendorf, and Gerald Zuercher
University of Dubuque

Since 2016, small mammals have been surveyed at Mines of Spain Recreation Area to assess the prevalence of the Lyme Disease-causing bacteria, *Borrelia burgdorferi*. This project sought to evaluate over-winter *Peromyscus* abundance and determine whether prevalence of bacteria remains at similar levels as in summer. Our Null Hypotheses were 1) there are no seasonal differences in *Peromyscus* abundance, and 2) there are no seasonal differences in *B. burgdorferi* prevalence in captured mice. We caught small mammals in forest and prairie using Ugglan multiple-capture live-traps from October 2018 until late spring 2019. Twenty traps were set in each habitat to allow comparison to summer trapping efforts. Several patterns have emerged. Significant declines in *Peromyscus* abundance have been documented in both habitats compared to summer. This was expected as overwinter survivorship often declines in small mammals living in seasonal environments. Overwinter forest *Peromyscus* abundance was significantly higher than prairie abundance. Finally, a sex-ratio shift occurred from fall to winter. Males were significantly more abundant during fall

while females were more abundant during winter. These results reject Null Hypothesis #1. Blood was obtained from the caudal vein and tested for *B. burgdorferi*. Results from molecular analyses will shed light on Null Hypothesis #2.

52. THE BRAIN OF THE KUDU (*TRAGELAPHUS STREPSICEROS*): MRI ATLAS AND PRELIMINARY 3D VOLUMETRICS

Muhammad Spocter¹, Austin Crose¹, June Olds², Rachel Derscheid², Cheuk Tang³, Bridget Wicinski³, Patrick R. Hof³, Chet C. Sherwood⁴, and Paul R. Manger⁵
Des Moines University¹, Iowa State University², Icahn School of Medicine at Mount Sinai³, George Washington University⁴, University of the Witwatersrand⁵

The Artiodactyla are the largest living order of hoofed mammals thus making them an interesting group for the study of neuroanatomical diversity. While artiodactyls have long been known to possess highly convoluted brains, comparative studies on this group have remained scarce, with a focus primarily on the domestic artiodactyls. In the current study we address this caveat by characterizing the neuroanatomy of an understudied South African antelope, the kudu (*Tragelaphus strepsiceros*). Using postmortem brain tissue obtained through collaboration with Iowa State University and the Blank Park Zoo, we used high resolution magnetic resonance imaging to create a preliminary MRI brain atlas of a kudu which was humanely euthanized for age-related quality of life concerns. MR sequences were acquired at 7 Tesla and post processing of the MRI scans were undertaken using ITKSNAP. While preliminary, this study provides the first MRI map of the Kudu brain and adds much needed baseline data to the study of neuroanatomical diversity in the Artiodactyla.

53. A HIGH-RESOLUTION MRI BRAIN ATLAS OF THE DOMESTIC GOAT (*CAPRA HIRCUS DOMESTICA*)

Muhammad Spocter¹, Emily Franzen¹, Cheuk Tang², Eric Rowe³, and Paul R. Manger⁴
Des Moines University¹, Icahn School of Medicine at Mount Sinai², Iowa State University³, University of the Witwatersrand⁴

Recent studies of artiodactyls have indicated that domestic goats (*Capra hircus domestica*) are able to perform surprisingly complicated behaviors, such as differentiating human attentional states and reading human communicative cues. One explanation to account for this, is that the process of domestication has resulted in changes in goat behavior (and underlying neural circuitry) that favor not only more docile interactions with humans but also increased ability to understand human behavioral cues. Unfortunately, no detailed studies exist describing the brains of the domestic goat or how this might compare with that of their wild progenitors. In the current study we address this caveat by characterizing the

neuroanatomy of domestic goat, through the use of high-resolution magnetic resonance imaging at 7 Tesla and associated diffusion tensor imaging. This study provides the first high resolution MRI atlas of the goat brain and provides comparative on the organization of the goat nervous system.

54. MEASURING THE EFFECTS OF BISPHENOL-A ON THE OLFACTION OF RATTUS NORVEGICUS THROUGH SCENT TRAINING^{aaa}

Sara Vettleson-Trutza, Paul Bartelt, Gary Coombs, and Carol Fischer
Waldorf University

Of the 260 million tons of plastic produced per year, > 10% of that ends up in Earth's oceans. As the plastic degrades, toxic compounds (e.g., bisphenol-A; BPA) are released. BPA can affect general brain function and growth, but its impact on specific areas of the brain remain unknown. The aim of this research is to test for a relationship between BPA and olfaction, because many marine organisms rely on scent for survival. I used operant conditioning to train rats to detect the scent of lemon juice. I chose rats as the test subject because they have excellent olfactory ability with > 1,000 genes coding for as many different types of olfactory receptors. The experimental group received water contaminated with 0.05mg/kg of BPA for four weeks. Variables tested included accuracy, memory and sensitivity. I am using a combination of ANOVA and repeated measures designs to analyze and identify any significant differences between and within the test and control groups. A preliminary examination of results suggest BPA affects the accuracy of a rat's ability to select lemon juice, suggesting effects on the forebrain. Expanding on the results from this research could help us better understand how plastic waste affects marine life.

