



Southern™
Illinois University
Carbondale

150
SOUTHERN

TRiO
RONALD E. McNAIR
POST-BACCALAUREATE
ACHIEVEMENT PROGRAM

McNair Scholars Program

Southern Illinois University Carbondale

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McNAIR SCHOLARS
PROGRAM



RESEARCH SYMPOSIUM

July 23, 2004

9:30 AM - 4:00 PM

Wham Auditorium

SOUTHERN ILLINOIS UNIVERSITY CARBONDALE

SCHEDULE OF EVENTS

Welcome: *Karen Renzaglia, Director, McNair Scholars Program*

Opening Remarks: *Walter V. Wendler, Chancellor*
Introduction by Lavon Pettis, 2004 McNair Scholar

Outline of Today's Events: *Julia Spears, Assistant Director*

Introduction of Judges:
Norma Ewing, Gerard Smith, and Carmen Suarez

Session One: *Maurice Betts, 2004 McNair Scholar, Moderator*

AGRICULTURAL SCIENCES

9:50 **Christine Goldstein, Forestry**
Karl Williard, Forestry Resource Management

APPLIED SCIENCES AND ARTS

10:10 **Kandace Fisher, Interior Design**
Melinda La Garce, Architecture and Interior Design

EDUCATION AND HUMAN SERVICES

10:30 **Donna Greaves, Social Work**
Cheryl Presley, Student Health Programs

ENGINEERING

10:50 **Gabriel Smith, Industrial Technology**
Dennis Watson, Agricultural Systems and Informatics

11:10 Break

Session Two: *Gabriel Smith, 2004 McNair Scholar, Moderator*

LIBERAL ARTS

11:20 **Natalie Bonner, Economics**
Daniel Primont, Economics

11:40 **Nicole Huffman, Sociology and Psychology**
Mark Schneider, Sociology

12:00 **Lavon Pettis, Psychology and Sociology**
Josephine Korchmaros, Psychology

Ronald E. McNair

Ronald Ervin McNair, was born on October 21, 1950, in Lake City, South Carolina to Carl and Pearl McNair. He attended North Carolina A&T State University in Greensboro, where, in 1971, he graduated magna cum laude with a BS degree in physics. In 1976 he earned his PhD degree in physics from the Massachusetts Institute of Technology.

Dr. McNair's many distinctions include: Presidential Scholar (1967-71), Ford Foundation Fellow (1971-74), and National Fellowship Fund Fellow (1974-75). He was named Omega Psi Phi Scholar of the Year (1975), was honored as the Distinguished National Scientist by the National Society of Black Professional Engineers (1979), and received the Friend of Freedom Award (1981).

Ronald E. McNair was nationally recognized for his work in the field of laser physics. In 1978, he was one of 35 applicants selected from a pool of ten thousand for NASA's space shuttle program and assigned as a mission specialist aboard the 1984 flight of the shuttle Challenger. On his first space shuttle mission in February 1984, McNair orbited the earth 122 times aboard Challenger. He was the second African American to fly in space. On the morning of January 28, 1986, McNair and his six crew members died in an explosion aboard the space shuttle Challenger.

His memory lives in each student who enters the McNair Program, and strives to receive the PhD After his death, members of Congress provided funding for the Ronald E. McNair Scholars Program dedicated to the high standard of achievement Dr. McNair displayed.

McNair Scholars Program Overview

The McNair Postbaccalaureate Achievement Program is a comprehensive program structured to prepare undergraduates for successful careers as graduate students, professors, and professional researchers. The program is an educational opportunity program funded under the Higher Education Act of 1965 collectively known as TRIO Programs. The McNair Scholars Program is funded by the U.S. Department of Education. The program awards grants to institutions of higher learning for projects designed to provide low-income/first-generation college students or students who are members of a group which is underrepresented in graduate education with effective preparation for doctoral study.

At Southern Illinois University Carbondale, the McNair Scholars Program accommodates twenty-two students each year. All students participate in academic-year and summer activities until they graduate. McNair Scholars are motivated students who have both the desire and the potential to earn a doctorate degree. By participating in the program, Scholars increase and refine their academic skills and learn the tools necessary to be successful in graduate schools.

