

The Ohio Academy of Science
117th Annual Meeting
 Hosted by
The University of Toledo
 April 11-12-13, 2008

About the Annual Meeting

The Ohio Academy of Science's Annual Meeting is for academic, governmental, and industry scientists and engineers, university and pre-college educators and teachers, and pre-college, undergraduate, and graduate students, and interested lay citizens in the Ohio region.

Welcome!

The University of Toledo welcomes you to the 117th Annual Meeting of The Ohio Academy of Science. We invite you to explore our campus and to share in the excitement and opportunities provided in this program.

REGISTRATION: Registration is required for all meeting presenters and attendees. On-site registration will be available at a higher rate. The Ohio Academy of Science must receive forms by April 1, 2008. Please use Registration Form on the last page. Mail completed form and fee to:

OAS Annual Meeting Registration

The Ohio Academy of Science
 PO Box 12519
 Columbus OH 43212-0519
 FAX 614/488-7629 (for Credit Card or PO only)

Registration by credit card or purchase order only will be accepted by FAX at 614/488-7629. Your registration materials, receipt, and name tag will be ready at the meeting registration desk upon your arrival. For further information, please call 614/488-2228.

An Adobe PDF form is available at:

<http://www.ohiosci.org/UTRegistrationForm.pdf>

Online payment option www.ohiosci.org/online.htm

Friday, April 11: Registration will not be open on Friday.

Saturday, April 12: Registration in the lobby of the Nitschke Hall from 7:30-11:00 AM. On-site registration is possible by check, VISA, or MasterCard. Cash is discouraged.

SATURDAY PARKING: Watch for signs. See map in program.

SMOKING POLICY: Smoking is not permitted in any building.

HOUSING: Please contact hotels and motels directly. See list on page 4.

MEALS:

Friday, April 11. None planned.

Saturday, April 12. Lunch available at nearby restaurants.

GENERAL SCHEDULE

Friday, April 11, 2008

3:00 PM-5:00 PM The Ohio Academy of Science
 Board of Trustees Meeting
 Room T.B.A.

Saturday, April 12, 2008

7:30 AM-11:00 AM **General Meeting Registration**
 Lobby of Nitschke Hall

8:30 AM-11:00 AM **Morning Podium Sessions**
 Nitschke Hall

9:00 AM-11:00 AM **Morning Poster Sessions**
 Nitschke Hall

9:00 AM-11:00 AM ***Lake Erie Symposium**
 Nitschke Hall Auditorium

11:15 AM **All-Academy Lecture**
 Nitschke Hall Auditorium



Ohio's Energy Future

By Mark R. Shanahan, PhD
 Energy Advisor to
 Ohio Governor Ted
 Strickland

MARK R. SHANAHAN is the executive director of the Ohio Air Quality Development Authority (OAQDA) and its Clean Air Resource Center. Appointed in 1989, he oversees the management of more than \$1.6 billion in outstanding bond issues as well as the Authority's research and special project programs.

On January 17, 2007, Governor Ted Strickland created the position of Governor's Energy Advisor through Executive Order 2007-02 and appointed Mr. Shanahan to the position. In that role, he is responsible for coordinating state agencies' efforts to develop a comprehensive Ohio energy policy and to implement the Governor's order to significantly reduce state agency energy consumption.

Mr. Shanahan oversees the work of the Ohio Coal Development Office, one of the nation's leading clean coal technology research, development and deployment programs. Since 1994, he has served as Ohio's Clean Air Ombudsman for small business.

An active member of the Air & Waste Management Association, he is group coordinator for the Technical Council's Environmental Management Group. He is also the Governor's delegated representative on the Third Frontier Commission.

Shanahan earned his Ph.D. from Case Western Reserve University. He received his M.A. (with honors) from the University of Pennsylvania and graduated from Boston College (magna cum laude, Phi Beta Kappa).

12:00 Noon	Lunch on your own Available at nearby restaurants.
12:15 PM	Official Notice of Annual Business Meeting for Academy Members Only. Nitschke Hall Room 5013
1:30-3:00 PM	*Lake Erie Symposium continued Nitschke Hall Auditorium

Sunday April 13, 2008

9:00 AM - 2:00PM **Earth Science Field Trip**

Paleozoic Bedrock and Quaternary Ecology and Geology of the Maumee Valley and Oak Openings Region of Northwest Ohio

Organized by
Mark J. Camp, Timothy G. Fisher, and Todd D. Crail

Registration note: There is a \$5.00 fee to defray costs. Please check and include this amount on the registration form at the back of this program.

Silurian and Devonian bedrock exposures along the Maumee River at Farnsworth Metropark, at Whitehouse, and near Sylvania provide opportunities to observe sedimentary structures of tidal flat deposition, stress features related to the faulting, mineralized vugs,

and various glacial markings. A stop at Fossil Park of the Sylvania Township Park System will allow collecting from the fossiliferous Middle Devonian Silica Shale.

A number of stops in the surrounding Oak Openings region, including Oak Openings Metropark and Preserve will lead to discussions about beach ridges, sand dune formation and chronology, Quaternary lake levels, shoreline depositional mechanics, the unique flora of oak savanna habitat, its relationship to sand dunes, and the recreation of oak savanna habitats. A newly discovered parabolic dune will be visited near Sylvania. Oak savanna habitats and relationships with sand dunes and shoreline features will be part of a visit to Nature Conservancy's Kitty Todd Preserve. A core will be pulled at Blue Creek near Whitehouse to demonstrate a radiocarbon dated sequence.

Assemble in Parking Lot 20 adjacent to Nitschke Auditorium at 8:30 AM. A picnic lunch and field trip guide are included.



THE UNIVERSITY OF
TOLEDO
1872

About Our Host

Chairperson, Local Arrangements
DR. NAGI G. NAGANATHAN, PhD
Professor and Dean
College of Engineering

THE UNIVERSITY OF TOLEDO is one of 13 state universities in Ohio. It was established in 1872 and became a member of the state university system in 1967. The University of Toledo and the Medical University of Ohio merged this year to form the third-largest public university operating budget in the state.

UT is a community built around eleven academic colleges and professional programs matched only by a handful of public universities nationwide, including The Ohio State University and the University of Michigan.

UT's main campus, located along the banks of the Ottawa River in a residential section of the city, includes historic buildings, modern facilities, contemporary residence halls and abundant green space.

The University of Toledo Health Science Campus is home to UT Medical Center hospitals and clinics and many of UT's health-science research and education programs that are teaching the next generation of physicians, nurses and other health care professionals.

Local Restaurants

Arturo's Fritz & Alfredo's

3025 N. Summit St.
Toledo, OH 43611
(419) 729-9775

Blarney Irish Pub

601 Monroe St.
Toledo, OH 43604
(419) 418-2339

Cousino's Navy Bistro

30 Main St.
The Docks at International
Park
Toledo, OH 43605
(419) 697-6289
(419) 697-6333

Crystal's Restaurant & The

Brasserie Bar
Clarion Hotel
3536 Secor Rd.
Toledo, OH 43606 (419) 535-
7070

Eddy B's

National City Bank Building
405 Madison Ave.
Toledo, OH 43604
(419) 246-3339
(419) 246-9591

Eileen's Wine & Martini Bar

The Docks at International
Park
26 Main St.
Toledo, OH 43605
(419) 697-6289

El Camino Real – West

2500 W. Sylvania Ave.
Toledo, OH 43613
(419) 472-0700

Erie Street Chowder House

237 S. Erie St.
Toledo, OH 43604
(419) 241-2620

Focaccia's Delicatessen

333 N. Summit St.
Toledo, OH 43604
(419) 246-3354

Frisch's Big Boy Family

Restaurants at Multiple
locations: Greater Toledo Area

Georgio's Café International

426 N. Superior St.
Toledo, OH 43604
(419) 242-2424
(419) 242-2155

Glass City Café

1107 Jackson St.
Toledo, OH 43604
(419) 241-4519
Fax: (419) 241-4769

Glass Pavilion Coffee Bar

Toledo Musuem of Art

2445 Monroe St.

Toledo, OH 43620
(419) 255-8000

Grumpy's Deli

34 S. Huron St.
Toledo, OH 43604
(419) 241-6728

HomeSlice Pizza

Historic Warehouse District, St.
Clair Village
28 S. St. Clair St.
Toledo, OH 43602
419-724-PIES (7437)

Library Cafe by Eddy B's

325 Michigan St.

Toledo Lucas County

Library - Downtown

Toledo, OH 43604
(419) 259-5212

Mad Mike's

Park Inn - Toledo
101 N. Summit St.
Toledo, OH 43604
(419) 241-3000
(419) 321-2099

Madison Bistro - Downtown

Toledo
Historic Spitzer Building
520 Madison Ave.
Toledo, OH 43604
(419) 244-4800
Fax: (419) 244 -0068

Mancy's Steakhouse

953 Phillips Ave.
Toledo, OH 43612
(419) 476-4154

Manhattan's Restaurant

1516 Adams St.
Toledo, OH 43624
(419) 243-6675
(419) 243-6535

Manos Greek Restaurant & Bar

1701 Adams St.
Toledo, OH 43624
(419) 244-4479
(419) 255-8881

Michael's Café & Bakery

101 Main St. (at Front St.)
Toledo, OH 43605
(419) 698-2988
(419) 698-1880

Mo Joe's

300 Madison Ave.
Toledo, OH 43604
(419) 244-1055

Murphy's Place

151 Water St.
Toledo, OH 43604
(419) 241-7732
(419) 241-7734

Oliver House Restaurant Complex

27 Broadway St.

Toledo, OH 43602
(419) 241-1253
(419) 243-9256

Packo's at the Park

7 S. Superior St.
Toledo, OH 43602
(419) 246-1111

PJ's Deli

500 Madison Ave.
Toledo, OH 43604
(419) 241-3354
(419) 241-3019

Real Seafood Co. of Toledo

The Docks at International
Park
22 Main St.
Toledo, OH 43605
Toll free:(888) 456-DINE
(3463)

Rockwell's Restaurant

The Oliver House Restaurant
Complex
27 Broadway
Toledo, OH 43602
(419) 241-1ALE (1253)

Rouge Bistro

6060 Renaissance Place
Toledo, OH 43623
(419) 824-5890
Fax: (419) 824-5893

Schmucker's Restaurant

2103 N. Reynolds Rd.
Toledo, OH 43615
(419) 535-9116

Spaghetti Warehouse

42 S. Superior St.
Toledo, OH 43602
(419) 255-5038
Fax: (419) 255-9225

Tango's Mexican Cantina

24 Main St.
The Docks
Toledo, OH 43605
(419) 697-4678

The Original Pancake House

3310 W. Central Ave.
Toledo, OH 43606
(419) 578-0342
(419) 578-0344

Toledo EasyStreet

822 Washington St.
Toledo, OH 43624
(419) 255-0010
Fax: (419) 246-9846

Toledo Museum of Art Café

2444 Monroe St.
Toledo, OH 43620
(419) 255-8000

Tom's Bar BQ & Grill

702 Front St.
Toledo, OH 43605
(419) 697-7400

Tony Packo's Café - Front St.

1902 Front St.
Toledo, OH 43605
(419) 691-6054
(419) 691-4865

Wesley's Bar & Grill

1201 Adams & Twelfth St.
Toledo, OH 43624
(419) 255-3333
Fax: (419) 930-3333

Zia's Italian Restaurant

The Docks at International
Park
20 Main Street
Toledo, OH 43605
(888) 456-DINE

Local Accomodations

Clarion Hotel and Conference Center

2340 S. Reynolds Rd.
Toledo, OH 43614
(419) 865-1361
Fax: (419) 865-6177

Clarion Westgate

3536 Secor Rd.
Toledo, OH 43606
(419) 535-7070
(419) 536-4836

Comfort Inn Westgate

3560 Secor Rd.
Toledo, OH 43606
(419) 531-2666

Hilton Toledo

3100 Glendale Ave.
Toledo, OH 43614
(419) 381-6800
(419) 389-9716

Holiday Inn / Splash Bay Indoor Water Park

1705 Toll Gate Dr.
Maumee, OH 43577
(419) 482-7777
Fax: (419) 897-0055

Park Inn Toledo

101 N. Summit St.
Toledo, OH 43604
(419) 241-3000
(419) 321-2099

Red Roof Inn - Toledo Westgate

3530 Executive Pkwy.
Toledo, OH 43606
(419) 536-0118

Toledo Riverfront Hotel, soon to be Crowne Plaza

444 N. Summit St.
Toledo, OH 43604
(419) 241-1411 or (419) 241-
1855

Index to Sessions

Symposium:

Declining Water Quality in the Western Lake Erie Basin: Increasing Invasion of Blue-Green Algae (Cyanobacteria), and Increasing Levels of Soluble Reactive Phosphorus

9:00 A.M. - 11:00 A.M. and
1:30 PM-3:00 PM
Nitschke Auditorium p. 5-9

Biology

Podium Session

9:00 AM
Nitschke Hall Room 1052 p. 10

Engineering, Mathematics and Environmental Sciences

Podium Session

8:30 AM
Nitschke Hall Room 5065 p. 11

Ecology and Molecular Ecology

Podium Session

9:00 AM
Nitschke Hall Room 5013 p. 13

Medicine and Health

Podium Session

9:00 AM
Nitschke Hall Room 4020 p. 15

Ecology

Podium Session

9:00 AM
Nitschke Hall Room 2004 p. 17

Medicine, Health and Physiology

Podium Session

9:00 AM
Nitschke Hall Room 3004 p. 17

Poster Session-Multidisciplines

09:00 AM – 11:00 AM
Nitschke Hall Commons p. 19

Declining Water Quality in the Western Lake Erie Basin: Increasing Invasion of Blue-Green Algae (Cyanobacteria), and Increasing Levels of Soluble Reactive Phosphorus

A Symposium co-sponsored by: The Ohio Fracture Flow Working Group

Organized by Dr. Julie Weatherington-Rice
Co-Coordinator Ohio Fracture Flow Working Group
298 W. New England Ave.
Worthington, Ohio 43085
Phone 614-436-5248 Fax 614-436-5239
E-mail weatherington-ri.1@osu.edu

Statement of Need/Purpose and Background of Topic

Through the combined efforts of numerous federal, state, and local agencies, Ohio research colleges and universities, and citizens of the Western Lake Erie Watersheds, the water quality of Western Lake Erie has improved significantly, from the poor water quality in the 1950's and 1960's. The improvement has continued even while invasive species populations have expanded in the lake. By the mid-1990s, the total phosphorus levels in the lake had been reduced to the recommended US Environmental Protection Agency levels. However, about the same time, the levels of soluble reactive phosphorus began to climb. Soluble reactive phosphorus was found in surface water flowing in from the watersheds, feeding the western lake. The rising quantity and storm-driven pattern of delivery was identified by the National Center for Water Quality Research members associated with Heidelberg College in Tiffin, Ohio. Members of this research group began notifying colleagues in professional organizations and at the relevant agencies of the upturn in soluble reactive phosphorus levels entering the western basin.

In the fall of 2006, after a prolonged northeastern storm, a species of blue-green algae (cyanobacteria), *Lyngbya wallei*, washed up on the shores of Maumee Bay. This species has never been documented in the Lake; it is found in the southern United States, especially in Alabama, Florida, and North Carolina and has not been found to be winter hardy. But when washed into the shallow warm waters of the Bay (which did not freeze during the winter of 2006-2007), the invasive algae successfully over-wintered and underwent a prolonged bloom, beginning in late March 2007. The condition was quickly reported to local governments and news outlets by local citizens who live and recreate on the bay. The Toledo Blade has published a number of feature stories on the invasion of the new type of blue-green algae.

The blue-green algae continues to inhabit the western basin, along with the natural summer bloom of the warm weather *Microcystis* blue-green algae. Dead algal mats that do not wash up on shore sink to the bottom of the lake and are carried out into the central basin. There, the biodegradation of these algae by microbes on the lake's bottom remove dissolved oxygen from the Lake's water. This depletion of dissolved oxygen expands the "dead zone" in the bottom of the lake.

This cycle and its impacts on fishing and tourism in the region were the topics of a recent article in the Columbus Dispatch on September 25, 2007. The article can be found at the following web link:

http://www.dispatch.com/live/content/science/stories/2007/09/25/sci_Erialgae.ART_ART_09-25-07_B4_7H7UMMK.html?print=yes&sid=101

To date, the only controlling mechanism that has been recognized to reduce the levels of blue-green algae growth in the western lake is reduction of the levels of soluble reactive phosphorus reaching the lake. To that end, the Ohio Environmental Protection Agency (EPA) has convened a Lake Erie Phosphorus Task Force, made up of the Federal and State agencies and university researchers who are studying/controlling the problem. The Task Force is charged with identifying the sources of soluble reactive phosphorus in the watersheds and making recommendations to reduce the delivered concentrations. The activities of the Task Force are tracked on the following Ohio EPA Surface Water web site:

<http://www.epa.state.oh.us/dsw/cafo/PTaskForce/PTaskForceWorkgroup.html>

Significance of Topic to Science and Society, Including the Economy and Quality of Life

In short, if a method to reduce the levels of soluble reactive phosphorus reaching the western lake is not found, this part of the lake is likely to become eutrophic and stagnant. The tourist industry of the 'North Coast' of Ohio centers on lake activities and the masses of blue-green algae will significantly impact these activities. In addition to the public nuisance of rotting mats of *Lyngbya wollei* and *Microcystis* on the beaches and in the shallow waters of the Lake, these algae are toxic. If these algae are collected in the raw water intakes of public-water supplies of the area, the suppliers will either have to explore new methods to treat the water or find alternative sources and these options will require extensive outlays of public funds. The algal mats not washed up on the shores and beaches of the western lake will be carried into the central basin where their decomposition will enhance and expand the 'dead zone'. The expanding dead zone will further impact fishing and tourism in the central and eastern basin of the lake.

As we are learning from the research undertaken by the Ohio EPA Task Force members, even if delivery of soluble reactive phosphorus is reduced, the tipping point in the watersheds and the western lake may have already been reached. Reversing the trend in soluble reactive phosphorus inputs to the Lake will involve more science and educating the people living in the contributing watersheds to undertake land use and lifestyle changes.

Audiences

This interdisciplinary topic requires researchers from a variety of fields to investigate the issues and help solve the problems. The outcomes have extensive ramifications in both public health and the economic stability of the region. One goal of this symposium is that it will attract not only a good cross section of all of the members of the Ohio Academy and their students, but that interested members of the affected community also will attend. To that end, we will publicize this symposium in the area.

This is an extremely complicated, interdisciplinary problem without simple answers. It will require the dedicated efforts of a host of scientists and engineers to define and solve the myriad components of the problem. However, in the end, the solution(s) to the problem will have to be implemented by the citizens living in the watersheds that feed the lake. They will have to modify their lives and their land uses to reduce the food for the exploding blue-green algae populations. If the citizens of the watershed do not understand the magnitude of the problem, they will not be willing to undertake the life-style changes that are necessary to reverse the delivery processes of the soluble reactive phosphorus.

Intended Learning Objectives and/or Benefits for Participants

For a number of the Ohio Academy members coming to the symposium, this may be their first introduction to the topic. The Ohio EPA Task Force members are still identifying the segments of the basins' populations who will hold the keys to solving the problem. We need to expose as many scientists and engineers to the problem as we can so that we can broaden the problem-solving base. It is possible that we will trigger the interest of a student or an established researcher who will then, in later research efforts, help to find some of the solutions we need to keep the soluble reactive phosphorus out of the lake and/or economically remove it once it is there. It has been our experience in the Working Group that broad outreach helps to find the scientists and engineers who can help us answer our questions and concerns. We have found that very often, the people best able to help solve our problems did not even know we needed their help.

As the Ohio EPA Task Force has established, the symposium will provide an atmosphere that will allow people of all backgrounds and disciplines to discuss the issues related to soluble reactive phosphorus and algae in the lake. The symposium will provide the ability for the group present to explore the Lake's condition from a variety of positions. It will promote the atmosphere of synergism that may lead to creative solutions of the problem(s). The symposium should help the current researchers collect ideas and approaches. It will expand our collective knowledge base and may also help to increase the ranks of those working to research/solve the issues at hand.

Symposium Content, Format and Schedule

The Symposium consists of a series of invited presentations. While we have identified several speakers, others were identified as part of the general abstract review. Currently, the following individuals and groups have been identified as presenters.

1. Julie Weatherington-Rice, Co-Coordinator Ohio Fracture Flow Working Group. The Ohio Fracture Flow Working Group will convene the symposium. To begin the discussion, Julie Weatherington-Rice will host the symposium and present an overview of the situation, identify the researchers involved, and outline the land-use practices identified to date by the Ohio EPA Lake Erie Phosphorus Task Force that may be driving the delivery of the soluble reactive phosphorus.

2. The second presentation discusses the topic of the exploding populations of blue-green algae in the western basin and its implications to the economy and health of the region. University of Toledo professor Tom Bridgeman will present this topic.

3. Expanding on Tom Bridgeman's presentation, Hui Wang, also from the University of Toledo, will discuss issues relating to the detection and quantification of the historic *Microcystis* algal blooms in the lake.

4. A connection between the blue-green algae populations and the increase in available reactive phosphorus in the water column is the next necessary link to understanding the problem. This link will be presented by Douglas Kane, Defiance College, building on the work of a team of researchers located at Defiance College, Heidelberg College, and The Ohio State University.

5. Following Douglas Kane's presentation, there will be two presentations led by The Ohio State University researchers exploring other relationships that also impact the water quality in the lake. Joseph Conroy will discuss the annual trends of dissolved oxygen depletion in the lake as it relates to weather.

6. Another member of Conroy's team will further discuss the importance of light penetration and chlorophyll concentrations on metalimnetic oxygen maxima in the lake which drives the formation of the lake's "dead zone".

7. This set of six speakers completes the morning session. At the end of the six presentations, the presenters will convene a panel to answer questions from the audience and/or from the other speakers. The morning session is scheduled to begin at 9:00 AM and finish at 11:00 AM in time for the All-Academy lecture.

8. To begin the afternoon session, the seventh presentation will explain the identification of ever-increasing volumes of soluble reactive phosphorus moving from predominantly agricultural watersheds into the western basin. David Baker from the National Center for Water Quality Research at Heidelberg College will present their historic and current findings.

9. Once the incoming levels of soluble reactive phosphorus have been identified, the next issue is the identification of the source(s) of the phosphorus. Rick Wilson, Ohio EPA Division of Surface Water, will present his experience in sampling for phosphorus, including soluble reactive phosphorus, and then couple those experiences with information gathered from an exhaustive literature search on the topic. This presentation will document the relationship between high phosphorus levels in the surface soils in agricultural land uses and the movement of that excess phosphorus into the surrounding surface water.

10. John Crumrine's research at Heidelberg College's National Center for Water Quality indicates that there is a linkage between existing phosphorus soil test data and soluble reactive phosphorus levels in the watersheds feeding Lake Erie. His findings will be presented in this ninth presentation.

11. After these nine presentations have been given, all of the presenters will convene as a panel of experts who will address questions from the audience. The panel members will discuss current voids in the understanding of the system and identify additional research that needs to be undertaken. Where possible, the panel will make recommendations to the citizens that can be implemented to begin to reduce the loading rates to the lake. The afternoon session is scheduled to begin at 1:30 PM and continue until 3:00 PM and/or until the audience and panel has completed their discussions.

Schedule

It is assumed that a meaningful symposium will last two hours in the morning and at least one hour in the afternoon. Each presenter will need approximately 15 minutes to provide quality information to the attendees. We are expecting that the National Center for Water Quality Research presentation by David Baker may require up to 30 minutes. Therefore, the six presentations and the first panel should be completed in the first two hours of the symposium. The last three speakers and the larger panel are scheduled for at least one and one-half hours in the afternoon.

Qualifications of Speaker and Arranger(s)

The speakers and/or organizations that are being represented are all recognized for their long-term commitment to the topic as well as for the quality of their research and presentations. It is the objective of the Ohio Fracture Flow Working Group to insure the same level of excellence in the symposium presentation.

The Ohio Fracture Flow Working Group has a long and successful working relationship with The Ohio Academy of Science. First organized under the umbrella of the Earth and Space Sciences Section in 1993, the Working Group has held numerous bi-annual stand-alone symposia and field days and joint symposia with The Ohio Academy of Science since the first symposium organized at the 1994 meeting that was also held in Toledo. In addition, members of the Working Group also conducted a symposium and field trip during the April 2006 Geological Society of America North Central Meeting at the University of Akron. The Working Group has also published two special issues of *the Ohio Journal of Science*, the June-September 2000 and the April 2006 issues. A third issue on the broader topic of fractured glacial till is planned to showcase the continuing critical research on this topic.

Abstracts for Each Presentation and the Symposium

Abstracts for each of the presenters have been submitted, peer-reviewed and published beginning on page 8. Abstracts were requested by the Working Group from many of the identified presenters. Other abstracts were identified as part of the general abstract review process.

Dissemination of working papers or presentations

Typically, presentations from Working Group symposia are collected and made available to interested attendees for the nominal cost of duplication and mailing. That effort can be offered for this symposium. In the past, we also have video-taped presentations and made the tapes available in the same way. Both options are available here. These activities clearly fall under the mandate of the Working Group and can be handled without additional assistance from The Ohio Academy and/or by members of the organizing committee.

The Ohio Academy of Science
Annual Meeting-April 12, 2008
The University of Toledo
Lake Erie Symposium Morning Session

Nitschke Auditorium

09:00 AM

INTRODUCTION TO THE "DECLINING WATER QUALITY IN THE WESTERN LAKE ERIE BASIN" SYMPOSIUM. Julie P. Weatherington-Rice, weatherington-ri.1@osu.edu, Bennett & Williams Environmental Consultants Inc., Columbus, OH 43231.

Beginning in the mid-1990s, the National Center for Water Quality Research at Heidelberg College, Tiffin OH, noted an increase in the soluble reactive phosphorus portion of the total phosphorus in surface water collected at their sampling stations in northern Ohio. The levels of soluble phosphorus have continued to increase during the last decade (1997 through 2007), although levels of total phosphorus have remained constant or declined. During the fall of 2006, an invasive southern fresh-water blue-green algae (cyanobacteria), *Lyngbya wollei*, was first identified in Maumee Bay. Identification and habitat research was spearheaded by researchers at University of Toledo's Lake Erie Center. These two research organizations and the Western Lake Erie Association convinced the Ohio Environmental Protection Agency to convene the Lake Erie Phosphorus Task Force, which was charged with identifying the source(s) of the increased levels of soluble phosphorus (consumed by the blue-green algae), and making recommendations for curtailing loading levels. The Task Force has identified a number of sources of soluble phosphorus and is examining them methodically to determine which provide major contributions. Identified sources include agriculture, point sources, urban/residential sources, internal loading in the lake, and other natural sources. This symposium will report on the research efforts of Task Force members and other scientists, including discussions of identified phosphorus reduction techniques that can be adopted by the citizens of the watersheds to slow down and/or reverse the eutrophication of the Lake, ostensibly caused by degradation of algal mats at the bottom of the Lake.

09:15 AM

CHRONOLOGY OF HARMFUL ALGAL BLOOMS IN WESTERN LAKE ERIE: 2002-2007 Thomas B. Bridgeman, Thomas.Bridgeman@utoledo.edu, University of Toledo Lake Erie Center, 6200 Bayshore Rd Oregon OH 43618

Since the mid-1990s, harmful algal blooms have plagued the waters of western Lake Erie with increased frequency. These blooms adversely affect water quality in terms of aesthetics, recreational use, and potentially, human health. In vessel-based observations made from 2002-2007, the most common nuisance species was *Microcystis aeruginosa*, a cyanobacteria that forms blooms during summer months. *Microcystis* blooms from 2002-07 were quantified using biweekly plankton tows (N=145) and a density separation method to separate *Microcystis* from other species. Patterns of bloom timing and density were then compared to USGS data from a major nearby tributary, the Maumee River, that is linked to bloom development by delivering the algal nutrients phosphorus and nitrogen to Lake Erie. Highest summer bloom volumes occurred in years with highest summer river flow (2003, 2004), while the lowest *Microcystis* volume occurred in the driest summer (2002). In addition to *Microcystis*, another cyanobacteria species, *Lyngbya wollei*, previously unreported in Lake Erie, formed large benthic mats along the southern shoreline of Maumee Bay in late summer of 2006. In September 2006, *Lyngbya* mats washed ashore, fouling beaches, private marinas, and shoreline property with layers of biomass up to 1.3 m thick. Early observations of *Lyngbya* mats suggest that the extent of shoreline fouling may depend on wind direction and water currents during the period in late summer when mats become mobile.

9:30 AM

DETECTION AND QUANTIFICATION OF MICROCYSTIS IN LAKE ERIE, OH. Hui Wang (jywanghui@hotmail.com), Cyndee Gruden, Cyndee.Gruden@UToledo.Edu

Dept of Civil Engineering, University of Toledo, 2801 W Bancroft St, Toledo OH 43606.

Microcystis blooms occur annually in the Western Lake Erie Basin. *Microcystis* produces a toxin which can be fatal to livestock and humans. Since Lake Erie is a drinking water source and a recreational site, it is necessary to minimize direct impacts to human health. The main objective of this research was to determine the factors affecting the spatial and temporal variation of *Microcystis* during and after a bloom in Western Lake Erie. In this study, surface water samples were collected from six sites (4P, GR1, 8M, MB18, MB20 and 7M) varying in distance from 2 to 30km from the mouth of the Maumee River. In situ measurements included dissolved oxygen concentration, pH, turbidity, and temperature. Samples were collected over a period of 3 months (6 events from July to October) in 2007. Each sample was settled in the graduated cylinder for 48 hours to separate *Microcystis*, and fluorescence microscopy was used to count *Microcystis* cells. *Microcystis* density ranged from 56 to 1.03×10^7 cells/ml. The massive *Microcystis* bloom occurred from mid-July to August when most sites sampled (11 of 18) had densities over 10,000 cells/mL. Site 8M located approximately 15km from the Maumee River had the highest concentration of *Microcystis* for 4 of the 6 sampling events. ANCOVA model was set up and analysis of environmental data as compared to *Microcystis* densities was performed by SAS program. The results suggest that temperature, nutrient concentration, turbidity, and DO concentration may have an impact on the *Microcystis* density.

9:45 AM

DECLINING WATER QUALITY IN WESTERN LAKE ERIE: CORRELATIONS BETWEEN SOLUBLE REACTIVE PHOSPHORUS (SRP) LOADING AND PHYTOPLANKTON BIOMASS. Douglas D. Kane, dkane@defiance.edu, Joseph D. Conroy, conroy.27@osu.edu, R. Peter Richards, prichard@heidelberg.edu, David B. Baker, dbaker@heidelberg.edu, David A. Culver, culver.3@osu.edu Defiance College, Natural Sciences and Mathematics Division, Defiance, OH, 43512.

Many hypotheses have been advanced to explain recurrent algal blooms in the western basin of Lake Erie, including abiotic (e.g., total phosphorus load) and biotic (e.g., dreissenid mussel excretion) explanations. We used two long-term (10 + year) datasets to test whether total phytoplankton biomass and cyanobacterial biomass correlated with soluble reactive phosphorus (SRP) loading from agriculturally-influenced tributaries (Maumee and Sandusky rivers) to the western basin of Lake Erie. We constructed linear regression models to determine if total phytoplankton biomass (and cyanobacterial biomass, individually) increased with recent SRP-load increases. Both total phytoplankton and cyanobacterial seasonal (May-October) average (arithmetic mean) wet-weight biomasses (mg L^{-1}) significantly increased with increased water-year total SRP load (metric tons = Mg) for the Maumee River (both total phytoplankton and cyanobacteria biomass vs. SRP load: $P = 0.008$, $R^2 = 0.56$) and the sum of SRP load for the Maumee and Sandusky rivers (total phytoplankton biomass vs. SRP load; $P = 0.007$, $R^2 = 0.57$; cyanobacteria biomass vs. SRP load: $P = 0.008$, $R^2 = 0.56$), but not for the Sandusky River ($P > 0.05$). However, when using seasonal median total phytoplankton and cyanobacterial biomasses as response variables to remove the influence of bloom events and the Beale Ratio Estimator to account for missing SRP data, only the relationship between median cyanobacterial biomass and Beale-ratio estimated SRP load were significant ($P < 0.05$). In conclusion, recent increased western basin tributary SRP loads possibly contribute to increases in phytoplankton biomass and more frequent algal blooms, especially cyanobacteria, in the western basin of Lake Erie.