Organismal Biology: Oral Presentations

133. MISSISSIPPI RIVER TURTLE TRAP SUCCESS BASED ON BAITING

Brianna Finnegan, Taline Holman, Thomas Scroggs, Alec Rutherford, and David Koch
University of Dubuque

The goal of this year's study was to determine the impact of bait on trap success for turtles. Previously, research was done looking at the population of freshwater turtles. Turtles are important because they play a critical role in our ecological environment by controlling aquatic vegetation and maintaining the health of our rivers and lakes. This year, trapping was done at 9-Mile Island in Pool 12 on the Upper Mississippi River system using hoop nets. Different types of bait used (chicken, fish, and sardines in soybean oil) were compared to a control bait containing no bait. Trapping was focused in a backwater

region of the island. The two most commonly caught turtle species we were *Chrysemys picta* (painted turtle) and *Chelydra serpentina* (common snapping turtle). We found that *Chrysemys picta* were caught more often in sardine-baited traps, while *Chelydra serpentina* preferred fish. Of note, we captured a single *Apalone mutica* (smooth softshell turtle) which appears to be a first record for Dubuque County, Iowa.

134. THE ROLE OF MORPHOLOGY, PHYSIOLOGY, AND DENSITY IN MALE REPRODUCTIVE SUCCESS IN A FRESHWATER TURTLE

Jessica Judson, Luke Hoekstra, Kaitlyn Holden, Rebecca Polich, Anne Bronikowski, and Fredric Janzen
Iowa State University

Reptiles exhibit a wide array of traits presumed important in sexual selection. However, we do not fully understand the role of male phenotypes and population sex ratio in mating choices in reptiles, particularly in freshwater turtles. We used the painted turtle (*Chrysemys picta*) as a model reptile to understand if certain male traits influence male reproductive success and how varying male density impacts the number of offspring sired. We held adult turtles in outdoor ponds of varying male density from April-August of this two-year study, where they mated and nested. We measured body size, claw length, arm stripe color, and immune health in males. We collected and incubated eggs in 2016 and assigned parentage for all hatchlings using a panel of 96 maximally-informative SNPs. We found that none of the male phenotypes we measured predicted reproductive success in any pond. However, we found a significant relationship between color and immune health in these turtles, suggesting that color may still have a role in signaling health to other individuals. We also found that the number of offspring produced by successful males in the pond with the lowest male density was higher than that of males in the high male density pond.

Physics, Atmospheric, and Space Sciences: Poster Presentations

55. THE SCINTILLATING, SCATTERING ARGON LIGHTS

Emily Grace
Northwestern College

Like all the noble elements, argon and xenon are scintillators, i.e. they produce light when exposed to radiation. Large liquid argon detectors have become widely used in low background experiments, including dark matter and neutrino research. However, as of starting this research, the index of refraction of liquid argon at the scintillation wavelength had not been measured and the then Rayleigh scattering length calculations disagree with measurements. I introduced a new calculation using previously measured data in liquid argon to extrapolate

the optical properties at the scintillation wavelengths using the Sellmeier dispersion relationship. Further, I tested these calculations using a test stand, to experimentally verify the scattering length of liquid argon. This experiment consisted of a long tube of liquid argon with window on one end and photomultiplier tube on the other side. The argon was scintillated at different positions using a collimated, external gamma source. The scattering length was calculated by examining the amount of light detected as a function of position from the window. This result of this calculation and measurement is now being used by the liquid argon detector community.

56. MAGNET TRANSIT THROUGH A CONDUCTING PIPE: AN EVALUATION OF THEORETICAL MODELS FOR INTERMEDIATE PIPE WALL THICKNESSES

Darby Kramer and Benjamin Bousquet
Wartburg College

When a permanent magnet falls through a conductive pipe, eddy currents induced in the pipe wall give rise to a braking force that causes the magnet to reach a terminal speed. Theoretical models that successfully describe the magnet motion in such an apparatus for both the thin-wall and thick-wall approximations have been presented in the literature. The aims of this study are to probe the limits of these models and investigate their accuracy in the parameter space between the two extreme regimes. Terminal speed data was collected for a cylindrical neodymium magnet falling through an aluminum pipe whose outer radius was iteratively reduced on a lathe. Our experimental results are in good agreement with the evaluated model in the thick-wall regime but differ from the predictions of the thin-wall model.

