

4-21-2017

Proceedings of the 129th Annual Meeting of the Iowa Academy of Science [Program, 2017]

Iowa Academy of Science.

Let us know how access to this document benefits you

Copyright ©2017 Iowa Academy of Science

Follow this and additional works at: https://scholarworks.uni.edu/ias_programs



Part of the [Life Sciences Commons](#), and the [Physical Sciences and Mathematics Commons](#)

Recommended Citation

Iowa Academy of Science., "Proceedings of the 129th Annual Meeting of the Iowa Academy of Science [Program, 2017]" (2017). *Proceedings of the Annual Meeting of the Iowa Academy of Science [Programs]*.
4.

https://scholarworks.uni.edu/ias_programs/4

This Program is brought to you for free and open access by the Iowa Academy of Science at UNI ScholarWorks. It has been accepted for inclusion in Proceedings of the Annual Meeting of the Iowa Academy of Science [Programs] by an authorized administrator of UNI ScholarWorks. For more information, please contact scholarworks@uni.edu.

**PROCEEDINGS OF THE 129TH
ANNUAL MEETING
OF THE
IOWA ACADEMY OF SCIENCE**



**April 21—22, 2017
University of Northern Iowa**

Iowa Academy of Science Board of Directors

Melinda Coogan, President
Paul Bartelt, President Elect
Carol Schutte, Past President
Directors (Year term ends)
De Anna Tibben (2017)
Jeffery Wilkerson (2017)
Mark Anderson (2018)
Elizabeth Stone (2018)
Lyn Countryman (2019)
Debora Christensen (2019)

Iowa Academy of Science Staff

Craig Johnson, Executive Director
Cory Johnson, Office Manager
Eve Halligan, Program Coordinator
Allison Wold, Student Assistant
Erika Wold, Student Assistant

Iowa Academy of Science

Corporate Members

Platinum

**Rockwell
Collins**

www.rockwellcollins.com/

Bronze

www.hnicorp.com/



bmcaggregates.com/



www.kemin.com/en

www.hy-vee.com/



Special Thanks

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

University of Northern Iowa

Mark A. Nook, President
Mary Friedrich, Dining Services Administration
Angie Sadler, Catering Manager
Marcy Seavey, STEM Coordinator, Academic Affairs
Roger Kueter, Associate Dean & Professor
Neil Clopton, Information Technology Specialist
Jack Shafer, Building Services Assistant Manager
Joshua Sebree, Ph.D. Asst. Professor
UNI Catering Staff
UNI Facilities Staff

IJAS Symposium & Other Special Recognition

Iowa Space Grant Consortium/NASA
Bob Watson
Ryan Clark
Chad Heinzel, Ph.D.
Laura Jackson, Ph.D.
Deborah Lewis
Tom Ervin
Larry Stone

Thank you to all section chairs, vice chairs and committee members and all who generously donated and/or purchased items in the IJAS Silent Auction.

And thank you to the many 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.



Welcome from IAS President Dr. Melinda Coogan

As scientists, we are living at a time of significant contributions and vital importance. Your support of the 129th annual meeting of the Iowa Academy of Science is crucial to the dissemination of valuable information and the support of young Iowa scientists whose enthusiasm inspires even the most severe curmudgeons. Thanks to the presence of Iowa's superior research and educational institutions, we have a unique opportunity to be at the forefront of current and future scientific breakthroughs and discoveries. Since 1875, the Iowa Academy of Science has provided leadership in these endeavors, and I would personally like to extend a warm welcome to you, your colleagues, and students as we continue this 145-year-old tradition. It is a pleasure to return to the University of Northern Iowa campus for our 129th annual meeting, and I hope your time in Cedar Falls initiates and refreshes friendships and excitement for science as you reflect upon the positive impact IAS has had on you, Iowa, and our global community.

Dr. Melinda Coogan, President

Committees and Sections

Committee on Committees and Elections

Chair: Paul Bartelt
Katie Borton (2017)
Tom O'Donnell (2017)
Thad Sheldon (2018)
Nicole Palenski (2018)
Tyrone Genade (2019)
Qun Wang (2019)

Conservation and Preserves

Chair: Paul Frese (2018)
Mike Goudy (2017)
Katherine Megivern (2018)
Ryan Rehmeier (2019)
Andy McCollum (2019)

Finance

Chair: Andrew Brittingham (2018)
Karen Breitbach (2017)
Kacia Cain (2017)
Jeanne Rogis (2018)
John Dawson (2019)
Leslie Flynn (2019)

Iowa Science Foundation

Chair: Kavita Dhanwada (2017)
Kristopher Keusman (2017)
Dawn Reding (2018)
Ken DeNault (2018)
Thomas Bonagura (2019)
Joseph Tiffany (2019)

Membership

Chair: Clinton Meyer (2017)
Lynne Campbell (2017)

Gary Fulton (2018)
Chris O'Connell (2018)
Donald Beitz (2019)
Michael LaGier (2019)

Recognition and Awards

Chair: Carol Boyce (2018)
Tom Ervin (2017)
Heidi Peterson (2017)
Lisa Chizek (2018)
Elitsa Ananieva-Stoyanova (2019)
Michael Carruthers (2019)

Societal Issues

Chair Jim Colbert (2017)
Birgitta Meade (2017)
Sherman Lundy (2018)
Sara Coleman (2018)
Joseph Nguyen (2019)
Jonnie Becker (2019)

Student Programs Committee

Chair: Gail Kunch (2017)
Tami Plein (2017)
Muhammad Spocter (2018)
Felicitas Avendano (2018)
Mike Goudy (2019)
Barbara Lemmer (2019)

Excellence in Science Teaching Awards (ESTA)

Chair: Tom Ervin
Members appointed by the Chair:

Ernie Schiller
Mike Zeller
Doug Herman
Gale Vermeulen
Mike Clough
Morgan Masters
Mary Lestina

Section Chairs, Vice Chairs

Anthropology

Mark Anderson, Vacant

Cell, Molecular, & Microbiology

Rasika Mudalige-Jayawickrama, Kelly Grussendorf

Chemistry

Jeremy Durelle, Joseph Nguyen

Community College Biologists

Beth Collins, Vacant

Ecology & Conservation

Neil Bernstein, Deborah Lewis

Engineering

Mark Wright, Al Ratner

Environmental Science & Health

Nicole Palenske, Thomas Bonagura

Geology

Chad Heinzl, John Dawson

Iowa Science Teaching

Organismal Biology

Eric Gangloff, Sara Sheeley

Physics, Atmospheric &

Space Sciences

Thank you for participating in the 129th Annual Meeting of the Iowa Academy of Science.

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

Iowa Academy of Science



www.scienceiniowa.org

FRIDAY SCHEDULE

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 am	IJAS Registration Open	Registration Desk/Great Room, 2nd Floor
8:00-8:15 am	Judges Meeting	220, Auditorium
8:00-5:45 pm	IAS Registration Opens	Registration Desk 2nd Floor
8:00-10:45 am	IJAS Oral Presentations	Rooms See pg. 9
8:00-11:15 am	IAS Book Store Opens	Great Room, 2nd Floor
8:00-10:30 am	Breakfast	Great Room, 2nd Floor
10:45-11:10 am	IJAS Student Poster	Great Room/Da Vinci Room
11:10-11:35 am	IJAS Awards Luncheon GROUP 1	216/222
11:35-12:00 pm	IJAS Awards Luncheon GROUP 2	216/222
12:00-12:20 pm	IJAS Awards Ceremony	220, Auditorium
12:20-1:15 pm	General Session I	220, Auditorium
1:15-1:30 pm	IJAS Poster Removal	Great Room, Da Vinci Room, 2nd Floor
1:30-2:10 pm	IJAS Activity	TBA
1:30-2:05 pm	Business Meeting	220, Auditorium
2:00-4:00 pm	Senior Poster Set-up	Great Room, Da Vinci Room, 2nd Floor
2:15-4:30 pm	Symposiums A, B, C	Room 409, See Proceedings
4:30-5:45 pm	Senior Poster Session/Social	Great Room, Da Vinci Room, 2nd Floor
6:00-7:30 pm	President's Banquet	216/222/220 (CAT, Sandbox, Auditorium)
7:45 p.m. - 8:45 p.m.	General Session II	Room 220, Auditorium

SATURDAY SCHEDULE

Book Store: **Friday** 7:30—4:30; **Saturday** 8:00—3:30;
 Great Room

Time	Events	Location
7:30-4:00 pm	Registration Desk Opens	Great Room, 2nd Floor
7:30-3:00 pm	IAS Bookstore Open	Great Room, 2nd Floor
8:00-10:30 am	Breakfast	Great Room, 2nd Floor
9:00-10:30 am	Beverages	3rd and 4th Floors
8:00 am—3:55	Section Meetings	See Schedule on page 5
11:00 a.m. - Noon	General Session III	220 Auditorium
Noon-12:30 pm	Luncheon-Box Lunch	216 (CAT Classroom)
12:40-4:30 pm	Section Meetings Continue	See Section Schedules pg 27
3:00 pm	Bookstore Closes	Great Room
4:00 p.m.	Registration Desk Closes	Great Room

IAS PROGRAM SCHEDULE

Saturday Refreshments in the Great Room

IAS Oral Presentations

8:00 a.m.— 4:00 p.m.

Schindler Education Center

See the oral presentation schedule below

Section Meeting Room Assignments

See detailed schedules pg. 27

Section	Time*	Location
Anthropology	8:00 am - 1:00 pm	See Geology Section Meeting
Cellular, Molecular, and Microbiology	8:00 am - 3:55 pm	Room 303
Chemistry	8:00 am - 10:20 am	Room 304
Community College Biologists	8:00 am - TBA	Room 133
Ecology & Conservation	8:00 am - 3:35 pm	Room 409
Engineering	8:00 am - 2:15 pm	Room 410
Environmental Science & Health	8:00 am - 3:35 pm	Room 404
Geology	8:00 am - 1:00 pm	Room 403
Iowa Science Teaching	8:00 am - 10:00 am	Room 408
Organismal Biology	8:00 am - 10:40 am	Room 406
Physics, Atmospheric and Space Sciences	8:00 am - 10:40 am	Room 301
Physiology & Health Sciences	8:00 am - 10:40 am	Room 308

* The time listed is the total time the section meetings are scheduled to run. The meetings will break at 11:00 for General Session III and Luncheon which ends at 12:30 p.m. Sections scheduled to meet in the afternoon resume at 1:15 p.m. Please see the oral schedules on pages 27 - 31 for specific presentation times.

Section Meeting schedules begin on Page 27

IAS PROGRAM SCHEDULE

Friday, Opening Sessions and Symposiums. Refreshments during the Social Hour.

12:20 p.m. Welcome from Marcey Seavey, STEM Coordinator, Academic Affairs

Friday, April 21, 2017 11:20p.m.

General Session I The Polar Vortex: Overview and Implications for Iowa Weather

Dr. Ken Budke Family Auditorium
Schindler Education Center, Room 220
University of Northern Iowa

Jim Lee
General Forecaster
National Weather Service



11:20 Friday IJAS Awards Luncheon

Ticket Required
216/222/220 (CAT, Sandbox,
Auditorium)



Friday, April 21, 2017 2:15-4:30 p.m.

Symposium A

Flooding, Climate Change and Agriculture: Strategies for Resilience

Room 409 Schindler Education Center University of Northern Iowa

Gene Takle, Ph.D., Iowa State University
Larry Weber, Ph.D., University of Iowa
Matt Liebman, Ph.D. Iowa State University

Symposium B

Iowa's Water Quality: Scientific Solutions and Legislative Trends
Dr. Ken Budke Family Auditorium Schindler Education Center,
Room 220

Matthew Helmers, Ph.D. Iowa State University
Christopher Jones, Ph.D. University of Iowa
Christine Nemec, Ph.D. University of Northern Iowa
Senator David Johnson, Ocheyedan

Symposium C - Workshop

Care and Management of Natural History Collections

1:30-2:05 p.m.

IAS Business Meeting, 220, Auditorium

Agenda

- Call Meeting to Order
- Welcome
- Approval of Agenda
- Recognition of Deceased Members and Moment of Silence
- Introduction of Board Members
- Honor Past-President and Outgoing Board Members



4:30—5:45 p.m.

IAS Senior Poster Session & Social Hour

Student Center Lounge

Poster numbers are available in the Abstracts beginning on page 24.

Join your friends and colleagues to learn the latest

6:00—7:30 p.m.

President's Banquet

216/222/220 (CAT, Sandbox, Auditorium)

Ticket required

President's Banquet Program

Dinner; Rooms 216 & 222

Welcome and Introductions, Craig Johnson, Executive Director; Auditorium (Room 220)

Executive Director Remarks

Introduction of Elected Officers

President's Address by Melinda Coogan

Passing of the Gavel



IAS PROGRAM SCHEDULE

Friday Evening, Distinguished and ESTA Awards during the President's Banquet .

Iowa Academy of Science Distinguished Awards

Nominations are due the first Friday in February

The contributions of Iowa's Scientific Community have transformed our world view, protected our natural heritage and fostered succeeding generations of eager science researchers. In recognition of the best contributions of Iowans to science research, science education, and service to science, the Iowa Academy of Science established the Distinguished Science Awards Program in 1980. Nominators and nominees do not

Distinguished Fellow



Neil Bernstein, PhD.

Distinguished Iowa Scientist



Gustavo MacIntosh, Ph.D

Distinguished Iowa Science



Heidi Sleister, Ph.D

Distinguished Iowa Science



Pat Singer, Ph.D

Excellence in Science Teaching Awards (ESTA)

Nominations are accepted continuously.

The submission deadline each year is January 31st.

The ESTA awards are presented at the Iowa Academy of Science Annual Meeting in April.

The winners of the ESTAs receive a plaque and a check for \$200. The awards are presented at the IAS Annual Meeting in April. Learn more about the ESTAs and about making a

Elementary Science



Brenda Kaufman

North Tama Elementary School

Elementary Science



Vonna Watson

North Tama Elementary School

Earth, Space, Environmental Science



Hallie Edgerly

Adel DeSoto Minburn Middle School
Adel

Middle or Junior High Science



Romona Jolliffe Satre

Ogden Middle School
Ogden

General or Multiple Science



Casey Giraud

Janesville Consolidated
Janesville

Life Science



Kevin Schneider

Dowling Catholic High School
West Des

Science Supervisory



Dr. Dawn Del Carlo

University of Northern Iowa
Cedar Falls

Physical Science



Holly Hinkhouse

Riverside High School
Oakland

IAS PROGRAM SCHEDULE

General Session II

Friday, April 21, 2017 7:45 p.m.

General Session II: From Molecules to Satellites: A Physical Chemistry Approach to Next Generation Spacecraft Technology

Dr. Ken Budke Family Auditorium
Schlinder Education Center, Room 220
University of Northern Iowa
Cedar Falls, Iowa



Jaime Stearns, Ph.D.
Senior Research Chemist
Space Vehicles Directorate

Saturday, April 22, 2017 11:00 a.m.

General Session III: The Northeast Iowa Intrusive Complex: is it another Mineral-Rich Duluth Complex

Dr. Ken Budke Family Auditorium
Schlinder Education Center, Room 220
University of Northern Iowa
Cedar Falls, Iowa



Speakers:

Benjamin Drenth, Ph.D.
Research Geophysicist
U.S. Geological Survey
Denver, Colorado

Dean Peterson, Ph.D.
Senior Vice President for Exploration, Duluth Metals Ltd
Research Associate, UMD Natural Resources Research Institute
Adjunct Asst. Professor, University of Minnesota Duluth

Publish in the Journal of the Iowa Academy of Science

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

Current and past issues included in your IAS membership

IJAS PROGRAM SCHEDULE

Friday, April 21, 2017

Time	Event	Location
7:30 - 8:30 a.m.	IJAS Registration	Great Room, 2nd Floor
7:30 — 8:30 a.m.	Poster set up	Great Room/Da Vinci Room
8:00 a.m.	Judges Meeting	153A
8:30 — 11:15 a.m.	IJAS Poster Presentations/Judging	Great Room/Da Vinci Room
8:30—10:45 a.m.	IJAS Oral Presentation/Judging	See Room Schedule below
11:20 — 12:10	IJAS Awards Luncheon	216/222/220 (CAT, Sandbox, Auditorium)
12:20 — 1:15 p.m.	IAS Welcome—General Session I	220, Auditorium
1:15—1:30	Remove IJAS Posters	Great Room/Da Vinci Room
1:30 — 2:10 p.m.	IJAS Activity	TBA
IJAS Adjourns	IJAS students attend IAS Symposiums	See IAS Schedule

IJAS RESEARCH PRESENTATIONS

Oral Presentations Room Assignments

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

IJAS Oral Presentation Rooms

Poster	Room Assignment	Poster	Room Assignment
1 - 14	Room 306	48 - 57	Room 408
15 - 27	Room 309	58 - 67	Room 410
28 - 37	Room 403	68 - 77	Room 158
38 - 47	Room 404	78 - 87	Room 144

IJAS AWARDS LUNCHEON

Honoring the Accomplishments of IJAS Students

Luncheon Program, Friday, April 21, 2017

Welcome, Gail Kunch, Chair, Student Programs Committee

Introduction of Iowa's 2017 National Youth Science Camp Delegates

Announcement of IJAS Competition Awards

Most Promising Young Scientist

Iowa Delegates to the American Junior Academy of Science, 2017

Iowa Alternates to the American Junior Academy of Science, 2017

IJAS \$500 Senior Scholarships

Recognition of all IJAS Members, Judges, and Sponsors

IJAS RECOGNITION

Honoring Iowa delegates representing Iowa nationally



2016 84th IJAS Science Symposium

Photo by Craig Johnson

2017 IJAS Delegates to the American Junior Academy of Science Annual Meeting

Sreelekha Kundu
Central Campus

Des Moines

Caleb Kong

Ames High School
Ames

Manasa Pagadala

Rivermont Collegiate
Bettendorf

Chaperone: Kacia Cain, Central Campus

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

IOWA JUNIOR ACADEMY

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

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. The Iowa Space Grant Consortium has awarded the IJAS \$5,000 in support of the Iowa

2016—2017 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

Xandra Abel
Zephan Abel
Lexi Buck
Kristyn Eves
Style Haeffner
Serenity Haynes

Hanna Huang
Sierra Kelman
Chase Krug
Manasa Pagadala
Summer Smith
Noah Solheim

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.

Grade 5

1. Birds of a Feather and our Weather

Drew Hundley & Brandyn Kipper
Orange Elementary, Waterloo

How does the weather effect how many birds at our bird feeding station? Our school started a bird feeding station two years ago at a new school site on a former farm field. We became interested in how many birds and what species came to our feeders. We also had heard that weather may effect how many birds would be at our feeders. We decided to record weather data and bird activity. To record weather data we wrote a grant to get an automatic weather recording station through the FESIRSE Program. We then chose to record the temperature, wind speed, wind direction, cloud cover and cloud type. This was done each school day at 10:45 am. We also counted birds at the feeder at the same time. Each day we filled the feeders so that there was ample opportunity for food. It was also important for us to learn to identify birds. Our teacher shared field guides and birding tips as well as binoculars. The new learning we have gained may be important for future students to decide what time would be best to view birds at our feeders.

Grade 6

2. Solar Heat: Which Material Works Best?

Grant Anderson & Keating Fuger
Central Lee Middle School

What do humans need to survive? We need food, water, and warm shelter. We all need a warm place to live, particularly when it's chilly outside. How do many of us warm our houses or apartments? We depend on fossil fuels to supply gas and electricity to our heaters. But burning fossil fuels to create energy is harmful to the environment. What if there was a way to warm our homes without burning fossil fuels and it was free? In this project, we built two solar air heaters out of common household materials, one with a foil backer and one that was painted to see if one warms the air better than the other. We predicted that the foil-backed heater would conduct more heat. Our hypothesis was not upheld as the paint-backed heater conducted more heat. We hope to continue this project with more days of data collection.

3. Fruit Freshness

Jacob Hohl & Gannon Wells
Central Lee Middle School

Our problem was our fruit did not last that long at home. We wanted to see if we could find a good way to keep fresh fruit longer. We hypothesized that by using an expensive Freshworks Produce Saver that our fruit would not rot as fast. We experiment using bananas and strawberries and tested them in 5 different bags and/or containers. We used a Freshworks Produce Saver, a Tupperware container, a brown paper bag, a plastic Ziploc bag and a Produce pouch green bag. We put the fruit in each container and check them daily until they were no longer edible. After 4 trials of bananas and strawberries, we conclud-

ed that the Freshworks Produce Saver did indeed keep our fruit the longest. However, the Ziploc bag, Produce pouch green bag and Tupperware were a close second while costing a lot less. By determining the cheapest way to keep our produce the longest will save people money.

4. How Fast Transition Metals Oxidize

Ian Perez
Ames Middle School

Our question was how fast do the different transition metals corrode? The different metals we used were Titanium, Nickel, Copper, Iron, and Zinc. We expected the iron to corrode the fastest because of the websites we looked at and because we've actually seen iron rust. We thought that either titanium or zinc would corrode the slowest. We used a LEGO motor to expose one set of samples to air and water. We put another set of samples in only water and in separate containers (after day 1) so they wouldn't contaminate each other. On the first day we put this set of samples in the same water bath and we did notice that there was some contamination in the samples. We put control samples in plastic bags. Every 24 hours, we looked at them under a microscope and looked for changes. After four days in the bath we saw that iron almost completely corroded and nickel did not corrode at all. The copper was corroding the second fastest and then titanium, and then zinc.

5. Here Fishy, Fishy!

Olivia Tennant
Central Lee Middle School

My name is Olivia Tennant. I am a sixth grader at Central Lee, in Donnellson, Iowa. The title of my project is Here Fishy Fishy, as fish are impacted by oxygen levels and I wanted to find out if field runoff has an impact to these waters. I assumed that waters impacted by field runoff would have a negative impact to oxygen levels. We are constantly adding chemicals to our fields and I wanted to make sure this was not negatively impacting our waters. I tested seven bodies of water to see what the percentage of oxygen was. The highest oxygen level was in the Des Moines River. This is because it was the largest body of water and the water was constantly flowing which allows oxygen to continue to be dispersed. G. McCarty had the highest levels of oxygen in a pond. This pond is surrounded by grass, livestock, and fields. This was inconclusive to my study as this pond was surrounded by field runoff. That is when I found out that this pond as well as J. McCarty's pond had been treated with AquaShade. AquaShade is a good chemical that increases photosynthesis. I then turned my study to looking closer at the surroundings and Phosphorus levels in the soils. The soil also has high Phosphorus which causes algae to grow and reduce the oxygen but by adding AquaShade it eliminates the algae and increases oxygen. I would like to continue to review phosphorus levels and the impact to our waters.

Grade 7

6. Preserving a Georgia Hot

Zephan Abel

IJAS RESEARCH PRESENTATIONS

Posters 217, 218, & Great Room; Oral Presentations—See page 9

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

Central Lee Middle School

The purpose of this experiment is to see which method mummifies a hotdog the fastest. I used 4 different methods to mummify hotdogs. I measured the length, weight and circumference of each hotdog. I placed each hotdog into a dish with either baking soda, salt or sugar. I placed 10 hotdogs in a heat resistant container with sand and placed them under 2 heat lamps. I placed 10 hotdogs in an empty container for my controls. I rechecked the hotdogs on a weekly basis. Each week I took the hotdog out and discarded what was in the container. I repeated the steps for another week. I did this for 3 consecutive weeks. Sand and heat mummified the hotdogs the fastest. The sugar was the 2nd fastest. After the first week, the salt had become hardened around the hotdogs. This made it easy to see how much it had decreased in length. The baking soda didn't mummify the hotdog very fast. My controls didn't change at all and by the 2nd week they had begun to grow mold.

7. Biomimicry

Xandra Abel
Central Lee

The purpose of this experiment is to see which hydrophobic coating prevents the most bacterial growth. I used 4 hydrophobic coatings in this experiment. 3 of the coatings were store bought and 1 was a homemade coating. I took sterile tongue depressors and sprayed them with the hydrophobic coatings. I then dipped them in distilled water and left them out on the dining room table. After several days, I swabbed each tongue depressor with a sterilized swab. After swabbing the tongue depressor, I swabbed the corresponding section in the petri dish. I placed all the petri dishes in the incubator. In the 1st trial the control petri dishes were completely covered on the 1st day. The Nano® coating had the least bacterial growth. The Rain Guard® Hydro-lok had the most bacterial growth. In the 2nd trial the petri dishes had less bacterial growth overall. The Rain Guard® Hydro-lok had the least bacterial growth. The Nano® coating had the most bacterial growth. In the 3rd trial the Rain Guard® Hydro-lok had the most bacterial growth. The homemade coating had the least bacterial growth. In the 3rd trial I noticed the bacterial colonies on the petri dishes were larger than the previous 2 trials.

8. Iowa Prairie Diversity

Sophia Cordoba
Ames Middle School

The purpose of my experiment was to measure prairie diversity within different types of prairies in Iowa because it is important to know how such a crucial ecosystem is developing and to know how well prairie restoration is really working. In order to do this, I went out to three different types of prairies to discover how they were growing differently in terms of diversity by finding the average Coefficient of Conservatism, a number assigned to represent how diverse an area is. This involved using a 1 meter by 1 meter quadrat to isolate a section of land. In this isolated section, the plants present were counted and identified. For the few plants that could not be identified in the field, clippings were taken to help identify the plants at a later time more accu-

rately. After that, the CC had to be calculated. First, all of the plants were put in a list and the CC was assigned to each one individually. Then, the total CC for each prairie was added up and divided by the total plants that had been there and multiplied by the square root of the number of native species. The results were that the restored prairie had a CC of 9.9, which was the highest. Next was the Roadside Prairie, with a CC of 7.27, closely followed by the Native Prairie, who had a CC of 7.26. These results seem to indicate that Iowan prairies are in good shape for sustaining life.

9. "Ca"n It Dissolve?

Josh Ellis
Central Lee Middle School

The purpose of this project was to determine if different calcium products farmers use have different dissolubility and availability for the plants to use. I feel it is important for farmers to know how much calcium is in a product that they could be using on their field. Calcium is used as a gate way for nutrients to get in and out of the plant. Calcium is also a soil additive, which helps improve soil structure. For my experiment I chose six different calcium products they were: Organical, Gypsum, Hi-Cal-Lime, Bio-Cal, Calcium Sulfate, and Ag Lime, for a check I had Distilled Water. I measured out the products so the same percent of calcium was in each jar. After that I put twelve ounces of distilled water into each jar, and shook them. Twenty-four hours later I did my first test. The Hi-Cal-Lime had forty parts per million, compared to the other products it was very low and continued to stay low. I also observed that the Bio-Cal and the Ag lime you could actually see the rock particles in the jar. I analyzed the data and the conclusion was that the Hi-Cal-Lime tested did not provide the most available calcium.

10. Homopolar Trains

Quenten Tweedy
Central Lee Middle School

A Homopolar train is constructed with a battery and disk magnets placed on each end. The magnets must be placed where they are opposite. This train will only run on its specially designed track. The track is made from copper wire that one must carefully wind to make a smooth and steady track so there is no difficulty for the train to make its run. Once the train and track are constructed the science comes into play. The train will not move until both magnets are touching the track. They act like brushes on a DC armature style motor. The current between the battery and magnets creates energy and propels the train in a rotary motion through the copper track. The train continues until either magnet break contact, the battery runs dead, or weight over comes energy. When one continues to add additional magnets, it makes the train run faster until weight overcomes energy that the battery produces. Voltage would have to be increased to maintain additional weight. Like a train designed to carry a load, the engine one would pick would be based on the load it would be pulling. I had assumed that with additional magnets the train would move faster and it did, however, it was true that there becomes a point that the weight of the magnets plays a part with interrupting the trains speed.

IJAS RESEARCH PRESENTATIONS

Posters 217, 218, & Great Room; Oral Presentations—See page 9

Number identifiers indicate the poster location. Poster presentations are listed by grade of the primary author. If different the grade of second authors are indicated in parenthesis.

Grade 8

11. Heavy lift drones: how does airfoil effect lift capacity?

Nick Brien
Ames Middle School

For my project I studied how an airfoil effects how much an airplane, or drone in this case, can carry. The rationale for this project is that as drones are becoming more popular bigger companies are starting to take an interest in using them, such as Amazon for package delivery. I wanted to figure out if a fixed wing aircraft could compete with the traditional rotary craft in lifting capacity. To test this I selected 3 different airfoils to see how much weight each could carry. The wings were cut out of a foam board with a hot wire. Two templates were placed on either side of the wing and the wire was dragged across the template forming the wing. The wings were then attached to a foam body with duct tape covering the nose and some of the wings for damage tolerance. As there are no control surfaces the plane will and eventually stall crash into the ground nose first as that is where the majority of the duct tape is.

12. A Breath of Fresh Air: Air Particles and Air Quality

Carolyn Daw
Central Lee Middle School

The purpose of this project was to determine if the air that today's society breathes, is actually clean like the saying "a breath of fresh air." A total of 1 12" ruler, 1 empty milk carton, scissors, 1 black permanent marker, Vaseline, a microscope, a digital camera, string, and a hole punch were used in this experiment. The milk carton was cut into 12 3x 3 squares and 3 squares were labeled for 1 specific location. This step was repeated 3 more times until all squares were coordinated into sets of 3 in each location, which included the control. The squares were then coated with a thin layer of Vaseline in order to keep the captured air debris. The squares were then hole punched and hung in their specific locations for a time span of 48 hours. For each day, a sample was collected from each square and was analyzed using a microscope and slides. The data was analyzed and a conclusion was reached that the air failed to pass the test of cleanliness. The samples that were by the pond had the most then that of the control samples, which had the least amount of air debris. The air that society breathes is not "a breath of fresh air". Therefore, the saying is a lye and people should be aware of what they are breathing in everyday.

13. Analyzing the Differences in the Biomass of Soybeans When Growing in Different Growing Densities

Style Haeffner
Danville

Food production is an important science study today both for feeding the world and for efficiently feeding NASA astronauts during space travel. Currently there are farms in high-rise buildings using hydroponic systems. I was trying to figure out the differences in biomass between growing in different growing densities. I had three groups of plants growing hydroponically. Each group had three tubs of the same size, or capacity, with different amounts of seeds planted in each. Each group had the same amount of fertilizers, which were phosphate, po-

tassium, and nitrogen. I measured each weight to see how much biomass was produced in each growing density.

14. How Much Bacteria are on Restaurant Menus? Phase III

Serenity Haynes
Central Lee Middle School

The purpose of this project was to determine if daily sterilization of restaurant menus helps in controlling bacteria growth and if the bacteria was positive or negative. I used 5 menus from each restaurant for this project. I would take the first menu and swab it with a sterilized swab, next I would sterilize the menus with my Lysol cleaner and counsel with the staff, and then I came back at closing time and swabbed the same menu as before and collected percent coverage of bacteria growth. Next I would do the last 4 menus exactly like the first menu for each of the 5 restaurants selected. For the control, I poured my nutrient agar into a petri plate, then spayed my Lysol cleaner (0.8mg) onto my sterilized swab. Then I made a zig-zag motion onto my petri plate. Then I put them on the incubator for 168 hours (7 days) to see bacteria growth and then completed gram staining. The data was analyzed and the conclusion was drawn that if you clean the menus, the percent of bacteria growth would be less than if you didn't clean them and some of the plates came out with gram-positive and gram-negative.

15. Light Reflectivity

Emily Schorr
Central Lee Middle School

This project in its present form is the result of different temperatures on the light reflectivity of different land types. The initial idea was to determine the light reflectivity of snow, soil, and saltwater. With little success of testing the light intake led to the use of a Lux Light Meter to test the light reflectivity of snow, soil, and saltwater. Reflectivity was found when the Light Meter probe was placed 6 cm above the land type and a flashlight 12 cm above the same land type being tested. The displayed number was multiplied by 0.0929 to find what the reflectivity was in footcandles or FC which is the currency of light. To contain the start reflectivity without a flashlight I worked in a dark room with very little light. This caused the real FC to be found. The snow reflected on average 12-14 FC, the soil was 1-2 FC, and the water from 0-1 FC. The contributions of this project seemed to be twofold. First, my data shows that the warmer types of land will be the soil and water because they don't reflect as much as snow. Second, my data shows that global warming will affect the poles and coastal areas the most because the water around them holds the most heat and light.

16. Dry Ice Is Sublime

Sam Slade
Ames Middle School

Does the sublimation rate of dry ice change with varying temperatures? Sublimation is when solids turns into gasses, skipping the liquid phase of matter. Dry ice is special because it is frozen CO₂ gas, and when it warms up, it returns to its gaseous state. I wanted to find out if changing the temperature as this happens would have any effect on its

IJAS RESEARCH PRESENTATIONS

Posters 217, 218, & Great Room; Oral Presentations—See page 9

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

rate of sublimation or change of form. Tubing was filled with water and connected to the valve. Dry ice was crushed and put into the sample cell. After taring the scale to only measure the weight of the dry ice, the sample cell was weighed. After weighing, the sample cell was connected to the valve, and then put into a water bath. The sublimated gas pushed water out of the tubing into a graduated cylinder. A timer was used to measure the time it took the water to flow into the graduated cylinder. The volume of gas produced was found by measuring the amount of water in the graduated cylinder, and the rate was calculated. This procedure was performed twice each at 30 oF, 64 oF, and 103 oF. The average rate of sublimation at 30o was 8.4 per ml/s/g, and at 64o was 11.6 per ml/s/g, and at 103o was 19.6 per ml/s/g. This shows that the rate of sublimation went up with the increasing temperature, more than doubling itself between 30o and 103o.

17. Does Tooth Floss Change the Bacterial Populations of the Mouth?

Davis Verhoeven
Ames Middle School

Many people rely on flossing to reduce oral bacteria and thus, cure/prevent gingivitis and/or dental caries. However, a recent publication has stated that clinical studies pertaining to the medical benefits of flossing have been lacking (Donn, Jeff (2016)). The studies that do exist have been funded by large floss companies, this being a potential bias, and have not tested to see whether flossing effects gingivitis or whether the effectiveness of flossing varies with age. My science fair project has been designed to test to see if a) flossing changes the oral flora and b) if flossing helps to prevent and/or cure gingivitis and dental caries. Plating serial dilutions from the floss of seventeen people who flossed and did not for one week has provided an answer. Based on the results, my study suggest that flossing does not influence gingivitis and only results in a very minor reduction in bacteria. Afterwards, the Polymerase Chain Reaction and the sequencing of the 16s gene were used to identify bacteria. A 2x2 contingency table on prism software was used. A p-value of 0.13 for children and 0.7 for adults was present (0.05 considered significant), thus, the reduction in bacteria was not significant. To test for a correlation between flossing and gingivitis, a survey was given to approximately seventy volunteers from varying dental clinics pertaining to their flossing habits and if they had gingivitis or not. No correlation was present.

