

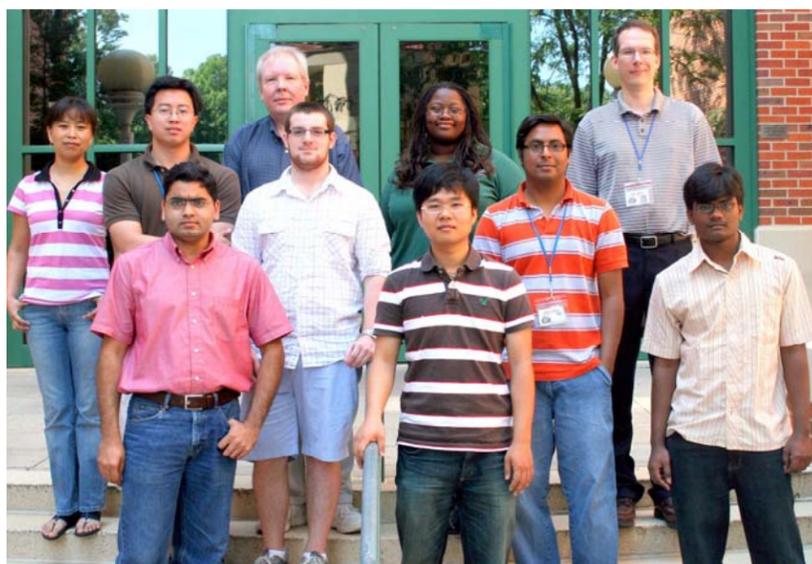


Mississippi Experimental Program to Stimulate Competitive Research

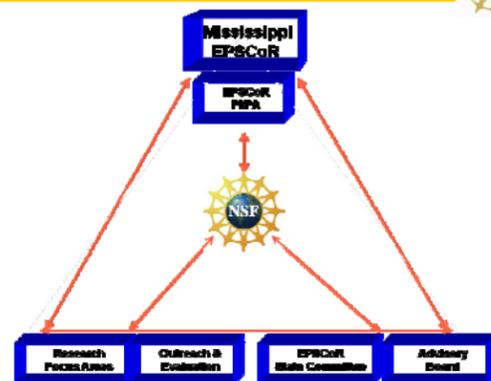


HIGHLIGHT

EPSCoR funding provides UM summer research experiences



Summer research students under the direction of Dr. Robert Doerksen, assistant professor of Medicinal Chemistry at the University of Mississippi, included PhD student, Prasanna Sivaprakasam, and undergraduate student Kitae Myoung, each partially supported by NSF EPSCoR. Tim Rich and Sidney Govan, instructor and undergraduate, respectively, at Rust College, were supported by the Education and Outreach portion of the EPSCoR funding. From left to right: Front row: Pankaj Daga, Kitae Myoung, Karthik Maddi; Middle row: Gang Fu, David Borzik, Prasanna Sivaprakasam; Back row: Dr. Aihua Xie, Tim Rich, Sidney Govan, Dr. Robert Doerksen.



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NEWSLETTER

Isokpehi travels to Nigerian Conference

Abuja, Nigeria was the location for the “Bioinformatics for Health Interventions in Africa Through Translation of Genomic and Biological Information” Conference.



Dr. Raphael Isokpehi, an assistant professor in the Department of Biology at Jackson State University, participated in the three

day conference and presented a session on “Examples of Translational Research Networks.”

EPSCoR funding enabled Isokpehi to meet face-to-face with researchers working in Africa who are interested in how bioinformatics and computational biology can be used to deliver health benefits from biological information. Participants at the workshop recog-

nized the role of international collaborations especially in modeling the ecology of infectious diseases, an area of interest to both the National Science Foundation and the National Institutes of Health. The meeting also provided a forum to identify laboratories in Africa where students and faculty in the Mississippi EPSCoR project can conduct collaborative research.

Perkins joins Computer Science Dept.

The Department of Computer Science and Engineering at Mississippi State University welcomes a new faculty member this fall—Dr. Andy Perkins who has recently completed his Ph.D.

at the University of Tennessee Knoxville. Partial support for Dr. Perkins’s position has been provided by NSF EPSCoR funding. His research is in the area of computa-

tional biology and he has already initiated collaborative research with several biology researchers at MSU.



Undergrads receive summer research awards

NSF EPSCoR funds have been used to provide support for undergraduate researchers in several laboratories at MSU and around the state. Two students from the Department of Computer Science and Engineering were awarded NSF EPSCoR undergraduate research awards in the summer of 2008. Summer support provided an



opportunity for Software Engineering senior, Susan Salkeld, to extend research she had started as a class project in a Computational Biol-

ogy class taught by Dr. Susan Bridges. The research is a collaborative effort with Dr. Mark Lawrence from the College of Veterinary Medicine at MSU. Salkeld has written software to compare all the genes of a strain of the food poisoning bacteria *Listeria monocytogenes* that has been sequenced by Dr. Lawrence’s laboratory with the genes of related species and strains. Salkeld will be a co-author of a paper describing this research.