10:00 AM

COMPARING ANNUAL TRENDS OF DISSOLVED OXYGEN DEPLETION IN LAKE ERIE: THE IMPORTANCE OF WEATHER. Joseph D. Conroy, conroy.27@osu.edu, Aquatic Ecology Laboratory, Department of Evolution, Ecology, and Organismal Biology, The Ohio State University, Columbus, OH 43212.

Studies of the temporal dynamics (e.g., dissolved oxygen depletion rate) and the annual areal extent of zones of hypoxia (low oxygen, $< 4 \text{ mg O}_2 \text{ L}^{-1}$) and anoxia (no oxygen, $< 1 \text{ mg L}^{-1}$) in Lake Erie often focus on the perceived influence of external nutrient load and, in turn, the perceived effects of people on affecting oxygen loss. However, bulk hydrodynamic processes as induced by weather may serve to diminish (e.g., through storm-caused mixing) or amplify (e.g., through water-column stagnation with low storm frequency) the effects of nutrient load on hypolimnetic oxygen loss. Here, I investigated how weather (wind speed) and associated hydrodynamic processes (wave height, water level) affected water

column dissolved oxygen concentration (DO) in the Sandusky subbasin of Lake Erie during 2005 and 2006. I measured temperature and DO at 0.5-m intervals with a calibrated multiparameter instrument (YSI Model 6600) at a site in the middle of the Sandusky subbasin on 19 and 17 dates in 2005 and 2006, respectively. Weather and hydrodynamic process data for both years were downloaded from National Oceanic and Atmospheric Administration websites (wind speed and wave height station 45005: <http://www.ndbc.noaa.gov>; water level station 9063079: <http://tidesandcurrents.noaa.gov>) and daily means were calculated. Initial water column stratification occurred in late-May following periods of calm, low wave-height weather conditions. Hypolimnetic DO dropped below 1 mg L⁻¹ by late-June in both years. The hypoxic zone maintained its volume under stagnant conditions and expanded and contracted with increased wind speed, wave height, and water level oscillations indicating the importance of weather and hydrodynamic processes on DO dynamics in Lake Erie.

10:15 AM

THE IMPORTANCE OF LIGHT PENETRATION AND CHLOROPHYLL CONCENTRATION ON METALIMNETIC OXYGEN MAXIMA (MOM) DEVELOPMENT IN LAKE ERIE. Joseph D. Conroy¹, conroy.27@osu.edu, Gwen L. Dubelko², dubelko.2@osu.edu, Sophie B. Lehmann³, slehmann08@wooster.edu, Douglas D. Kane⁴, dkane@defiance.edu, and David A. Culver¹, ¹Dept of Evolution, Ecology, and Organismal Biology, The Ohio State University, Columbus, Ohio 43212, ²School of Environment and Natural Resources, The Ohio State University, ³Dept of Geology, College of Wooster, and ⁴Natural Science and Mathematics Division, Defiance College.

Recurring seasonal hypoxia (low dissolved oxygen DO concentration, < 4 mg O₂ L⁻¹) and anoxia (< 1 mg L⁻¹) greatly affects pelagic and benthic biota in Lake Erie's central basin. Here, we report the presence of metalimnetic oxygen maxima (MOM) throughout the Sandusky subbasin, the southwest portion of the central basin during 2005, 2006, and 2007. Using weekly (or more frequent) vertical-profile sampling of water temperature (degrees Celsius) and DO at 0.5-m intervals at seven sites in the Sandusky subbasin during summer (June-August), we found that MOM frequently occurred (in 72 of 135 DO vertical profiles) during 2005-2007. We hypothesized that the shallow depth (mean depth = 13.3 m relative to the central basin mean depth = 18.5 m) and high productivity (as chlorophyll *a* concentration, Chl *a*) of the Sandusky subbasin permitted adequate light penetration (as Secchi Disk transparency, SD) facilitating metalimnetic phytoplankton growth. We tested this prediction in 2007 and found that deeper, eastern subbasin sites more frequently had DO profiles with MOM than shallower, western subbasin sites (about 67% of the profiles versus 33% for eastern and western sites, respectively). However, neither Chl *a* nor SD predicted MOM occurrence ($P > 0.05$, $R^2 < 0.10$). These results reveal that either light penetration or the presence of primary producers is unimportant for MOM occurrence or that our temporal and spatial scales of investigation did not appropriately identify effect scales. Nevertheless, occurrence of MOM in the Sandusky subbasin and possibly the rest of the central basin may ameliorate hypoxic and anoxic conditions.

10:30-11:00 AM: Morning Panel Discussion

Lake Erie Symposium Afternoon Session
Nitschke Auditorium

1:30 PM

INCREASING TRENDS IN DISSOLVED PHOSPHORUS LOADING TO LAKE ERIE FROM NORTHWESTERN OHIO WATERSHEDS: 1994-2007. David B. Baker dbaker@heidelberg.edu, John P. Crumrine jcrumrin@heidelberg.edu, R. Peter Richards prichard@heidelberg.edu, and Jack W. Kramer jkramer@heidelberg.edu. National Center for Water Quality Research, 310 E. Market St, Tiffin OH 44883.

To support nutrient management programs in the Lake Erie Basin, the National Center for Water Quality Research at Heidelberg College has been monitoring the export of nutrients and suspended sediments from northern Ohio watersheds since 1975. Using automatic samplers located at U.S. Geological Survey stream gages, three or four samples per day have been collected on a year-round basis, with multiple samples per day analyzed during storm events and single samples per day during non-storm periods. Between 1976 and 1985, total phosphorus loads to Lake Erie averaged 13,299 metric tons, with nonpoint sources accounting for 72% of the total. These observations led to the initiation of various conservation tillage programs to reduce erosion and export of suspended sediments and particulate phosphorus. Between 1976

and 1995, these conservation programs resulted in reductions in suspended solids and total phosphorus loading from the Maumee and Sandusky watersheds by 22% and 44%, respectively. Dissolved reactive phosphorus had dropped by an even larger 86%. Although suspended sediment and particulate phosphorus loading has continued to decline since 1995, dissolved reactive phosphorus loading has increased dramatically, now reaching or exceeding the late 1970 values. Because 100% of dissolved reactive phosphorus is bioavailable to algae, these loading trends warrant examination as potential causes of recently observed increases in blue-green algal growth in western Lake Erie. The dissolved phosphorus loading from the Maumee and Sandusky watersheds is primarily associated with storm runoff events, which indicates that agricultural runoff is the major cause of the increased soluble phosphorus export.

2:00 PM

PHOSPHORUS TRANSPORT FROM THE SOIL TO SURFACE WATER, FIELD OBSERVATIONS SUPPORTED BY A REVIEW OF CURRENT LITERATURE. Patrick D. (Rick) Wilson Rick.Wilson@epa.state.oh.us. Ohio EPA, Division of Surface Water, CAFO Unit, Columbus, Ohio, 43216.

As part of the investigative practices of the Division of Surface Water-Concentrated Animal Feeding Operation Unit at the Ohio EPA, surface and subsurface drainage and in-stream water quality samples are collected during runoff events from the agricultural landscape (including manure application sites). Water quality analyses of these events indicate that the soluble phosphorus component of the total phosphorus concentration may be more significant than is regularly reported, and demonstrates the need for more multivariate data collection at the sub-watershed scale. These analyses support the data collected by the National Center for Water Quality Research at Heidelberg College, and also highlight the need to associate water quality data with watershed nutrient management and soils data. Because of significant increase of both soluble reactive phosphorus loads in watersheds draining into Lake Erie and blue-green algae populations in the western basin, the Ohio EPA established the Lake Erie Phosphorus Task Force. The Task Force has conducted an extensive literature review to further understanding of the relationship of phosphorus build-up in soils, nutrient management in the agricultural landscape and the translocation of soluble reactive phosphorus to surface water. Although cursory, field investigations and sampling of runoff in agricultural regions of the state (where nutrients are applied in the form of manure, and inorganic fertilizer) seem to correlate well with research conclusions from literature that suggest nutrients will be lost where nutrients are applied to land such that it is prone to runoff. Consequently, improved nutrient management techniques for fertilizers (timing, rate, form) will reduce the load of runoff from land.

2:15 PM

ELEVATED SOIL TEST PHOSPHORUS LEVELS MAY EXPLAIN INCREASING DISSOLVED REACTIVE PHOSPHORUS CONCENTRATIONS AND LOADS IN WESTERN LAKE ERIE TRIBUTARIES. John P. Crumrine jcrumrin@heidelberg.edu, David B. Baker dbaker@heidelberg.edu, R. Peter Richards prichard@heidelberg.edu. National Center for Water Quality Research, 310 E. Market St, Tiffin, OH 44883.

Over the past 12 years concentrations and loads of dissolved reactive phosphorus (DRP) have been increasing in western Lake Erie tributaries and may be leading to increased blue green algae growth and degraded water quality for swimming, fishing, and drinking. In the predominantly agricultural watersheds of the Maumee and Sandusky rivers, northwest Ohio DRP increases came from one or more of three sources: commercial fertilizers, animal manures, and soil fertility measured by soil test phosphorus (STP). An evaluation of STP data from commercial laboratories indicates that STP levels average twice those needed for optimal corn and soybean production. Data further show that reduced and no-tillage crop production systems can elevate STP levels at the 0-2 inch (0-5 cm) depth by as much as two times over levels from a standard 0-8 inch (0-20 cm) soil test. In counties having large livestock or poultry numbers, where past manure application has produced high standard STP levels, reduced tillage and no-till can cause very high STP levels at the 0-2 inch (0-5 cm) depth. In a study to evaluate phosphorus stratification in cropland soils of the Rock Creek watershed, Seneca County, Ohio, STP levels at the 0-2 inch (0-5 cm) depth were doubled under no-tillage and increased one and a half times under reduced tillage systems compared to a standard 0-8 inch (0-20 cm) soil test. As contrasted to commercial laboratory data, standard STP levels were not highly elevated, partly because of low livestock numbers within the watershed.

Biology—Nitschke Rm. 1052**Podium Presentations****Dr. Mark Headings, Presiding**

09:00 AM

POTENTIAL CHANGES IN THE FOREST COMMUNITY STRUCTURE OF THE LAKE ERIE ISLANDS DUE TO THE INVASION OF THE EMERALD ASH BORER (*AGRILUS PLANIPENNIS*). Megan A. Eckardt megan.a.eckardt@vanderbilt.edu, Douglas D. Kane, dkane@defiance.edu, 26700 Midland Rd., Bay Village OH, 44140.

The Emerald Ash Borer (*Agrilus planipennis*) is an invasive species of wood-boring beetle (Coleoptera: Buprestidae) that has recently invaded the Lake Erie Islands and is targeting and killing ash trees (*Fraxinus spp.*) endemic to the United States. An Emerald Ash Borer presence survey was conducted in Kelley's Island State Park in June of 2007, noting the incidence and severity of the signs of EAB presence, including dieback of crown branches, yellowing of leaves, and epicormic branching. In addition, a forest composition study was conducted to examine the composition of the forests with a high density of ash trees (Kelley's Island State Park, Kelley's Island, OH and Petersen Woods, Middle Bass Island, OH). Tree community comparisons were made with Boerner's 1984 study by calculating average synthetic importance values (IV) (mean of the relative frequency, relative density, and relative coverage) and then ranking each tree species according to Boerner's index scale (5-1, with 5 having the highest importance). Green (swamp) ash (*Fraxinus pennsylvanica*) had an IV of 4 and 5 on Kelley's and South Bass Islands, respectively. Twenty of 25 ash trees surveyed at Kelley's Island State Park showed at least two signs of EAB infestation. From these results, the prediction is that as the ash trees die as a result of EAB infestation, an opportunity will be created for succession in the forest canopy. The most likely tree species to replace ash and fill this open ecological niche in the high canopy of the Lake Erie Islands will be the silver maple (*Acer saccharinum*), as no other high canopy tree species was found to be of high importance in the current forest community.

09:15 AM

ASSESSMENT OF GENETIC MODIFICATION IN CENTRAL OHIO FOODS. Claire Brandon, cbrandon@capital.edu, Kerry Cheesman Capital University 1 College and Main PO Box 169 Columbus OH 43209.

Expansion of agricultural biotechnology has allowed for the development of genetically modified (GM) plants via gene transfer, allowing for enhanced traits. Genetic modification can be found around the world in soybean, corn, and cotton crops. Long term results of GM foods in consumers have yet to be determined and regulations controlling these products vary. The current system in the United States does not require GM foods to be labeled; however, if a food is labeled "organic" it must contain less than 5% GM content. A previous study was carried out to test local corn products for genetic modification. Analysis of corn products, such as corn meal and corn muffin mix, revealed a 70% rate (n=13) of GM in products with no indication of GM content on the labels. None of the corn products labeled "organic" (n=8) were found to contain GM within the detection limit of the assay. Work is currently being done on soy products such as soy nuts, soy chips, and soy flour to determine genetic modification. Using standard techniques and materials from Bio-Rad Laboratories, DNA was extracted and duplicated from various foods such as corn flour, corn chips, and corn muffin mix and amplified with PCR to detect the transgenic CaMV 35S promoter and/or NOS terminator sequences (found in approximately 85% of all GM foods). Samples were run on 3% agarose gels, along with GM-positive and negative controls, stained with ethidium bromide and visualized with UV light. Results will be used to compare the authenticity of labeled "organic" products and to determine the number of unlabeled soy products containing genetic modification.

9:30 AM

ENERGY ALLOCATION TO GROWTH BY JUVENILE GARTER SNAKES (*THAMNOPHIS SIRTALIS*) FROM TWO POPULATIONS COLLECTED IN DIFFERENT THERMAL ENVIRONMENTS. Spiro Mavroidis, smavroidis@defiance.edu, A. Ralph Gibson, a.gibson@csuohio.edu, Defiance College, 701 North Clinton, Defiance, OH 43512

The pattern by which energy is allocated to various processes (e.g., maintenance, growth, storage, and reproduction) and the way

this pattern changes in response to environmental fluctuations and/or life-history needs throughout the life of an animal may influence that individual's growth, survival, and reproductive success. Natural selection may act on animal characteristics that enhance the ability to acquire and allocate energy. The main objective of this study was to compare energy allocation patterns between two populations of common garter snakes (*Thamnophis sirtalis*) found at different elevations (Grand River Wildlife Area (GRWA: elevation 225m ASL), OH & Spruce Knob Lake (SKL: elevation 1158 ASL), WV). More specifically, do the two populations differ in the amount of energy allocated to growth? GRWA (N = 17) and SKL (N = 13) juvenile snakes were fed three times weekly over the five-week period while measuring food consumption, weight, and snout-vent length (SVL). Snakes were kept at 26°C with a 12L:12D photoperiod. Average weekly meal sizes for GRWA and SKL were 56.9% (s.d. = 21.8%, N = 85) and 61.3% (s.d. = 27.9%, N = 65) of their body mass. There was no significant difference in the amount ingested per week between the two sites ($t_s = 0.94$, $df = 28$, $P = 0.354$). In addition, initial and final mass and SVL measurements did not differ significantly between the sites ($t_s = 1.83$, $df = 28$, $P = 0.078$; $t_s = 1.48$, $df = 28$, $P = 0.150$, respectively). Finally, the mass and SVL change, expressed as a percent of initial measurements, were not significantly different between the sites ($t_s = 0.15$, $df = 28$, $P = 0.882$; $t_s = 0.54$, $df = 28$, $P = 0.596$, respectively). In short, for this age grouping and under common conditions, allocation to growth is similar between these two populations of garter snakes.

9:45AM

ALTERING LIFE HISTORY TRAITS: A SIZE-SELECTIVE PREDATOR DECREASES THE SIZE OF ITS PREY. Chelsea O. Bennice, bennice.1@osu.edu, Joseph D. Conroy, conroy.27@osu.edu, and David A. Culver, culver.3@osu.edu, Dept of Evolution, Ecology, and Organismal Biology, The Ohio State University, Columbus OH 43210.

Predators negatively influence prey primarily through decreasing their total abundance. However, size-selective predators may also decrease fecundity through selective removal of large, more fecund individuals. Removal of large individuals may decrease trophic efficiency by decreasing the energy reaching higher trophic levels. Better understanding of the interaction between a size-selective zooplanktivorous fish (young-of-year saugeye, *Sander vitreus* females x *S. canadense* males) and its zooplankton prey (*Bosmina* sp.) in an aquaculture setting is especially important in maximizing fish production. At Hebron State Fish Hatchery, Hebron, Ohio in 2003, we took zooplankton samples (0.5-m diameter, 64 μ m-mesh net tows) during the production season (April-May) in 12 ponds, measured *Bosmina* sp. individuals (mm) under a microscope (at 50 x) in the laboratory, and calculated neonate size (5th percentile of non-ovigerous females), the size at first reproduction (SFR, 10th percentile of ovigerous females), and maximum size (95th percentile of all measurements) for each pond on each date. Additionally, we calculated a predation index (number of saugeye m^{-3} produced in each pond) to relate prey size to predator density. We hypothesized that prey size would decrease with increased predation according to the size-efficiency hypothesis. From linear regression analyses (size = response variable, predation index = predictor variable) we found significantly smaller SFR ($F_{1,56} = 8.8$, $P < 0.01$, $R^2 = 0.14$) and marginally significantly smaller maximum size ($F_{1,56} = 2.6$, $P = 0.11$, $R^2 = 0.05$) with increased predation. These results reveal that size-selective predation may decrease prey size, especially reproductive size, potentially limiting trophic efficiency.

10:00AM

MATHEMATICAL MODEL AND EXPERIMENTAL RESULTS OF BIOFILM GROWTH. David A. Nassar - dan19@uakron.edu, Andrew E. Stine - aes27@uakron.edu, Curtis B. Clemons - curtis@amrl.uakron.edu, J. Patrick Wilber - pwilber@math.uakron.edu, Gerald W. Young - jerry@amrl.uakron.edu, Dept of Theoretical and Applied Mathematics, The University of Akron, Akron, OH 44325-4002, and Amy Milsted - milsted@uakron.edu, Dept of Biology, The University of Akron.

A biofilm is a community of microorganisms embedded in a matrix of polysaccharides, proteins and nucleic acids. The medical treatment of infections resulting from biofilms is complicated because biofilm microorganisms are more resistant to antimicrobial agents than the same microorganisms in non-biofilm conditions. This presentation describes a subset of a comprehensive experimental and mathematical modeling investigation addressing the treatment of biofilms in the respiratory tract. The subset study's purpose is to experimentally validate a mathematical model for

biofilm growth. Biofilms are produced by inoculating single colonies of bacteria (*Pseudomonas aeruginosa*) into 10ml of Tryptic Soy Broth and incubating at 37° C. The biofilms are grown for 1, 3, 5, and 7 days (n=4 biofilms per time point). Biofilms are imaged in light, fluorescent, and scanning electron microscopy to quantify thickness and composition. Biofilm thickness ranges from 5 to 20µm, and estimated volume-fractions of bacteria, extracellular polymeric substance (EPS), and void are 0.05, 0.64, and 0.31, respectively. The mathematical model consists of reaction-diffusion equations for the transport of soluble components (nutrient, antimicrobial, and detachment-promoting agent), coupled to population equations for the particulate components (bacteria populations, EPS, and liquid). A one-dimensional approximation through the thickness of the biofilm is used to solve for the soluble and particulate components and an evolution equation for the biofilm thickness. Effectiveness of antimicrobial treatment options, optimal dosing, and durations of treatment will be calculated with the model.

10:15AM

DESCRIPTION OF EXTRAFLORAL NECTARIES FOUND ON YARD-LONG BEANS, *VIGNA UNGUICULATA* L. WALP. SUBSP. *SESQUIPEDALIS* L. VERDC. Mark E. Headings¹, headings.1@osu.edu, Leslie Morris², morris.508@osu.edu, and Jackie Hammel³, hammel.8@osu.edu, ^{1,3}The Ohio State University Agricultural Technical Institute, 1328 Dover Rd, Wooster OH 44691, and ²USDA-ARS at The OSU Ohio Agricultural Research and Development Center.

Floral nectaries commonly occur on many of the flowering plants. Less known are extrafloral nectaries which occur on plant parts outside of the flower. Field investigations were conducted in 2007 with the objective of continuing to screen different types of beans for the presence of extrafloral nectaries. These nectaries provide a food source for nectar-seeking insects, such as certain ants, wasps, flies and beetles. The focus of this investigation is to determine and describe the presence of extrafloral nectaries on yard-long beans (*Vigna unguiculata* L. Walp. subsp. *sesquipedalis* L. Verdc.) Yard-long beans, are also classified as *Vigna sesquipedalis*. Plant material was examined under a Hitachi S-3500 variable pressure scanning electron microscope, from which 32 photos were produced. Extrafloral nectaries were found located on the stems adjacent to where the flower is formed and may be present on both sides of the stem. They appear as distinctly raised structures with one to seven orifices each. A young nectary has a plug in an orifice, and as the nectary matures, the plug is expelled and an additional new orifice, with a plug, is added. This process may continue until there are at least 7 orifices in the nectary. Over the past few years the authors have examined over 40 different types of beans of which three have very similar extrafloral nectaries to that of yard-long beans, namely, mung beans, adzuki beans and cowpeas (California Blackeye No. 5). Also, extrafloral nectaries have been observed on fava beans (Broad Windsor), but they are structurally different and are located on a different plant part.

10:30AM

THE EFFECTS OF INCREASING NESTING RESOURCES ON THE BIODIVERSITY OF ANTS (HYMENOPTERA: FORMICIDAE) IN URBAN GREEN SPACES. Russell L. Friedrich, (rfriedr@UTNet.UToledo.Edu), Stacy M. Philpott, (stacy.philpott@utoledo.edu), Department of Environmental Sciences, University of Toledo, 2801 W. Bancroft St., MSail stop 604, Toledo OH 43606.

Urbanization negatively affects biodiversity, yet few studies have examined the impacts of urbanization on insects. Furthermore, few examining biodiversity loss in urban areas have investigated specific characteristics of urban habitats limiting native biodiversity. For ants, the availability of potential nesting sites, an important factor in ant communities, may vary in different urban habitats. Three urban habitat types (2 gardens, 2 vacant lots, and 2 forests) were compared to examine the availability and ant preferences for different nesting resources (small and large hollow twigs and cavities).— Seventy-two artificial large hollow twigs (8.3 cm long, 6 mm opening), small hollow twigs (14 cm long, 2 mm opening), and spherical hollow cavities (5.22 cm³ to 12.77 cm³ long, 1 mm opening) were added to each of the six sites from May to August 2007 to determine whether nest site limitation impacts ant communities. Natural nests similar to those added artificially were also collected to compare occupancy percentage. Both artificial and natural nests were opened to calculate the percentage occupied by ants.— Across all habitats, small twigs represented 81.1% of natural nests, cavity nests represented 10.1%, and large twigs 8.2%. Ants occupied 19 % of natural large twigs, 23% of cavities,

and 7 % of small twigs. For artificial nests, 25% of large twigs, 1% of small twigs, and 1% of cavities were occupied. The high percentage of occupied artificial large twigs could imply this resource is limiting. Thus nesting resources are an important factor mediating ant communities in urban habitats.

10:45 PM

VASCULAR PLANTS OF THE KING ROAD LANDFILL, LUCAS COUNTY, OHIO Kristopher D. Barnswell, kbarnsw2@utnet.utoledo.edu, Daryl F. Dwyer, daryl.dwyer@utoledo.edu, University of Toledo, Toledo, OH 43606-3390.

Vascular plants of the King Road Landfill (KRL), located in Sylvania, Ohio were surveyed to evaluate the developing plant community and determine whether it was progressing towards a woodland representative of the Oak Openings Region. The KRL operated from 1954 – 1976; sandy soil obtained from a nearby borrow pit was used as cover material. The survey was made during the 2004-growing season using the USDA Forest Inventory and Analysis method for phase two plots. Late successional species were identified only in the older, eastern landfill section. Exotic species accounted for nearly 40% of the 151 species identified; several rare species (e.g., *Digitaria filiformis*, *Lupinus perennis*, and *Panicum lindheimeri*) were present. Regional, native plant communities were defined by surveying the vascular plants of four representative woodland communities within the Oak Openings Metropark: floodplain, sand barren, oak savanna, and deciduous forest. The plant species composition of the KRL was most similar to that of the oak savanna. However, comparative analysis revealed little true similarity to any of the regional woodlands (Jaccard Index values < 0.5). Two factors may be responsible for this: (1) an insufficient time period (30 years) to reach a mature plant community, and (2) the vegetation surrounding and colonizing the KRL also was dissimilar to that of the regional woodlands (Jaccard Index values < 0.5).

Engineering & Mathematics

Nitschke Rm 5065

Daniel Repperger, Presiding

8:30 AM

EQUATIONS OF THE SLOPE b AND Y-AXIS INTERCEPT a OF Y= a + bx. De Nguyen, denhung@earthlink.net, 9205 Telfer Run, Orlando FL 32817.

The purpose of this paper is to establish generalized equations for the slope b and y- axis intercept a of $y = a + bx$ (1) that epidemiologists use to study an association between two variables. Let consider an outbreak of food poisoning in which x represent levels of poison and y its victims. Their causal relationship is best defined by a linear correlation in the form of $y = a + bx$. A set of bivariate data is $(x_1, y_1), (x_n, y_n)$. Their representative line is a straight line. The bivariate data are divided into two groups A and B. The means of groups A and B are (x_A, y_A) and (x_B, y_B) . Their representative line is determined by these two points. By replacing x_A, y_A, x_B and y_B in equation (1):

$$y_A = a + x_A \quad (7)$$

$$y_B = a + x_B \quad (8)$$

The equations for b and a derive from equations 7 and 8 :

$$b = \frac{\Sigma y_B - \Sigma y_A}{\Sigma x_B - \Sigma x_A} \quad a = \frac{\Sigma y - b \Sigma x}{n}$$

The established equations b and a are accurate and simple. They will help epidemiologists in their work.

8:45 AM

COMPLEXITY OF VISUAL ICONICS OBJECTS AND INFORMATION THEORY. D. W. Repperger¹, daniel.repperger@wpafb.af.mil, C. A. Phillips², Denise L. Aleva¹, Steve C. Fullenkamp³, ¹Air Force Research Laboratory, AFRL/RHC/V, Wright-Patterson, AFB, OH 45433, ²Wright State University, ³General Dynamics Corporation, Dayton, OH.

An important goal of making complex displays more efficient in providing information to human decision makers is to ascertain the levels of complexity of visual iconic objects on the displays. Through performance studies, quantitative limits of human

information processing were obtained related to military iconic objects. The military iconic object set (MIL2525B) is the standard which was investigated. The hypothesis is that as visual iconic objects become more complex, they exponentially lose their ability to accurately portray information to decision makers. Seven subjects participated in an evaluation of a visually rendered military iconic object for up to ten degrees of complexity (dimension number). Subjects were required to make a binary choice on the state of a dimension at different presentation times. The accuracy of the subject's choice was determined. Across subjects and stimulus presentation times showed an exponential dependence between accuracy and dimension number with correlation greater than 0.92. The null hypothesis that no change in performance would occur as dimension number increased could be rejected with $p < .001$. The exponential rule between performance and complexity obtained shows that correct identification drops rapidly beyond 6 dimensions of the object. This study demonstrates that the design of military iconic objects must take into account humans limitations on their ability to glean information from displays in an efficient manner. Adding more data to complex displays is not necessarily productive in informing decision makers about intricate visual renderings.

9:00 AM

ESCHERICHIA COLI IN RECREATIONAL WATERS OF MAUMEE BAY STATE PARK: SOURCE IDENTIFICATION AND A TREATMENT SOLUTION; Colin de Saint Victor, colindsv@gmail.com; Daryl F. Dwyer, daryl.dwyer@utoledo.edu; Pamela S. Struffolino, pstruff@utnet.utoledo.edu; University of Toledo Lake Erie Center, 6200 Bayshore Rd. Oregon OH 43618; William G. Petruzzi, Hull and Associates, Inc., bpetruzzi@hullinc.com

Berger Ditch is a source of *Escherichia coli*, an indicator of fecal contamination, to the public recreational waters of Maumee Bay State Park (MBSP), located in northwest Ohio, on the shores of Lake Erie. We attempted to demonstrate that increased water flow and contaminant densities of *E. coli* would correlate to the occurrences of swimming advisories posted at the beach (densities of *E. coli* in the lake water, that exceed 126 colony forming units (CFU) per 100 ml). An automated system was installed 150 m upstream of the outlet of Berger Ditch to monitor flow conditions (direction, velocity, and depth) and collect water samples. Densities of *E. coli* in water samples were determined by membrane filtration and growth of bacteria using modified mTEC (incubation for 2 h at 35°C, followed by 44.5°C for 22 h). The average non-storm event discharge was approximately 13 cubic feet per second (cf/s) with densities of *E. coli* between 200 and 300 CFU/100 mL. Storm events caused stream discharge to increase to 100 cf/s or more; during these events, densities of *E. coli* typically exceeded 1,000 CFU/100 ml. Swimming advisories typically occurred during or after the high-flow events, and seem to occur after small increases in flow also. A model treatment wetland was designed using the *E. coli* and flow data, and is presented as part of this study.

9:15AM

COPPER CHLORIDE IMPREGNATED SORBENTS FOR IN-FLIGHT MERCURY CAPTURE IN COAL-FIRED POWER PLANTS. Sang-Sup Lee (lesp@email.uc.edu), Joo-Youp Lee (joo.lee@uc.edu), and Tim C. Keener (Tim.Keener@uc.edu) Dept of Civil & Environmental Engineering, University of Cincinnati, Cincinnati OH 45221-0071.

In the United States, the regulation for mercury emissions from coal-fired power plants will begin in 2010. Although a number of laboratory and field tests have been conducted with raw or chemically promoted activated carbons and non-carbon sorbents, economical and efficient sorbents for mercury removal still remain to be developed to minimize additional costs by mercury controls. This study examined the possibility of using copper chloride impregnated sorbents developed in our laboratory for mercury emissions control from coal-fired power plants. An entrained-flow reactor system was constructed to simulate in-flight mercury capture in ducts in an upstream particulate matter control device and test sorbents for their performance in mercury removal. Two kinds of copper chloride impregnated sorbents (CuCl₂-clay and CuCl₂-carbon) were prepared by impregnating 10 % copper chloride into montmorillonite K 10 clay and raw activated carbon respectively. In addition, brominated activated carbon (Darco Hg-LH) served as a benchmark sorbent with which mercury control capability of other sorbents could be compared. In the entrained-flow system, CuCl₂-clay showed Hg⁰ oxidation efficiencies of 60 ~ 85 % comparable to the mercury removal capability of Darco Hg-LH. In addition, CuCl₂-carbon demonstrated 3 ~ 10 % higher efficiencies in Hg⁰ removal than Darco Hg-LH at the similar injection

rates. The promising performance of the copper chloride impregnated sorbents warrants further testing as excellent sorbents for mercury emissions control from full-scale coal-fired power plants.

9:30AM

LONG - TERM TILLAGE EFFECTS ON SOIL CARBON. Alan P. Sundermeier, sundermeier.5@osu.edu, K.Rafiq Islam, islam.47@osu.edu, Ohio State University Extension, 639 Dunbridge Road, Ste 1, Bowling Green OH 43402.

Long-term tillage effects can significantly influence soil carbon content. Agricultural soil carbon (C) sequestration through conservation management is a viable option to improve soil quality. To evaluate the impacts of no-till (NT) on C sequestration in soil, composite soil samples at 0-7.5, 7.5-15, 15-22.5 and 22.5-30 cm of depth were randomly collected from 2, 23, and 40 year NT, and conventionally tilled (CT) plots in NW Agricultural Research Center at Wood County, Ohio. Soil samples were processed and analyzed for total extractable carbon (Ext C). Results indicated that tillage and soil depth significantly affected the amount of Ext C. When comparing Ext C values at the soil surface (0-7.5 cm): conventionally tilled plots had 5.5 grams Ext C/kilogram of soil (g/kg), 2 year no-till had 6.4 g/kg, 23 year no-till had 7.0 g/kg, and 40 year no-till had 10.0 g/kg. At the deepest sampling depth, 22.5-30 cm, Ext C values were: CT = 4.5 g/kg, 2 year NT = 2.5 g/kg, 23 year NT = 3.5 g/kg, and 40 year NT = 3.6 g/kg. On average, tillage effects were more pronounced at surface than at subsurface soil depth. Combined over soil depths (0 to 30 cm), the storage of carbon increased in response to NT. Results suggested that C sequestration in soils under long-term NT compared to CT is possibly due to surface deposition of crop residues, less disturbance, slow and efficient decomposition of residues, and greater physical protection.