18. To Dissolve or Not to Dissolve, That Is the Question Phase III

Claire Wills
Central Lee Middle School

Many people suffer from migraine headaches, including me. I have taken many medications as treatment for my headache symptoms. I wanted to know if taking ibuprofen gel caps with apple juice would increase the dissolve rates of the ibuprofen, leading to the medication being dissolved quicker for faster headache pain relief. I tested ibuprofen gel caps dissolved in hydrochloric acid heated to body temperature and ibuprofen gel caps dissolved in hydrochloric acid and apple juice heated to body temperature. I hypothesized the dissolve rate of the ibuprofen would be quicker dissolving in the heated hydrochloric acid, without the apple juice. I then collected data on how long each gel cap took to dissolve. I completed 30 trials of hydrochloric acid

heated to body temperature and 30 trials hydrochloric acid heated to body temperature adding apple juice. My hypothesis was upheld as ibuprofen gel caps dissolved faster in the heated hydrochloric acid without the addition of apple juice.

19. "Meat" the Bacteria

Erin Yoon & Arundae Fernando
Ames Middle School

In many families, chopping boards are used daily. Without proper cleaning, the amount of bacteria will grow, causing serious food-borne illnesses. We wanted to investigate how the amount of bacteria was influenced after different cleaning methods. To carry out our experiment, we had chopping boards of two different materials; wood and plastic, as well as three different food sources: beef, chicken, and salmon. E Coli was made and added as a positive control. For our experimental procedure, we took our bacterial liquid cultures out of the shaking incubator, then took a sterilized culture tube, and carefully spilled it over the appropriate chopping board. Using a spreader, we distributed the liquid evenly throughout and immediately took a sterilized needle to scrape off bacteria and smear into the petri dish. This was done three times in 20-minute increments. Our experiment for the food items was a slightly different than the procedure for E Coli. We began with taking one side of the food source and thoroughly smeared onto the corresponding chopping boards. Taking a sterilized needle we scraped the residue from the chopping board onto the corresponding petri dish. We repeated this process in three 20 minute increments. At the initial starting point, we found that a number of bacteria on wood was much greater than plastic. As time ticked on, it was clear that wood has fewer bacteria than plastic. This is because wood is a natural anti-bacterial material. For cleaning methods, the clear result was the Dishwashing method.

Grade 9

20. Anticipating the Amplitude of Alternative Non-Corrosive Deicing Materials

Cain Brandon
West Central Valley High School

My project is to find an alternative deicing material that is less prone to corroding steel and is also more effective at committing its task than current deicing substances. My procedure I would need to follow for ten days. Within those ten days, I partook in two tests with the chemicals. I needed to make sure that all of my chemicals where liquids before I could start, so I mixed a 50/50 solution of the selected chemical and water. I dripped a drop of my 50/50 solution in the center of a steel slab and placed another on top as to enclose the solution between the two slabs. I repeated this process 18 times. They would stay out in a shed for 7 days with a sun lamp on them at all times until they would eventually move to a warmer indoor garage for three days. I would then uncover each subject and base its level of corrosion off of a scale I had created between shades, patterns, and texture of affected area. The second test was where I would place a manufactured disc of ice on a sponge, soaked in the 50/50 solution, and I would time each chemical solution to see which would be more effective at its job. I concluded that the list of deicers used in this test, from best to

IJAS RESEARCH PRESENTATIONS

Posters 217, 218, & Great Room; Oral Presentations—See page 9

Number identifiers indicate the poster location. Poster presentations are listed by grade of the primary author. If different the grade of second authors are indicated in parenthesis.

worst, were Methanol, Ethylene Glycol, Sodium Chloride, Magnesium Chloride, and Urea.

21. Does Smell Affect Taste?

Aliyah Dickson
West Central Valley

I was first introduced to this topic when I wanted to figure out if plugging your nose when you eat something so you won't taste it was just a myth, or if it really did work. Once I started looking into it, I realized that there are many people who don't do that by choice; they really can't smell. My purpose changed from the beginning of my project to the end. My hypothesis was that I believed the sense of smell was very important in how you taste, but your other senses will kick in and do what your nose can't. My hypothesis turned out to be true. I blindfolded 3 of my friends so that they could not see what they were eating, and had them plug their noses before they ate different types of food. My procedure went as expected, and most of the foods they guessed right were because of the texture. So I concluded that smell does affect taste, but your sense of sight and touch fill in for your lack of smell.

22. Does Smell Misinterpret Taste?

Paige Donnelly
West Central Valley High School

I chose how to test if a certain smell affect the way you taste something. When food enters your mouth, the food stimulates the chemical receptors on the roof of your mouth. Those receptors travel through your nose to the olfactory bulbs and together it forms taste. I am testing how strong the smell needs to be to disrupt that system. I am doing this to see if there is a solution to people not liking the flavor of a food. I think that the lemon juice will override the flavor and it will block the receptors from traveling to your brain. I tested 6 people with different foods. I took one person at a time in a room blindfolded. They first put a Dixie cup of lemon juice in front of their nose and I put 4 different foods in their mouth which were tortilla chips, sour gummies, spicy beef stick, and a chocolate bar. In my research I concluded that plugging your nose blocks the receptors from perceiving smell.

23. Punching Thru with Brute Force

Jacob Egger
West Central Valley High School

The purpose of this science fair project is to show how easy it is to be hacked without 2-step verification. Why care about passwords? Well say you lose your password on an important website you could lose credit card numbers, personal info, etc. The problem most people come across when their password is hacked is they didn't have 2 step verification. I'll do this by installing the python.py and the passwords.txt file here What were the results? Well, there wasn't a very likely chance of not hacking the password, what you're doing when you try to guess a password is called a Dictionary attack (an attempted illegal entry to a computer system that uses a dictionary headword list

to generate possible passwords) or brute force hacking (is a trial and error method used by application programs to decode encrypted data such as passwords or Data). My conclusion of this project is that the odds of hacking a password without the proper program are slim to none, but the only reason this project was conducted was to show how easy it is to be hacked without 2-step verification.

24. The Effects of Temperature on Aerosol Particle Size and Number.

Jacob Kelty & Megan Sherman
Center Point Urbana High School

Air quality is important to human health. Particles smaller than a human hair are not visible to the eye, but can exacerbate respiratory issues. Aerosols are particles carried in the air and can come from vehicle exhaust, dirt, and power plants. Temperature and relative humidity are known to affect aerosol numbers. In this study, the number and size of aerosol particles in a residential area were compared at two different temperatures, 45F and 50F using the Clear-CAICE aerosol monitor. Data showed that there was not much difference between the particle counts in both temperatures. However, while the coarse particles feel in the good range for the EPA Air Quality Index, the concentration of fine particles was in the moderate health risk category. While only emitting water vapor, the nuclear power plant in the vicinity may have impacted the data.

25. Improving Traffic Efficiency at T-Junctions

David Kim
Ames High School

Traffic inefficiency is a global problem that will continue to grow as an increasing number of people begin to use cars. Inefficiencies can add up to result in lost minutes, hours, or even days in the form of traffic congestions. One such congestion occurs each day before the beginning of the school day at a T-Junction in front of Ames High School. To fix this issue, I modeled the scene using a simulation software and ran two different simulations. One modeled the results of adding stoplights to the T-Junction, and another modeled the results of adjusting the curvature of the T-Junction. The simulations were run for what equates to hours of real time and the results were compared. The findings were that adjusting the curvature resulted in the least amount of idle time and the most throughput in the T-Junction.

26. Compound Bow Vs. Long Bow

Spencer Lamb
West Central Valley High School

My science fair experiment will be on whether the compound bow or the longbow is more accurate. My purpose behind wanting to do this for my science fair project is because I really enjoy shooting my bow. I tested my project with a target set up and I was approximately 25 feet away from my target. I used the same type of arrow and the same field head. My hypothesis is that the compound bow will shoot more accurate than the longbow. I am going to set a target exactly 20 feet away from a target and whatever bow would shoot closest to the designated target. My results are that the compound bow shot a lot better than the

IJAS RESEARCH PRESENTATIONS

Posters 217, 218, & Great Room; Oral Presentations—See page 9

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

longbow. The compound bow shot nine inches more accurate than the longbow. Everything that was done to one bow was done to the other. I used the same distances and the same arrow hole. I also used that same arrow on each bow the guarantee the bows were equal for their pinpoint accuracy. My conclusion is that the compound bow shot a lot more accurate than the longbow. The compound bow out shot the longbow in every single shot test. If you combine all the numbers I got from my testing the compound bow out shot the longbow by a solid 9 inches in a set of ten rounds. So my final conclusion is that the compound bow shoots a lot more accurate than the longbow.

27. Homemade Water Filtration Systems

Abigail Tibben
Ames High School

In my ninth grade science fair project from Ames High School, I tested the effectiveness of putting an extra layer of material in homemade water filters at removing nitrates. After visiting the Ames Water Treatment plant, and finding various websites showing how to make a homemade water filter, I chose to make the homemade water filters from the following common products: 2 liter bottles, coffee filters, charcoal, sand, and gravel. I chose to add banana peels, coffee grounds, and sawdust to each filter to see if these would help remove nitrates. I made sixteen water filters: four having banana peels inside, four with coffee grounds, four with sawdust, and the last four without any additives as my control set. I did this test because many cities in the midwest, such as Des Moines, Iowa and Flint, Michigan, have problems with nitrates and lead in the water supplies. I wanted to see if adding these natural ingredients would help remove unwanted nitrates from water supplies. I hoped to find whether or not the added ingredient would help remove more nitrates more effectively than the filter system alone. I found that the control filter system was more effective when compared to all of them, as all of the additives added nitrates. The bananas increased the nitrates by 10 times the original amount. The fact that the plant material (banana peels) increased the nitrates, caused me to think about other plant materials, such as corn stubble, and if they would add nitrates to water runoff. Nitrate levels in natural water supplies is a huge concern in the midwest, especially in Des Moines, Iowa. Further studies testing the effects of corn, soybean, and wheat stubble are logical next steps from this research.

Grade 10

28. There's a Science Experiment in my Stomach! : Phase III

Madison Barnhardt
Central Lee High School

When you think of stomach acid, you think the stuff in your stomach that breaks down food, right? This is true. The one main thing that stomach acid does is help us, but it also can hurt us in many ways than just one. Gastroesophageal Reflux Disease (GERD) is one of the biggest diseases that is caused by stomach acid being/getting too high. This can cause breaks and tears in the stomach lining of a human and in some cases, animals. My project is the process and exploration of making foods and medicines safer for alkalizing stomach acid when it gets too high, which can cause numerous amounts of pain for someone

who has GERD or even for the normal human who just had some bad food the night before. Phases I and II were focused on reducing the amounts of medicines that were needed for an average human. Phase III is focused on the foods that can help with GERD and acid reflux and also, what remedy helps the most with these effects on our bodies.

29. Calling It Quits: Phase 2

Brooke Finney
Central Lee

My experiment's purpose was to compare the lung capacities of a subject with COPD and subjects that has have no history with smoking. I chose this experiment because smoking is a huge problem, which is preventable, and causes many problems due to your health. My hypothesis was that the average lung capacity of subjects that have COPD will be 40% less than the subjects that have no history with smoking. I got information from a researcher at University of Iowa Hospital. He gave me the lung capacity of subjects with COPD, along with their age and height. My groups were Males 6-69, Females 60-69, Males 70-79, and Females 70-79. I had to find a person that had no history with smoking that matched up to each person on our COPD chart, based on age and height. The goal was to make the "same person," but one of them has COPD and one of them does not. I had to make sure that the height and age of the COPD subject and their "match" were near the same so the comparison will be accurate and that they would be compatible with each other. I found people and recorded their height, age, and took their lung capacity. They took the hardest, deepest, and fastest breath into the Peak Flow Meter. The red indicator rose up to a number and I recorded it. I repeated this three times and took their best blow. Then I paired the non-smoking subject up with a COPD subject, based on height and age. Then I analyzed our data and compared everything. I concluded that the average lung capacity of a COPD person was 52% less than the average person! This is very important because lung capacity determines your later health. So, if you stay away from cigarettes not only with your health be better, but they will be much happier!

30. Comparison of Cigarette and E-Cigarette Aerosol Emissions

Angela Graf
Center Point Urbana High School

Smoking has long been recognized as hazardous to the respiratory health of both the smoker and the persons who receive secondhand smoke. Electronic cigarettes (E-cigs) have become popular in recent years as smokers try to reduce the impact of the traditional cigarettes on their health. However, little research has been done that studies the impact of secondhand emissions from E-cigs. The purpose of this study was to compare the aerosol emissions from a tobacco cigarette and two types of electronic cigarettes (low and high intensity). Using the Clear-CAICE aerosol monitor, the emissions from a cigarette were collected in a vial using a tube and a pump. Emissions from an E-were collected from a smoker in a box. Every effort was made to reduce the contact between the aerosol and the researcher. In addition, the parents of the researcher were present while the research occurred. Data showed that the traditional cigarette had particle concentrations in the

IJAS RESEARCH PRESENTATIONS

Posters 217, 218, & Great Room; Oral Presentations—See page 9

Number identifiers indicate the poster location. Poster presentations are listed by grade of the primary author. If different the grade of second authors are indicated in parenthesis.

moderate and very unhealthy ranges (EPA Air Quality Index) while E-cigs had a somewhat lower health risk with fine particles in the good range and coarse particles in the moderate (low intensity) and unhealthy for sensitive groups (high intensity) ranges. The data suggest that more research needs to be done on the hazards of E-cigs to ensure that both users and those around them are knowledgeable about the health risks.

31. Comparison of Aerosols Emitted from Household Air Fresheners.

Abigail Hawken & Natalie Kongable
Center Point Urbana High School

Air quality is important to human health. Household aerosols come from water spray, cleaners, and hairspray, among many others. While cleaners have hazard warnings, no such warnings come with many household air fresheners such as candles, sprays, and incense. In eastern cultures, the burning of incense is a common practice. The purpose of this study was to compare the aerosols emitted from household air fresheners. Using the Clear-CAICE aerosol monitor, the emissions from a scented candle, incense, an Air-Wick solid, and an aerosol spray were compared. Data showed that the fine particles from the candle, spray, and incense were beyond the hazardous range according to the EPA Air Quality Index with the incense having more than double the concentration of particles in this range. The largest number of coarse particles were emitted by the spray air freshener. While more study on aerosols is needed, the data suggest that consumers may need information on the potential health risks associated with air freshener use.

32. Effects of Pretreatment on the Pyrolysis of Mixed Solid Wastes

Helen Hu
Ames High School

Globally, 1.3 billion tons of waste are generated per year, with production set to double by 2025. Such a large influx of refuse is costly, inefficient, and poses an environmental and public health threat. This study explores the option of converting waste to fuel, with the objective of maximizing oil yields while improving fuel quality. Three different methods of pretreatment were performed on paper waste; acid wash, acid infusion, and hot water wash. Pretreatment was aimed to remove or alter the structure of inorganic particles within the paper to produce an improved fuel. For both the acid wash and infuse, paper was mixed with a 2% sulfuric acid mixture, however in the acid wash pretreatment the acid was later rinsed out with DI water. The hot water wash was conducted at 100°C for four hours. The paper samples were then pyrolyzed using a tubular furnace. The change in ash content, product distributions, high heating values of liquid oil/pyrolysis char, and chemical composition of oil products were measured and compared. Acid wash was shown to be the most successful pretreatment method, significantly better than the other pretreated/untreated samples. Acid washed paper was then mixed with polyethylene terephthalate and pyrolyzed. Results revealed improvements in co-pyrolysis, as compared to untreated paper with polyethylene terephthalate. Due to significant reductions in ash content for the acid wash samples, fuel yields grew by 268% and the fuel energy increased from 5 to 14.69 MJ/kg. The liquid oil also contained the highest amount of

fermentable sugar.

33. The Efficacy of Clove Oil Versus Tricaine Methanesulfonate on *Fundulus majalis* and *Amphiprion ocellaris*.

Mercadees Johnson-Stewart & Julie Warburton
Central Campus

The choice of particular anesthetics is crucial to ensure the health of the organism is maintained through the procedure, and afterwards. Anesthesia is routinely used in fishes to perform surgeries, tissue sampling, and also during shipping. Two species of fish *Fundulus majalis* and *Amphiprion ocellaris* required anesthesia to collect samples to test for parasites. A total of four fish, two of each species, were anesthetized using either clove oil or tricaine methanesulfonate (MS-222). Although both anesthetics are common in practice and have been used in this lab, the differences in induction and recover times in different species was unknown. Limiting the induction time can reduce overall stress that the fish may experience. While improving recovery times ensures the fish is swimming and ventilating more quickly, and normally. Each trial was recorded from the time the fish was added to a beaker with saltwater, to induction, and recovery. Observations and notes were recorded on behavior, ventilation, and time. Here, we report on the current progress of these trials and compare the efficacy of the anesthetics within, and across, species. Often, certain procedures require specific anesthetics and while many anesthetics are effective across a wide range of species, species variability can play a role in choice of anesthetic.

34. Radioactive Decay

Jonathan Kalbach
West Central Valley High School

My project is about radioactive particles decaying in a cloud chamber. My hypothesis was that I should be able to see the radioactive particles decaying in the cloud chamber. First to start building the cloud chamber I had to gather all of my materials needed. Second I had to build the cloud chamber. Then I had to retrieve the radioactive particle from the smoke detector. After that I had to put the alcohol on the black felt of the cloud chamber and then quickly put the radioactive particle in the cloud chamber. Then I had to warm up the cloud chamber in my hands. Then I used the flashlight to see the trails of the radioactive decay. Finally I recorded all my data. The results of the project concluded that my hypothesis was right. I was able to see the radioactive particle decay in the cloud chamber and I was able to get all the data collected for this project. The reasoning for this project was to see the radioactive particles decay in a cloud chamber and to measure and count all of the trails left from the decaying particle. In the future I am planning to move on with this project and to see if I can stop the trails from the decaying particle.

35. The Effects of Energy Drinks on Mice's Activity Levels

Sierra Kelman
Danville

Every year Americans alone consume more than 29 billion gallons of

IJAS RESEARCH PRESENTATIONS

Posters 217, 218, & Great Room; Oral Presentations—See page 9

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

energy drink liquids. Potential side effects of drinking excessive amounts of energy drinks include, but are not limited to; cardiac arrests, headaches, insomnia, jitters, vomiting, nervousness, and allergic reactions. Energy drinks can control someone's life if they consume too much. Mice are one of the closest animals that resemble the human in the way their body works and reacts to different things. I tested mice to determine if energy drinks speed up reaction time and change their reactions to their surroundings. The objective of my project is to determine if Energy Drinks affect mice's overall activity level. I observed this by introducing energy drink into the mice's diet and recording run times on a predetermined track. My hypothesis is that when a predetermined amount of energy drink is given to each individual mouse, the overall run time average would decrease by 25%. The mice were tested separately three times each for both the control and the Energy Drink. After all mice had been tested, they were monitored for approximately 8 hours. My hypothesis was somewhat supported in the fact that the time did increase, it just increased more than I expected. The mice were very "jittery" during the experiment and I assume that this was because of the increase in caffeine and sugar contained in the drink.

36. The Efficiency of Passive Solar Heating, Part III

Caleb Kong
Ames High School

As the funding for basic research decreases, it is critically important to continue exploring simple scientific ideas which may lead to breakthroughs. Passive solar heating is a simple yet effective way of addressing this issue, in addition to the growing concern of climate change. This experiment addresses a small part of a bigger idea on passive solar heating—the influence of a sample wood flooring's density and a double paned window—on a model house. Twelve cubes with side lengths of one-foot were constructed from blue board. A section was cut out of each model to install one of two window sizes. A thermometer for measuring the temperature of the house was installed. Three types of wood flooring were used: bamboo, oak, and cedar. Based on prior knowledge, the highest density wood (oak) flooring and double paned window were hypothesized to cause a higher temperature in the model house. The houses were mounted off the ground outside on a ladder and temperatures were taken every ten minutes during the day. The flooring switched after several days of testing. A few houses had consistently lower than normal temperatures, due to either the leaking of heat from cracks in the house, or the positioning and angle of the sun not being equal among houses. Although two of the houses have faults, casting out these outliers produces more logical results. Oak has higher temperatures than cedar which in turn surpasses bamboo. Double pane windows had noticeably higher temperatures than the single pane windows as well.

37. Can the Chemicals of Fingerprints Distinguish Gender or Age in Forensic Investigations?

Hana Lee
Ames High School

Fingerprints have been used in forensic investigations in order to match unique ridge patterns to criminals. However, the lack of regis-

tered fingerprints in databases hinder the capability to identify convicts. In an age of exponentially advancing technology, new analytical technologies allow for the analysis of chemical compounds that makeup a fingerprint to be studied, such as mass spectrometry (MS), a technique to measure the distribution of masses of all chemical compounds. Here, MS is used to address the questions on whether these chemical compounds can be used to distinguish age and gender. More specifically, one of the major compounds, triglyceride (TG), is investigated for the difference within family members; middle-aged mom and dad, a teenage girl, and a pre-teen boy. TG is made up of glycerol and three fatty acids, the fatty acids having a wide variety of varying carbon chain lengths and double bonds. This complexity is known to be affected by biological systems including disease, age, and gender. By monitoring the difference in complex patterns of fatty acids in TG, it may be possible to distinguish age and gender. A differential pattern between female vs male family members is observed, as well as some differences between the ages. Additionally, food oil is found to contaminate the TG patterns, but can be virtually isolated from human TGs. This study unveils the potential for fingerprint TGs to be utilized in forensic investigations.

38. Microbial Fuel Cell

Haley Nizzi
West Central Valley High School

Beginning my project on microbial fuel cells, I was going in without very much knowledge. But throughout all the research and testing, I learned a lot of new things. After researching MFCs for awhile, I saw many other people's experiments. One significant thing I noticed is that if their microbial fuel cell actually worked, it produced a small amount of electricity. That led to my hypothesis concerning this experiment in general. I thought that if I conducted the experiment correctly, I would find that there would be a small amount of electricity produced. I also think that if I were to do this project again, or even a related project, that if I used more materials and such, that I would generate a larger amount of electricity. My hypothesis led to me actually creating a microbial fuel cell using muck as the anaerobic bacteria. The results I gathered somewhat supported my hypothesis, but I originally thought that there would be more consistency with my results. In the end, there wasn't much consistency and I wish to do more experiments to see if I can stop that. So, in conclusion, my experiment produced a small amount of electricity recorded in millivolts, but the results varied a lot.

39. Energy Quest

Jaicee Wathne
West Central Valley High School

For my research project I created a solar air heater. The reasoning for choosing my topic was to see if I could make a room warmer without using a powered heater. As I started my project I first created the solar air heater with materials that I gathered from my school and are also cost effective. The materials can be very easily obtained around any home. My hypothesis for my project was that the solar air heater would work as well as a powered heater and create as much heat as a powered one could. My experiment tested the temperature that the

IJAS RESEARCH PRESENTATIONS

Posters 217, 218, & Great Room; Oral Presentations—See page 9

Number identifiers indicate the poster location. Poster presentations are listed by grade of the primary author. If different the grade of second authors are indicated in parenthesis.

solar air heater made by seeing what the original temperature started at in the room to what it ended at with calculating the outside temperature into it. My plan was to test the heater for four weeks. And see if there was any big changes in the temperatures and also to see if the solar heater would create as much heat as a powered heater would to actually heat a room. I am still continuing to run test on my project to gather the best results, and to see if any changes could be made.

40. Comparison of Aerosol Emitted from Gas and Diesel Powered Vehicles

Lauren Whitney
Center Point Urbana High School

Volkswagen recently had to recall cars because their diesel vehicles were not meeting air quality standards. Research on how diesel exhaust compares to gas exhaust is important to car buyers who want to make eco-friendly purchases. In this study, the number and size of air particles in the exhaust from both diesel and gas powered vehicles were compared. Two gas and two diesel vehicles were tested in the outdoors using the Clear-CAICE aerosol monitor. The diesel vehicles were two different types: one made prior to air quality regulations, and one made afterward. Data showed that while both types of exhaust emitted particles considered by the EPA Air Quality Index to be harmful to human health, the diesel vehicles were less so. In addition, the exhaust from the regulated diesel vehicle appeared to have less of an impact on health than the non-regulated vehicle. While this study was an introduction to exhaust comparisons, more data on the types of exhaust would be needed to make conclusions regarding health and air quality.

Grade 11

41. A Multi-Faceted Approach to Animal Health in a Student-Run Laboratory and Aquarium

Mary Beth Armstrong & Sophia Gustafson
Central Campus

Central Campus Regional Academy is a public school in Des Moines, Iowa offering career-based programs to high school students. One program is the Marine Biology Career Academy which provides students the opportunity to run their own laboratory and aquarium as professional marine scientists may. With approximately 150 different species of marine organisms, in over 100 aquariums, it is critical that the health of each organism is monitored from the moment it 'swims' through the door. Quarantine procedures are setup for new organisms for observations of parasites and to provide prophylactic medications as needed. After a 30-day quarantine period, fishes, in particular, are anesthetized and non-lethal samples are collected from the epidermis, fins, gills, and fecal matter. Each sample is observed under a microscope for any abnormalities. Once cleared, the organisms are acclimated to their dedicated aquarium. On the other end of the spectrum, performing effective necropsies of dead organisms is also critical to ensure the remaining living organisms in the aquarium are healthy. Similar samples are taken as in quarantine, but additional observations and samples can also be taken from internal organs. Thus, if there is an observed parasite or disease in the expired organism, treatment proto-

cols can be administered. Acute observations, at any stage in the organism's life, is crucial to provide the best care and overall health of the organism.

42. Natural Trap Cave Fossils: From Ground To Collection

Skylar Davis
Central Campus

Natural Trap Cave (NTC), located in the northern Wyoming, has produced a treasure trove of fossils from the Late Pleistocene to early Holocene (31,000 – 3,000 years ago). The objective of this project was to participate in each of the steps (cleaning, repair, identification, cataloging, & photographing) necessary for long-term, fossil preservation. The fossils that were included in this project were collected from NTC between 2014 – 2016. The biggest component of this project entailed identifying the isolated skeletal elements of different bones from over 10 different mammals found in NTC, using comparative skeletons of modern relatives and published scientific literature (books, papers, and internet resources).

43. The life of the Birkenstock bacteria

Nicole Duarte
Central Campus

This experiment was preformed to compare the effectiveness of three commons cleaners, dawn dish soap, bleach, and Birkenstock brand cleaner. Even with these cleaners people tend to drag bacteria around with use like baggage. Bacteria primarily lives within and around shoes. During this procedure the shoe was swabbed and bacteria was placed to grow on a trypticase soy agar petri dish. The largest colony (#4) was then taken and place on a second sterile Petri dish with three antibacterial disks. This showed that bleach was the most successful in killing *Bacillus subtilis* but least effective in killing *Staphylococcus aureus*.

44. Testing Bacteria on the bottom of my feet

Sydney Fischer
Central Campus

This experiment tested bacteria on the bottom of feet after wearing dance shoes. Dance shoes were worn for 45 minutes to collect the bacteria. Both feet were swabbed for bacteria. Then the right foot was stuck in listerine for 3 minutes and left foot was stuck in Hello Beautiful bath and body works body wash for 3 minutes to see if they killed the bacteria. There was *Corynebacterium xerosis*, *Serratia marcescens*, *Corynebacterium psuedodiphtheriticum*, *Staphylococcus epidermis*, *Sarcina Lutea*, *Brevibacterium linens*, *Streptococcus faecalis*, *Micrococcus luteus*, *Bacillus subtilis*, *Staphylococcus aureus* found after wearing dance shoes for 45 minutes. Listerine killed all bacteria. Body Wash only killed *Sarcina Lutea*, *Brevibacterium linens*, *Staphylococcus epidermis*.

45. The Impact of Corn Dust Aerosols in Barns

IJAS RESEARCH PRESENTATIONS

Posters 217, 218, & Great Room; Oral Presentations—See page 9

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

Jessica Grundmeyer & Margaret Burke
Center Point Urbana High School

Air quality can impact human health. In barns, the dust from corn and other feeds can affect both the animals and the humans. The researchers in this study feed farm animals such as cattle and horses on a daily basis. The purpose of this study was to compare the size and amount of aerosol particles emitted while feeding cattle. Using the Clear-CAICE aerosol monitor, the number and size of aerosols were measured before, during, and after feeding. Data showed that particle concentrations were in the good range for both coarse and fine particles according to the EPA Air Quality Index. While this study was done in a well-ventilated barn, other barns may not be as conducive to respiratory health.

46. Retainer Cleaners

Kylie Hanna
Central Campus

This experiment was based on what would clean dental retainers the best. Three methods were used: Listerine Cool Mint Antiseptic mouthwash, retainer cleaner called “Efferdent”, and Crest Pro-Health Advanced Extra Whitening Power + Freshness toothpaste. Common bacteria found from the dental retainer by gram staining were *Staphylococcus aureus* and *Staphylococcus epidermis*. The results showed that all cleaners were unable to kill all the bacteria but prevented certain bacteria and a fungus from growing. Both the toothpaste and mouthwash method had killed a fungus.

47. How Clean are your Glasses?

Benjamin Harper
Central Campus

Since a large part of the population wore glasses, how truly clean are they. This was a very unpopular topic so the strength of this study may vary. Three different ways to clean glasses along with a control were used to see how bacteria grew on glasses. Although there was a low range of bacteria, the amount was outstanding. Other than one type of bacteria, all others were eliminated, by at least one of the three ways.

48. Natural or Chemical Based Cleaners?

McKenna Horstmann
Central Campus

This experiment was performed to test and compare the effectiveness between natural and chemical based cleaners. The chemical cleaners compared were a bleach solution and Lysol’s All-Purpose cleaner. The natural cleaners used were a diluted solution of household vinegar and a plant-based cleaner, The Honest Company’s Multi-Purpose cleaner. A bacterial sample was gathered from an uncleaned cafeteria table, the multiple types of bacteria grown by transferring bacteria to a clean petri dish and placement in an incubator, observed, heat fixed, gram stained, observed through oil immersion, and identified. One type of bacteria grown, *Bacillus subtilis*, was selected to test against the four cleaning products through the use of antibacterial disks. The clear

zones around the antibacterial disks varied in average size and complete clearness. It was found that *Bacillus subtilis* was the most susceptible to the Lysol’s All-Purpose chemical cleaner as the average clear zone was 19mm. *Bacillus subtilis* was the most resistant to the Clorox solution of bleach as the average clear zone was 0mm. The Honest Company’s Multi-Purpose cleaner resulted in partial clear zones which could likely be because it contained no single-purpose antimicrobials only disinfectant compounds derived from plants. The vinegar solution also resulted in partial clear zones which could be due to it being such a weak solution.

49. Effectiveness of Different Antibacterial Soaps

Treyton Jenkins
Central Campus

Many different soap varieties boast such a statement as “Kills 99.9% of all bacteria” on their packaging. This project hopes to determine what type of soap from 4 different varieties--“Softsoap Antibacterial Hand Soap”, “Method Hand Wash”, “Dial Antibacterial Liquid Hand Soap,” and “Avalon Organics Hand Soap”—works most efficiently on bacteria, and which species of bacteria they work most efficiently on. This is performed by taking a sample of bacteria from an unwashed hand and allowing the bacteria to grow. Each different bacteria colony will be allowed to grow on their own, and then placed in samples of each different soap. The soap type that causes the largest circle of dead bacteria is the most efficient killer of that particular bacteria species.

50. Killing the Bacteria in the Mouth

Vanessa Jones
Central Campus

This experiment was done to show how well bacteria was killed with Crest toothpaste. This experiment involved trying to kill the bacteria that was in a human 17 year old girl’s mouth all day with Crest, which didn’t work entirely. It was tested by brushing the teeth for 2 minutes and having the teeth rinsed with tap water. Then, the bacteria taken from the mouth was placed nutrient agar, then placed into an incubator to grow. Finally, the bacteria was gram stained and observed under oil immersion. While *Bacillus subtilis* was killed, *Brevibacterium linens*, *Corynebacterium pseudodiphtheriticum*, and *Corynebacterium xerosis* were left after the experiment.

51. Investigating DNA Damage of the B16 Cell Line Succeeding Exposure to Sunlight

Merrina Lan
Ames High School

The research sought to investigate the effect of the length of sunlight exposure on DNA damage in B16 cells on a cellular level and strengthen the claim that sunlight can induce cancerous growth. B16 cells were distributed to 3 cell plates, a control and two levels of differing length of sunlight exposure. Then the HCS DNA Damage kit was used to examine the percentage of cells that showed DNA damage and cell membrane damage. We found a positive correlation between the length of sunlight exposure and DNA damage, which indi-

IJAS RESEARCH PRESENTATIONS

Posters 217, 218, & Great Room; Oral Presentations—See page 9

Number identifiers indicate the poster location. Poster presentations are listed by grade of the primary author. If different the grade of second authors are indicated in parenthesis.

cates that sunlight has the potential to induce DNA damage. However, the standard deviations are large and the results are not statistically significant though a trend of increase is apparent. In the future, larger sets of data need to be collected so as to reduce chance variation and potentially perform a linear regression to better trace the trend. Further research can also investigate the methods that potentially protect cells from DNA damage and their effectiveness.

52. Bacteria Living in Dog Water Bowls vs. Cattle Water Troughs

Tiffany LeMaster
Central Campus

Bacteria affected pets and livestock lives in a profound way. People did not realize how much bacteria were in watering containers. Three samples each were taken from a cattle waterer and a dog water dish. They were then grown on trypticase soy agar in petri dishes, tested and identified. Gram+cocci, gram+bacilli, and fungi were all present. Bleach and Dawn Ultra dish soap were used to kill the bacteria. The clear zone around the bleach antibacterial discs were an average of 26 mm compared to 22 mm around the Dawn Ultra dish detergent. Bleach was the most effective anti-bacterial to kill the *Streptococcus faecalis*, *Brevibacterium linens*, fungi found in dog water three, and *Staphylococcus aureus* colonies.

53. How to kill mucus bacteria

Shamari Little
Central Campus

There has been a debate on whether hand sanitizer or wash the hands is better. Human mucus was swab and transferred to Trypticase Soy Agar for further examination. Each bacterium was presented before and after the antibiotic disks were contaminated. *Staphylococcus aureus*, *Citrobacter freundii*, *Micrococcus luteus*, *Sarcina lutea*, *Corynebacterium xerosis*, were all resistant to the sanitized antibiotic disks.

54. Water Purification

Nicole Masteller
Central Campus

The experiment will be done to see how well a water purification works at killing *E. coli* bacterium and other bacterium. 1 Aquatabs (water purification tablet) was bought at a survival store for experiment.

55. Does Gum Prohibit Bacterial Growth

John Rickabaugh
Central Campus

Bacteria from human's mouth after chewing orbit mint flavored gum for 10 minutes was tested. Bacteria was swabbed from a human's mouth and growing it on a Trypticase Soy Agar petri dish to examine the typical bacteria found in the human's mouth. Trypticase Soy Agar

petri dish was coated with the contaminated swab. Colony 1, a fungus was used to make a lawn on the the Trypticase Soy Agar. 4 circle pieces of gum were punched out and placed on the agar. *Staphylococcus aureus*, and *Sarcina lutea* were both present before chewing but was not present after chewing gum. *Micrococcus roseus*, *Staphylococcus epidermidis*, *Micrococcus luteus*, and a fungus were present after chewing gum due to the gum pulling off the previous bacteria facilitating growth of more bacteria. After incubation of the antibiotic disk, results showed the zone of inhibition was zero .