57. AIR QUALITY SIMULATION USING AERMOD MODEL

Isaac Neppel, Jacob Hogan, Jens Petersen, Jason Schutter, and Xinhua Shen
University of Northern Iowa

In order to analyze the influence of meteorological condition and terrain elevation on air pollution dispersion, in this project, the air pollution dispersion from various point sources was simulated using the AMS/EPA Regulatory Model (AERMOD). Hourly surface meteorological data and the upper air data were retrieved from the National Oceanic and Atmospheric Administration (NOAA). Surface characteristics including albedo, surface roughness and Bowen ratio were obtained from U.S. Geological Survey (USGS) National Land Cover Database. Meteorological data and Surface characteristics were processed by a pre-processor AERMET and further passed to AERMOD. Digital terrain elevation data were acquired from USGS Digital Elevation Model (DEM) data. Terrain elevation data were processed by a terrain pre-processor AERMAP and

further passed to AERMOD. The simulation results demonstrated significant influence of wind speed, wind direction and atmospheric stability on the ground level concentration. The influence of complex terrain was also investigated in this research.

58. PHOTOMETRIC TRANSFORMATIONS OF CEPHEIDS IN THE LARGE MAGELLANIC CLOUD AND MILKY WAY

Logan Winford and Siobahn Morgan
University of Northern Iowa

Variable RR Lyrae and Cepheid stars are widely studied due to their use as well defined distance indicators and tracers of stellar evolution. The characteristics of their light variation can be defined using a Fourier series, and the Fourier coefficients have well known trends with the stars' pulsation periods. Observational data is often in various photometric filters, resulting in multiple sets of Fourier coefficients for each star. Large data bases have light curve data in either infrared filters (I), or visible filters (V). This investigation examined Fourier coefficient data in both I and V filters from over 1800 Cepheid variable stars within the Large Magellanic Cloud. This data will be used to determine a set of linear relations to convert the Fourier coefficients between the two filters, which will allow astronomers to obtain various physical parameters for these stars, such as metallicity. The linear relationships will be presented and compared to similar relationships for galactic Cepheids, to determine the influence of metallicity on the Fourier coefficients.

Physics, Atmospheric, and Space Sciences: Oral Presentations

135. STATE SELECTIVE SINGLE ELECTRON CAPTURE FROM MOLECULES BY HIGHLY CHARGED IONS

Jim Perez and Amanda Hayden
Luther College

In this work we study state selective n,l single electron capture from H₂O and CO₂ by bare highly charged ions at low collision energies (10 eV/amu to 3keV/amu) using a three body Classical Monte Carlo (CTMC) Method. Building on the work of Otranto and Olson [Phys. Rev. A 75, 022709 (2008)], we model the active electron's radial distribution using one center expanded Self Consistent Field molecular orbital wavefunctions developed by R. Moccia [J. Chem. Phys. 40, 2164 (1964)]. The results indicate a significant improvement in agreement with experimental data over one center calculations that use hydrogenic distributions.

136. MAGIC SIZED AU ISLANDS ON MOS2

Andrew Stollenwerk, Tim Kidd, Jacob Weber, Ryan Holzapfel, and Evan O'Leary
University of Northern Iowa

Quantum well states were found to play a critical role in determining the geometric structure of Au(111) islands grown on the surface of MoS₂. Island stability increases as quantum states shift farther from the Fermi level, lowering the energy of the island. The wave nature of electrons causes the total energy to oscillate with island dimensions resulting in preferred or "magic" sizes. The preferred dimensions have a relatively large periodicity of nearly 2 nm and persist to much higher temperatures than have been observed in other electronic growth mode systems. These observations are likely due to the weak bonding at the Au/MoS₂ van der Waals interface, which minimizes strain but can still induce epitaxial growth without a wetting layer or significant lattice matching. The abrupt van der Waals gap at the interface also gives rise to strong electronic confinement, ideal for the formation of quantum well states. These findings indicate the potential to explore electronic growth modes in a new class of systems based on metal - layered semiconductor interfaces.

137. QUANTITATIVE TECHNIQUES FOR MODELING AND ANALYZING IMAGES AND TIME SERIES DATA FROM INTRACELLULAR TRANSPORT AND SINGLE MOLECULE MICROSCOPY

Ali Tabei
University of Northern Iowa

The advancements in microscopy and tracking techniques plus the recent developments in image processing and quantitative analyzing techniques have provided us with a unique opportunity to investigate subcellular molecular events and extract information from images and time series movies. In this talk, I will discuss how as a physicist, we use theory and computational methods to extract physical and biologically relevant information from biological data with a special look at cytoskeleton dynamics and single molecule microscopy.