Special Thanks To:

Judges: Norma Ewing, Gerard Smith and Carmen Suarez.

To all of our **McNair Mentors:** Lydia Arbogast, Michael Collard, Kevin Foster, Josephine Korchmaros, Melinda La Garce, John Martinko, Matt McCarroll, Cheryl Presley, Daniel Primont, Karen Renzaglia, Mark Schneider, Lori Vermeulen, Dennis Watson, and Karl W.J. Williard.

Our **Selection Committee:** Loretta Battaglia, Thomas Calhoun, Patricia McNeil, Olayinka Mohorn, Karen Renzaglia, Prudence Rice, Julia Spears, Carmen Suarez.

We appreciate the involvement of the following people in the summer research program—(you helped make it a success!): Barb Elam, James Scales, Touch of Nature facilitators Sunshine and Craig, Jeff Underwood, Barnabas Gikonya, Mark Watson, Jo Korchmaros, Larry Hickman, Chris Sievers, Lori Vermeulen, John Mead, Manoj Mohanty, Zhigang Wang, John Bozzola, Hilarie Dee Gates, Steve Schmitt, Magdala Rice, Marilyn Richards, and Patti Cosgrove.

Plant Biology Department for use of the TEMS Classroom; Himanshu Ray and Andrew Blackwell for the logo design; Sydney Dillard for her hard work creating the McNair newsletter; Mindy Foskey at Attitude Design for her assistance developing great promotional items; Prudence Rice and John Koropchak for their guidance: the U.S. Department of Education for the grant award: McNair Program Staff: Tina Price and Himanshu Ray for their hard work and dedication. Christian Spears for his constant support.

To all the other individuals at SIUC for generously contributing their time and support to make this program successful!

12:20 Lunch (Wham Room 219)

1:00 MASS COMMUNICATIONS AND MEDIA ARTS
Deaneese Williams, Journalism News-Editorial
Kevin Foster, Black American Studies

Session Three: Natalie Bonner, 2004 McNair Scholar, Moderator

SCIENCE

1:20 **Maurice Betts, Chemistry**
Lori Vermeulen, Chemistry

1:40 **Renee Lopez-Smith, Plant Biology**
Karen Renzaglia, Plant Biology

2:00 Break

2:10 **Cortez McBerry, Microbiology**
John Martinko, Microbiology

2:30 **Shavonne Montgomery, Chemistry**
Matt McCarroll, Chemistry

2:50 **Andrea Wilton, Physiology**
Lydia Arbogast, Physiology

3:10 Break

3:20 **Closing Remark: John Dunn, Provost**
Introduction by Christine Goldstein, 2004 McNair Scholar

3:30 **Awards Ceremony**

McNair Scholars Program Staff
Karen Renzaglia, Director
Julia Spears, Assistant Director
Tina M. Price, Program Assistant
Himanshu Ray, Graduate Assistant

2004 McNair Summer Research Program Scholars and Mentors

Maurice Betts*Lori Vermeulen*

Associate Professor and Chair
Chemistry

Kandace Fisher*Melinda La Garce*

Associate Professor
Architecture and Interior Design

Donna Greaves*Cheryl Presley*

Director, Student Health Programs

Renee Lopez*Karen Renzaglia*

Research Professor
Plant Biology

Shavonne Montgomery*Matthew McCarroll*

Assistant Professor
Chemistry

Gabriel Smith*Dennis Watson*

Associate Professor
Agricultural Systems & Informatics

Andrea Wilton*Lydia Arbogast*

Associate Professor
Physiology

Natalie Bonner*Daniel Primont*

Professor
Economics

Christine Goldstein*Karl Williard*

Assistant Professor
Forestry

Nicole Huffman*Mark Schneider*

Associate Professor, Sociology

Cortez McBerry*John Martinko*

Associate Professor and Chair
Microbiology

Lavon Pettis*Josephine Korchmaros*

Assistant Professor
Psychology

Deanese Williams*Kevin Foster*

Assistant Professor
Black American Studies

Andrea Wilton

Physiology, College of Science

Mentor: Lydia Arbogast, Physiology

The Phosphorylation of Tyrosine Hydroxylase Serines 19, 31, and 40 during Lactation

