

**14th ANNUAL STUDENT RESEARCH SYMPOSIUM
ABSTRACTS**

**COLLEGE OF NATURAL SCIENCES AND
MATHEMATICS**

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BIOLOGY

Spatial and temporal patterns of fish assemblages in a floodplain wetland mosaic of the Mississippi River

Floodplain habitat connected to the Mississippi River has declined and is particularly rare in upper and middle regions of the basin. The Missouri Department of Conservation recently purchased a tract of floodplain habitat in Scott County, Missouri having a diversity of aquatic areas (e.g., lowland stream, floodplain pond, and beaver pond) that periodically connect with the Mississippi River. Our objective was to survey fishes found in the study area and to examine variation in fish assemblage structure due to habitat and season. During spring and fall of 2006 and 2007, fishes were collected by seining, overnight sets of fyke nets, and gill nets. We collected a total of 16,633 fishes, comprised of 35 taxa. Resident fish assemblage composition was highly represented by native species of lowland faunal regions (e.g., *Micropterus dolomieu* and *Lepomis gibbosus*). Assemblage structure varied in habitats sampled. A beaver pond, characterized by greater depths and presence of submerged vegetation contained the most unique assemblage. Species richness tended to be higher during spring, and seasonal patterns were influenced by flooding and summer dry periods. Riverine species (e.g., *Alburnus alburnus*, *Notropis heterodon*, *Notropis heterodon*) were only present in the wetland complex following flooding from the adjacent Mississippi River. The data suggest the floodplain area continues to support fishes typical of complex, floodplain habitat that periodically connects with the Mississippi River. Planned restoration activities by the Missouri Department of Conservation may further enhance the value of this floodplain area to the Mississippi River ecosystem.

Leaf Temperature, Photosynthesis, and Gas Exchange in Developing Sunflower Leaves

Plants dissipate heat by emission of long wave radiation, convection, and most significantly, in the process of transpiration (Fitter and Hay, 2002). Optimizing temperature is critical for metabolic processes, especially photosynthesis. Recent research (Snider et al 2007, in press) suggests that springtime optimum temperature range for photosynthesis is higher and stomatal conductance lower in young *Rhus glabra* (Anacardiaceae) leaves in comparison to mature leaves. This trend was absent when measurements were taken during summer and fall suggesting that higher temperatures in young spring leaves may promote temperature-sensitive processes. Prior to Snider et al 2007, the phenomena of elevated spring temperatures in immature leaves was unknown; here we investigate the possibility that elevated spring time temperatures in young leaves is not restricted to sumac trees. To test this hypothesis, we reared three cohorts of sunflowers, *Helianthus annuus* (Asteraceae), under controlled environmental conditions and measured: leaf surface temperature, stomatal conductance rates, actual quantum yield, leaf surface area, leaf perimeter, total chlorophyll, and the number of stomata/mm². Preliminary results showed that young sunflower leaves are warmer, have lower stomatal conductance, lower actual quantum yields, and chlorophyll content than do mature leaves. We further showed that temperature optima determined and using chlorophyll fluorescence were higher for young leaves than mature leaves. We suggest that the higher temperatures observed in young leaves compared to more mature leaves may be a common phenomenon in plants resulting in enhanced leaf expansion in the spring and pre-adaptation for the higher temperatures to come later in the growing season.

Antibody Heavy Chain V(D)J Rearrangements In Mercury-Treated Vs. Control A.Sw Mice

The A.SW congenic strain of mice has been used as a model of chemically induced autoimmunity for three decades. Subtoxic mercuric chloride (HgCl₂) treatment induces a defined autoimmune syndrome in these mice, characterized by production of antinucleolar antibodies (ANoA) of the IgG1 and IgE isotype. Lacking from the literature on this model is a study of which specific antibody heavy-chain gene segments utilized within mature, circulating B-cell receptors (BCR's) are positively selected out of the B lymphocyte repertoire by mercury treatment. This study utilized a nested polymerase chain reaction (PCR) approach on sorted individual cells from treated and sham-treated A.SW mice. This method was followed by sequence analyses of gel-purified products, to identify individual V(D)J gene segments utilized in B lymphocytes from treated and non-treated animals.