9:45 AM

INTRODUCING A NEW OIL SEED CROP TO OHIO - WINTER CANOLA. Edwin M. Lentz, lentz.38@osu.edu, The Ohio State University Extension - Seneca County, 3140 S State Route 100, Tiffin OH 44883.

Winter canola (*Brassica rapa* L.) is a potential new crop for Ohio. Grain yields may be affected by stand establishment problems and/or winter survival. It was hypothesized that management practices, such as increased seeding rate or the use of fungicide-treated seed may increase grain yields. To test this hypothesis, the variety "Wichita" was established at two Ohio sites (near Custer and Fremont) in the fall of 2005 and 2006. Experimental design was a two-factor randomized block replicated six times. Treatments included three seeding rates of 6.7, 10.1 or 13.4 kg ha⁻¹ with or without a commercial fungicide, HELIX XTRA. In 2006, yields were 4477.3, 4431.4, and 4297.1 kg ha⁻¹ at Custer and 2414.2, 2481.5, 2556.8 at Fremont for the 6.7, 10.1 or 13.4 kg ha⁻¹ rates, respectively. Only the Fremont site, which had grain yields of 2263.9, 2353.1 and 2270.2 kg ha⁻¹ for the 6.7, 10.1 or 13.4 kg ha⁻¹ rates, respectively, survived the winter in 2007. In 2006, yields from fungicide-treated seed were 4399.6 kg ha⁻¹ and 2505.2 kg ha⁻¹ and yields from untreated seed were 4404.3 and 2463.1 kg ha⁻¹, at Custer and Fremont, respectively. In 2007, yields were 2281.1 for treated seed and 2311.6 for untreated seed at Fremont. An ANOVA test (p=0.05) showed yield means were not statistically different among the three seeding rates or between the means of treated and untreated seed. Results suggest that Ohio producers should not expect an increased yield response to larger seeding rates or the use of fungicide-treated seeds.

10:00 AM

GEOLOGIC CO₂ SEQUESTRATION RESEARCH IN OHIO. Douglas J. Mullett, doug.mullett@dnr.state.oh.us, Lawrence H. Wickstrom, larry.wickstrom@dnr.state.oh.us, Ohio Dept of Natural Resources, Division of Geological Survey, Columbus OH 43229-6693.

As we are dependent on the combustion of fossil fuels for electrical power generation, it is essential that we reduce greenhouse gas emissions to lessen the potential for anthropogenic global climate changes. Ohio's future energy plans include clean coal technologies, ethanol and synthetic fuels, and the management of CO₂, a major greenhouse gas. Developing Ohio's potential for sequestration with these new energy sources and production methods will be a challenge involving proper planning and siting of facilities and the implementation of new regulations. Geological sequestration involves the capturing of CO₂ from industrial air

emissions and permanently storing the collected gases in suitable geologic reservoirs. Potential reservoirs include depleted and producing oil and gas fields, unmineable coal seams, and deep brine-filled formations. Such reservoirs have naturally stored crude oil, natural gas, brine and CO₂ for millions of years. The Ohio Department of Natural Resources, Division of Geological Survey, in partnership with agencies from surrounding states, the U.S. Department of Energy, Battelle Memorial Institute, and academic institutions have been researching Ohio's potential for geologic sequestration since 2000. Early analyses of potential reservoirs included gathering and analyzing geological and geophysical data (mainly from the state's existing oil and gas records), which were then integrated through mapping and geostatistical techniques to provide three-dimensional models of subsurface units. These models form a base from which CO₂ sequestration capacities can be calculated. Initial assessments of Ohio's deep CO₂ storage capacity indicates that Ohio can potentially sequester approximately 45 billion tons of CO₂. Follow-up investigations, such as the completed 8,695 foot test well in Tuscarawas County, and pilot projects will provide more detailed information via drilling and analyses of deep wells, injection testing, and modeling.

10:15 AM

SOIL TEXTURES THAT SUPPORT FRACTURES IN THE GLACIALLY-DERIVED MATERIALS OF OHIO, MICHIGAN, IOWA, AND WISCONSIN. Eun Kyoung Kim, kim.916@osu.edu, Ann D. Christy, christy.14@osu.edu, and Julie Weatherington-Rice, weatherington-ri.1@osu.edu. The Ohio State University, Dept. of Food, Agricultural, and Biological Engineering, Columbus OH 43210.

Field investigations and laboratory experiments on fracture formation in glacially-derived materials across several Midwestern states were performed to identify the range of soil textures that were observed to support fracturing. The total data set included Ohio field data (n=143), Wisconsin field data (n=98), plus laboratory samples derived from Ohio (n=30), Iowa (n=1), and Michigan (n=1) soil cores. Grain sizes of the materials were determined according to USDA size classification (sand, silt and clay). Clay mineralogy was also analyzed by X-ray diffraction analysis on selected samples. Controlled fracturing experiments were performed in triplicate. Laboratory methods included grinding soil core samples, adding water and varying amounts of silica sand, pouring the mixtures into 8.5-inch diameter pans, allowing them to dry for over a week, and photo-documenting the presence or absence of fractures. The data generated by these lab experiments were added to the field data to develop statistical and practical predictive models. Based on the combined data set (n=273), glacially-derived materials and their soils were predicted to fracture if their grain size analysis showed less than 75% sand and greater than 6% clay. All texture classes of soils were predicted to sustain fracturing except loamy sand and sand. An implication of this work is that every glacially-derived soil in Ohio and their underlying glacially-related parent materials, with the exception of soils formed on beach ridges, kames, eskers, and outwash deposits, is likely to support fracture formation.

10:30 AM

INNOVATIVE TDR SENSOR-ASSISTED STUDY ON THE EFFECTS OF FREEZE-THAW ON SOIL BEHAVIORS. Javanni M. Gonzalez, jxg212@case.edu, Xinbao Yu, xxy23@case.edu, Yan Liu, y.liu@case.edu, Xiong Yu, xxy21@case.edu, Case Western Reserve University, Dept of Civil Engineering, Cleveland OH 44106-7201.

Freeze-thaw process is a major contributing factor to pavement deteriorations located in cold regions. Frost heave and thaw settlement compromises the performance of pavement subgrade by introducing non-uniform settlements. This process also induces earth pressure on embedded structures such as water pipes and tunnels. This research explored the use of Time Domain Reflectometry (TDR) technology to accurately measure the extent of freeze/thaw process cycles in soil. This research exploration is based on the fact that a significant change of dielectric constant results from the phase transition of water from liquid to solid status. Laboratory experiments were conducted where soil specimens were subjected to controlled freeze-thaw cycles. Both cohesive soil and non-cohesive soils were investigated. Monitoring instrument for freeze-thaw process include Time Domain Reflectometry (TDR) and those for measuring resistivity and temperature. Experimental results indicate TDR method is superior over the commonly used temperature probe and electrical resistivity meter in that TDR not only measures the entire time line of the freeze/thaw process but also accurately determines the instantaneous freeze/thaw status at a given time. TDR results are also less influenced by the soil constituents (soil type), environmental (salinity) and mechanical

factors (external stress). Two additional advantage of TDR for field applications is that the monitoring instrument is inexpensive and that measurements are automatic. Advancing the existing knowledge on the effects of freeze/thaw on soil mechanical properties requires innovative instrumentation to accurately measure the extent of freeze/thaw process cycles. This research indicates TDR technology was able to accurately identify the various stages in the freeze/thaw process (such as the beginning and ending point of freeze/thaw process and the percent of water phase transition between liquid and solid phase of these transitions). All of these transitions have important engineering implications. It thus is a promising technology to be incorporated in the study of the mechanics of soil freeze/thaw stages.

10:45 AM

MICROBIAL SOURCE TRACKING: A MODEL WATERSHED FOR STUDY OF PATHOGEN ORIGIN, FATE, AND TRANSPORT. Natsuko N. Merrick, nakano.8@osu.edu, Linda K. Dick, dick.80@osu.edu, Warren A. Dick, dick.5@osu.edu, The Ohio State University SENR, Hayden Hall, OARDC Wooster OH 44691.

Transport of human and animal wastes into natural waters can result in contamination with fecal pathogenic microorganisms that are increasingly becoming a serious health risk. However, difficulties of differentiating non-point sources of microbial pollutants limit the number of options to control the contamination. A reliable and practical microbial source tracking method is needed to establish the source of microbial pollutants and to develop land management strategies to interrupt transmission of the disease problems associated with contaminated water. To investigate the applicability of a host specific polymerase chain reaction (PCR) approach which would identify the source of microbial pollutants in the Sugar Creek watershed, fecal samples from humans and 8 different animals and base flow water samples from 11 sampling sites were tested with human, ruminant, horse, and swine specific PCR primers. Stringent host specificity was observed when the method was tested using fecal samples. However, the same method tested with water samples taken monthly from July to September 2005 revealed problems associated with the PCR reaction. Dilution of samples eliminated the inhibition problem, although this also lowers the sensitivity of the method. The relationship between the PCR results and land use patterns was examined to identify land management practices that could lead to microbial contamination. Recurrent positive PCR signals with the human specific primer were observed at the sampling points downstream from high-density residential areas. We conclude that base water flow may transport microbial pollutants from human wastes into receiving streams.

Ecology & Molecular Ecology

Nitschke Rm 5013

Matthew Neilson, Presiding

9:00 AM

GENETIC DIVERGENCE PATTERNS OF THE RAINBOW DARTER *ETHEOSTOMA CAERULEUM*: A WATERSHED ANALYSIS FROM MITOCHONDRIAL DNA SEQUENCES AND NUCLEAR MICROSATELLITES Amanda E. Haponski amanda.haponski@utoledo.edu, Timothy Bollin tim.bollin@tps.org, and Carol A. Stepien carol.stepien@utoledo.edu 6200 Bayshore Rd. Oregon OH 43618.

The Rainbow Darter *Etheostoma caeruleum* is a small benthic fish common in the eastern United States in stream riffles, whose population genetic structure in the Great Lakes region is largely unknown. The Ohio Environmental Protection Agency's (OEPA) Index of Biotic Integrity uses this species as an indicator for good water quality. Mitochondrial DNA sequences were analyzed from the cytochrome *b* gene and control region, along with nuclear microsatellite data, to compare the population structure and genetic variation of the rainbow darter within and outside of the Lake Erie watershed, including the Big Darby Creek, the Blanchard, Chagrin, Cuyahoga, Grand, and Little Miami Rivers, Ohio. Nucleotide sequences of the cytochrome *b* gene (1122 bp) revealed 34 different haplotypes. Two distinct and divergent population groups were recovered based on Bayesian Structure analysis and a $\hat{Q}_{ST} = 0.383$, one in the Lake Erie watershed (Blanchard, Chagrin, Cuyahoga, and Grand Rivers) and the other in the Ohio River system (Big Darby Creek and the Little Miami River), which did not share haplotypes. The two groups are genetically separated by a *p*-distance of 0.011, diverging ~550,000 years ago during the mid-Pleistocene Epoch according to our molecular clock calibration for darters.

9:15 AM

MOLECULAR, MORPHOLOGICAL, AND BIOGEOGRAPHIC RESOLUTION OF CRYPTIC TAXA IN THE GREENSIDE DARTER *ETHEOSTOMA BLENNIOIDES* COMPLEX Amanda E. Haponski amanda.haponski@utoledo.edu and Carol A. Stepien carol.stepien@utoledo.edu. 6200 Bayshore Rd, Oregon OH 43618.

DNA sequencing has led to the resolution of many cryptic taxa, which are especially prevalent in the North American darter fishes (Family Percidae). The Greenside Darter, *Etheostoma blennioides*, commonly occurs in the lower Great Lakes region, where two putative subspecies, the eastern "Allegheny" type *E. b. blennioides* and the western "Prairie" type *E. b. pholidotum*, overlap. The objective of this study was to test the systematic identity and genetic divergence distinguishing the two subspecies in areas of sympatry and allopatry in comparison to other subspecies and close relatives. DNA sequences from the mtDNA cytochrome *b* gene and control region and the nuclear *S7* intron 1 comprising a total of 1,497 bp were compared from 294 individuals across 18 locations, including the Lake Erie basin and the Allegheny, Meramec, Ohio, Susquehanna, and Wabash River systems. Results showed pronounced divergences ($\hat{d}_{ST} = 0.92 - 0.97$; p -distance = 0.025-0.039) among taxa presently designated as *E. b. blennioides*, *E. b. newmanii*, and *E. b. pholidotum*, as well as identification of a fourth clade in the Meramec River. Most traditional morphological characters were statistically significant ($P < 0.0001$) in distinguishing between populations of *E. b. blennioides* and *E. b. pholidotum*, including scale counts and degree of ventral squamation using a multivariate analysis of variance and chi-square tests; but overlapped, precluding accurate identification of individuals. The four significantly divergent taxa of the Greenside Darter complex should be further evaluated for potential elevation to species status.

9:30 AM

SOURCE IDENTIFICATION(S) FOR EXOTIC EURASIAN ROUND GOBY (*Apollonia melanostoma*) POPULATIONS IN NORTH AMERICA. A COMPARATIVE ANALYSIS OF NUCLEAR MICROSATELLITE AND MITOCHONDRIAL DNA SEQUENCE DATA. Joshua E. Brown, Joshua.Brown@utoledo.edu, Carol A. Stepien, Carol.Stepien@utoledo.edu, Lake Erie Center and Department of Environmental Sciences.

The Eurasian round goby *Apollonia melanostoma* (formerly known as *Neogobius melanostomus*) invaded the North American Great Lakes in 1990 via ballast water, where it quickly spread and has become one of the most abundant benthic fishes in the lower lakes. The round goby found a ready-made food source in the also-invasive dreissenid mussel population, and is prey to game fishes and preys upon their eggs and young. The objective of the present study was to elucidate the likely source population(s) for the North American introduction(s) and to evaluate spread patterns using a dual genome population genetic approach. We sequenced the mitochondrial DNA cytochrome *b* gene and analyzed seven nuclear microsatellite loci to test the genetic relationships of 1158 individuals from 25 North American and 22 Eurasian population sites. Results showed two subspecies in Eurasia – *A. m. melanostoma* centered in the Black Sea and *A. m. affinis* in the Caspian Sea drainage. Both lineages recently expanded into other parts of Eurasia, and only the Black Sea lineage colonized North America. High genetic diversity characterizes North American and Eurasian populations, supporting very large North American introductions originating from a large number of founding propagules. Allelic differences separate Great Lakes locations, indicating multiple introduction sources and significant population structure. Bayesian assignment tests, three-dimensional factorial component analysis, analysis of molecular variance, and contingency tests of genetic differentiation significantly link the central Great Lakes region with genotypes from the port of Kherson, Ukraine near the mouth of the Dnieper River in the north central Black Sea ($p > 0.75$). Other Great Lakes sites reveal different linkages. Genotypes that are common in the Great Lakes are also common in saline waters of the Black Sea, suggesting that the round goby likely will be successful in spreading throughout North American coastal estuaries – given transport and the opportunity.

9:45 AM

TEMPORAL AND SPATIAL POPULATION GENETIC STRUCTURE OF THE EURASIAN ROUND GOBY: INVASION PATTERNS IN THE GREAT LAKES. Emily A. Sopkovich Emily.Sopkovich@utoledo.edu, Joshua Brown (Joshua.Brown@utoledo.edu) & Carol A. Stepien (Carol.Stepien@utoledo.edu). Lake Erie Center and Dept of Environmental

Sciences, University of Toledo, 6200 Bayshore Rd, Toledo OH 43618

The Ponto-Caspian round goby *Apollonia melanostoma* (formerly *Neogobius melanostomus*) invaded the Lake St. Clair region in 1990 via ballast water. It quickly spread throughout the Great Lakes and is now one of the most abundant benthic fishes in the lower Great Lakes. The objective of this study is to test whether the genetic composition of the exotic population has remained the same from place to place and over the time course of the invasion. We sequenced the mitochondrial cytochrome *b* gene and analyzed eight newly-developed nuclear microsatellite loci to test for spatial and temporal patterns. We tested 397 individuals from 2-3 time periods (ranging from 1993 to 2007) at five locations in Lakes St. Clair, Erie, and Michigan. Results using the cytochrome *b* gene showed negligible temporal genetic change within round goby population sites and some spatial divergences among different locations ($F_{ST} = 0.000 - 0.172$). Microsatellite analyses revealed significant temporal genetic change in round goby samples from Lake Michigan between 1998 to 2007 ($F_{ST} = 0.106$). Samples from Lake St. Clair and the St. Clair River, the original introduction point, were each temporally consistent in genetic composition ($F_{ST} = 0.009$; 0.017, respectively), whereas those from Lake Erie changed ($F_{ST} = 0.021 - 0.048$). Therefore, peripheral population sites appear to have changed over the time span of the invasion, whereas central sites remained more genetically stable. In addition, there is spatial genetic structure among the different locations, likely reflecting differential introduction histories. Genetic information thus aids our understanding of the ecological adaptations underlying the round goby's invasion success.

10:00 AM

A TEMPORAL ANALYSIS OF WALLEYE GENETIC STOCK STRUCTURE IN LAKE ERIE. Jo A. Banda jo.banda@utoledo.edu, Carol A. Stepien carol.stepien@utoledo.edu, Great Lakes Genetics Laboratory, Lake Erie Center, University of Toledo, Toledo OH 43606

Walleye, *Sander vitreus*, is one of the most important exploited fish species in the lower Great Lakes, whose genetic stock structure is of importance to fishery management. Research using nuclear DNA microsatellite loci and mtDNA sequences have shown that many spawning groups of walleye in Lake Erie genetically differ due to spawning site philopatry by both males and females. This study is the first to test whether these walleye spawning population groups are temporally stable. We used variation at 10 nuclear microsatellite loci to compare the genetic composition of walleye spawning in the Maumee River (the largest Lake Erie spawning group) across 12 years; 1995 (N=50), 1998 (N=28), 2003 (N=76), and 2006 (N=51), and made statistical comparisons with our 2003 database from the 10 major Lake Erie spawning sites (N=410). Results showed no temporal differences among walleye spawning in the Maumee River in three of the four sampling years ($F_{ST} = 0.001-0.005$), indicating a common gene pool for all except the 2003 samples. The genetic composition of the 2003 walleye run in the Maumee River significantly differed from the other years ($F_{ST} = 0.045-0.056$), exhibiting more gene flow with other southern Lake Erie shore spawning groups ($F_{ST} = 0.001-0.002$). This 2003 run constituted the largest walleye recruitment year in Lake Erie for two decades, and greater gene flow may have enhanced recruitment, which merits further study. Our investigation illustrates the importance of testing temporal patterns of genetic variation (rather than a single year "snapshot") to understand stock structure.

10:15 AM

A LANDSCAPE GENETIC ANALYSIS OF GREAT LAKES YELLOW PERCH POPULATIONS IN RELATION TO THEIR VARIATION ACROSS NORTH AMERICA. Osvaldo J. Sepulveda Villet osepulv@utnet.utoledo.edu and Carol A. Stepien carol.stepien@utoledo.edu. Lake Erie Center, University of Toledo. 6200 Bayshore Rd. Toledo, OH, 43618.

The Yellow Perch, *Perca flavescens*, is a key North American sport and commercial fish whose abundances and distribution center in the lower Great Lakes. Its populations have fluctuated historically due to unstable recruitment patterns and exploitation. Our study analyzes population genetic structure across its native range, using a landscape genetics approach and provides an important management tool and interpretation of its phylogeographic and recent history. Eleven microsatellite loci and mitochondrial DNA control region sequences are analyzed for over 700 spawning individuals from Lakes Superior, Michigan, Huron, Erie, and Ontario with outlying populations from Lake Winnipeg, Lake Champlain, the upper Mississippi River Basin, and the Atlantic and Gulf coastal regions. Analyses include phylogenetic trees, pairwise divergence

comparisons, AMOVA partitioning, Mantel regression, Bayesian assignment, and Monmonier geographic networks. Appreciable fine-scale genetic structure in Lake Erie is described ($\hat{e}st = 0.179$, $P = 0.03$), ranging to pronounced broad-scale divergence Great Lakes versus Atlantic coastal populations ($\hat{e}st = 0.418$, $P < 0.0001$). This Atlantic coastal group did not contribute to the Post-Pleistocene founding of modern Great Lakes populations. Patterns in the Great Lakes suggest contributions from at least two primary glacial refugium groups. The Lakes house genetically separable population groups, with further population division in most. Yellow Perch spawning in eastern Lake Erie appear more closely allied to groups in Lake Ontario than to those in western Lake Erie.

10:30 AM

QUANTIFYING MICROCYSTIS SP. IN WESTERN LAKE ERIE AND MAUMEE BAY USING DENSITY SEPARATION AND MICROSCOPY, 2002-2006. Jesse E. Filbrun jessef@bgsu.edu Biology Dept. Bowling Green State University, Justin D. Chaffin jchaffi2@UTNet.UToledo.Edu Dept. of Environmental Sciences / Lake Erie Center University of Toledo, Thomas B. Bridgeman TBridge@UTNet.UToledo.Edu Dept. of Environmental Sciences / Lake Erie Center University of Toledo, 469 S. Summit St. #77 Bowling Green OH 43402

Growth of the toxic cyanobacteria, *Microcystis* sp., has increased in recent years in Maumee Bay and western Lake Erie resulting in harmful algal blooms (HABs) during summer months. To investigate environmental causes of HABs, it is important to quantify differences in algal abundance between months and years. However, because cell counts of *Microcystis* are time-consuming, it is difficult to process sufficient samples to adequately characterize multiple blooms. We developed a density separation technique that permitted relatively rapid quantification of *Microcystis* volume in archived zooplankton tows from western Lake Erie. We report the results of sample analysis for 2002-2006. *Microcystis* volume in samples collected approximately biweekly at six sites ($N = 145$) was determined in calibrated Imhoff cones and some samples ($N = 60$) were further processed to determine *Microcystis* cell density. Total cells in the sample and cell density in the lake water increased linearly with volume of *Microcystis* in samples ($r^2 = 0.84$ and 0.89), indicating that volume estimates can be used as a surrogate for cell counts. Averaging *Microcystis* cell density on a monthly basis for all sites allowed for temporal representation of bloom intensity, whereas monthly density by site allowed for a spatial illustration of the blooms. From heaviest to lightest *Microcystis* blooms (average monthly *Microcystis* volume $\cdot m^{-2}$ summed over July, August, September), the years are ranked as follows: 2003 ($355.2 \text{ ml} \cdot m^{-2}$), 2004 ($311.4 \text{ ml} \cdot m^{-2}$), 2006 ($233.5 \text{ ml} \cdot m^{-2}$), 2005 ($120.8 \text{ ml} \cdot m^{-2}$), 2002 ($54.5 \text{ ml} \cdot m^{-2}$).

10:45 AM

WHAT'S IN A NAME? NEW IDENTITY OF INVASIVE GOBIES IN THE GREAT LAKES. Matthew E. Neilson (matthew.neilson@utoledo.edu) and Carol A. Stepien (carol.stepien@utoledo.edu); Lake Erie Center and Department of Environmental Sciences, University of Toledo; 6200 Bayshore Rd, Oregon OH 43618

Exotic species often belong to poorly-understood groups whose true phylogenetic relationships are unknown. In areas prone to species invasion, such as the Great Lakes, this taxonomic confusion often obfuscates correct ecological comparisons, and thus renders conservation and management policies potentially invalid. The round (*Neogobius melanostomus*) and tubenose (*Proterorhinus marmoratus*) gobies - along with other members of the Ponto-Caspian neogobiin gobies - have undergone recent Eurasian range expansion, as well as establishing invasive populations in Great Lakes waterways. We sequenced mitochondrial and nuclear DNA from native and invasive populations of 14 neogobiin goby species to determine their evolutionary history. The lineage containing the round goby and its sister species was separate from that containing the remainder of the genus *Neogobius* (100% bootstrap support for both lineages), showing that the round goby belongs in a separate genus. The subgeneric name for the round goby (plus sister species) thus is elevated to generic status, making the new name of the round goby *Apollonia melanostoma*. We found genetic distance of 0.166 between freshwater and marine lineages of tubenose gobies, indicating species level separation. There are two separate species of tubenose goby - the original *P. marmoratus* in marine and estuarine habitats and the "new" freshwater species in Eurasian rivers and the Great Lakes. The freshwater tubenose goby was originally described as *P. semilunaris* Heckel 1837 (prior to its synonymy with *P. marmoratus*), and the name is resurrected for this taxon. This study highlights the use of genetic tools in

understanding and describing cryptic taxonomic diversity in invaded ecosystems.

Medicine & Health

Nitschke Rm 4020

Christopher Drummond, Presiding

9:00 AM

MIDGUT MITOCHONDRIAL TRANSHYDROGENASE IN WANDERING STAGE LARVAE OF THE TOBACCO HORNWORM, MANDUCA SEXTA. Kurt P. Vandock, kurtv@bgsu.edu, Stan L. Smith, stanlee@bgsu.edu, Carmen F. Fioravanti, cfiorav@bgsu.edu, Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43403.

Fifth larval instar *Manduca sexta* midgut mitochondria catalyze ecdysone conversion to the active hormone, 20-hydroxyecdysone, via ecdysone 20-monooxygenase (E-20M). The monooxygenase preferentially uses NADPH that would arise from a reversible transhydrogenase catalyzing the following reaction: $\text{NADPH} + \text{NAD}^+ \ll \text{NADP}^+ + \text{NADH}$. This mitochondrial transhydrogenase was characterized using isolated *M. sexta* midgut mitochondria. Organelles or mitochondrial membranes were isolated by differential centrifugation, and transhydrogenase activity was assessed by the NAD(P)H-dependent reduction of acetylpyridine-NAD(P). The transhydrogenase was indeed found to be reversible. The NADPH-forming reaction occurred as a nonenergy- and energy-linked activity with energy for the latter derived from electron transport-dependent NADH or succinate utilization, or by Mg^{++} -dependent ATPase. The NADH-forming and all NADPH-forming reactions were optimal at pH 7.5, stable to dialysis, and thermally labile. N,N -dicyclohexylcarbodiimide, an inhibitor of proton translocators, inhibited the NADPH \rightarrow NAD $^+$ and energy-linked NADH \rightarrow NADP $^+$ transhydrogenations, but not the nonenergy-linked NADH \rightarrow NADP $^+$ reaction. Oligomycin, an ATPase inhibitor, only inhibited the ATP-dependent energy-linked activity. All transhydrogenations were membrane associated. This is the first demonstration of the reversibility of the *M. sexta* transhydrogenase and, more significantly, the occurrence of nonenergy-linked and energy-linked NADH \rightarrow NADP $^+$ transhydrogenations. These findings make apparent an energetic relationship between the NADPH-forming reactions and the physiologically required E-20M.

9:15AM

EFFECTS OF CYCLIC GMP ON ECDYSONE 20-MONOOXYGENASE ACTIVITY. Christopher A. Drummond, cdrummo@bgsu.edu, Stan L. Smith, stanlee@bgsu.edu, Dept of Biological Sciences, Bowling Green State University, Bowling Green OH 43403.

Ecdysone 20-monooxygenase (E-20-M) is the cytochrome P-450 dependent steroid hydroxylase responsible for the conversion of the insect molting hormone ecdysone (E) to its more physiologically active form 20-hydroxyecdysone (20-HE). E-20-M activity fluctuates in a stage and tissue specific fashion. In the tobacco hornworm, *Manduca sexta*, midgut E-20-M undergoes a 50-fold increase in activity temporally coincident with larval-pupal reprogramming in the last larval stadium. This increase is elicited by its substrate E. In the present study, we found that the second messenger cyclic GMP may also be involved in the increase in midgut E-20-M activity (enzyme activity measured by radioassay). Pre-incubating midgut tissues with dibutyl cyclic GMP elicited a 74% increase (586 pg 20-HE formed/min/mg tissue, $n = 9$) in E-20-M activity compared to untreated or dibutyl cyclic AMP treated tissues (337 pg 20-HE formed/min/mg tissue, $n = 9$). Under *in vivo* conditions, injections of the guanylate cyclase inhibitors LY-83583 or methylene blue elicited decreases in E-20-M activity by 65% and 80%, respectively, compared to sham injected controls (control E-20-M activity 419 pg 20-HE formed/min/mg tissue, $n = 19$). Such inhibitions could be reversed with co-injections of dibutyl cyclic GMP or SNAP, a guanylate cyclase activator. In addition, co-injecting dibutyl cyclic GMP with suboptimal doses of the E agonist RH-5849 elicited higher midgut E-20-M activity (3-4X) compared to injections of E agonist alone. Collectively, these findings provide strong pharmacological evidence that the second messenger cyclic GMP may be involved in a steroid hormone regulated event.

9:30 AM

ABSOLUTE QUANTIFICATION PCR FOR THE RAT MULTIDRUG RESISTANCE (MDR1) GENE EXPRESSION ANALYSIS. Maria Clara Coutinho

Pereira^{1,2}, mariacclarabh@yahoo.com.br, Almir S. Martins^{1,2}, malmir@uakron.edu; Gioconda Alves de Assumpção¹, giocondaassumpcao@gmail.com; Maura da Pascoa Vilela¹, mauravilela@hotmail.com; Jerusa de Almeida Santos¹, jerusaalmeida@yahoo.com.br, José Maurício Siqueira¹, jms.bh@terra.com.br, Amy Milsted², milsted@uakron.edu; Anilton C. Vasconcelos¹, anilton@icb.ufmg.br, Maria Carolina Doretto¹, carol@icb.ufmg.br; ¹ Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil and CNPq, ²The University of Akron, 302 Buchtel Commons, Akron OH 44325.

Untreatable epileptic seizure challenges clinical and experimental researchers. P glycoprotein (Pgp) acts as efflux pump for hydrophobic substrates in normal tissues, is encoded by *mdr1a/b* genes and is a putative candidate that explains the lack of response to drug treatment. We study Wistar Audiogenic Rats (WAR), epileptic rats genetically selected for audiogenic seizures. The antiepileptic drug Phenytoin did not block seizures in up to 50% of the WAR, suggesting that WARs could be a suitable model for drug resistance studies. The present work aims to optimize an absolute quantitative PCR (AQPCR) for *mdr1a/b* mRNA expression in sound-stimulated WARs (n=6) compared to sound-stimulated Wistar (WS; n=6) and to Wistar controls (WC; n=5). RNA was extracted from skeletal muscle (skm) and liver, and primers were designed for a 84 bp *mdr1* mRNA target. S26 ribosomal amplicon target was used to normalize AQPCR. Reverse transcription of 1 µg total RNA was followed by AQPCR of 2 µl of cDNA from each reaction. Protocols used were as specified by ABI 7000 SDS Sybr Green kit. The dissociation curve yielded an amplicon Tm of 79.1 °C. The standard curve ranging from 1.8 to 1.8x10⁻⁷ ng showed linear regression (r²=0.9934), with a slope = -2.91 (E=100%). *Mdr1* cDNA expression (ng/µg total RNA) was 0.004, 0.013, 0.463 for skm and 0.555, 1.581, 0.622 for liver of WC, WS and WAR, respectively. The AQPCR shows differences between tissues in the three groups and should be applied to future *mdr1* gene expression studies in Phenytoin resistant WAR.

9:45 AM

SEQUENCE CONSERVATION OF MULTIPLE SRY COPIES IN RATTUS NORVEGICUS. Joel A Farkas (jaf28@uakron.edu), Jeffrey Dunmire (dunmire@uakron.edu), Amy Milsted (milsted@uakron.edu), Monte E Turner (met1@uakron.edu). Dept of Biology, Akron OH 44325-3908.