Prolactin (PRL), an essential hormone of lactation, has a vital role in the continuation of mammalian species. Circulating PRL levels remain elevated in response to the suckling stimulus from the young as a result of a decrease in dopamine (DA) input from the brain to PRL-producing cells in the pituitary. During non-lactational states, PRL levels are suppressed by DA from tuberoinfundibular dopaminergic (TIDA) neurons in the brain. DA is synthesized from tyrosine in a pathway that is coordinated by the enzyme tyrosine hydroxylase (TH). This enzyme contains four identified regulatory phosphorylation sites, three of which are the focus of our work: Ser 19, Ser 31, and Ser 40. The objective for this study was to determine if the suckling stimulus alters the phosphorylation states of these three serines. One group of lactating rats remained with their pups, whereas another group was deprived of pups. Five groups of pup-deprived rats were subsequently reunited with their pups for durations of: 15-min, 30-min, 1-hr, 2-hr, and 4-hr. The stalk median eminence, where the TIDA nerve terminals are located, was then removed from the brain. This tissue is where the DA synthesis and secretion occurs. The samples were analyzed with phosphorylation site-specific antibodies for TH using the Western blot technique, and a densitometer was used to determine the degree of phosphorylation. Phosphorylation states of Ser 40 and Ser 31 were increased in pup-deprived dams, but were decreased within 30-min of suckling, and remained low. Ser 19 phosphorylation was not significantly different, but there was a tendency for reduced phosphorylation at 2 and 4-hr after the onset of suckling stimulus. TH protein quantity was unchanged as a result of the suckling stimulus. Dephosphorylation of TH may contribute to the decrease in DA, allowing PRL to rise in response to the suckling stimulus. This experiment will help define cell-signaling mechanisms important in the brain during lactation.

Shavonne Montgomery

Chemistry, College of Science

Mentor: Matt McCarroll, Assistant Professor, Chemistry

Structural Study of Lipid-Free Apolipoprotein A-I and the HDL Cholesterol Transport System

Cholesterol has become a major health concern among the medical community. Many studies have made an effort to understand the complexities of the high-density lipoprotein (HDL) cholesterol transport system. HDL is composed of apolipoprotein A-I (apo A-I), lipids, triglycerides, cholesterol, and cholesteryl esters. HDL transports cholesterol from cells and low-density lipoproteins to the liver where it is disposed by the body. The purpose of this study is to determine the 3-dimensional structure of apo A-I by using fluorescence resonance energy transfer (FRET), the transfer of excited state energy from one molecule to another. In this study, five truncated mutants of apo A-I were created using modified *E. coli* bacteria. One amino acid was replaced by cysteine on a given helix per mutated protein. Apo A-I was purified using column chromatography. An analysis of the product indicated that high yield of apo A-I was obtained. It also showed that trace amounts of other proteins existed in the solution. Once purification methods are optimized, preliminary measurements of apo A-I can be made.

Christine Goldstein

Forestry, College of Agricultural Sciences

Mentor: Karl Williard, Forestry

Soil Water Nitrogen Leaching in Riparian Autumn Olive Stands in Southern Illinois

Autumn Olive is a nitrogen fixing, invasive, exotic shrub that has become naturalized in the eastern United States. Our study objective was to determine whether excess nitrogen (nitrate and ammonium) was leaching below riparian autumn olive stands, potentially contributing to stream nitrogen loads. To achieve this objective, we installed six tension lysimeters in both autumn olive and open field plots at three riparian sites in southern Illinois. Soil water samples were collected monthly and analyzed for dissolved nitrate, ammonium, pH, and specific conductivity in the Forestry Laboratory of Watershed Research at Southern Illinois University Carbondale (SIUC). Soil water ammonium concentrations were relatively low and were similar between autumn olive (Mean: 0.0985, StDv: 0.1547) and open field (Mean: 0.1154, StDv: 0.1923) plots. Soil water nitrate concentrations were relatively high under autumn olive stands (Mean: 5.6147, StDv: 15.9191) and were significantly higher than open field plots (Mean: 0.0687, StDv: 0.1129). This high soil water nitrate could potentially contribute to non point source nitrogen pollution of streams, and the presence of autumn olive in riparian areas may convert these ecotones from net nitrogen sinks to net sources of nitrogen.