138. QUASI-CONTINUOUS STELLAR PHOTOMETRIC MONITORING FROM AN IOWA SITE

Jeff Wilkerson
Luther College

For the past 15 years, we have monitored a single half-degree square field of view centered on open star cluster M23, making photometric measurements of more than 1600 stars on every clear, relatively moonless, night from about March to October, using observing equipment on the Luther College campus. We have observed unambiguous pulsation in more than 70 stars in the field, 5 short-period eclipsing binary systems and several non-repeating apparent stellar brightening events. Ultimately, our ability to complete population studies and monitor small changes in these systems is dependent on the photometric

precision we can achieve. Our photometric precision is limited by the crowded nature of the spatially undersampled field, the faintness of the stellar population being observed, our observing equipment, our photometric process and, significantly, the atmospheric conditions of Northeast Iowa. After providing a progress report on the project broadly, I will detail our photometric efforts to date, the photometric limits we have achieved thus far, and our planned efforts to further improve the photometric quality of our data set.

Physiology & Health Sciences: **Poster Presentations**

59. PHARMACOLOGICAL VALIDATION OF A FORCED SWIM TEST ASSAY OF DEPRESSIVE-LIKE BEHAVIOR IN DROSOPHILA MELANOGASTER

Aryana Rasti, Victoria Coombe, Jerica Muzik, and Christopher Kliethermes
Drake University

Depression and related mood disorders are major health problems, and while there are some existing treatments, there is a need to develop better ones. The forced swim test (FST) has good predictive validity and reliability in screening for antidepressant drugs in rodents, and a version of this assay has recently been developed for use in the fruit fly, *Drosophila melanogaster*. In the current experiments, male and female flies were exposed for 30 min or 24 hours to several drugs known to affect FST behavior in rodents, including fluoxetine, reserpine, ethanol, picrotoxin, and desipramine, and the effects of these drugs on FST behavior were analyzed. We found a significant effect of acute fluoxetine to increase swim time, while fluoxetine given for a day produced the opposite result. None of the remaining drugs produced any changes in FST behavior. These results suggest that struggle time in the FST might be regulated differently in flies compared with rodents, although serotonergic function might regulate this behavior across species. Ongoing experiments using additional drugs and neurogenetic tools are probing the role of monoamines in the regulation of this behavior. These studies should help in understanding the neurobiology of depressive-like behaviors, and might lead to the identification of novel therapeutic targets in depression.

60. THE EFFECT OF MANUAL THERAPY TREATMENT TECHNIQUES ON LOWER EXTREMITY JOINT KINEMATICS DURING RUNNING: A CASE STUDY

Kevin Carlson and Alisa Drapeaux
Drake University

Subject was a 48 year old male with a history of Achilles tendonitis, ITBS, hip/low back pain with running. The XSens captured motion while running. Lumbar spine, hip, ankle and foot ROM hip ROM were assessed. The subject attended

treatments 2x/week for 7 weeks. Treatment included manual therapy to the lumbopelvic region and lower extremities. Dependent variables were bilateral foot contact time, bilateral hip transverse plane motion and bilateral ankle sagittal plane motion. Pre-treatment and post-treatment ipsilateral and bilateral differences between groups were analyzed with paired samples t-tests ($p < 0.05$). Significant differences were found between ipsilateral and bilateral pre- and post-treatment contact times; right foot sagittal plane joint angle at foot off; left hip transverse plane joint angle at foot contact and foot off, all bilateral pre- and post-treatment hip angles at foot contact and foot off, all bilateral pre- and post-treatment ankle angles at foot contact and foot off. Clinical exams paralleled the change in hip external rotation bringing the hips to a more neutral position. In addition, the final clinical exam noted a decrease in subtalar eversion bilaterally which relates to the improved pelvic symmetry.

61. EFFECTS OF VIRTUAL HAND TRAINING IN INDIVIDUALS WITH PARKINSON'S DISEASE

Zach Elias¹, Bindu Balakrishnan¹, and Mohan Ganesan²
University of Dubuque¹, Clarke University²

Parkinson's disease (PD) limits hand function due to tremors, rigidity, and bradykinesia. The aim of this project is testing the feasibility, and efficacy of virtual reality training on hand functions within PD. The intervention includes virtual hand exercises using a RAPAE Smart Glove™ with a visual display that focuses on hand functions including pronation, supination, radial deviation, ulnar deviation, flexion and extension of wrist. Additionally, the training focuses on timing and coordination of movements. The tremor data is recorded using the TREMOR12 App and hand functions are assessed using the hand components of the motor score section of the Unified Parkinson's Disease rating scale (UPDRS) at baseline and after the 4 weeks of training. Training and assessment were carried out during the "ON" period of medication. As a pilot study, we recruited three individuals with PD and the result obtained from one patient following the virtual reality training shows there is a decrease in the overall hand component UPDRS score indicating improvement in hand functions. The decrease in score was found in both sides but more prominently in the more effected side. A larger cohort of patients is needed to elucidate the use of virtual hand training in PD patients.

