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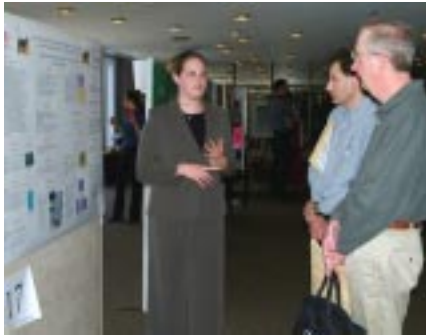
Undergraduate Research Forum

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UNDERGRADUATE RESEARCH FORUM

ABSTRACTS • 2004



The Undergraduate Research Forum is part of REACH (Research-Enriched Academic Challenge), a campus-wide program for undergraduates coordinated by the Office of Research Development and Administration. For more information, see www.siu.edu/~reach.

The forum is being held in conjunction with the 2004 Research Day (sponsored by Phi Delta Kappa, Phi Kappa Phi, Sigma Xi, and the Society for Neuroscience) and the Illinois Junior Science and Humanities Symposium.



*2003 First Prize
Winner Brenda
McCollum*



**Student Center Gallery Lounge
March 29, 2004
Southern Illinois University Carbondale**



To learn more about
the **Undergraduate
Research Program**
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Undergraduate Research Forum
March 29, 2004
Southern Illinois University Carbondale

Program

Judging of posters: 8:30 - noon
Poster session: 1:00 - 3:30 p.m.
Award presentations: 3:30 p.m.

Organizer

Dena Stogsdill, ORDA

Sponsors

Office of the Provost
Office of Research Development and Administration (ORDA)

Poster Judges

Jim Allen, History
Sara Baer, Plant Biology
Laura Bell, University Honors Program
John Bozzola, IMAGE Facility/Plant Biology
Brian Butler, Center for Archaeological Investigations
Joan Davis, Dental Hygiene
Richard Fifarek, Geology
Brenda Gilbert, Psychology
Thad Heckman, Architecture and Interior Design
Jodi Huggenvik, Physiology
Anita Kelly, Zoology
James Le Beau, Administration of Justice
Pat Manfredi, Philosophy
Kathleen Rigney, Psychology
Bob Swenson, Architecture and Interior Design
Jeff Underwood, Geography

Special Thanks

Prudence M. Rice, Linda Martin, Kyle Perkins, John Dunn,
and Marilyn Davis

STUDENT PARTICIPANTS / MENTORS

1. Amoneeta BecksteinJosephine Korchmaros
2. Kevin Bochenek and Travis BosticJames Wright
3. Miguel Chu, Lori Curl, and Danisha Lewis.....James Wright
4. Sean Clark*Eric Jacobs
5. Melissa Croy, Elizabeth Johnson,
and Joel NadlerJosephine Korchmaros
6. Peter Dittmar.....Brad Taylor and Alan Walters
7. Roxanne Dobens, Elizabeth Lorentzen,
and Lora MoultonJames Wright
8. Richard Gallens and Jeremy HelfertJames Wright
9. Michael Gawrysiak*David Gilbert
10. Johnny Guffey, Jarus Jones, and
Conor RobinsonJames Wright
11. Thomas Heatherly II*Matt Whiles
12. Erin HollidayMichael Collard
13. Eric JohnsonKaren Renzaglia
14. Sarah KnightDaniel Hillyard
15. Jessica Loesch.....Stephen Dollinger
16. Renee Lopez-SmithKaren Renzaglia
17. Elizabeth LorentzenRobert Swenson
18. Katherine Millar*Barbara Crandall-Stotler
19. Rebecca Morse, Lavon Pettis,
and Costas TsouloupasJosephine Korchmaros
20. Jennifer Respass*Lisabeth DiLalla
21. Conor RobinsonRobert Swenson
22. Marcy RuglandFran Harackiewicz
23. Nathan Sandberg*Che Rhodes
24. Edward Pablo de Sa SauerbrunnSusan Ford
25. Dean Sherman*James Garvey
26. Luke Sherrill*Douglas Smith
27. Joseph StringerYuqing Hou
28. Phillip SzymcekScott Ishman
29. Tricia Trimble*Michael Lydy
30. Victoria Winslow*Charla Lautar
31. Diane Zeman*Brooks Burr

*Recipient of a 2003 Undergraduate Research/Creative Activity Award.

Victoria A. Winslow

Dept. of Dental Hygiene

Employment of Recent Graduates of SIU's Dental Hygiene Baccalaureate Program

The Southern Illinois University dental hygiene baccalaureate program is designed to prepare the graduates to successfully enter the oral health profession of dental hygiene in any one of the six designated roles of the dental hygienist as defined by the American Dental Hygienists' Association: clinician, educator/health promoter, manager, researcher, consumer advocate, and change agent. In addition, the graduates are prepared to continue their education in graduate or professional programs. The objective of this study was to investigate the career opportunities or employment positions utilized by Southern Illinois University's dental hygiene baccalaureate graduates.

Surveys were mailed to graduates of classes from 1999-2002. The response rate was 70 percent (N=78). Results indicated the following: 39% of the respondents are employed full-time at general private practices, 39% are employed part-time at general private practices, 6% are employed full-time at universities, 6% are employed full-time at specialty practices, 6% are employed at both specialty and general private practices, and 4% are employed at universities and general private practices (N=74).

This outcomes assessment indicates that majority of the Southern Illinois University's dental hygiene baccalaureate graduates have not expanded their roles outside of the traditional dental hygiene positions. The respondents claimed barriers that prevented them from seeking other dental hygiene careers included lack of opportunities, experience, education, resources, salary, and time due to other obligations.