The Y chromosome gene, *Sry* has been shown to be responsible for testis determination in mammals, but has also shown to be transcribed in adult tissues. While most mammals have a single copy of *Sry* on the Y chromosome, several rodent species have been shown to have multiple copies. Previously, six divergent copies of *Sry* had been identified on a single Y chromosome in the *Rattus norvegicus* SHR/ua strain, all possessing a full coding region and conserved reading frame, but differing by SNPs and insertions/deletions. Here, sequence analysis of *Sry* was expanded to include more flanking DNA sequence and four related strains: SHR/ua, SHR/crl, WKY/ua, and SD/hsd. Sequence was determined by cloning and sequencing of amplified genomic DNA. In addition to the coding region, more than 400bp of 5' flanking, and 1200bp of 3' flanking regions were sequenced. All strains possess multiple copies of *Sry*, with similar copy identity. 5' flanking and coding regions show little difference between like copies in different strains. 3' flanking regions of all *Sry* copies, from all strains, show extreme sequence conservation (>99.9%). This degree of conservation suggests that gene conversion is active in the 3' flanking region between divergent copies on a single Y chromosome. The presence of same copies in these different strains suggests that these have resulted from duplication events prior to the creation of strains. Sequence conservation between like copies in different strains, suggests either selective constraint or recent divergence from a common ancestor.

10:00 AM

ESTABLISHMENT AND SCREENING OF THREE STABLY TRANSFECTED CHO CELL LINES EXPRESSING RAT SRY. Rupali Sharma rs51@uakron.edu, Adam C. Underwood AUnderwood@walsh.edu, Amy Milsted milsted@uakron.edu, The University of Akron, 302 Buchtel Commons, Akron OH 44325-3908.

The *Sry* gene encodes a transcription factor that is a member of the HMG-box family of DNA binding proteins. It plays a vital role in testis determination but is also expressed in adult male tissues. While most mammalian Y chromosomes have only 1 *Sry* locus, our

laboratory has determined that the rat species, *Rattus norvegicus*, has 6 unique loci. Our objective was to obtain recombinant *Sry* protein for studies of *Sry* protein characterization. To achieve this, we prepared stably transfected lines of CHO (Chinese hamster ovarian) cells containing *Sry* copies 1, 2 and 3. Each of the three types of *Sry*-transfected cells was maintained in separate 96 well plates with selective media. After two cell passages, the most robust cells from 24 of the wells were selected from each 96 well plate and these new cells were cultured. After 30 days, all cells were collected for screening by an immunoblot. The cell lysates obtained from CHO lines transfected with *Sry* 3 and analyzed by a western blot indicated that all 24 colony forming units were expressing *Sry* 3 protein. From this analysis we can conclude that the stably transfected lines of CHO cells containing *Sry* 3 are successfully incorporating the recombinant DNA and are expressing the desired protein. These cell lines can continue to be used as a source of *Sry* protein and they also provide a better model of comparison for *in vivo* expression of *Sry* than a transiently transfected cell line.

10:15 AM

THE MECHANISMS OF APOPTOSIS IN LEUKOCYTES OF CDV INFECTED DOGS. Helen L. DelPuerto^{1,2}, helendelpuerto@hotmail.com, Almir S. Martins^{1,2}, alisbete@icb.ufmg.br, Amy Milsted¹, milsted@uakron.edu, Luciana Moro², moro@icb.ufmg.br, Gissandra F. Braz², gissa_braz@yahoo.com.br, Fabiana Alves², alves.bio@gmail.com, Anilton C. Vasconcelos², anilton@icb.ufmg.br, ¹The University of Akron, 302 Buchtel Commons, Dept of Biology, Akron OH 44325-3908 and ²Universidade Federal de Minas Gerais, Dept of General Pathology, Belo Horizonte MG, Brazil.

Canine distemper virus (CDV) causes canine distemper diseases in dogs and in other carnivores. CDV is characterized by fever, nasal discharge, encephalomyelitis, conjunctivitis, gastroenteritis and pneumonia. The cellular pathogenesis includes mainly complications in the CNS and immunosuppressive systems, which are not completely understood. Several viruses have been shown recently to cause cell death by means of apoptosis induction. Dogs naturally infected with CDV show apoptosis in lymphoid tissues and cerebellum. However, apoptotic pathway mechanisms for CDV are not well determined. Our goal was to develop a sensitive method for diagnosis of CDV. We used quantitative PCR to investigate expression of the pro-apoptotic caspases 3 and 8, and anti-apoptotic Bcl-2, in leukocytes of infected dogs. CDV diagnosis was performed by gel-based RT-PCR, using previously characterized primers. Six CDV positives and 6 negative samples were selected for apoptotic gene expression comparison by a Real Time PCR SYBR@GREEN protocol. Caspase -3 cDNA expression (ng/µg total RNA) was 4.7 times higher in the CDV positive (0.14) than in the CDV negatives (0.03); Caspase -8 was 6.2 times higher in the CDV positive (0.52) than in the CDV negatives (0.083); and Bcl-2 levels did not change in CDV positives (0.035) and negatives (0.037). Results demonstrated that CDV infection induced transcription of caspases -3 and -8, while Bcl-2 expression did not change. This suggests that CDV might cause immune suppression induced by apoptosis in leukocytes via caspase-3 activation, but the main cascade for this induction may occur due to activation of the caspase-8 pathway.

10:30 AM

PREPARATION OF *Sry*/pIVEX BACTERIAL EXPRESSION CONSTRUCTS AND RECOMBINANT PROTEIN EXPRESSION. Sarah E. Scott, ses37@uakron.edu, Adam C. Underwood, AUnderwood@walsh.edu, Amy Milsted, milsted@uakron.edu, University of Akron, Dept of Biology, 302 Buchtel Commons, Akron OH 44325-3908.

Sry is a gene on the Y chromosome that is responsible for testes formation during development. The *Sry* protein acts as a transcription factor. *Sry* is also expressed in adult male tissues, which suggests the possibility of additional functions. There are six unique *Sry* loci present in *Rattus norvegicus*, and the functions of these are yet to be identified. The objective of this project was to insert each of the six rat *Sry* genes into the pIVEX2.4 expression plasmid and collect the recombinant protein for use in future *Sry* research. An N-terminal histidine tag encoded by the pIVEX2.4 vector allowed for one-step purification of the *Sry* protein by using Ni sepharose 6 fast flow beads (GE Healthcare). All six rat *Sry* genes were successfully cloned into pIVEX2.4. All constructs were transformed into Lucigen BL21(DE) *E. coli* and induced for 2 hours with .75mM IPTG at a cell density of 0.8 at OD₆₀₀. Collection and subsequent analysis of recombinant protein by SDS-PAGE

confirmed expression from *Sry2/pIVEX2.4A* and *Sry3/pIVEX2.4A* clones. These two *Sry* proteins are currently being used in gel shift assays to study its role as a transcription factor.

Session 7 Ecology
Nitschke Rm 2004
T.B.A., Presiding

9:00 AM

CONTRASTING FISH COMMUNITIES UPSTREAM AND DOWNSTREAM OF A DAM IN THE OTTAWA RIVER, NORTHWEST OHIO: PHASE I OF A DAM REMOVAL STUDY. Johan F. Gottgens
johan.gottgens@utoledo.edu, Amanda I. Arceo, Todd D. Crail, Dept of Environmental Sciences, MS 604 University of Toledo, Toledo OH 43606.

Dams may impact fish migration and, consequently, the biological community as a whole. Such impacts are often cited to support dam removal but few studies have actually quantified fish community structure pre- and post-removal. We contrasted the fish community upstream and downstream from the Secor Road dam (16.5m wide; 2.9m high), the only remaining barrier in the Ottawa River (NW Ohio). Using block seines, the fish community was sampled in both locations six times during the spring and summer of 2003 and 2004. Here we report on our sampling design and results pre-removal. The identical protocol will be repeated in spring and summer of 2008 and 2009 after the November 2007 dam removal. Nearly 1,200 fish were identified to species, measured, assessed for parasites and breeding condition, and released unharmed. Upstream and downstream QHEI scores were comparable, as were measurements of dissolved oxygen, specific conductivity, pH, temperature, canopy cover and discharge at each sampling event. Species richness, normalized for sample size, varied between sites and sampling dates and was higher downstream. The Index of Biotic Integrity was stable at 40 (fair) downstream and ranged from 28 (terrible) to 33 (poor) upstream. Shannon diversity scores at the upstream site were 0.77 to 1.09, lower than the downstream range of 1.91 to 1.93. Species present downstream but absent upstream included several sunfish (*Lepomis spp.*), Northern Pike (*Esox lucius*) and Yellow perch (*Perca flavescens*). Despite its small size, the dam may have considerable impact on the fish community composition in the Ottawa River.

9:15 AM

TESTING THE IMPACT OF PLANT COLONIZATION ON FISH COMMUNITIES IN AGRICULTURAL DITCHES OF THE OTTAWA RIVER, NORTHWEST OHIO. T.D. Crail
todd.crail@utoledo.edu, J.F. Gottgens
johan.gottgens@utoledo.edu, Department of Environmental Science, MS 604 University of Toledo, Ohio 43606.

Colonization by wetland plants of channelized stream banks and the resulting fluvial geomorphology are surmised to produce more-stable channel cross-sections and improve water quality. We tested the impact of such colonization on fish communities in farm ditches of the Ottawa River, a western Lake Erie tributary, by comparing twelve 20-m stream segments with and without plant intrusion (heterogeneous or Ht and homogeneous or Ho, respectively). Fish communities were sampled by sweep and block seine in each segment eleven times between June 2005 and October 2006. Temperature, pH, turbidity, dissolved oxygen, conductivity, canopy cover and discharge were comparable between Ht and Ho segments at each sampling event. A total of 10,501 fish representing 24 species were identified and released. Only 0.6% of the total catch belonged to non-native species. The average Shannon diversity, species richness and number of trophic guilds were significantly higher in Ht segments ($p=0.028$, $p=0.029$, $p=0.008$, respectively) using repeated measures ANOVA. Moreover, Ht segments appeared to host greater abundance (119.7 ± 32.2) than Ho sites (53.5 ± 13.8) although that difference was only significant at the $p=0.074$ level due to large inter-annual variability in fish abundance within each habitat type. A modified-IBI was not significantly different between habitats (Ht= 21.8 ± 0.1 ; Ho= 21.2 ± 0.2). Our census included 1,615 least darters, *Etheostoma microperca*, a previously undocumented population and listed as a State Species of Concern in Ohio. *E. microperca* was three times more abundant in Ht than in Ho stream segments. These farm ditches showed a surprisingly robust, species-rich fish community that may be maintained by allowing wetland plant colonization along stream banks.

9:30 AM

INFLUENCE OF WETLAND SIZE ON AQUATIC COMMUNITIES WITHIN WETLAND RESERVOIR SUBIRRIGATION SYSTEMS IN NORTHWESTERN OHIO. Peter C. Smiley Jr.,
rocky.smiley@ars.usda.gov, and Barry J. Allred,
barry.allred@ars.usda.gov, USDA-ARS Soil Drainage Research Unit, 590 Woody Hayes Drive, Columbus OH 43210.

Establishment of a water management system known as the wetland-reservoir subirrigation system (WRSIS) results in the creation of wetlands adjacent to agricultural fields. Specifically, each WRSIS consists of one wetland designed to process agricultural chemicals (WRSIS wetlands) and one wetland to store subirrigation water (WRSIS reservoirs). Previous research within three WRSIS constructed in the Maumee River watershed in northwestern Ohio has examined plants and aquatic animals in WRSIS wetlands, but not WRSIS reservoirs. The hypothesis of this study was that the larger, deeper WRSIS reservoirs would have different vertebrate communities than the smaller, shallower WRSIS wetlands. Fishes, amphibians, and reptiles were sampled by seining, hoop netting, and gee minnow trapping in three WRSIS wetlands and three WRSIS reservoirs in the summer of 2006 and 2007. A blocked two factor ANOVA coupled with the SNK test was used to determine if differences in community structure occurred between wetland types and years. No difference in species richness or abundance occurred between WRSIS wetlands and reservoirs, but amphibian relative abundance was greater in WRSIS wetlands than reservoirs ($n = 6$, $p < 0.05$). Jaccard's similarity index scores ranged from 0 to 0.5 and indicated species composition was different between WRSIS wetlands and reservoirs. No difference in species richness or amphibian relative abundance occurred among years, but abundance was greater in 2006 than 2007 ($n = 6$, $p < 0.05$). Our results suggest that WRSIS may benefit wetland dependent vertebrates through the creation of different sized wetlands within agricultural watersheds.

9:45 AM

EFFECTS OF INVASIVE REED GRASS (*PHRAGMITES AUSTRALIS*) ON PAINTED TURTLE (*CHRYSEMYS PICTA*) FORAGING EFFICIENCY. Michael R. Frank,
Michael.Frank@otterbein.edu, Sarah S. Bouchard,
Shouchard@otterbein.edu, Otterbein College,
 Dept of Life and Earth Science, One Otterbein College, Westerville OH 43081.

Reed grass (*Phragmites australis*) is an invasive, emergent wetland plant that forms very dense, monospecific stands. Such high plant densities may influence the ability of wildlife to maneuver through the habitat. Some fish, for example, experience decreased foraging efficiency in the presence of various invasive plants, and turtles may be similarly affected. The purpose of this study was to examine the effect of reed grass on the foraging ability of painted turtles (*Chrysemys picta*) in a laboratory setting. Four experimental treatments were established: two open water controls, one reed grass (197 stems/m²), and one native broad leaf cattail (*Typha latifolia*, 31.5 stems/m²). Plant stem densities were based on field densities. Twelve wild turtles (120 - 598g) were allowed to forage for 5 pieces of night crawlers (*Lumbricus terrestris*) for 15 minutes. They foraged twice in each treatment in a repeated measures design. Time required to locate and eat their first prey item and average time between prey items were not significantly different between native and invasive plant treatments ($p > 0.05$). However, there was a significant positive relationship between these foraging measures and body mass in the invasive treatment ($R^2 > 0.373$, $p < 0.05$), but not in the native treatment ($R^2 < 0.01$, $p > 0.05$). Although all turtles demonstrated a remarkable ability to maneuver through the reed grass treatment given their rigid body, larger turtles took longer to forage. Because female turtles are larger than males, a sex biased effect of reed grass on painted turtles may exist.

Session 8 Medicine, Health & Physiology
Nitschke Rm 3004
T.B.A., Presiding

9:00 AM

DIFFERENTIAL EXPRESSION OF SIX SRY ISOFORMS IN SKELETAL MUSCLE FROM TWO STRAINS OF *Rattus norvegicus*. Lauren A. Playl
lplayl@uakron.edu, Jeff Dunmire
dunmire@uakron.edu, Monte Turner
meturner@uakron.edu, Amy Milsted
milsted@uakron.edu, The University of Akron,

Dept of Biology, 302 Buchtel Commons, Akron OH 44325-3908.

Sry, a Y-linked transcription factor expressed in male genital ridge embryonic cells, directs testis development. *Sry* transcripts have been reported in adult mouse brain and human testis, prostate, and prostate tumors. The rat genome contains six *Sry* genes. Tissue and strain specific differences in *Sry* expression profiles have been reported in testis, adrenal, and kidney of borderline hypertensive SHR/y and normotensive WKY rats. It has been proposed that rat *Sry 1* confers elevated blood pressure in SHR/y rats compared to WKY controls. To begin to study *Sry* expression and function in other adult tissues, we hypothesized that *Sry* is expressed in adult male rat skeletal muscle with strain specific differences in the gene or isoform expression profiles. Skeletal muscle RNA samples from 15-20 week old WKY and SHR/y rats were reverse transcribed to generate cDNA. *Sry* cDNA was amplified with fluorescent-tagged primers and relative proportions of *Sry* isoforms determined by fragment analysis. Each sample (n=2 per strain) was run in duplicate and results individually averaged for each isoform. WKY skeletal muscle expressed *Sry 2* (91.1 ± 8.6%) and *Sry 1* (8.2 ± 8.2%). SHR/y skeletal muscle expressed *Sry 2* (55.3 ± 38.9%), *Sry 1* (12.8 ± 12.8%), *Sry 3* (28.9 ± 21.6%), and combined *Sry 3B/3B1* (3.84 ± 3.84%). Neither strain expressed *Sry 3C*. Strain specific differences in *Sry* expression profiles existed for all *Sry* isoforms except *Sry 1*. Differences in expression profiles of the *Sry* isoforms are consistent with differences in regulation of these genes in SHR/y versus WKY rats.

9:15 AM

TOY CHOICE IN AN AUTISTIC FEMALE Lauren R. Meyer meyer_l@denison.edu Denison University, 8342 Slayter Union, Granville, OH 43023.

Previous studies have demonstrated that children with autism tend to play with human-like toys less often than their typically developing peers. Since autism affects males four times as often as females, these previous studies may be showing that the predominantly male subjects used were exhibiting gender-related preferences not influenced by autism. This IRB-approved investigation studied an autistic female to determine whether she differed in toy choice from a typically developing female peer (both aged five). It was hypothesized that the autistic subject would choose dolls and figurines less often than her normally developing peer. Three sessions, each consisting of five trials each lasting up to 7 minutes, were conducted with each child. They were presented with two toys, one "human-like" figurine, and one "non-humanlike" toy such as a car or manipulative. The autistic girl chose to play with the human-like toys 2/15 times while the typically developing girl did 6/15. When human toys were chosen, the autistic girl spent an average of 82 seconds in engaged play and the typically developing girl spent 139 seconds. The small number of trials renders the difference in toy choice and engagement time statistically insignificant. The autistic girl played longer with the "other" toys (average of 165 seconds) than with the human-like toys (82 seconds). These trends are consistent with previous studies and suggest that autism itself, not merely gender, may be the cause of observed differences in play.

9:30 AM

POSTPRANDIAL TEMPERATURE SELECTION IN NOTOPHTHALAMUS VIRIDESCENS. Kimberly Ann Gieras, kgieras001@defiance.edu, (Spiro Mavroidis, smavroidis@defiance.edu), Defiance College, 701 N. Clinton St. Defiance OH 43512.

Body temperature in animals greatly influences biochemical processes, especially in ectoderms, as they are unable to generate their own body heat and must rely on their immediate environment for thermoregulation. This study will focus on *Notophthalmus viridescens*, the Eastern red-spotted newt, which is native to the northern United States and Canada and leads an aquatic lifestyle as an adult. The purpose of this study is to compare the animal's preferred postprandial body temperature to that of its preferred normal temperature. It is hypothesized that the newt will move to a higher temperature during digestion. A Plexiglas arena has been constructed with separate quadrants, each set at a specific water temperature (15, 18, 21 and 24 °C) and easily accessible to the animals. Aquarium heaters, filters and temperature probes will be used for regulating and monitoring temperature. It is assumed that due to the small size of *N. viridescens*, water temperature will be equal to the animal's body temperature. The newts will be fed once each week, with the mass of each animal being measured before and after feeding to calculate consumption. Data collection will begin in mid-November 2007 and continue for 6 weeks. It is expected that the newts will prefer a higher postprandial temperature compared to that found during fasting. Also, it is

expected that the animals will follow a daily routine of temperature regulation on non-feeding days, choosing a higher temperature before 9:00 in the morning and a lower temperature after 6:00 in the evening.

9:45 AM

ANALYSIS OF FOMITE CONTAMINATION TO EVALUATE THE EFFECTIVENESS OF CLEANING PROCEDURES IN OHIO NORTHERN UNIVERSITY ATHLETIC FACILITIES. Jamie M. Szippel j-szippel.1@onu.edu 10680 Ada Rd, Ada OH 45810.

This project investigated the effectiveness of cleaning procedures used in the fitness, weight, and locker rooms of Ohio Northern University (ONU) athletic facilities by monitoring bacterial contamination of fomites. Additional tests were used to evaluate the presence of a common skin microbe, *Staphylococcus spp.*, and in particular, Methicillin-resistant *Staphylococcus aureus* (MRSA). Using swabs moistened in sterile nutrient broth, samples were collected from different fomites (N=23) in the facilities 18 hours after scheduled cleaning, once monthly from August- November, 2005. Samples were transported using Stuart medium. Following vortex extraction in 2 ml of sterile saline, each was streaked for isolation on blood agar (growth control) and on Mannitol Salt Agar (MSA) and incubated at 37° C for 24-48 hours. Overall microbial contamination was quantified via colony count. Yellow colonies on the MSA were tested for coagulase activity using a latex agglutination assay. Gram positive *Staphylococci* colonies with a positive coagulase test (17) were inoculated onto Mueller-Hinton agar containing 6 ig/ml Oxacillin and incubated for 24 hours at 37° C to determine their sensitivity to the antibiotic. No growth was recorded indicating the *S. aureus* collected was not MRSA. Uncleaned facilities demonstrated distinct trends of increased overall microbial contamination, and specifically *S. aureus* growth, as compared to sites that received stringent, daily cleaning. The data suggest a correlation between effective cleaning and decreased microbial contamination.

10:00 AM

EFFECTS OF THERAPY AND EXERCISE ON DELAYED ONSET MUSCLE SORENESS Alexandra L. Miller a-nippert@onu.edu Ohio Northern University 402 W College Ave Unit# 3412 Ada OH 45810.

Delayed onset muscle soreness (DOMS) is the pain and discomfort that occurs after unaccustomed eccentric activity, and it can interfere with one's daily activities. The purpose of this study was to investigate whether twenty minutes of thermotherapy, cryotherapy, or moderate-intensity cardiovascular exercise could effectively reduce the severity of delayed-onset muscle soreness. To induce DOMS, twenty four untrained females performed three sets of 10 maximal eccentric repetitions on a Paramount AP-2000™ leg extension machine using only one leg. The subjects were randomly assigned to a thermotherapy, cryotherapy, moderate-intensity cardiovascular exercise, or a no therapy (control) group. Treatments were administered for 20 minutes 24 hours after the eccentric exercises were completed. Range of motion and muscle soreness were measured pre, 24, and 48 hours post-exercise. ANOVA test ($\alpha=0.05$) demonstrated that baseline range of motion and 24 hour post-exercise pain levels were not significantly different among groups. Paired two sample means t-Tests ($\alpha=0.05$) showed that cryotherapy ($p=0.034$), thermotherapy ($p=0.021$), and exercise ($p=0.004$) all significantly improved knee flexion. However, only thermotherapy and moderate-intensity cardiovascular exercise significantly improved flexion and reduced muscle soreness ($p=0.024$ and $p=0.008$, respectively). These results indicate that both thermotherapy and moderate-intensity cardiovascular exercise effectively alleviate DOMS.

10: 15 AM

BLADDER DYSFUNCTION. De Nguyen, denhung@earthlink.net No. 0140, 9205 Telfer Run, Orlando FL 32817.

The purpose of this paper is to present the possibility of a bladder dysfunction. Patrick C. Walsh found that many men had all the symptoms of a benign prostatic hypertrophy without an enlarged prostate. Three male patients of the Floyd Medical Clinic with hypertension exhibited urinary frequency, urgency, and urge incontinence at the age of 50 years. The examination of their prostate was normal. Their laboratory test results were normal including a PSA below 3 ng/ml. Their blood pressure of 145/92 mmHg was treated with Nifedipine XL 30 mg daily. They returned a week later for follow up. Surprisingly, their urinary irritative symptoms were controlled as well as their blood pressure. They were followed up to 4 years with yearly PSA levels below 4 ng/ml. These cases suggested the possibility of age-related bladder dysfunction which is probably secondary to atherosclerosis. A hypothesis of local

arterial stenosis induces a metabolic acidosis that triggers uncontrolled and erratic muscle contractions of the bladder leading to clinical symptoms. Vasodilator agents release hypoxia in the early stage. A better study with much larger sample size of patients is needed with angiographic investigation and urinary flow measurement to clarify the hypothesis.

Poster Session

Nitschke Hall 9:00-11:00 AM

Poster Board No. 001

THE EFFECTS OF NATURAL FLUCTUATIONS IN EARLY MATERNAL CARE ON THE AFFECTIVE AND BEHAVIORAL STATES OF THE OFFSPRING OF LONG-EVANS RATS. Ashley M. McFarland (amcfarl@bgnet.bgsu.edu), Travis J. Beckwith (tbeckwi@bgnet.bgsu.edu), Trang Tran (ttran@bgsu.edu), Megan Greenwald (mgreenw@bgnet.bgsu.edu), Howard C. Cromwell (hcc@bgsu.edu). Dept of Psychology, Bowling Green State University, Bowling Green, OH 43403.

Maternal care in rodents is a strong determinate of lifelong stress responsiveness and emotional regulation. The goal of this study is to observe the natural fluctuations of maternal care in rodents and examine the effects of these fluctuations on the affective and behavioral states of offspring throughout development. Maternal care is observed for 8 days after birth. Using mean levels of arched back nursing and maternal licking and grooming (MLG), the dams are categorized into high MLG and low MLG groups. Out of 28 dams observed, 3 displayed high levels of licking and grooming and 4 displayed low levels of licking and grooming. The pups of these litters were then run through 2 tests: 1) response to isolation and 2) condition odor. For (1), each pup is isolated for 2 minutes at postnatal day 10. For (2), on PND 15, a place preference test is conducted where pups can choose to remain in a maternal odor-paired environment or a neutral odor environment. As an indicator of affective state, ultrasonic vocalizations (USVs) are recorded during each behavioral test. Rats emit 20-40kHz frequency calls during isolation distress when they have been separated from the dam to prompt pup retrieval and MLG. Results were analyzed using inferential statistics including analysis of variance and post-hoc T tests. There proved to be a significant main effect between MLG condition (high, medium, and low) and number of isolation USVs during each test: Isolation, $F(2,337)=8.589$, $p<0.001$; and COP, $F(2,350)=3.743$, $p=0.025$. Post-hoc t-test indicate a significant difference between high and low animals in each test: Isolation, $t(101)=3.486$, $p=0.001$; COP, $t(86)=3.668$, $p<0.001$.

Poster Board No.002

THE EFFECTS OF PRENATAL FLUOXETINE EXPOSURE ON THE AFFECTIVE AND BEHAVIORAL STATES OF THE OFFSPRING OF LONG-EVANS RATS. Megan Greenwald, mgreenw@bgnet.bgsu.edu, (Howard C. Cromwell) hcc@bgnet.bgsu.edu, Bowling Green State University, Bowling Green OH 43403.

Exposure to pharmaceutical agents during gestation can have a profound impact on postnatal behavior. Most studies regarding the teratogenic effects of fluoxetine using both humans and animal models have focused on gross physical abnormalities. The goal of this study is to determine the effect of prenatal exposure to fluoxetine (8 mg/kg/day) on several social and emotional behavioral measures: maternal licking and grooming, conditioned odor preference, novel odor approach and juvenile play behavior. Prenatally exposed animals were compared to animals without prenatal exposure to any medications. Maternal care was studied for eight days after birth, measuring levels of arched back nursing and maternal licking and grooming. The pups were then subjected to three additional tests: 1) response to isolation, 2) conditioned odor preference (COP), and 3) play behavior. Ultrasonic vocalizations were recorded during each behavioral test as a measure of the affective status of the animal. For (1), each pup was isolated on postnatal day 10 for 2 minutes. For (2), a place preference test was conducted on postnatal day 15; rat pups can choose to spend time in an area with either a maternal-paired odor or a neutral-paired odor. In (3), beginning on postnatal day 24, pups were weight-matched to a littermate, isolated, then allowed to interact in a testing chamber for 5 minutes every other day for 6 days. Results were analyzed using inferential statistics including analysis of variance and post-hoc T-tests. Findings from this study have implications for understanding the impact of early exposure to medication on psychological development.

Poster Board No.003

PERINATAL PCB ALTERS SOCIAL BEHAVIOR IN JUVENILE MALE SPRAGUE-DAWLEY RATS. Banafsheh Jolous-Jamshidi, bjolous@bgsu.edu, Ashley McFarland (amcfarl@bgsu.edu), Howard C. Cromwell, hcc@bgsu.edu, and (Lee A. Meserve) imeserv@bgsu.edu. Dept of Biological Sciences, Bowling Green State University, Bowling Green OH 43403-0208.

Social recognition is a class of behavior that is responsible for pair bonding and attachment to other members of the species. Brain circuits responsible for bringing about this behavior are present in the central and medial amygdala as well as ventromedial hypothalamus (VMH) which contain oxytocin receptors. Oxytocin producing neurons in the paraventricular nucleus (PVN) and pre-optic area of the brain project to these areas and have been indicated to modulate social recognition. Polychlorinated biphenyls (PCB) are a class of environmental toxicants that can exert effects at both the cellular and behavioral levels. They exert toxic effects on nearly every part of the body including the brain especially during development. In the present study, the effects of a mixture of PCB 47 and 77 have been measured on circulating oxytocin levels, the area of the PVN and social recognition in juvenile male Sprague-Dawley rats. Rat offspring were either from control dams (offspring $N = 18$) or were exposed to low-doses of PCB [12.5 ($n = 15$) or 25 ppm ($N = 15$)] perinatally via the maternal diet. Social recognition was determined in juvenile rats under red light on postnatal day 21 using connected social (containing either a familiar of unfamiliar rat) and non-social (empty) cage boxes to determine relative time spent in each box. PVN area was measured microscopically in brain slices, and oxytocin was measured with a specific enzyme-linked immunosorbent assay. The difference in the investigation time of PCB animals as compared to controls between the social and non-social boxes (approx. 30 % more time in the social box than controls with familiar and 10% greater with unfamiliar rat) suggests that the 25 ppm dose of PCB causes subtle disruption in social recognition. However, PVN areas and circulating concentrations of oxytocin were not significantly altered by PCB ($p > 0.05$). These results could indicate that low doses of PCB 47 and 77 do not appreciably affect the morphology of brain areas or modulatory hormones, and that PCB influences social recognition by other means.

Poster Board No.004

EFFECTS OF POLYCHLORINATED BIPHENYL MIXTURES ON ESTROGEN RECEPTOR- β , HIPPOCAMPUS, LEARNING AND MEMORY. Avanti N.Desai desaia@bgsu.edu, Ashley McFarland amcfarl@bgsu.edu, Howard C. Cromwell(hcc@bgsu.edu), and Lee A. Meserve imeserv@bgsu.edu. Dept of Biological Sciences, Bowling Green State University, Bowling Green OH 43403-0208.

Polychlorinated biphenyls (PCB), are a group of 209 structurally related chemical compounds (congeners), that were once used in industrial applications, particularly as electrical insulating fluids and as heat exchange fluids, until concern regarding possible adverse effects on the environment and human health resulted in the cessation of production and an ultimate ban on manufacture in most countries. PCB have been reported to cause a variety of health effects including endocrine disruption, immunologic, reproductive, carcinogenic, and neurologic deficits. They are not only a potential health threat to adult humans, but also to the developing fetus and infant because they cross the placenta and are found in breast milk. In the present study, a mixture of two PCB congeners, non-coplanar (PCB 47) and coplanar (PCB 77), were administered to young female Sprague-Dawley rats by route of maternal dietary consumption (either 12.5 ppm or 25.0 ppm, w/w). Alterations in learning and memory were determined by radial arm maze on postnatal day 27 by comparing performance of control rats (not exposed to PCB; $N = 21$) to that of rats exposed to PCB at 12.5 ($N = 24$) or 25ppm ($N = 25$) of the PCB mixture. The rats were then transcardially perfused, and brains were excised. Immunohistochemistry for estrogen receptor- β was carried out on free-floating 30 μ M sections of brain. Sections from -3.30, 3.60, and 3.80 mm from the bregma point were stained with cresyl violet acetate stain, and hippocampal area measurement was performed using imaging software. A semiquantitative comparison of staining density (1+, 2+, or 3+) suggested a greater intensity of ER- β staining in female rat hippocampus exposed to PCB 47/77 at 25 ppm concentration, than control, and 12.5 ppm exposed rats. On the contrary, a decrease in the hippocampal area measurement was observed in the case of 25 ppm PCB exposed rats. Significant behavioral effects involving spatial learning and memory were not observed in the present study. However, animals exposed to PCB

47/77 at 25 ppm showed a trend toward improved performance. Taken together, these data support the role of small amounts of this PCB mixture as an endocrine disruptor, with subsequent effects on brain morphology and behavior.

Poster Board No.005

THE NEUROSCIENCE OF DECISION-MAKING: A SUMMER BRAIN BOOT CAMP AT DENISON UNIVERSITY. Kristina Mead. meadk@denison.edu. Biology Department, Denison University, Granville Ohio 43023.