56. Sugar free gum testing

Carla Ruiz
Central Campus

This experiment was performed to have a better understanding of the effectiveness of Wrigley's Orbit Peppermint Sugar Free Gum, and how it eliminates the bacteria when a piece of sugar free gum was chewed. There were many sources that agreed to the statements about Sugar free gum being a better choice than sugared gum, when compared to the benefits of the oral health. Normal eating routine and oral routine were performed throughout the experiment. Crest 3D White Toothpaste and Wrigley's Orbit Peppermint Sugar free gum were used throughout the experiment. Swabbing of the top gums were swabbed and put onto a petri dish. *Staphylococcus epidermis* was eliminated as well as *Corynebacterium xerosis*. *Corynebacterium pseudodiphtheriticum*, *Staphylococcus aureus* and *Micrococcus luteus* were not eliminated by chewing sugar free gum. *Sarcina luteus* and *Bacillus megaterium* were present after chewing sugar free gum but not present before.

57. Difference in Bacteria Elimination Between Male and Female Shampoo

Andy Tran
Central campus

Male and female shampoo are used every day in everyday lives. They have the same affect but are made in many different ways. This experiment was to discover how the difference of shampoo of the same brand (Figure 1) affects elimination of common bacteria found in hair. The results were for two bacteria which was *Micrococcus luteus* and *Sarcina lutea*. These two bacteria were grown from two strands of hair over 48 hours inside of an incubator that was kept at 37 degrees celcius. The bacteria were tested in the dove shampoo and the results was that the female shampoo was able to eliminate *Micrococcus luteus*, while the male shampoo appeared unaffected. Also *Sarcina lutea* was eliminated by the male shampoo, while the female shampoo appeared unaffected. The conclusion was that male and female shampoos are able to kill certain types of bacteria that the other gender of shampoo cannot. Overall the most common colonies were taken and placed in an individual trypticase soy agar, which was *Micrococcus luteus* and *Sarcina luteus* and placed disk in male and female shampoo. Once soaked in there, one disk placed in the male shampoo, and one from the female shampoo was placed in each petri dish and then waited for 48 hours. Colony 1 possible ID was *Micrococcus luteus*. While colony 2 possible ID was *Sarcina lutea*

IJAS RESEARCH PRESENTATIONS

Posters 217, 218, & Great Room; Oral Presentations—See page 9

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

58. The effects of mouthwash and toothpaste together

Tina Tran
Central Campus

This experiment was performed to test the effectiveness of mouthwash and how well mouthwash works with toothpaste when it is present. Crest mouthwash and Sensodyne toothpaste were used and the teeth were swabbed. The teeth were first swabbed before the mouthwash and toothpaste. The teeth were then swabbed again after the use of (Crest) mouthwash (approximately 36 ml were used). Finally, the teeth were swabbed after the combination of both (Crest) mouthwash and (Sensodyne) toothpaste. All cotton swabs were spread onto separate petri dishes. The overall results were successful and showed a significant difference in the number of bacteria on the petri dishes. It decreased the amount of *Staphylococcus epidermis* (from Figure 1b to Figure 1c), and completely eliminated the bacterium *Staphylococcus aureus* (from Figure 1a to Figure 1c).

59. The Effects of Colloidal Silver Nanoparticles on Two Different Bacteria and a Fungus

Andrew Van Nice
Des Moines Central Campus

Silver has been noted as having significant antimicrobial properties, particular silver nanoparticles. Silver nanoparticle-citrate solution was tested as an antimicrobial agent against *Sarcina lutea*, *Staphylococcus epidermis*, and a fungus in an incubator at 37°C. There was no visible effect of the silver nanoparticles on the three organisms, with each growing completely up to the edge of the antibacterial discs soaked in the silver nanoparticle solution. A few causes of the silver nanoparticles being ineffective could have been clumping of the particles due to the warm temperatures, and a citrate coating on the particles, suppressing silver ions from being released by the nanoparticles.

60. Bath tub Bacteria

Nadine Veasley
Central Campus

Cleaning companies are always claiming their products kill the majority or even all of the bacteria on the front but many specify which bacteria the cleaner actually kills on the back, in small print. In this experiment, the claims of Comet, Scrubbing Bubbles, Lysol and Mr. Clean were put to the test. Five bacteria were found in this experiment; *Bacillus megaterium*, *Lactobacilli*, *Diphtheroids*, *Corynebacterium xerosis* and *Pseudomonas fluorescens*. *Corynebacterium xerosis* was the most prominent so it was the bacteria tested with the antibiotic disks. After doing antibacterial disks and Gram Staining, it was discovered that *Corynebacterium xerosis* is resistant to all of the cleaning supplies tested.

61. Greenies vs Toothpaste

Hailey Zugg
Central Campus

This experiment tested the effectiveness of “Greenies Dental Treats” compared to “Tartar Control Toothpaste” in removing oral bacteria in dogs. A 7-year-old German shepherd and an 8-year-old Löwchen participated in this study. Each dog’s mouth was thoroughly swabbed before eating one “Greenies Dental Treat” and then thoroughly swabbed after eating one “Greenies Dental Treat”. 24 hours later, the same method was repeated for “Tartar Control Toothpaste”. Each dog was thoroughly swabbed before brushing, followed by the use of “Tartar Control Toothpaste” and a finger toothbrush, the dog’s teeth were brushed according to instructions on packaging. The dog’s mouth was thoroughly swabbed directly after. All swabs were then evenly wiped onto the Trypticase Soy Agar (TSA) in a petri dish, and kept for observation. Upon observation, the results showed the “Tartar Control Toothpaste” was far more effective than “Greenies Dental Treats” at reducing the amount of oral bacteria in dogs. After brushing each dog’s teeth with “Tartar Control Toothpaste” the only remaining bacteria was *Micrococcus luteus* in both dogs. Whereas after feeding each dog one “Greenies Dental Treat” *Corynebacterium pseudodiphtheriticum*, *Streptococcus epidermidis*, and *Citrobacter freundii* were the remaining bacteria in each dog. In conclusion, it is clearly shown the glycerin paired with bicarbonate and sorbitol in the “Tartar Control Toothpaste” had a much greater effect on the elimination of oral bacteria in dogs.

62. Hatching Shipped Chicken Eggs

Rabsa Naseer
Central Academy

RABSA NASEER Title: Hatching Shipped Chicken Eggs I investigated whether the shipment process of chicken eggs affects their hatch rates or not. To do this, I purchased chicken eggs online (out of state) through My Pet Chicken and incubated them at 99.5° F while recording variables: temperature, humidity, etc. At the end of the experiment, one of six eggs I incubated developed completely and hatched. My hatch rate was 15%; further online research through Backyard Chickens found that shipped eggs do normally have lower hatch rates from 0% to 50%. Shipping does affect the hatch rates of fertile chicken eggs, and lowers them compared to incubating local eggs or eggs incubated under hens. To improve this experiment, I would hatch a larger number of eggs and unshipped chicken eggs to compare the shipped data to, considering they were both hatched in the same standards. •"Adopting and Caring for Backyard Chickens." The Humane Society of the United States. The Humane Society of the United States, n.d. Web. 1 Sept. 2016. •Barth, Brian. "How to Incubate Chicken Eggs." How To Incubate Chicken Eggs. Modern Farmer, 09 Apr. 2015. Web. 1 Sept. 2016. •"Raising BackYard Chickens, Build a Chicken Coop, Pictures of Breeds." BackYard Chickens. N.p., n.d. Web. 1 Sept. 2016. •"Raising Backyard Chickens. Purchase Chicken Coops, Baby Chicks & Learn About Chicken Breeds." My Pet Chicken. My Pet Chicken, n.d. Web. 1 Sept. 2016. •Will, Oscar H. "Expert Tips for Incubating Chicken Eggs." Grit. N.p., 24 Jan. 2011. Web. 1 Sept. 2016.

Grade 12

63. Particle Count Variability According to Population Fluctuation in

IJAS RESEARCH PRESENTATIONS

Posters 217, 218, & Great Room; Oral Presentations—See page 9

Number identifiers indicate the poster location. Poster presentations are listed by grade of the primary author. If different the grade of second authors are indicated in parenthesis.

Enclosed Spaces

Ben Grimm & Matthew Klaes
Osage High School

The goal of this project is to test the amount of particulate matter in the atmosphere (aerosols) that are produced by natural sources such as dust and liquid droplets, and artificial sources such as human pollution. This experiment will answer the questions “How does the amount of particulate matter change as the amount of people and activity in a room changes?” and “What happens to the particulate matter after the room is emptied and the activity stops?” During this experiment, we will analyze three activities within a closed area: a gym during a night of basketball games, a chorus room during choir rehearsal, and a band room during band rehearsal. We will test the amount of particulate matter in each room multiple times and compare the data in order to answer the experiment questions. Our hypothesis is the amount of particulate matter in the room will rise as the amount of people and activity increases and the particulate matter will disperse after the room is emptied and the activity stops.

64. Analyzing Vitamin C in Helianthus

Clayton Haeffner
Danville

I have an interest in agriculture and I love working with plants. I read an article on microgreens and nutrients. I decided to look at nutrients in sunflowers and whether different growing patterns affected the amount of vitamin C in sunflowers. The objective of my project is to determine if different growing methods of sunflowers increases the amount of vitamin C in the microgreens. My hypothesis is that we will find Vitamin C in all the sunflowers, but there will be an increase in vitamin C in shorter growth times. Sunflowers were grown from seed and dried. Testing was done on all samples. My results are inconclusive as of today. I am going to dry at least another week and retest.

65. Antibiotic Effectiveness

Esteban Heredia
Central Campus

This experiment was conducted in order to test the effectiveness of 3 commercially available antibiotics Tea tree oil, Hydrogen Peroxide and Bacitracin. The bacteria identified were Staphylococcus epidermis and Micrococcus luteus came from the surface of the skin and were grown using a Trypticase Soy Agar (TSA) petri dish. The average zone of inhibition that killed Staphylococcus epidermis for tea tree oil (18mm) was significantly larger than hydrogen peroxide(14.8mm) and bacitracin (0mm). Staphylococcus epidermis was susceptible to tea tree oil and hydrogen peroxide. Staphylococcus epidermis was resistant to bacitracin.

66. Particle Count Variability According to Population Fluctuation in Enclosed Spaces

Matthew Huisman & Alexa Maakestad

Osage Community High School

The goal of this project is to test the amount of particulate matter in the atmosphere (aerosols) that are produced by natural sources such as dust and liquid droplets, and artificial sources such as human pollution. This experiment will answer the questions “How does the amount of particulate matter change as the amount of people and activity in a room changes?” and “What happens to the particulate matter after the room is emptied and the activity stops?” During this experiment, we will analyze three activities within a closed area: a gym during a night of basketball games, a chorus room during choir rehearsal, and a band room during band rehearsal. We will test the amount of particulate matter in each room multiple times and compare the data in order to answer the experiment questions. Our hypothesis is the amount of particulate matter in the room will rise as the amount of people and activity increases and the particulate matter will disperse after the room is emptied and the activity stops.

67. Particle Count Variability According to Population Fluctuation in Enclosed Spaces

Matthew Klaes & Alexa Maakestad
Osage Community High School

The goal of this project is to test the amount of particulate matter in the atmosphere (aerosols) that are produced by natural sources such as dust and liquid droplets, and artificial sources such as human pollution. This experiment will answer the questions “How does the amount of particulate matter change as the amount of people and activity in a room changes?” and “What happens to the particulate matter after the room is emptied and the activity stops?” During this experiment, we will analyze three activities within a closed area: a gym during a night of basketball games, a chorus room during choir rehearsal, and a band room during band rehearsal. We will test the amount of particulate matter in each room multiple times and compare the data in order to answer the experiment questions. Our hypothesis is the amount of particulate matter in the room will rise as the amount of people and activity increases and the particulate matter will disperse after the room is emptied and the activity stops.

68. Effectiveness of Dental Products in Eliminating Bacteria in Water

Quynh Luu
Central Campus

Several studies have shown bottled water having a higher count of bacteria than tap water and comparing the effectiveness of dental products in reducing the population of bacteria in the mouth. Samples from Aquafina bottled, tap water, and fridge filtered water were cultivated by placing them on trypticase soy agar for bacterial growth to compare the bacteria population. The bacterial colonies were later on placed on the same trypticase soy agar as antibacterial discs of Crest fluoride toothpaste and Listerine mouthwash to test the effectiveness of the dental products on each type of bacteria. Result showed that all types of bacteria in this study were gram positive cocci which were Staphylococcus aureus, Micrococcus luteus, Sarcina lutea, and Staphylococcus epidermis. Crest fluoride toothpaste were shown to be more effective.

IJAS RESEARCH PRESENTATIONS

Posters 217, 218, & Great Room; Oral Presentations—See page 9

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

tive in eliminating *Staphylococcus aureus*, *Sarcina lutea*, and *Staphylococcus epidermidis* while Listerine mouthwash was shown to be more effective on *Micrococcus luteus*.

69. Particle Count Variability According to Population Fluctuation in Enclosed Spaces

Garrett Maakestad & Alexa Maakestad
Osage Community High School

The goal of this project is to test the amount of particulate matter in the atmosphere (aerosols) that are produced by natural sources such as dust and liquid droplets, and artificial sources such as human pollution. This experiment will answer the questions “How does the amount of particulate matter change as the amount of people and activity in a room changes?” and “What happens to the particulate matter after the room is emptied and the activity stops?” During this experiment, we will analyze three activities within a closed area: a gym during a night of basketball games, a chorus room during choir rehearsal, and a band room during band rehearsal. We will test the amount of particulate matter in each room multiple times and compare the data in order to answer the experiment questions. Our hypothesis is the amount of particulate matter in the room will rise as the amount of people and activity increases and the particulate matter will disperse after the room is emptied and the activity stops.

70. Particle Count Variability According to Population Fluctuation in Enclosed Places

Alexa Maakestad & Matthew Klaes
Osage Community High School

The goal of this project is to test the amount of particulate matter in the atmosphere (aerosols) that are produced by natural sources such as dust and liquid droplets, and artificial sources such as human pollution. This experiment will answer the questions “How does the amount of particulate matter change as the amount of people and activity in a room changes?” and “What happens to the particulate matter after the room is emptied and the activity stops?” During this experiment, we will analyze three activities within a closed area: a gym during a night of basketball games, a chorus room during choir rehearsal, and a band room during band rehearsal. We will test the amount of particulate matter in each room multiple times and compare the data in order to answer the experiment questions. Our hypothesis is the amount of particulate matter in the room will rise as the amount of people and activity increases and the particulate matter will disperse after the room is emptied and the activity stops.

71. Bacteria in Lakes and Creeks

Jade Miller
Central Campus

Microbes are a vital part of aquatic ecosystems, and each body of water has a unique bacterial profile. A wide array of chemicals can end up in waterways due to runoff from farms or neighborhoods. Chemicals such as everyday household cleaners can have a negative effect on aquatic life killing off not only harmful bacteria, but also the organisms that are important parts of the food chain. This experiment

had two objectives: the first was to compare the bacteria found in a lake to those of a stream (both of which were freshwater ecosystems), and the second was to observe the effect of two commonly used cleaners- 409 and Lysol- on the bacteria of these ecosystems. In this experiment, water samples were taken from Clive Lake and Jordan Creek and the resulting bacterial cultures were compared and identified. The two bodies of water produced very different results-- a wide variety of bacteria colonies were found in each water sample-- and overall, 409 was observed to be a more effective antibiotic than Lysol in killing *Candida albicans* and *Staphylococcus epidermidis* found in the bodies of water. *Corynebacterium xerosis* was found in both samples. *S. aureus*, *S. epidermidis*, and *Bacillus megaterium* were found in the creek sample. *C. pseudodiphtheriticum*, *Candida albicans*, *Bacillus subtilis*, *Streptococcus faecalis*, *Brevibacterium linens* were found in the lake sample.

72. Frequency and Commonality of Household Bacteria

Sulejman Mujkanovic
Central Campus

Overall, this experiment, of which it has been done multiple times, shows that many of these bacteria are treatable with cleaners that we have available. Surprisingly some areas that were expected to have extremely high growth of bacteria, either had slow growth or had many non-harmful bacteria, compared to some areas like a sponge for dish cleaning. The results were none the less very insightful in learning where bacteria grow the most in the house. It is also useful for people who will do this experiment in the future and want to see if their results are consistent with this one. The methods and the materials are also very easy to learn for this project and can be repeated multiple times.

73. Are Dogs Mouths Cleaner Than Humans

Makaela Ramsey
Central Campus

This experiment was conducted to test the myth, “are dogs mouths cleaner than human’s mouths”. The experiment was conducted by using two German Shepard saliva and one human’s saliva, which were streaked on a Tryptic Soy Agar, to grow the bacteria, after 48 hours in an incubator at 37 degrees Celsius the bacteria grew. The bacteria were than compared. The results showed the bacteria found in the dog’s mouth were in fact not much different than the bacteria found in the human’s mouth. So the myth on “dog’s mouths are cleaner than humans” was actually proven false. Which can also be backed up by most veterinarians.

74. What's Growing On Your Phone?

Kayla Roberts
Central Campus

Almost everyone has cellphones and take them with them everywhere including the bathroom. This being said they could easily house many forms of bacteria. Cleaners are commonly used to kill bacteria on many surfaces. Three swabs were taken of three different cellphones.

IJAS RESEARCH PRESENTATIONS

Posters 217, 218, & Great Room; Oral Presentations—See page 9

Number identifiers indicate the poster location. Poster presentations are listed by grade of the primary author. If different the grade of second authors are indicated in parenthesis.

An antibiotic disk test was done using 409, Lysol, Germ-X, and bleach. The most common possible bacteria were forms of Staphylococcus. The cleansers 409, Lysol and bleach eliminated the most bacteria. The Germ-X did not eliminate any bacteria.

75. Limiting Antibiotic Resistant Bacterial Strains Using the Oligodynamic Effect

Evangeline Scheibe & Achala Thippeswamy
Ames High School

Our research would aim to investigate the effect of a variety of metals on bacterial cultures over the course of a number of generations- contrasted with the end result of regular administration of antibiotics over the same number of generations. The metals would be compared and ranked as well, taking into account concentration, toxicity, and prevalence of resistant strains at the end of serial batch cultures. The metals we plan to use will include iron, zinc, and copper. The bacteria we would use would be E.coli due to its ability to quickly grow, easy to work with, readily available, and is a common bacterial infection. However, the procedure is dependant on the availability of metals and bacteria in the ISU labs, and the funds provided to us by our school and by our research program.

76. The effects of bleach on bacteria

Itacia Sholley
North

Bleach has always been advertised to kill 99.9% of bacteria and is supposed to be one of the best disinfectants around. This experiment was conducted to test the theory, during the experiment it was founded that the bleach killed most of the bacteria's colonies but the bacteria from the first trial (no bleach) was still there after bleach had been added. Similar experiments have been performed and all seem to have the same results, colonies die off some but the bacteria is still there.

77. Comparison of lettuce production by aquaponics systems with different amount and distribution of grow media

Noah Solheim
Waverly Shell Rock High School

Aquaponics is a means of producing food indoors in areas with scarce land availability or to extend the natural growing season. Aquaponics combines aquaculture (raising fish in captivity) with hydroponically grown vegetable crops. These systems mimic natural nutrient cycles by supplying the plants with nutrients from fish waste and using plant uptake of nutrients to manage water quality for the fish. Vegetable grow beds in an aquaponics system require grow media to support plants' root systems and provide surface area for the growth of nitrifying bacteria. Grow media are a significant expense in setting up an aquaponics system. I constructed two aquaponics systems: one with a grow bed filled with clay pebble media and another with the media confined to floating pots. I compared the appearance and mean mass of lettuce plants grown in each system. I predicted that plants in the media-filled grow bed would reach a larger size and be darker in color by the end of a 45-day trial. The results falsified my prediction: the

mean mass of plants in the two treatments and their appearance were nearly identical. These results suggest that the floating pot method could reduce the expense of aquaponics systems without compromising vegetable production.

78. Sanitation of the 5 second rule

Brenda Vega
Central Campus

This experiment was perform to test the safety of consuming food dropped on the floor for 5 seconds. Most data from other experiments don't support the 5 second rule; according to these experiment the amount of bacteria collected from dropping food in regards to data available can vary with the type of food, the floor used, and the amount of time the food was left on the ground. In this experiment 2 types of food: apples and gummy bears were tested. Both these foods were swabbed with a Q-tip to test for initial bacteria. New pieces of apples and gummy bears were then dropped on a uncleaned wooden floor, then new pieces of these foods were dropped on the same floor after cleaning. Results showed overall more bacteria colonies on the food dropped on the clean floor, then on the dirty floor, this could have been due to the cleaning utensils used (the broom and the mop). Results also showed more bacteria colonies on the apples then on the gummy bears, this was most likely due to an apple's moisture which can facilitate bacteria contamination.

79. Oral Bacteria Killers

Crystal Velazquez
Central Campus

This experiment was performed to see what top brand toothpaste kills bacteria the most. Three methods were used: Colgate Total, Crest Whitening Scope, and Sensodyne Extra Whitening. Common bacteria found by gram staining were Corynebacterium pseudodiphtheriticum and Staphylococci. The results showed that all toothpastes were unable to kill all the bacteria but narrowed down the many small colonies into single large colonies.

80. Improvements in Culture Methods of the Grass Shrimp, *Palaeomonetes* sp.

Hanna Walker & Josie Nolan
Central Campus

Central Campus is a Regional Academy in Des Moines, Iowa that provides students unique and advanced opportunities to explore a career in Marine Science, among other fields. One such opportunity that Marine Biology students receive is to culture the grass shrimp, *Palaeomonetes* sp. The *Palaeomonetes* culture system was initially started to provide the food source for specialized organisms in the lab that require live food, such as the scorpion fish, *Taenionotus triacanthus*, and the painted frogfish, *Antennarius pictus*. After several 'trial-and-error' variations of culture systems, the final setup proved to be most effective at conserving space, providing good water quality, and maximizing hatchlings. Rather than only holding one female grass shrimp in one tank at a time, this method houses 10 females in one holding tank. The current culture system has been up and

ACADEMY OPPORTUNITIES

Volunteer to Advance Science in Iowa

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

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

Learn about more...

www.scienceiniowa.org

or contact the IAS office

319-273-2021

IAS WEBSITE



Iowa Academy of Science

Promoting science research, science education, the public understanding of science, and recognizing excellence in these endeavors.

The IAS website is the center of the universe for Academy business, meeting information and registration, membership renewals, and information on Academy activities. You may access the Journal of the Iowa Academy of Science, submit articles, submit Iowa Science Foundation proposals, volunteer to help at Academy events, vote in Academy elections, and much more. Your membership information is available to you online and you are able to update your profile. In short the IAS website is an efficient way for us to communicate with you and for you to interact with the Academy. Visit the IAS website often to see what is happening and to learn about activities and events that may interest you. The website is updated regularly - certainly weekly but often daily and with an added bonus - we are much greener using much less paper and associated office supplies.

SECTION MEETINGS

Saturday, See individual sections for room and schedule.

Anthropology Section

See Geology

Cellular, Molecular & Microbiology Section

Room 303

- 8:40 **101.** THE EFFECT OF TBX2 ON BTG2 EXPRESSION IN THE MDA-MB-468 HUMAN BREAST CANCER CELL LINE^{BBB}
- 9:00 **102.** DIFFERENTIAL EXPRESSION OF TEOSINTE BRANCHED-1-LIKE (TBL) GENES AND THEIR ROLE IN FLORAL SYMMETRY AND BRANCHING PATTERN OF SYMPODIAL ORCHIDS
- 9:20 BREAK
- 9:40 **103.** SEX DIFFERENCES IN AXONAL GUIDANCE CUE EXPRESSION OF THE HYPOTHALAMUS
- 10:00 **104.** DISCOVERING FREEZING TOLERANT GENES FROM THE NATIVE ORCHID *APLECTRUM HYEMALE* (MUHL. EX WILLD.) TORR.^{ISF}
- 10:20 Section Business Meeting: **Election of New Officers New Business**
- 10:40 Travel to General Session III
- 11:00 General Session III
- 12:00 Lunch
- 1:15 **105.** ANTIBACTERIAL EFFECTS OF DIFFERENT CULTIVARS OF GARLIC ON AN ARRAY OF BACTERIA
- 1:35 **106.** MECHANICAL PROPERTIES OF CYTOSKELETAL STRUCTURE DETERMINED BY ATOMIC FORCE MICROSCOPY IN SINGLE-CELL AND MULTICELLULAR *DICTYOSTELIUM DISCOIDIUM*^{ISF}
- 1:55 **107.** THE ROLE OF THE dFOXO INTERACTOME IN CELLULAR HOMEOSTASIS AND STRESS RESISTANCE IN *DROSOPHILA MELANOGASTER*
- 2:15 **108.** MULTI-DRUG RESISTANT *STAPHYLOCOCCI* IN SPRINGS AND STREAMS IN NORTHEAST IOWA
- 2:35 BREAK
- 2:55 **109.** BORIC ACID INHIBITION OF THE COMMON DERMATOPHYTE *TRICHOPHYTON RUBRUM*
- 3:15 **110.** EPIDEMIOLOGICAL AND EXPERIMENTAL EVIDENCE OF SEX-DEPENDENT RESPONSES TO INFECTION WITH *LEISHMANIA INFANTUM*
- 3:35 **111.** THE POWER OF GWAS: IDENTIFYING NOVEL REGULATION FACTORS IN THE AUTOPHAGY PATHWAY USING *DROSOPHILA MELANOGASTER* AS A MODEL
- 3:55 Conclude Meeting

Chemistry Section

Room 304

- 8:40 **112.** THE FORMATION OF A LIPOSOME-DRUG DELIVERY SYSTEM
- 9:00 **113.** SURFACE ADSORPTION OF HUMIC ACID ON TiO₂ NANOPARTICLES AND ITS IMPACT ON THE BIOAVAILABILITY OF TiO₂ NANOPARTICLES

SECTION MEETINGS

Saturday, See individual sections for room and schedule.

- 9:20 BREAK
- 9:40 **114.** DESIGN OF THE TIME-OF-FLIGHT MASS SPECTROMETER USING CHEMICALLY DEVELOPED SEMI-CONDUCTIVE ELECTRODE AS A MULTI-POTENTIAL ION GUIDE
- 10:00 **115.** MECHANICAL PROPERTIES OF INDIVIDUAL SUBSTRATE-DEPOSITED SEA SPRAY AEROSOL PARTICLES
- 10:20 **Section Business Meeting:** Election of New Officers s New Business

Community College Biologists

Room 133

Ecology and Conservation Section

Room 409

- 8:20 **116.** EFFECT OF RHAMNUS CATHARTICA ON THE GROWTH RATE OF GALLUS GALLUS^{BBB}
- 8:40 **117.** EXPLORATION OF SIMPLE AND COMPLEX CUTICULAR HYDROCARBONS OF THE WESTERN THATCHING ANT (*FORMICA OBSCURIPES*)^{BBB}
- 9:00 **118.** UNGLACIATED TERRITORY: EXPLORING THE LICHEN DIVERSITY OF WHITE PINE HOLLOW PRESERVE IN SEARCH OF A LOST IOWA LICHEN
- 9:20 BREAK
- 9:40 **119.** STOPOVER ECOLOGY OF THE LEAST SANDPIPER IN IOWA^{ISF}
- 10:00 **120.** FINE SCALE TERRITORIAL CERULEAN WARBLER (*SETOPHAGA CERULEA*) HABITAT DATA IN IN YELLOW RIVER STATE FOREST, IOWA
- 10:20 **Section Business Meeting:** Election of New Officers/ New Business
- 10:40 Travel to General Session III
- 11:00 General Session III
- 12:00 Lunch
- 1:15 **121.** SAVING THE PAST TO PROTECT OUR FUTURE: CONSERVATION OF THE CHAMBERED NAUTILUS
- 1:35 **122.** TOXICITY OF INSECTICIDES COMMONLY USED IN CORN AND SOYBEAN PRODUCTION ON MONARCH BUTTERFLY (*DANAUS PLEXIPPUS*) LARVAE
- 1:55 **123.** COMMON MILKWEED (*ASCLEPIAS SYRIACA*) INVASION AND PERFORMANCE IN TALLGRASS PRAIRIE PLOTS OF VARYING DIVERSITY
- 2:15 **124.** CONSERVATION ASSESSMENTS OF TWO MUSCATINE COUNTY NATURAL AREAS
- 2:35 BREAK
- 2:55 **125.** REVISIONS TO THE FLORA OF IOWA
- 3:15 **126.** UPDATING THE STATE LIST OF ENDANGERED, THREATENED, AND SPECIAL CONCERN PLANT SPECIES
- 3:35 Conclude Meeting

Engineering Section

Room 410

SECTION MEETINGS

Saturday, See individual sections for room and schedule.

- 1:15 127. ORGANIC VS. NON-ORGANIC FOODS?
- 1:35 128. CHARACTERIZING GELATIN HYDROGEL VISCOELASTICITY WITH DIFFUSING COLLOIDAL PROBE MICROSCOPY
- 1:55 129. MSW MANAGEMENT IN THE US – A REVIEW
- 2:15 **Section Business Meeting:** Election of New Officers/New Business

Environmental Science and Health Section

Room 404

- 9:00 **Section Business Meeting:** Election of New Officers/New Business
- 9:20 BREAK
- 9:40 130. AIR QUALITY IMPACTS OF CO-FIRING BIOMASS IN A COAL-FIRED POWER PLANT
- 10:00 131. CARBOHYDRATE TRANSFER TO SEA SPRAY AEROSOL
- 10:20 132. ANTHROPOGENIC AND BIOGENIC SOURCES OF FINE PARTICULATE ORGANIC AEROSOLS IN THE SOUTHEASTERN UNITED STATES
- 10:40 Travel to General Session III
- 11:00 General Session III
- 12:00 Lunch
- 1:15 133. MOLECULAR MARKERS FOR SOURCE IDENTIFICATION AND APPORTIONMENT OF AMBIENT PARTICULATE MATTER IN KATHMANDU, NEPAL
- 1:35 134. MANMADE ANTARCTIC SEAWATER GLACIERS TO CONTROL GLOBAL SEA LEVEL RISE
- 1:55 135. BIOMASS ECOMASONRY: NOVEL GREEN TECHNOLOGY TO CUT GLOBAL CO₂ EMISSIONS
- 2:15 136. *ESCHERICHIA COLI* DETECTION AT BACKBONE LAKE
- 2:35 BREAK
- 2:55 137. EVALUATING GENE EXPRESSION IN HUMAN LIVER CELLS FOLLOWING METOLACHLOR EXPOSURE
- 3:15 138. NOVEL METHOD FOR QUANTIFICATION OF ODOROUS VOLATILE ORGANIC COMPOUNDS IN THE AIR WITH SOLID PHASE MICROEXTRACTION AND GAS CHROMATOGRAPHY-MASS SPECTOMETRY
- 3:35 Conclude Meeting

Geology Section

Room 403

- 8:00 139. CHALLENGES OF HYDROLOGIC SAMPLING IN A HIGHLY POLLUTED RIVER: A LEARNING EXPERIENCE FROM NEPAL
- 8:20 140. RASCAL WATERSHED ANALYSIS OF DRY RUN CREEK, BLACK HAWK COUNTY, IOWA
- 8:40 141. PRECIPITATION TRENDS AND PRECIPITATION EXTREMES: CLIMATE CHANGE AND FLOOD EVENTS IN THE CEDAR RIVER VALLEY (IOWA)
- 9:00 142. PROCURING PROBOSCIDEAN PARTS FROM POND DEPOSITS PERCHED ABOVE THE POOL OF LAKE RED ROCK

SECTION MEETINGS

Saturday, See individual sections for room and schedule.

- 9:20 **143.** A NEW MODEL FOR THE DEVELOPMENT OF THE MANSON IMPACT STRUCTURE'S CENTRAL PEAK AND ITS RELATION TO MANSON SOFT WATER
- 9:40 **144.** NEW ACHIEVEMENTS OF THE MIDDLE ORDOVICIAN WINNESHIEK LAGERSTÄTTE AND THE DECORAH IMPACT STRUCTURE
- 10:00 **145.** CREATING A NEW BEDROCK GEOLOGIC MAP OF MITCHELL COUNTY, IOWA
- 10:20 **Section Business Meeting:** Election of New Officers/New Business
- 10:40 Travel to General Session III
- 11:00 General Session III
- 12:00 Lunch
- 1:00 Geological Society of Iowa – Field Trip

Iowa Science Teaching Section

Room 408

- 8:40 **146.** USING GAME-BASED LEARNING TO CREATE MORE EFFECTIVE SCIENCE FIELD TRIPS AND CONNECT REAL-WORLD EXPERIENCES TO CLASSROOM-BASED LEARNING
- 9:40 **148.** THE NEW, PEER-REVIEWED *JOURNAL OF STEM ARTS, CRAFTS, AND CONSTRUCTIONS*: WHAT'S IT ALL ABOUT?^{ISGC}
- 10:00 **Section Business Meeting:** Election of New Officers/New Business

Organismal Biology Section

Room 406

- 8:20 **149.** EPIGENETIC INHERITANCE AND PREDISPOSITION TO SEX IN TEMPERATURE-DEPENDENT SEX DETERMINATION
- 8:40 **150.** PREPARING FOR WINTER DORMANCY: INSIGHT INTO THE EFFECTS OF COLD TEMPERATURES ON CONDITION, METABOLISM, AND HORMONAL RESPONSE IN THE CHECKERED GARTER SNAKE, *THAMNOPHIS MARCIANUS*
- 9:00 **151.** PROTECTIVE FUNCTIONS OF PIGMENTS AGAINST SOLAR RADIATION IN HAWAIIAN DAMSELFLY *MEGALAGRION CALLIPHYA*
- 9:20 BREAK
- 9:40 **152.** CAUSES AND CONSEQUENCES OF MULTIPLE PATERNITY IN THE COMMON GARTER SNAKE (*THAMNOPHIS SIRTALIS*)^{ISF}
- 10:00 **153.** TARDIGRADES OF HARDIN COUNTY, IOWA
- 10:20 **Section Business Meeting:** Election of New Officers/New Business
- 10:40 Travel to General Session III
- 11:00 General Session III

Physics, Atmospheric and Space Sciences

Room 301

SECTION MEETINGS

Saturday, See individual sections for room and schedule.

- 8:40 **154.** EFFECT OF DISORDER ON THE MAGNETIC AND ELECTRONIC STRUCTURE OF MnCrVAI
- 9:00 **155.** EFFECT OF FE SUBSTITUTION ON THE STRUCTURAL, MAGNETIC AND ELECTRON-TRANSPORT PROPERTIES OF HALF-METALLIC Co₂TiSi
- 9:20 BREAK
- 9:40 **156.** IMPROVING PHOTOMETRIC RESOLUTION OF A STELLAR FIELD WITH APERTURE AND PROFILE PHOTOMETRY
- 10:00 **157.** STABLE ISOTOPE CHEMISTRY IN TITAN HAZE AEROSOL^{ISGC}
- 10:20 **Section Business Meeting:** Election of New Officers/New Business
- 10:40 Travel to General Session III
- 11:00 General Session III
- 12:00 Lunch
- 1:15 **158.** CHARGE TRANSFER BETWEEN BARE IONS AND MOLECULES AT LOW COLLISION ENERGIES
- 1:35 **159.** DISTINCT SURFACE AND BULK CHARGE DENSITY WAVES IN ULTRATHIN 1T-TAS₂
- 1:55 Conclude Meeting

Physiology and Health Sciences Section

NOTES

Saturday, See individual sections for room and schedule.