62. FOOTWEAR FOR BARBELL BACK SQUATS PART I: WEIGHTLIFTING SHOES VS. CROSS-TRAINERS

Brooks Ginn, Collin Seymour, Jacob Hardy, Ian Malaby, Zach Mathews, Etta Moline, Madison Coffman, Callie Zobeck, and David Senchina
Drake University

Previous work by our lab and others' have shown that weightlifting shoes may not improve athletes' biomechanics or performance of back squats; however, that collective work was recently criticized because of heterogeneous squat technique across studies. This investigation aimed to address that criticism by comparing back squat performance when athletes wore weightlifting shoes versus cross-trainers. Squat depth was standardized (thighs parallel) and subjects were verbal instructed to stay back on their heels. Eleven athletic males (20.3 ± 1.3 years, 179.4 ± 7.0 cm, 81.9 ± 10.8 kg) performed three repetitions of back squats at 75% 1RM in each condition. Foot force production, knee angle, perceived exertion, and perceived shoe comfort and stability were measured for each condition. There were no statistically significant differences for any of the outcomes. There were two statistical trends such that subjects perceived the weightlifting shoes as being more stable than the cross-trainers, and such that the weightlifting shoes may have led to greater rear-foot force production at the apex of the squat. These findings are consistent with and support the previous collective work, suggesting that inter-subject differences in squat depth did not likely influence previous results.

63. CONNECTIVE TISSUE INFILTRATION INTO THREE-DIMENSIONAL SINTERED COBALT CHROME ALLOY^{aaa}

Bethany Haus and Eryn Zuiker
Minnesota State University, Mankato

Biomaterials used in medical implantable devices must sufficiently integrate within the biological system and be compatible with surrounding tissue. In this study, cobalt chrome (CC) will be utilized, offering high biocompatibility while minimizing immune reactivity. CC will be used in conjunction with Hydroxyapatite (HA), a bioactive material that is an essential component of normal bone and teeth. We will test the biocompatibility of a CC/HA alloy, fabricated using a three-dimensional printer. To test the biocompatibility in-vivo, one-by-two-by-four millimeter alloy pieces (50% HA, 50% CC) will be inserted onto rat skulls through a small incision made via aseptic surgery. After five weeks, the implants and surrounding tissues will be removed and observed using scanning electron microscopy. The surrounding tissues will be examined for inflammation and other signs of tissue damage or rejection. We hypothesize that the alloys will be encapsulated by dense connective tissue (CT) continuous with the periosteum, and that CT will infiltrate to form a dense cellular and fibrous matrix. These findings will help contribute to the science of medical implantation and tissue rejection and improve our understanding of medical device alloys used for hip, femur and other implants.

64. NEUROLOGIC EFFECTS OF NEONICOTINOID, GLYPHOSATE, AND IRON IN C. ELEGANS

Elsa Leyhe, Rachel Koller, Meretta Hanson, and Stephanie Fretham
Luther College

Neurodegenerative diseases such as Alzheimer's and Parkinson's are complex and influenced by environmental factors prevalent in Iowa including pesticides and metals such as iron. The neurologic risks of pesticides such as organophosphates and rotenone are well known, however very little work has examined the neurologic effects of neonicotinoids (neonics) and glyphosate. These widely used pesticides have been considered generally safe because their targets are not found in humans or other mammals, however recent studies suggest they may disrupt neuronal function through other mechanisms. Furthermore, high levels of metals such as iron are often present in Iowa well water and are known to accumulate in the brain with age and correlate with cognitive impairment. The objective of this study is to address the influence of these compounds on neurologic function using the nematode model organism *Caenorhabditis elegans*. Results from assessment of pharyngeal pumping (feeding behavior regulated by neuronal reflexes) and dopamine-dependent basal slowing behavior will be presented from young adult animals exposed to the neonic thiacloprid, glyphosate, or iron (ferric ammonium citrate).