In order to better tap the interdisciplinary potential of neuroscience at a liberal arts institution, the Mellon Foundation funded four lectures on different interdisciplinary aspects of decision-making followed by a 2007 summer research experience for a small group of nine faculty and five students at Denison University. The summer research experience consisted of a week of workshops on different aspects of the neuroscience of decision-making, a daily journal club, and 5-6 week independent projects. One student used a survey to analyze college and major choice ($n=42$), one filmed toy choice and play time by normally developing and autistic female children ($n=2$), one tested the effect of music on deciding the emotional content of a face ($n=48$), and one tested factors affecting maze arm selection by crayfish ($n=15$). Students ($n=4$) reported that the experience increased their appreciation for the interdisciplinary nature of science (mean score \pm S.D. = 6 ± 1.4 out of a maximum score of 7), and that they learned about the effort and rewards of working independently (6 ± 1.4). Some students reported that this experience caused them to consider new career possibilities, while others reaffirmed their original choice (4 ± 2.4). Faculty ($n=5$) indicated that thinking about their scholarship in the context of decision-making was useful (5.3 ± 2.2), and that participation enriched their sense of the value of an interdisciplinary approach (6.8 ± 0.5). The summer research experience in the neuroscience of decision-making was therefore effective in promoting learning and scholarship for both faculty and students.

Poster Board No.006

UNCOVERING THE MOLECULAR PATHWAYS DOWNSTREAM OF PTEN IN MOUSE EMBRYONIC FIBROBLASTS Laryn J. Kovalik kovali_l@denison.edu Denison University, Slayter Box 7623, Granville OH 43023 (Dr. Lina I. Yoo) yool@denison.edu

The cell signaling pathway downstream of the tumor suppressor gene, *Pten*, was examined in Mouse Embryonic Fibroblasts (MEF). Inactivation of *Pten* is a genetic alteration frequently found in many mouse cancers. Although the mechanisms involved in tumor formation following *Pten* loss are still being investigated, there are observable similarities in the molecular pathway when wild type and *Pten*-deficient MEF cells were compared with wild type and *Pten*-deficient bladder cells. Western blot analysis revealed differences in protein levels of *PKC ϵ* , *FAK*, and *JAK2* in MEF and bladder cells; an increase in protein levels for *GSK* and *CSK* was observed when *Pten* was deleted in both MEF and bladder cells. Understanding the mechanisms involved following *Pten* deletion could lead to cancer therapy that is tissue-specific, based on the differences between cell types. Establishment of a similar mechanism in MEF and bladder cells after *Pten* loss could also lead to a general cancer therapy for multiple cancer types. Since *Pten* regulates the *PI3K/Akt* pathway, *Pten*-deficiency could result in unrestricted cell growth and survival. As expected, western blot analysis showed increased *AKT* phosphorylation at Ser 473 after *Pten* loss in the MEF cell line. Increased *pY529 Src* protein levels in the *Pten*-deficient MEF cells was also consistent with increased *CSK* protein levels since *CSK* may be important for regulation of downstream targets such as *AKT* via *Src* phosphorylation. Identification of signaling molecules affected by *Pten* deletion will help to elucidate mechanisms of tumor development in varying tissues.

Poster Board No.007

FACTORS INFLUENCING DENISON UNIVERSITY STUDENTS' CHOICE OF COLLEGE, MAJOR, AND CAREER Chibuzo Ubagharaji ubagha_c@denison.edu Slayter Box 8291 Denison University Granville, OH 43023.

This study examined social and economic factors that influenced Denison University students' choice of college, major, and career. Forty-two Denison students responded to an IRB-approved questionnaire asking them to rank social and economic factors causing them to attend Denison, choose a major, and a career. I hypothesized that the majority of students came to Denison because of economic variables, and that parental influence and money were the most influential factors in students' choice of major and career.

35.8% of the respondents came to Denison for scholarships, 24.7% came for student-professor interactions, 16.7% came for small class size, and 4.7% came for specific academic disciplines. 54.7% of students came to Denison because of economic factors and 45.2% came because of social factors. The top three factors that influenced students' choice of major were personal interest, future career ambitions, and a desire to make a positive impact in the world. The most important influence from individuals came from mothers (4.78 ± 1.13 , out of 5) and fathers (4.34 ± 1.5). Major factors affecting career choice were personal fulfillment (5.00 ± 1.43 , out of 6) and making a difference in the world (3.98 ± 1.81). Other factors include future economic success (2.83 ± 1.72) and having or adopting children (2.93 ± 1.63). By knowing which factors influence Denison college students' choice of college, major, and career, we can learn more information about college decision-making and admission counselors can better understand their students.

Poster Board No.008

ANALYSIS OF FACIAL EXPRESSION IS AFFECTED BY EXPOSURE TO 2 MINUTES OF MUSIC IN HUMAN SUBJECTS. Chinmoy I Bhatiya, bhatiy_c@denison.edu (Kristina Mead, meadk@denison.edu), 8420, Slayter Union, Denison University, Granville OH 43023.

Studies have shown that subjects in one emotional frame of mind tend to decipher the same emotion from the facial expressions of other people. Thus, analysis of facial expression can be used as an indicator of the subject's emotional state. The present study was conducted using a self-designed internet based survey in which 48 subjects were exposed to three music clips for no longer than 2 minutes each. The three clips were categorized as "happy", "sad" and "angry" on the basis of the prominent mood expressed in each. After each track, subjects were required to evaluate the level of the "happy", "sad" and "angry" emotions on a scale of 0 (lowest) to 7 (highest), on sets of neutral, emotionless faces. Subjects exposed to "happy" music were found to rate neutral faces with a mean "happy" rating of 3.021, significantly higher than the mean "sad" rating of 1.465 and mean "angry" rating of 0.792. Similarly, after exposure to "sad" music, subjects were found to rate neutral faces with a mean "sad" rating of 2.889, significantly higher than the mean "happy" rating of 1.861 and a mean "angry" rating of 1.299. The three ratings obtained after exposure to "angry" music were not significantly different from each other. The presence or absence of lyrics in the music tracks did not significantly alter the ratings obtained from the subjects. From this study, the minimum time required for music tracks to affect analysis of facial expression can be narrowed down to 2 minutes or lower.

Poster Board No.009

EXAMINATION OF VEGETATION SUCCESSION IN A RECENTLY CONSTRUCTED, CENTRAL-OHIO WETLAND. Simonne T. Benoit, benoit_s@denison.edu, (Douglas Spieles, spielesd@denison.edu), 7249 Slayter Union, Denison University, Granville OH 43023.

The "no net loss" policy in the United States stipulates that destruction of natural wetlands should result in the replacement of equal or greater acreage. However created, wetlands do not always match natural wetland structure or function. Previous research indicates that mitigation sites tend to contain more pioneer species, non-native dominants, and species with lower conservation quality than naturally occurring wetlands. The purpose of this study is to evaluate the initial vegetation distribution and quality of the Dutch Fork Wetlands, created in the summer of 2006 in Licking County, Ohio. The distribution of volunteer plant species was hypothesized to correlate with specific abiotic conditions of the basins, while the distribution of introduced plant species was hypothesized to be independent of abiotic conditions. Soil cores to 10 cm were taken along a 15 x 15m grid in six wetland basins, and bulk density, percent organic matter and pH were determined for each sample. All plant species were counted within a 5m² quadrat at every gridpoint. Plant species were further classified according to their wetland indicator status and floristic quality value. Analysis of Variance Techniques was used to analyze differences in abiotic conditions ($n=371$) and plant community characteristics ($n=371$). Regression was used to examine the relationship between species richness and diversity with these abiotic factors ($n=371$). Results show that basins differ based on soil abiotic features and 14 of the most common 20 species were volunteer. This suggests that random dispersal is important in determining early wetland plant communities.

Poster Board No.010

A POPULATION ESTIMATION OF WHITE-TAILED DEER (*Odocoileus virginianus*) AT THE WILDS.

Gregory J. Leasure glecture@muskingum.edu, (James L. Dooley Jr. jdooley@muskingum.edu), Muskingum College, 163 Stormont St, New Concord OH 43762.

White-tailed deer (*Odocoileus virginianus*) can exert important influences on the composition and structure of forests through foraging activities. Above moderate densities (10 deer/ km²), impacts can be severe. Therefore, accurately estimating deer densities within habitats of interest is essential if effective habitat management plans are to be developed. Research was conducted at the Wilds, a 10,000-acre conservation facility in Cumberland, Ohio, with the purpose of estimating deer population numbers. Six transects within the Wilds were observed for deer numbers over the course of three months. As deer were observed along each transect, the number of deer in a cluster and their distance perpendicular from the transect were recorded. Data collected will be interpreted through Program Distance, a biological statistics program that will provide both abundance and density estimates for each transect and the property as a whole. Initial Program Distance analyses suggest that the density of deer within the Wilds is around 43 deer/ km². Final results from this year will be compared to past research. Developing accurate estimates of densities within and between years will prove critical in predicting future impacts of ecosystem development and advancing the development of management plans.

Poster Board No.011

CLONING AND EXPRESSION OF THE TAQ DNA POLYMERASE GENE FROM *THERMUS AQUATICUS*. Anna V. Belyaevskaya, belyaev@muskingum.edu, (Jenna N. Parrish jparrish@muskingum.edu), (Amy J. Santas, asantas@muskingum.edu), Muskingum College, 163 Stormont St, New Concord OH 43762.

Taq polymerase is a protein expressed in the extreme thermophile *Thermus aquaticus* that was discovered in Yellow Stone National Park geysers. *Taq* polymerase has become an essential tool in the process of amplifying DNA since it was first discovered over 40 years ago. The expense of commercial *Taq* polymerase can be a limiting factor in DNA analysis projects. Our goal, in this project, is to clone the *Taq* polymerase gene from *Thermus aquaticus* using the pGEM-3Zf plasmid and subsequently transform *Escherichia coli* with this genetic material. Transformed *Escherichia coli* will be cultured and the *Taq* protein will be purified from them. To verify cloning success, a restriction enzyme digestive process will be performed to determine which *Escherichia coli* bacteria contain the pGEM-3Zf plasmid with the cloned *Taq* gene inserted in an open reading frame within the plasmid. The quality of the isolated polymerase will be tested through SDS (Sodium Dodecyl Sulfate) Polyacrylamide Gel Electrophoresis and Polymerase Chain Reaction. The purified *Taq* polymerase will be used in course work as well as research projects at Muskingum College for activities including DNA amplification, DNA sequencing and DNA fingerprinting. Therefore, this work creates new opportunities for manipulative genetic experiments within our research program.

Poster Board No.012

BIOCHEMICAL EVIDENCE OF DYSTROGLYCAN COMPLEX IN MURINE EPIDERMIS. Becky J. Schroeder (rebeccas@muskingum.edu) and (Dr. Amy J. Santas) (asantas@muskingum.edu) Biology Dept, Muskingum College, 163 Stormont St, New Concord OH 43762.

A patient-friendly treatment for cancer has eluded us for decades. Studying wound healing in epidermis can provide insights on the processes (cell division and cell migration) that are uncontrolled in cancer. Recent evidence suggests that the dystroglycan disappears from wound-activated keratinocytes both at eight and twelve hours after an incisional wound. This disappearance of dystroglycan in epidermis indicates a down-regulation of dystroglycan in epidermal wound healing. Recent evidence also suggests that dystroglycan appears to be down-regulated in some cancers. Dystroglycan itself has already been identified in epidermis. The purpose of this study is to identify other proteins that are associated with the dystroglycan complex in murine epidermis. Our characterization of the dystroglycan complex in epidermis and alterations of the complex during wound healing will provide insight into the aberrant regulation of cell migration and division, which occurs in cancer. Using murine skeletal muscle as a positive control, proteins of the dystroglycan complex were identified in murine epidermis through Western blot analysis. Alpha-dystrobrevin, utrophin, and delta-sarcoglycan were identified in murine epidermis and are likely associated with alpha and beta-dystroglycan. This same method will be used to identify the

presence or absence of other dystroglycan associated proteins in murine epidermis as compared to the dystroglycan complex and associated proteins in murine skeletal muscle.

Poster Board No.013

GIRAFFE NUTRITION STUDY AT THE WILDS, OHIO. Jessica Teaff jteaff@muskingum.edu and Jonathan Grennell jgrennell@muskingum.edu, (Jim Dooley jdooley@muskingum.edu), Muskingum College, 163 Stormont St., New Concord OH 43762.

Captive management of giraffe (*Giraffa camelopardalis*) has been hampered because of health and diet issues. Specifically, giraffe often suffer from rumen acidosis, which can lead to compromised digestion and shortened lifespan. Additionally, many individuals suffer from urolithiasis, a blockage of stones in the urinary tract, which can lead to sudden death. Several studies have suggested zoo diets may be part of the problem. This study was designed to test for potential benefits of alternative diets using the number of ruminations observed and several other stress-indicating behaviors as response variables. The test subjects were animals kept at the Wilds. It was hypothesized that there would be differences in these response variables as a function of change in diet. Giraffe were divided into two groups of four animals each. Each group was assigned to a diet treatment: ADF-16 vs. Wild Herbivore. Giraffe given ADF-16 were put on pasture and were able to eat browse, and those given Wild Herbivore remained at the barn. The study used Instantaneous Point Sampling (at 30 second intervals) to record rumination and behaviors of the giraffe. Each giraffe was observed in 10-minute intervals for four hours in the morning (8am – 12pm), afternoon (12pm – 4pm), and evening (4pm – 8pm). There was a total of approximately 72 hours of observations. Initial analyses indicate that giraffe in the barn exhibited lesser rumination rates and more stress-indicating behaviors relative to pasture animals, suggesting that the combination of ADF-16 and browse may have provided superior nutritional benefits relative to Wild Herbivore alone.

Poster Board No.014

Composition and Ecology of Myxomycetes in a Temperate Deciduous Forest of Southeastern Ohio. Ashley Campbell campbell@muskingum.edu, (Jim Dooley jdooley@muskingum.edu), Muskingum College, 163 Stormont, New Concord OH 43762.

Myxomycetes are members of the kingdom Protozoa class Eumycetozoa; they are fungus-like organisms present in most terrestrial ecosystems. While the importance and ecology of myxomycetes are yet to be fully understood, many researchers have suggested that because microorganism communities are important to develop and preserve biodiversity and maintain process benefits to the community, further baseline data is important for expanding the scientific understanding of myxomycetes as contributors to forest communities. A survey comparing the biodiversity of spring and fall plasmodial slime molds (myxomycetes) was conducted at the Wilds during 2007. Point quadrat sampling techniques were used over 13 pre-existing transects set in forty acres of deciduous forest in order to: 1) survey myxomycete species richness in deciduous forest habitat 2) identify environmental factors influencing distribution of these species. Standard moist chamber method was then used to incubate samples in an environmental control room where samples were exposed to normal light and constant temperature (26 C°) conditions until fruiting bodies appeared. Approximately 740 samples were collected over two seasons, and preliminary results indicate that at least 31 different species were present in this particular forest.

Poster Board No.015

PARASITE LOADS IN LARGEMOUTH BASS (*Micropterus salmoides*) ON A RECLAIMED SURFACE MINE IN SOUTH-EASTERN OHIO (THE WILDS). Brock M. Huntsman, brockh@muskingum.edu; (Danny J. Ingold, ingold@muskingum.edu; Biology Dept) Muskingum College, New Concord, OH 43762.

Sunfish species harbor a variety of parasites. Their vulnerability to parasites may be influenced by water quality, which in turn may compromise the immune systems of individuals. Little, if any, research has reported on the susceptibility of sunfish species to parasites on reclaimed surface mines. The goal of this study was to examine the parasite loads of largemouth bass (*Micropterus salmoides*) collected from ponds at The Wilds; a 4,500 hectare reclaimed surface mine situated in southern Muskingum County. In particular, the focus of this study was to determine if parasite

loads correlate with several water quality parameters including pH, turbidity, and salinity. During a weekly collection period from June through September 2007, 51 fish were caught using fishing rods and bait from five different ponds. The ponds, varying in their water quality characteristics, ranged from 0.8 to 3 hectares. Each fish was euthanized, gill clips were taken, and a necropsy was performed. Additionally, liver samples from each bass were preserved to be analyzed for encysted macro-parasites. A total of six parasite species were identified among the entire sample, including: yellow grub (*Clinostomum* spp.), black spot parasites (*Neascus* spp.), *Contracaecum* spp., *Dactylogyrus* spp., *Trichodina* spp, and liver parasites. These parasites were found in gill clips, within body cavities, on and within organs, and on the external scale surface of individuals. Parasite load data will be plotted along side water quality measurements in order to detect possible patterns. If potential linear relationships appear in the graphical data, subsequent correlation analysis will be run.

Poster Board No.016

PARASITE LOADS IN THREE SUNFISH SPECIES (*LEPOMIS* sp.) ON RECLAIMED SURFACE MINE PONDS IN SOUTHEASTERN OHIO (THE WILDS).

Michael Zimmermann, michaelz@muskingum.edu; Danny J. Ingold, ingold@muskingum.edu; Biology Dept, Muskingum College New Concord, OH 43762.

The water quality of ponds on reclaimed surface mines has been shown to potentially compromise the health of some fish species (particularly Centrarchids), by increasing their vulnerability to both ecto- and endoparasites. In this study, parasite loads in bluegill sunfish (*Lepomis macrochirus*), redear sunfish (*L. microlophus*) and longear sunfish (*L. megalottis*), taken from four ponds at the Wilds, were examined from June through September 2007. The goal was to determine whether different measures of water quality might be related to parasite loads in any or all these species. Fifty three fish were sampled from the four ponds using a fishing pole equipped with both live and artificial baits (seining and electro-shocking options were unavailable). Once attained, each fish was checked for the presence of ecto-parasites within the fins, gills, and external body surface. A small gill clip was taken and viewed under a microscope to check for microscopic parasites. Subsequently, each fish was necropsied and its internal body cavity was checked for additional parasites. The liver, spleen, and caudal kidney were removed and preserved in formalin. Initial tissue analysis, undertaken at the Ohio State University, revealed that four parasite species were present in the three sunfish species. These included two larval trematodes, yellow grub (*Clinostomum marginatum*) and black grub (*Neascus* spp.), a digenetic trematode (*Dactylogyrus vastator*), and an anisakid nematode (*Contracaecum* spp.). Parasite load data will be plotted against various water quality parameters (nitrate, ammonia, pH, salinity, turbidity, hardness, and dissolved oxygen) in an attempt to detect potential linear relationships between the two.

Poster Board No.017

USE OF A PROGESTERONE ASSAY TO DETECT PREGNANCY IN RHINOCEROS AT THE WILDS.

Bonnie J. Whitt, bwhitt@muskingum.edu, (Barbara Wolfe bwolfe@thewilds.org), (Amy J. Santas, asantas@muskingum.edu). Muskingum College, New Concord OH 43762, and The Wilds, Cumberland OH 43732. 163 Stormont St, New Concord OH 43762.

The entire rhinoceros taxon is on the verge of extinction. Due to habitat loss and poaching, rhinoceroses in the wild are often not alive long enough to mature to breeding age. Efforts to breed captive rhinoceroses have met limited success and could be improved with a simple method to detect early pregnancy. The goal of this research was to set up an assay at the Wilds to detect pregnancy in the Indian (*Rhinoceros unicornis*) and the Southern White (*Ceratotherium simum simum*) rhinoceros species. The Wilds is located in Southeastern Ohio and is known as an innovative wildlife conservation center. The assay that will be implemented at The Wilds is a competitive enzyme immunoassay which will be utilized to detect progesterone metabolite levels in feces. This enzyme immunoassay will be modified from a previously established Progesterone Assay in order to efficiently perform routine analysis of rhinoceros progesterone metabolite levels at The Wilds. Progesterone levels increase drastically in pregnant females when compared to non-pregnant females; therefore increases in metabolites of the hormone progesterone will be measured to determine rhinoceros pregnancy. Fecal samples will be used to detect progesterone as nearly all of the progesterone metabolites are excreted through the feces. In addition, feces are easier to collect versus urine or serum. The data collected will be used to allow for early detection of pregnancy in rhinoceroses. This work

will involve the development of the Enzyme Immunoassay at The Wilds and includes methods used to manage data and organize reagents.

Poster Board No.018

LOCALIZATION OF A DYSTROGLYCAN COMPLEX IN HUMAN EPIDERMIS. Nicklaus J. Hess, nhess@muskingum.edu, (Amy J. Santas, asantas@muskingum.edu), Muskingum College, 163 Stormont St, New Concord OH 43762.

The purpose of this study is to determine whether human epidermis contains the dystroglycan protein complex first identified in skeletal muscle. The dystroglycan protein complex consists of α - and β -dystroglycan protein subunits and additional proteins including syntrophin, dystrobrevin, α -sarcoglycan, β -sarcoglycan, α -sarcoglycan, β -sarcoglycan, e-sarcoglycan, sarcospan, and dystrophin or utrophin. The α -dystroglycan protein subunit is a peripheral protein that is attached to the integral membrane β -dystroglycan subunit. Together, α - and β -dystroglycan serve as a link between the extracellular environment and the cytoskeleton. In animal and human tissue studies, dystroglycan has been found in muscle, nervous, connective, and some simple epithelial tissues. Dystroglycan has been identified in epidermis; however, it is unclear whether it exists as a multi-protein complex within epidermal tissue. Cryosectioned, non-diseased human epidermal tissue samples will be fixed in 5% formalin and processed using immunohistochemistry. Antibodies that detect members of the skeletal muscle dystroglycan complex will be used to examine whether these proteins exist within epidermis. If these proteins are detected, their localization within the epidermis will be elucidated. The data will ultimately serve to characterize the dystroglycan complex in epidermal wounds. Our analysis of human skin wounds has revealed that dystroglycan is missing in cells at the edge of an incisional wound. Wound healing is a normal process through which dystroglycan is physiologically regulated. However, prior to studying the regulation of the epidermal dystroglycan complex, we must identify which of the several proteins known to comprise the skeletal muscle dystroglycan complex are present in the epidermal dystroglycan complex.

Poster Board No.019

ANALYSIS OF BRAIN STRUCTURAL CHANGES IN A COMMUNITY SAMPLE OF WOMEN WITH POSTTRAUMATIC STRESS DISORDER AS A RESULT OF CHILD ABUSE EXPOSURE. Lisa M. Martorano, s08.lmartorano@wittenberg.edu, Cathy Pederson, cpederson@wittenberg.edu, Stephanie Little, slittle@wittenberg.edu and Robin Osborn D.O. Wittenberg Biology Dept, Springfield OH 45501.

The long term effects of child abuse can deter brain development and function in adult abuse survivors. This study attempts to make a positive correlation between participants with post-traumatic stress disorder (PTSD) secondary to child abuse and reduced volumes in the hippocampus, pituitary, and caudate nucleus. Participants were recruited through newspaper advertisement and were right handed females between 20 and 40 years of age. Women who matched the study criteria, based on phone interviews, were screened using a demographics questionnaire and a variety of psychological testing including the *Childhood Trauma Questionnaire* and *Millon Multi-axial Clinician Inventory*. Those accepted into the study took the *Weschler Memory Scale*, *Wonderlic Personnel Test*, *Clinician Administered PTSD Scale*, and a magnetic resonance image of their brain. Women were then placed into one of three groups: post traumatic stress disorder as a result of child abuse (n=21), child abuse without PTSD (n=18), and normal controls (n=21). Each MRI slice of a brain structure was traced three times using the 3DBrainStation. Averages were calculated and summed to determine total volume of each structure. Demographic matching between groups showed no differences in age, body mass index, education, alcoholic drinks per year, and pack years smoking (p>0.05). There was no significant difference between the groups in hippocampal (p=0.426 left, 0.547 right), pituitary (p=0.273) and caudate nucleus (p=0.622 left, 0.959 right) volumes. Furthermore, PTSD diagnosis did not influence structural volume. The results show that child abuse may not be a detrimental factor in altering brain structural development in a community sample of women with posttraumatic stress disorder.

Poster Board No. 020

OBLIGATE BIODIVERSITY OF OHIO'S CARBONATE CAVES. Horton H. Hobbs III

hhobbs@wittenberg.edu Dept of Biology, Wittenberg University, PO Box 720, Springfield, OH 45501-0720 and Erin R. Hazelton erin.hazelton@dnr.state.oh.us Ohio Department of Natural Resources, Division of Natural Areas and Preserves.

Funded by a grant from the USFWS, the Wittenberg University Speleological Society and the Division of Natural Areas and Preserves (DNAP) partnered to complete bioinventories in 86 of Ohio's carbonate caves during summer 2007. Methods included sight biological surveys and placement of aquatic Dendy traps and terrestrial pit-fall traps (number dependent upon habitat diversity). Invertebrate specimens were collected, preserved in 70% alcohol, and identified or sent to experts for identification. Although Ohio's dolomite and limestone caves are not as extensive as those in some neighboring states, they play a vital role in the life history of many organisms including twelve state-listed species. Of these, two troglobiont carabid beetles (*Pseudanopthalmus ohioensis*, *Pseudanopthalmus krameri*), a stygobiont asellid isopod (*Caecidotaea filicispeluncae*), and a troglobiont chthoniid pseudoscorpion (*Apochthonius hobbsi*) are site-specific endemics of southwestern Ohio caves. The stygobiont, *Caecidotaea rotunda*, was noted in three caves and a spring in Ohio. Viable populations for all state-endemic cave species were observed except for *P. krameri*, which was not documented during the survey, nor has it been sighted since the 1970's. The stygobiont crangonyctid amphipod, *Crangonyx ohioensis* – not state-listed, was collected from four caves in southwestern Ohio. There is need for continued research since many caves remain undocumented and most have not been examined in over 20 years. Research planned for 2008 includes bat hibernacula counts, completion of carbonate cave bioinventories, and initiating surveys in sandstone and conglomerate caves of eastern Ohio. DNAP and USFWS will use these data to help protect and manage Ohio's cave ecosystems.

Poster Board No. 021

DRIFT TENDENCIES OF A GORDIID WORM (NEMATOMORPHA: GORDIOIDEA) IN A SOUTHWESTERN OHIO STREAM. Alexander Silvis s08.asilvis@wittenberg.edu Department of Biology, Wittenberg University, PO Box 720, Springfield OH 45501, David A. Wallingford (s08.dwallingford@wittenberg.edu), Polly A. Bargar (ce.pbargar@wittenberg.edu), Jeffery L. Bradstreet (s08.jbradstreet@wittenberg.edu), Horton H. Hobbs, III (hhobbs@wittenberg.edu).

The life history of gordian worms (hairworms) is not fully understood, but it is generally known that juveniles parasitize and mature primarily in the gut of terrestrial and aquatic invertebrates assigned to three phyla: Annelida, Mollusca, Arthropoda. Adults are free-living, non-feeding aquatic worms that emerge from the host to breed but whose other activities are largely unknown. Six, twenty-four hour drift studies were conducted from October and November discontinuously from 1978 to 2007 at a site upstream from C. J. Brown Reservoir on Buck Creek in Clark County, a third order, alkaline stream flowing over gravel-cobble substrate of glacial till and overlying Silurian dolomite. Adult gordian worms appear routinely to enter the aquatic drift in the fall. Hairworms were found in the drift at approximately 1900h, peaked in number between 2100h and 2200h, and subsided by 2300h. Between 1900h and 2300h as many as 28 individuals were collected in drift nets, while the maximum caught in any other three hour period was 2; total number varied by year. Outside of the peak 1900h to 2300h period, capture of nematomorphs occurred during only 6 of 64 sampling periods. This study is one of the first to document quantitatively the drift pattern of gordiid worms and will be useful in further studies of their life histories.

Poster Board No. 022

SPATIAL INVENTORY OF KARST FEATURES IN CARTER CAVES STATE RESORT PARK, CARTER COUNTY, KENTUCKY USING INTEGRATED GPS AND GIS TECHNOLOGIES. Alexander Silvis (s08.asilvis@wittenberg.edu) Wittenberg University, P.O. Box 720, Wittenberg University, Springfield OH 45501 and Horton H. Hobbs III (hhobbs@wittenberg.edu) Dept of Biology, Wittenberg University.

Located in Carter County, Kentucky, Carter Caves State Resort Park is situated at the northern edge of one of the major karst regions of Kentucky and has a high density of caves, sinkholes, and other karst features. Currently, the precise geographic coordinates of the majority of these features are unknown; a formal inventory to record the location and various characteristics of caves within the park is in progress. Historically, the lack of a precise inventory and map has restricted the ability of the park to manage its resources, plan for development, and address threats to the cave ecosystems within its jurisdiction. Recognizing the need for such information, the park has worked cooperatively with the Wittenberg University Speleological Society for more than twenty years in gathering information on the cave resources within the park. It has not been until recently however, that the capability

of generating professional quality maps using geographic information systems (GIS) has arisen. Over the past year, approximately half of the known cave and karst features within the park have been inventoried with the aid of geographic position systems (GPS) technology and integrated into a GIS map of the park and surrounding county. In addition, caves that have been formally surveyed (N = 19) have survey maps joined to their coordinates, allowing for spatial analysis of surface level concerns to the subsurface caves, as well as hydrologic flow analysis. For the map to be of real use the remaining cave and karst features must be inventoried and surveyed.

Poster Board No. 023

PUTAMEN AND BMI: THE RELATIONSHIP THROUGH THE MOTOR PATHWAY OF THE BRAIN. Jeffrey D. Schak, s09.jschak@wittenberg.edu, John Strawn, jstrawn@wittenberg.edu, (Cathy L. Pederson) cpederson@wittenberg.edu. Wittenberg University, Box 1177, PO Box 6100, Springfield OH 45501.

The putamen, a subcortical nucleus of the basal ganglia, is known to be involved with both the motor and reward systems. The hypothesis of this study was that the volume of the putamen would be inversely correlated with body mass index (BMI). Twenty participants were selected from a database of women that contained psychological and demographic information as well as brain MRIs. These participants were then divided into two groups of ten based on BMI (meters/kilograms²). The low BMI group ranged below 20 and the high BMI was greater than 30. Demographic matching ensured that the two groups were statistically similar in alcoholic drinks per year (p=0.267), age (p=0.114), general intelligence as measured by the *Wonderlic Personnel Test* (p=0.889), and average abuse scores calculated from the *Childhood Trauma Questionnaire* (p=.133). Using 3D Brainstation, the right putamen was traced on horizontal MRI sections. The area of each slice was measured twice, and the average areas were summed to calculate the total volume of each putamen. The total volume of the putamen was negatively correlated with BMI (r=-.733; p=.006) which indicated that as BMI increases, the volume of the putamen decreased. Future studies that include both the eating and exercise habits of participants and measure the volume of the putamen would extend these findings and possibly give a neurological basis for obesity.

Poster Board No. 024

FECAL COLIFORM BACTERIA CONCENTRATIONS DO NOT DEPEND ON SEMI-DIURNAL TIDES IN CARTERET COUNTY, NORTH CAROLINA. Rachel C. Ianni (s08.rianni@wittenberg.edu), Wittenberg University, PO Box 720, Springfield OH 45501, William W. Kirby-Smith (wwks@duke.edu), Duke University.

Because shellfish are heavily fished for human consumption there is a concern for the effect of shellfish quality on human health. Oysters, like the ones found in Ware Creek, an embayment off the Newport River in Carteret County, North Carolina, collect water-borne bacteria and viruses that have the potential to be passed on to consumers. Ware Creek has been closed to shellfishing due to high concentrations of fecal coliform bacteria (FC). The purpose of the study was to determine if the FC concentration in Ware Creek was tide dependant. Fifteen water samples were collected using an American Sigma Model 900 Autosampler at rising, high, falling, and low tide over a three week period. Samples were tested using a multiple-tube fermentation technique to determine most probable number (MPN) of FC in the samples and what portion of FC was *E. coli*. FC was predicted to be lower in concentration at high tide due to the inflowing ocean water which would dilute the concentration as well as increase the salinity of the embayment, killing the bacteria. The Wilcoxon Matched Pairs test showed no significant differences between the concentrations of FC bacteria at rising (64.40), high (62.53), falling (50.00), and low tides (180.47). The average concentration of *E. coli* at low tide (207.67) was significantly higher than the concentration at high tide (50.27) and falling tide (26.20), but was not different from that at rising tide (52.20). Thus, FC concentrations were not tide dependant, though the human pathogen *E. coli* did vary with tides.