Jonathan Harper, a freshman at MSU, worked in Dr. Bridges’ laboratory between his junior and senior years at the MS School for Math and



Science as part of the College of Engineering Quest program. With EPSCoR support, he returned to work this past summer with Dr. Bridges and Dr. Jeff Wilkinson in the Department of Biochemistry and Molecular Biology to develop a new algorithm to classify samples of fungi based on the melting point of their DNA. Harper presented a poster describing his research at the Bioinspired Design Conference at MSU in August and will present his work at the Argonne Symposium for Undergraduates in Science, Engineering and Mathematics at Argonne National Laboratory this month. Harper will also co-author a journal article describing this research.

Teachers attend summer bioinformatics workshop

Thirty teachers from across the state of Mississippi returned from the five day 2008 MS-EPSCoR *Bioinformatics Workshop for High School Teachers and College Instructors* armed with excitement and the tools needed to better prepare and excite students about computational sciences and biotechnology. Participants of the workshop included science, mathematics, and technology teachers from grades 8-12 and college instructors from 2-yr and 4-yr institutions. Funded by the NSF EPSCoR, this workshop introduced secondary and postsecondary instructors to emerging fields in the computational sciences (e.g. computational biology and modeling of human physiology). Participants experienced inquiry-based and laboratory instruction and received research-based curriculum materials developed through MS-EPSCoR and the Human Genome Project (NIH). Contributors to the workshop included research and education faculty from institutions of the Mississippi Research Consortium (Jackson State University, Mississippi State University, University of Mississippi, University of Southern Mississippi) and BioRad Laboratories (CA). Bioinformatics is defined as research, development, and/or application of computational tools and approaches for expanding the use of biological, medical, behavioral or health data, including those to acquire, store, organize, archive, analyze, and/or visualize such data. Hands-on experiences in computational sciences and biotechnologies increased participants' awareness of and excitement in the field and better prepared them to implement activities in the classroom and share the excitement of hands-on science with their students.

The workshop was coordinated by MSU undergraduate students, Hailey O'Neal, Betsy Dowdle, and Marion Harris, who serve as the MS EPSCoR Education/Outreach Planning Team under the direction of Dr. Giselle Thiabaud, Mississippi EPSCoR Education and Outreach Coordinator and Director of MSU's Electron Microscope Center.

Contributors included Dr. Susan Bridges, Professor of Computer Science (MSU), Dr. Sherry Herron, Director, Center for Science & Mathematics (USM), Dr. Robert Hester, Professor of Physiology (UMMC), Dr. Raphael Isokpehi, Assistant Professor of Biology (JSU), Ms. Essy Levy, Curriculum and Training Specialist (Bio-Rad Laboratories), Dr. Fiona McCarthy, Assistant Professor, Dr. Bindu Nanduri, Assistant Research Professor, Mr. Ken Pendarvis, Research Associate, and Ms. Juliet Tang, Facilities Manager (LSBI), all from MSU.



China Taylor from West Lowndes High School incorporates a green fluorescent protein into bacteria causing the bacteria to glow green when illuminated with UV-light.

UMMC host undergraduates

Joyee Esters, a sophomore from Millsaps College and



Andrew Diaz, a junior from Mississippi State University participated in the University of Mississippi Medical Centers' Summer Undergraduate Research Experience (SURE).

Both Esters and Diaz were supported by the NSF EPSCoR funding and worked



Seed grant funds CompBio project



Dr. Bindu Nanduri, Assistant Research Professor, MSU Institute for Digital Biology and Dept. of Basic Sciences, and collaborator Dr. Edwin



Swiatlo, University of MS Medical Centers' project titled "Streptococcus Pneumonia TIGR4 Response to Iron Restriction Using Genome Tiling Arrays: A Computational Systems Biology Approach" forms the framework for elucidating the specific roles of novel sRNAs in pneumococcal normal physiology and pathogenesis.

The emerging regulatory roles of RNA in living systems continually expand the central dogma in molecular biology. While the full spectrum of cellular functions regulated by small non-coding RNAs (called sRNA in prokaryotes) are yet to be established, efforts are under way to identify as well as study the role of non-coding regulatory RNAs in biological systems. Post-transcriptional gene regulation mediated by sRNAs is important for bacterial virulence. *S. pneumoniae*, a Gram positive human pathogen is the most common cause of community-acquired pneumonia and (Continued on Page 3)

in Dr. Robert Hester's laboratory.

Their work focused on learning how to use Quantitative Circulatory Physiology (QCP), a simulation of human physiology, and running simulations to verify the accuracy of the model. Esters will continue to work during the 2008-2009 school year providing critical validation simulations of the new Quantitative Human Physiology (QHP), which was developed as part of the current EPSCoR RII project.