Room 308

- 9:20 **160.** THE CONTRACTILE EFFECTS OF QUILLAJA SAPONIN ON SMOOTH MUSCLE TISSUE ISOLATED FROM THE UTERINE HORNS OF *MUS MUSCULUS*^{BBB}
- 9:40 **161.** AQUEOUS EXTRACTS OF CALABASH SEEDS (*CRESCENTIA CUJETE*) MILDLY CONTRACT ISOLATED UTERINE TISSUES FROM *MUS MUSCULUS*^{BBB}
- 10:00 **162.** GHRELIN: A LINK BETWEEN HUNGER, LEARNING, AND INCREASED HIPPOCAMPAL NEUROGENESIS
- 10:20 **Section Business Meeting:** Election of New Officers/New Business
- 10:40 Travel to General Session III
- 11:00 General Session III
- 12:00 Lunch

ABSTRACTS BY SECTION

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

ANTHROPOLOGY POSTER PRESENTATIONS

1. THE USE OF SPATIAL ANALYSIS IN IDENTIFYING ACTIVITY AREAS AT A WOODLAND ERA ARCHAEOLOGICAL SITE

Caitlin Conlon
Cornell College

Site 13DK96 is a Prairie Lakes region Woodland era site that is nestled on the western side of Sunken Lake in northwestern Iowa. During previous seasons, the excavation teams have investigated a hearth, the only defined feature at the site thus far, which contained charcoal, fish vertebrae, fire-cracked rocks, at least two decorated rim sherds, and two projectile points. The charcoal was carbon dated to roughly 1,780 years before present. In 2016, the excavation team collected all of the fish vertebrae, turtle shell, other bones, lithic, and fire-cracked rock that was found within the units they dug as part of a contiguous 16 square-meter block excavated in 50-x-50-x-5 centimeter quadrants for spatial control. In recent years spatial analysis has emerged as a growing as a necessity in archaeology, and can be used to discern both the activity areas and chronology of a site. Maps of the site have been made using Excel and ArcGIS that show the distribution of each artifact type throughout the different levels of the site. I use these maps to identify evidence for activity areas within the excavated block at the site based on the distribution of artifacts.

2. IOWA'S NEW MAMMOTH WITH ARCHAEOLOGICAL POTENTIALS

Christopher Coudray
University of Iowa

The Lake Red Rock mammoth was discovered in October of 2014 eroding from the lake shoreline. The site was partially excavated during May of 2016 by the University of Iowa Office of the State Archaeologist. The site is located in Marion County in the south-central part of Iowa approximately 25 miles southeast of Des Moines. The project is exploring whether there is any preserved association between the mammoth and humans existing in the area at the same time as the animal. The laboratory investigation seeks to establish how many animals, and of what species, perished at the site and what the ice age environment was like. The taphonomic processes resulting in the burial and preservation of the bones are being documented and the remains carefully examined for cut marks or other evidence of human modification. The adhering sediments returned to the lab with the bones are being subject to flotation processing to check for lithic microdebitage as a single stone (chert) flake was recovered nearby the mammoth although not in secure association. My goal is to build a database for the Iowa region of proboscidean sites to further the efforts to discover a location with preserved evidence of mammoth-human interaction.

3. WRESTLING WITH CERAMIC TYPOLOGIES: A CASE FOR HOLISTIC ANALYSIS

Mads Hoofnagle
University of Iowa

Ceramic analysis can be a field shrouded in mystery, where 'instinct' and 'inherent skill' are cited as often as any form of scientific analysis. Some argue for its abolishment in favor of purely quantitative measures such as statistical or chemical analysis, while others defend its current state of existence as a valuable and necessary form of artifact analysis. There is a compromise between the two, where our understanding of 'ware types' and ceramic analysis can be structured around certain analytical pillars that are easily replicable and understandable by other researchers. These pillars consist of overall design themes, residue analysis results, and temper point counting results. In the case presented, that of Woodland period site 13DK96 in the Prairie Lakes Region of Iowa, the original ware type definitions turned out to be largely frustrating and a reconsideration of definitions and boundaries is proving fruitful.

4. SITE COMPARISONS OF EARTHQUAKE DESTRUCTIONS IN ROMAN CORINTH

Mary Kort
Cornell College

Corinth has been subject to much seismic activity throughout the years. Several ancient literary sources (Suetonius, Cassius, and Marcellinus) have identified earthquakes during Roman occupation of Corinth; however, it cannot be known from these sources if Corinth was affected. This paper has identified five archaeological criteria to tell if an earthquake has occurred. Earthquakes can be shown through 1. Fallen walls, 2. Block imprints on the floors, 3. The force of which objects hit the ground, 4. Signs of reconstruction (Williams 1986, 4-5), and 5. Other nearby sites that show similar destruction (Stiros, 10). In applying these criteria, I verify the literary sources and show that there were in fact five destructive earthquakes between 44 BCE and 375 CE, effectively ending four of the Roman phases. In order to assess these criteria, I have researched the excavation reports of two different sites in Roman Corinth: East of the Theater and the Sanctuary of Demeter and Kore.

5. SOURCES OF SINAGUA OBSIDIAN POINTS AND DEBITAGE THROUGH XRF ANALYSIS

Daniel Lee¹, John Whittaker¹, Lee Sharpe¹ & Jeffery Ferguson²
¹Grinnell College & ²Missouri University Research Reactor

The rooms at Lizard Man Village, Fortress Hills, and New Caves in Arizona were occupied between 1050 and 1250 AD. This project analyzes projectile points and debitage from these three sites using the XRF instruments at Missouri University Research Reactor. We sorted over 300 obsidian points and debitage from the other lithic remains, and analyzed the samples using an ARL Quant'x EDXRF Spectrometer. The sites are located near the San Francisco volcanic field which

provided an abundant amount of obsidian. Most of the samples came from Government Mountains, with a few pieces from R.S. Hills. Points that came from sources further away were most likely trade points.

6. ARCHAEOLOGICAL ANALYSIS OF NEPALESE GUNFLINTS

Anais Levin and John Whittaker
Grinnell College

During the early 19th century, Nepal came under British control and began receiving armaments from the East India Company. We analyzed a sample of the thousands of gunflints from a royal cache bought and marketed by International Military Antiques in 2004. Most of the gunflints are of British and French origin, however, given the presence of flints that are of different materials and dimensions, there may have also been an undocumented local gunflint industry. Evidence of re-sharpening and reuse of gunflints as strike-a-lights is common, but it varies depending on the origin of the gunflints. Given the variability in quality and form, it appears that the gunflints provided to the Nepalese were not always the best available.

7. SEDIMENTARY PETROLOGY AND ITS POTENTIAL AS AN ANALYTICAL TOOL IN ARCHAEOLOGY: DETERMINING INFLUENCE OF TECHNO-FUNCTIONAL PROPERTIES OF RAW MATERIALS ON PREHISTORIC SOCIO-BEHAVIORAL EVOLUTION AND PROCUREMENT STRATEGIES

Elena Skosey-LaLonde
Cornell College

The practice of optical microscopy as an analytical tool is crucial in the procurement of quantitative data for the petrographic analysis of all rock types, unconsolidated materials, grain morphologies, and anthropogenic materials. Information obtained from detailed thin section studies, using both transmitted and reflected light, enable researchers to quantify their sample(s) through observed microscopic features including mineralogy, textural analysis, identification and sequencing of diagenetic phases, tectonic history of sample protolith, and modal analysis and porosity characterization of their sample(s). This study seeks to outline the methodology of optical petrography through the analysis of core T3.13.1(a) from Cedar Co. IA. While a larger sample size is needed to provide definitive results, this preliminary study indicates that characterizing the petrographic and mineralogical makeup of raw material through the microscopic analysis of (micro) cryptocrystalline materials, has great potential in demonstrating the role that material quality played in the development of knapping method, tool production, (import)export potential, and procurement and trade patterns, indicating a poorly understood socio-behavioral trend in the Paleoindian.

Cellular, Molecular & Microbiology

Poster Presentations

8. PI3K/AKT SIGNALING INFLUENCES NEURONAL FUNCTION IN *C. ELEGANS*^{βββ}

Leah Barkema, Marta Williams & Stephanie Fretham

Luther College

The phosphatidylinositol 3-kinase (PI3K)/Akt signaling pathway integrates external and internal cues such as growth factors, nutrients, energy levels, and oxidative stress to regulate many important cellular functions necessary for growth, plasticity, and stress responses. PI3K/Akt signaling is altered in many different neurological conditions, although its role in these diseases is not clear. In order to better understand how PI3K/Akt signaling contributes to neurologic disease, this study used *Caenorhabditis elegans* (*C. elegans*) to assess the influence of PI3K/Akt activity on neuronal function and overall organism health. *C. elegans* are small, non-parasitic nematodes with a well-characterized genome and nervous system including homologs of the mammalian PI3K/Akt signaling and neurotransmitter systems. Wild-type and *C. elegans* strains with genetic mutations known to affect PI3K/Akt signaling were cultured on agar plates seeded with *E. coli* as a food source. PI3K/Akt mutants demonstrated an inverse relationship between pathway activity and lifespan, as well as altered expression of antioxidant and stress response genes consistent with previous studies. Of interest, dopamine and serotonin dependent feeding behavior was altered in PI3K/Akt mutants relative to wild-type animals, suggesting that the pathway may play a role in dopamine and serotonin production or uptake.

9. PREVALENCE OF LYME DISEASE CAUSING BACTERIA *BORRELIA BURGDORFERI* IN LOCAL RODENTS

Korissa Blasing, Kelly Grussendorf & Gerald Zuercher
University of Dubuque

Lyme disease is one of the fastest growing infectious diseases in the U.S., with cases mainly found in northeastern states and the upper Midwest. In 2014, there were 194 confirmed cases of Lyme disease reported in Iowa. Because of its growing number of cases in the U.S., particularly in Iowa, we set out to determine specific carriers and exposure rates of ground-dwelling rodents at a local recreational area in Dubuque. Lyme disease is caused by the bacteria *Borrelia burgdorferi*, and many rodents serve as natural reservoirs. Ticks feed on these rodents during their development and can pick up the bacteria. These ticks then go and feed on other animals, such as dogs and humans. When the tick makes contact with the host's skin, its saliva coats the spiral bacteria, protecting and hiding this intruder from the host's immune system. *B. burgdorferi* continues to avoid the host's immune response causing swelling, and ultimately effecting and damaging tissues throughout the body. During the summer of 2016, we trapped multiple rodents at a local recreational, highly visited, area in Dubuque. Blood samples were taken from the tail of the rodents and are currently being tested for the presence of *B. burgdorferi*.

10. MICROTUBULE-ASSOCIATED PROTEIN TAU ENHANCES TUMOR NECROSIS FACTOR-INDUCED CELL DEATH IN NEURONAL CELLS

Elvis Castro, Ty Gandy & Chad Leugers
Morningside College

Tau, a neuronal microtubule-associated protein, has recently been shown to enhance MAPK signaling through the ERK

pathway. Over-activation of ERK and other MAPK pathways such as JNK and p38 in response to chronic inflammation and oxidative stress can lead to significant neuronal atrophy and cell death in neurodegenerative diseases such as Alzheimer's disease. Since the role of tau in JNK and p38 activation due to chronic inflammation remains unclear, we aimed to further investigate tau's impact on these pathways downstream of various inflammatory stressors such as Tumor Necrosis Factor Alpha (TNF α) and glucose deprivation. Neuronal PC6-3 cells, D5-20 cells overexpressing human tau, and rTau4 cells with depleted endogenous tau were treated with either TNF α or deprived of glucose to investigate the effects of chronic inflammation. Tau overexpression increased cell death in cells exposed to TNF α . However, glucose deprivation experiments showed that tau expression level had no noticeable effect on cell death. These findings suggest tau is able to enhance inflammatory stress-related cell signaling as it has been previously reported for growth factor-induced signaling, and increase our understanding of the mechanisms of neurodegenerative disease. Subsequent experiments will address the nature of tau's interactions with stress-related signaling pathways.

11. EFFECTS OF NICOTINE ON A549 LUNG TUMOR CELLS

Victor Espinoza & Brian Lenzmeier
Buena Vista University

Cigarette smoking is a major cause of lung cancer. Not only is non-small cell lung cancer correlated with smoking but also there are other physiological factors at play. Nicotine is a component of cigarettes and has been found to induce resistance to apoptosis, increase proliferation of lung cancer cell lines, and induce angiogenesis. We carried out a series of experiments to examine the effects of nicotine on cell viability, UV-sensitivity, mitochondrial function, lysosomal function, and apoptotic effects on the nucleus. Experiments were done on both A549 lung tumor cells and B16 melanoma cells using a variety of fluorescence microscopy approaches. This study hopes to contribute to our understanding of how nicotine induces resistance to chemotherapy and the role mitochondrial signaling plays in this resistance. If a cellular mechanism can be elucidated as the cause for nicotine-induced treatment-resistance by tumor cells, then more specific treatments to bypass therapeutic resistance might be possible.

12. DEVELOPMENT OF CELL CULTURE TECHNIQUES FOR STUDIES OF CHEMOTHERAPY DRUGS

Daneel Gayle & Kelly Grussendorf
University of Dubuque

The use of cell culture is a common technique used in many areas of biological research. At the University of Dubuque we are working to develop tissue and cell culture techniques for experimental uses in different courses and research areas. We have worked to set up primary cell culture lines from fish, due to the simplicity of use for undergraduate students. By using fish, it allows for a relatively quick extraction of different tissues and cell types as well as less stereological and technical challenges that are often faced when handling cell lines. We have worked with the Fish Health Center in La Crosse, WI to

develop techniques and materials needed for carrying out this work. We have been successful in developing different primary cell lines and plan on continuing to study the effects of the commonly used chemotherapy drug, methotrexate.

Methotrexate works to slow the growth of cells and decreases the activity of the immune system. Methotrexate is also used to treat various skin conditions, including severe cases of psoriasis. With our newly developed cell culture lines, we plan on studying the effect of methotrexate on various cell types, primarily focusing on epithelial cells.

13. CATALOGING METABOLIC ACTIVITY AND OXIDATIVE STATUS OF PI3K/AKT PATHWAY MUTANTS IN *C. ELEGANS*^{BBB}

Tanner Gibbons, Trevor Kao & Stephanie Fretham
Luther College

Altered energy metabolism and oxidative stress have been observed in many neurological diseases such as Parkinson's Disease and ALS. A particular cellular pathway of interest in this association is phosphatidylinositol 3-kinase (PI3K)/Akt signaling which is also altered in these diseases. It is a regulatory pathway influencing cellular metabolism, structure, and gene expression in response to nutrient availability, growth factor signaling, and overall energy levels. It is unknown if altered energy metabolism and oxidative stress are connected to PI3K/Akt activity in neurologic disease. To better elucidate the relationship between metabolic output, oxidative state, and PI3K/AKT signaling activity, this study used wild type and mutant *Caenorhabditis elegans* (*C. elegans*), a small non-parasitic soil nematode containing homologs of most PI3K/Akt components. ATP, glutathione, and reduction potential were assessed in wild type and PI3K/Akt mutant *C. elegans*. Preliminary results indicate that decreased PI3K/Akt activity resulted in elevated ATP levels while increased PI3K/Akt activity decreased ATP levels. Furthermore, both increased and decreased PI3K/Akt activity altered glutathione and reduction potential. Together these observations suggest an inverse relationship between PI3K/Akt activity and ATP concentration and that any abnormality in PI3K/Akt signaling can alter the oxidative status in *C. elegans*.

14. ISOLATION OF PRAIRIE MICROORGANISMS AND THEIR IMPACT ON THE GROWTH OF *AMORPHA CANESCENS* AND *LIATRIS ASPERA*

Josh Johnson & Lee Macomber
Central College

Tallgrass Prairie is a complex ecosystem that a vast number of species rely on as a habitat. A significant amount of biodiversity could be lost if restoration efforts are not continued and if practices of restoration are not improved. Many species of plants that are important to this ecosystem often do not appear in restored prairies, despite efforts to introduce them. This suggests that there may be a missing soil attribute that these plants require. Symbiotic bacteria and fungi play an important role in the nitrogen cycle and the health of prairie plants. In an effort to improve tallgrass prairie restoration, microorganisms were isolated from the roots and soil of leadplant (*Amorpha canescens*) and tall blazing star (*Liatris aspera*) found in a remnant prairie. The individual

isolates, a mix of all isolates, or soil from the remnant prairie was used to inoculate restored prairie soil. Seeds were planted in this amended soil to determine if leadplant or tall blazing star seed germination was enhanced.

15. ASSAY OF MITOCHONDRIAL FUNCTION FOR COMPLEX I THROUGH IV WITHIN THE ELECTRON TRANSPORT CHAIN FROM LIVER MITOCHONDRION OF ATRAZINE EXPOSED CHICKENS (*GALLUS GALLUS*)^{BBP}

Haley Jorgensen & Debra Martin
Saint Mary's University of Minnesota

Atrazine (ATR) is a widely used herbicide that has been found in water systems at concentrations higher than the EPA limit of 3 ppb. Around the time ATR became available (early 1960s), there has been a decrease in Ring-necked Pheasant population in Minnesota. To determine if/how ATR may be affecting the health of Ring-necked Pheasants, an analysis of another avian species, chicken (*Gallus gallus*), was utilized. Previous research with rodents suggests that ATR causes metabolic dysfunctions by affecting the electron transport system (ETS) of the liver. The analysis conducted was to evaluate the mitochondrial function within all four complexes (CI-CIV) of the ETS when the newly hatched chicks were chronically exposed to different concentrations of ATR (0 ppb, 30 ppb, and 300 ppb) within their drinking water for 21 days. The mitochondrial function of each chick's liver (n=16/group) was assessed. Initial studies on Complex I and Complex II show a dose dependent decrease of ETS function. These results indicate that ATR exposure affects the metabolic ability of the liver cells.

16. EXPRESSION OF A SMAD4-GFP FUSION PROTEIN IN A BMP RESPONSIVE MOUSE MYOBLASTIC CELL LINE (*C₂C₁₂*)

Baridosia Kumbe, Kolter Freidhof & William Jones
Upper Iowa University

Bone morphogenic proteins (BMPs) are members of the transforming growth factor β (TGF- β) family of growth factors. BMPs cause cells to differentiate. BMPs are known to act on the mouse *C₂C₁₂* myoblastic cell line. *C₂C₁₂* cells can differentiate into myoblasts capable of contraction. However, BMPs cause *C₂C₁₂* cells to differentiate into osteoblasts. BMPs signal through cell surface receptors which phosphorylate receptor specific SMAD proteins. These phosphorylated SMAD proteins associate with a common SMAD protein, termed SMAD-4, and transport into the nucleus where they regulate various genes.

This project's goal was to express a SMAD-4-GFP fusion protein in *C₂C₁₂* cells creating a reporter cell line. *C₂C₁₂* cells were selected for hygromycin resistance and tested for GFP expression. A hygromycin resistant cell line was isolated, but only a fraction of the cells expressed the GFP protein. Sub-cloning allowed for the isolation of a GFP expressing clone, however, the SMAD-4-GFP expression was unstable and GFP expression was lost over a few passages. It was hypothesized that the over expression of the SMAD-4 protein may have led to spontaneous signaling causing the cells to slow down or stop dividing.

17. NEW INSIGHTS INTO THE "MANNA FROM HEAVEN" HYPOTHESIS^{ISGC}

Clare Laubenthal, Marek Sliwinski & Joshua Sebree
University of Northern Iowa

Titan's atmosphere is unique in that its atmospheric chemistry is thought to be similar to that of the Earth's atmosphere before the development of life. Aerosols form as a result of the radiation of organic gases by ultraviolet light. These aerosols are thought to be similar to the prebiotic hazes that formed in the atmosphere of Earth during the Archean Era and which allowed for the eventual development of microbial life. We are investigating whether Earth soil bacteria can grow, using these aerosol analogs as a nutrient source. This study is based on microbial metabolism study done by Carl Sagan, which detailed bacterial growth using Titan-analog tholins as the sole carbon source. We are building upon this study, using aerosol analogs that more closely match those of modern-day Titan coupled with modern day detection techniques. The tholins used in this study are made from carbon-13 spiked gases, in order to quantitatively evaluate our results via a metabolic NMR study. The results of this study will provide new insights as to how Earth's atmosphere could have supported primordial life.

18. GENOME-WIDE ANALYSIS TO REVEAL NOVEL REGULATORS OF GERMLINE STEM CELL SELF-RENEWAL AND DIFFERENTIATION IN *DROSOPHILA TESTIS*

Ying Liu, Ping Kang & Hua Bai
Iowa State University

Stem cells are critical for organ development and tissue homeostasis. Understanding the mechanisms of stem cell self-renewal and differentiation are critical for developmental and cancer biology. Germline stem cells (GSCs) from the *Drosophila testis* provide one of the best genetic systems to study stem cell regulation. Several previous studies in *Drosophila* have been conducted in different stem cell populations. Because of the limitations of RNAi technique, many identified candidate genes were not well studied and characterized. Especially the function of intracellular proteins is still generally unknown, such as the function of cytoskeletons. In addition, the contribution of natural variation in stem cell regulation through single nucleotide polymorphisms (SNPs) and specific single nucleotide mutations is not well understood. In this study, we used the 198 inbred lines from *Drosophila melanogaster* Genetic Reference Panel (DGRP) to perform a genome-wide association analysis and search for stem cell and niche regulators. We identified 36 lines that showed significantly altered stem cell number phenotypes. Genome-wide association study (GWAS) revealed that 85 SNPs and 33 genes are significantly associated with stem cell regulation. A follow-up functional validation analysis identified 3 novel genes that play a role in stem cell self-renewal. Thus, our results suggest that GWAS is a powerful approach to identify novel genes and pathways involved in stem cell regulation

19. WALKING ON SELF-SIMILAR STRUCTURES

Michael Martin, Colten Lastine, Joseph Tibbs & Ali Tabei

University of Northern Iowa

The objective of our research was to use Matlab to simulate the motion of micro motors using stochastic processes on self-similar structures, such as two-dimensional fractal structures; i.e., the Sierpinski Triangle, percolated lattices at the percolation threshold, images of actin filament networks, and directed motion lattices. For the analysis of the walks we used the relative angle distribution for the motion of the simulated micro motors between successive time intervals. The significance of our project extends to ideas relating to the stochastic processes beyond the mean square displacement of the random walk simulation, such as experimental particle tracking, colloidal systems, and transport by molecular motors on filament networks both *in vitro* and *in vivo*.

20. THE ROLE OF AMYLOID-BETA IN REGULATING NUCLEAR ACTIN FOLLOWING TRAUMATIC BRAIN INJURY^{BBB}

Madison Mix, Krista Bergquist, Hannah Hart & Douglas Brusich
Wartburg College

Traumatic brain injury (TBI) is known to cause progressive neurodegeneration. At the cellular level, TBI leads to increased deposition of amyloid-beta protein in neuronal tissue. Amyloid-beta aggregation also represents a pathological hallmark of Alzheimer's disease, which is the most common form of neurodegeneration. However, the shared genetic and molecular outcomes of TBI and amyloid-beta accumulation are not well-established. In order to address this gap in knowledge, we employed a fly model of Alzheimer's disease in which transgenic, human amyloid-beta peptides were constitutively or transiently expressed in fly brains, and paired this genetic approach with TBI. Flies expressing amyloid-beta peptides had a reduced lifespan, and showed greater rates of mortality when subjected to TBI. Further, we show that similar to neurodegeneration, TBI influences the accumulation of nuclear actin, which is thought to be important as a stress response mechanism. Together, our data reveal a cellular mechanism linking TBI and neurodegeneration that may help to explain shared pathology.

22. EFFECTS OF SEX HORMONES ON PC12 CELLS WITH THE PRESENCE OF NGF

Abigail Mokhtary, JulieAnna Olague & Zane Strawser
Wartburg College

Sex hormones have direct influences on neuronal development (Ngun et al., 2012). Neurons are difficult to develop in culture (Singh et al. 2008), therefore, Rat Pheochromocytoma cells from the PC12 line are commonly used as models for experiments on neuronal differentiation (Manger 2006). PC12 models show if differences between male and female hormone levels impact neurite outgrowth. The use of Nerve Growth Factor (NGF) promotes neurite outgrowth on PC12 models. NGF with estradiol or testosterone will reveal more information about their effects on PC12 neurite outgrowth. Treatment of estradiol and NGF promotes outgrowth on PC12 cells (Ferriere et al. 2013 and Sierra-Fonseca et al. 2014). Although a receptor and binding site for testosterone is present on PC12 cells (Estrada et al. 2006 and Alexaki et al. 2006)

limited research reveals gaps in understanding outgrowth on PC12 cells treated with testosterone and NGF.

Sex hormones will have an impact on neurite development in PC12 cells treated with NGF, thus NGF and testosterone will produce outgrowth on PC12 cells. Following proper protocol, PC12 cells and their various treatment outcomes will be observed using measurement software and a scaling system.

23. THE KISS OF DEATH FOR CANCER? THE EFFECTS OF CHEMOTHERAPEUTICS AND HERBAL SUPPLEMENTS ON THE LONGEVITY OF *CAENORHABDITIS ELEGANS*

Erin Morley, Fabian Salazar, Kathryn Keller, Taylor Nelson & James Hampton
Buena Vista University

According to the Centers for Disease Control and Prevention, cancer is the second largest cause of death in the United States, accounting for 584,811 deaths in the most current US survey. There are a wide variety of genetic causes and the medical community has developed a number of chemotherapeutic treatments for those specific cancers. However, research continues apace for new compounds and approaches for hundreds of other types of cancer. To increase the rate of drug discovery, we have developed a screening process which allows the rapid and inexpensive screening of possible chemotherapeutic agents utilizing a model animal: *Caenorhabditis elegans* (*C. elegans*). Longevity studies of worms carrying mutant versions of oncogenes or tumor suppressor genes allow us to compare the effects of different media adjuncts on life span. We will report the results for mutant and wild type worm lines grown on media containing Cyclophosphamide (Cytoxan) or Paclitaxel (Taxol), two current chemotherapeutic agents; European Mistletoe Extract and Ginseng, two herbal supplements; and a combination of adjuncts.

24. MICROBIAL HEAVY METAL RESISTANCE AT GLACIAL AND RIVERINE WETLANDS

Matthew Nieland, Brittany Gill, Taylor Hixson, Allie Vanek, Austin Schmidt, Sean Fitzgerald & Anni Moore
Morningside College

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

25. ANTIPROLIFERATIVE EFFECTS OF COMMON PLANT EXTRACTS ON TUMOR CELLS *IN VITRO*

Morgan L. Olhausen, Joseph S. Tolsma, Beaton S, Becker J, Blankespoor A, Bruinsma S, Buyert T, Carver J, Gritters R, Hillman M, Hollinger P, Jenness J, Krier A, Lorfeld L, Lunn S, Muro J, Muyskens B, Sitzmann H, Soondrum J, Spaans T, Van Kalsbeek J, Van Surksun C, Yoerger A, and S. S. Tolsma
Northwestern College

In 2015, the World Health Organization identified cancer as responsible for 1 in 6 deaths globally, spurring continued scientific research. Our research interests include discovering plant extracts with antiproliferative activity, identifying active chemical components, and elucidating mechanisms of chemoprevention. We observed dose-dependent inhibition of cell growth *in vitro* using *Vinca rosea* (periwinkle), *Rosmarinus officinalis* (rosemary), *Viscum album* (mistletoe), *Impatiens balsamina* (forget-me-not), and *Taxus cuspidata* (Japanese yew) extracts on five cell lines. Extracts from mint, oregano, marigold, and lavender did not impede cell growth. We used HPLC to measure the concentrations of antiproliferative chemicals in extracts. To determine if growth suppression was due to single, additive, or synergistic chemical activity, we treated cell lines with equivalent concentrations of chemical alone and chemical in the context of whole extract. Our data indicate that inhibition by *Vinca* extracts is due to a vinblastine-like compound, Japanese yew extracts to a taxoid, and rosemary extracts to carnosic acid. We were unable to attribute inhibition solely to mistletoe lectins in mistletoe or to 2-methoxy 1,4-naphthoquinone in *Impatiens* extracts. We are testing additional plant extracts, combinations of chemicals, additional cell lines, and measuring microtubule stability, cell migration, and the ability of extracts to induce apoptosis.

26. DETERMINING THE ROLE OF OPPA IN NICKEL TRANSPORT USING THE MODEL ORGANISM *BACILLUS SUBTILIS*

Isaac Ramos & Lee Macomber
Central College

As the human population increases exponentially, demand for food is of concern. The dilemma is that arable land will not increase significantly with the demand for food, therefore crop yields have to be optimized. To produce bountiful yields, it is critical that the nitrogenous source urea found in fertilizers propagate from the soil into the plant. However, soil microorganisms often compete with nitrogen fertilizers. One such organism, *Bacillus subtilis*, contains a urease which degrades urea to ammonia. Urease contains a dinuclear nickel active site, but the exact mechanism by which nickel enters the cell is unknown. Investigation of *B. subtilis* nickel transport is critical to provide a target towards the inhibition urea degradation in fertilizers. Mutagenesis screening has identified several putative nickel transport genes, one of the genes under investigation is *oppA*. In preliminary experiments, an *oppA* mutant and wild-type (PY79) strain were grown in minimal media in 0 mM or 10 mM Ni(II) concentrations. Interestingly, in the absence of nickel the *oppA* mutant grew significantly faster than wild-type. To pursue this further, we decided to move from the chimera PY79 to a more wild-type strain background NCIB 3610.

27. USE OF *CAENORHABDITIS ELEGANS* TO STUDY THE MOLECULAR AND CELLULAR ROLE OF THE MUSCLE PROTEIN DYSFERLIN

Kathryn Silberstein & Kelly Grussendorf
University of Dubuque

Limb Girdle Muscular Dystrophy (LGMD) is a genetically-linked disease that is characterized by the degradation of muscle tissue. This disorder is due to inadequate muscle repair that has been correlated to disruption in the cellular protein, dysferlin. Dysferlin belongs to the protein family, Ferlin, which has highly conserved functions throughout many species. To address the cellular and molecular role of dysferlin, we are using the model organism, *Caenorhabditis elegans*. *C. elegans* serves as an ideal organism for these studies. Many techniques have been developed for cellular studies in this organism, and their genome is highly manipulative through different techniques. *C. elegans* also serves as an ideal model for studying the role of cellular proteins in muscles because of their transparency. We are able to study the structural maintenance and loss of maintenance in organisms that have a mutation in the dysferlin gene. We are currently carrying out work with the molecular marker, GFP, to study the cellular and subcellular structures within the muscles of *C. elegans* in wild-type and various strains with different mutations in dysferlin.

28. EXTRACTS FROM THE PRAIRIE TURNIP (*PSORALEA ESCULENTA*) POSSESS A UNIQUE PATTERN OF ANTIBACTERIAL ACTIVITY

Avery Sitzman, Olivia Matz, Abby Furlich, Teerstyn Johnson, Nhi Pham, Jane Mattingly, Max Pizzaro, Sharlene Torres-Garcia, Mishell Garcia, Patrick Ryan, Paul Weber & Daniel Jung
Briar Cliff University

Recent research focusing on natural products has generated materials with remarkable pharmacological activities. Historically, many plants have been employed in treating infection or inflammation. The prairie turnip (*Psoralea esculenta*), found in the prairies of Iowa, is known to contain flavonoids. Recently flavonoids are the subject of anti-infective research, and many researchers have shown them to possess antifungal, antiviral, and antibacterial activity. Previous research in this lab revealed that the extracts from *Psoralea esculenta* possess anti-bacterial activity against some pathogenic bacteria as well as non-pathogenic bacteria. Of the organisms studied, *Mycobacterium* and *Staphylococcus* are known invasive human pathogens while *Pseudomonas* is an opportunistic pathogen. The results showed that the survival rates of invasive pathogens are quite low (~10%), whereas those of opportunistic pathogen are considerably higher (35%). To further investigate whether this apparent difference in antibacterial activity of the extracts is a general trend extending across a variety of bacteria, we tested the effects of extracts on *E. coli* K12 (non-pathogen) and *Klebsiella* (opportunistic pathogen). These results showed that the extracts from *Psoralea esculenta* represent unique antibacterial activity.

29. COLLEGE STUDENTS' PERCEPTIONS OF DIRECT-TO-CONSUMER GENETIC TESTING & THE ROLE OF GENETIC COUNSELORS

Heidi Sleister, Paige Ernste, & Gretchen Koenigs
Drake University

Direct-to-consumer genetic testing (DTC-GT) involves genetic tests marketed directly to consumers without required involvement of a health-care professional. Consumers submit a saliva sample by mail, and the DTC-GT company's laboratory determines the consumer's genotype at thousands of locations in the genome, analyzes the genetic data, and informs the consumer via the web about his/her data. Approximately one-third of the U.S. population is aware of DTC-GT, and consumers report using the service to learn about ancestry, trait information, and disease risk. Concerns about DTC-GT include the security and privacy of collected genetic data, the accuracy of disease-risk analysis, and the absence of an expert to interpret the data. Genetic counselors can help interpret genetic-testing data and provide education and support for patients diagnosed with or at risk for genetic conditions.

To understand college students' perceptions of DTC-GT and the role of genetic counselors, ~100 students were recruited to complete an anonymous, 10-minute survey with questions related to demographics, genetics knowledge, family health history, genetic testing, and genetic counseling. Survey results will be presented. The findings of this study are important because DTC-GT is accessible and affordable, and college students are in a position to make their own healthcare and reproductive decisions.

30. EFFECT OF PRAIRIE TURNIP EXTRACTS ON INDOLEAMINE 2,3-DIOXYGENASE EXPRESSION IN MACROPHAGES

Ashley VanCleave, Brendan Schryver, Nicholas Gorden, Paul Weber & Daniel Jung
Briar Cliff University

The goal of our research is to determine whether an extract from the *Psoralea esculenta*, the prairie turnip (PT), will affect the expression of indoleamine 2, 3-dioxygenase (IDO1), an enzyme that catabolizes the conversion of tryptophan to kynurenine and other metabolites. Two metabolites of the kynurenine pathway (KP), kynurenine and kynurenic acid, function to suppress the immune response. Depending on the situation, this immunosuppressive effect can be beneficial or harmful. In recent experiments in this lab prairie turnip extracts exhibited antioxidant activity, the destruction of free radicals, which is important in the immune response. The destruction of free radicals may be mediated via IDO1 expression. In this work, IDO1 expression of macrophages treated with PT extracts was determined using three different molecular techniques. First, IDO1 gene expression was monitored in macrophages by RT-PCR. Second, the level of IDO1 protein was quantified by western blot technique. Finally, IDO1 activity was monitored by assaying metabolites of the KP by HPLC.