Kandace Fisher

Interior Design, College of Applied Sciences and Arts

Mentor: Melinda La Garce, Architecture and Interior Design

The Effects of Ambient Colors of Light on Human Behaviors of the Attention Deficit/Hyperactive Disorder (ADHD) Type

The purpose of this pilot study was to 1) test research protocol on two participants, one with ADHD and one without ADHD, i.e., exposure length to specific color wavelengths, illumination levels, specialized light sources, and light measuring equipment; 2) recommend any necessary protocol revisions; and, from study data, 3) determine if the hypothesis can be supported, albeit with a sample of two. The research question is: does human exposure to specific ambient color wavelengths of light and white light affect behaviors of the ADHD type? The hypothesis is: specific ambient color wavelengths of light and white light have different effects on behaviors of the ADHD type. The issue is: if behaviors of the ADHD type increase or are intensified by specific color wavelengths of light, then those wavelengths could likely be eliminated from the ambient light in environments for those with ADHD. This study is unique in that it analyzes the effects of ambient color wavelengths of light and white light and not focused or point sources of intense light.

Two research participants of essentially the same age were exposed individually at five separate sessions for a period of three hours each to white light and four specific color wavelengths of light. Participants were videotaped during each session. Behaviors of the ADHD type were determined by review of the literature and from report of the ADHD participant's parents. Systematic observation of the videotapes will be made by trained observers to identify and tabulate behaviors. Comparative analyses will be made.

The two research participants have been videotaped for approximately fifteen hours each; observers/recorders of the participants' behaviors are about to be trained to perform the systematic observation; tabulation of the recorded behaviors will be made; comparative analyses will be made; and findings will be disseminated. The principal investigators for this behavioral observation study of ADHD behaviors are Kandace Fisher (McNair scholar) and Melinda La Garce (McNair mentor). This study is part of a larger pilot study that includes systematic behavioral observation and blood assays of participants of differing ages, gender, and health conditions. The principal investigators for the larger study are Melinda La Garce, Luciano Debeljuk, and Sharon Smaga.

Cortez McBerry

Microbiology, College of Science

Mentor: John Martinko, Associate Professor and Chair, Microbiology

A Point Mutation in the Single Chain Trimer Complex

The Major Histocompatibility complex (MHC) proteins are found on the surface of all nucleated cells. These proteins are involved in the presentation of peptide to the immune system through T-cells. Specifically, MHC class I presents endogenous peptide to cytotoxic T-lymphocytes (CTL), eliciting an immune response. A MHC class I/peptide complex model has been constructed that encodes the MHC protein and peptide on the same strand of DNA. These model structures called Single Chain Trimers (SCT) are expressed as the complete MHC protein linked with a peptide sequence, this construct is designed to promote presentation of the desired peptide to CTL. Results show that the desired sequence was transformed into the chosen plasmid. This research will be continued through the academic school year and will be focused on the effects that a single amino acid change has on the binding of peptide to MHC class I and the presentation of antigen peptide to CTL. Future applications of this research could be the use of Single Chain Trimers as DNA based vaccines for viruses and cancers.

Renee Lopez-Smith

Plant Biology, College of Science

Mentor: Karen Renzaglia, Plant Biology

Does Actin Play a Role in Fertilization in *Ceratopteris richardii*?