agricultural runoff and leaching or leakage of human sewage and livestock wastes. In Perry County, thin or unconsolidated soil layers and numerous sinkholes allow rainwater to flow directly into many caves without filtration that may otherwise provide remediation of contaminants. As a consequence, water quality can quickly and severely decline with very rapid transmission of pollution from the surface into caves and conduits of the karst aquifer. Contaminants which are suspected to be present in the caves have been shown to alter brain chemical activity and hormone levels in individual organisms, and can cause serious food base reductions in already nutrient-limited cave streams. This study will allow researchers to obtain valuable data on the presence of potentially harmful chemicals in Grotto Sculpin habitat, and provide baseline data for future monitoring efforts. Canisters containing both POCIS and SMPDs will be deployed in five cave streams during spring and summer of 2008. Extracts from exposed samplers will be analyzed for a number of organophosphorous and organochlorine pesticides, in addition to polycyclic aromatic hydrocarbons (PAHs), polybrominated diphenyl ethers, and several fragrances.

Effects Of Scheduled Burning In Control Of Competition Between Native And Invasive Honeysuckle In Arkansas

My research investigates the impact of seasonal timing of controlled burns on a native and an exotic species of honeysuckle in Arkansas. Japanese Honeysuckle is one of the most widespread and problematic exotic species in Arkansas forests and forested edges. To control this species, land managers use herbicide treatments and controlled burning. Burning has the advantage of being more selective, killing or damaging species without adaptations to fire, but leaving other more fire adapted species. Japanese honeysuckle responds to fire with a complete top kill, but regrows rapidly from roots and runners, so is at least somewhat adapted to recover from an occasional fire. Although the impacts of fire on *Lonicera japonica* have been studied, no information exists on the impact of fire on the native honeysuckle, *Lonicera spicata*, that Japanese Honeysuckle has replaced in many parts of Arkansas. It is possible that *Lonicera spicata* is more adapted to fire than the exotic species, and that as fire frequency has decreased in Arkansas, the competitive advantage has gone to the exotic Japanese Honeysuckle. The issue addressed by this study is whether *Lonicera spicata* is adapted to more frequent fires than *Lonicera japonica*. Plants of both species were burned in fall, spring, or left as a control. Regrowth of spring shoots from the root stock indicated that for control treatment, *Lonicera japonica* produced significantly more shoots. However, fall burns increased shoot production by *Lonicera spicata*, while decreasing shoot production by *Lonicera japonica*. Consequences for managing these two species will be discussed.

Taxonomic distribution and ecological function of girdling by caterpillars of prominent moths (Lepidoptera: Notodontidae)

Many insect species exhibit a behavior known as girdling: they chew a furrow around stems or leaf petioles, often before ovipositing. Few studies have examined girdling associated with feeding, although investigation of this behavior may provide insights not only into insect foraging ecology, but also plant physiology. The goal of my research is to determine which species of caterpillars in the prominent moth family (Notodontidae) cut girdles, what factors affect girdling behavior, which plant vascular tissues are severed by girdling, and what the function of girdling is. Data collected so far indicate that girdling occurs in at least two distinct branches of the notodontid family. Caterpillars typically girdle in the ultimate or penultimate instar (larval stage), and the frequency of girdling varies between seasons, years, and host plant species, but is not affected by switching larval host plants partway through development.

are separating based on size or sex and if they are preferentially avoiding areas of high human contact potential (i.e. boat routes and ramps).

Systematics and Population Structure of the Chicken Turtle,

The chicken turtle () is a semi-aquatic species inhabiting ponds and lakes throughout much of the southeastern United States. Currently, the species is classified into three subspecies based on morphological characteristics. However, environmental conditions can greatly affect morphology and in light of recent molecular data which indicates a classification inconsistent with the morphological data, the accuracy of the current subspecies classification is questionable. In order to better determine the relationship among chicken turtle populations, a systematic study will be conducted by sequencing and comparing mitochondrial genes from chicken turtle populations throughout the species' range. In addition, there has been growing interest into the effects of habitat fragmentation on gene flow among animal populations. Most studies have been concerned with species that have been impacted by anthropogenic disturbances. The chicken turtle represents a species that naturally occurs in fragmented population, and is ideal for expanding our knowledge into how fragmented populations are structured. Therefore, the genetic structuring of five chicken turtle populations within Arkansas will be compared by using microsatellite variation in order to compare levels of population diversity.