Cellular, Molecular & Microbiology Oral Presentations

101. THE EFFECT OF TBX2 ON BTG2 EXPRESSION IN THE MDA-MB-468 HUMAN BREAST CANCER CELL

LINE^{BBB}

Claire Judeh & Matt Rowley
Saint Mary's University of Minnesota

TBX2 is a transcription factor that is associated with breast cancer. TBX2 is linked with the deregulation of the cell cycle in part by potentially suppressing B-cell translocation gene 2 (BTG2) expression. BTG2 is an antiproliferative gene identified as one of the early growth response genes that potentially plays a role as a negative regulator of tumor suppressor genes in humans. Therefore, if this gene is suppressed by TBX2, then the cell cycle can proceed uninhibited. Previous data using murine epithelial cells suggested that the overexpression of TBX2 in mouse mammary epithelial cells increased or had no effect on BTG2 expression. However, this data was inconclusive due to low transfection efficiency and therefore needed to be repeated. In order to increase the transfection efficiency, MDA-MB-468 human breast cancer cell line will be used because it can be more easily transfected and therefore will increase the number of cells expressing TBX2. MDA-MB-468 cells were transfected with TBX2, immunofluorescence was used to verify TBX2 expression, RNA was isolated to synthesize cDNA, and RT-PCR was performed to determine BTG2 expression levels. By understanding the effect of TBX2 on BTG2 expression, this study may provide more insight on how TBX2 promotes breast cancer.

102. DIFFERENTIAL EXPRESSION OF TEOSINTE BRANCHED-1-LIKE (TBL) GENES AND THEIR ROLE IN FLORAL SYMMETRY AND BRANCHING PATTERN OF SYMPODIAL ORCHIDS

Amanda Harrop¹, Anna Runge¹, Rasika Mudalige-Jayawickrama¹ & Teresita Amore²

¹University of Dubuque & ²University of Hawaii

The TCP gene family play a crucial role in determining the branching pattern, lateral organ development and floral symmetry in major plant families. The orchid family has two main branching patterns: monopodial where the main axis is continuously growing; and sympodial where the main axis finish its growth by producing an inflorescence. In corn, expression of tb-1 in axillary buds leads to suppression of side branches and development of female inflorescence (ear primordia) in its place. Our main objective is to isolate and characterize the tb-1 like gene(s) from sympodial orchids and compare their expression profiles in monopodial and sympodial orchids. We isolated a tb-1-like gene from a *Dendrobium* hybrid genomic DNA using genome walker method. Nucleotide sequence show tb-1-like gene does not contain any introns within the open reading frame. The deduced amino acid sequence show TCP domain and the arginine rich domain (R domain) is conserved. The expression profile show tb-1 is strongly expressed in the young terminal buds of the inflorescence. Axillary buds express tb-1 like gene strongly when they are dormant while expression weakens as they start to grow. These results suggest tb-1 may play a major role in floral development and the branching pattern in sympodial orchids.

103. SEX DIFFERENCES IN AXONAL GUIDANCE CUE

EXPRESSION OF THE HYPOTHALAMUS

Sarah Schlichte
Buena Vista University

Sex differences in physical attributes and cognitive functioning have been clearly demonstrated, yet when it comes to brain structure not many differences exist. Instead sex differences in the brain may be identified at the molecular level, especially during development, when neuronal connections that govern behaviors are being established. To establish connections, guidance cues and neurotrophic signals work to ensure proper axon guidance. Located at the distal tip of the axon, growth cones take in attractant and repulsive cues to direct axon guidance. This leads to the hypothesis that a sex difference in guidance cue expression could lead to differences in cytoarchitecture or axonal connections between males and females. To determine if there is a sex difference in guidance cue expression, the amount of guidance cues including semaphorin, ephrin, nerve growth factor (NGF), netrin, brain-derived neurotrophic factor (BDNF), and slit were examined in mice. To do this, hypothalamic and cortical tissue samples were collected at embryonic ages and examined for changes in gene expression using qPCR. Three guidance cues, BDNF, NGF, and ephrin, warrant further investigation, suggesting differences in gene expression between males and females could lead to differences in neuronal locations or connections within these developing regions.

104. DISCOVERING FREEZING TOLERANT GENES FROM THE NATIVE ORCHID *APLECTRUM HYEMALE* (MUHL. EX WILLD.) TORR.^{ISF}

Rasika Mudalige-Jayawickrama & Lalith Jayawickrama
University of Dubuque

In our quest to find native orchids in Dubuque area, we came across an unusual orchid, *Aplectrum hyemale* (putty root), which show exactly the opposite of normal winter response. This unusual orchid produces a functional green leaf in mid-October and keeps this leaf viable until the next spring. Our main objective was to monitor the physicochemical changes of this plant and identify the genes that are upregulated during the cold acclimatization period. We monitored the amount of chlorophyll, anthocyanin and the expression of freezing induced genes in Putty-root leaves. Our results indicate the amount of chlorophyll remain high throughout the winter even when the leaf is under the snow. The anthocyanin concentration is very high as the leaf emerges from the tuber in early October and slowly reduces to very low levels. We speculate that anthocyanin may protect the young leaf from high sunlight as the canopy opens up in fall. We used a process known as complementary DNA (cDNA) suppressive subtractive hybridization (SSH) in order to isolate the freezing induced genes. The results of SSH indicated six unique DNA bands in the cold induced sample. Most genes isolated are responsible for chloroplast metabolism and energy production. We will discuss their possible role in winter acclimatization.

105. ANTIBACTERIAL EFFECTS OF DIFFERENT CULTIVARS OF GARLIC ON AN ARRAY OF BACTERIA

Matthew Anderson & Aditi Sinha
Loras College

There is growing interest in the use of phytochemicals as potential antimicrobial agents. *Allium sativum*, commonly known as garlic, may have antibacterial effects against a wide array of bacteria. The objectives of this study were to determine: (i) if different cultivars of garlic have varying inhibitory effects on six nonpathogenic strains of bacteria, and (ii) if the cultivars are more effective at inhibiting bacterial growth than known antibiotics. The Kirby Bauer disk diffusion method was used to measure the zone of inhibition of bacteria exposed to garlic. The garlic cultivars used were Spanish Roja, Romanian Red, Korean Red, Georgian Fire, and Inchelium Red. The bacteria used were three gram negative (*S. marcescens*, *E. coli*, *N. capsulatum*) and three gram positive (*S. epidermitis*, *S. ureae*, and *S. aureus*). Spanish Roja, Romanian Red, Korean Red, and Georgian Fire had significantly higher inhibitory effects on the bacteria than Inchelium Red. Additionally, all garlic cultivars tested were significantly more effective at inhibiting the growth of bacteria than the four antibiotics tested. The different cultivars of garlic may inhibit bacterial growth differently due to varying concentrations of secondary compounds present. The results from this study provide further insight into the antimicrobial effects of garlic.

106. MECHANICAL PROPERTIES OF CYTOSKELETAL STRUCTURE DETERMINED BY ATOMIC FORCE MICROSCOPY IN SINGLE-CELL AND MULTICELLULAR *DICTYOSTELIUM DISCOIDIUM*^{ISF}

Kate Cooper¹, Yan Wu² & Cal Stovie¹
¹Loras College & ²University of Wisconsin - Platteville

The evolution of multicellularity is an intriguing biological mystery. It is known that the cytoskeleton contributes to cell structure, to the structure of multicellular organisms, and is dysregulated in many diseases. Atomic Force Microscopy (AFM) is a technique that allows for examination of elastic properties by using a very small tip to “push” against the sample and determine the mechanical resistance, which is related to the cellular cytoskeletal structure. Whereas AFM measurements have been taken of many different kinds of living cells, previous research has not investigated whether free-living cells have similar mechanical resistance to a cell in a multicellular organism. *Dictyostelium discoidium* is a social amoeba that exists as both individual cells and multicellular organisms. This project investigated the mechanical stiffness of a *Dictyostelium* in the multicellular state for the first time. Early data suggest a cell in the multicellular structure offers less resistance than an individual *Dictyostelium*. Related actin amounts obtained by confocal microscopy will be presented. The full analysis will be described and possible explanations hypothesized. Future work will continue to refine this analysis and investigate mutant *Dictyostelium* in order to better understand the mechanisms of this difference and its relationship to multicellularity.

107. THE ROLE OF THE dFOXO INTERACTOME IN CELLULAR HOMEOSTASIS AND STRESS RESISTANCE IN *DROSOPHILA MELANOGASTER*

Allison Birnbaum & Hua Bai
Iowa State University

The insulin signaling pathway in *Drosophila melanogaster* is responsible for cellular growth and development. It has also been shown to regulate mechanisms of aging through the downstream transcription factor dFOXO, the single gene ortholog of the mammalian Forkhead Box O (FOXO) protein family, which localizes in the nucleus upon depletion of insulin. The FOXO protein regulates a wide array of cellular functions including apoptosis, metabolism, cell cycle arrest, stress resistance, and aging. To date, only a few proteins are known to interact with dFOXO to regulate transcriptional activation of genes. To further characterize the role of the dFOXO protein network (interactome) in the process of stress resistance and aging, we have conducted a pull-down assay using a tagged-dFOXO protein followed by mass spectrometry. This has led to the identification of 54 dFOXO interacting proteins. From this list, we selected several proteins of interest based on their predicted functions for further analysis. Mortality assays reveal transgenic RNAi fly lines targeting several candidate proteins show enhanced resistance to paraquat (PQ)-mediated stress. Co-Immunoprecipitation between dFOXO and candidate proteins further confirm novel protein-protein interactions. Thus, we have identified a comprehensive dFOXO interaction network involving many novel regulators that can impact homeostasis and stress resistance.

108. MULTI-DRUG RESISTANT *STAPHYLOCOCCI* IN SPRINGS AND STREAMS IN NORTHEAST IOWA

Luke von Eschen, Kayla Ingvalson, Joel Denney & Eric Baack
Luther College

Many Iowa rivers and streams are impaired due to high bacteria levels, particularly following heavy rain, and higher bacteria levels are linked to increased risk of illness. We investigated levels of drug resistance in *E. coli* and *Staphylococcus* bacteria found in streams and springs of NE Iowa, where abundant sinkholes link springs to surface contaminants. *E. coli* counts frequently exceeded recommended limits in springs around Decorah. *Staphylococcus* resistant to oxacillin were commonly found, and many of these were resistant to other antibiotics, including vancomycin. Frequencies of multi-drug resistance in *Staphylococci* varied among springs in the Decorah area. We are continuing this work to identify the species of *Staphylococcus* present in our samples, and determine potential causes for the variation in multi-drug resistant bacteria frequency.

109. BORIC ACID INHIBITION OF THE COMMON DERMATOPHYTE *TRICHOPHYTON RUBRUM*

Martin Schmidt
Des Moines University

Trichophyton rubrum is a dermatophyte that causes most cases of fungal infections of the skin and nails. While such infections are merely a nuisance in healthy people, they are more problematic in patients with reduced healing capacity. Boric acid (BA) has been shown to be an effective treatment for vaginal *Candida albicans* yeast infections where it inhibits

invasive growth through destabilization of the cytoskeleton. The effectiveness of BA against yeast infections suggests that a similar treatment is feasible for *T. rubrum* infections. Importantly, at moderate concentrations BA promotes wound healing, which would be particularly beneficial for diabetic patients with impaired regenerative capacity. The data presented show that BA represses *T. rubrum* growth at concentrations of 0.05%. On solid media, BA suppresses the formation of aerial mycelia and conidia, restricting the growth of the fungus to the subsurface of the agar. At concentrations above 0.1%, BA is fungicidal and the application of a drop of 2% to an agar surface suppresses growth of embedded *T. rubrum* conidia. The antifungal activity of BA occurs thus within the range that stimulates wound healing (0.1-0.3%). BA appears to be particularly effective against superficial hyphal elements, suggesting that exposure to oxygen potentiates the antifungal effect.

110. EPIDEMIOLOGICAL AND EXPERIMENTAL EVIDENCE OF SEX-DEPENDENT RESPONSES TO INFECTION WITH *LEISHMANIA INFANTUM*

Ryan D. Lockard¹, Elizabeth A. Turcotte¹, Selma B. Jeronimo², Mary E. Wilson³, Nilda E. Rodriguez¹
¹University of Northern Iowa, ²Universidade Federal do Rio Grande do Norte, Natal, Brazil, ³University of Iowa

Males and females experience differential prevalence, morbidity, and mortality in infectious diseases. In general, infectious diseases are more prevalent and severe in males. We examined sex-dependent responses to infection with the parasitic protozoan *Leishmania infantum*, which causes visceral leishmaniasis in Brazil. Macrophages isolated from male and female mice were infected with attenuated parasites and examined with light microscopy. Cells of male origin had higher percent infection and parasite loads than cells from females. This suggested that cellular-level differences between the sexes may influence infection. Examination of liver samples from two mouse strains infected with virulent *Leishmania infantum* showed that males experienced higher parasite loads than females. This demonstrated a male bias in infected mice with different genetic backgrounds. Furthermore, epidemiological evidence from an endemic region of Brazil revealed a higher prevalence of symptomatic disease in males compared to females (64% versus 36%) despite similar levels of exposure to the parasite. This strong male bias was particularly pronounced post-puberty, suggesting a role for sex hormones in the dichotomous disease prevalence. Together, our results support a model in which biological differences at the organismal and cellular level drive the increased male susceptibility to visceral leishmaniasis observed in the human population.

111. THE POWER OF GWAS: IDENTIFYING NOVEL REGULATION FACTORS IN THE AUTOPHAGY PATHWAY USING *DROSOPHILA MELANOGASTER* AS A MODEL

Axelle Weeger
Iowa State University

Using the autophagy pathway, a cell under stress can recycle its own damaged proteins and organelles to continue supplying

energy to the organism. To better understand this pathway, and uncover novel regulation factors, we have used the DGRP fly panel to assess autophagy response before and after starvation stress in genetically diverse backgrounds of *Drosophila melanogaster*. We then applied GWAS technology to the phenotypic data, and were able to isolate 298 unique SNPs associated with a constitutive, non stress induced, autophagy response and 222 unique SNPs associated with responses to stress. These SNPs are linked with 112 unique genes in the case of stress independent autophagy and 97 genes of interest in the case of stress dependent autophagy. In particular the GWAS identified gene CG30427, which is of specific interest because of its implication in lifespan regulation. In addition, many genes isolated in the constitutive panel are associated with calcium ion transport, which is critical for proper pH balance. Finally, the screen also identified DOR (Diabetes and Obesity Regulated), a gene involved in the autophagy pathway, which demonstrates that GWAS is a powerful tool capable of identifying and correlating both known genes and potential novel regulators.

Chemistry Poster Presentations

31. USING FLUORESCENCE TO QUANTIFY PACLITAXEL OR PACLITAXEL-LIKE SUBSTANCES IN JAPANESE YEW

Sarah M. Beaton, Mikaela J. Frank, Lucas A. Lorfeld, Renju Pun, Jorgia E. Weisser, Alexandria M. Yoerger & David C. Arnett
Northwestern College

Taxol (paclitaxel) is a commonly prescribed antiproliferative drug used to treat various types of cancer. Paclitaxel is typically isolated from the bark of Pacific yew (*Taxus brevifolia*), but other sources of paclitaxel would be welcome. Preliminary results from the Northwestern College Biology Department indicate that extracts derived from Japanese yew (*Taxus cuspidata*) have antiproliferative properties, raising the provocative possibility that Japanese yew extracts could contain paclitaxel or paclitaxel-like substances. We are investigating this possibility through two fluorescence assays, both of which monitor a binding equilibrium established between fluorescently labeled paclitaxel and the protein tubulin. This equilibrium is disturbed by the presence of unlabeled paclitaxel, either from a standard source or from an extract. The competition between labeled and unlabeled paclitaxel may be observed through a change in fluorescence anisotropy if unlabeled tubulin is used or through the amount of FRET occurring if labeled tubulin is used. In either case, comparison between the standard paclitaxel and the extract allows for quantification of paclitaxel or paclitaxel-like substances in the extract.

32. STUDENTS' PERCEPTION OF HOW SCIENCE WRITING HEURISTIC PRE-LABS PREPARE THEM FOR LAB

Nicholas Bonde & Dawn Del Carlo
University of Northern Iowa

The Science Writing Heuristic (SWH) is a pedagogical approach that aims to engage students in the process of scientific argumentation (Rudd, Greenbowe, & Hand, 2001). Unfortunately, past studies fail to address what students gain by doing a SWH specific pre-lab. As a consequence, this

project aims to fill the gap in the literature and investigate how students believe pre-labs prepare them for a lab in SWH lab format. This study examined students' perceived gains from their pre-lab assignments, and how they used these gains throughout the course of lab. Specifically: 1) How do students utilize SWH formatted pre-labs to prepare for their laboratory experiments? and 2) How does the quality of these pre-labs affect student preparation over the course of the semester? Pre-lab assignments were collected and analyzed at three points in the semester. Pre-labs were analyzed for quality of beginning questions, procedure, and background information. Additionally, post-lab interviews were conducted at the beginning and end of the semester. Results from the pre-lab analysis will be presented.

33. ULTRAVIOLET PHOTOCHEMICAL RELEASE OF DISSOLVED SUBSTANCES FROM CRUMB RUBBER (ARTIFICIAL TURF SUBSTRATE)

Christian Burford & John Helms
Morningside College

Usage of artificial turf has been on the rise. These alternative playing surfaces are cheaper to maintain, easier to replace, and usable in a wider variety of weather conditions than their grass counterparts. Crumb rubber is typically used as a cushioning substrate atop modern artificial turfs. However, recent studies have suggested that ingestion of crumb rubber by athletes may have long-term health effects, such as cancer. Little information exists regarding the long-term environmental impacts of using crumb rubber for outdoor applications. The present study used simulated sunlight to investigate whether exposure to UV radiation causes dissolution of potentially toxic metals and/or organic compounds such as PAHs from the solid crumb rubber. Preliminary experiments indicate that UV exposure causes an enhancement of the release of dissolved phase chromophoric (colored) matter under both neutral and weakly acidic conditions. The results of this study significantly improve our understanding of the substances released into the environment by the outdoor use of crumb rubber substrate as well as the physical and chemical mechanisms by which that release occurs.

34. EXPLORING THE USE OF PALLADIUM ON CARBON AS A CATALYST FOR THE SUZUKI REACTION

Jason Davidson & Mark Sinton
University of Dubuque

The Suzuki reaction, a widely used method for synthesizing biphenyl compounds, traditionally involves the use of a tetrakis (triphenylphosphine)palladium(0) catalyst ($\text{Pd}(\text{PPh}_3)_4$) and toxic solvents such as benzene. Work by Satterlee and Davidson (Satterlee, 2012, Davidson, et. al., 2016) to make the reaction more green showed that benzene could be replaced with dimethyl carbonate, and that palladium (II) acetate ($\text{Pd}(\text{OAc})_2$) can be substituted for $\text{Pd}(\text{PPh}_3)_4$. Continuing this work, we show that 10% Pd on carbon can be substituted for $\text{Pd}(\text{OAc})_2$, and that the reaction can be run in an absolute ethanol solvent.

35. METHOD DEVELOPMENT FOR ANALYZING VIBRATIONAL MODES OF UNATTACHED VIOLIN

PLATES

Madison Flesch, Jack Rollison & Dr. Curtiss Hanson
University of Northern Iowa

It is generally accepted that every violin has different tone quality and color. The best violins are made by experienced luthiers that craft each with precision to produce the best possible tonal quality. The quality of the finished violin is dependent upon both the specific shape and the quality of the wood used in the construction. Because the hard wood used in violin construction is inhomogeneous, the composition and structure of material used is critical to the final product. The vibrational characteristics of the violin components are unique and therefore optimized for each individual violin. Although measuring how the material affects the resonance changes of the unattached front and back plates has been done for many years, the results have been difficult to quantify. Using an accelerometer attached to a free plate, we have developed a two-dimensional method of analyzing how these vibrational modes of the plates change on the surface of the plate. The vibrational movements of the components are recorded and the relative amplitudes and frequencies mapped. Using this method, the effects of chemical treatment on unattached violin plates can directly measure the changes in the tone quality and vibrational modes in comparison to the untreated plates. The results from the test runs done using the method described above will be discussed.

36. METHOD DEVELOPMENT FOR ANALYZING VIBRATIONAL MODES OF VIOLINS THROUGHOUT CONSTRUCTION PROCESS

Jack Rollison, Madison Flesch & Curtiss Hanson
University of Northern Iowa

Since the mid-17th century luthiers have been crafting and evaluating the quality of violins. In order to evaluate the quality of a violin luthiers often tap on the wood and use their hearing and sense of touch to feel vibrations. That evaluation is based solely on the luthier and their experience level. Attempts to find a quantitative way to evaluate violins have been conducted by Carleen Hutchins. Typically, these evaluations are performed using hologram interferometry, unfortunately this method is rather expensive. An accurate and low cost quantitative method to analyze violins using vibrations would be invaluable. Two dimensional vibrational analysis is a viable method to achieve these goals. By covering the frequency range from 70 Hz to 5070 Hz, the violin can be analyzed using a low cost accelerometer to identify which frequencies the wood resonates and has the highest amplitude with. At each resonant frequency the harmonics can also be analyzed. Due to the nature of the methods employed, the vibrational characteristics of the violin can be studied during every step of construction. The results from tests run using the methods described above will be discussed.

37. ANALYSIS OF SOLVENT STORAGE PROPERTIES OF POLYUREA-SHELL MICROCAPSULES CONTAINING A FREE-RADICAL INITIATOR CORE

Tyler Halligan & Brian McFarland
Morningside College

In this study, polyurea-shell microcapsules were synthesized with an initiator core consisting of a free-radical initiator, and their leakage/storage properties within different storage media were analyzed. The initiator chosen for this study was cumene hydroperoxide (CHP). The leakage properties were analyzed by storing the capsules in various solvents of differing polarity, and periodically testing the solvent media using gas chromatography to analyze the percentage of leaked initiator present. Our hypothesis is that if the capsules are stored in more polar media, then they will exhibit a higher degree of core leakage because of increased permeability to the storage media. Results have indicated that a larger percentage of the core initiator leaks from the microcapsules within the first several days of storage when stored in polar solvents, supporting our hypothesis.

38. FRONTAL POLYMERIZATION OF ACRYLATE MONOMERS

Jared Jochum, Chad Bertagni & Brian McFarland
Morningside College

This research investigates the use of various free-radical initiator/monomer systems, and the effects that microencapsulation of the initiator can have on these systems. By encapsulating a free-radical initiator, one can effectively isolate it in a shell apart from a surrounding monomer medium, and increase the storage lives of pre-mixed monomer/initiator systems. The monomers and initiators each had varying polarities, which were hypothesized to have effects on the microcapsule stabilities and in turn other observed properties. In this proposed research we examined several factors: stability/quality of the microcapsules (through infrared spectroscopy and gas chromatography), reactivities (through videotaping of the reactions and subsequent measurement of the frontal velocities), and properties of the polymers produced (through thermal imaging and mechanical testing). It was discovered that many factors affect the reactivity of these systems and the physical properties of the polymers produced--the factors include initiator type, initiator concentration, monomer type, and whether the initiator is encapsulated or dissolved. Several trends were observed when these factors were studied.

39. pH DEPENDENCY OF TYROSINASE

Luke Meadows & Mark Sinton
University of Dubuque

The enzyme tyrosinase catalyzes the conversion of several steps in both the dopamine and melanin synthetic pathways, and is found in almost all plants, animals, and bacteria. Previous work in our lab has shown that potato tyrosinase has an unexpected activity at high temperature (80°C) that the mushroom version of the enzyme does not exhibit. We have extended this work by observing potato and mushroom tyrosinase activity and kinetics across a range of pH values. These data show that each enzyme has a wide pH range at which significant activity is seen, but that optimal activity is seen at different pH values (pH 7-8 for potato tyrosinase, and pH 9-10 for mushroom tyrosinase). This suggests that each enzyme has a slightly different catalytic mechanism. In addition, the optimal pH values suggest that either cysteine,

tyrosine, lysine, and/or arginine are likely critical residues at each enzyme's active site.

40. GMO OR NON-GMO?

Katrina Pagel & Ken Turner
University of Dubuque

This research takes an introductory look at two important questions for the consumer: 1) Can we recognize GMO foods? And, 2) Is there a difference in the amino acid make-up between GMO and Non-GMO foods? To answer the first question, researchers chose one of many "GMO" genes commonly associated with crops, the "Round-up Ready" gene. Samples of Organic vs. Conventional corn leaves were chosen and samples underwent Polymerase Chain Reaction, PCR, prior to DNA testing. Results were inconclusive. To answer the second question, leaf samples from Organic vs. Conventional corn were extracted and analyzed for amino acids. This procedure was further modified to convert the free amino acids into dinitro-phenyl (DNP) derivatives by means of 2,4- dinitrofluorobenzene. After several iterations of process development, results illustrated key differences in the make-up of the Organic vs. Conventional corn.

41. GC/QQQ LIMITS OF DETECTION FOR BIOMOLECULES IN ABIOTIC AEROSOLS^{ISGC}

Madeline C. Roach, Tate M. Christensen & Joshua A. Sebree
University of Northern Iowa

Many laboratory experiments have been carried out to attempt to recreate the atmospheric chemistry of both Titan and the early Earth. Attempts to create biological compounds from prebiological atmospheres have been carried out since these atmospheres were more reducing than that of Earth. However, several obstacles occur including: working with and characterizing lab-generated aerosols, the formation of a large number of species, and the limited sample amounts. We have worked to develop a new method for aerosol analysis. By derivatizing the aerosols with MTBSTFA, we are able to take advantage of the chemical nature of many prebiotic molecules. Since MTBSTFA only targets acidic hydrogens, we can selectively solvate only the derivatized compounds. These compounds are then injected into a GC-MS/MS triple-quad operating in trapping mode on the first quadrupole to detect the derivatized compounds. The combination of derivitization and triple-quad analysis has allowed for the development of a method that is both extremely sensitive and selective for prebiotic molecules. Using this method, called Multiple Reaction Monitoring (MRM), we could detect as little as 40 femptomoles of derivatized compounds. With this method, we are able to identify several compounds found in plasma generated aerosols, photochemically generated aerosols, and some compounds found in both.

Chemistry Oral Presentations

112. THE FORMATION OF A LIPOSOME-DRUG DELIVERY SYSTEM

Addy First & Joseph G Nguyen

Mount Mercy University

The use of liposomes to assist in drug delivery has already had an impact in biomedicine and has been shown to help stabilize various drugs and overcome issues with cellular and tissue uptake. Thus, liposomes are an attractive drug delivery system due to their flexible properties that allow for easy modifications to address a vast variety of different delivery considerations. The presentation will discuss the efforts made towards making a novel liposome-drug delivery system, which could eventually be utilized as an anti-cancer therapeutic drug.

113. SURFACE ADSORPTION OF HUMIC ACID ON TiO₂ NANOPARTICLES AND ITS IMPACT ON THE BIOAVAILABILITY OF TiO₂ NANOPARTICLES

Sanjaya Jayalath¹, Vicki H. Grassian² & Sarah C. Larsen¹

¹University of Iowa & ²University of California San Diego

TiO₂ nanoparticles have diverse industrial applications including paints, cosmetics and water purification. Potential release of TiO₂ nanoparticles to the environment raises concerns due to their ability to interact with different ecosystems and organisms. This study focuses on the interaction of TiO₂ nanoparticles of two different sizes with natural organic matter, such as humic acid, present in the environment. These interactions depend on properties of nanoparticles as well as environmental factors such as pH and ionic strength. In this study, the pH dependent adsorption of humic acid on TiO₂ nanoparticles is studied using attenuated total reflectance Fourier transformation infrared spectroscopy. Furthermore, the impact of humic acid adsorption on nanoparticle aggregation is studied. According to these results, the humic acid adsorption varies with the pH and the nanoparticle size. The adsorption is higher at lower pH (3.7) compared to higher pH (6.0 and 8.0). Also the adsorption is higher on 5 nm nanoparticles than on 22 nm nanoparticles. The adsorption is mainly attributed to carboxylic functional groups of humic acid. Adsorption of humic acid decreases aggregate sizes of TiO₂ nanoparticles and increases surface charge of the nanoparticles depending on the pH, potentially increasing the bioavailability of TiO₂ nanoparticles in the environment.

114. DESIGN OF THE TIME-OF-FLIGHT MASS SPECTROMETER USING CHEMICALLY DEVELOPED SEMI-CONDUCTIVE ELECTRODE AS A MULTI-POTENTIAL ION GUIDE

Dmytro Kravchuk, Curtiss Hanson, Madison Flesch & Jonathan Nederhoff

University of Northern Iowa

Over the decades, the field of analytical chemistry has been progressing toward design of precise instrumentation, namely mass spectrometers, that provide high sensitivity for identification of unknown molecules. In most mass spectrometers, such high sensitivity, along with high resolution of spectra is achieved through incorporated mechanically-shaped metallic electrodes, that generate electric fields used for chemical analysis. The focus of this research is the construction of a reflectron time-of-flight mass spectrometer system (re-TOFMS) that uses a chemically developed semi-conductive electrode as a variable or multi-potential ion guide

(MPIG), instead of a traditional mechanical electrode. Semi-conductive electrodes consist of a non-conductive monofilament coated with a resistive polymer mixture. The ability to generate multiple potentials across such electrodes is achieved through variation of either thickness of paint application or composition of the resistive polymer mixture. Due to chemical nature of the electrode, it has a capability to generate complex electric fields making it suitable to serve as an ion trap region or a reflectron region in the TOFMS system. Moreover, chemically developed electrodes lead to a great reduction in cost compared to the mechanical model, as well as a potential for development of a microscale handheld analyzers with extreme sensitivity.

115. MECHANICAL PROPERTIES OF INDIVIDUAL SUBSTRATE-DEPOSITED SEA SPRAY AEROSOL PARTICLES

Kamal Ray & Alexei Tivanski

University of Iowa

The study of the aerosol particles' size, morphology, phase and composition is important to understand the effect of the aerosol particles on climate. In the presence of water, aerosol particles change morphology, height to diameter ratio i.e. aspect ratio (AR), and mechanical properties. However, the variation of AR and mechanical properties of different aerosol particles in controlled humidity morphology have not been reported yet for submicrometer sized (500 nm to 1000 nm) aerosol particles. In the current study, at 20% relative humidity (RH) morphology, AR and mechanical measurements were made for substrate deposited sea spray aerosol (SSA) particles by using atomic force microscopy (AFM) to distinguish them from other atmospheric particles. For this study, eight atmospheric relevant SSA inorganic (NaCl and MgSO₄) and organic (lipopolysaccharides, glucose, azelaic acid, glutaric acid, palmitic acid, and malonic acid) systems were chosen as model compounds that significantly contribute to the generation of SSA particles. Also, six inorganic-organic binary chemical systems (NaCl-malonic acid, NaCl-glucose, magnesium sulphate-glucose) were studied in 1:3 and 3:1 molar ratios to understand much more complex systems. AFM 3D images and force spectroscopy were utilized to establish a correlation between morphology, AR and mechanical properties of SSA particles of single and binary model compounds.

Ecology & Conservation Poster Presentations

42. MONITORING THE TROPHIC STATE OF VOLGA LAKE

Brian Andera

Upper Iowa University

Volga Lake, in Fayette County, IA, is on the impaired list due to phosphorus overload, which triggers massive algae blooms in the summer. Carlson's trophic state index (TSI) uses total

phosphorus levels, chlorophyll a levels, or Secchi disc readings to determine trophic state. TSI values calculated from total phosphorus, chlorophyll a and Secchi disc data collected in 2015 all indicate that the lake is approaching a hypereutrophic state. The purpose of this study was to collect Secchi disc data in 2016 to continue to monitor the trophic state of Volga Lake. Secchi disc readings were collected from each of the three arms of the lake, as well as at the deepest part of the lake which is near the dam. This poster presents the TSI computed from data from the dam site and provides a comparison to data from 2015. Average TSI was higher in 2016 and the TSI exceeded the minimum for classification as hypereutrophic over three months, as opposed to only two months in 2015. If this trajectory continues, Volga Lake is likely to become prone to fish kills due to depleted dissolved oxygen levels.

43. PREDICTING LIFE STAGES FROM MEASUREMENTS OF GROWTH IN ORNATE BOX TURTLES

Meleah Baloch¹, Robert Todd¹, Neil Bernstein¹, Andrew McCollum² & Tyker Skorczewski²

¹Mount Mercy University & ²Cornell College

One of two large reproductive populations of the Iowa state-threatened ornate box turtle (*Terrapene ornata ornata*) exists in the Hawkeye Wildlife Area (HWA) of Johnson County. Using data collected in the field we use nonlinear regression to model the relationship between carapace length and the annuli count. Not only is the model confirmed by various tests of fitness, but it has a strong correlation with previously identified properties of the turtles' life cycle. Using this model we are able to roughly identify annuli counts with maturation of turtles from hatchling to adult, and, therefore, predict life stages from measurements within the data. Three inflection points are described as indicative or growth stages that correspond with phases of logistic growth.

44. BAT FATALITY AND ACTIVITY AT A SINGLE-TURBINE WIND FACILITY IN NORTHEASTERN IOWA

Lillian Brondyke¹, Jane Busch², Nathaniel Hemming¹, Cassandra Peterson¹, Dawn Reding¹

¹Luther College & ²Northeast Iowa Montessori School

Accumulating evidence indicates that bats are particularly susceptible to wind turbine associated fatalities. Many studies have recently examined bat collisions at wind facilities, and some patterns are emerging. However, virtually all of the studies have been conducted at large-scale wind farms. It is unclear whether the patterns observed will also apply to single-turbine sites. Our goal was to investigate bat activity and fatality at the Luther College wind turbine, Decorah, Iowa. We conducted daily carcass searches and nightly acoustic monitoring from 15 April – 15 October 2016. We found a total of 52 bat carcasses representing 6 species (Little Brown, Silver-haired, Eastern Red, Big Brown, Tricolored, and Hoary). In contrast to most previous studies, we found the resident cave-dwelling species represented a higher proportion (57%) of the total fatalities. The Little Brown bat was the most common species recovered as well as acoustically identified. Total number of bat calls approached or exceeded 1000 per night in late July. The relatively high activity and fatality level may be

attributed to a general attractiveness of single turbines or to the specific location of this wind turbine. To tease these apart, future efforts should focus on examining patterns at other single-turbine sites.

45. EFFECT OF RYE COVER CROP ON SOIL BULK DENSITY AND WATER STABLE AGGREGATES ON A FAYETTE SILT LOAM

Samuel Franzen & Jennifer Stoffel

Upper Iowa University

Cover crops seeded just prior or at harvest promote soil health while reducing runoff, erosion, and nutrient leaching. The objective of this study was to examine effects of a rye cover crop on soil bulk density (DBD) and percent of water stable aggregates (%WSA) on a farm in Elgin, Iowa. Due to treatment duration, it was hypothesized that there would be no significant difference between treatments. Field samples were collected from no-till fields on Fayette Silt Loam soils which had recently been in a corn-corn-soybean crop rotation. Cover crops were seeded for the past three years including the fall of this study. The control field was left fallow after harvest. Replication at the subplot level. Seeding density, germination rates, DBD and %WSA were measured in the field with cover crops. The mean DBD for the cover crop treatment area was 1.2 g/cm³ and 1.3 g/cm³ for the control (P-value=0.006). The mean %WSA for the cover crop was 58.1% while the control was 61.9%; however, these data were not significantly different (P-value=0.527), as hypothesized. Differences in DBD could be attributed to historical differences between the two fields, such as differing crop rotations, manure application, or the onset of crop production.