65. HERBAL SUPPLEMENTS AND ATHLETES: USAGE RATES AND SUPPLEMENT BIODIVERSITY

Quinn Myers, Christopher Kliethermes, and David Senchina
Drake University

The goal of the present work was to determine the extent of both general and specific herbal supplement use by athletes based on published nutrition surveys. Compared to previous analyses, the present work applied a stricter, taxonomy-based definition of "herbal supplement" and a larger literature base. Forty-four studies published prior to September 2018 met all inclusion criteria. Collectively, they represented 17,128 athletes with a disproportionate representation of males (72%) and majority Olympic/elite-level athletes (54%). Survey sizes were highly variable (389 ± 352 athletes per study). The average number of herbal supplements used per athlete was 14% if an unweighted average was calculated or 16.2% if a weighted average was calculated. The most widely-used supplements were ginseng (genus *Panax*, used by 6.4% of athletes and reported in 68% of studies) and echinacea (genus *Echinacea*, used by 3.9% of athletes and reported in 50% of studies). Across all studies, 23 different herbal supplements were reported, representing 23 distinct genera, 19 families, 17 orders, 4 classes, and 2 divisions. One hypothesis that might explain the use of such diverse taxa relates to common plant secondary metabolite pathways being shared across major plant lineages and subsequent differential gene regulation.

66. THE EFFECTS OF REPEATED TESTING IN THE ELEVATED PLUS MAZE: MEASURING ANXIETY IN SYRIAN HAMSTERS

Hannah Nyman, Sara Ashar, and Dr. Samantha Larimer
Wartburg College

Severe anxiety affects many humans. By observing behavior on an elevated plus maze (EPM), researchers can explore anxiety in rodents to gain a better understanding of anxiety disorders. Our study assessed two cohorts of male Syrian hamsters (*Mesocricetus auratus*) across multiple trials to explore how repeated exposure affected performance on the EPM. One group of animals had repeated exposure, followed by a 13-week break and then additional exposure to evaluate whether animals returned to a naïve state after a break. Anxiety was measured via time spent in various sections of the maze, as well as amount of activity. Our results showed that long term repeated exposure to the EPM does have an effect on rodents, though the pattern of that effect varied depending on variable examined and the cohort of animals.

67. MODULATION OF BOVINE MAMMARY GLAND EPITHELIAL CELL MONOLAYER PERMEABILITY BY EXTRA-CELLULAR ADENOSINE TRIPHOSPHATE

Madison Shatek, Holly Salzbrenner, and David McClenahan
University of Northern Iowa

Epithelial cells lining the secretory units and the ducts of the bovine mammary gland perform an important role in regulating the movement of various macromolecules and whole cells during normal lactation and mastitis. Many host and bacterial produced substances can greatly affect the barrier function of this epithelial monolayer during mastitis. One potential player in this process, that can be released by both the host and through bacterial degradation is adenosine triphosphate (ATP). ATP likely interacts with the purinergic receptor P2X7 in mediating some of the effects associated with mastitis. A bovine mammary gland epithelial cell line, Mac-T cells, were tested with various concentrations of ATP and inhibitors of P2X7 to determine their effects on epithelial cell monolayer permeability by measuring the transwell epithelial electrical resistance (TEER) of the monolayer. ATP did increase Mac-T cell monolayer permeability almost immediately after its addition, and this was reversible by the use of P2X7 inhibitors. These results would indicate that ATP, through its interactions with the P2X7 receptor, modulate epithelial cell function in the bovine mammary gland, especially in regards to the barrier function that epithelial cells normally provide.

68. BRIDGING THE GAP BETWEEN SCIENCE AND START-UP! NEUROSMART: A NEUROSCIENCE STUDENT MENTORING AND RESEARCH TRAINING PROGRAM

Muhammad Spocter¹, Aracely Miron-Ocampo², Kacia Cain², and Brenda Foncesca³

Des Moines University¹, Des Moines Public Schools², Kemin Industries³

Most science graduates are poorly equipped to think of their scientific knowledge as the first step towards the production of products/services/ technologies that could directly help with discovery and innovation. One way, in which to remedy this would be to focus efforts on workforce development through the development of bioscience-business collaboratives. Here we report on a collaborative undertaking between the public-school system (Des Moines Public Schools, Central Campus), a major health sciences university (Des Moines University) and a key regional business employer (Kemin Industries), aimed at developing a unique training opportunity for high school students in the combined areas of neuroscience and business. Through the use of a mixed instructional approach, this piloted program provides a one of kind, quality over quantity mentorship design, allowing students to progressively build their knowledge and research skills through working with experts in the fields of neuroscience and business in a semester long research class. Students receive the unique opportunity to study at a medical school all while obtaining college credit through Des Moines Area Community College and also learn to apply their knowledge in project-based learning environments using advanced medical technology. NeuroSMART has had a tremendous impact on female, minority, and low-income students: 80% of participants are female, 80% are minorities, and 72% are low-income.