Diane Zeman

Dept. of Zoology

Changes in Channel Border Fish Communities of the Middle Mississippi River at Grand Tower, Illinois, Over the Past Two Decades

The ecological integrity of the Mississippi River has been severely compromised by human activity during the past 50 years. Although many studies have been conducted on both the Upper Mississippi and Lower Mississippi River, few detailed studies have been published on non-commercial or non-sport fishes of the Middle Mississippi River. There is also limited information on the species composition of the non-pooled sections of the Middle Mississippi River between the confluence of the Missouri and the Ohio Rivers. One of the few studies conducted on species composition and abundance of shoreline fishes was the graduate thesis completed in 1983 by Michael A. Klutho at Southern Illinois University, Carbondale.

The objective of my research was to determine changes in fish community structure of the Middle Mississippi River at Grand Tower, Ill., over the past two decades. A comparison study was completed during the period 1 March through 1 December 2003. Biweekly fish sampling was carried out and the following variables were measured: time of day and year, substrate type, water level, and water temperature. Initial results show a dramatic change in the species composition of the shoreline fishes of the Middle Mississippi River, including an increase in exotic species and probable extinction of the flathead chub, *Platygobio gracilis*.

Phillip Szymcek

Dept. of Geology

A Benthic Foraminiferal Assessment of Holocene Oceanographic Change: Northern Antarctic Peninsula Margin

A 20.53 meter sediment sequence of Holocene glacio-marine sediments was recovered in core NBP0003-JPC38 from the Vega Drift, northern Antarctic Peninsula. Samples were collected every 4 cm for foraminiferal analyses to determine Holocene paleoceanographic and paleoclimatic variability of the northern Antarctic Peninsula margin. The foraminiferal data were analyzed using principle component and cluster analyses. Results of these analyses show significant stratigraphic changes in the benthic foraminiferal record of the Vega Drift. Transfer function analysis of the foraminiferal data, using modern foraminiferal biofacies of the Antarctic Peninsula margin, indicate significant Holocene oceanographic changes. Two dominant assemblages characterize the core, the *Textularia weisneri* assemblage and the *Stainforthia fusiformis* assemblage. The bottom-most section of the core, 16.0 meters to base, is dominated by the calcareous *S. fusiformis* assemblage that also occurs in several abrupt intervals within the upper 16 meters of the core. This assemblage is characterized by abundant calcareous forms including *Globocassidulina bitora*, *G. subglobosa*, *Nonionella iridea*, and the planktonic species *Neogloboquadrina pachyderma*. The *S. fusiformis* assemblage has greatest affinities to modern assemblages found in the higher productivity areas of the Larsen Ice Shelf and western Antarctic Peninsula. The top 16.00 meters (~7000 yrs. BP to recent) of the core is dominated by agglutinated forms, and defined by the *Textularia weisneri* assemblage. The unaltered *T. weisneri* assemblage is similar to modern assemblages directly to the south of the Vega Drift in the Prince Gustav Channel. Most agglutinated forms tend to decrease downcore, and comparisons to modern analogues imply post-depositional disintegration. The altered assemblage is dominated by *Miliammina arenacea*, which resists taphonomic dissolution. The foraminiferal analyses provide important paleoceanographic information related to the depositional architecture of the Vega Drift as interpreted from its sediment thickness, distribution, and internal structures.

Amoneeta Beckstein

Dept. of Psychology

Attraction's Effect on Memory: Amount of Personal Details Remembered About Strangers

This study explored the effect of physical attraction on memory of personal details of a stranger. Using a between subjects design, Introduction to Psychology students ($n = 40$) viewed 10 facial shots of physically attractive females or 10 facial shots of females of average physical attractiveness. It was hypothesized that people hearing personal information about attractive females are more likely to remember the content and details than those who hear personal information about females of average attractiveness. The results did not support this hypothesis strongly enough to say that they did not occur merely by chance. There was a slight group difference whereby the group viewing the attractive pictures did score higher on a test of memory than those who viewed the average pictures. Additional analysis revealed the possibility that females tended to remember more personal details of female photos than males remembered.

Kevin Bochenek and Travis Bostic

Dept. of Architecture and Interior Design

B & B and Associates Design Studio

The objective of this project was to study climate, resources of an individual building, and site with the consideration of sustainable design principles. After researching the economic, social, and environmental conditions of four cities we chose Portland, OR. The site is a 150' by 200' brown field located near the center of the city. After site and regional studies the design started with a room and a garden. To keep it simple we started by creating a strong correlation between architecture and nature. The design then slowly developed from sketches, models, and daylighting studies into a full plan. Heating, cooling, and mechanical systems further developed design decisions about the building performance. Research and calculations were then used to choose the optimal systems to be incorporated into the design. Passive cooling design strategies were employed such as earth contact, cross ventilation, and night ventilation of thermal mass. After applying these strategies and competing calculations on heat loss it was determined that we needed no air-cooling unit. The passive heating strategy we used was direct solar gain, which provided a solar savings fractions of 31%. Through the use of landscaping, hydrozoning, and storm water management, the site also performs at high standards. Sustainable design was the basis for the project, but taking it one step further to restoring and maintaining the environment was achieved.

Joseph Stringer

Dept. of Chemistry & Biochemistry

Yield Improvements on the Synthesis of 3,5-dihydroxyVallestril

3,5-dihydroxyVallestril, a potential anticancer agent and a bacterial metabolite of estrogenic 3-hydroxyVallestril, had been synthesized through a multi-step process. The synthesis, however, had a low overall yield due to the last three steps. The goal of this project is to improve the yields of the last three steps in order to obtain a sufficient amount of 3,5-dihydroxyVallestril to test its anticancer activity. The approach to improving the first low-yield step was to find the right combination of base and ester to effectively complete an aldol condensation with 4,6-dimethoxy-2-naphthaldehyde. With NaH and methyl propionate, the yield of the aldol condensation with a model compound, *p*-anisaldehyde, was significantly increased. After this step, a Michael addition using Gilman's reagent, followed by methylation at the "a" position of the carbonyl group, has shown the best results so far.