Poster Board No. 025

EFFECT OF COLOR VARIATION ON THE SHELL SELECTION PROCESS OF THE SAN SALVADOR HERMIT CRAB, *CLIBANARIUS TRICOLOR* Rachel C. Ianni (s08.rianni@wittenberg.edu), Wittenberg University, PO Box 720 Springfield OH 45501, Jacob T. Ark (s08.jark@wittenberg.edu), Adam C. Walton (s07.awalton@wittenberg.edu), Kathleen A. Reinsel (kreinsel@wittenberg.edu).

Hermit crabs depend on gastropod shells for shelter and to avoid predation. Shell selection may be influenced by stimuli that aid in the detection of a suitable shell. During June 2006 in San Salvador, The Bahamas, it was observed that *Clibanarius tricolor* inhabited darker colored shells in the lower intertidal zone and lighter colored shells in the higher intertidal zone. These shells appeared to match the color of the substrate on which they were observed, suggesting that shell color may serve as a form of camouflage. Thus, it was predicted that shell-less *C. tricolor* would choose a shell whose color was most similar to that of the surrounding environment. Five groups of ten shell-less hermit crabs were placed in black, white, and blue colored arenas with ten black and ten white gastropod shells. Crabs were given fifteen minutes to choose a shell. *C. tricolor* chose significantly more black shells within the white arena ($\pm^2_1 = 5.49$; $p < 0.05$). However, crabs did not exhibit a preference in either the blue arenas ($\pm^2_1 = 0.61$; $p > 0.05$) or black arenas ($\pm^2_1 = 0.00$; $p > 0.05$). Therefore, *C. tricolor* does not appear to select shells based on color to match the surrounding environment.

Poster Board No. 026

THE EFFECT OF MAJOR DEPRESSIVE DISORDER ON GLOBUS PALLIDUS VOLUME Rebekah K. Stewart s08.rstewart@wittenberg.edu, Jessica A. Baldrige s08.jbaldrige@wittenberg.edu, (Cathy L. Pederson) cpederson@wittenberg.edu Wittenberg University PO Box 6100, Student Box #2939, Springfield OH 45501.

The globus pallidus is a subcortical nucleus that is part of the basal ganglia and has been implicated in major depressive disorder. The hypothesis of this study was that the volume of the globus pallidus would be larger in the depression group than in the normal control group. The left globus pallidus volumes for 9 healthy control female subjects and 10 female subjects with major depressive disorder were compared. No significant statistical differences were found between groups in demographic areas including childhood abuse, age, intelligence, number of alcoholic drinks per session, number of alcoholic drink a year, and packs per year smoking ($p > .05$ for each ANOVA). There was a significant difference in major depression between the two groups ($F(1,19) = 611.52$, $p < 0.001$). The globus pallidus was traced using 3D BrainStation for Macintosh. The areas were measured twice on each slice (once by each researcher) and the two measurements were averaged and then summed to calculate the total volume. No statistical difference was found between the experimental and control groups in the volume of the globus pallidus using ANOVA ($F(1,18) = 0.49$, $p = 0.50$), and there was no correlation between the volume of the globus pallidus and major depressive disorder ($r = -.048$, $p = .85$). Insignificant results may be largely due to small sample size and contamination by Post Traumatic Stress Disorder and abuse. Future studies may focus exploring gender differences in individuals with clinically diagnosed major depressive disorder.

Poster Board No. 027

EFFECTS OF DIOXIN ON LIMB REGENERATION IN THE MEXICAN AXOLOTL. Jensen T. Lewis, lewisjt@muc.edu, 5279 Rootstown Rd, Ravenna OH 44266; Susan E. Ball, ballse@muc.edu, (Leonard G. Epp, epplg@muc.edu); Mount Union College, 1972 Clark Ave, Alliance OH 44601.

The environmental contaminant, dioxin (2,3,4,8-Tetrachlorodibenzo-p-dioxin), has been shown to inhibit Zebrafish caudal fin regeneration. Previous observations in our laboratory suggested this also may be true for amphibian limb regeneration. The purpose of this study is to determine the effects of dioxin on the timing and morphology of limb regeneration in the Mexican axolotl, *Ambystoma mexicanum*. Forelimbs or hindlimbs of twenty nine 10 cm axolotls were amputated. Dioxin was provided IP at concentrations of 70ng/g or 140ng/g to groups of 3-7 animals. Four subject groups were used: Control, Sham-injected, 70ng/g, or 140ng/g. Dioxin was injected based on weight of animals at the time of amputation or one week post-amputation. These times correspond to pre- and post-blastema formation, an early developmental stage critical to regeneration. Initial observations of the subsequent stages of regeneration indicate dioxin does not affect the rate of limb regeneration when compared to the rate of regeneration in control or chloroform (sham) injected animals. Observations of the morphology of regenerated limbs (e.g. proportioning or patterning) utilizing Victoria Blue stained regenerated limbs is now underway. These experiments may identify a model system for later studies investigating molecular mechanisms involved in the regulation of regeneration.

Poster Board No. 028

BAT WING SPAN AND WING AREA ESTIMATED FROM SKELETAL ELEMENTS. Jacqueline A. Runestad Connour (connourj@findlay.edu) and Amy K. Reed. The University of Findlay, 1000 North Main St, Findlay OH 45840.

Flight and foraging behavior have been linked to wing area and span in living bats. Fossil bats are represented only by skeletons, making it difficult to infer behavior from wing dimension. This study hypothesizes that wing area and span can be estimated from skeletal elements and associated with flight and foraging behavior in extant bats, and that the results can help interpret behavior in fossils. The study sample consists of skeletons of 10 extant bat species ($N = 2-11$, Families Pteropodidae, Phyllostomidae, and Vespertilionidae). Measurements were taken with calipers and include lengths of the humerus, radius, third, and fifth digit. Wing spans and areas were estimated from these measurements and from area formulae for triangles and rectangles, and can not be compared directly to field data. Estimated aspect ratios were calculated by dividing the square of wing span by wing area. Results from linear regression indicate that both wing span and area scale with geometric isometry relative to body mass. Results for aspect ratio indicate that long distance flying bats, such as *Eidolon helvum*, have greater ratios, indicative of long narrow wings. Those bat species with lower aspect ratios include most of the smaller bats, indicative of short broad wings. These species include *Eptesicus fuscus* which engages in slow maneuverable flight in dense vegetation. In conclusion, this study shows that flight and foraging behavior can be inferred from skeletal estimates of wing dimensions. However, larger samples and more behavioral information are needed before results can be applied to fossils.

Poster Board No. 029

ENHANCING COMPREHENSION OF MOLECULAR BIOLOGY'S "CENTRAL DOGMA" CLAY MODELS, COMPUTER SIMULATIONS, CONCEPT MAPS, OR FREE TIME? Ariane Djeussoung, Ariane.djeussoung@otterbein.edu, 1546 Mc Naughten Rd, Columbus OH 43232, Andrea Graytock, agraytock@otterbein.edu, (Simon Lawrance, slawrance@otterbein.edu), Otterbein College, Dept of Life & Earth Sciences, Westerville OH 43081.

Failure to grasp the important concepts of the central dogma (DNA @ mRNA @ proteins) often leaves college freshman biology students with a weak foundation in molecular biology. It is hypothesized that the use of stimuli (clay model, concept map, and computer exercise) prior to the genetic engineering experiment introduced in the first college biology course will improve students' understanding of the central dogma. The experiment that the students will perform focuses on the analysis of the phenotype and genotype of *E. coli* expressing a recombinant DNA molecule containing genes that confer resistance to ampicillin and kanamycin. In order to determine the students' understanding of the central dogma concepts, a study is designed using a Quasi experimental pre/post test design. Subjects ($N=67$) will be split into four different lab groups and introduced to different instruments (authors designed tests and quizzes) over several weeks prior to and after the genetic engineering experiment is performed in the lab. The four groups will receive the following different stimuli prior to the experiment: Three of the groups will work either with authors' designed hands-on models, authors' designed concepts map, or an interactive computer based tutorial. The fourth group will be given no stimulus (other than "free time"), and is designated as the control. The MANOVA and Bonferroni Post Hoc tests will be used to analyze obtained data and to assess whether any of the groups receiving the stimulation based tools show an improved comprehension of the central dogma of molecular biology as compared to the control "free time" group. Significance will be determined at $p < 0.05$.

Poster Board No. 030

SCREENING PLANT SPECIES FOR PHYTOREMEDIATION OF ARSENIC IN NORTHWEST OHIO; Jordan R. Rofkar, jordan.rofkar@utoledo.edu, and Daryl F. Dwyer, daryl.dwyer@utoledo.edu. The University of Toledo, Lake Erie Center, 6200 Bayshore Rd, Oregon OH 43618.

The overall objective of this research was to identify plant species, native to northwest Ohio, that can be utilized for phytoextraction of arsenic from contaminated soil. Above-ground accumulations of arsenic were compared in nine plant species using bioconcentration factor (BCF), a measure of tissue concentration relative to concentration in a hydroponic solution. Seedlings were grown for

two weeks hydroponically in a nutrient solution amended with arsenic (1.5 or 15 mg As L⁻¹). Samples (1 to 7 replicates) of above-ground tissues and roots were collected, oven-dried, acid-digested, and analyzed for arsenic using inductively coupled plasma – optical emission spectrometry (ICP-OES). The maximum BCF was observed in *Lemna minor* (1495.66; 1.5 mg As L⁻¹ treatment). In the remaining eight species, mean BCF values ranged from 3.15 (*Populus deltoides*; 1.5 mg As L⁻¹) to 13.59 (*Gaillardia pulchella*; 1.5 mg As L⁻¹) in above-ground tissues, and from 76.48 (*Panicum virgatum*; 15 mg As L⁻¹) to 1020.01 (*Viola cornuta*; 15 mg As L⁻¹) in root tissues. Mixtures of these native plant species will be used to test and design a passive phytoextraction system for arsenic-contaminated soil and water.

Poster Board No. 031

Increasing Chemistry Comprehension with Online Learning Applications. Michael. T. Homsher, Hafed Bascal, Jeffrey. Jenson, Janet Summers and Donna Emlinger, The University of Findlay, Department of Chemistry Frost 131, Findlay, OH 45840 homsher@findlay.edu.

Education and retention of students as scientists, technologists, engineers, and mathematicians is a national priority. Our research in Summer and Fall 2007 applied an NSF sponsored online interactive tutorial program to three University classes. We investigated the effectiveness of Mastering Chemistry (MC), an online teaching system to improve student comprehension of general and organic chemistry topics. Mastering Chemistry guides the instructor in the creation of an online class, enrolling students in the class, selecting assignments, and grading parameters, thus creating their own course schedule. Instructors reviewed available online learning exercises paired with the text, selected grading parameters/scales from automated tutorial assignments and activities that support individualized learning and assessment for each student. Instructors used online learning reports to evaluate their course learners relative to a national level NSF cohort. This comparison benchmark identified opportunities for increased student mastery and retention based on increased student engagement with the learning modules with lower scores. Eighty (80) percent of participants in the MC Fall 2007 classes earned a grade of C or better, (n = 132) while meeting or exceeding the NSF cohort average. Our Fall, 2007 Chemistry programs engaged five instructors and over 200 students to implement two levels of introductory chemistry and one organic chemistry class from high school to university levels using MC. An NSF program, Student Assessment of Learning Gains was employed for course assessment purposes (91 returns). The combination of online tutorial programs and student assessment of learning gains contributes to increasing the number of future qualified scientists.

Poster Board No. 032

SURFICIAL GEOLOGY MAP OF THE MANSFIELD 30 X 60 MINUTE QUADRANGLE. Douglas. L. Shrake, doug.shrake@dnr.state.oh.us, E.R. Venteris, G.E. Larsen, G.A., Schumacher, R.R. Pavey, and M.P. Angle, Ohio Department of Natural Resources, Division of Geological Survey, 2045 Morse Rd C-2 Columbus OH 43229-6693.

The surficial geology map of the Mansfield 30 x 60 minute quadrangle shows the complex geologic history representative of the transition between the till plains, the glaciated Allegheny plateau, and the unglaciated Appalachian plateau physiographic regions in Ohio. The map covers the geographic region of Richland, Ashland, Crawford, and Morrow and portions of seven more counties in north-central Ohio. Data to generate the vertical stratigraphic sequences shown on the map came from county soil surveys, water-well logs, Ohio Department of Transportation and Ohio Environmental Protection Agency boring logs, oil and gas well logs, fieldwork, and published and unpublished information from the Ohio Division of Geological Survey and other sources. Analysis of the surficial and buried fluvial drainage in the map area indicates a history of flow reversals and pro-glacial lakes breaching their impoundments, creating new outlet channels. The extensive history of pro-glacial lakes in the map area is indicated by numerous lacustrine or patchy lacustrine deposits as the topmost stratigraphic layer, particularly notable in the northwest quarter of the map. The southeast quarter of the map area contains a relatively extensive deposit of sand and gravel that locally exceeds 100 feet in thickness and may represent a pre-Wisconsinan depositional event. This map completes surficial geology coverage of the Interstate 71 corridor and the north-central and northeastern areas in Ohio. The eight surficial geology maps covering this portion of Ohio will be a valuable asset for planning and development in this

region. Mapping was partially funded by a U.S. Geological Survey STATEMAP grant.

Poster Board No. 033

DETERMINATION OF THE PERSISTENCE OF PHARMACEUTICALS IN BIOSOLIDS USING LIQUID CHROMATOGRAPHY-TANDEM MASS SPECTROMETRY. Alison L. Spongberg, alison.spongberg@utoledo.edu, Chenxi Wu, chenxi.wu@utoledo.edu, Jason D. Witter, jason.witter@utoledo.edu, Dept of Environmental Sciences, Mail Stop 604, University of Toledo, Toledo OH 43606.

Pharmaceuticals are increasingly being used in households, medicine, and animal husbandry. Over the past decade concern has been raised regarding their potential impacts on aquatic organisms and relation to antibiotic resistance. Certain classes of pharmaceuticals survive wastewater treatment, allowing for pathways to the natural environment directly by effluent discharge, or via runoff from agriculture lands where biosolids are applied as a soil amendment. However, information on their environmental fate is scarce in literature. The objective of this work was to determine the persistence of ten pharmaceuticals (Ciprofloxacin, Tetracycline, Doxycycline, Clindamycin, Clarithromycin, Erythromycin, Carbamazepine, and Triclosan in biosolids. Aerobically digested biosolids samples (N=18) were collected from a wastewater treatment plant in Lucas County, OH, and stored in five gallon plastic buckets at the R.A. Stranahan Arboretum (Sylvania, OH) under several conditions. Replicates (N=3) in each of the following conditions were studied: aerobic without light, aerobic with light, and anaerobic, in the field, and an anaerobic un-spiked control in a lab setting. Each treatment was analyzed for background concentrations, then spiked with pharmaceutical standards and subsequently analyzed for pharmaceutical residues over a three-month period. Samples were extracted using ultra-sonication and solid phase extraction, and analyzed by liquid chromatography-tandem mass spectrometry. No degradation was observed for Ciprofloxacin, Carbamazepine, and Triclosan; Tetracycline and Doxycycline degraded slowly; and relatively fast degradation was observed for Clindamycin, Erythromycin, and Clarithromycin. Degradation was enhanced under aerobic condition whereas no impact was observed from sunlight irradiation.

Poster Board No. 034

ISOLATION, DIVERSITY ANALYSIS, AND METABOLIC CHARACTERIZATION OF HYDROCARBON-DEGRADING BACTERIA. Mina S. Makary, mina.makary@otterbein.edu, (Amy E. Jessen-Marshall, ajessen-marshall@otterbein.edu), Otterbein College, SMC Box # 12255, One Otterbein College, Westerville OH 43081.

Globally, it is estimated that 0.1% of the total petroleum production (3914.1 million metric tons in 2006) is released into the environment during recovery, transport, refining, and product usage. Because of the negative impact of petroleum hydrocarbons on natural habitat and human health, considerable research on microbial bioremediation has been undertaken to remove these contaminants from ecosystems. The purpose of this study is to investigate the bacterial diversity of local hydrocarbon-contaminated soils, as well as characterize individual hydrocarbon-degraders. Soil samples (N=15) were collected from pristine sites and areas visually contaminated with oil on the Otterbein College campus. Soil samples (N=8) were serially diluted and inoculated onto hexane and minimal salt media plates to allow for the growth of hydrocarbon-utilizing microbes and onto rich media to determine the overall bacterial population. Clear zones were observed surrounding the bacteria on hexane media, indicating the ability to degrade the hydrocarbon in the media. Diversity indices of control and hydrocarbon-degrading microbial populations were established to understand the long-term effects of contamination and to determine the presence of hydrocarbon-degraders. Additionally, sixteen different hydrocarbon-degrading bacterial strains were isolated and identified using colony morphology, staining, Enterotube™ biochemical tests, and selective media. Consequent genomic DNA isolation has been successful, and ribosomal DNA sequencing of these strains is underway to identify the species. Further analysis will include the use of gas chromatography to assay the metabolic products of the hydrocarbon-degrading microorganisms. This work will contribute to the field by adding to the growing knowledge of microbial bioremediation and its environmental applications.

Poster Board No. 035

NEW ONLINE INTERACTIVE MAP PLACES OHIO DIVISION OF GEOLOGICAL SURVEY CORE

COLLECTION AT YOUR FINGERTIPS. Gregory A. Schumacher, greg.schumacher@dnr.state.oh.us, Marshall H. Goodman, Donovan M. Powers, Joseph G. Wells, and Kelli L. Vogt, Ohio Dept of Natural Resources, Division of Geological Survey, H. R. Collins Laboratory, 3307 South Old State Rd, Delaware, OH 43015-7635.

Core Locations in Ohio and Adjacent States is a new and powerful online map for geologists, students, and engineers to learn more about the subsurface geology of the Ohio region. The web-based interactive map was produced using Geographic Information System (GIS) methods. The associated database files provide access to a wealth of data on 843 cores drilled in Ohio, Kentucky, and West Virginia. A color-coded symbol provides the location where each core was drilled and indicates the geologic system or period at the core's base. Adjacent to each core symbol, the Ohio Division of Geological Survey (ODGS) identification number and the stratigraphic units cored is shown. A click on each core location symbol links users to database information such as: American Petroleum Institute (API) number; geographical coordinates; county, township, and topographic quadrangle location data; lease name; operator name; cored interval in feet; total depth; and cored stratigraphic units. The database also includes information about any sampling restrictions for a specific core and whether core descriptions, sample laboratory analyses, or geophysical logs are available. The map's explanatory text provides information about the ODGS core collection, how to use the map, and information concerning visiting the H. R. Collins Core and Sample Repository. Production of map MG-4 was partially funded by a grant from the U. S. Geological Survey National Geological and Geophysical Data Preservation Program. *Core Locations in Ohio and Adjacent States* (map MG-4) is available at www.ohiodnr.com/geosurvey/.

Poster Board No. 036

PRELIMINARY NOTICE OF A THIRD PALEONISCOID (ACTINOPTERYGII: PALAEONISCIFORMES), WITH A VERTICAL SUSPENSORIUM, FROM THE UPPER DEVONIAN (FAMENNIAN, IIF) CLEVELAND SHALE OF CUYAHOGA COUNTY, OHIO. T. G. Martin, martin120@oh.rr.com, Dept of Vertebrate Paleontology, Douglas W. Dunn, ddunn@cmnh.org, Dept of Invertebrate Paleontology, Cleveland Museum of Natural History, 1 Wade Oval Dr, Cleveland OH 44106-1767.

Examination of 524 Cleveland Museum of Natural History Vertebrate Paleontology Department paleoniscoid (Actinopterygii: Palaeonisciformes) specimens from the Upper Devonian (Famennian, IIF) Cleveland Shale of northern Ohio by longtime department volunteer Terry Martin has established at least one additional paleoniscoid genus in the Cleveland Shale vertebrate fauna. The specimens (CMNH 8065, 8868, 9521, 9560, 9667, 9785), collected in Cuyahoga County during the I-71 highway construction salvage project in 1965-1966, clearly differ from the two genera, *Tegeolepis clarki* (Newberry, 1888) and *Kentuckia hlavini* Dunkle, 1964, previously described from this unit. Similar in size to *Kentuckia* (about 10 cm., = 4 in.; *Tegeolepis*, 60 cm.-1m.), and with similarly shaped (rhombic) and sized (*Tegeolepis* scales are minute) but differently ornamented scales, the new paleoniscoid also differs in the following characters. The mandible's length/height ratio and ornamentation differ from *Kentuckia*'s. Compared to the oblique suspensorium of both genera (*Tegeolepis*'s is more oblique than *Kentuckia*'s) its suspensorium is much more vertical, similar to the lower Carboniferous (Mississippian) European genera *Mesopoma* and *Canobius*. Specimens have only been found in the shale itself, not concretions. Because the specimens' stratigraphic levels within the unit are unknown (probably collected as float), nothing can be said of its range or possible biozonation within the unit. Continuing collection from exposures and preparation of unopened concretions in the department's collection may uncover more specimens of this paleoniscoid, providing more knowledge of its anatomy, taxonomic relationships, geographic and stratigraphic range, and possible biozonation.

Poster Board No. 037

THE EFFECTS OF A SEMI-RIGID ANKLE BRACE ON BALANCE AND JOINT PROPRIOCEPTION IN COLLEGE VOLLEYBALL ATHLETES. Laura C. Vuyk, l-vuyk@onu.edu, Ohio Northern University, Dept. of Biology, Ada OH 45810.

Ankle braces are a proven defense against athletic ankle injuries, however some clinicians have scrutinized their use on healthy ankles arguing that it will weaken the musculature and make a person dependent upon them. Previous studies have shown proprioceptive awareness has predictive value in the frequency of ankle sprains. An ankle brace works to prevent injury by offering

mechanical support as well as cutaneous cues as to where a person's ankle is positioned in space. Based on findings from previous studies it is hypothesized that wearing a semi-rigid ankle brace for eight weeks will either not affect or help an individual in proprioceptive functions. In order to test the hypothesis, this study evaluated the balance and proprioceptive awareness of the ONU women's volleyball team by comparing the response of those athletes who wear semi-rigid ankle braces (n=7) and those who wear no ankle protection at all (n=5). This study demonstrated that over a ten week period proprioceptive capabilities did not significantly change; however, there were differences between the two groups. A statistical T-test (p<0.05) demonstrated that plantarflexion movements were significantly more proprioceptively accurate in the control group while dorsiflexion, eversion and inversion proprioceptive functions were not significantly different between the two groups. Based on these findings, the current study partially disagrees with past research, and suggests that there may be a detrimental effect of wearing ankle braces; however due to limitations of this study it cannot pinpoint the exact cause of the proprioceptive differences.

Poster Board No. 038

ADAPTABILITY DEFECTS DUE TO DECREASED ROBUSTNESS IN AN RNA VIRUS. Kimberly L. Lust¹ lustk@findlay.edu, Isabel Novella² isabel.novella@utoledo.edu ¹1000 North Main St, The University of Findlay, Findlay OH 45840 and ²University of Toledo.

Vesicular stomatitis virus (VSV) subjected to repeated genetic bottleneck in hamster cells have a defect in their adaptability (defined as their capacity to adapt to a given environment) compared to control, non-bottlenecked strains. Adaptability was measured as the rate of fitness increase averaged from multiple replicas. However, occasionally individual replicas of some viral strains with overall adaptability defects undergo fitness increases comparable to those of the controls. Virus survival depends not only by its degree of adaptation (fitness), but also by their ability to incorporate mutations with minimal fitness cost (robustness). We hypothesized that strains with adaptability defect have lower robustness than controls strains. The hypothesis was tested using four VSV viral strains: two strains derived from MARM U (a control strain) and two strains derived from MRb (a strain that is neutral compared to MARM U, but has an adaptability defect.) Each test strain was subjected to six replicas of a regime of plaque-to-plaque passages, which allows the fixation of any non-lethal mutation. After 20 passages fitness was determined in triplicate for each population by direct competition against wild type reference, for a total of 72 determinations. The two controls strains lost fitness from 7.8±0.98 to 4.57 and from 6.2±1.11 to 3.98. The test strains decreased their fitness from 6.2±0.67 and 7.2±0.41 to 2.54 and 1.26, respectively. Thus, the overall fitness loss was more marked in viruses with adaptability defects (p<0.005), demonstrating a larger average negative effect of mutations in strains with adaptability defects, and, therefore, a lower robustness.

Poster Board No.039

REFOLDING OF THE C_H3 DOMAIN OF IMMUNOGLOBULIN A FOR BIOPHYSICAL ANALYSIS. Bryan W. Poulsen¹, poulsenbw@rose-hulman.edu, Monica T. Brooks², mtbrooks@email.uc.edu, Andrew B. Herr², andrew.herr@uc.edu, ¹Rose-Hulman Institute of Technology, Dept of Applied Biology and Biomedical Engineering, Terre Haute IN 47803 and ²University of Cincinnati, Dept of Molecular Genetics, Cincinnati OH 45221.

Immunoglobulin A (IgA) plays an important role in preventing infection by triggering immune responses via the IgA-specific Fc receptor, Fc α RI. Multivalent antigen-IgA complexes activate Fc α RI-mediated signaling pathways, resulting in a pro-inflammatory immune response. However, recent findings show that monomeric targeting of Fc α RI activates an anti-inflammatory pathway. To investigate monomeric targeting of Fc α RI, we have expressed the C_H3 domain of IgA in E.coli Tuner (DE3) pLysS cells. C_H3 was isolated by sonication and solubilization of inclusion bodies with 8M urea. C_H3 refolding was conducted using dilution and dialysis techniques, testing various additives to optimize the maximum yield of refolded protein (20-58 percent refolded protein). Proper refolding was confirmed by analytical ultracentrifugation sedimentation velocity experiments (A₂₃₀, 20°C, 48,000 rpm), which demonstrated that refolded C_H3 was predominantly dimeric. It was found that dialysis refolding in the presence of cyclophos-4 yielded 25% refolded protein, 100% of which was determined to be dimeric by analytical ultracentrifugation. The long-term goal of this research is to use the refolded C_H3 protein to determine the relative contribution of the C_H3 domain in the IgA:Fc α RI interaction, and to investigate utilizing C_H3 as a potential therapeutic agent in disease

where there is an inappropriate pro-inflammatory immune response, such as in autoimmune disease, asthma, and allergy.

Poster Board No. 040

THE ROLE OF PITX2 IN ANTERIOR SEGMENT DYSGENESIS IN MOUNTAIN HORSE BREEDS.

Heather E Shannon

Heather.Shannon@otterbein.edu & (Simon Lawrance slawrance@otterbein.edu), Department of Life & Earth Sciences, Otterbein College, Westerville OH 43081

Anterior Segment Dysgenesis (ASD) is an ophthalmic disorder present in several breeds of *Equus caballus*, and is especially prevalent in mountain horse breeds. This congenital disorder causes multiple abnormalities of the eye including cysts in the ciliary body, megalocornea, dyscoria, retinal dysplasia, and nuclear cataracts. Many ASD abnormalities are comparable to those seen in humans with Axenfeld-Reiger syndrome, which has been linked to mutations in the gene encoding the transcription factor, PITX2 (paired-like homeodomain transcription factor 2). PITX2 is a member of the Pitx homeobox gene family and is required for anterior segment development. The purpose of this study is to determine whether ASD in mountain horses is caused by a mutation in PITX2. The focus of the study has been exon 5 of PITX2. For this study, genomic DNA from 25 mountain horses with ASD and genomic DNA from 25 mountain horses without ASD will be extracted from hair follicles. Exon 5 of the PITX2 gene will be amplified using primers specific for the introns flanking exon 5. The DNA will then be sequenced and aligned using ClustalW to identify potential mutations. At present, equine DNA has been successfully isolated and the exon has been completely sequenced for several samples. It is anticipated that the results of this study will contribute toward a better understanding of the etiology of ASD as well as the creation of a diagnostic genetic test for ASD in mountain horse breeds.

Poster Board No. 041

QUANTITATIVE DETECTION OF CANINE DISTEMPER VIRUS IN BLOOD SAMPLES OF ASYMPTOMATIC DOGS BY REAL TIME PCR, Almir S. Martins^{1,2},

alisbete@icb.ufmg.br; Helen L. DelPuerto^{1,2},

helendelpuerto@hotmail.com, Amy Milsted¹,

milsted@uakron.edu, Luciana Moro²,

moro@icb.ufmg.br; Gissandra F. Braz²,

gissa_braz@yahoo.com.br; Fabiana Alves²,

alves.bio@gmail.com; Anilton C. Vasconcelos²,

anilton@icb.ufmg.br, ¹The University of Akron,

302 Buchtel Commons, Akron, OH 44325-3908;

²Universidade Federal de Minas Gerais, Belo

Horizonte, Brazil.

Canine distemper is a systemic viral disease characterized by immunosuppression followed by secondary infections. In most cases the clinical diagnosis of distemper is difficult to confirm. Considering the great infectious potential of the disease, the possibility of carrying out an antemortem diagnosis of distemper is important. Absolute quantitative real time PCR (AQPCR) was used for detection and diagnosis of canine distemper virus (CDV) in blood of 5 asymptomatic dogs and vaccine samples. CDV-specific oligonucleotide primers of 20 and 21 nt length were designed for the amplification of an 84 bp target CDV nucleocapsid protein coding region fragment. Another target fragment of 93 bp of canine β -actin was utilized as endogenous control. After conventional reverse transcription at 45°C, cDNA samples were used for AQPCR in ABI Prism 7000 SDS with the PE Biosystems SYBR®Green and protocol. Standard calibration curves were determined for both CDV and β -actin target amplicons. Quantitative results were generated by ABI-Prism Software. Dissociation curves for target fragments confirmed the AQPCR specificity. Slopes for calibration curves from both CDV and β -actin in the range of -3.2 demonstrated a reaction efficiency of 100% and a high linearity with $r^2 = 0.989$. Positive controls confirmed that the product detected was CDV, and negative (no template) controls showed no CDV PCR products. The AQPCR detected 3 positives in 5 dogs asymptomatic for CDV. The present protocol detected as little as 10^{-8} ng of CDV cDNA in asymptomatic dogs, and may be suitable for future viral quantification and epidemiologic studies. (Sponsored by CNPq-Brazil).

Poster Board No.042

REGULATION OF P21 EXPRESSION IN HUMAN BLADDER CANCER CELL LINES Ashley L DuMont

dumont_a@denison.edu, Slayter Box 7632

Denison University Granville, OH 43023, (Lina I Yoo) yool@denison.edu

Mice deficient in the tumor suppressor *Pten* (phosphatase and tensin homolog deleted on chromosome 10) are susceptible to developing tumors in the prostate but are not as susceptible to developing

tumors in the bladder. These *Pten*-deficient mice also have elevated levels of the cyclin-dependent kinase inhibitor p21 in the bladder but not in the prostate, indicating that the upregulation of p21 in the bladder is tissue specific. The correlation between p21 upregulation and fewer incidences of tumors in the bladder as well as p21's role in the cell cycle suggest that p21 may be involved in downregulating tumor formation in the bladder. The expression of p21 in human bladder cancer cell lines is being studied to see if there is any correlation to a mouse model previously described. Serum-starvation experiments have been conducted with two human bladder cancer cell lines, UM-UC-3 and UM-UC-14, which have been shown to express p21. Protein levels of phosphorylated AKT were evaluated to determine the effectiveness of the serum starvation experiments. Results indicate that when cells are serum starved for 24 hours and then medium with 10% serum is added back to the cells, over time, phosphorylated AKT levels increase. p21 levels increased in a similar pattern to the phosphorylated AKT levels. From these initial observations, it is proposed that AKT is regulating p21 at the protein level. To test this hypothesis we are currently conducting serum starvation experiments with the addition of a phosphatidylinositol 3-kinase (PI3K) inhibitor which specifically targets the PI3K/AKT signaling pathway to further explore this possibility.

Poster Board No.043

INDUCTION OF SINUS TACHYCARDIA BY EPHEDRINE IN RANA PIPIENS Karen E. Marshall
k-marshall@onu.edu, Ohio Northern University,
402 W College Ave Unit 1647 Ada OH 45810.