46. EFFECT OF SURFACE FIRE ON SPECIES COMPOSITION AND MICROCLIMATES IN CENTRAL IOWA FOREST

Sufyan Hamouda & Thomas Rosburg

Drake University

Habitat loss, alteration and disturbance over the last 200 years has greatly diminished the occurrence of natural woodland and forest fires in Iowa and the Midwest. Ecosystem structure and species composition of woodlands have changed from the pre-settlement landscape. This study aims to investigate the effect of prescribed burns in restoration of woodland and forest ecosystems. Three sites in central Iowa were studied to compare paired burned and control plots. Burns took place between 15 March and 30 April 2016, while field data was collected from June through September 2016. Variables compared include 40 variables for species abundance, 8 variables for structure and vegetation quality, and 2 variables for light levels. Microclimate data (temperature, wind, light, relative humidity) were collected on three dates over 3-day periods. Most herbaceous species were not affected by the burn; 2 forbs decreased on the burn plots relative to the control. More significant changes were seen in the removal of woody vegetation under 2 meters tall. Light levels in the shrub layer were higher on the burn plot compared to the control. Ordination of the plots shows a very similar shift in species composition due to the burn at two of three sites.

47. MICROPTERUS DOLOMIEU HEALTH IN THE PRESENCE OF ORCONECTES RUSTICUS IN NORTHERN WISCONSIN LAKES

Matt Meulemans & Jeffrey Butikofer

Upper Iowa University

Smallmouth bass, *Micropterus dolomieu*, have value in Wisconsin as both gamefish and biological control to prevent the overpopulation of species such as the *Lepomis* genus and rusty crayfish, *Orconectes rusticus*. Specifically, smallmouth bass are important because they can limit rusty crayfish densities to prevent destruction of aquatic vegetation in areas where rusty crayfish are not native. This study was conducted to determine how rusty crayfish affect the apparent health of smallmouth bass in five lakes compared to that of bass in six lakes without rusty crayfish. Length and weight of smallmouth bass were measured and fish were aged using dorsal spines. Analysis of the collected data using condition factors indicated that smallmouth bass benefit in the presence of invasive rusty crayfish in five Northern Wisconsin lakes. Smallmouth bass in lakes also occupied by rusty crayfish had a higher condition factor, potentially as a result of preying on crayfish.

48. TESTING BEHAVIOR RESPONSE TO ENRICHMENT IN CAPTIVE RAPTORS

Natasha Miskimen¹, Shawn Hawks² & Scott Figdore¹

¹Upper Iowa University & ²Iowa Raptor Project, Iowa Department of Recreational Services

The Iowa Raptor Project maintains captive birds of prey for educational purposes. Many are placed on public display as well as handled on the glove. An initial study was undertaken to observe how four husbandry enrichment items (a duck decoy, a toy mouse, an egg carton with treat and an acrylic mirror) might impact the well-being of captive birds housed at the center. Four adult birds were used in the study: an injured one-wing Red-tailed Hawk, an imprint adult Harris's Hawk, a Turkey Vulture, and a wing-injured Bald Eagle. Birds were observed with each enrichment object via remote video camera during three separate one-hour periods. Ratings based on the birds' responses (e.g. negative fear, positive interaction or indifference) to the enrichment object were assigned at 1-minute intervals during each observation period. Since the center was open to the public during the enrichment observations, periods of human distraction were also recorded. Of the four enrichment items, the acrylic mirror stimulated the most positive interaction, with all four birds displaying active engagement for over half of the combined three hours of observation. Additional results will be discussed, and where appropriate, related to each bird species' respective natural behaviors.

49. HABITAT SELECTION AND BEHAVIORS OF HATCHLING, JUVENILE, AND ADULT ORNATE BOX TURTLES IN IOWA

Nakola Nyambe¹, Neil Bernstein¹ & Andrew McCollum²

¹Mount Mercy University & ²Cornell University

One of two large reproductive populations of the Iowa state-threatened ornate box turtle (*Terrapene ornata ornata*) exists in

the Hawkeye Wildlife Area (HWA) of Johnson County. Declines in ornate box turtle populations in many states are significant due to habitat loss, nest predation, and human interactions. For populations to remain protected, proper micro- and macro- habitats must be sustained. Previous studies by our research group focused on habitat requirements of breeding adults. From 2011 - 2016, we monitored hatchlings, juveniles and adults through radio telemetry and quantified habitat usage of prairie, forest, agriculture fields, wetlands, and shrubs. We also quantified the solar coverage experienced by turtles because of their habitat choice and digging behaviors. All age classes were predominantly found in prairie or prairie-shrub habitat. In addition, for most of the year, turtles were shielded from direct solar radiation by either the habitat or their behavior, or both.

50. TREE SPECIES COMPOSITION OF OLD-GROWTH SUGAR MAPLE – BASSWOOD FORESTS IN NORTHEASTERN IOWA^{βββ}

James Ostlie & Elizabeth Lynch

Luther College

This study was undertaken to determine the species composition and structure of old-growth, two sugar maple-dominated forest remnants in Winneshiek County, Iowa. Unlike most mature sugar maple forests in the county, these stands are on relatively flat sites with thick silt loam soils. We measured the density and dominance of all trees >1.37 m tall in 20 150-m² plots. Plot locations were selected to sample across three topographic positions: sloping upland on Fayette/Dubuque silt loam, flat mid-slope on Fayette silt loam, and flat lowland on alluvial soil. The largest trees in these stands exceed 75 cm dbh, suggesting these stands originated prior to European settlement on sites that were protected from fires. In all three areas, sugar maples had the highest dominance and density followed by American basswood and eastern hophornbeam. Sugar maple density was highest in the mid-slope plots. The alluvial site had higher densities of bitternut hickory and basswood than the other sites. Sugar maples were well represented in all size classes, suggesting recruitment will continue as long as environmental conditions remain suitable.

51. DESIGN OF A MOLECULAR SEX IDENTIFICATION TEST FOR THREE BAT SPECIES

Cassandra Peterson & Dawn Reding
Luther College

Bats are ecologically important species that are experiencing threats from wind energy development. It is important know whether males and females are equally at risk for turbine-associated fatalities. Although researchers are often able to identify the sex of bats based on morphology, damage and decay of the carcasses can make this challenging. DNA-based tests provide an unbiased approach for identifying sex for even the most challenging carcasses. However, published tests currently work for only a few species. The goal of our research is to design a working molecular sex test for three important bat species: Big Brown, Little Brown, and Silver-haired. We used PCR to amplify an intron region of the zinc-finger-X (zfx) and zinc-finger-Y (zfy) gene on known males using general mammalian primers. We then used molecular

cloning techniques to isolate these fragments. For each species, we picked 10 clones to culture, isolate plasmid DNA, and sequence. These DNA sequences are being used to design internal, species-specific primers that will allow for a quick and easy method of separating zfx/zfy bands via gel electrophoresis. These primers will be tested on individuals of known sex to ensure accuracy of the test, which will provide a useful tool for studying bats.

52. EFFECTS OF INVASIVE SHRUBS ON BIODIVERSITY AND SEED BANK DYNAMICS IN SOUTHWESTERN WISCONSIN

Jaclyn Rittgers, Eric Huber, Sean Engel, Colton Schnetzer & Michaelleen Golay

Wartburg College

Invasive species negatively alter ecosystem health. These impacts have been studied via above ground vegetation, but researchers have seldom investigated how invasive species change soil seed banks. The present study aimed to further investigate how the invasive shrubs *Lonicera spp.* (honeysuckle) and *Rhamnus cathartica* (common buckthorn) impact temperate forest ecosystem's biodiversity by examining seed banks from a forest near La Crosse, Wisconsin. We collected samples from three plots within uninvaded, invaded, and managed treatment sites. An invaded treatment site was dominated by the invasive shrubs common buckthorn and/or honeysuckle. The uninvaded treatment site was relatively free of invasive shrubs (i.e. may be present in the site but not dominating the plots). Finally, the managed treatment site was previously invaded, but the shrubs were cut and treated with herbicide within the past decade. At each plot within the three treatments, we obtained seed bank cores, recorded environmental variables, and obtained samples for soil moisture test. Soil cores were spread on potting soil in germination trays and kept in a growth chamber. Differences in number of woody and herbaceous germinants between treatments indicate effectiveness of management techniques and severity of the shrubs' invasiveness.

53. A COMPARISON OF BREEDING FOREST BIRD SPECIES OF NORTH CEDAR/SNY MAGILL WILDLIFE MANAGEMENT AREA, 2007 AND 2016

Jacob Rogers & Paul Skrade

Upper Iowa University

Forest bird species in the eastern United States have been declining for several decades. This is largely attributed to increases in habitat loss, forest fragmentation, nest predation, and nest parasitism. The North Cedar/Sny Magill Wildlife Management Area in Clayton County, Iowa is an almost 1800 acre property of which >80% is forested. The woodland is a mixture of steep slopes and ridge tops with a cold water trout stream that flows through the property. A forest wildlife stewardship plan was developed in 2005 to increase wildlife habitat for a variety of wildlife species and protect any endangered species in the area while still allowing for recreation and improved water quality. To meet these needs, there were four main forest management applications: early successional, even age, uneven age, and viewshed. Bird

surveys were conducted in 2007 to determine the forest bird community prior to management activities and follow-up surveys to determine the effectiveness of the management were conducted during the breeding season of 2016. Over 60 species were recorded including 11 species considered of Greatest Conservation Need in the state of Iowa. However, several of the primary species the management was intended to conserve were not detected.

54. DOES MARKING WITH DAYGLO ECO AURORA PINK PIGMENT POWDER AFFECT THE DEVELOPMENT OR SURVIVAL OF MONARCH CATERPILLARS?

Nancy Shryock, Diane Debinski & Victoria Pocius

Iowa State University

In order to understand insect movement, it is common to externally mark insects with fluorescent powder to track their behavior. However, it is important to know whether marking is detrimental to insect health. This study was conducted to determine whether marking with fluorescent powder is safe for use in movement studies of monarch butterfly (*Danaus plexippus*) larvae. Larvae were exposed to DayGlo ECO Aurora Pink Pigment powder once during each instar to determine whether powder exposure affected their development and survival. One hundred 1st instars were divided evenly into a control and treatment group; the treatment group was dusted with fluorescent powder. Larvae were reared to adulthood on *Asclepius syriaca*; development and survival of each individual was monitored. Larval, pupal, and adult measurements were recorded for each individual. Adult butterflies were observed to determine whether they mated and laid viable eggs. We found no significant differences between treatment and control groups with respect to survival. Similarly, there were no significant differences in larval, pupal or adult measurements. Surviving adults mated successfully and laid viable eggs. In summary, DayGlo ECO Aurora Pink Pigment powder marking had no adverse effects on larval development or survival.

55. PEWI: A DYNAMIC LAND USE & ECOSYSTEM SERVICE TRADEOFFS ASSESSMENT TOOL

Robert Valek, Lisa Shulte Moore & John Tyndall

Iowa State University

PEWI, or People in Ecosystems/Watershed Integration, is a simple web-based learning tool to help people understand human-landscape interactions and ecosystem service tradeoffs. PEWI addresses our need to balance agricultural production with other environmental benefits, including clean water, abundant wildlife, and recreation. The learning tool also aims to generate discussion amongst users about site-appropriate land uses and alternative yields, including timber and woody biomass production from forest land use-types. While PEWI focuses on the US Corn Belt, its lessons can apply to agricultural regions globally. Here we will present the tool and answer questions related to its use in classrooms and with agricultural stakeholders. To play, access background info, or download learning exercises, visit our website: nrem.iastate.edu/pewi.

56. COMPARISON OF ACADIAN FLYCATCHER (*EMPIDONAX VIRESCENS*) BREEDING HABITAT AT TWO SITES IN NORTHEAST IOWA

Jacob VanLaningham & Paul Skrade

Upper Iowa University

The Acadian Flycatcher (*Empidonax virescens*) is a forest bird species of Greatest Conservation Need in Iowa. Although its breeding range covers much of the eastern half of North America, very little is known about the status of this species within our state. Across their breeding range they are found primarily in large tracts of mature forest, which are uncommon in Iowa. In the summer of 2016 we surveyed for Acadian Flycatchers on two public properties that are primarily mature forest: the Paint Creek Unit of Yellow River State Forest and Backbone State Park, and collected vegetation data at eight points (four at each) to compare habitat at these two sites. We divided each of our vegetation survey points into four sub-plots, each 23m in diameter, and identified the tree species, measuring their diameter at breast height. At our 19 bird survey points we detected 23 individuals. The most common tree species in Backbone State Park was ironwood (*Ostrya virginiana*) and eastern cottonwood (*Populus deltoides*) was the largest, whereas silver maple (*Acer saccharinum*) was the most abundant in Yellow River State Forest and black walnut (*Juglans nigra*) were on average the largest.

Ecology & Conservation Oral Presentations

116. EFFECT OF RHAMNUS CATHARTICA ON THE GROWTH RATE OF GALLUS GALLUS^{BBB}

Maeve McDonnell & Ray Faber

Saint Mary's University of Minnesota

Ruffed Grouse, *Bonasa umbellus*, a bird species native to the Midwestern United States, has recently experienced a significant population drop. A shrub plant, Common Buckthorn, *Rhamnus cathartica*, was imported to the Eastern United States and was quickly labelled as an invasive species and spread across the United States. Common Buckthorn spreads due to the laxative effect in the berries causing birds to disperse Common Buckthorn seeds shortly after consumption. Ruffed Grouse is speculated to feed on Common Buckthorn berries and it is hypothesized that the laxative effect causes Ruffed Grouse to have a slowed growth rate leading to a population drop. For this study, Common Buckthorn berries were incorporated into chick feed and fed to 20 chicks for two weeks while another group was fed a control. The growth rate of the control group was 6.789 grams per day and the growth rate of the dependent group was 7.506 grams per day. A two-sample t-test found a p-value of 0.054 which suggests that the growth rate of the chicks fed Common Buckthorn and the control was not significantly different. It is concluded that Common Buckthorn does not have a negative effect on the growth rate of Ruffed Grouse.

117. EXPLORATION OF SIMPLE AND COMPLEX CUTICULAR HYDROCARBONS OF THE WESTERN

THATCHING ANT (*FORMICA OBSCURIPES*)^{BBB}

Kayla Perri, Moni Berg-Binder & Jaime Mueller
Saint Mary's University of Minnesota

Chemical recognition is the primary method of communication among insects. Ants distinguish nestmates from [nonnestmates](#) by using their antennae to detect the hydrocarbons located on the lipid layer coating their cuticles. Cuticular hydrocarbons (CHCs) are long hydrocarbon chains ranging from 23 to 31 carbon atoms. The more complex CHCs have more branching, substituents and [functionality](#), [when](#) compared to the simpler ones. Among 78 different ant species, the more complex CHCs are produced by fewer species when compared to the simpler CHCs. The more complex CHCs are also produced by the ant species that normally produce the simpler ones. *Formica obscuripes* is a common, conspicuous ant with a range across much of North America. However, there is limited information about its CHC signature. The CHC signatures of three different ant colonies of *F. obscuripes* were explored using Gas Chromatography-Mass Spectrometry, with particular attention paid to the presence of simple and complex CHCs. Analyzing the CHCs of this ant species will allow for the exploration of the relationship between complex and simple CHCs, as well as contribute to the expanding field studying ant CHCs.

118. UNGLACIATED TERRITORY: EXPLORING THE LICHEN DIVERSITY OF WHITE PINE HOLLOW PRESERVE IN SEARCH OF A LOST IOWA LICHEN

Katie Thompson & Jim Colbert
Iowa State University

Our understanding of the lichen diversity of Iowa is anything but current and comprehensive, including that of White Pine Hollow Preserve in Dubuque County, Iowa. As a part of the "Driftless Area", White Pine Hollow is uncharacteristic of Iowa in regards to its vegetation and landscape features; perhaps most notable is the presence of algific talus slopes. Considering these differences, it is reasonable to hypothesize that the preserve may possess a high level of lichen diversity potentially including rare or unreported species for the state. A lichen diversity survey of White Pine Hollow is currently underway showing interesting results. Fifty-eight species have been identified including three unreported species for the state of Iowa and two only once previously reported. Furthermore, White Pine Hollow was one of the last places that the potentially extirpated lichen *Lobaria pulmonaria* was collected in Iowa in 1901. Currently, efforts are in place to propagate *L. pulmonaria* in a greenhouse setting to provide insight as to whether a reintroduction of this lost Iowa lichen may be feasible.

119. STOPOVER ECOLOGY OF THE LEAST SANDPIPER IN [IOWAISE](#)

Rachel A. Vanausdall & Stephen J. Dinsmore
Iowa State University

Understanding the stopover ecology of shorebirds in the midcontinent region is important for evaluating site importance and determining conservation strategies for shorebirds. During the fall of 2016, we estimated the residency time of a common

fall migrant, the Least Sandpiper (*Calidris minutilla*). We radio-tracked 37 individuals at Saylorville Reservoir in central Iowa and measured several morphological traits for each bird. We hypothesized that increasing body condition, an indicator of overall health, would negatively affect the length of stay of migrant Least Sandpipers. Using Program MARK, we built competing models to assess the influence of morphological traits and time of season on the daily probability that a Least Sandpiper would remain at the stopover location (i.e., daily survival rate). The best supported model suggested that daily survival was constant and did not include any seasonal pattern or covariate. The daily survival rate was 0.85 (SE = 0.02) and [the](#) mean residency time was 6.28 days (SE = 0.27 days). Our study provides some of the first information on how a common shorebird uses a stopover site in central Iowa. We hope this baseline information will eventually prove useful when evaluating site quality to benefit migratory shorebirds.

120. FINE SCALE TERRITORIAL CERULEAN WARBLER (*SETOPHAGA CERULEA*) HABITAT DATA IN IN YELLOW RIVER STATE FOREST, IOWA

Chase Grabau & Paul Skrade
Upper Iowa University

The Cerulean Warbler (*Setophaga cerulea*) is a species of conservation concern across its breeding range. However, the breeding population in northeast Iowa near the Mississippi River appears to be doing quite well. To gain a better understanding of this species' fine-scale habitat preferences [in 2016](#), we conducted ten minute avian point count surveys at 98 points in Yellow River State Forest. This area is managed for timber production as well as recreational use and wildlife habitat with portions of limited management tending to have larger deciduous trees. We documented 8 different territorial males and collected vegetative data at sites where [CERW](#) were [consistently present and absent since 2012](#). Maple (*Acer sp.*) were the most abundant both at sites where [CERW were present and absent, and there appears to be a positive relationship between CERW and](#) large walnut trees. Additional vegetative data collected in the spring of 2017 will also be included.

121. [SAVING THE PAST TO PROTECT OUR FUTURE: CONSERVATION OF THE CHAMBERED NAUTILUS](#)

Gregory Barord
Central Campus

Chambered nautilus, relatives of octopuses, have a lineage that extends back 500 million years in the oceans. However, 50 years of unregulated fisheries have decimated populations, some to extinction, to supply a world-wide demand for the ornamental nautilus shell. These declines were only anecdotal reports and never quantified with scientific data. Recently, a team set out to quantify these claims and determine the current state of nautilus populations across their range in the South Pacific. A combination of historical sampling methods, such as baited traps, and modern techniques, such as underwater video surveillance, were used to assess the potential impact of fisheries and compare fished versus non-fished populations. Altogether, the data showed that fished populations were significantly smaller than non-fished populations with fisheries

being the most likely reason for the difference. These data were included in a proposal to list nautiluses in Appendix II of the Convention on International Trade in Endangered Species and would require countries to provide data showing that their export of nautiluses did not affect wild populations. The success of the listing, though, depends on the continued collaboration between countries and organizations for long-term monitoring and the continued use of educational and awareness programs.

122. TOXICITY OF INSECTICIDES COMMONLY USED IN CORN AND SOYBEAN PRODUCTION ON MONARCH BUTTERFLY (*DANAUS PLEXIPPUS*) LARVAE

Niranjana Krishnan, Keith Bidne, Joel Coats & Steven Bradbury
Iowa State University

The monarch butterfly (*Danaus plexippus*) is renowned for its 3000-mile annual migration across North America. In recent [years its](#) population has declined significantly, thus conservation efforts in the Midwest are underway that focus on restoring milkweed plants, the sole food source of monarch larvae. Many milkweed plants established in Midwestern states likely will be in proximity to corn and soybean fields. Toxicity of insecticides used for pest management in these crop production systems on monarch larvae is largely unknown. There is a need to generate dose-response curves for representative insecticides to assess potential risks associated with pest management regimes and different milkweed habitats.

Larvae could be exposed to foliar insecticides via cuticle absorption as a result of spray drift. Also corn and soybean seeds are typically treated with neonicotinoids, which can leach into the soil and may be absorbed by milkweed plants from subsurface water. [Subsequently](#) larvae could be exposed through consumption of milkweed leaves. The toxicity results provide information for assessing potential risks of acute exposure to insecticides at increasing distance from their use sites. This information in turn will help inform options for placing new monarch breeding habitat in landscapes dominated by corn and soybean production.

123. COMMON MILKWEED (*ASCLEPIAS SYRIACA*) INVASION AND PERFORMANCE IN TALLGRASS PRAIRIE PLOTS OF VARYING [DIVERSITY](#)

Mark Myers, Griffin Geick, Corinne Myers, & Daniel Pimentel Fernandes de Souza
University of Northern Iowa

The monarch butterfly (*Danaus plexippus*) is a wide-spread, migratory insect currently under consideration for protection as a threatened species under the Endangered Species Act. A primary cause of recent monarch population declines has been the large-scale loss of their milkweed host plants (*Asclepias* sp.) from Midwestern agricultural fields. Efforts to restore monarch habitat and increase milkweed abundance on non-agricultural lands will require the development of management techniques to promote natural colonization by milkweeds and/or the planting milkweeds during restoration projects. We studied common milkweed (*Asclepias syriaca*) invasion and

performance in experimental plots comprised of 1, 5, or 32 tallgrass prairie species at the Cedar River Ecological Research Site in Black Hawk County, Iowa. We found that common milkweed was approximately 5 times more abundant in switchgrass monocultures than in 5- or 32-species mixes. In addition, milkweeds in switchgrass were taller, flowered earlier, and had greater leaf chlorophyll concentrations and lower rates of senescence than plants in 5- and 32-species mixes. Our findings suggest that even relatively low-diversity tallgrass prairie plantings are resistant to common milkweed invasion and that increasing milkweed abundance in managed prairie restorations may require the application of frequent disturbance and/or the inclusion of milkweeds in initial seed mixes.

124. CONSERVATION ASSESSMENTS OF TWO MUSCATINE COUNTY NATURAL AREAS

Wayne Schennum^{1,2}, John Pearson¹, Mark Leoschke¹, Dale Maxson² & Scott Moats²

¹Iowa Department of Natural Resources & ²The Nature Conservancy of Iowa

Muscatine and Louisa [Counti](#) es in southeast Iowa have several natural areas that formed in the sand deposits of Glacial Lake Calvin. Most remnants of native vegetation occur along the Cedar River. They contain sand prairies, open wetlands, and floodplain forests. Two natural areas are Pike Run WMA and Greiner Family Preserve. Pike Run is a 187-acre dune-and-swale ecosystem. A 76-acre unit contains sedge meadows and marshes in swales and old fields on dune crests. Over 102 native plants were found in its wetlands. Little disturbed, it was [graded A](#) . The 111-acre southerly parcel has dune-and-swale topography covered by sand prairies, open wetlands, and floodplain forests. The prairies and wetlands have 123 native plants and were graded high quality. The endangered Pale green orchid and special concern Northern adder's tongue fern were observed. The 117-acre Greiner Family Preserve is owned by The Nature Conservancy. Its 8.3-acre ponded marsh-wet prairie has 38 native plants, including the Pale green orchid, threatened Meadow beauty, and special concern Tufted rush. Its 80-acre dry and wet sand prairies were farmed, and are being restored. The upland has 62 native plants and a large population of special concern Regal fritillaries.

125. REVISIONS TO THE FLORA OF IOWA

Thomas Rosburg
Drake University

The Vascular Plants of Iowa, an annotated checklist and natural history by Larry Eilers and Dean Roosa, has been the standard for botanical research in Iowa since its publication in 1994. Over 20 years have passed since it was published, and during that time many studies have revealed additional plant species that occur in Iowa. [In](#) some cases, these are native species that have been discovered since 1994. In many cases, these are species that are not native to Iowa and which may have been [overlooked, or more likely](#) have migrated to Iowa since 1994. Some of these newcomers are native to North America, others are not. In both of these examples, the change to Iowa's flora is an ecological one. A third category of revision to Iowa's flora is [due to](#) new taxonomic data, where a

new species is recognized on the basis of phylogenetic studies that usually involve genetic analyses. Taxonomic studies can represent either additions or deletions of species to the flora. This paper will provide an overview of the contribution my work over the last 30 years makes to this effort. This includes 13 ecological additions, 7 taxonomic additions, and 3 examples of taxonomic deletions.

126. UPDATING THE STATE LIST OF ENDANGERED, THREATENED, AND SPECIAL CONCERN PLANT SPECIES

John Pearson
Iowa Department of Natural Resources

Since its inception in 1978, the Iowa list of endangered, threatened, and special concern species has been updated several times to reflect evolving knowledge. Taxonomic revisions and field inventories since the previous listing for plants prompt an update in 2017. Consultation with experts has developed recommendations for grasses (Poaceae) via Lynn Clark (Iowa State University), sedges (*Carex*) by William Norris and Scott Zager (Iowa Carex Project), dewberries (*Rubus*) by Mark Widrlechner (USDA Agricultural Research Service), prickly-pear cacti (*Opuntia*) by Eric Ribbens (Western Illinois University), aquatic vascular plants by Gary Phillips (Iowa Lakes Community College) and Darcy Cashett (Iowa Department of Natural Resources), and lichens by Jim Colbert (Iowa State University):

- Poaceae: addition of three state records; delisting of *Andropogon virginicus* (discovery of many populations) and *Panicum gattingeri* (merged with *P. philadelphicum*)
- *Carex*: addition of five state records, delisting of *Carex aggregata* (discovery of many populations)
- *Rubus*: addition of 18 rare species by discovery of state records and by annotation of historical collections following modern taxonomic concepts
- *Opuntia*: pending re-examination of *O. macrorhiza* and *O. humifusa*
- Aquatic vascular plants: addition of eight rare species following statewide lake inventory
- Lichens: first-ever inclusion of this group, 28 species not observed since 1960

Engineering Poster Presentations

57. SCIENTIFIC COMPUTATIONS ON GPU ON THE WEB: A USE CASE OF DISTRIBUTED VOLUNTEER COMPUTING FOR HYDROLOGICAL APPLICATIONS

Muhammed Ali Sit, Yusuf Sermet, Ramil Agliamzanov & Ibrahim Demir
University of Iowa

Recent developments in web technologies and standards allow client-side scripting languages to run at speeds close to native application, and utilize the power of Graphics Processing Units (GPU). Using a client-side scripting language like JavaScript, we have developed an open distributed computing framework that makes it easy for researchers to write their own hydrologic

models, and run them on volunteer computers GPU's. Users will easily enable their websites for visitors to volunteer sharing their computer resources to contribute running advanced hydrological models and simulations. Using a webbased system allows users to start volunteering their computational resources within seconds without installing any software. The framework distributes the model simulation to thousands of nodes in small spatial and computational sizes. A relational database system is utilized for managing data connections and queue management for the distributed computing nodes. Although the usage of web workers demonstrated in this project, it is not necessary distribute the work in order to benefit from the WebGL wrapper for JavaScript. In this paper, we present a webbased distributed volunteer computing platform to enable large scale hydrological simulations and model runs in an open and integrated environment.

Engineering Oral Presentations

127. ORGANIC VS. NON-ORGANIC FOODS?

Dr. Barbara Ehlers
Upper Iowa University

Participants will be engaged in an interactive session from the Environmental Issues Instruction (Eii) professional development based on Food, Farming, and Climate Change. The experience is based on the issue of organic vs. non-organic foods. Discussion will be based on common beliefs, factual evidence and direct observation. What are the advantages and disadvantages of each? What are the differences? What drives the decisions made daily in the purchase of foods? Other lesson ideas from the Eii professional development will be shared.

128. CHARACTERIZING GELATIN HYDROGEL VISCOELASTICITY WITH DIFFUSING COLLOIDAL PROBE MICROSCOPY

Soheila Shabaniverki & Jaime Juarez
Iowa State University

In this study, we investigate viscoelasticity in gelatin hydrogels using diffusing colloidal probe microscopy (DCPM) to directly measure the elastic potential energy interaction between colloidal probes and the underlying viscoelastic media. Gelatin samples are prepared in four different concentrations between 0.3 wt% to 0.6 wt% to examine changes in viscoelasticity with concentration. A force balance describing the interaction between the colloidal probes and the hydrogel as a spring-damper system lead to a simple model for mean square displacement. A histogram of locations sampled by the colloidal probes is directly related to the elastic potential energy and the effective spring constant of the gelatin hydrogels. The effective spring constant is a fixed parameter used in the mean square displacement model to find effective viscosity. These parameters are comparable to viscoelastic

parameters obtain by a microrheology analysis of two-dimensional mean square displacements. These results can serve as a guide for assessing hydrogel systems where viscoelastic properties are an important factor in material design.

129. MSW MANAGEMENT IN THE US – A REVIEW

Yunye Shi & Miranda Noack

St. Ambrose University

Municipal solid waste (MSW) is one of the major threat to many cities all over the world. The paper compares various routes of MSW management from open dump and landfill to thermo-chemical conversion such as gasification for their technical advances and environmental impact. An attempt has been made to provide a comprehensive understanding of the characteristics, generation, transportation, and treatment technologies of MSW practiced in the United States.

Environmental Science & Health Poster Presentations

58. THE POTENTIAL EFFECTS OF GLYPHOSATE ON SOIL CO₂ LEVELS

Michelle Clinesmith & Melinda Coogan

Buena Vista University

Understanding soil health in relationship to microbial abundance is important to ecosystem sustainability, especially within agricultural regions. Microbial activity is one of the most important determiners of soil health, and glyphosates, the most heavily-applied agricultural herbicide, may have a negative effect on the activity of soil microbes. This research project compared the potential effects of glyphosates on microbial activity among soil samples taken from glyphosate-treated and non-glyphosate-treated farmland. Data collection included the use of a LI-COR LI-6400XT, which can be used to measure $\mu\text{mol CO}_2\text{mol}^{-1}$ levels in soils. Three CO₂ levels were measured at each site; one site which had not been treated with glyphosate and one which was routinely treated with glyphosate. Results showed an average of $429.5 \mu\text{mol CO}_2\text{mol}^{-1}$ for the non-treated sites and $477.4 \mu\text{mol CO}_2\text{mol}^{-1}$ for the treated sites. Excel Student t-test results reported a p value of 0.04 ($\alpha = 0.05$), indicating a statistically significant difference between the non-treated and treated soils. Although a significant difference resulted, this study found higher average CO₂ levels in the treated sites when compared to the non-treated sites. Larger sample sizes would need to be analyzed to support these findings.

59. LIFE CYCLE GREENHOUSE GASES AND POLLUTANTS EMISSIONS OF ELECTRIC VEHICLES RUNNING IN THE WORLD

Hongbo Du¹, Esther Armah¹ & Xinhua Shen²

¹Prairie View A&M University & ²University of Northern Iowa

To reduce the pollution of big cities, the leading governments in the world are encouraging companies to develop electric vehicles and use electric vehicles in cities. Limited research exists on life cycle emissions of electric vehicles, but no comprehensive data is available for major countries in the world. Our research examines the environmental impacts of using electric vehicles in major countries, such as USA, China, India, Japan, Australia, Brazil, Germany and South Africa. A life cycle assessment tool for Greenhouse Gases (GHGs), Regulated Emissions, and Energy Use in Transportation (GREET) model developed by Argonne National Laboratories is used to evaluate life cycle emissions of passenger cars powered with electricity. Emissions of VOCs, NO_x, SO_x, PM₁₀, PM_{2.5} and GHGs are evaluated from the life cycle of electricity including electricity generation, electricity distribution and car driven by electricity. The results show how the emissions vary in the different countries, and how the emission reductions of electric cars are compared to gasoline and diesel cars in the USA. Our research clarifies that the electricity distribution efficiency also plays an important role on the life cycle GHG and pollutant emissions of electrical vehicles.

60. EXPLORING THE ENVIRONMENTAL FATE OF TETRACYCLINE-LIKE ANTIBIOTICS USING FLUORESCENCE EXCITATION EMISSION MATRIX SPECTROSCOPY

Nicci McGuire & John Helms

Morningside College

Tetracyclines serve several purposes as livestock feed additives ranging from treatment of various diseases to the promotion of enhanced weight gain. The tetracyclines have been the most widely used antibiotics in the beef cattle industry. Antibiotics found in river water, soil and groundwater have caused concern for increasingly common antibiotic resistance in microorganisms and the adverse effects on ecological, livestock and human health. In natural waters such as surface waters and soil pore waters, the tetracyclines exhibit characteristic fluorescence with excitation wavelengths centered around 370 nm and emission maxima ranging from 500 nm to 540 nm. For the present study, we used a technique known as fluorescence excitation-emission matrix spectroscopy (EEM) to distinguish this fluorescence from normal background fluorescence due to soil derived dissolved organic matter (DOM). The technique reveals that both the excitation and emission maxima of tetracyclines are shifted to significantly longer wavelengths relative to that of DOM. This study will also present new observations relating to photochemical and microbial degradation processes for the tetracycline and oxytetracycline. This research provides insight into the extent of soil and water contamination by antibiotics and their fate in the environment.

61. KNOWLEDGE DISCOVERY, INTEGRATION AND COMMUNICATION FOR EXTREME WEATHER AND FLOOD RESILIENCE USING ARTIFICIAL INTELLIGENCE: FLOOD AI ALPHA

Yusuf Sermet & Ibrahim Demir

IIHR - Hydrosience and Engineering

Nobody is immune from extreme events or natural hazards. The National Research Council (NRC) report discusses the topic of how to increase resilience to extreme events through a vision of resilient nations in the year 2030. This abstracts presents our project on developing a resilience framework for flooding to improve societal preparedness with objectives; (a) develop a generalized ontology for extreme events with primary focus on flooding; (b) develop a knowledge engine with voice recognition, artificial intelligence, natural language processing, and inference engine. The knowledge engine will utilize the flood ontology to connect user input to relevant knowledge discovery outputs on flooding; (c) develop a data acquisition and processing framework from existing environmental observations, forecast models, and social networks. The system will utilize the framework, capabilities and user base of the Iowa Flood Information System (IFIS) to populate and test the system; (d) develop a communication framework to support user interaction and delivery of information to users. The interaction and delivery channels will include voice and text input via web-based system (e.g. IFIS), agent-based bots (e.g. Microsoft Skype, Facebook Messenger), smartphone and augmented reality applications (e.g. smart assistant), and automated web workflows (e.g. IFTTT, CloudWork) to open the knowledge discovery for flooding to thousands of community extensible web workflows.