Luke K. Sherrill

Dept. of Psychology

Effects of Vagus Nerve Stimulation on Spatial Navigation Following Fluid Percussion Brain Injury

Traumatic brain injury often results in impaired cognitive function. This study assessed the effects of vagus nerve stimulation (VNS) on cognitive function in an animal model of traumatic brain injury (TBI).

The spatial navigation abilities of 60 Long Evans rats (20 injured and VNS stimulated, 20 injured and not stimulated, and 20 shams operated, uninjured controls) were tested using the Morris water maze task (MWM). Prior to MWM testing, each rat had been implanted with a unilateral cuff electrode on the vagus nerve and, one week later, underwent either a fluid percussion injury or was sham operated. In the experimental group, VNS was initiated 2 hours post injury and applied every following half hour for the next 3 weeks. Each rat was trained in the MWM to locate a nonvisible submerged platform in a large tank with many extramaze visual stimuli. Training consisted of 16 trials, in blocks of 4 trials/day for 4 days. The time taken to find the platform (goal latency), the total distance from the platform (cumulative distance), and the total time spent swimming in the area of the platform (dwell time) were recorded.

Both the injured/stimulated and injured/unstimulated groups of rats demonstrated significant deficits in being able to locate the submerged platform as compared to sham controls. In comparing the injured/stimulated and the injured/unstimulated groups, VNS did not have a significant effect in improving the impaired spatial cognitive abilities of the TBI injured rats. It is possible that the frequency or current parameters of VNS were insufficient to produce observable improvement in the spatial cognitive behavior. The location of the injury may also interact with these results in that the motor cortex was injured and the swimming required in the MWM task requires a tremendous amount of motor exertion. Thus, even if VNS was enhancing recovery of cognitive abilities, motor weakness following TBI might have prevented us from being able to find evidence for improved spatial learning due to the nature of the dependent variables employed, all of which could be influenced by muscle strength.

Miguel Chu, Lori Curl, and Danisha Lewis

Dept. of Architecture & Interior Design

Sustainable Design Through Architecture

As future architects and designers it is our responsibility to promote a greater awareness toward sustainable development. The U.N. World Commission on Environment and Development has recognized that, with current development practices, the capacity of the planet to supply resources and to absorb pollution or waste was going to be too small to support the projected world population. Therefore, the Commission offered a definition of development, economic growth and resource management, which could be “sustained.” Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Our assignment was to design a small office building starting with just a room and a garden. Unlike many typical office buildings, the goal for our building was to incorporate sustainable design techniques and serve as an example of what architects and designers could apply to the future of building design.

In order for us to develop a sustainable office building, we conducted research on sustainable design practices. Through our research, we learned to incorporate several sustainable techniques. Some of the techniques which our building utilizes include passive cooling strategies, passive heating strategies, natural ventilation, a solar water heating system, sustainable waste system, a rainwater cistern, and a solar energy system.

Our other areas of research included climatic studies, sun paths and sun angle studies, and daylighting studies. Our design was not limited to just passive mechanical equipment but we also maximized the efficiency of our building through the shape and materials of the building itself.

The results of our research led us to a sustainable building that was successfully designed to save energy. Despite the fact that our building was located in the hot arid desert of Phoenix, Ariz., our building managed to stay cool in the summer and warm at night in the winter with little dependence on non-renewable energy.

Sean Clark

Dept. of Psychology

Token Reinforcement and Progressive-Ratio Schedule Performance in Rats: The Effects of Food Schedule Manipulation on Breakpoint

An animal model of a token economy was used to test predictions of learning based upon behavioral economics and conditioned reinforcement. Schedules of token reinforcement consist of three interlocked contingencies—the token production schedule, the exchange schedule, and the food schedule. In the present study, rats' lever pressing was maintained by presentation of marbles that were later exchanged for sweetened condensed milk. Marbles were delivered according to a progressive ratio schedule that increased by 2 responses with each marble delivered by the schedule. Sessions terminated when 15 min transpired without completing a ratio. The last ratio completed was deemed the "breakpoint." Exchange periods were arranged by a random ratio schedule, wherein the probability of transitioning to an exchange period following a marble deliver was 0.33. Marbles were exchanged for milk presentations according to a random ratio schedule. The requirements of the random ratio food schedule were varied across conditions. Thus, the unit price per milk presentation was varied across conditions.

Preliminary results suggest that increasing the food schedule requirements (i.e., unit price) decreased progressive ratio breakpoints. As work output did not increase with increases in the unit price of milk, the results were inconsistent with predictions based on behavioral economic theory, but were consistent with predictions based upon reinforcement theory.

Dean M. Sherman

Dept. of Zoology & Fisheries and Illinois Aquaculture Center

The Spatial Distribution of Hybrid Striped Bass and Its Potential Interactions with Other Species in a Power Plant Lake

The vertical and horizontal spatial distribution of fishes in reservoirs should largely be affected by temperature and dissolved oxygen concentrations. To determine how spatial variation in abiotic factors affected distribution of hybrid striped bass and their potential prey and competitors, we deployed three experimental gill nets at three thermally distinct sites in a southern Illinois power plant lake during summer through fall 2003. At each site, we positioned a net in the epilimnion, metalimnion, and hypolimnion.