69. FOOTWEAR FOR BARBELL BACK SQUATS PART II: CROSS-TRAINERS WITH HEEL ELEVATION VS. NO HEEL ELEVATION

Callie Zobeck, Etta Moline, Madison Coffman, Zach Mathews, Ian Malaby, Jacob Hardy, Collin Seymour, Brooks Ginn, and David Senchina
Drake University

Weightlifting shoes are purported to improve weightlifting performance in part due to their elevated heel; however, they are expensive, especially for novice or recreational athletes for whom weightlifting may only be a minor part of their overall training. The purpose of this investigation was to compare back squat performance when athletes wore cross-training shoes with a 2.5-lb weight plate under their heels versus without the weight plate. Eleven athletic males (20.3 ± 1.3 years, 179.4 ± 7.0 cm, 81.9 ± 10.8 kg) performed three repetitions of back squats at 75% 1RM in each condition. Squat depth was standardized (thighs parallel) and subjects were verbally instructed to stay back on their heels. Foot force production, knee angle, perceived exertion, and perceived shoe comfort and stability were measured for each condition. There were no statistically significant differences for any variables; thus, findings suggest that placing slight (~8 cm) external elevation under the heels may not improve back squat

biomechanics or performance. None of the subjects were professional weightlifters, so it is possible that a significant effect may be found at the elite level.

70. CHANGE IN CORTISOL AND STATE ANXIETY: THE EFFECTS OF A COGNITIVE STRESSOR ^{aaa}

Sanah Munir
Wartburg College

The effects of a stressor on cortisol and state anxiety were investigated. Physical and cognitive stress results in increased cortisol levels (Boudarene et al., 2002) and state anxiety (Qi et al., 2016), respectively. It was hypothesized that a cognitive stressor increases cortisol and state anxiety levels. Method: Cortisol levels and state anxiety (State-Trait Anxiety Inventory, Spielberger, 1983) were measured among 81 college students (19.25 ± 1.10 years) before (pre) and after (post) the introduction of the stressor (timed math problems). Cortisol was obtained through salivary samples, and an immunoassay kit was used to analyze cortisol concentrations. Results: Paired-sample t-tests were utilized; cortisol and state anxiety were the repeated variables. The stressor caused a decrease in cortisol, $t_{77} = 2.16$, $p < .05$ and an increase in state anxiety, $t_{80} = -2.55$, $p < .05$. Cortisol levels ($\mu\text{g/dL}$) were: pre= 0.11 ± 0.07 ; post= 0.09 ± 0.08 ; and state anxiety was: pre= 36.01 ± 10.10 ; post= 38.27 ± 11.53 . Discussion: The cognitive stressor decreased cortisol levels, contradicting the hypothesis and findings of Boudarene et al. (2002). However, it increased state anxiety, confirming the hypothesis and findings of Qi et al. (2016). Consequently, a cognitive stressor appears to have different effects on the physiological and psychological indicators of stress; future studies may want to further examine this. These findings may have implications for management of stress.

71. THE IMPACT OF SPORTS VISION TRAINING ON HITTING PERFORMANCE OF COLLEGIATE BASEBALL PLAYERS

Connor Tupper and Paul Bartlett
Northwestern College

There has been a surge of research on vision training and its implications in a sports setting over the past decade. A large body of research is available on the implementation of ophthalmology-based vision training exercises for athletes' performance on a standardized task, but few of these articles address the implications of vision training for on-field performance. To help fill this gap, the present study examines the efficacy of a vision training on hitting performance through a pitching simulation that approaches game-like with the Northwestern College Varsity Baseball Team. Hitting performance of a Varsity and a Junior Varsity control group was first assessed with 40 pitches thrown by a pitching machine followed by a 9-week vision training program

performed by Varsity hitters that included a battery of vision training exercises. Following the training program the hitters were retested and results of the 14 Varsity and 7 Junior Varsity hitters were analyzed. Our findings showed significant differences in exit velocity between groups suggesting the vision training program may have played a role in the observed differences. The present research strengthens the small body of research investigating the impact of vision training for on-field performance benefits.

72. Zory Hamblin¹ and Kenneth Snell²
Upper Iowa University¹, Sanford Health Pathology Clinic²

During the summer of 2018, I had an internship experience at Sanford Health Pathology Clinic in Sioux Falls, SD. I chose this internship opportunity because I wanted to learn more about the workings of a pathology clinic, and also to see if it was the right future career path for me. In the clinic, I observed and assisted twenty-five different autopsies, including suicide, gunshot or shotgun wounds, natural or accidental death, and homicide. The internship allowed me multiple opportunities for hands-on experience; for example, using the electric saw to open the rib cage, weighing the organs and using an electric saw to open the skull. In addition to that, I practiced dissecting techniques including the kidneys, the process of cutting into the skull to obtain the brain and also the pituitary gland. The benefits I've gained through this internship experience, such as exposure to the techniques and the hands-on experience, will greatly help me with my future career.