The few ultrastructural studies that have been conducted on fertilization in land plants focused on the union of the sperm and egg nuclei. Nothing is known about the role of the cytoskeleton in this complicated process. To determine whether or not actin, a cytoskeletal protein, is involved in fertilization in ferns, I conducted experimental studies on *Ceratopteris richardii*. Spores were sown on a nutrient medium and gametophyte growth was monitored for the presence of receptive sex organs. To release swimming sperm, each plate was flooded with one ml of one of the following four treatments: 1) 100ug/ml cytochalasin B, an actin inhibitor, in 1% DMSO, 2) 1 mg/ml cytochalasin B in DMSO; 3) distilled water (control), and 4) 1% DMSO. Cultures were harvested 4 and 8 minutes from flooding to examine the effects of cytochalasin B on fertilization, and 4 and 8 days from flooding to determine the influence on embryo development. Additional cultures were maintained and monitored until 17 days after flooding. The percent of embryo-producing gametophytes was calculated for each treatment. Morphological data were collected in the light, scanning, and transmission electron microscopes. Swimming gametes of this fern in the water and DMSO treatments contain a dense ridge that encircles the leading edge of the cell. While in the archegonial neck, the dense ridge expands and contains numerous actin-sized filaments. These 5-7 nm filaments are visible in the sperm near the egg nucleus after fertilization. Disruption of the integrity of the dense ridge is evident after treatment with cytochalasin B, suggesting that actin is a component of the dense ridge. Significantly fewer embryos occur on gametophytes treated with cytochalasin B than in the controls. No sporophytes are evident on 17-day cytochalasin B treated plants, while numerous, well-developed sporophytes are seen on control plates. These results support the speculation that actin is not only necessary for fertilization but it is also intimately involved in normal embryo and gametophyte development.

Donna Greaves

Social Work, College of Education and Human Services

Mentor: Cheryl Presley, Student Health Programs

Attitudes and Perceived Roles in AOD Prevention: Faculty and Staff as Agents of Change on College Campuses

Alcohol and illicit drug use has been a growing problem on college campuses for many years. There have been several programs created and implemented to intervene with the “drinking tradition” seen on many campuses but the results have not been very promising. One overlooked and under estimated source for change is campus faculty and staff. These people, through their continuity on campuses and their constant interaction with the student population as well as the community at large, have the power to be highly influential in changing the campus attitudes concerning drinking and drug use.

While many programs have been developed that do encourage involvement of the entire campus community, the emphasis is on student participation and students supporting each other.

This study examined the attitudes and perceived roles of faculty and staff in prevention efforts on college campuses. Analyzing data from an aggregate sample of the 2003 Core Alcohol and Drug Survey we answered three questions pertaining to policy, perceptions of campus and willingness to be actively involved in prevention efforts. The results have led to several recommendations for improving prevention efforts

Gabriel Smith

Industrial Technology, College of Engineering

Mentor: Dennis Watson, Agricultural Systems & Informatics

Predicting Torque and Fuel Consumption with CAN Data

Environmental regulations limit the amount of exhaust gas emissions allowable by new engines. These regulations are difficult to monitor while operating in situ. There is a direct relationship between fuel consumption and torque in respect to the amount of emissions produced. The research plan was to predict torque and fuel consumption of a propane engine from data available on the controller area network (CAN) of the engine and environmental conditions. This project consisted of: collecting CAN and environmental data from a Ford 642 LP engine, analyzing the data, using the Model Quest software to create an accurate equation to predict torque and fuel consumption, and inspecting the accuracy of the algorithm. The results from this study produced a very accurate formula to calculate torque and fuel consumption with CAN and environmental data from this particular engine.

Maurice Betts

Chemistry, College of Science

Mentor: Lori Vermeulen, Chemistry

Synthesis and Characterization of a Zirconium Phosphate/Nicotine Intercalation Compound

We are interested in the use of layered materials as drug delivery host systems. We have successfully prepared a series of zirconium phosphate intercalation compounds in order to investigate the effect of ultrasound on the de-intercalation rate. Here we describe the successful preparation of a zirconium phosphate/nicotine intercalation compound. The synthesis and characterization of this new intercalation compound by powder X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FTIR) are reported.

Deanese Williams

Journalism, College of Mass Communication and Media Arts

Mentor: Kevin Foster, Black American Studies

Uncovering Truths: Using the Old Slave House for Cultural and Educational Advancement in Southern Illinois

"The Old Slave House" is the most widely known name for a 19th century residence in Equality, Illinois that was built and originally occupied by the salt producer and businessman, John Hart Crenshaw. It is likely that the third floor of the building housed black laborers who worked in Crenshaw's salt works. With proper study and analyses, the Old Slave House can be used to further Black American Studies in southern Illinois by exposing the existence of slavery in Illinois, and by uncovering the role that enslaved Africans played in building this region. Over the course of my research, I compared the studies of two antebellum sites, Carter's Grove in Virginia and the Hermitage plantation in Tennessee, to explore the extent to which archeological and architectural analysis would be beneficial at the Old Slave House site. I found archeological and architectural analyses to be important for uncovering material cultural, establishing the overall climate of master/ slave relationships, and differentiating enslaved Africans' sense of community from that of their owners. With similar studies, the Old Slave House could be used to promote Black American Studies, provide a more accurate account of the history of southern Illinois, and help fill the gap in cultural knowledge about Black Americans' regional past.