Reproductive Ecology of the Alligator Gar, , in the Fourche LaFave River, Arkansas

The alligator gar, , has declined throughout its range in the southern United States. Very little information is available on the reproductive biology of this large, riverine species in need of conservation. We documented spatial and temporal aspects of the alligator gar's reproductive ecology following the discovery of young-of-year individuals in the Fourche LaFave River system, a tributary of the Arkansas River. During spring and early summer of 2007, we determined the timing and location of alligator gar spawning events by sampling larvae with dip nets and seines, as well as, a direct spawning observation. Initially, we found evidence of two spawning events (late May and mid to late June) in two small, lowland tributaries of the Fourche LaFave River (West Fork Mill Creek and Lawson Creek). The spatial pattern of abundance of alligator gar larvae suggested spawning occurred primarily in tributaries as no larvae were collected in adjacent floodplain or main channel habitats. On the afternoon of June

17, we directly observed spawning in West Fork Mill Creek and subsequently monitored egg masses and early larval stages. Spawning events corresponded with an increase in river stage on the lower Fourche system due to back flooding from the Arkansas River when water temperatures ranged from approximately 22°C to 25°C. Flood waters receded during late July, and juvenile alligator gar (19.5 – 43 cm TL) isolated from the mainstem of the Fourche LaFave River were found in West Fork Mill Creek, Lawson Creek, and an additional tributary, Caney Creek. Currently, 92 alligator gar juveniles are involved in a mark-recapture study to examine condition, growth, and survival in disconnected tributaries. Our initial observations underscore the value of small, 1st-order tributaries as spawning and nursery habitat for alligator gar and highlight the importance of considering entire drainage networks in the conservation of large-river fishes.

Fishy Explorations on the Fourche LaFave River: Who were the Beneficiaries of an Extensive Summer Flood?

The flood-pulse concept predicts that fish production and the reproductive success of fishes in floodplain river ecosystems will be maximized during flooding. The response of fishes will vary with the timing, duration, and magnitude of a flood event, but knowledge of how fish species are influenced by flood characteristics is incomplete. It is imperative to fill knowledge gaps given the world-wide degradation of river-floodplain ecosystems, particularly the reduction of floodplain area and altered hydrology. We characterized fishes, both adults and young-of-year, utilizing an inundated area of the floodplain of the Fourche LaFave River in Arkansas associated with high magnitude, high duration summer flooding during 2007. Using a novel technique, we sampled fishes continuously from 20-28 July in a tributary draining a portion of the floodplain with a modified box trap. Fishes were sampled during the descending limb of the flood event. A total of 42,882 individuals, including 39 species, were captured during sampling. A majority of fishes captured, representing 20 species, were young-of-year individuals indicating substantial use of the inundated floodplain as nursery habitat. A large percentage of young fishes were followed by _____, _____, _____, and _____ . The summer flooding event, initiated by high discharge in the Arkansas River, appeared to have enhanced the reproductive success of fishes in the Fourche LaFave River system, particular species that spawn during late substantial

The Role of Sodium Hydrogen Exchangers in MCF-7 Tumor Cell Survivability

significantly) the endothelin-1 constriction by a similar magnitude. The lack of significance is most likely due to the fact that ET-1 induces a contraction using two different sources of calcium; its release from the sarcoplasmic reticulum and extracellular calcium influx. Overall, this study suggests that E2, 2HOE, and 2MeOH do not have a dramatic effect on the potent constrictive peptide, ET-1.