Hybrid striped bass and most other fishes largely occurred in the metalimnion during summer stratification. Highest catch per unit effort (CPUE) of hybrid striped bass occurred during summer at mid-water depths (metalimnion) with oxygen concentrations > 3-4 mg/L and temperatures ranging from 25C to 29C. At one site, hybrid striped bass abundance was positively correlated with high CPUE of pelagic forage fish (particularly *Dorosoma* spp.). Only before July and after October did the abundance of hybrid striped bass and other fishes occur at moderate CPUEs in the epilimnion and hypolimnion, when temperature and oxygen concentrations were similar to those in the metalimnion during summer. Abiotic factors drive distributions of hybrid striped bass and dictate its potential interactions in thermally diverse systems.

Edward Pablo de Sa Sauerbrunn

Dept. of Anthropology

South American Monkey Teeth Casts and Evolutionary Variation

The objective of this project is to show the importance of the research we have done on these South American monkey casts. The tooth variation is very important because it gives us an idea of species determination in the fossil record. The results were revealing in that it showed the average size of different teeth and the different characteristics of them. Since we knew what species each one of these belonged to, we can then determine based on these variations how many species we have in the fossil record and then be able to trace primate evolutionary history more efficiently in that manner. There is one other similar study done with Madagascar monkeys, and like this one it revealed many important aspects about primate evolution.

Melissa Jo Croy, Elizabeth Elaine Johnson, and Joel Theodore Nadler

Dept. of Administration of Justice, Dept. of Psychology

“Bad Boys” Petty Crime Attitudes

This research looked at the possibilities of affecting people's attitudes concerning petty crime behavior. Petty crime was defined by such acts as failing to return lost or borrowed items, stealing low value items, downloading music, and copying homework. College students (n=55, 56% male and 44% female) were randomly assigned into two groups. One group was given a presentation on the negative effects of petty crime on society, while the other group was given no presentation. All participants then completed the petty crime attitude test (P.C.A.T.) containing 20 questions assessing attitudes towards various petty crimes.

It was hypothesized that presentation of statistics regarding the negative effects of petty crime on society would increase negative attitudes towards petty crimes. The results of this study did not support this hypothesis. However, analyses showed that participants in the presentation group reported statistically greater awareness of the problem of petty crime than participants in the no presentation group. Additionally, further analyses showed that females were statistically less accepting of petty crime than males.

This study indicates that information alone may not be sufficient to change people's attitudes. Future studies may want to examine the differences between males and females concerning their attitudes towards petty crime behavior.

Peter J. Dittmar

Dept. of Plant, Soil, & Agricultural Systems

Influence of Stand Density and Harvest Date on Grade Distribution of Sweetpotatoes in Grown on Heavy, Fertile Soils

The effects of planting density and harvest date on the yield and grade distribution of sweetpotato roots were measured in a split plot experiment arranged in a randomized, complete block design with 3 replications. Main plots were four harvest dates (1, 14, and 28 Sept. and 12 Oct.) with three planting densities (1, 2, or 3 rows per 91 cm wide raised beds) as sub-plots. 'Beauregard' plants were planted on 15 June at the Horticulture Research Center at Southern Illinois University Carbondale.

Compared to the yield (6938 kg/ha-1) at first harvest date, delaying harvest increased yields of U.S. No. 1 roots by 55%, 70%, and 110% for the 14 Sept., 28 Sept., and 12 Oct. harvests, respectively. Jumbo yields remained about one third of No.1 yields regardless of harvest date. Increasing plant density from one row to two or three rows increased the yield of No. 1 roots by approximately 50%. The proportion of jumbo to U.S. No.1 roots decreased from 83% in the standard one-row density to 33% and 14% in the two and three row densities, respectively.

These results suggest that increasing the density of sweetpotato plantings increases yields and thus revenues for growers utilizing heavy, fertile soils in the variable precipitation pattern of the lower Midwest where harvest delay is common.

Nathan Sandberg

School of Art & Design

Superseeds

Superseeds are seeds that have been genetically modified with the help of modern biotechnology. They may look like other seeds but this superficial exoskeleton is all they have in common with naturally occurring seeds. Genetically modified organisms have had part of their genetic information removed from their DNA and, in return, have received a portion of another organism's genetic blueprint.

This sharing of genetic information has been happening in the plant kingdom forever, naturally. More recently, biotechnological corporations have been trading genetic information between all five-classification kingdoms.

Like every debate, there are many different sides to this argument. As an artist I am not trying define what is right and wrong, rather I am trying to raise awareness of important social issues. Few people know that genetic engineering takes place, therefore they could never know if it was good or bad. They are rarely even told that they are ingesting tomatoes that contain the genes of an arctic fish. Without a label or indication, no one knows what they are eating.

I have created my own Superseeds. They are related to genetically altered seeds in the way that they are unidentifiable and were not created by nature. Human hands using a methodical yet creative process created them. Much like the scientists creating organisms that have never existed before, I am creatively exploring. Using the fundamental elements of design I am interpreting the natural world from which the seeds that yield the food we eat usually come from.

I have pursued a creative and essentially unique process, though I am sure someone has pursued a variation of this same technique in glass before, nature has been genetically altering itself forever. Now with the help of modern biotechnology, evolution and adaptation are controlled and science becomes another creative medium. A creative and curious scientist will be able to create whatever he or she can imagine.

Marcy Rugland

Dept. of Electrical & Computer Engineering

Triple-Band Planar Inverted F Antenna Design

The rapid progression of wireless communications has led to mobile communication units, such as cellular phones, becoming smaller and smaller, while the demand for the use of multiple frequency bands has increased. Today's wireless communications demands require the ability to function in multiple frequency bands, including the global system for mobile communication (GSM; 890-960 MHz), the digital communication system (DCS; 1710-1880 MHz), the personal communication system (PCS; 1850-1990 MHz), and the universal mobile telecommunication system (UMTS; 1920-2170 MHz), as well as in wireless local area network systems (WLAN; 2.4 and 5.2 GHz).