Physiology & Health Sciences: Oral Presentations

139. INVESTIGATION INTO THE USE OF A CNM HERBAL INDUCER CONTAINING ACTAEA RACEMOSA, LEONURUS CARDIACA, MITCHELLA REPENS, AND VIBURNUM OPULUS AS APPLIED TO ISOLATED MUS MUSCULUS UTERINE STRIPS^{âââ}

Clayton Neuenschwander and Teresa DeGolier
Bethel University

Alternative or holistic solutions in the form of herbal remedies meant to ease or expedite the process of labor have often been pursued and administered but have seldom been quantitatively tested for efficacy. Previous research at Bethel University has shown some validation for a commonly used herbs such as *Caulophyllum thalictroides*, *Rubus idaeus*, *Ricinus communis* and *Oenothera biennis* on isolated mouse uterine strips. This study tested an array of herbals used in a Certified Nurse Midwife (CNM) tincture, which included *Actaea racemosa*, *Mitchella repens*, *Leonurus cardiaca* and *Viburnum opulus* in a similar design. These four herbals were prepared as individual solutions (*A. racemosa*=7, *M. repens*=7, *L. cardiaca*=2, *V. opulus*=2) and applied individually to tissues in an organ bath

apparatus. Results indicated that all tissues produced significant increases ($p<0.0001$) in contractile force at higher herbal treatment concentrations (1.35-4.05g/100mL stock) when compared to their own endogenous motility. These forces, however, were not significantly different from one another but were comparable to those produced by 10^{-5} M oxytocin. The results indicate that the individual components of this CNM tincture contract the uterine tissues, but further research is necessary to find if synergism exists among the four treatments when applied directly from the tincture.

140. THE CONTRACTILE EFFECTS OF VARIOUS SPECIES OF THE ANGELICA GENUS ON ISOLATED UTERINE TISSUE OF MUS MUSCULUS^{âââ}

Abby Puk and Teresa DeGolier
Bethel University

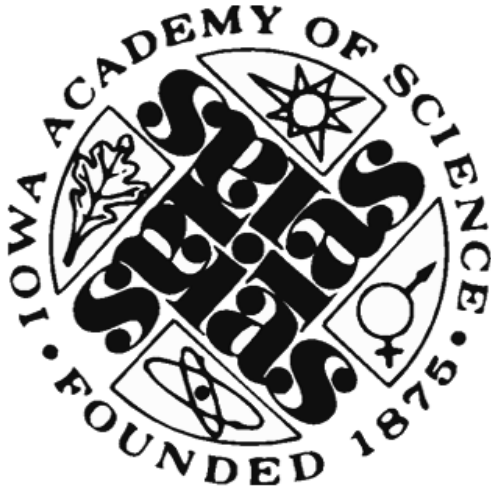
Herbal preparations have been utilized in midwifery to facilitate the birthing process. Nevertheless, these preparations are not under the scrutiny of the Food and Drug Administration, and there is a lack of clinical trials to demonstrate their safety and effectiveness. The *Angelica* genus—including *Dong Quai* (*Angelica sinensis*), *Angelica archangelica*, and *Angelica sylvestris*—has been used by midwives to induce uterine contractions. The goal of this project was to investigate midwifery claims by measuring the contractile effects of *A. sinensis*, *A. archangelica*, *A. archangelica* in combination with juniper berry, and *A. sylvestris* on isolated *Mus musculus* uterine horns. All *Angelica* species, when tested at similar concentrations (1.8 g/100 mL stock), produced contractile forces greater than that of the tissue's own spontaneous motility ($P<0.0001$; *A. sinensis* $n=5$, *A. archangelica* $n=4$, *A. sylvestris* $n=4$). Of the *Angelica* species, *Dong Quai* yielded the greatest contractile force. In addition, *A. archangelica* demonstrated concentration dependency when producing contractile forces ($P=0.0012$). The results herein support that the *Angelica* species reported in midwifery literature do indeed induce contractions at the reduced level of isolated tissue. Future research that would demonstrate the absorption and distribution of the herbal constituents following oral consumption would lend more support to the use of these herbals at the organismal level.

141. IMPLANTATION SPACING OF EMBRYOS IN MUS MUSCULUS EXPOSED TO ATRAZINE^{âââ}

Bailey O'Hare
Saint Mary's University of Minnesota

Pesticide and herbicide exposure is an increasing concern for adverse reproductive risks. As one of the most prevalently used herbicides in the world, Atrazine is a chemical of interest. The present study examines the effects of atrazine on murine implantation spacing. Without even distribution a number of adverse effects may happen such as abnormal embryo

development, miscarriage, placenta previa or ectopic pregnancies. Mice exposed to 0, 3, 30, or 300 ppb atrazine present in their drinking water until gestational day 5.5-7.5 did not show a significant difference in embryo spacing in the uterus ($F(1,195)=0.028$, $p=0.868$).



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