Pseudoephedrine, a stereoisomer of ephedrine, belongs to a family of drugs known as sympathomimetic drugs which act as stimulants. As an over-the-counter and prescription drug, pseudoephedrine can treat sinus congestion, inflammation and ear infections. It can also counteract the effects of beta-blockers, which are often prescribed to persons with high blood pressure or heart conditions to decrease the heart rate, cardiac output and blood pressure. This study was designed to determine if ephedrine can induce sinus tachycardia, an elevated heart rate, in *Rana pipiens* (N=15). The central nervous system of each frog was destroyed and the heart was exposed. A hook was placed through the heart's apex and attached by a string to a force transducer so that ventricular contraction could be monitored continuously. Baseline recordings were determined after a ten minute stabilization period. In controls (N=5), five consecutive 1 mL doses of saline (0.9%) were dripped over the heart every five minutes to establish the impact of the vehicle control. The experimental group (N=10), received incremental doses of ephedrine (1.0, 3.0, 6.0, 12.0, and 24.0 mg/mL). Neither the initial force of contraction (control 0.29 ± 0.08 g; experimental 0.30 ± 0.22 g) nor the heart rate (control 47.26 ± 10.08 bpm; experimental 47.13 ± 6.13 bpm) were significantly different between groups. Analysis (ANOVA) did not reveal any significant differences ($\alpha=0.05$) in force from multiple saline administrations (controls) or increasing concentration of ephedrine; or on heart rate in controls. However, bradycardia, a significantly decreased heart rate, resulted, with increasing doses of ephedrine, not tachycardia as originally postulated.

Poster Board No.044

THE EFFECTS OF INVASIVE AQUATIC PLANTS ON THE ONTOGENETIC DIET SHIFT OF FRESHWATER TURTLES USING STABLE ISOTOPES AS DIET INDICATORS Maria S. Wheeler,

Maria.Wheeler@otterbein.edu, Sarah S. Bouchard,

S.Bouchard@otterbein.edu 44 W Main St, Apt A,

Westerville OH 43081.

Invasive plants can create dense, monospecific stands, which can increase the structural complexity of aquatic habitats. Studies have shown that such structural complexity can be negatively correlated with predatory fish foraging efficiency. The purpose of this study is to determine whether the presence of invasive emergent plants, such as reed canary grass (*Phalaris arundinacea*), common reed grass (*Phragmites australis*) and narrow-leaved cattail (*Typha angustifolia*), impacts the diet of painted turtles (*Chrysemys picta*) using stable isotopes as diet indicators. Painted turtles developmentally begin as carnivores and undergo an ontogenetic diet shift to herbivory as they mature. However, we hypothesize that turtles from habitats heavily impacted by invasive plants will show less carnivory because their foraging is hindered by the density of the invasive plant stems. Blood samples were collected from 39 turtles in 7 different northeastern Ohio ponds and marshes (5 with and 2 without invasive plants) as well as representative potential plant and invertebrate diet items. All samples have been dried and ground, and will be sent to a lab for analysis of their nitrogen isotope ratios. We will compare the $\delta^{15}N$ of blood from turtles from the different habitats using an ANOVA to determine if the degree of carnivory varies. The more carnivorous the turtle, the higher the

$\delta^{15}\text{N}$ of the blood. We therefore hypothesize that turtles from habitats heavily impacted by plants will have lower $\delta^{15}\text{N}$ values than those from less impacted habitats.

Poster Board No. 045

USING INVERSION TO SOLVE THE APOLLONIUS CIRCLES PROBLEM. Michael D. Fu, michael.fu1993@sbcglobal.net, 2985 Iowa Ct., Beavercreek OH 45431. (Beavercreek High School)

The objective of this project is to use inversion to solve Apollonius' Circles Problem. Apollonius' Problem is largely recognized as one of the most ingeniously complex geometric construction problems of all time. Curiously enough, Apollonius of Perga actually gave a solution to the problem in his *Tangencies*. However, *Tangencies* was lost, and a simple and an elegant solution has escaped the grasp of some of the greatest geometers since. Apollonius' problem is as follows: Construct the circle which is tangent to any three objects that may be any combination of points, lines, and circles. This may seem simple at first glance, but it is actually exceedingly complex. The case with the three objects as circles is the most difficult, for as much as eight solutions are possible. This project deals with a simple and elegant solution that was discovered through studies in inversive geometry. By applying properties of inversion, a pre-problem was first solved: to construct a circle tangent to two circles and passing through a single point. A Java Applet was also made to simulate this construction. The complicated original problem was then simplified into one very similar to the pre-problem through shrinking and enlarging circles. Additionally, solutions of many "special cases" were discovered in which the circles have a unique arrangement with respect to each other. Results of the project show that circles inversion concepts invented in the 1820's by Jacob Steiner are extremely useful in breaking down complex problems into much simpler ones.

Poster Board No.046

WILL THE PH OF A SOLVENT AFFECT THE FORMATION OF A CRYSTALLINE SOLUTION? Kanasha P Hall, kph333@sbcglobal.net, 363 Buxton Ave, Springfield OH 45505 (Springfield South High School)

Crystallization refers to the "formation of solid crystals from a homogeneous solution." An important factor for crystal formation is solution saturation. The purpose of this experiment was to determine if the pH of a solvent affects the formation of a crystalline solution, and to observe the growth of a crystalline solution in ionized and deionized water. The hypothesis was that the pH value of the ionized water would affect crystallization. The materials were distilled water, tap water, one 500 milliliter beaker, two 250 milliliter beakers, a stirring hot plate, temperature probe, pH strips, Analytical Balance, and Aluminum Potassium Sulfate. During these experiments, the pH value of the deionized and ionized water were initially seven. Addition of aluminum potassium sulfate (alum) to each solvent decreased the pH to acidic values. The summary of this project is that the pH of neither the deionized or ionized solvent affected the formation of the crystals. An improvement for these experiments would be to try several different pH values. The height and weight of the crystals were not measured; results were observed and documented by pictures. The Alum crystals crystallized at the same rate and had the same symmetry. Crystalline solutions can form in many solvents, regardless of the pH value. Water is the universal solvent because of its dissolving power and availability. Water molecules have two hydrogen atoms and one oxygen atom. Crystal formation is a sensitive process. Although the pH values of varying solutions differ in themselves, crystallization is under these conditions independent of pH value.

Poster Board No.047

ARE AUDITORY STIMULI BETTER RETAINED THAN TACTILE STIMULI? Jeremiah J. Shaw jeremiah.shaw@att.net 3901 East Enon Rd, Yellow Springs OH 45387.

This project sought to discover if auditory stimuli are better retained than tactile stimuli. The hypothesis states that the tactile stimuli would be better retained than the auditory stimuli. This is suggested because the tactile system is more complex than the auditory system, including a vast array of receptors, and the majority of the parietal lobes, all dedicated to tactile processing. To test this hypothesis, 36 subjects of three different age groups (Group A = Age 6-9; B = 10-14; C = 37-58) were tested. Subjects were blindfolded and asked to tactilely examine six objects, one at a time (5 sec each). Secondly, they were presented with six sounds from a computer, hearing only one at a time. Data for the immediate, delayed (15 min) and recognition memory were recorded. In immediate memory, auditory stimuli ($M = 5.10$) had a higher average

retention rate than tactile stimuli ($M = 4.79$). In delayed memory, tactile stimuli ($M = 4.67$) had a higher average retention rate than auditory stimuli ($M = 4.54$). In recognition memory, auditory stimuli ($M = 5.52$) had a higher average retention rate than tactile stimuli ($M = 5.13$). Overall, the adult group had a higher average retention rate than both child groups across all memory tests. When taken together the results indicate, that overall, auditory stimuli were better retained than tactile stimuli. Yet, in delayed memory, tactile stimuli were better retained. In memory training programs for people with brain disorders, acoustic/auditory stimuli could be used to reinforce learning.

Poster Board No.048

THE PULSE RATE. Adam T. Pollitt, adam.p.2012@yahoo.com; 1224 Bat Roost Rd., Manchester OH 45144. (Manchester High School)

This project was to determine, who had the higher pulse rate between 7th and 8th grade males and females. The project was to prove that 12 and 13 year old females have a higher pulse rate than boys of the same age. Girls begin puberty before boys giving their estrogen and other hormones more time to travel through their body, causing their pulse rate to be higher. The test was to prove who had the higher pulse rate among the four groups. Pulse rates were collected from 21 males and females from each test group, separating and recording each student's pulse rate, gender, and grade. The figures were compared. The average rate for 7th grade females was 75.3bpm. The average rate for 7th grade males was 75.3bpm. The 8th grade males pulse rates were averaged at 72.55bpm; the girls' rates were higher at 79.55bpm. The 8th grade females pulse was higher by 4.25bpm over the 7th grade females. The 8th grade males dropped 2.75bpm from the 7th grade boys. In conclusion, the largest change was an increase to the girls' pulse rates between 7th and 8th grade. When comparing all junior high males and females pulse rates, the females' pulse rate were higher than the boys' rate. The hypothesis was correct. Females do have a higher pulse rate than males.

Poster Board No.049

THE FEASIBILITY OF SOLAR STILLS FOR WATER PURIFICATION IN A COLD ENVIRONMENT. Theresa R. Gordnier, writer101@fuse.net, 26 Cameron Cir, Centerville OH 45459. (Dominion Academy of Dayton)

Recently, the issues of reliance on non-reusable energy sources and of water pollution have received heightened attention. Solar stills address portions of both these environmental problems, harnessing the sun's energy for water distillation. However, it is uncertain if solar stills designed for personal water purification will be successful at cold temperatures. Box, parabolic, and traditional stills were designed and constructed from household materials including cardboard, plastic, and aluminum foil. It was hypothesized that although a box still would purify the most water, none of the stills would purify 237 ml of water at temperatures near or below 0° C. The three stills were placed in a sunny location in Centerville, OH., where tests were conducted from Jan. 29, 2007 through Feb. 1, 2007. Each test lasted 10 to 13 hours. from morning to evening. For each test, 237 ml salt water (105 ml of salt per 1.9 L tap water) was poured into each still. Weather and temperature information was recorded at the beginning, midpoint, and end of each test. Purified water was measured and tested for purity by taste, sight, and electrical conductivity. The traditional still produced a maximum volume of 22.5 ml of distilled water daily. This water neither tasted salty nor conducted electricity, but did contain other visible contaminants. The parabolic and box stills produced insufficient samples for testing. It was concluded that though the traditional still model was the most successful design, all designs would require major re-engineering to produce enough water for personal consumption.

Poster Board No.050

THE EFFECT OF MYELOPEROXIDASE ON MYOCARDIAL INFARCTION AND SURVIVAL IN APOE/SR-BI KNOCKOUT ANIMALS. Suzanne B. Mazhuvanchery, suzmaz89@gmail.com, 5571 Ridgewood Ln, Brecksville OH 44141 (Hathaway Brown). Nina C. Bhat - nina.bhat@gmail.com. Dr. Marie-Luise Brennan - brennam@ccf.org, Dr. Stanley L. Hazen - hazens@ccf.org - Cleveland Clinic.

Cardiovascular disease is the leading cause of death in the United States. Research has shown patients who suffered from myocardial infarctions have elevated levels of an enzyme known as myeloperoxidase. Myeloperoxidase is a protein that oxidizes low density lipoprotein (LDL), lipids and other proteins, promoting plaque deposition and cardiovascular disease. Plaque in coronary

arteries can erode, leading to plaque rupture and heart attack. People die from heart attacks due to complications that arise from it. One potential factor causing complications is myeloperoxidase, hence the importance of further studying this enzyme. Only recently has a new mouse cardiovascular disease model that experiences myocardial infarction been established. The novel apolipoprotein E/scavenger receptor BI double knockout model was used to study the role of myeloperoxidase. Myeloperoxidase/ apolipoprotein E/ scavenger receptor BI triple knockout mice and apolipoprotein E/ scavenger receptor BI double knockout mice were bred. Survival and heart tissue histology were performed. Chlorination of tissue was also tested for. We found that double knockout mice lived much shorter lives than wild-type mice. They lived on average 10 weeks as opposed to 2 years. The triple knockout mice lived shorter than double knockout mice, living on average 51 days versus 61 days ($p=0.002$). Histology showed thrombi in coronary arteries and cellular infiltration into the myocardium. Chlorotyrosine levels were found in double knockout mice, providing evidence of myeloperoxidase activity in heart tissue. The double knockout model is a unique model for studying atherosclerosis. There is cellular infiltrate, thrombi and myeloperoxidase activity. A survival difference in the triple knockouts suggests myeloperoxidase may play a protective role and have other vital functions in the body.

Poster Board No.051

ROCKET FINDER: PART I, DIRECTION-FINDING ANTENNAS. Cherylyn M. Geers, cherylyn@one.net, 3721 Dust Commander Dr, Hamilton OH 45011-5525 (Homeschool).

The ultimate goal of this long-term project is to create a system to locate model rockets after they have been launched. This part of the project investigated direction-finding antennas. Dipole, yagi and quad antennas were constructed, and their patterns were measured to determine the best type of antenna for direction-finding. The antenna patterns were recorded using a spectrum analyzer, signal generator, log periodic measuring antenna and turntable. Five trials were performed using each antenna. The antenna that was tested was connected to the signal generator. The measuring antenna was connected to a spectrum analyzer. The antenna being evaluated was placed on the turntable. It was then rotated and the signal level was measured every 11.25°. The antenna gain for each measurement was calculated by comparing it to the reading of an antenna with known gain. The dipole gain was -2 dBi, the yagi gain was 6 dBi and the quad gain was also 6 dBi. The front/back ratio was 1 dB for the dipole, 7 dB for the yagi and 3 dB for the quad. Since the ratio is higher on the yagi, it is the most directional.

Poster Board No.052

FINDING ALTERNATIVE FATS. Erin R. Danneker, codanneker@mac.com, 1964 Cherry Stone Lane, Greenville NC 27858 (Bishop Flaget School).

This experiment focuses on finding alternative fats to those high in trans fat. The hypothesis was that fries fried in shortening and vegetable shortening will be most liked by people who taste them, will cost less, will have the most trans and saturated fat content, and will have a longer shelf life than those fried in canola oil or vegetable oil. For the experiment, four different kinds of fats were purchased (differing in amounts of trans fat) as well as other needed supplies. Four batches of fries were fried in different kinds of fat. A baked batch of fries was used for the control group. All fries were blindly taste tested. Cost was determined by the total cost divided by number of tablespoons per container. The shelf life test consisted of the fries being left open to air and examined weekly for mold growth. The hypothesis was not correct in two of the four areas examined. The first area, for taste, was that the canola oil was rated the highest (3.68 on a 5 point scale) and not a shortening (1.56 for shortening). The second area, for the shelf life, was that the canola oil was the least moldy. However, the shortenings were higher in trans and saturated fat with a combined 5-6 g/Tbsp (as listed on the nutrition label) compared to 1-2 g/Tbsp for the oils. Both of the shortenings were also cheaper (\$.0168 and \$.0238/Tbsp. for vegetable shortening) than the oils (\$.0420 canola and \$.0264/Tbsp vegetable oil).

Poster Board No.053

WILL CORN YIELD AND NITROGEN LOSS INCREASE WITH INCREMENTAL NITROGEN APPLICATIONS. Andrew J. Haun, whaun@loganrec.com, 7361 Twp. Rd. 163, West Liberty OH 43357.

Nitrogen (N) is required for plant growth and utilized in the largest amount by the corn plant compared to the other primary nutrients. Following N application, bacteria begin the biological breakdown process of N, resulting in potential N loss. Nitrogen application to

corn (*Zea mays L.*) six weeks after planting provides N for more efficient plant uptake. In this study, two fields had 0.7 acre plots divided into five different comparisons: 0 lbs. N/Ac., 60 lbs. N/Ac., 105 lbs. N/Ac., 135 lbs. N/Ac., and 165 lbs. N/Ac. All treatments received nitrogen applications six weeks after planting. Soil samples were collected prior to N application and 10, 38, and 60 days afterwards and analyzed for N content. To determine the amount of nitrogen in the corn plant, leaf tissue samples were collected when corn was silking and stalk samples were collected at maturity. At harvest, each nitrogen treatment was weighed, grain samples collected, and yield determined. Each plot was evaluated separately. The agronomic optimum N rate was 145 lbs./Ac, and the economic optimum was 143 lbs. N/Ac for CR-55 plot; whereas, the agronomic optimum N rate was 71 lbs./Ac. and the economic N rate was 60 lbs./Ac for the CR-5 plot. The hypothesis was supported as nitrogen loss increased with increasing nitrogen rates and corn yield increased. Corn yields can be enhanced with less nitrogen application if managed for most efficient yields on a field-by-field basis that results in improved environmental stewardship.

Poster Board No. 054

HOUSEHOLD HYGIENE; ANTIBACTERIAL SPRAYS. Toral S. Vaidya, pvaidya744@aol.com, 744 Courtwright Blvd., Mansfield OH 44907 (St. Peter's High School).

The project was to answer the question, "Which household liquid spray works the best to kill bacteria on surfaces." Six different sprays at a 100% concentration, six 50% diluted in distilled water sprays, and distilled water were tested to determine which one was most effective. Samples tested were 100% Bleach, 50% Bleach, 100% Vinegar, 50% Vinegar, 100% Ethyl alcohol, 50% Ethyl alcohol, 100% Isopropyl alcohol, 50% Isopropyl alcohol, 100% Lemon Juice, 50% Lemon Juice, 100% Thievesä, 50% Thievesä, 100% Distilled Water, and a dry wipe. Thievesä is an essential oil blend containing clove, cinnamon bark, lemon, eucalyptus, and rosemary. Products were tested on separate 6x8 cm. rectangles. First spray bottles were made, each containing the assigned liquid formula. Counter surfaces were swabbed and plated, sprayed twice, wiped with sterile gauze for 10 seconds, allowed to dry, and swabbed and plated again. The swabbed agar plates were placed in an incubator at 36 degrees Celsius for 48 hours. The staphylococcal bacterial colonies on each plate were counted and recorded. This procedure was performed in two different trials. In result, 100% Ethyl alcohol, 50% Ethyl alcohol, and 100% Isopropyl alcohol eliminated 100% of the staphylococcal colonies. 100% Ethyl alcohol had 48 staphylococcal colonies on before plate and 0 on after; 50% Ethyl alcohol had 79 colonies on before plate and 0 on after; 100% Isopropyl alcohol had 27 colonies on before plate and 0 on after. Alcohol in the concentration of 70- 92% rapidly kills bacteria by denaturing bacterial proteins.

Poster Board No. 055

A STUDY OF STEM CELL MIGRATION IN RESPONSE TO CHEMOKINES. Julianne M. Golinski, jgolinski@sbcglobal.net, Robert H. Miller, rhm3@case.edu, Anne K. DeChant, akd6@case.edu, 1145 John Glenn Dr, Seven Hills OH 44113 (Hathaway Brown School)

Multiple sclerosis is an autoimmune disorder that results in demyelinating lesions in the nervous system. This experiment was conducted to study the possibility of repair of these lesions by attracting new cells to lesioned areas using chemokines, proteins known to affect the migration of neural stem cells and precursor cells. A study of stem cell migration in response to chemokines was conducted to determine whether certain chemokines either promoted or inhibited neural stem cell migration. It was hypothesized that the chemokines SDF1 and Fractalkine would promote stem cell migration. Neuronal stem cells were grown from six adult rat brains as neurospheres and mixed with low melting point agarose. A drop of the mixture was placed on a coverslip and allowed to solidify. The coverslips, eight for each chemokine, were submerged in cell growth media containing the specific chemokine and cultured for forty-eight hours to allow the stem cells to migrate. The coverslips were then stained with GFAP, an antibody that labels astrocytes, differentiated brain cells. Images were taken of the cells and the distance they migrated from the edge of the agarose drop was measured using a computer program. Most of the untreated cells migrated 0µm to 500µm from the drop. The majority of the SDF1 treated cells migrated between 300µm and 900µm with few cells migrating shorter or longer distances. Most cells treated with Fractalkine migrated 750µm to 2500µm. The results are consistent with the hypothesis that SDF1 and Fractalkine promote neural stem cell migration.

Poster Board No.056

EFFECTIVENESS OF A SUMMER ENRICHMENT PROGRAM FOR DISADVANTAGED MIDDLE SCHOOL GIRLS. Kelsey M O'Hearn, kelseyohearn@gmail.com, 2555 Coventry Road, Shaker Heights OH 44120; Stephanie Blumer, sblumer09@hb.edu (Hathaway Brown School)

This study examined the impact of ASPIRE, a summer educational program for underprivileged middle school girls who demonstrate leadership and/or academic promise. Each year approximately 30 rising 6th grade girls are enrolled into the three year program. The objectives of ASPIRE focus on the development of academic skills, oral and written communication, collaboration and leadership, positive role models and peer relationships. To assess these objectives, a 165 item, PDA-based survey with standardized measures was administered to participants before and after the 2005, 2006, and 2007 summer programs, yielding a total of six data points for each participant. Additionally, a subset of the ASPIRE survey was administered to a sample of girls (n=60) from similar backgrounds and academic success as a comparison group to the girls in the final year of the program. ASPIRE participants entered the program with elevated perceptions of their skills, competence, and engagement in the academic process. Over time scores on most indicators either remained stable or declined, although important academic indicators, school engagement and study strategies, rebounded after each additional summer experience. While participant scores at the end of the program tended to be lower than the beginning, scores on indicators of school engagement, study strategies, personal value of education, oral and written communication and collaboration and leadership were significantly higher than those of the comparison group (all $p < .05$). This suggests that exposure to the ASPIRE program may have slowed a downward trend and succeeded in maintaining academic interest and competence throughout the middle school years.

Poster Board No. 057

WHICH TYPE OF FERTILIZER IS MORE EFFECTIVE FOR GROWING GRASS. Jonathan R. Martin, tam1@fuse.net, 1576 Rockhurst Ln, Cincinnati OH 45255 (McNicholas High School).

This experiment was an attempt to determine the best fertilizers to use for growing grass seed. It was completed to find out whether chemical or organic fertilizer made the grass seed grow faster. The hypothesis was that chemical fertilizer would make the grass seed grow faster than organic fertilizer. After four weeks, the seed that was given water grew to an average height of 13.4 centimeters, the organic fertilizer 13.2 centimeters, and the chemical fertilizer 12.4 centimeters. This hypothesis was wrong. From this data it was proven that both organic and chemical fertilizer produced approximately the same rate of growth. While searching and gathering information on the growth of lawns, important information was found. This proved and agreed with the results of this experiment. Two separate trials were conducted. There were drainage holes added to the bottom of the containers the second time to check if this was the cause of the problem. It proved that the main item to look for in fertilizers was the amount of nitrogen contained. The analysis of the data collected showed there was little difference between organic or chemical fertilizers. This was proven by taking an average height of all the samples. It was found in the conclusion that the amount of water and nitrogen the soil contained would affect the health and growth of the grass.

Poster Board No.058

THE EFFECT OF DIFFERENT SUGARS ON THE RATE OF FERMENTATION IN YEAST. Tessa M. Polakowski tessapolakowski@yahoo.com 7280 Country Club Lane, West Chester OH 45069 (Ursuline Academy).

Yeast use sugar during fermentation (anaerobic respiration) to convert monosaccharides into carbon dioxide and ethanol. Yeast cells were tested for their effectiveness in utilizing a variety of sugars for fermentation. The rate of fermentation in yeast cells was measured by monitoring the pressure build-up over time using the Calculator-Based Laboratory (CBL) system, a pressure probe, and a graphing calculator. Yeast cells, *Saccharomyces cerevisiae*, were fed eleven different 5% sugar solutions, three trials for each sugar, and the means were calculated and compared. Yeast had the highest carbon dioxide formation rates using sucrose, followed by: Splenda®, dark brown sugar, powdered sugar, light brown sugar, glucose, Sugar- In- The- Raw®, maltose, fructose, Equal®, and galactose. Using a 2- sample T-test ($n = 3$ and $p = 0.05$), the rate (atm/s) of yeast cell fermentation was found to be: significantly higher using sucrose than all the other sugars, significantly higher using Splenda® than all sugars except powdered sugar, and

significantly higher using dark brown sugar than all sugars except powdered sugar. The varied rates are possibly due to specific enzyme availability. The high rate of respiration of yeast cells when Splenda® is available suggests that bakers could use this sugar substitute (in place of sucrose), in particular, for diabetics, without compromising yeast effectiveness or food quality.

Poster Board No. 059

TREBUCHET TRAJECTORY. Sam W. Salchak, CasalRedd@aol.com, 10036 Bellbrook Rd, Waynesville OH 45068 (Bellbrook Middle School).

Trebuchets were used in medieval warfare and were considered a great weapon of the time. Range was a key in effectively hitting a target, forming the basis of this project: exploring the ideal trajectory to fire a projectile the farthest distance. Research in motion equations suggested that this would be 45 degrees. To test range versus angle of launch, two small scale models that fired beans were constructed and tested before a full scale model which fired golf balls was built. The materials for the early prototypes were two bags of popsicle sticks, one bottle of wood glue, paper, string, and one bean. The full scale model used 264cm of 2x4" wood, 107cm of 2x6" wood, 56cm of treated 2x6" wood, 152cm of 1" dowel, a plywood base, 70cm of black pipe, two pipe flanges, 43 cm of PVC, a Tupperware bowl, fasteners(nails, screws, pegs, glue), and five golf balls. For the full scale experiments three release angles were chosen: 60, 45, and 30 degrees. Other than the angle of release, the golf balls were fired under identical conditions. At a 60 degree launch the range was 303.4 cm. This was 22.7 percent more than at 45 degrees (247.2cm) and 176.8 percent more than the 30 degree launch (109.6 cm). This disproved my hypothesis. Further investigation indicated that for this trebuchet design, the 60 degree launch angle allowed a counterweight to fall further, creating more initial velocity for the projectile, and generating the greatest range for the conditions tested.

Poster Board No. 060

THE EFFECTS OF SMOKE ON THE GROWTH AND CONDITION OF PHILODENDRON HOUSE PLANTS, SYLVANIA, OHIO. L. A. EARL, otearl@bex.net, 5627 Birch Hollow Ct., Sylvania OH 43560. (Sylvania Franciscan Academy).

Following an interdisciplinary study on the effects of secondhand smoke on the human respiratory system, further questions were conjured regarding the effects of cigarette smoke on plants. A problem statement was then developed: Does smoking effect the growth of philodendrons? The hypothesis was that the cigarette smoke would decrease the amount of philodendron growth. Two card-board boxes, one with holes for ventilation, and six philodendrons were used for the experiment. Three plants were placed in the ventilated box and the other three in the non-ventilated box. The experiment began by an adult lighting one cigarette, placing it into the ventilated box and letting both groups of plants stay in their separate boxes for one hour, twice a day during a two week period. The growth recorded each day from both exposed and non-exposed philodendrons, varied from a half of one inch to one inch, except for a few times when a leaf fell off or a bud on a vine turned into a large leaf. The hypothesis was proven to be inconclusive because the growth between the two groups of plants differed only by one and two thirds centimeters. However, despite the lack of distinction of growth between the groups, the condition of the philodendrons in the exposed group was much worse than that of those in the non-exposed group.

Poster Board No. 061

CAN THE CHEMICAL COMPOSITION OF RUBBERS AFFECT THE DURABILITY AND PROPERTIES OF RUBBER MATERIAL WHEN EXPOSED TO ENVIRONMENTAL AND CHEMICAL CONDITIONS? John C. Boykin III, jcb58@aol.com, 6618 Pearl Rd., Parma Heights OH 44130 (Incarnate Word Academy).

Natural and synthetic rubbers were tested under various environmental and chemical conditions to determine if the composition of rubbers would affect their durability and strength. Eight types of rubber were tested, Nitrile, Natural Gum Rubber, SBR (Styrene butadiene), Latex, Teflon®, SBR Styrene butadiene black, Neoprene® and EPDM (ethylene propylene monomer). The rubber samples were all cut into equal sizes for testing. Twenty two different tests were run on each rubber and repeated three times and averaged, totaling 1056 tests. Tests included chemical, hardness, impact, abrasion, freeze, heat and burn tests. Chemicals included gasoline, salt, bleach, caustic and acid tests. It was hypothesized that the Teflon® rubber would withstand the environmental tests and not decompose. The rubbers were ranked based on their test measurements. Measurements included:

hardness, percent change in area and volume, roughness grit, absorption, density, flexibility. Of the many tests performed the gasoline test gave significant variation, Nitrile increased in size +20%, Gum rubber +36%, Latex +50%, SBR red and black +11%, Neoprene[®] +24%, EPDM +21% and Teflon[®] 0%. SBR red had the lowest abrasion at 5% /square inch. Ranking results summary of the 22 tests (1= smallest change from original rubber properties) is as follows. SBR red 1, SBR black 2, Teflon[®] 3, EPDM 4, Neoprene[®] 5, Latex 6, Gum 7, Nitrile 8. Natural and Latex rubbers performed the worst with size change and chemical tests. Teflon[®] was the most resistant to gasoline but less resistant to abrasion. Neoprene[®] had a 25% / square inch abrasion but did not deteriorate in any of the chemical tests. Nitrile did not test superior in any test. In conclusion, SBR red had fewer property changes and deformed the least when exposed to chemicals and environmental conditions in these tests.

Poster Board No. 062

THE EFFECTS OF WATER POLLUTION ON PULMONATE AND PROSOBRANCH SNAIL POPULATIONS. Jane E. Lodwick
alienfarmsinkansas@yahoo.com 13113 Spring Blossom Trail, Chesterland, Ohio 44026. **Beaumont School.**

The goal of this experiment was to determine if lung-breathing pulmonate snails dominate over the gill-breathing prosobranch snails in ponds that have comparatively high levels of pollution indicators. Five different ponds were analyzed, and the number and type of each snail indicator (shell) at each pond was carefully recorded. Additionally, 150 ml water samples were collected once from each pond and tested to determine general hardness, carbonate hardness, pH levels, ammonia levels, and nitrate/nitrite levels. Pond temperature and pond size were also determined. The snail shells and water pollution indicators from each pond were then compared to those of other ponds, and overall, the aforementioned hypothesis was proven to be incorrect. Pulmonate snails did not necessarily dominate in ponds with poor overall water quality. They did, however, tend to be more plentiful in ponds with a general hardness level of 80.0 ppm. Prosobranch snails responded well to ponds with nitrate levels of 5.0 ppm, nitrite levels of .1 ppm, ammonia levels of .6 ppm, large ponds, carbonate hardness levels of 70 ppm, and water temperatures between 9 degrees Celsius and 10 degrees Celsius (inclusive). Both kinds of snails were found in ponds with pH levels of 7.5.

Poster Board No. 063

FROM PRISM TO RAINBOW: WHY RAINBOWS HAVE DIFFERENT WIDTHS. Rebecca J. Rabinovich, becky_rabinovich@yahoo.com, 32790 Wintergreen Dr, Solon OH 44139 (Solon HS)

This project explores why different rainbows have different widths. Because rainbows are caused by light refraction in raindrops, it was hypothesized that the angle between the refracted beams of the sunlight's component colors - the degree of dispersion - depends on the incident angle of the sunray, and hence on the position of the sun above the horizon. To prove it, the experiment utilized a prism to represent the raindrop and green and red laser pointers to represent a sunray. The light rays were shined through the prism, located 300cm away from a wall, at predefined incident angles, and the distance between the rays' projections on the wall quantified the degree of dispersion. Because of the measurement sensitivity to minute changes in the setup, the incident angle was controlled by placing the prism on a rotating stand and measuring the incident angle by the degree of stand rotation. The results, averaged over three trials, showed that the incident angle affects the degree of dispersion: at a 35° angle, the degree of dispersion was 24.13cm, dropping to 3.18cm at 55°, and increasing again to 10.79cm at 80°. However, the hypothesis did not hold when applied to rainbows: a raindrop is spherical - unlike the prism - and parallel rays of sunlight enter it at the same wide range of incident angles regardless of the sun's position over the horizon. Further reading revealed that the rainbow width is determined by raindrop size, which may be explained by the wave nature of light.

Poster Board No. 064

CAN NATURAL SUBSTANCES PURIFY ACID MINE DRAINAGE?. Rebecca K. McGrail, rmcgrail1@sbcglobal.net, 366 Westwood Dr, Steubenville OH 43953. (Steubenville Catholic Central High School).