To meet the miniaturization requirement of mobile communication units while incorporating the ability to resonate at multiple frequencies, novel antenna designs must be developed. Planar inverted f antennas (PIFA) are small enough to be implemented inside the housing of mobile communication units. Currently, dual-band PIFAs have been implemented as such. The goal of this research project is to develop a triple-band PIFA with resonant frequencies in the 900, 1800, and 2450 MHz bands. The design process will include computer simulation followed by fabrication and testing of the simulated design.

Roxanne Dobens, Elizabeth Lorentzen, and Lora K. Moulton

Dept. of Architecture and Interior Design

A Room and a Garden

In the architecture course ARC 481, Environmental Design III: Energy & Systems, three-person teams design an architecture studio and garden which incorporates various systems in order to achieve an environmentally friendly space. In order to make architecture an environment which is good to learn in, good to live in, and good to work in, elements of nature need to be addressed. A room must be designed by its solar access, ventilation, natural lighting, wind control, and connection to the exterior.

Our team chose San Diego, Calif., as the site for the building. Choosing San Diego meant that the elements of ventilation, natural lighting, and connection to the exterior needed to be addressed. The design process of both the studio and garden included researching precedents, studying sun charts, and calculating items such as daylighting factors, heat gain/loss, and solar savings fraction. The final design includes a green roof on the main section of the building, and a Teflon fabric roof over the design studio, offices, and conference room. The studio has a direct connection to the garden, where two 12-foot doors can be opened, allowing the exterior to become interior. Solar-heated air is directed from the air space in the Teflon roofing system to a rockbed and sent through the HVAC system. Operable windows are incorporated throughout the building to take advantage of the northwest and southwest winds for natural ventilation. To eliminate the possibility of excess heat loss, the Teflon roofing system has two layers with a nine-inch air space. Storm water is collected in a collector pool and raked stone system. It is stored in a cistern and distributed throughout the site in an irrigation system. The process of researching and designing resulted in a regenerative space that meets the needs of today without compromising the needs of the future.

Richard Gallens and Jeremy Helfert

Dept. of Architecture and Interior Design

A Room and a Garden

This small office located in Seattle, Wa., was designed to meet stringent sustainability standards while incorporating aesthetically pleasing characteristics. To accomplish the sustainability standards this design utilizes passive systems such as cross ventilation, daylighting, grey water system, thermal mass cooling, and a solar hot water system. Given the location of Seattle in a temperate climate zone, additional cooling systems are eliminated. Due to the mild winter excessive heating systems are not needed, and therefore a simple baseboard hot water system supplied by a small water heater and solar hot water collectors is all that is needed to supply adequate heat to the building.

The studio opens to a large garden to the south which creates an outdoor space suitable for growing food and other vegetation for the office as well as providing opportunities for the staff to relax and participate in gardening. Within the garden is a natural pond which catches storm water runoff and greywater from the building. The water is then filtered through a living machine and sent to an onsite cistern located on the north side of the building.

By combining the above-mentioned passive systems, this building meets the stringent sustainability standards set by the guidelines for the project.

Conor Robinson

Dept. of Architecture & Interior Design

The Architecture and Construction of the James B. Eads Ironclads (Civil War Gunboats)

During the Civil War, the western waters played a major role in Union victories. A major contributor to the Northern Forces was the development of ironclad gunboats. James B. Eads, an engineer who made a fortune salvaging shipwrecks, was commissioned by the United States to build seven of these vessels at Carondelet shipyards near St. Louis, and at Mound City, Ill. Eads, who was quite familiar with how riverboats worked, took plans drawn by Naval Constructor Samuel Pook and in less than four months put the “City Class” gunboats into service. These boats were like nothing ever built before. Each of these vessels weighed in around 500 tons (120 tons of iron plating) with an armament of 13 cannons. Shortly after the City Class boats were put into action, Eads was again asked by the Navy to design and build a series of light-draft boats, similar to the ocean-going *Monitor*. He submitted plans and within a short time launched four monitors into service.

The objective of this project is to research the design, architecture, and structure of the Eads gunboats. This will include plans from the initial design phase to the building of the final vessels, as well as the mechanical equipment and armament. How were these revolutionary vessels developed and constructed in such a short time? What made them so effective against the Confederate forces? Were there weaknesses in the design of the ironclads? The results of the project will analyze and propose answers to these questions about the gunboats.

Jennifer A. Respass

Dept. of Psychology

Maternal Instinct versus Paternal Instinct: Nurturing Behaviors of Mothers and Fathers

This project aims to compare the sensitivity of mothers versus fathers with their infants. Typically mothers are considered the primary caregiver and, as such, are very involved in their children's lives. Fathers are thought to be less involved, and when they are engaged with their children it is often as a playmate (Hetherington & Parke, 1999) and in a more physically arousing manner (Bee, 2000). This difference in behavior between mothers and fathers may result from differential sensitivity. However, Jain, Belsky, and Crnic (1996) cited evidence that fathers' behaviors toward their children were comparable to mothers' behaviors in sensitivity and nurturance. It was predicted that fathers would be as sensitive as mothers in parent-child interactions.

Data consisted of taped interactions of mothers or fathers attempting to elicit vocalizations from their 7- or 9-month-old infants. The sample, consisting of 89 father-child and 89 mother-child interactions, is part of the Twin Infant Project (TIP; DiLalla et al. 1990). A coding scheme involving language and actions, such as praise, proximity, and contact, was employed to assess sensitivity. Multivariate analysis revealed no effect of sex of parent on parental sensitivity ($F(4,113) = 1.22, p=n.s.$) or on the child positive and negative affect variables ($F(3,111) = 1.96, p=n.s.$). However, there was a significant effect of sex of child on these variables ($F(3,111) = 5.24, p<.01$). There was no significant parent by child interaction ($F(3,111) = 2.39, p=n.s.$).