Developing a Staging Model for

we developed for this study. The Polymerase Chain Reaction is being used to amplify specific fragments of DNA using SSR and iSSR molecular markers based on the published literature. We expect to find that individual plants from a family share more genetic similarities compared to unrelated breeding plants. Data obtained through this study will contribute to the current knowledge regarding the genes and molecular pathways that specify preferred traits in blackberry and other plants within the genus .

Physiological levels of 2-methoxyestradiol stimulates calcium-activated potassium channels

2-Methoxyestradiol (2-

h, 24 h, and 10 d hypoxia incubation display phosphorylation of eif2! similar to that of thapsigargin treatment, a positive control agent for UPR induction. These results suggest a dynamic relationship between cellular stress and eif2! status: cells appear to phosphorylate eif2! as a means of survival in response to acute stress and additive stresses, yet are able to overcome and adapt to a chronic single stress.

period. Subsequent to spawning, adults die due to loss of the digestive tract that occurs during adult transformation. Specimens were collected from September 2004 through April 2006 with a backpack electrofisher. We measured total body length, eye diameter and weight of the digestive tract, gonads, fat, and total body. Eye diameter increased significantly throughout the collection period in both metamorphosing and non-metamorphosing individuals. Metamorphosing individuals developed a significantly larger eye compared to non-metamorphosing individuals. Gonadal development began in November and gonadosomatic index (GSI) peaked in January and remained high through February. In metamorphosing individuals GSI was negatively correlated with both visceral fat ($r = -0.73$, $P < 0.001$) and digestive somatic index ($r = -0.72$, $P < 0.001$). Digestive tract mass of metamorphosing specimens decreased sharply during early

Effects of Physical Habitat Alteration on Fish Communities in the Middle Fork Saline River, AR

As agriculture and urban development continue to infringe upon the borders of riparian zones, ensuing environmental concerns including loss of riparian vegetation, increased erosion, and sedimentation into streams may severally alter biotic communities (Indiana Division of Fish and Wildlife 2002). The Middle Fork of the Saline River is in close proximity of Hot Springs

phases, and have begun preliminary confocal analysis with the ultimate goal of identifying and quantifying fission and fusion events. This project will not only aid us in determining whether FszA plays a regulatory or mechanical role in the mitochondrial fission process, but also increase our overall understanding of mitochondrial fission across all eukaryotic lineages.

Estrogen increases SERCA expression and activity in coronary arteries

The sarcoplasmic reticulum (SR) is responsible for sequestering intracellular calcium to prevent intracellular Ca^{2+} overload or to mediate vascular relaxation. For instance, a fraction of the Ca^{2+} entering the cell due to membrane depolarization is sequestered by the SR calcium-ATPase pump (SERCA). The aim of this study was to determine if we could correlate the estrogen (E2) induced changes in SERCA expression with vascular tone. Right coronary arteries were dissected from female pig hearts. The distal portion of the arteries was sectioned into longitudinal strips and incubated for 24 hours in physiological concentrations of E2 (1×10^{-9} M and 1×10^{-12} M). After 24 hours the tissue was homogenized to determine immunoreactivity against SERCA2. Our results indicate that E2 elicits a 52% higher increase in SERCA expression than that of the negative control. To measure vascular tone, coronary arteries were sectioned into rings and suspended in organ baths. The SR was depleted of Ca^{2+} using caffeine, and the contractile response to a low Na and KCl depolarizing solution in the absence and presence of thapsigargin (SERCA inhibitor) was measured. Our preliminary results show that the E2-induced increase in SERCA expression generates a contraction at a slower rate. Therefore, E2's upregulation of SERCA expression in the SR may contribute to the cardioprotective benefit of E2 in women.

since in humans, they are disrupted in schizophrenia and other cognitive disorders. Because structure and function are known to be related in all biological systems, mapping the normal three-dimensional (3-D) structure and distribution of the persisting subplate population is the initial step in discovering the role these mysterious cells play in normal and abnormal brain function. The persisting subplate cells have never before been investigated past the age of 60 days (young adulthood) in rats, the standard neuroscience model. We are establishing the precise location and structure of these cells across development and aging by use of microinjection, immunohist