The research goals of this study were to determine if natural substances can be used in the treatment of acid mine drainage (AMD) and which natural substance returns the results closest to the receiving stream's initial conditions. It was hypothesized that pelletized lime (CaO) will restore AMD closest to the receiving

stream's conditions due to its alkalinity. The addition of CaO as an alkali will lower total acidity. It will decrease conductivity and increase dissolved oxygen through the removal of dissolved metals in AMD. A PVC pipe was inserted into the drainage area and flow measurements were taken. A coffee filter with one Liter of filter carbon, pelletized lime, sand, or soil from the drainage area was placed into a 2.2 Liter stainless steel strainer. The strainer was placed over a 3.5 Liter bucket and placed under the pipe. The AMD was allowed to run through the filter and fill the bucket. The water was tested for total acidity, total alkalinity, conductivity, dissolved oxygen, and pH. AMD and unaffected stream water were also tested for comparison. The results show that filter carbon was able to improve the conditions of the AMD by lowering total acidity 30 ppm and conductivity 480.5 μ S/cm on average, increasing dissolved oxygen 955.95 mg/L on average, and maintaining pH and total alkalinity. In conclusion, natural substances can be used in the treatment of AMD. Filter carbon shows the most potential as a filter, but further testing is required. This leads to the rejection of the hypothesis.

Poster Board No. 065

EFFECTS OF POWDERED ROOTING HORMONE ON THE GROWTH OF DIEFFENBACHIA. Christopher R. Cooper, musicislife101@hotmail.com, 3109 Williams Creek Dr., Cincinnati OH 45244. (Turpin High School)

Gardeners and farmers use rooting hormone on plants to speed up the process of propagation and increase the likelihood of healthy plants. In December of 2006, 20 Dieffenbachia cuttings were planted in pH-balanced soil. Prior to planting, 10 of these cuttings were dipped into powdered rooting hormone containing auxin. All 20 plants were watered with distilled water until water seeped through the hole in the bottom of the pot. All plants were grown in a greenhouse under artificial light at a temperature between 20°C and 23°C. They were given a month to grow. The average root length of the plants without hormone was 15 mm, longer than those with hormone. The average number of roots for a plant with hormone was 6 more than plants without the hormone. Additional observation showed that the plants without hormone had stronger stalks and greener leaves. These additional observations along with the measured results lead to the conclusion that the plants without hormone were healthier.

Poster Board No. 066

DOES YEAST AFFECT THE ALCOHOL LEVEL IN WINE? Julie A. Wise, lildubbs13@aol.com, Mathews High School, 2481 Waynewood Drive, Fowler, Ohio 44418

The purpose of this experiment was to test the effect of yeast on the alcohol level derived in the fermentation process of wine. The researcher's hypothesis was that any quantity of yeast would not affect the alcohol level in the wine. Yeast amounts of 0.176 oz., 0.352 oz., and 0.528 oz. were added to 64 oz. bottles of juice and tested to see if the alcohol level changed. Nine tests were completed - 0.176 oz. of yeast was added to three bottles of juice; 0.352 oz. of yeast to three bottles of juice, and 0.528 oz. yeast to three bottles of juice. First, the alcohol level in each bottle of juice was measured, using a hydrometer. The researcher then added 1 ½ cups sugar and yeast to the juice to begin fermentation. During fermentation, the researcher recorded changes in the wine color and fermentation rate, the amount of bubbling that occurred. Potassium metabisulphite was added to stop fermentation. The wine was then tested for its alcohol level. Tests with 0.176 oz. of yeast resulted in 3%, 9%, and 8 % alcohol levels. Tests with 0.352 oz. of yeast resulted in 10%, 8.5%, and 15% alcohol levels. Tests with 0.528 oz. of yeast resulted in 11.5%, 14%, and 15 % alcohol levels. Results indicate that the higher the amount of yeast added to the juice, the higher the resultant alcohol level, thus, disproving the original hypothesis.

Poster Board No. 067

A NOVEL FUNCTION FOR COMMD1 IN NKCC1 FUNCTION. Casey Glassman¹, cglassman09@hb.edu, Carole M. Liedtke², carole.liedtke@case.edu, Laura Smith², laura.smith@case.edu. ¹6237 Tourelle Dr., Highland Hts. OH 44143, ²Dept. of Cystic Fibrosis Research, Case Western Reserve University. (Hathaway Brown School)

The basolateral Na⁺-K⁺-2Cl⁻ co-transporter (NKCC1) is essential for secretion of fluid into the pulmonary airways. NKCC1 mediates entry of Cl⁻ into cells for exit at the apical membrane by CFTR, a Cl⁻ channel. Fluid movement in the lungs is critical for humidification of inspired air and for optimal hydration of mucus. Loss of the

carboxyl terminus (CT) of NKCC1 leads to physiological changes in hearing, salivation, pain perception, spermatogenesis, and renal function. We hypothesized that NKCC1 carboxyl terminus interacts with an intracellular protein necessary in normal NKCC1 function. Using yeast-2 hybrid methodology, we identified a 21 kDa protein called COMMD1 interacting with carboxyl terminus (CT) of NKCC1. A 26 kDa protein called GST, which facilitates isolation and purification of attached proteins, was tagged to COMMD1. GST-tagged COMMD1 was expressed, purified, and used in binding experiments. GST-COMMD1 binds to CT-NKCC1 in a concentration-dependent manner. COMMD1 has been associated with ubiquitin signalling which leads to protein degradation. Ubiquitinated NKCC1 was detected in immunoprecipitated (IP)-NKCC1 from HT29 colonic cell lines. HT29 cells stably expressing silencing RNA (siRNA) to COMMD1 blocked 84.1% of COMMD1 expression and reduced ubiquitinated NKCC1 by 87.7%. In Calu-3 airway epithelial cells, ubiquitinated NKCC1 was detected in total cell lysate and in immunoprecipitated NKCC1. siRNA to COMMD1 was electroporated-into Calu-3. siCOMMD1 reduced COMMD1 protein expression by 97.5% but did not affect activation of NKCC1. Our results indicate that COMMD1 binds to CT-NKCC1 and regulates ubiquitination of NKCC1. Supported by a grant from the NIH HL-058598.

Poster Board No. 068

THE FEASIBILITY OF *SUS DOMESTICUS* MANURE IN A NOVEL MICROBIAL FUEL CELL DESIGN FOR VOLTAGE PRODUCTION AND BACTERIAL LOAD REDUCTION. Rachel A. Yoho, ryoho@columbus.rr.com, 1230 South Galena Rd, Galena OH 43021-8511. (Big Walnut High School).

Microbial fuel cells (MFC) are devices that use bacteria to generate electricity. The goals of this investigation were to test a new design of MFC (with electrodes existing only in either anaerobic or aerobic conditions), determine the optimal electrode material, test the viability of *S. domesticus* manure as a fuel source, and determine if bacterial populations decrease over time in the MFC. It was hypothesized that the new design MFC would work most efficiently with a graphite and carbon cloth combination electrode, the manure would be a viable fuel source, and the bacterial populations would decrease after the MFC had produced a voltage over time. *S. domesticus* manure (liquid and solid), plastic containers, various electrode materials (copper, graphite, silver, charcoal), silicon sealant, and proper safety materials were used. Laboratory materials and procedures included Tryptic Soy agar, CHROMagar™, serial dilution techniques, and anaerobic incubation. The testing of 19 MFCs (28 electrode combinations) revealed that the MFC filled with *S. domesticus* manure produced voltage, that carbon cloth over graphite electrode produced the highest voltages (up to 0.303 V, approximately 300% increase over other materials), and that there was an average aerobic bacterial reduction of 99.8% over approximately 1300 hours for the carbon cloth/graphite electrodes. *Enterococcus*, *E. coli*, and *Staphylococcus* were present during final aerobic and anaerobic testing. This investigation suggests that *S. domesticus* manure has potential for electricity generation on farms and MFC may be able to reduce the number of bacteria in the manure prior to disposal by fertilization of fields.

Poster Board No. 069

AQUATIC PLANTS AND WATER POLLUTION. Angela M. Rudnicki, TYSSwimmer4303@aol.com, 1973 Burr St, Toledo OH 43605 (Sylvania Franciscan Academy).

Aquatic plants are vital to the life of many species that live in lakes, rivers, ponds, and streams. According to recent studies, aquatic plants such as duckweed take in many pollutants in these water sources faster than bacteria can degrade them. To determine the effect of water pollution on aquatic plants, the growth of aquatic plants in different types of water was studied. Nine groups of duckweed from Maumee Bay State Park were collected and grown in three different types of water at room temperature: Maumee River water, tap water, and chlorinated water (containing eight times the chlorine of tap water). Diameter, area, water, and air temperature were recorded on three different days. Total growth was determined by measuring the diameter of the group then calculating the area. The duckweed did not grow in chlorinated water, but grew equally well in tap water and in Maumee River water. In conclusion, this experiment was designed to discover if aquatic plants can be an indicator for water pollution. The investigation did not show a definite answer to this question. If this experiment was to be revisited, a change in the hypothesis would take place because aquatic plants can adapt to water with varying qualities. The experiment may reveal different and more definite results if it was re-done. The duration of the experiment should be extended for further research. Some pollutants could possibly extend the life of aquatic plants because they have the ability to take in water pollutants faster than bacteria can degrade them.

Poster Board No. 070

CLEANING UP OPEN WATER PETROLEUM SPILL WITH MAGNETIC SAWDUST. Raymond Tan, ztan@cinci.rr.com, 8308 Cherrydale Ct., Mason OH 45040. (Mason High School).

Oil spills from tankers may cause ecological disasters in the marine environment as well as along shorelines. The commonly used oil clean-up and collection strategies may not always work well especially if there are waves on the water surface. Sawdust is inexpensive and is available in huge quantities. It is hypothesized that sawdust can be made magnetic to help in its retrieval from open water after it has been used to absorb oil spills. In this experiment, sawdust was indeed made magnetic using iron sulfate salts impregnation followed by deposit conversion with sodium hydroxide and heat treatment. The oil absorption measurements were conducted on the sawdust with a 1:1 mixture of engine oil and salt water (3.5% salt) to simulate the oil spill at sea. It was found that the oil absorption capacity of the magnetic sawdust remained almost the same as that of the untreated sawdust, at sawdust to oil ratios of 0.0, 0.25, 0.50, 0.75 and 1.0. The solar degradation rates of spilled oil in the sawdust were also estimated with an accelerated solar irradiation chamber. They were found to be 10.1% and 10.6% weight loss respectively for the oil in untreated sawdust and magnetic sawdust after 24 hours of accelerated solar irradiation. The magnetic sawdust remained magnetic even after oil/water absorption. It could be easily collected with a magnetic device on the clean-up boat.

Poster Board No. 071

TENNIS BALLS – TEMPERATURE AFFECTS BOUNCE. Ryan J. Girard, g-girard@sbcglobal.net, 257 Deer Trail Ct., Reynoldsburg OH 43068. (Bishop Hartley High School).

Isaac Newton's three laws of motion, friction, and temperature affect the bounce of a tennis ball. Even the fuzz on the cover of the tennis ball is important. This project's objective was to determine if temperature affects the bounce of a tennis ball. The hypothesis was that tennis balls stored in 38°C (100°F) would bounce higher than tennis balls stored in -18°C (0°F). The materials consisted of nine new pressurized tennis balls, one plastic bag, and a baking dish. Three tennis balls were frozen in the bag at -18°C for four hours in a freezer. Three tennis balls were heated in the baking dish at 38°C for four hours in an oven. As a control, three tennis balls remained at room temperature. Each of the nine balls was dropped from a height of 2.54m (100 inches) five times each. The height of the first bounce of each trial was recorded. The height was averaged for each category: frozen, heated and normal. The average bounce height for the balls stored in the -18°C temperature was 20.02 inches, 38°C 62.5 inches, and room temperature 55.27 inches. The hypothesis was correct. So, the tennis balls stored in the high temperature of 38°C bounced much higher than the balls stored at -18°C. Tennis players and tennis coaches could use this information when storing tennis balls or considering temperature on the day of a match so their skills can be adjusted to match the expected height and speed of the tennis ball.

Poster Board No. 072

DNA: ANALYZING CANINE DNA PROFILES, Shefali S Shah, alpanjay@yahoo.com, 469 Private Dr # 10463, Proctorville OH 45669 (Fairland Middle School)

There are approximately 350 genetic diseases in canines and over half of these diseases have similar human versions. Canine species are more homogenous than human species; thus it is preferable to work with canine DNA to learn more about genetic diseases. This project analyzes the DNA profiles of multiple canines (*Canis lupus familiaris*). The purpose of the project was to validate if each subject has a unique DNA profile as measured by the 16 allele sizes and their positions. Someday mapping the complete Canine Genome and understanding the specific trait of each allele will lead to elimination of genetic diseases, both in canines and humans. The hypothesis of this analysis was that each subject has sufficient difference in DNA to create a unique profile. Four canines (N=4) from different breeds, gender and groups (sporting or herding) were chosen as test subjects. Cheek cells were collected from each subject and were amplified using a process called Polymerase Chain Reaction. Then, during electrophoresis a sequencing machine creates the profiles of each subject that maps the locations and sizes of each allele. Although, large portions of the DNA were the same in every profile, certain DNA fragments of each canine were different. The results indicated that three herding canines were exactly 50% similar. Sporting canine was less than 50% similar to the herding canines. It was concluded that even though all canines are descendants of the Gray Wolf each canine does have a unique profile.

Poster Board No. 073

DOES INCREASING STRUCTURAL MEMBER LENGTH INCREASE TENSILE STRENGTH? Sarah K. Mayo, panthers10@zoominternet.net, 309 Township Rd. 1135, Proctorville OH 45669. (Chesapeake Middle School).

A Pratt Through Truss bridge was constructed out of cardboard file folders following detailed specifications. Built out of solid bars and hollow tubes, the bridge was load-tested to determine how successfully the structure worked. It was observed that an external load applied to the bridge structure resulted in internal forces – tension or compression – developing within each structural member. Focusing on tension forces in the solid bars, the hypothesis was that increasing the length of the structural members would not increase tensile strength. Test specimens were twelve bars–four each of three different lengths (17.7cm, 20cm, 22cm) and all of the same width (6mm). Experimental testing was conducted using a simple, home-built wooden lever machine. Specimens were individually clamped to the lever machine, and load (sand) was added to a bucket until the specimen failed. The weight of the sand was then charted. The mass of the bucket/sand that caused each specimen to fail was converted to a force using the equation W (weight of the object) = mass (mass in kg) \times g (acceleration of gravity, 9.81 meters/sec²). The mass was expressed in kilograms, therefore, the weight (W) was in newtons. The principle of the lever was applied using the equation T (unknown internal force/tensile strength) = W (weight of the bucket and sand) L_2/L_1 (L_2 and L_1 being measured directly from testing machine) to determine the force in each test specimen at failure. Data entered on a spreadsheet program revealed the tensile strength of the 22cm bars to be 28.28N (newtons), 27.02N, 30.86N, and 26.97N. The tensile strength of the 20cm bars was 30.40N, 26.92N, 28.74N, and 26.36N. The tensile strength of the 17.7cm bars was 30.25N, 31.21N, 31.56N, and 30.10N. An x-y scatter plot graph showing tensile strength vs. member length was then created. Experimental results proved that there was no relationship between member length and tensile strength. This experiment is important because in order to evaluate a structure's load-carrying ability, an engineer must be able to determine the strengths of the structural members that comprise it.

Poster Board No. 074

3.2.1. BLAST OFF Michael R. Kovalchik II lkovalch@insight.rr.com 7581 Lanetta Lane, Westerville, OH 43082 Saint Charles Preparatory School

Rockets have always been an interest of man. Going farther and faster means a lot to a rocket scientist. The objective of this project was to see what design of model rocket nose cone allows the rocket to achieve the greatest amount of altitude. The hypothesis was that if pointed, hemispherical, and hybrid (a mix between a pointed and hemispherical nose cone) nose cones are used, then the pointed nose cone will achieve the greatest altitude. To test this, the same rocket was launched five times while using a B6-6 model rocket engine with each type of nose cone, using an altimeter to measure the altitude it reached in meters with a possible range of 1-600 meters. It turned out the hemispherical nose cone reached the greatest altitude with an average altitude of 397.76 meters. The pointed nose cone achieved the second greatest altitude with an average altitude of 366.96 meters, and the hybrid nose cone achieved the least altitude with an average altitude of 326.1 meters. There is a reasonable explanation to this, as more research was done to figure out these puzzling results. One piece of information had an old carpenter's trick. It is that if you blunt the end of a pointed nail by hitting it against something hard, it will cut clean through the wood without splitting it. If you think of the nail as the nose cone, wood as air, and the splitting as drag, it explains these results.

Poster Board No. 075

LEARNING PREFERENCES VS PHYSIOLOGICAL RESPONSES Ethan J. Varner, ethan_varner@hotmail.com 14285 Road K14 Ottawa, Ohio 45875 (Miller City-New Cleveland High School)

Cognitive psychology is one of the least understood scientific fields. Understanding the mind can yield educational improvements. Sixty-three fourth and fifth grade students were tested using a Multiple Intelligence Test to determine his/her preferred learning style. The three leading subjects in Linguistic and Spatial-Visual styles and, three neutral subjects, from each of the classes were given a second test. Each was given two tests, a Linguistic test (subjects were read a list of fifteen words twice and then they recited the words) and a Spatial-Visual test (subjects were given thirty seconds

to memorize fifteen words. Blood pressure was taken before and after testing to establish physiological responses. Learning in ways that conflict with a person's preferred learning style will instigate anxiety and memory will be compromised. When a person learns in ways that are parallel with his/her preferred style, he/she will become comfortable and remember more words. Female results with preferred style include sixty-seven percent of subjects have a decrease in diastolic pressure and fifty-three percent had a higher memory score. Twenty-seven percent earned a lower memory score and twenty percent had no change in memory score. Male results with preferred style include eighty-seven percent of subjects have an increase in diastolic pressure and forty-nine percent had a lower memory score in their preferred style. Thirty-eight percent had a higher score and thirteen percent had no change in memory score.

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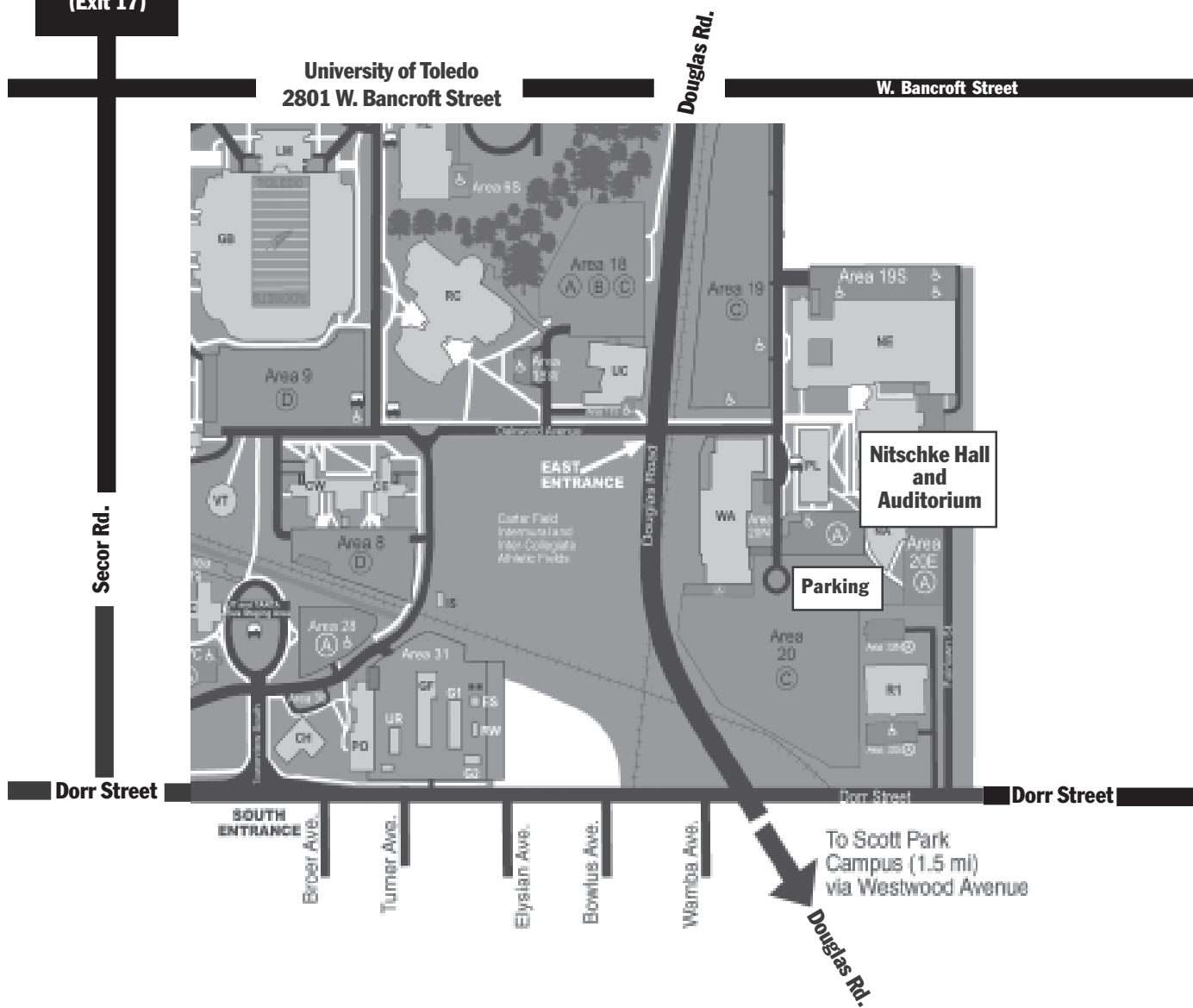
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Planning Notes

Registration and all sessions are in Nitschke Hall in the extreme southeast section of the campus.

<http://enrollmentservices.utoledo.edu/pages/directions.asp>



How to get to The University of Toledo

2801 W. Bancroft
Toledo, Ohio 43606-3390

See: <http://enrollmentservices.utoledo.edu/pages/directions.asp>

From the Ohio Turnpike (Use Exit 64):

- Follow I-75 north to I-475 (Exit 204).
- Travel west on I-475 to the fourth exit, Secor Road (Exit 17).
- Turn left onto Secor Road.
- Proceed on Secor Road past Bancroft Street.
- You are now at UT. Please refer to the map (or confirmation letter, if applicable) for specific program locations.

Via I-75 from the North:

- Continue south on I-75 to I-475 (Exit 204).
- Travel west on I-475 to the fourth exit, Secor Road (Exit 17).
- Turn left onto Secor Road.
- Proceed on Secor Rd. past Bancroft Street.
- You are now at UT.

Via I-75 from the South:

- Continue northbound on I-75 past downtown Toledo to I-475 west (Exit 204, Ann Arbor/Sylvania).
- Note: Do not take the first I-475 exit south to Perrysburg.
- Travel west on I-475 to the fourth exit, Secor Road (Exit 17).
- Turn left onto Secor Road.
- Proceed on Secor Rd. past Bancroft Street.
- You are now at UT. Please refer to the map .

Via U.S. 23 from the North:

- Continue south on U.S. 23 to I-475 east (Exit 14, bear left).
- Follow I-475 east to the second exit, Secor Road (Exit 17).
- Turn right onto Secor Road.
- Proceed on Secor Rd. past Bancroft Street.
- You are now at UT. Please refer to the map (or confirmation letter, if applicable) for specific program locations.

**The Ohio Environmental Science
& Environmental Engineering
SCHOLARSHIP PROGRAM**

<http://www.ohiosci.org/OESEESCHOLARSHIPS.htm>

SAMPLE APPLICATION

Please use online form:

<http://www.ohiosci.org/OESEESCHOLARSHIPS.htm>

Deadline: Mail First Class. Postmarked by **June 1**.

Page 1 of 2

\$1,250 two year programs and \$2,500 for four or five year programs, non-renewable

THESE MERIT BASED, NONRENEWABLE, SCHOLARSHIPS will be given to undergraduate students admitted to Ohio state or private colleges and universities who can demonstrate their knowledge and commitment to careers in environmental sciences or environmental engineering. Students must be in the final year of the program by the autumn term. Awardees will be selected by an Academy appointed panel using a blind review process. Scholarships may be used for tuition, fees, books, personal protection equipment, tools, instruments and field equipment but not housing.

1. Check Title Ms. Mr.
2. First _____ 3. Middle _____ 4. Last _____
5. Home Address _____
6. City _____ 7. State ____ 8. Zip _____
9. EMAIL _____ 10. Home # (____) _____ 11. Social Security # _____
12. Year in school by autumn term: 2nd 4th 5th
13. College or University _____
14. Academic major _____ 15. Expected graduation date _____
16. Advisor's full name _____ 17. Office# (____) _____
18. If selected, are you willing to participate in annual follow-up surveys for three years after receipt of a scholarship? YES NO
19. May the Academy release your name and resume to potential employers? YES NO

PLEASE ATTACH APPROPRIATE

SUPPORTING INFORMATION TO RESPOND TO THE FOLLOWING:

20. Academic record with an overall GPA of at least 3.0. Your current GPA _____ on a 4.0 system. Please attach a current (full) transcript and circle the GPA. Transcript must include all courses taken to-date. Enclose an "OFFICIAL" transcript with your original signed application and unofficial copies in the 6 identical sets. Alternatively, attached a single sealed transcript to your original signed application.
21. Attach a maximum two page vita, biosketch, or resume that includes the following elements, in this order: complete contact information, education, employment and/or internships (basic information only), honors/awards, professional memberships, publications (full citation), presentations given and professional meetings attended, and community service.

Continued on page 2

22. Repeat First and Last Name _____

Applicants from four-year colleges: Each of the following essays may not exceed one two-sided page, double spaced, 12 point font, 1" margins.

23. Attach an essay (not exceeding one two-sided page, double spaced, 12 point font, 1" margins) to describe your reasons for choosing a career in environmental science or environmental engineering and how this scholarship will help you.

24. Attach an essay detailing any original research, scholarship, employment and/or internships, or other unique contributions to environmental science or environmental engineering.

25. Attach an essay describing your extracurricular activities and participation in organizations that demonstrate your leadership and interpersonal skills and social responsibility.

Applicants from two-year colleges: Please combine your response to requirements **23, 24 and 25** into a **single essay** that covers as many of the points as possible with the length not to exceed **three two-sided pages**, double spaced, 12 point font, 1" margins.

26. Attach two letters of recommendation from education or environmental professionals, addressed to Scholarship Review Committee. One must be from a faculty member at your institution.

27. **Amount Requested** \$ _____ 28. **Date needed** _____ Maximum: \$1,250 for two year programs and \$2,500 for four or five year programs, non-renewable.

Scholarship checks will be sent to the college financial aid office. All applicants will be notified of the scholarship recipients.

I certify that all information provided is true and accurate, I authorize independent verification, and I understand that if awarded a scholarship, information contained in this application may be released to the media.

29. SIGNATURE _____ 30. DATE _____

Please enclose a self-addressed, stamped postcard to acknowledge receipt of your application.

QUESTIONS? Phone (614) 488-2228 • Email oas@iwaynet.net
<http://www.OHIOSCI.org>

MAIL FIRST CLASS postmarked by June 1:
a complete, original signed copy with stapled attachments
and 6 identical, two-sided, collated and stapled
(please do not bind in a folder or cover) copies (7 total)

**Environmental Science Scholarships
The Ohio Academy of Science
PO Box 12519
Columbus OH 43212-0519**

THE OHIO ACADEMY OF SCIENCE

Registration Form

117th Annual Meeting
 April 11-12-13, 2008
 The University of Toledo

Advance registration must be received by April 1, 2008

ALL MEETING ATTENDEES MUST REGISTER: Access to sessions by name tag only. Name tag, information packet and receipt will be available at the meeting. Please return the completed registration form along with the appropriate fees to the address printed below.

STUDENTS, SPOUSES, OR RELATIVES: A special discount schedule has been approved to promote and encourage participation of undergraduates, pre-college students, non-science spouses or relatives. All students, non-science spouses, parents or relatives must register using a separate form. This registration does not include membership or meals.

_____ Non-science spouse, parent or relative of first author	After Apr 1	\$10	\$20
--	------------------------	------	------

*Discount Rate for students who are not first author:
 (Does not include membership)

_____ 1-4 from same institution	\$20	\$30
_____ 5-10 from same institution	\$15	\$20
_____ 11 or more from same institution	\$10	\$20

**Each person must use a SEPARATE REGISTRATION FORM
 Please copy this form as needed.**

PLEASE PRINT OR TYPE

Check: _____ Ms. _____ Mrs. _____ Mr. _____ Dr.

Name _____
 First Middle Last

Job Title _____

School, Organization, Agency, Institution, or Employer _____

Is the following a home address? _____ Yes _____ No

Students MUST use home, dorm or apartment address.

Address _____

City _____

State _____ Zip _____ County _____

Work Phone (_____) _____

Home Phone (_____) _____

FAX (_____) _____

Email _____

MAIL FORM WITH PAYMENT TO:
 The Ohio Academy of Science
 PO Box 12519
 Columbus OH 43212-0519
 FAX 614/488-7629

Registration Fees

Please check appropriate categories. One fee covers the entire meeting except for field trip. **Payment must be received by April 1, 2008 to avoid higher rates.** On-site registration will be accepted at the higher rate by credit card or check ONLY. **ONLY first authors have pre-paid registration when they submitted their abstracts and DO NOT NEED to return this form.** First authors are already registered for the meeting.

CURRENT MEMBER REGISTRATION RATE		After Apr. 1
_____ Professional	\$65	\$70
_____ Retired	\$40	\$45
_____ Student	\$25	\$30

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Includes membership

_____ Professional	\$140	\$145
_____ Retired with Journal	\$ 80	\$ 85
_____ Retired without Journal	\$ 65	\$ 70

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_____ Pre-college student	\$20	\$30
_____ College student	\$20	\$30
_____ 5-10 students each	\$15	\$20
_____ 11 or more students each	\$10	\$20

*See table at left for more information.

NON-SCIENCE SPOUSE, PARENT OR A RELATIVE OF A FIRST AUTHOR

_____ Spouse, parent or relative	\$10	\$20
----------------------------------	------	------

Please use a separate form for each.

_____ LAKE ERIE SYMP. ONLY (included in full registration)	\$20	\$20
_____ SUNDAY EARTH SCIENCE FIELD TRIP	\$5	\$5

MEMBERSHIP RENEWAL

_____ Family	\$85
_____ Regular Member	\$75
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_____ Student (Age 17 & under) w/o OJS	\$25

TOTAL ENCLOSED \$ _____

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NO REFUNDS AFTER April 1, 2008.
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 _____ Check enclosed payable to The Ohio Academy of Science
 _____ Purchase order enclosed No. _____
 _____ **Online payment option** www.ohiosci.org/online.htm
 _____ Please charge my credit card
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Billing address for card _____
 _____ Phone _____

CardNumber _____
 Exp. Date _____
 3-digit Security Code (last 3 digits on back of card)

Signature _____

REGISTRATION POLICIES

117th Annual Meeting

The OHIO ACADEMY of SCIENCE

Hosted by

THE UNIVERSITY OF TOLEDO

TOLEDO, OH

APRIL 11-12-13, 2008

Advance registration must be **received** by April 1, 2008 to qualify for lower rates.

ALL attendees must register.

ALL MEETING ATTENDEES: Access to sessions by name tag only. Name tag, information and receipt will be available at the meeting. Please return the completed registration form along with the appropriate fees to the address printed below.

ONLY first authors have pre-paid registration when they submitted their abstracts and DO NOT NEED to return this form. First authors are already registered for the meeting.

STUDENTS, SPOUSES, PARENTS OR RELATIVES: To promote and encourage participation of undergraduates, pre-college students, non-science spouses, parents or relatives, a special discount schedule has been approved. **All students, non-science spouses or relatives must register using a separate form.** This registration does not include membership or meals which must be paid separately.

After
April 1 st.

Spouse, parent or relative of first author	\$10	\$20
--	------	------

Discounted Rates for students who are not first author:

(Does not include membership)

1-4 from same institution	\$20	\$30
5-10 from same institution	\$15	\$20
11 or more from same institution	\$10	\$20

Please use a SEPARATE REGISTRATION FORM for each person.

Copy the form on the reverse side as needed.

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