Retaining assumptions of the traditional parental division of labor has significant social implications. For instance, mothers are more frequently awarded child custody because it is often believed that they are naturally better caregivers than are fathers. However, this study suggests that fathers are equally as sensitive as mothers in interactions with their children.

Michael J. Gawrysiak

Depts. of Psychology & Philosophy

Effects of Nicotine on Behavior and Affect in a Lab and Natural Environment

The purpose of this study was to examine nicotine's influence on activity selection and mood by assessing and comparing behaviors, emotions, and task performance in a laboratory and natural environment. Participants were 16 smokers (8 males and 8 females, ages 18-35) who smoked at least 10 cigarettes per day consistently for the past two years. Smokers refrained from nicotine 12 hours before each of two experimental sessions. On each of the experimental days, participants were escorted to the SIUC Student Center three hours after receiving either a nicotine patch or placebo. Once at the Student Center, participants completed four activity trials. Each trial required the participant to select and perform a mentally demanding activity (e.g. logic problems) or a relaxing activity (e.g. television). Participants were then escorted back to the laboratory to complete three additional trials. On the second day, participants were required to complete the same procedure as the first; however, they were required to complete the activities not previously selected. This stipulation was imposed to prevent participants from selecting relaxing activities on both days, thereby aiding the participant to take into account how they feel at the time of selection. On experimental day two, participants selected activities to perform based on how they feel had they been provided with an option. All measurements were administered and collected on hand-held computers for convenience and to confirm response times. Patch administration was counterbalanced between males and females and experimental days. Participants tended to select the mentally demanding activities while having been administered Patch A, both in the laboratory and natural environment. When participants were administered Patch B, they tended to select the relaxing activities in the laboratory and natural environment. We expect that the results may indicate that nicotine influences a person's choice when deciding whether to perform a challenging or relaxing activity. This would be the first study to demonstrate that nicotine can influence task choice and preferences.

Johnny Guffey, Jarus Jones, and Conor Robinson

Dept. of Architecture and Interior Design

Environmentally Sustainable Office Building

The objective of this project was to relate climatic conditions to the design of a small office building. Design decisions were based on latitude, time zone, magnetic deviation, wind data, solar radiation, ground water temperature, and outdoor temperatures from selected months. Along with the climatic data, research was obtained on brown fields, hydrozoning, xeriscaping, and native plant species to gain as much knowledge as possible to adequately approach the design process.

The resulting design effectively addresses all of the above mentioned criteria. Due to rather harsh winter design conditions, ample south glazing was used. Primarily this glazing was used to offset Denver's winter climate by allowing solar gain, although the dramatic view of the Rocky Mountains was also considered in the placement of glass. Heat to the building is supplied by a boiler, accompanied by a roof-top pond with solar collectors to help ease the amount of energy used to heat the water. Although the main design consideration in Denver is heating, the location also requires a substantial amount of cooling. To achieve the desired comfort levels, earth tubes complemented with water, and cross-ventilation were employed. The earth tubes take advantage of Denver's 54-degree ground temperature. Along with a small amount of water vapor the earth tubes function to cool the building 80% of the time. Along with earth tubes, a sufficient amount of cross-ventilation is implemented to bring internal temperatures to a comfortable range.

Sustainable design is an ecological doorway to the future. It allows future generations to enjoy the same beauty mother nature has given freely for so many years, despite man's greed for her work. By teaching and more importantly practicing sustainable design, true respect for nature's gifts can be gained.

Rebecca Morse, Lavon Pettis, and Costas Tsouloupas

Dept. of Psychology

Males Versus Females: Who Are Female-Helpers More Likely to Assist?

The primary purpose of this study was to find out if women are likely to assist females or males in non-emergency, non-threatening situations. The scenarios described non-emergency situations in which the help needed was of little cost to the person offering help. An example would be providing directions to a student on the university campus. Furthermore, it was hypothesized that females will be more willing to assist other females than to assist men.

For this study, a group of 50 female undergraduates were recruited from Southern Illinois University. The age of the participants was between 17-20 years old. The participants were randomly assigned in two groups. Each participant received the Ouranio Toxo Helping Scale questionnaire consisting of 21 scenarios. Each scenario was accompanied by a question asking the participants to rate their willingness to help for each event. The first group received questions about helping females whereas the second group received the same questions about helping males. The primary statistic analysis employed to check the effectiveness of the experimental manipulation was independent-groups *t*-test. The results indicate a statistically significance difference, $t(48)=1.724$, $p=.0455$, $d=0.058$. This analysis indicated, as predicted, that women's helping behavior is affected by the gender of the person who needs help and that females will be more likely to help females than males.

Considering the extensive exploration of gender differences, results from this research provide potentially important information. This research could help explain these differences because helping intentions are predictors of responsibility, emotional support, and good communication skills, which are essential characteristics for successful interaction between the helper and the person who needs help.

Katherine Millar

Dept. of Plant Biology

Antimicrobial Properties of Three Liverworts: Radula obconica, Blasia pusilla, and Pallavicinia lyelli

Many liverworts possess the ability to deter pathogenic agents such as fungi and bacteria. It is thought that the chemicals liverworts produce in their oil bodies are responsible for this activity. However, few studies have been done to isolate specific compounds of the oil bodies that are biologically active. The purpose of this study was to expand existing knowledge of liverwort biological activity and to isolate the compounds that are responsible for the observed activity.