Natalie Bonner

Economics, College of Liberal Arts

Mentor: Daniel Primont, Economics

The Illinois Malpractice Crisis

The state of Illinois currently has no cap, an upper limit on what is allowed, on how much a person can receive for non-economic damages in a medical malpractice suit. The malpractice insurance rate in Illinois is so expensive because the state constitution finds caps unconstitutional. Illinois has been traumatically affected by the current crisis of expensive malpractice rates, Southern Illinois more specifically. The St. Clair Medical Society has predicted that by July 2004 the malpractice rates will have increased by 7.4% from last January. These rates have caused our doctors to retire early, go out of business, or in some cases "jump the border to surrounding states. Doctors fear malpractice litigation and have begun to practice "defensive medicine", meaning that they may perform more tests than may be needed because they do not want to be sued. Doctors have also begun to deny patients that may need complex treatment. Many people are suffering from the malpractice crisis. It has been as extreme as cities not having specialists that can deliver babies or treat trauma cases. Here in Southern Illinois, there is not a single neurologist. Economically, the crisis among the U.S. deals with efficiency, and productivity. The research has focused on how other states' approach the medical malpractice crisis. The crisis states and the non-crisis states were looked at to attempt to find what works the best. Information from internet-sources, journals, and newspapers were used. I used surveys, reviewed litigation cases, and analyzed statistical data. The research found that costs incurred because of the malpractice crisis indirectly affect the cost of certain Government Programs. Doctors and consumers agree that awards for non-economical damages should be capped. Finally, the research found that states with caps on non-economic damages have a 12% increase in the supply of doctors over non-cap states. In conclusion, caps are beneficial. By enforcing caps, possibilities of lower health care, and better access to care are within reach.

Nicole Huffman

Sociology and Psychology, College of Liberal Arts

Mentor: Mark Schneider, Sociology

Disability and Law: Testing *The Behavior of Law*

The initial objective of this research was to test Donald Black's theory of the behavior of law using cases initiated by persons with disabilities. Black argues that law, viewed as governmental social control, is a quantitative and directional variable, with less law being initiated by lower ranked, socially peripheral, and unorganized individuals against higher ranked, well connected and organized individuals. The disparity decreases as does the relational distance between plaintiff and defendant. As disabled individuals have been mainstreamed, Black's theory suggests, the per capita volume of law they initiate should increase. Initial plans were to test Black's theory by comparing changes in the social location disabled persons, from 1900 or 1950 to 2000, with the quantity of law they initiated. Significant problems were encountered operationalizing the variables or gathering data on them. The focus of research shifted to whether the American with Disabilities Act should be seen as a cause or a consequence of the increasing social centrality of disabled persons, with the latter position supporting Black's theory and the former contradicting it. The history of this legislation will be analyzed both in relation to Black's theory and to the perspective Theda Skocpol articulates in *Protecting Soldiers and Mothers: the Political Origins of Social Policy*.

Lavon Pettis

Psychology and Sociology, College of Liberal Arts

Mentor: Josephine Korchmaros, Psychology

The Generalization of Stereotypes of Black Women

Past research suggests a relationship between group membership and stereotype content. The purpose of this study was to find out what stereotypes are activated when people think of Black women and women. We hypothesized that there would be some but not total overlap in stereotype content about Black women and women. People of various ethnic backgrounds (49 females, 51 males, and 1 person of unknown gender) aged 18 to 78 were recruited from the summer Sunset Concert Series. Participants were asked to list whatever came to mind when thinking about either Black women or women. Consistent with past research and hypotheses, attractiveness was mentioned more often for women than for Black women and speaking loudly was mentioned more often for Black women than for women. Contrary to hypotheses, sensuality and sexuality were mentioned more often for women than for Black women. This research can help understand attitudes and behaviors directed towards Black women and women.