- 81 cm TL) and 91 adult shortnose gar (49 - 76 cm TL) collected during May to July 2007, corresponding to back-

CHEMISTRY

Use Of Sulfur Tetrafluoride to Produce Perfluorinated Monomers

A perfluorinated ketone, $C_6F_5CO(CF_2)_6CF_3$, has been synthesized by the Grignard alkylation of pentafluorophenylmagnesium bromide with perfluorooctanoyl chloride. Subsequent fluorination with sulfur tetrafluoride produces the perfluorinated alkylbenzene, $C_6F_5CF_2(CF_2)_6CF_3$, in near quantitative yield. Complete characterization by FTIR, GC/MS, and NMR is presented. This compound will be used to produce fluorinated monomers suitable for Diels-Alder polymerizations. Synthesized polymers will resemble fluorinated versions of Dow's commercially available hydrocarbon "SiLK" materials.

A Photochemically-Triggered Amino Acid Radical Precursor

Radical intermediates have long been implicated in the damage of biomolecules such as proteins. Radical damage pathways often involve a cascade of reactions that can be initiated by reactive oxygen species such as hydroxyl radical. This intermediate generates protein-centered radicals capable of undergoing subsequent reactions. The study of this process is complicated by the fact that hydroxyl radical is nonselective and can attack a particular amino acid at multiple sites, leading to multiple protein centered radicals. In an effort to circumvent this problem, an amino acid containing a photolabile phenylselenenyl group has been designed. Photolysis of this amino acid will induce C-Se bond homolysis, thereby specifically generating an amino acid radical. Hence, this compound will provide a model system with which to study the mechanism of radical mediated protein damage.

The Influence of Type-II Diabetic Drugs on Retinoid Metabolism

Retinoids, vitamin A analogs, have important implications in Type-II diabetes. All-*cis*-retinoic acid (*cis*-RA) and 9-*cis*-retinoic acid (9-*cis*-RA) act as ligands for retinoic acid receptors (RAR) and retinoid X receptor (RXR). These receptors form heterodimeric partners with other receptors including peroxisome proliferators-activated receptor gamma (PPAR γ). When RXR and PPAR γ dimerize, they initiate the transcription of proteins that decrease blood sugar levels.

One such family of diabetic drugs, thiazolidinediones (TZDs), have two biochemical functions. First, TZDs act as ligand for PPAR". Secondly, they are inhibitors of cytochrome P₄₅₀, which is responsible for the metabolism of -RA. This project investigates the metabolism of -RA in the presence of TZDs. Using Sprague-Dawley male rat microsomes, which contain the cytochrome P₄₅₀ family of enzymes, metabolism of -RA was examined in the presence and absence of TZDs. The goal of our research is to determine if metabolites of -RA are altered in presence of TZDs.

Isolation and Characterization of All- -Retinoic Acid Isomers

All- -retinoic acid and its isomer 9- -retinoic acid (9- -RA) are biologically active

Human ADAM7 mRNA is Expressed in B-Cell Lineages

ADAMs (a disintegrin and metalloprotease) are a novel protein family exhibiting both adhesive

**Radiocarbon measurements of carbonaceous aerosols from Mexico
City in 2003**

A Pilot Study Of Immune Responses To A Novel Nickel-Based Anti-Tumor Compound In Mercury Susceptible A.Sw Mice

studies have previously exhibited cytotoxic activity of a novel nickel compound, $[\text{dpeNi}^{\text{II}}\text{CYSEt}^+]\text{Cl}^-$, in a human breast cancer cell line (MCF-7). A concern of utilizing metal molecule-based therapies in human beings, however, is allergic reactions and/or induction of immune system abnormalities. This is evident in case studies of chrysotherapy using gold-based molecules for treatment of rheumatoid arthritis. In an attempt to assess possible immune system modulation by this compound, a pilot project was initiated. The goal of this pilot study

Understanding The Stability of Metal-borohydride Compounds

Experimental and computational techniques were used to elucidate the structure, bonding, and the nature of the stability of two transition-metal borohydride compounds, Tp^*NiBH_4 and Tp^*ZnBH_4 (Tp^* = hydrotris(3,5-dimethylpyrazolyl)borate). A combination of density functional theory and multi-reference configuration interaction was successfully used to reproduce the crystal structure, as well as the vibrational, electronic, and magnetic spectroscopy of these compounds. Our results show that both the $^3\text{-Ni(II)}$ compound and the $^2\text{-Zn(II)}$ compound exhibit a significant covalent interaction between the metal-center and the borohydride anion. The consistent model determined from the combination of the experiment and theory also provides insight into the stability of not yet synthesized metal borohydride compounds.