Three species of liverworts, *Blasia pusilla*, *Pallavicinia lyelli*, and *Radula obconica*, were tested for their antimicrobial activity against *Bacillus subtilis*, *Escherichia coli*, and *Aspergillus niger*. Only *R. obconica* displayed antibacterial activity, and this activity was only against *B. subtilis*. Several fractions of *R. obconica* extract showed antibacterial activity. The most active compounds in these fractions seem to be bisbibenzyls, compounds characteristic of *Radula* species.

Thomas Heatherly II

Dept. of Zoology

Diversity and Community Structure of Littoral Zone Macroinvertebrates in Southern Illinois Reclaimed Surface Mine Lakes

Fourteen reclaimed surface mine lakes were sampled within the Sparta Illinois National Guard training facility for benthic macroinvertebrates in spring 2003. The objectives of this research were: (1) to inventory the aquatic macroinvertebrates present; (2) to examine which factors influence invertebrate communities in these systems; and (3) to observe the applicability of commonly used stream bioassessment metrics to Midwestern surface mine lakes. A dip net was swept over two or three 2-meter transects of littoral zones of each lake, from which 300 macroinvertebrates were randomly removed following rapid bioassessment protocols. Macroinvertebrates were identified primarily to genus and a multimetric approach was used to examine community structure and tolerance. Oligochaetes were typically the most abundant taxon, followed by *Hyallela*, Chironomidae, *Physa*, and *Caenis*. I used a principal components analysis and forward stepwise multiple regressions to examine the effects of several lake variables on diversity metrics. Simpson diversity was positively correlated ($r^2 = 0.92$, $P = 0.0003$) with lake area, percent rock and gravel substrate, Simazine concentration, bank slope, and transparency. The taxa in these lakes were composed of 70% predators, while collector-gatherers and grazers made up 20% and 9% of the taxa respectively. Taxa richness, diversity, percent insect taxa, and percent contribution by the dominant taxon all proved to be practical indices for this study, while a Hilsenhoff index and EPT (Ephemeroptera, Plecoptera, and Trichoptera) did not show enough variability to be useful.

Erin Holliday

Depts. of Physiology & Pharmacology

Use of Microarray and Real-Time PCR to Determine the Molecular Basis of Seizures in the Genetically Epilepsy-Prone Rat (GEPR)

The Genetically Epilepsy-Prone Rat (GEPR) is an animal model for seizure activity in humans. We hypothesized that seizures arise from alterations in gene expression in the inferior colliculus (IC) of the brain, and that the basis for this inherited disorder might be identified through microarray analysis.

Total RNA was isolated from the IC of GEPR and control Sprague-Dawley rats. cDNA was synthesized by direct labeling with Cy3-dCTP and Cy5-dCTP. The rat cDNA microarrays (Agilent Technology) were spotted with two identical arrays of 14815 unique rat cDNAs. One slide was hybridized with Cy3-labeled GEPR and Cy5-labeled normal cDNA, and the other slide was hybridized with a dye reversal of the cDNA (Cy5-labeled GEPR and Cy3-labeled normal cDNA). Hybridization was conducted in a Microarray Hybridization chamber (Gene Machines, San Carlos, CA), using the reagents and wash conditions specified by the supplier's protocol (Agilent). Slides were analyzed with an Axon GenePix 4000B dual laser microarray scanner and GenePix Pro 4.1 software (Axon, Union City, CA) that allows for gridding and flagging of spots. Data was then normalized using the lowess function from the com.bruja.sma software package.

We identified transthyretin as a potential gene that is differentially expressed in the GEPR IC. Real-time quantitative polymerase chain reaction (qPCR) was established for the control gene GAPDH. Analysis of transthyretin is currently being conducted to verify the microarray results.

Elizabeth Lorentzen

Dept. of Architecture and Interior Design

Understanding the Architecture of the Twilight

In 2001, the unearthing of the steamboat *Twilight* reopened interest in an historical era. This was a steamboat that existed during the "Golden Era of Steamboats," a magical part of U.S. history. After the excavation, the remains of the *Twilight* were moved to St. Charles, Mo., where they are now being stored in 12,000-square-foot warehouse. Due to a lack of interest in the St. Charles area, the owners are proposing to move the remains to Paducah, Ky., to be put in a river heritage museum.

There are still questions that need to be answered about the *Twilight*. We do know where the *Twilight* sank, and how it sank, but which towns were nearby? Did these towns have newspapers that recorded the sinking? More importantly, how was this steamboat constructed and what was its architecture? These questions lead to underlying topics that first needed to be researched. How were steamboats first invented and designed? Did the architecture style of the steamboat change over time? What was the structure of the steamboat, and how did it support the loads?

I have been researching these areas in order to understand more about the physical characteristics and components of steamboats in general, and the *Twilight* specifically. There are no known photographs or sketches of the *Twilight*, but based on research of similar steamboats of the era, I formulated theories about the appearance and structural characteristics of the steamboat *Twilight*. By understanding the basic components of how all steamboats were constructed: how the hull was shaped, the tonnage of boats, sizes, engine sizes, etc., I can formulate a reconstructed image of the *Twilight*.

Renee A. Lopez-Smith

Dept. of Plant Biology

*Fertilization in the Fern *Ceratopteris richardii**

Although investigations into the union of gametes (egg and sperm) in ferns date back some 100 years, our current understanding of fertilization (syngamy) in these plants remains limited at best. Research on this phenomenon has mainly been conducted on seed plants, while the process of syngamy in ferns remains poorly understood. The purpose of this investigation was to observe ultrastructural details of fertilization in the fern *Ceratopteris richardii* and to concentrate on aspects of this process that have not been examined in ferns. Observations were made on the light, transmission, and scanning electron microscopes. Particular emphasis was placed on the shape and structure of the sperm cell and how it relates to the archegonial neck canal (female sex organ).