62. EVIDENCE OF DDT RESUSPENSION THROUGH DREDGING OF A MIDWEST AGRICULTURAL LAKE SYSTEM

Derek Simonsen & Melinda Coogan

Buena Vista University

Although the organochlorine dichlorodiphenyltrichloroethane, DDT, was outlawed in select countries during the 1972 Stockholm Convention, DDT and daughter compounds can persist in the environment for approximately forty years. When sorbed to substrate, DDT does not pose a measurable threat, but once disturbed by anthropogenic activities such as dredging, resuspension and bioaccumulation in organisms may occur. This study investigated whether DDT compounds were present at detectable levels in Storm Lake by analyzing water column and planarian (*Dugesia tigrina*) samples. Storm Lake is a 3,097-acre glacial lake located in NW Iowa and has been dredged since the year 2000 to reduce turbidity levels. To determine DDT concentrations in water and *D. tigrina* samples, an Agilent 7890A/5975 GC/MS was utilized. Following GC/MS method development for DDT Mix, and the development of an external calibration curve, water and *D. tigrina* samples were processed and scanned within a m/z range of 50–500. Results indicated that DDT Mix levels in water samples were nondetectable, but detectable levels of DDT and DDD were found in *D. tigrina* samples at averages of 188.7 ppb DDT and 543.4 ppb DDD. These results support potential bioaccumulation of DDT and its daughter compound DDD in agricultural lake systems.

63. POTENTIAL METABOLIC DEGRADATION OF TRICLOSAN IN UTERO AND RESIDUAL EFFECTS ON LANGERHAN CELLS

Olivia Tuel, Derek Simonsen & Melinda Coogan

Buena Vista University

Triclosan is a common antimicrobial agent found in a wide variety of personal care products, but has recently undergone regulation by the U.S. Food and Drug Administration and will be removed from products by the end of 2017. Triclosan has been widely studied as an estrogen mimicking compound and has also been shown to photodegrade into 2,7/2,8 dibenzochloro-p-dioxin. This research hypothesized that triclosan may metabolically produce 2,7/2,8 dibenzochloro-p-dioxin in mouse amniotic fluid after maternal ingestion due to a 2013 Buena Vista University research project that showed a unique tail hair follicle anomaly among dosed pups. This 2013 project hypothesized the tail anomaly may be related to 2,7/2,8 dibenzochloro-p-dioxin production because of a 1989 article written by Phuvel showing dioxin effects on Langerhan cells. Pregnant mice were dosed with 1 ppb triclosan solution from day 13 of pregnancy until euthanization at day 19. Amniotic fluid was then extracted and analyzed using an Agilent 7890A/5975 GC/MS. A range of m/z 50–500 was scanned to confirm the retention times of the analytes. Results indicated that 2,7/2,8 dibenzochloro-p-dioxin levels in amniotic fluid were non-detectable. Additional mouse samples will be further analyzed in order to increase sample sizes and potential detection.

64. PHYSIOLOGICAL EFFECTS OF PERFLUOROOCCTANE SULFONATE (PFOS) ON DANIO RERIO (ZEBRAFISH) EMBRYOS

Cortney Weaver¹, Garrett Reed² & Melinda Coogan¹

¹Buena Vista University & ²Iowa State University

Perfluorooctane Sulfonate (PFOS) is a stain and water substance that can be found in everyday items, such as carpets, clothing, fabrics for furniture, paper packaging for food, and many industrial processes. The EPA has found that PFOS, which are persistent, bioaccumulative, and toxic to mammals and wildlife, can be found at measurable levels in natural aquatic systems as well as drinking water sources. This research examined potential developmental effects on *Danio rerio* (zebrafish) by first placing four embryos in separate PFOS solutions of 0.00, 0.01, 0.05, 1.00, 3.00, or 5.00 ppm. Endpoint measurements included LC₅₀, survivability, yolk circumference, embryo circumference, and spine angle data. Statistical analyses comparing endpoint to control data reported a significant difference for survivability at 3.00 ppm and for spine angles at 0.01 ppm. Additionally, data collected resulted in an LC₅₀ level of 2.00 ppm. The EPA is still investigating effects of PFOS and has begun to establish health advisory levels based on similar research results.

Environmental Science & Health Oral Presentations

130. AIR QUALITY IMPACTS OF CO-FIRING BIOMASS IN A COAL-FIRED POWER PLANT

Ibrahim Al-Naiema & Elizabeth Stone
University of Iowa

Biomass is renewable fuel that holds significant potential for

electrical energy production. Biomass co-firing is the practice of adding biomass as a partial substitute for coal in a high efficiency boiler. It draws upon widely-available existing infrastructure and presents immediate opportunity for the production of low-cost renewable energy. The University of Iowa 2020 sustainability goals include increasing the use of renewable fuels. Our previous study demonstrated that co-firing 50% oat hulls (by weight) in a fluidized bed boiler significantly reduced the emission of particulate matter (PM) by 90%, polycyclic aromatic hydrocarbons (PAH) by 40%, metals by 65%, and fossil carbon dioxide by 40%. In this study, emissions from co-firing coal with miscanthus grass (7% by weight) in a flatbed boiler was evaluated and compared to the combustion of coal only. The study revealed that co-firing miscanthus grass with coal reduces fossil carbon dioxide emissions by 6% and significantly reduced the emission of PM by 40%. Toxic metals, including Pb, Ni, Co, Cu, and Cr were also reduced, while no significant change in PAHs emission was observed. This study demonstrates that co-firing miscanthus grass with coal provides several benefits to air quality.

131. CARBOHYDRATE TRANSFER TO SEA SPRAY AEROSOL

Elias Hasenecz & Elizabeth Stone
University of Iowa

The ocean, which covers over 70% of earth's surface, is a globally important source of atmospheric aerosols whose composition and properties are both climate relevant and under-examined. Surface active organic matter found in seawater is selectively transferred to and enriched in the ocean surface and sea spray aerosols (SSA) via bubble bursting. Among SSA enriched species are carbohydrates which originate from biological sources. Since SSA composition determines climate relevant properties, it is important to explore why carbohydrate transfer to SSA occurs. Therefore, SSA were produced with bubble generating devices to study how increasing the number of monomer units affects SSA transfer. Sub-surface, surface and SSA samples were analyzed for carbohydrates and ions via high performance ion exchange chromatography with pulsed amperometry and conductivity detection respectively. Enrichment factors were calculated for surface samples and non-size-resolved SSA relative to sub-surface seawater. No enrichment was observed for total suspended particles, which may be due to large mass contributions from large particles masking enrichment in smaller, less massive particles where greatest enrichment is expected. Current experiments explore polysaccharides, which are expected to be more enriched, and collect size-resolved SSA as organic species show greater enrichment in smaller particle sizes.

132. ANTHROPOGENIC AND BIOGENIC SOURCES OF FINE PARTICULATE ORGANIC AEROSOLS IN THE SOUTHEASTERN UNITED STATES

Anusha P. S. Hettiyadura, Elizabeth Stone & Thilina Jayarathne
University of Iowa

Atmospheric fine particulates with aerodynamic diameter $<2.5 \mu\text{m}$ ($\text{PM}_{2.5}$) adversely affect human health and alter the earth's radiative balance. The southeastern US experiences elevated levels of $\text{PM}_{2.5}$, particularly during summer, that is driven by high levels of sulfate and organic carbon. In this study, we estimate the biogenic and anthropogenic sources of $\text{PM}_{2.5}$ organic carbon at Centreville, AL, in southeastern US during the summer of 2013 using molecular tracer-based positive matrix factorization (PMF). PMF identified eight factors that contributed to $\text{PM}_{2.5}$ organic carbon. Two of these reflect primary emission sources: biomass burning (11%) and fossil fuel burning (8%). The six other factors reflect secondary organic aerosol (SOA) that forms in the atmosphere from reactions of volatile organic compounds (VOC). Each SOA factor had a distinguishing feature: photochemical reactions (9%), nighttime formation (21%), and biogenic VOC precursors reacted under low- NO_x conditions (13%), high- NO_x conditions (11%), atmospherically-aged (6%), and sulfate-influenced (21%). Overall, these results indicate that more than 50% of the OA in Centreville are related to anthropogenic activity, and thus are controllable.

133. MOLECULAR MARKERS FOR SOURCE IDENTIFICATION AND APPORTIONMENT OF AMBIENT PARTICULATE MATTER IN KATHMANDU, NEPAL

Md Robiul Islam, Thilina Jayarathne, Ashley Gilbert & Elizabeth A. Stone
University of Iowa

Airborne particulate matter (PM) adversely impacts human health through respiratory and cardiopulmonary diseases. Kathmandu, the capital of Nepal, is among the cities worldwide with the most severe PM pollution. Reduction of air pollution requires a quantitative understanding of its major sources. In this study, we use molecular markers to identify and quantify source contributions. PM samples were collected at Bode site in Kathmandu during April 11-24, 2015. The measured average concentration of $\text{PM}_{2.5}$ (with diameters $< 2.5 \mu\text{m}$) was $68 \mu\text{g}/\text{m}^3$, nearly 3 times the WHO 24 hour guideline of $25 \mu\text{g}/\text{m}^3$. $\text{PM}_{2.5}$ was comprised in part by water-soluble ions, including sulfate (16%), ammonium (9%), nitrate (4%), indicating secondary inorganic aerosol contribution, as well as calcium (1.2%) and magnesium (0.1%), reflecting airborne soil dust. Major fractions of $\text{PM}_{2.5}$ were organic carbon (27%) and elemental carbon (13%). To gain insight to sources of organic carbon, gas chromatography coupled to mass spectrometry was used to quantify molecular markers, including levoglucosan, hopanes, and 1,3,5-triphenylbenzene. 1,3,5-triphenylbenzene is used for the first time as molecular marker to estimate garbage burning contribution to $\text{PM}_{2.5}$ in Nepal as 22% on average. Chemical mass balance source apportionment modeling will be used to apportion source contributions to organic carbon.

134. MANMADE ANTARCTIC SEAWATER GLACIERS TO CONTROL GLOBAL SEA LEVEL RISE

Kurt Kleinschnitz
Maharishi University of Management

A global solution to the problem of sea level rise could be more effective, easier, faster, and far less expensive than a patchwork of national and regional initiatives. Seawater could be sequestered in immense manmade seawater glaciers on the land mass of the West Antarctic (14 million sq km). Calculations suggest wind resources there can power the project using wind generators, and roughly 1 million 2.5 mW generators would be required at full-scale implementation. The power requirements are almost entirely for lifting seawater, with relatively minor amounts for human comfort and equipment. Antarctica is sufficiently cold to freeze and maintain the seawater quantities required, especially if sufficient height of the manmade glaciers can be achieved. To drop global sea levels by one meter requires sequestration of roughly 360,000 cubic km of seawater. If a one km height could be achieved, sequestration for 1 meter of sea level rise requires just 3% of the Antarctic land mass. Thus space is ample. Pumping rates could match the rate of rise, currently 3.2 mm/yr, or 1,150 cu km/yr. By comparison the Mississippi River discharges 400 cu km per year.

135. BIOMASS ECOMASONRY: NOVEL GREEN TECHNOLOGY TO CUT GLOBAL CO₂ EMISSIONS

Kurt Kleinschnitz
Maharishi University of Management

Greenhouse gas emissions CO₂ totaled 37.5 billion tons in 2015. Ecomasonry is a transformational technology that can annually sequester 3 billion tons, nearly 8% of global greenhouse gas emissions, in as little as 10 years. Ecomasonry blocks use biomass and a nontoxic cementitious binder. Ecomasonry blocks differ from most of today's construction blocks because they are simultaneously load-bearing AND insulating. At full-scale production, these blocks would be the least expensive construction material. A number of biomass materials have been investigated. Five Iowa homes were been completed using blocks manufactured in Iowa. The thermal performance of one home was followed for three years with these results: energy savings 46%; utilities expenses reduced 55%; greenhouse gas emissions reduced 67%. Local production of biomass for ecomasonry is suited to nearly every region of the world. The binder employed was a natural mined magnesium cement, not cooked. Worldwide reserves are immense and reported on every continent. Ecomasonry blocks were found suitable for the US building codes--placed in the same category as AAC block. Ecomasonry block homes provide a high quality of life environment: security, safety, and silence. They're bullet-proof. Failure mode analysis suggests an extraordinary useful lifespan, double that of frame construction.

136. *ESCHERICHIA COLI* DETECTION AT BACKBONE

LAKE

Nicole Meyer & Rebecca Schmidt
Upper Iowa University

Escherichia coli is monitored at the beach area at Backbone Lake, Backbone State Park. The DNR monitors thirty-nine lakes across the state of Iowa to inform the public of water safety, swimming advisories, and water borne pathogens such as *E. coli*. *E. coli* is a gram negative bacteria used as an indicator of water contamination and to measure potential fecal contamination. Backbone is classified as vulnerable from testing positive for water borne pathogens at the public beach location. Given additional potential sources of bacterial contamination from human use and environmental influx, water sampling was done in seven locations within the lake to test if *E. coli* were found outside the beach location. A dichotomous key was followed to determine if cultures grown from water samples taken were positive for the bacteria. EMB differential agars grew only gram negative bacteria, and high-lactose-fermenting cultures were spread into citrate tubes to identify citrate negative *E. coli*. The sampling results from the cultures tested showed that *E. coli* colonies were found throughout the lake. Potential confounding factors include protocol differences between the Department of Natural Resources and the tests described here, and the fact that there was flooding the week before water samples were collected.

137. EVALUATING GENE EXPRESSION IN HUMAN LIVER CELLS FOLLOWING METOLACHLOR EXPOSURE

Navinder Brar, David McClenahan & Kavita R. Dhanwada.
University of Northern Iowa

Metolachlor, a commonly used pre-emergent pesticide, is a frequent contaminant of ground and surface waters. It inhibits protein and chlorophyll synthesis in plant cells, but its effect on mammalian cells is not clear. Previous work from our lab studying the non-target effects of metolachlor demonstrated low-level metolachlor exposure inhibits growth in human cell types such as fibroblasts, HepG2 liver cells and THP-1 alveolar macrophages, and alters expression of several proteins involved in cell cycle control. But it is not well understood what other cellular processes are altered by exposure to metolachlor.

In our study, DNA microarray analysis was used to screen for altered gene expression after increasing concentrations of metolachlor exposure in HepG2 cells to determine a possible cellular mechanism of action. After preliminary analysis, we expect to find differences in the expression of a family of genes involved in cell growth and cell cycle control as we have previously found differences looking at individual proteins in these processes between control and treated cells. We will generate heat maps of clustered genes, and pathway analysis will be performed to determine affected pathways. This type of analysis has been demonstrated previously with other pesticides including atrazine and other chloroacetanilide family members.

138. NOVEL METHOD FOR QUANTIFICATION OF ODOROUS VOLATILE ORGANIC COMPOUNDS IN THE AIR WITH SOLID PHASE MICROEXTRACTION AND GAS CHROMATOGRAPHY-MASS SPECTROMETRY

Madina Tursumbayeva, Jacek Koziel & Devin Maurer
Iowa State University

Finding rugged and farm-proven sampling methods for odor measurement and mitigation of emissions continues to be a challenge. The objective was to develop a new method to quantify odorous volatile organic compounds (VOCs) in air. The main goal was to transform a fragile lab-based technology into a sampler that can be deployed for longer periods of time in remote locations. The developed method uses improved solid-phase microextraction (SPME) for combined on-site air sampling and sampling preparation. No power source is needed and the technique is solvent-less. SPME fiber is retracted into a protective glass liner, thus, extraction of odorants is not affected by elements. Gas chromatography coupled with mass spectrometry is used for sample analysis in the laboratory. Specific objectives were (1) build and verify standard gas generation system that simulates livestock barn emissions in laboratory, (2) use one model compound for method development and the proof of concept, and (3) test the new method in real environment. New method was evaluated under field conditions by comparing it to the standard method (sorbent tubes). This research shows that SPME fiber retracted into a glass liner is a low-cost, simple, yet accurate sampling technique for quantification of odorous VOCs.

Geology Poster Presentations

65. GEOCHEMICAL SIGNATURES OF QUATERNARY SEDIMENTS WITHIN THE MAQUOKETA QUADRANGLE (JACKSON, CO., IOWA)

Chad Heinzl & Clifton Foy
University of Northern Iowa

The Quaternary geology of the 7.5' Maquoketa Quadrangle was mapped by undergraduate scientists from the University of Northern Iowa (EDMAP - G15AC00209). The study area lies in a terrain of dissected Pre-Illinoian glacial deposits that blanket a Silurian bedrock surface with significant relief. The study area is characterized by two primary landform region types the Iowan Erosion Surface and East Central Iowa Drift Plain. The focus of this secondary deliverable is to characterize the geochemistry of the quadrangle's sediments and pedogenic developments. Primary sediment assemblages sampled include: Loess uplands, till plains, alluvial valleys and eolian sand ramps. A PANalytical MiniPal4 XRF was used to obtain chemical signatures (weight% & ppm). Preliminary results of the loess upland sediments indicate ranges of: Pb (13.4 to 26.3 ppm), Ni (20.7 to 36.8 ppm), Sr (136.2 to 183.8 ppm), and FeO (3.1 to 5.07%). These data are being used to delineate the complex interrelationships between natural and anthropogenic variables that may influence soil development, surficial to

groundwater flow, and contaminate transport through Iowa's East Central and Southern Drift Plain regions. These local mapping data may facilitate wise land-use planning decisions.

66. SURFICIAL GEOLOGY OF THE ORCHARD 7.5' QUADRANGLE, IOWA

Phil Kerr, Stephanie Tassier-Surine, Matthew Streeter,
Huaibao Liu & Ryan Clark
Iowa Geological Survey

The Iowa Erosion Surface (IES) has long been the most abstruse landform region in Iowa. The IES is dominated by pedisidement and loamy sediment. It is located to the east of the Des Moines Lobe (DML), the last glacier to advance into Iowa. Early workers proposed that the IES was a glacial deposit that advanced into the state sometime between the early Wisconsin and Illinoian stages (100 ka – 300 ka). Later researchers showed the age to be much younger- the Late Wisconsin stage before the Last Glacial Maximum. Recent work done by the IGS has deminstarted strong evidence for Middle Wisconsin aged glacial advance beyond the eastern extent of the Des Moines Lobe. This sediment is known as the Sheldon Creek Formation. The extent of the Sheldon Creek is not as obvious as the DML, since the sediment has undergone severe erosion and alteration due to the periglacial environment during the formation of the IES. Cores collected and described for this project have further extended the eastern edge of the Sheldon Creek Formation.

67. ARCHAEOMETRIC ANALYSIS OF GREEK AND PHOENICIAN CERAMICS FROM SELINUNTE, SICILY

Paige LaPlant & Chad Heinzl
University of Northern Iowa

Selinunte, an important archaeological site, is located on the south-western coast of Sicily about 25m above sea level. It was built over three hills (Marinella, Manuzza, and Gaggera) and is 1500m long by 1000m wide, with the Acropolis taking up 500m by 300m. The site rests on top of lower Pleistocene aged sedimentary rocks made mostly of sand and clay with calcarenite. The purpose of this study is to compare the chemistry of Greek and Phoenician pottery collected from Selinunte and to determine the provenance of the artifacts. In total, 30 samples were tested, 25 of which are approximately 6th century BC pottery pieces collected from Selinunte. The other 5 are sediment samples collected from the island of Lipari along the Cave di Caolino Trail. The pieces were crushed with a mortar and pestle and examined using XRF analysis with MiniPal 4. The highest concentrations from Lipari, tested both with and without oxides, were SiO₂ (18-71.3%), Al₂O₃ (6.9-23%), Fe₂O₃ (0.5-13.4%), and CaO (0.052-28.3%). The results from the Selinunte pieces are still to come. These findings will then be compared to other geological areas to determine the place of origin, as well as differences in Greek and Phoenician pottery styles.

68. HEAT TREATMENT AND ITS EFFECTS ON EASTERN IOWAN CHERT

Terra Perez & Chad Heinzl
University of Northern Iowa

Native Americans, e.g. Ioway and Illini, commonly used eastern Iowa's outcrops to obtain chert for tools and weapons. Chert is not as chemically pure and desired as flint, but through trial and error it was determined that heat treating chert increased its usefulness. This study investigated the effects of applied heat upon the Silurian Hopkinton and Blanding Fms. chert from Jackson County and lower Mississippian Maynes Creek Fm. chert of Butler, Grundy, and Mitchell Counties in Iowa. The collected chert samples were broken into approximately 12*12 cm pieces. Physical features of each sample were recorded, noting weight (grams), dimensions (cm), color (Munsell), and any other significant details (e.g. fossils). Once recorded, the samples were placed in crucibles and surrounded by silica sand. The heat was applied to each sample using two muffle furnaces, one set to 300°C and the other to 600°C. Each sample spent eight hours under applied heat. After the samples cooled, the physical properties were characterized. Preliminary results indicate noticeable changes between the pre- and post-heat-treatment of the Silurian chert samples.

69. CORNELIA CAMERON'S GEOLOGIC WORK ON THE SOUTHERN IOWA DRIFT PLAIN

Eliza Ross & Chad Heinzl
University of Northern Iowa

Dr. Cornelia Cameron dedicated her career to the study of geology and peat. She received her B.A. and M.S. degrees in botany before earning a Ph.D. in geology. Over the course of four decades, Dr. Cameron worked with the United States Geologic Survey (U.S.G.S.) creating an impressive and diverse body of work. Our current research, attempts to bring to light some of Dr. Cameron's unpublished geologic work (1960s) from Clarke and Decatur Counties (Iowa). Dr. Raymond Anderson (Iowa Geological Survey) discovered remnants of Cornelia's work including: brilliant hand-drawn cross-sections, surficial maps and stratigraphic sections from a series of nearly 200 UGSG cores drilled in Clarke and Decatur counties. These data come from the Southern Iowa Drift Plain, Iowa's most extensive landform region. This region contains a vast record of Pre-Illinoian glaciation, a period of landscape stabilization/soil development (Yarmouth-Sangamon Paleosol), mantled by loess deposits, and subsequent fluvial dissection. We aim to use Dr. Cameron's work to gain a better understanding of Iowa's recent (past two million years) geologic history. We are currently working (digitizing, creating a geographic information system, and potentially a running a geochemical survey) on Dr. Cameron's stratigraphic sections and developing our own field/laboratory data.

70. GEOMORPHIC ANALYSIS OF DRY RUN CREEK, CEDAR FALLS, IOWA

Andy Thompson, Chad Heinzl, Tyler Dursky, Chris Baish & Danika Patten
University of Northern Iowa

Dry Run Creek (DRC) watershed is a primary drainage basin located in northwestern Black Hawk County. It is fed predominantly by agricultural runoff in its upper reaches, and becomes heavily urbanized as it travels through the city of Cedar Falls, before draining into the Cedar River. The stream

was deemed impaired by the EPA in 2007. A watershed assessment was conducted by University of Northern Iowa Geomorphology students during the fall 2016 semester using handheld GPS devices, standardized RASCAL data sheets, and sediment sampling procedures to characterize the stream segments. Concentrating on land-use, canopy cover and bank stability, the assessment may help expose areas of DRC that are highly susceptible to degradation. Preliminary data reveals that: riparian land use is 34% urban and 42% row crop, 58% of the stream has little to no canopy cover, and 37% of the stream banks were moderately unstable to unstable. Remediation practices – such as buffer zones and rain gardens – could be a great start to reversing the declining trend of DRC. With a growing urban population, monitoring and community outreach and education are imperative for the future health of DRC.

71. VOLGA RIVER HYDROGEOLOGY

Ben Weber
Upper Iowa University

The Volga River which largely flows through Fayette County in Northeast Iowa has been observed as having a volatile water level due to multiple variables along the stream. Gains and losses through groundwater infiltration, springs along the bank of the stream, and hidden undercuts factor into the non-typical water levels. Tests of the Volga River near Fayette, Iowa were to assess the amount of water gained or lost in the section of the river. By calculating discharge at multiple locations, a determination could be made on whether or not the river was gaining or losing water in a particular stretch. These tests along with water temperature can help understand where and why the river is gaining or losing water. Lastly, using well logs, the geology of the river was assessed to further support the findings of the study.

Geology Oral Presentations

139. CHALLENGES OF HYDROLOGIC SAMPLING IN A HIGHLY POLLUTED RIVER: A LEARNING EXPERIENCE FROM NEPAL

Sushil Tuladhar¹, Mohammad Iqbal¹, Tara Nidhi Bhattarai² & Chad Heinzl¹

¹University of Northern Iowa & ²Tri-Chandra Campus, Tribhuvan University, Kathmandu, Nepal

A new international collaboration between the University of Northern Iowa (UNI), USA and Tribhuvan University (TU), Nepal was initiated in 2015. The project is funded by the U.S. National Science Foundation. The project deals with environmental assessment of Bagmati River in Kathmandu Valley, Nepal. Ten (10) sites along the Bagmati River were sampled twice a week from middle of May through late July in 2015. Water samples were analyzed for temperature, pH, total dissolved solids (TDS), conductivity, dissolved oxygen (DO), total suspended solids (TSS), turbidity, E. coli, total coliform, biochemical oxygen demand (BOD), nitrate, total phosphorus (TP), and chloride. Stream sediments were analyzed for metals,

including As, Mg, Pb, Cu, Fe, Ni, Cr, Cd, Mn, Zn, Co, and Al. The results showed extremely deteriorated water quality conditions of the river as it enters through the major areas of the city downstream. The high levels of E. coli and very low DO in the stream water along the urbanized section showed influence of direct sewage disposal. Some of the challenges of hydrologic sampling in a highly polluted river were site inaccessibility, too turbid water, health safety, high traffic, and limited human resources.

140. RASCAL WATERSHED ANALYSIS OF DRY RUN CREEK, BLACK HAWK COUNTY, IOWA

Danika Patten, Chad Heinzl, Chris Baish, Tyler Dursky & Andy Thompson

University of Northern Iowa

Dry Run Creek watershed is a primary drainage basin located in northwestern Black Hawk County. It is fed predominantly by agricultural runoff in its upper reaches, and becomes heavily urbanized as it travels through the city of Cedar Falls, before draining into the Cedar River. The stream is perennial, however some have been emptied and new segments have developed both naturally and artificially. Re-evaluation of the creek is underway and indicates some changes in urban and rural areas. Data was collected during the fall of 2016 by University of Northern Iowa geomorphology students, using handheld GPS devices and standardized data sheets. Geographic data includes: Right and left bank land use, right 44% row crop and left 40% row crop; row crop being the dominate land use. 58% of the stream has less than 10% canopy cover with 62% of the banks dominantly silt. 41% of the steam has none or less than 30% in-stream habitat. Bank stability ranging from 13% moderately stable to 19% moderately unstable. There are many possibilities of remediation practices that can improve both stream and water quality. Native vegetation can be installed to create a natural buffer to decrease runoff and bank erosion, increasing bank stability.

141. PRECIPITATION TRENDS AND PRECIPITATION EXTREMES: CLIMATE CHANGE AND FLOOD EVENTS IN THE CEDAR RIVER VALLEY (IOWA)

Lee Potter

University of Northern Iowa

Monthly and annual precipitation averages for five weather stations in the Cedar River basin were analyzed using linear regression and chronostatistic tools. These stations (Austin, Minnesota; Charles City, Waterloo, Cedar Rapids, and Iowa City, Iowa) correspond to hydrologic stations, and provide historical data ranging from 66 years to 123 years culminating in 2016. Regressions for all five stations show linear increase,

ranging from 0.043 to 0.116 inches per year. Semivariograms for each station show little variation, outside of noise, over periods ranging from 45 to 65 years. Beyond those intervals, variation increases slightly, and that increase is noticed beginning around 1955. Summer months showed increased variation. Except for 1993, major flood events in the basin (including historic floods of 2008 and 2016) occur in “wet” years, but not more “wet” than other wet years without major flooding. Average monthly precipitation tended to increase for most months (and most stations) except for September records at some stations. This suggests that even flood years may come up short on water at the end of the growing season. Without delving into cause, residents in the Cedar Basin should expect continued increasing annual precipitation and some increase in variation in the future.

142. PROCURING PROBOSCIDEAN PARTS FROM POND DEPOSITS PERCHED ABOVE THE POOL OF LAKE RED ROCK

Mark Anderson

University of Iowa

In 2014, Marion County Conservation Board ranger Mike Kalkwarf was conducting a routine shoreline inspection when he noted large skeletal elements along the eroding shoreline of Lake Red Rock, Marion County, Iowa. Kalkwarf relayed his discovery to Red Rock U. S. Army Corps of Engineers (USACE) personnel who in turn contacted Jim Ross, Chief—MVR Environmental Compliance Section USACE-RPEDN-Rock Island. Ross arranged with John Doershuk, State Archaeologist and Director of the OSA, to make a site visit on a frozen November 2014 day to assess the situation. Upon recognizing that these skeletal elements likely represented a proboscidean of some kind, a follow up site visit was made in early June 2015. This time multiple skeletal elements were noted, GPS points recorded, photographs taken, and an initial geomorphological assessment was made. These and two additional visits set a research plan in motion that culminated in a University of Iowa Internal Funding Initiative award through the Office of the Vice President of Research and Economic Development. This grant provided the OSA with the resources for a two-week field recovery and roughly a one-year window for research exploring potential ancient human-proboscidean interactions at Lake Red Rock.

143. A NEW MODEL FOR THE DEVELOPMENT OF THE MANSON IMPACT STRUCTURE’S CENTRAL PEAK AND ITS RELATION TO MANSON SOFT WATER

Ray Anderson

University of Iowa

Recent drilling in the 74.1 Ma Manson Impact Structure (nc Iowa) in search of water resources for the town of Manson

provided a wealth of information on the history of the crater's central peak (*cp*) and of "Manson soft water," the only naturally soft groundwater in Iowa. The new drill discoveries informed the modeling of the formation of the crater's large central uplift, driven high by the slumping crater rim before collapsing back into the crater moat. Compression during *cp* collapse produced a landslide of basement crystalline rocks into the moat, which was quickly overtopped by a similar landslide of red clastic sediments from the crater wall. Both were then overwhelmed by the debris flow resurge deposit driven by the returning pre-impact sea. At the same time crater melt-rock was cascading down the sides of the *cp*, a suevite flow with the characteristics of a volcanic pyroclastic flow and here defined as a *suevitic* flow (*sf*). The *sf* initially advanced over the crystalline rock landslide then into the resurge deposit before being overwhelmed by the debris flow. The Manson soft water is sourced from the crystalline rock landslide materials and recovered by Manson city wells from the fractured overlying *sf*.

144. NEW ACHIEVEMENTS OF THE MIDDLE ORDOVICIAN WINNESHIEK LAGERSTÄTTE AND THE DECORAH IMPACT STRUCTURE

Huaibao Liu & Robert McKay
Iowa Geological Survey

Research on the Middle Ordovician Winneshiek fauna and the Decorah Impact Structure is continuous. Recent achievements include the studies on part of conodont apparatuses, "small carbonaceous fossils" (SCFs), Winneshiek Shale geochemistry analysis, and the comprehensive study of the impact structure. The studied conodonts are identified as *Archeognathus primus* Cullison, 1938 and *Iowagnathus grandis* n. gen & sp. The complete apparatuses of the 6-element *A. primus* and the 15-element *I. grandis* are characterized by giant elements and robust basal bodies. The SCFs are likely from an unknown micro-arthropod. The detailed analysis of planar microdeformation features in quartz grains confirms the meteorite impact origin of the Decorah structure, and its mechanism features and possible influence to the life are discussed. Results from the Winneshiek Shale geochemistry analysis indicate that the Decorah impact event matched the asteroid breakup during the Ordovician. The many new fossil forms from the Winneshiek fauna provide unusual evidence to the theory of the Great Ordovician Biodiversification Event (GOBE), and the collaboration with meteorite impact supports the hypothesized link between GOBE and the asteroid breakup. Results from the Winneshiek researches have been widely used for public education, including the 2017 exhibition in the University of Iowa's Mobile Museum.

145. CREATING A NEW BEDROCK GEOLOGIC MAP OF

MITCHELL COUNTY, IOWA

Ryan Clark
Iowa Geological Survey

The Bedrock Geologic Map of Mitchell County represents the culmination of three years of geologic mapping conducted as part of the Iowa Geological Survey's (IGS) ongoing participation in the United States Geological Survey's (USGS) National Cooperative Geologic Mapping Program (STATEMAP). Recent flooding in the region and an increased demand on bedrock aquifers for irrigation has generated significant interest from local government and conservation groups which highlighted the need for a better understanding of the geologic setting of the region. Mitchell County occupies approximately 470 square miles of primarily agricultural land situated in north-central Iowa. The mapping area is within the northern portion of [the Devonian Iowa Basin](#), a region of thickened shelf carbonate and shale that was deposited from the late Eifelian through early Frasnian stages. Creating the Bedrock Geologic Map of Mitchell County incorporated all available data, including existing geologic maps from Iowa and Minnesota, applicable publications, soil survey maps, over 100 bedrock exposures, and more than 900 borehole records. The resulting bedrock geologic map illustrates the refined topography of the bedrock surface as well as the distribution of bedrock units at the formation level.

Iowa Science Teaching Poster Presentations

72. SUPPORTING TEACHERS IN ADVANCING STEM PRACTICES

Michele Cozza
STEMscopes

Partnering with two county schools, Accelerate Learning conducted a year-long (2015-2016) initiative to improve 3rd-8th grade STEM teacher practices, as part of an MSP grant. Participating teachers (n = 44) had access to the STEMscopes curriculum, materials kits, and 60 hours of professional development (9 full-day trainings) aimed at improving science content knowledge and STEM instructional practices. Results show that participating teachers improved their STEM instructional practices and science content knowledge across the school year.

As part of the grant requirements, teachers were evaluated on their STEM instructional practices and science content knowledge throughout the school year. For STEM instructional practices, teachers were observed during fall, winter, and spring of the 2015-2016 academic year and assessed on a scale of 1-4 (novice to role model) on their execution of 15 research-based STEM teacher actions across 3 domains: Creating an Environment for Learning, Building Scientific Understanding, and Engaging Students in Scientific & Engineering Practices. It is important to note that teachers often spend many years developing these qualities—reaching "role model" (4) status takes a significant investment in personal and professional growth. Repeated-measures ANOVAs were conducted to determine if teachers experienced significant growth in these skills across the school year.