COMPUTER SCIENCE

Simulation Study on Grid Computing Performance

With the quick development of web technique, the need of communication and information sharing grows significantly. To meet such demand, many researchers bring in the idea of Grid computing, which works as a service for sharing computer power and data storage capacity. Grid computing goes beyond simple communication between computers and ultimately aims to turn the global network of computers into one vast computational resource. However, the management and scheduling of resource in such a large-scale Grid system is complex, therefore, we need to use tool to analysis it before applying to real world. Simulation appears to be a feasible way. Gridsim toolkit is an effective simulation tool that allows modeling and simulation of entities in Grid computing system – users, applications, resources, and resource brokers for design and evaluation of scheduling algorithms. In this research project we use the Gridsim toolkit to simulate a Grid computing system that distributes the jobs submitted by a group of

A Research of Global Optimized Video Rate Control Algorithms

Recent success of networked multimedia applications has generated a lot of research in video compression. Rate control (RC) is crucial for video compression as it regulates the output bit rate of a video encoder in order to obtain optimum visual quality within the available budget of transmission bit 72 594 cm cm BTs wsss ratencontrol(a) 0.2 blims(a) 0.2 (re) 0.2 (he)0.2 ur(i) 0.2 (s) -0.2 m c

bjwsiss(a) 0.((re) 0.2 n t) 0.2 wFio obtaingblaim(a) 0.2 bl restssopro vihess

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consideration. In this research, with the objective to obtain accurate initial quantization parameters, we propose a new complexity measure for

MATHEMATICS

Implementation of the Space Time Finite Volume Method on a One Dimensional Wave Maker

by considering the error in a sequence of approximations. A method for applying Richardson

PHYSICS AND ASTRONOMY

Thickness Determination Using Rutherford Backscattering Of Alpha Particles

A Van de Graaff particle accelerator at the Ion Beam Modification and Analysis Lab (IBMAL),
University of North Texas*, propelled an

to represent a typical range of temperatures for red giant stars. Changing the temperatures appeared to have no effect the averages for the elements.

Design of Automated System for Pain Threshold Measurement in Pre-Diabetic Rats

There are approximately 800,000 new diabetic cases every year. One current diabetic research

scattering cross section to be inversely proportional to the square of the alpha particle beam energy.

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Gamma Ray Spectroscopy: Determining Half-Lives And Absorption Coefficients *

This project utilizes two applications of gamma ray spectroscopy. One experiment seeks to identify the characteristic gamma rays of the two gallium isotopes, ^{70}Ga and ^{72}Ga . These two isotopes are the radioactive result of neutron irradiation of the two stable isotopes, 69

ratios of calcium, potassium, and carbon in the femurs and skulls of the HLS versus control specimens. These variations showed dependence on sample position in the bone relative to the hip joint and the sutures for the samples from the femur and skull samples, respectively.

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UCA #220410

A Comparison Of The Light N-Capture Elements To Barium In Halo Stars

Determining the Speed of Sound and Bulk Modulus of Various Fluids

Through experimentation using a tone burst generator, signal generator, an oscilloscope, a simple tube and some sending and receiving speakers it was possible to find the speed of sound in various fluids. Then using a beaker and triple beam balance it was possible to determine the density of these fluids. From density and the speed of sound through the fluid it was then possible to find the bulk modulus for each respective fluid. The fluids that were tested were; baby oil, soap, honey, ketchup, and a water cornstarch mix at various ratios.

PRESENTER/MENTOR LIST
Student Presenters in Bold

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