Released, free-swimming sperm cells are tightly coiled but become greatly elongated and lose their cytoplasm in the vicinity of the receptive female. More than one sperm cell can be seen swimming side by side in the neck canal as they compete for the egg. Unexpected dramatic changes occur at the anterior-most region of the sperm cell once it arrives in the archegonial neck canal. An anterior region known as the dense ridge expands and forms what may be a type of mating structure that allows the sperm cell to dock to the egg. Once the gametes have fused, the expanded dense ridge, which comprises numerous parallel filaments, appears to facilitate the fusion of sperm nucleus and the nucleus of the egg.

This study has produced new insights into the biology of this plant. It is now pertinent to examine fertilization in other species to see if comparable structures and processes exist in other non-seed plants. All fertilization characteristics have phylogenetic implications and comparative analyses across land plant taxa yield important information in ascertaining evolutionary relationships.

Eric Johnson

Dept. of Plant Biology

*An Investigation into the Foot and Seta of the Liverwort *Sphaerocarpos texanus**

This study uses light, scanning, and transmission electron microscope techniques to investigate the structure and development of the seta and foot of the sporophyte of the liverwort *Sphaerocarpos texanus*. The sporophyte of land plants is the diploid generation that produces spores by meiosis (reduction division). *Sphaerocarpos* is a spring ephemeral liverwort with a life span of approximately three months. It is found in feral agricultural fields and on bare soil.

The sporophyte of *Sphaerocarpos* consists of a capsule, which houses the spores, a seta, and a foot. Both sides of the placenta, the junction between the sporophyte foot and gametophyte, have transfer cells with thick secondary wall ingrowths. The wall ingrowths are thought to be involved in the transfer of nutrients from the mother generation (gametophyte) to the developing embryo and resulting sporophyte. Wall ingrowths first appear in the gametophyte. Those in the sporophyte generation appear later but develop much quicker and are less dense than those in the gametophyte. Transfer cells in the sporophyte contain large concentrations of mitochondria. The establishment of placental transfer cells precedes meiosis and spore production in the capsule. Plasmodesmata are abundant throughout the different regions of the sporophyte and they aid in the transport of nutrients from the foot through the seta and to the developing spore mother cells. After meiosis, the seta becomes necrotic and breaks apart, thus separating the nearly formed spore tetrads in the capsule from the rest of the sporophyte. Spores remain in tetrads (groups of four spores that are the products of meiotic divisions) and are distributed and typically germinate in this arrangement.

Sarah M. Knight

Dept. of Administration of Justice

Cloning Technology and Politics

There is little political analysis of cloning technology, and most of that examines the ethical complexities of new reproductive medical procedures and policies. Commentaries typically weigh the pros and cons of using cloning technologies. The pros are said to include the capability to improve the diagnosis of diseases, to better understand who is at higher risk of common diseases, and to develop treatments for genetic disorders. The cons are said to include biologic selection of children, harm to the gene pool, and the urge to clone an entire human being.

My examination of cloning technology takes a different approach. It is designed to analyze how policy originated and evolved in state politics and how state governments are responding to it. It is principally a study about cloning technology rather than a prescription for making policy or decisions in individual cases. Data include: professional and mass media; religious interests; professional, medical, and public policy agendas; public opinion; and legislative proposals and enactments.

Besides analyzing the politics of cloning technology, I have examined the way that social scientists approach research on the policy-making process and the content of state policy. This research shows that the content of policies differs from state to state and over time, and that these substantive differences are important and worthy of more thorough analysis.

Jessica Loesch

Dept. of Psychology

Does Cognitive Reorganization of Traumatic Events Predict an Increase in Psychological and Emotional Well Being?

In an attempt to systematically study individual differences which contribute to varying levels of happiness and the regulatory processes inherent, the researcher has looked to narrative accounts that participants produce concerning various emotion-laden memories. It is believed that disclosing painful life events verbally is necessary in order to create a new schematic structure and allows writers to give meaning to those events. This structuring promotes an integration of thoughts and feelings of the experience into a more healthy cognitive reorganization. This reorganization may allow for a new, less threatening perspective of the event and may allow for closure once an individual can interpret cause-and-effect implications and understand why the event has occurred. It is posited that self-disclosure initiates a process of emotional regulation and that through careful analysis of text samples, cognitive and affective changes can be mapped. By noting who has increases in psychological and physical health from baseline due to their expressive writing, the experimenters can begin to make inferences as to what differences in writing style indicate improvements.

Tricia A. Trimble

Dept. of Zoology

Assessment of Water Quality at the Sparta, Illinois, National Guard Armory

This study focused on the effects of various contaminants on the aquatic resources present in a 2800-acre area located in Sparta, Randolph County, Illinois. This area was previously strip-mined, has been reclaimed, and is now the property of the Illinois National Guard, whose intent is to conduct military training operations in the area. There was potential for pesticide contamination due to agricultural activities surrounding the watersheds. Therefore, the National Guard requested a preliminary risk assessment to measure pesticide concentrations in water, fish, and sediment samples.

Objectives included determining the water quality of 15 existing lakes and two streams on a seasonal basis. Parameters tested included alkalinity, total suspended solids, carbon dioxide, hardness, dissolved oxygen, pH, temperature, conductivity, and chlorophyll *a*. Additionally, water samples, sediment, and fish were analyzed for lead as well as current-use and organochlorine pesticides.

The results of pesticide analysis showed that atrazine was detected during every season and in every body of water sampled. In sediment samples, analytes were detected at 34 of the 45 sites, with the most abundant chemical being DDT. Endrin was detected most often in fish filets and DDT was the most detected compound in fish livers. Lead concentrations were not significantly elevated in either fish or sediment.