73. RESEARCH AND ENRICHMENT: IMPLEMENTING A CELL AND MOLECULAR BIOLOGY TEACHING LAB AT UPPER IOWA UNIVERSITY

William Jones & Rebecca Schmidt

Upper Iowa University

A Roy J. Carver Trust grant to the Department of Biology and Chemistry of Upper Iowa University has allowed integration of modern Cell and Molecular Biology techniques into student research projects and course enrichment. Students interested in pursuing careers in the biological and health sciences have been introduced to the current state of the art. Additionally, use of this equipment has promoted awareness of careers using cell biology techniques. Such careers include graduate and professional programs in health sciences, clinical lab work, biotechnology, and agribusiness research and development. Students learned to culture eukaryotic cells and analyze cell structure and behavior with fluorescent microscopy. These new capabilities enriched courses such as Cell and Molecular Biology, Botany, Microbiology, Principles of Biology and Anatomy and Physiology. The scope and capabilities of individual undergraduate student research has greatly expanded. Since spring of 2015, nine student researchers, utilizing these resources, have investigated topics ranging from soil microbiota, fluorescent microscopy of eukaryotic cell structure, fluorescence of photosynthetic pigments, cell sensitivity to bacterial proteins, and cellular expression and localization of transfected fluorescent proteins. These laboratory capabilities are expected to continue attracting student interest and appreciation of cell biology-related opportunities.

74. IMPACT OF PROFESSIONAL DEVELOPMENT PREFERENCES ON SECONDARY SCIENCE TEACHER CLASSROOM BELIEFS AND PRACTICES

Jessica Wayson¹, Dawn Del Carlo¹ & Sarah Boesdorfer²

¹University of Northern Iowa & ²Illinois State University

Participation in teacher professional development is common place in a teacher's commitment to lifelong learning. Professional development can have a large impact on science teacher classroom practices depending on the type and duration of the professional development (Supovitz & Turner, 2000). Many forms of professional development exist, such as conferences, reflections, professional learning communities, and action research, but teacher participation differs per type. Kwakman (2003) determined a variety of factors effect why teachers participate in certain professional development programs over others such as professional attitudes, loss of personal support, and feasibility of innovative activities. However, the effect of professional development preference has not been well studied in relation to its effect on teacher practices and beliefs. In order to better understand this dynamic, a nationwide online survey was developed and sent to secondary science teachers (N=460). The findings of this survey indicate a relationship does exist. During analysis, teachers were grouped by professional development type preference including collaboration, reflection, conducting research, and standard professional development (such as conferences and workshops). Significant differences emerged

from each group and implications for effective professional development practices will be addressed.

Iowa Science Teaching Oral Presentations

146. USING GAME-BASED LEARNING TO CREATE MORE EFFECTIVE SCIENCE FIELD TRIPS AND CONNECT REAL-WORLD EXPERIENCES TO CLASSROOM-BASED LEARNING

Dana Atwood-Blaine

University of Northern Iowa

Science field trips usually result in an engaging and enjoyable experience for students, but one that may not be as focused on the desired learning objectives as teachers would like. Additionally, an experience outside of the classroom doesn't always translate directly into meaningful learning that can be extended and measured when students return to the classroom. Using mobile, location-based technology and the open-source, game-based learning platform ARIS, we can create goal-oriented and inquiry-based field trip experiences that not only engage students with the learning objectives, but also result in an experience that is more fun and motivating for students than the traditional free-exploration type of science field trip. Data and media collected by student-players during the field trip can then be used during follow-up classroom lessons. This session will provide research results as well as an example of a mobile, game-based learning experience that was implemented with pre-service elementary teachers on a field trip to the University's greenhouses. The learning objectives for the field trip include all 3 dimensions of NGSS: the Disciplinary Core Ideas around organisms' structures and processes, several of the Science & Engineering Practices, and the Crosscutting Concepts of Patterns and Structure and Function, specifically.

148. THE NEW, PEER-REVIEWED *JOURNAL OF STEM ARTS, CRAFTS, AND CONSTRUCTIONS*: WHAT'S IT ALL ABOUT?^{ISGC}

Audrey Rule, Dana Atwood-Blaine & Mason Kuhn

University of Northern Iowa

The *Journal of STEM Arts, Craft, and Constructions* published two issues of volume 1 in fall 2016 and is presenting the first issue of its second volume this spring. This online, open-access scholarly journal seeks to engage professionals including preK-12 teachers, informal educators, museum or zoo educators, STEM coaches and lead teachers, and university faculty in a conversation about the benefits of arts integration; the ways that the STEM subjects can be integrated with the arts to produce effective teaching (STEAM Education); and how the Next Generation Science Standards (NGSS), including the engineering standards of the NGSS, can be effectively implemented with integrated arts, crafts, or constructions. Articles can address preK-12 education, informal STEM learning, post-secondary education, and adult learning. The journal contains both research articles and practical articles, along with editorials. The Journal has a national board of Associate Editors managing blind peer-review of papers and an international audience. This presentation will describe the origin, scope, and goals of the journal and provide a rationale for arts-integration and spatial thinking in STEM areas. Work

presented in early issues was supported by a grant from the Iowa Space Grant Consortium and the Iowa Biotechnology Association. The journal's website is: <http://scholarworks.uni.edu/journal-stem-arts/>

Organismal Biology Poster Presentations

75. INFERRING POLYPLOID ANCESTRY IN SUNFLOWERS USING 900 LOCI^{ISF}

Eric Baack & Ales Varabyou
Luther College

Sunflowers (genus *Helianthus*) are native to North America and include around 50 species. Recent work has clarified the relationships among diploid taxa, but their relationships to species with four or six sets of chromosomes remains unclear. We used gene baits to obtain data from hundreds of loci and over 40 species in a single sequencing run. We report on the challenges of assembling short sequence reads to use in phylogeny reconstruction when a single individual might have four or more distinct alleles at a single locus.

76. EFFECT OF ACUTE NUTRITIONAL STRESS ON HONEYBEE OVARY DEVELOPMENT

Marit Bakken, Alex Walton & Amy Toth
Iowa State University

Honeybees (*Apis mellifera*) are a eusocial species characterized by a division of labor. The queen influences worker division of labor by producing Queen Mandibular Pheromone (QMP), which affects social behavior, maintenance of the hive and inhibition of ovary development in worker bees. Nutrition has been shown to have an effect on morphology, physiology and behavior in honeybees, and thus affects workers' responses to QMP and ovary size. For this experiment we hypothesized that acute nutritional stress would increase workers' response to QMP and reduce ovary size. Larval bees were nutritionally restricted for 10 hours, and after emerging as adults were transferred to the lab for cage experiments for QMP assays. After the assays, bees were collected and their ovaries were dissected. For our ovary dissections, we found that restricted bees did have fewer ovarioles than unrestricted bees, and we also found a significant difference in response to QMP. This study provides the first experimental evidence showing a connection between early life nutritional stress, ovary development and adult behavior in honeybees. Stressing bees just for 10 hours can lead to significant changes in behavior and morphology, showing the importance of nutrition in larval bees, and possibly other organisms as well.

77. VALIDATION OF THE ELEVATED PLUS MAZE FOR MEASURING ANXIETY IN MALE GOLDEN HAMSTERS

Diane Delgado & Samantha Larimer Bousquet
Wartburg College

Anxiety disorders affect much of our human population. Animal models are useful in measuring anxiety levels because they avoid the ethical complications of testing on sensitive human populations. One of the frequent methods for measuring anxiety in rodents is the elevated plus maze. What is unknown is whether or not the elevated plus maze gives us consistent

results over multiple trials. Male golden hamsters were tested over three trials, with one week in between each trial. Over the course of five minutes, the hamsters' behavior was observed via an over-head video camera. The number of times the hamster went into each arm was recorded, as well as the amount of time spent in each arm. The consistency across trials for each hamster was examined in 25 subjects.

78. CICHORIC ACID CONCENTRATION IN ECHINACEA AFTER INOCULATION WITH GLOMUS INTRARADICES

Alex Samson, Matthew Eden, Jenna Niccolls & Michaelen Golay
Wartburg College

Echinacea, commonly known as purple coneflowers, are a group of herbaceous flowering plants. Dietary supplements synthesized from *Echinacea* contain several secondary compounds that are believed to exhibit immunostimulatory properties. Cichoric acid is a plant secondary compound that has been linked to various medicinal benefits in humans. Because *Echinacea* are commercially important, growers seek to increase production of biomass and secondary compounds. Fungal symbionts may be an option for increasing plant productivity. Soil inoculation with the endomycorrhizal fungus *Glomus intraradices* can increase plant biomass and production of secondary compounds. This study explores whether inoculation with *G. intraradices* will affect the quantity of the secondary compound, cichoric acid, within the leaves of five *Echinacea* species. The five species, *Echinacea angustifolia*, *E. pallida*, *E. paradoxa*, *E. purpurea*, and *E. tenesseeensis*, have been studied to varying degrees in greenhouse environments. We hypothesized that there will be a difference between inoculated and non-inoculated individuals, specifically that inoculated *Echinacea* will have greater cichoric acid production in the leaves. Data collection will include calculation of total biomass and quantification of cichoric acid, by high performance liquid chromatography (HPLC) and ultraviolet (UV) mass spectrometry. Comparisons among species will be exploratory.

79. EXPRESSION OF HEPATIC ACETYL-COA CARBOXYLASE AND NEURAL PROTEINS VEGF-A AND NEUROFILIN-1 IN MICE (*MUS MUSCULUS*) EXPOSED IN UTERO TO ATRAZINE^{βββ}

Raelynn Speltz, Acacia Wimmer, Jay Heinle & Debra Martin
Saint Mary's University of Minnesota

Atrazine (ATR) is an herbicide that has contaminated water sources to levels above the EPA safe level of 3 ppb. Multiple studies have found ATR to have a physiological effect on animals. Chronic exposure of mice ATR showed increased serum fatty acid and hepatic lipids suggesting metabolic dysregulation. Chronic exposure of zebrafish to ATR showed behavior changes suggesting neural dysfunction. This study was to investigate ATR's effect on mice exposed *in utero*. Newborn mice were exposed during gestation and their livers or brains were extracted. Liver proteins and mRNA were analyzed by immunoblot or RTPCR to determine the amount of acetyl-CoA carboxylase (ACACA) expression. Brain proteins were analyzed by ELISAs to determine the amount of VEGF- α or Neuropilin-1 protein. Using a one-way ANOVA,

it was determined that for ACACA protein, there was significant increase ($p < 0.05$) between the control group and the 3 ppb group ($p = 0.000$) but for mRNA there was no difference suggesting translational regulation. For the neural proteins, both VEGF- α and Neuropilin-1 were significantly decreased from the control group to the exposed groups ($p = 0.049$ and $p = 0.001$, respectively). Since both VEGF- α and Neuropilin-1 are involved in angiogenesis this suggests ATR can affect neural development.

Organismal Biology Oral Presentations

149. EPIGENETIC INHERITANCE AND PREDISPOSITION TO SEX IN TEMPERATURE-DEPENDENT SEX DETERMINATION

Daniela V Flores and Fredric J Janzen
Iowa State University

Vertebrates with temperature-dependent sex determination (TSD), a mechanism relying on incubation temperature to determine the sex of developing embryos, are especially threatened by environmental change. Previous studies have suggested that behavioral and molecular plasticity may provide opportunities for these species to adapt. DNA methylation is well-known for its dynamic ability to silence genes and influence phenotypes, and evidence is accumulating for its role in TSD systems. Using the painted turtle, *Chrysemys picta*, this study investigated the potential role of DNA methylation in the TSD sex determining mechanism. Quantification assays and bisulfite conversion allowed for the observation of genome-wide and loci-specific DNA methylation, respectively. We compared differences between sexes, as well as investigated inheritance of methyl marks and their ability to predispose individuals to a particular sex by observing different life stages of related individuals. Epigenetic inheritance has the potential to mediate the effects of environmental change on the population dynamics of species with TSD, as the methylation composition of a gene whose product plays a critical role in gonad differentiation may influence an individual's final sex. This can be leveraged by global conservation efforts, as well as evolutionary and ecological studies, as global change threatens to extinguish reptiles with TSD.

150. PREPARING FOR WINTER DORMANCY: INSIGHT INTO THE EFFECTS OF COLD TEMPERATURES ON CONDITION, METABOLISM, AND HORMONAL RESPONSE IN THE CHECKERED GARTER SNAKE, *THAMNOPHIS MARCIANUS*

Kaitlyn G. Holden, Eric J. Gangloff, Anne M. Bronikowski
Iowa State University

Characterizing the physiological response to prolonged cold exposure in ectotherms is essential in understanding the maintenance of long-term energy balance. As global climatic patterns continue to change, it becomes increasingly important to quantify the thermal reaction norms of metabolic and hormonal function during periods of hibernation and inactivity. Furthermore, little is known about the drivers of individual

variation in physiological responses to sustained cold temperatures. Here we used the checkered garter snake, a widespread ectothermic vertebrate, to test the influence of thermal environment on metabolism and physiology. In this experiment we describe the thermal response curves of oxygen consumption rate, plasma glucose concentrations, and plasma corticosterone concentrations during a temperature step-down protocol (20, 15, 10, and 5°C) simulating the descent into hibernation followed by an extended period of prolonged hibernation at 5°C and consequent step-up protocol (5, 10, 15 and 20°C). We will discuss these results in the broader context of mechanisms that maintain physiological functionality and survival during seasonal periods of inactivity in a temperate ectotherm.

151. PROTECTIVE FUNCTIONS OF PIGMENTS AGAINST SOLAR RADIATION IN HAWAIIAN DAMSELFLY *MEGALAGRION CALLIPHYA*

Jongbeom Park, Jackie Brown & Elaine Marzluff
Grinnell College

Megalagrion calliphya is a damselfly species endemic to Hawaii that displays female-limited color dimorphism, with red males, red females, and green females. Since the frequency of andromorph females is positively associated with solar radiation, we tested the hypothesis that red colored pigments protect *M. calliphya* from sunlight either by working as light absorbers or as antioxidants. We investigated the effect of sunlight exposure on the males and both female morphs. Red females had the highest antioxidant capacity and green females had the lowest. Further, all three morphs showed a significant decrease in antioxidant capacity upon exposure to solar radiation, suggesting that red colored pigments mainly work as antioxidants. While relative amounts of decarboxylated xanthommatin, one of the two red-colored pigments, were different among morphs, the amounts of xanthommatin were not significantly different. Further, the sums of both of these ommochromes were not significantly different. Although it is not certain whether the concentration of certain ommochromes determine color, the ratio of reduced to oxidized ommochromes may be responsible for different antioxidant capacities and color differences.

152. CAUSES AND CONSEQUENCES OF MULTIPLE PATERNITY IN THE COMMON GARTER SNAKE (*THAMNOPHIS SIRTALIS*)^{ISF}

Merritt C. Polomsky, Elena M. Thornhill, Eric J. Gangloff & Anne M. Bronikowski
Iowa State University

Differences in reproductive success between the sexes can have important impacts on sexual selection and sexual dimorphism. For example, multiple paternity (multiple males contributing to a single reproductive event), is common in many snake species. Previous work in the common garter snake (*Thamnophis sirtalis*) shows variation in levels of multiple paternity between geographically distinct populations, but the reasons for these varying levels are unknown. In this experiment, I tested for varying levels of multiple paternity in two disparate populations from across the species' geographic range. In addition, I tested for ecological and physiological

correlates of this variation. By using genetic markers (nine microsatellite loci) wild caught snakes of both sexes as well as captive born offspring were genotyped ($n = 575$ individuals). I analyzed these genetic markers to establish sibling relationships among sampled littermates and to identify fathers. Using these data, we provide empirical evidence to show potential relationships between multiple paternity and traits such as litter size, neonate size, and reproductive success and discuss the potential fitness effects of multiple paternity.

153. TARDIGRADES OF HARDIN COUNTY, IOWA

Laura Tibbs¹, Bienvenido Cortes¹ & William Miller²
¹Benedictine College & ²Baker University

Tardigrades, commonly known as water bears, are microscopic animals that live in moss and lichen but are best known for their ability to survive extreme conditions, including temperatures near absolute zero and even the vacuum of space. Iowa was the site of one of the earliest collections of tardigrades in the United States in 1873, but only one additional paper on the tardigrades of this state has been published in the last 140 years. Both papers focused on tardigrades in central Iowa, living in either freshwater algae or in deciduous trees. This project expands upon the known tardigrade diversity of the state through collection efforts in northern Iowa trees. Twenty-nine moss and lichen samples were collected from deciduous and coniferous trees in Hardin County during December 2015, and tardigrades were extracted from these samples. 560 specimens were collected, which included six new species records for the state of Iowa (*Macrobotus* sp., *Paramacrobotus* sp., and four species in the genus *Milnesium*) as well as one new genus for the state (*Ramazzottius* sp.) Pseudoplates, tardigrade structures that were only described for the first time in 2016, were also observed in some of the specimens.

Physics Poster Presentations

80. USING FOURIER COEFFICIENTS TO EXAMINE THE METALLICITY OF THE MILKY WAY AND OTHER GALAXIES^{ISGC}

Keith Doore & Siobahn Morgan
University of Northern Iowa

Photometric data in the I and V -band magnitudes for c-type RR Lyrae variables was obtained for seven globular clusters found within the Milky Way galaxy. The I and V -band light curves were used to determine the Fourier coefficients in each magnitude system. Quality relationships were then derived that linearly relate the coefficients to one another. After eliminating poor quality stars, relationships were then created to transform the Fourier coefficients from the I to the V -band. These relationships along with the quality relationships were applied to the RRc star within the Milky Way Bulge, Small Magellanic Cloud, and Large Magellanic Cloud sets of the OGLE IV survey data, and any poor quality stars were removed from the data set. Using the estimated V -band coefficients, metallicity values were calculated for each star using the metallicity formula of Morgan, Wahl & Wiecehorst (2007). Metallicities were then analyzed to determine if any patterns or trends in metallicity emerged.

81. FOG CHEMISTRY IN THE CEDAR VALLEY^{ISGC}

Juliana Herran, Cody M. McCoy, Matthew L. McIntosh, Joshua A. Sebree, Alexa R. C. Sedlacek & Xinhua Shen
University of Northern Iowa

Fog is a meteorological phenomenon with supersaturated air at ground level. Fogs act as important processors of ambient aerosols and soluble trace gases. During the fog formation process, activated aerosol particles heterogeneously nucleate water vapor and grow to fog droplets. Scavenged and newly formed species can be removed through occult or wet deposition processes or be released back to the ambient air as the fog dissipates. In this research, fogwater samples were collected using a Caltech Active Strand Cloud Collector Version 2 (CASCC2). Air is drawn by a fan through the collector and across inclined Teflon strands. Fog droplets are impacted upon the Teflon strands where they coalesce and run down the strands and through a Teflon collection trough and Teflon tube into a polyethylene collection bottle. Meanwhile, backward trajectory of the air parcel was analyzed, including information concerning the air parcel's origin, transport distance, and the residence time in each region during its transport. In this research, the National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory's HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) model was used to calculate backward trajectories. The National Weather Service's National Centers for Environmental Prediction (NCEP) Global Data Assimilation System (GDAS) model output was used as the meteorological data set input.

82. PERTURBATIONS OBSERVED IN THE ORBITAL ELEMENTS OF THE SPECTROSCOPIC BINARY 57 CYGNI

Zachary Jeffries and Kenneth McLaughlin
Loras College

We present spectroscopy confirming repetitive Doppler-shifts and photometry confirming no eclipses in the double-line spectroscopic binary 57 Cygni. Our spectroscopy is limited to a range encompassing H-alpha and the helium 667.8 nm line. Doppler-shifts of both stars were well-resolved in the helium line but less so in H-alpha. Although we find the radial velocities derived from both lines reasonably consistent we retained only the helium-line derived velocities for sinusoidal curve-fits to the orbital dependence. The fit-amplitudes specify the ratio of the stellar masses as 1.03 ± 0.05 , a ratio that is in agreement with previous assessments. We find an eccentricity of 0.028 ± 0.024 and a longitude of periastron of $163.5 \pm 2.5^\circ$; the former is significantly lower than that previously reported while the latter is in agreement but calls into question the apsidal motion predicted four decades ago. Our modeling suggests the presence of an external third body was implicit in this reported apsidal motion, as well as the most likely mechanism for our observed variation in eccentricity. Based upon the spectral type assignment, the near-circular orbit and the established mass ratio, we can place restrictions on the orbital inclination from 51.5 -to- 53.0° , in reasonable agreement with previous estimates.

83. NANOCELLULOSE AEROGEL COMPOSITES FOR

CATALYTIC ACTIVITY

Timothy Kidd, Byron Fritch & Bradley Derek
University of Northern Iowa

Nanocellulose is a material composed of simple cellulose, albeit broken down into nanoscale form. We have derived techniques using ultrasonic agitation in distilled water to physically break down microcrystalline cellulose into building blocks composed of finite numbers of molecules. The cellulose, which begins as an insoluble powder, mixes to form a homogenous suspension as it is reduced in size. We are able to create homogenous mixtures down to 0.2% cellulose concentrations without significant clumping. By freeze-drying, the water sublimates to create an aerogel composed solely of nanocellulose and air. The water is removed very effectively so that the resulting aerogel has a similar nanocellulose-air ratio as the original nanocellulose-water ratio of the suspension. These materials are then exposed to titanium isopropoxide vapors to create TiO₂-nanocellulose composites. The TiO₂ coating acts as a useful catalyst in breaking down organics while the nanocellulose aerogel serves as a high surface area template to enhance catalytic activity. Our work shows that surface area remains consistent with the aerogel template down to about the 95% level, with challenges arising in less dense materials owing to a lack of structural integrity.

84. CHARACTERIZATIONS OF AIR QUALITY IN HOUSTON, TEXAS

Riley H. Mullins¹, Hongbo Du², Raghava R. Kommalapati²,
Xinhua Shen¹
University of Northern Iowa¹ & Prairie View A&M
University²

Houston is known to experience severe air pollution problems. The Houston-Galveston-Brazoria (HGB) area in southeast Texas is heavily industrialized; many petrochemical and chemical plants locate in this region. Shipping and transportation activities as well as large population also contribute to air pollution in this area. In this research, observation data of CO, NO_x, NO_y, VOC and O₃ were used to analyze the daily and seasonal as well as weekday/weekend variations of these species. Further, CAMx (Comprehensive Air quality Model with extensions) model was used to simulate the air quality in the Houston area. Diurnal variations of CO, NO_x, NO_y, VOC and O₃ were observed in the Houston area. Average O₃ concentrations were higher in summer than in winter due to higher photochemical reactions in summer. Lower CO and NO_x concentrations were observed during weekend than weekday, average peak concentrations of CO and NO_x at weekend were lower than those on weekday. O₃ concentrations were higher during weekend than those on weekday; average peak concentrations of ozone at weekend were higher than those on weekday.

85. RAMAN SPECTROSCOPY OF 1T'-MOTe₂ ULTRATHIN LAYERS

Logan Winford,¹ Adam W. Tsen² & Rui He¹

¹University of Northern Iowa & ²University of Waterloo,
Ontario, Canada

MoTe₂ is an important transition metal dichalcogenide that could be used to realize the type-II Weyl fermions. Bulk

MoTe₂ has 1T' phase that is monoclinic and centrosymmetric at room temperature. At temperatures lower than ~200 K, it undergoes a phase transition into a T_d phase that is orthorhombic and has no inversion symmetry. In this project, we studied ultrathin (few-nm-thick) layers of MoTe₂ using variable-temperature Raman spectroscopy in a large temperature range of 10-420 K. We observed Raman signatures of the T_d phase in these ultrathin layers at room temperature.

86. ANISOTROPIC PROPERTIES OF EXFOLIATED MULTI-LAYERED SINGLE CRYSTAL V₂O₅

Gaihua Ye¹, Sukrit Sucharitakul², Zhipeng Ye¹, Xuan Gao² & Rui He²

¹University of Northern Iowa & ²Case Western Reserve University

Vanadium pentoxide, V₂O₅, is layered material. It is used in many industrial chemical reactions. For bulk V₂O₅, the lattice parameters are a=11.51 Å, b=3.56 Å, and c=4.37 Å. We probed vibrational and electrical properties of exfoliated flakes of V₂O₅ with thicknesses between 10-100 nm using Raman spectroscopy and electrical transport. We find that V₂O₅ is highly anisotropic in the plane. Intensities of Raman modes depend strongly on the relative orientation between the crystal axes and the directions of polarization of incident/scattered light. Through four-probe measurement, conductance anisotropy up to order of 10² between a and b crystal axis is observed. Moreover, samples show thermally activated carriers with activation energy extracted to be 0.11-0.14 eV through electrical conductance measurement at different temperatures. Through Hall measurement, the exfoliated samples show Hall mobility up to 7 cm²/Vs comparable to that of bulk crystals. Work at CWRU is supported by Air Force Office of Scientific Research (AFOSR) Grant FA 9550-12-1-0441. Work at UNI is supported by NSF CAREER Grant No. DMR-1552482 and RUI Grant No. DMR-1410496.

87. RAMAN SPECTROSCOPY OF INTERLAYER INTERACTIONS IN VAN DER WAALS HETEROSTRUCTURES

Zhipeng Ye¹, Pavel Lukashov¹, Diana Odhiambo², Michael Roth², Samuel Lane³, Hui Zhao³ & Rui He¹

¹University of Northern Iowa, ²Northern Kentucky University & ³University of Kansas

Van der Waals heterostructures are of great current interest because of their important applications in electronic and optoelectronic devices. We study MoS₂/MoSe₂ and graphene/MoSe₂ stacked atomic layers using Raman spectroscopy. We find that the Ag mode of MoSe₂ at around 240 cm⁻¹ shifts to higher frequency when graphene layers are stacked vertically to form heterostructures. However, this Ag mode from MoSe₂ remains at the same frequency when it forms vertical heterostructures with MoS₂. Density functional theory is used to probe the change of phonon frequencies and electronic band structures of these heterostructures.

Physics Oral Presentations

80. USING FOURIER COEFFICIENTS TO EXAMINE THE METALLICITY OF THE MILKY WAY AND OTHER GALAXIES^{ISGC}

Keith Doore & Siobahn Morgan
University of Northern Iowa

Photometric data in the *I* and *V*-band magnitudes for c-type RR Lyrae variables was obtained for seven globular clusters found within the Milky Way galaxy. The *I* and *V*-band light curves were used to determine the Fourier coefficients in each magnitude system. Quality relationships were then derived that linearly relate the coefficients to one another. After eliminating poor quality stars, relationships were then created to transform the Fourier coefficients from the *I* to the *V*-band. These relationships along with the quality relationships were applied to the RRc star within the Milky Way Bulge, Small Magellanic Cloud, and Large Magellanic Cloud sets of the OGLE IV survey data, and any poor quality stars were removed from the data set. Using the estimated *V*-band coefficients, metallicity values were calculated for each star using the metallicity formula of Morgan, Wahl & Wieckhorst (2007). Metallicities were then analyzed to determine if any patterns or trends in metallicity emerged.

81. FOG CHEMISTRY IN THE CEDAR VALLEY^{ISGC}

Juliana Herran, Cody M. McCoy, Matthew L. McIntosh, Joshua A. Sebree, Alexa R. C. Sedlacek & Xinhua Shen
University of Northern Iowa

Fog is a meteorological phenomenon with supersaturated air at ground level. Fogs act as important processors of ambient aerosols and soluble trace gases. During the fog formation process, activated aerosol particles heterogeneously nucleate water vapor and grow to fog droplets. Scavenged and newly formed species can be removed through occult or wet deposition processes or be released back to the ambient air as the fog dissipates. In this research, fogwater samples were collected using a Caltech Active Strand Cloud Collector Version 2 (CASCC2). Air is drawn by a fan through the collector and across inclined Teflon strands. Fog droplets are impacted upon the Teflon strands where they coalesce and run down the strands and through a Teflon collection trough and Teflon tube into a polyethylene collection bottle. Meanwhile, backward trajectory of the air parcel was analyzed, including information concerning the air parcel's origin, transport distance, and the residence time in each region during its transport. In this research, the National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory's HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) model was used to calculate backward trajectories. The National Weather Service's National Centers for Environmental Prediction (NCEP) Global Data Assimilation System (GDAS) model output was used as the meteorological data set input.

82. PERTURBATIONS OBSERVED IN THE ORBITAL ELEMENTS OF THE SPECTROSCOPIC BINARY 57 CYGNI

Zachary Jeffries and Kenneth McLaughlin
Loras College

We present spectroscopy confirming repetitive Doppler-shifts and photometry confirming no eclipses in the double-line spectroscopic binary 57 Cygni. Our spectroscopy is limited to a range encompassing H-alpha and the helium 667.8 nm line. Doppler-shifts of both stars were well-resolved in the helium line but less so in H-alpha. Although we find the radial velocities derived from both lines reasonably consistent we retained only the helium-line derived velocities for sinusoidal curve-fits to the orbital dependence. The fit-amplitudes specify the ratio of the stellar masses as 1.03 ± 0.05 , a ratio that is in agreement with previous assessments. We find an eccentricity of 0.028 ± 0.024 and a longitude of periastron of $163.5 \pm 2.5^\circ$; the former is significantly lower than that previously reported while the latter is in agreement but calls into question the apsidal motion predicted four decades ago. Our modeling suggests the presence of an external third body was implicit in this reported apsidal motion, as well as the most likely mechanism for our observed variation in eccentricity. Based upon the spectral type assignment, the near-circular orbit and the established mass ratio, we can place restrictions on the orbital inclination from 51.5 -to- 53.0° , in reasonable agreement with previous estimates.

83. NANOCELLULOSE AEROGEL COMPOSITES FOR CATALYTIC ACTIVITY

Timothy Kidd, Byron Fritch & Bradley Derek
University of Northern Iowa

Nanocellulose is a material composed of simple cellulose, albeit broken down into nanoscale form. We have derived techniques using ultrasonic agitation in distilled water to physically break down microcrystalline cellulose into building blocks composed of finite numbers of molecules. The cellulose, which begins as an insoluble powder, mixes to form a homogenous suspension as it is reduced in size. We are able to create homogenous mixtures down to 0.2% cellulose concentrations without significant clumping. By freeze-drying, the water sublimates to create an aerogel composed solely of nanocellulose and air. The water is removed very effectively so that the resulting aerogel has a similar nanocellulose-air ratio as the original nanocellulose-water ratio of the suspension. These materials are then exposed to titanium isopropoxide vapors to create TiO₂-nanocellulose composites. The TiO₂ coating acts as a useful catalyst in breaking down organics while the nanocellulose aerogel serves as a high surface area template to enhance catalytic activity. Our work shows that surface area remains consistent with the aerogel template down to about the 95% level, with challenges arising in less dense materials owing to a lack of structural integrity.

84. CHARACTERIZATIONS OF AIR QUALITY IN HOUSTON, TEXAS

Riley H. Mullins¹, Hongbo Du², Raghava R. Kommalapati², Xinhua Shen¹
University of Northern Iowa¹ & Prairie View A&M University²

Houston is known to experience severe air pollution problems. The Houston-Galveston-Brazoria (HGB) area in southeast Texas is heavily industrialized; many petrochemical and chemical plants locate in this region. Shipping and

transportation activities as well as large population also contribute to air pollution in this area. In this research, observation data of CO, NO_x, NO_y, VOC and O₃ were used to analyze the daily and seasonal as well as weekday/weekend variations of these species. Further, CAMx (Comprehensive Air quality Model with extensions) model was used to simulate the air quality in the Houston area. Diurnal variations of CO, NO_x, NO_y, VOC and O₃ were observed in the Houston area. Average O₃ concentrations were higher in summer than in winter due to higher photochemical reactions in summer. Lower CO and NO_x concentrations were observed during weekend than weekday, average peak concentrations of CO and NO_x at weekend were lower than those on weekday. O₃ concentrations were higher during weekend than those on weekday; average peak concentrations of ozone at weekend were higher than those on weekday.

85. RAMAN SPECTROSCOPY OF 1T'-MOTe₂ ULTRATHIN LAYERS

Logan Winford,¹ Adam W. Tsen² & Rui He¹

¹University of Northern Iowa & ²University of Waterloo, Ontario, Canada

MoTe₂ is an important transition metal dichalcogenide that could be used to realize the type-II Weyl fermions. Bulk MoTe₂ has 1T' phase that is monoclinic and centrosymmetric at room temperature. At temperatures lower than ~200 K, it undergoes a phase transition into a T_d phase that is orthorhombic and has no inversion symmetry. In this project, we studied ultrathin (few-nm-thick) layers of MoTe₂ using variable-temperature Raman spectroscopy in a large temperature range of 10-420 K. We observed Raman signatures of the T_d phase in these ultrathin layers at room temperature.

86. ANISOTROPIC PROPERTIES OF EXFOLIATED MULTI-LAYERED SINGLE CRYSTAL V₂O₅

Gaihua Ye¹, Sukrit Sucharitakul², Zhipeng Ye¹, Xuan Gao² & Rui He²

¹University of Northern Iowa & ²Case Western Reserve University

Vanadium pentoxide, V₂O₅, is layered material. It is used in many industrial chemical reactions. For bulk V₂O₅, the lattice parameters are a=11.51 Å, b=3.56 Å, and c=4.37 Å. We probed vibrational and electrical properties of exfoliated flakes of V₂O₅ with thicknesses between 10-100 nm using Raman spectroscopy and electrical transport. We find that V₂O₅ is highly anisotropic in the plane. Intensities of Raman modes depend strongly on the relative orientation between the crystal axes and the directions of polarization of incident/scattered light. Through four-probe measurement, conductance anisotropy up to order of 10² between a and b crystal axis is observed. Moreover, samples show thermally activated carriers with activation energy extracted to be 0.11-0.14 eV through electrical conductance measurement at different temperatures. Through Hall measurement, the exfoliated samples show Hall mobility up to 7 cm²/Vs comparable to that of bulk crystals. Work at CWRU is supported by Air Force Office of Scientific Research (AFOSR) Grant FA 9550-12-1-0441. Work at UNI is supported by NSF CAREER Grant No. DMR-1552482 and RUI Grant No. DMR-1410496.

87. RAMAN SPECTROSCOPY OF INTERLAYER INTERACTIONS IN VAN DER WAALS HETEROSTRUCTURES

Zhipeng Ye¹, Pavel Lukashev¹, Diana Odhiambo², Michael Roth², Samuel Lane³, Hui Zhao³ & Rui He¹

¹University of Northern Iowa, ²Northern Kentucky University & ³University of Kansas

Van der Waals heterostructures are of great current interest because of their important applications in electronic and optoelectronic devices. We study MoS₂/MoSe₂ and graphene/MoS₂ stacked atomic layers using Raman spectroscopy. We

Be Part of the IAS Speaker Series at the Saylorville Visitor Center

Promote the Public Understanding of Science

**June - July - August
Saturdays at 2:00 p.m.**

General Interest Programs for families or adults are welcome!

Sign Up at:

www.scienceiniowa.org/saylorville

find that the Ag mode of MoSe₂ at around 240 cm⁻¹ shifts to higher frequency when graphene layers are stacked vertically to form heterostructures. However, this Ag mode from MoSe₂ remains at the same frequency when it forms vertical heterostructures with MoS₂. Density functional theory is used to probe the change of phonon frequencies and electronic band structures of these heterostructures.

Physiology & Health Sciences Poster Presentations



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

Iowa Academy of science
BRC 50
University of Northern Iowa
Cedar Falls, Iowa 50614-0508
(319) 273-2021
www.iacad.org