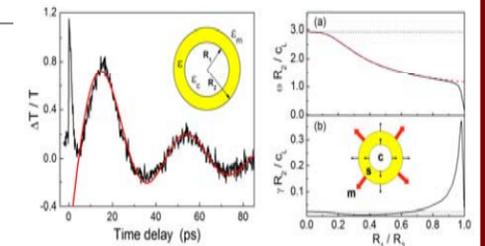
Jackson - Lyon match 'Music' of nano-spheres

Nanotechnology is a rapidly developing branch of science that cuts across physics, chemistry, biology and engineering. During past several years, tremendous advances have been made in the development of new hybrid nanostructures – composite nanometer-sized objects that combine useful properties of various materials they are made of. Among the highlights of novel nanostructures are *metal nanoshells* – thin metallic spherical shells grown on a dielectric core. These small objects, usually ranging from 10 to 100 nanometers in diameter, possess unique optical and mechanical properties that, combined with their high degree of tunability, make them extremely useful in a variety of biomedical applications. For example, one of such applications is

cancer treatment by means of optical heating, with focused infrared radiation, of tumors stacked with metal nanoshells delivered there via the bloodstream.

One of major challenges in this area, however, remains a quick and reliable identification of nanoshells among several other types of nano-objects that are simultaneously produced during the manufacturing process. The idea as to how to "pinpoint" a nanoshell is that it possesses a unique "sound pitch" – a distinct acoustical vibration frequency that a nanoshell emits when subjected to a rapid heating by an ultrashort laser pulse. This method was first suggested and implemented in the international collaboration between theory group at the JSU Depart-

ment of Physics (Drs. Arman Kirakosyan and Tigran Shahbazyan) and experimental group at the Lyon University, France (Dr. Fabrice Vallee). The experimental measurement of acoustical wave emitted by a vibrating nanoshell in the Lion University Nonlinear Optics Lab perfectly matched the calculations made in the JSU Computational Nanoscience Lab. It turns out that the "music of nano-spheres", although still undetectable by human ear, is nevertheless clear enough to distinguish between various types of nanostructures. The joint Jackson-Lion paper was published in the January of 2007 issue of the most prestigious nanoscience journal – Nano Letters, by American Chemical Society.



The target prediction analysis for these sRNAs identified a number of virulence factors that are relevant for pneumococcal pathogenesis. They found that a major proportion of these virulence factors were expressed under normal culture growth conditions in *S. pneumoniae*.

Seed grant funds CompBio project

Continued from Page 2
meningitis, sinusitis, chronic bronchitis, and otitis media. Increasing rates of resistance to antibiotics complicates the efforts to treat pneumococcal infections. Thus, pneumococcal disease remains a serious public health concern and understanding the regulatory mechanisms of pathogenesis and virulence in pneumococcus could identify novel targets for prophylactic and/or therapeutic interventions. Described for the first time, is a genomic tiling array approach for global

identification of small sRNAs in *S. pneumoniae* serotype 4 clinical isolate TIGR4, utilizing the whole genome tiling arrays for the analyses as they offer an unbiased view of transcription at the genome level and identified 50 novel sRNAs in the TIGR4 genome. The identified sRNAs were broadly categorized into cis-regulating and transregulating RNAs based on their predicted mode of action. Sequence comparison shows that sRNAs with common features cluster together.

Undergrads receive comp science scholarships

Eleven undergraduate students at Mississippi State University were recipients of the MSU EPSCoR Computational Science Scholarships for the 2008 summer term and the 2008-2009 academic year. These students, under the direction of MSU faculty, are involved in computational science research (comp bio, comp chemistry, systems modeling), with majors in the sciences, mathematics, and engineering. Scholarships provide financial support for research experiences that increases the students' awareness of and excitement in the field, and better prepares them for further research and careers in the computational sciences. Recipients of the summer 2008 and 2008-2009 academic year scholarships, along with their majors and project titles, are as

follows:

Susan Salkeld, Computer Science, Strains Testing the Distributed Genome Hypothesis; Jonathan Harper, Computer Science, Data Mining of Spatial Relationships Among Dispersed Repetitive Regions; Michael Lamb, Chemical Engr., Determination of the Physio-Chemical Properties of Lung Tissue and Integration Within CFD Simulations; Joshua Rodgers, Chemical Engr., Simulations of the Interactions of Polyamides With DNA; Brandice Nowell, Bio Sciences, The Design of a Catalyst for an Aldol Reaction Using Computational Chemistry; Zachary Dicks, Mathematics, Computer Science minor, Modeling the Spread of the Invasive Cactus Moth in the Southeastern

United States; Chelsea Lindley, Bio Engr., Coupling Simulation with System-level Physiological Model; Michael Lamb, Chemical Engr., Transport Modeling of Particle Deposition and Drug Delivery in the Lung; James L. Sylvester, Bio Sciences, Inferring Patterns of Microsatellite Evolution From Their Distribution, and Implied Stability Using a Comparative Genomic Approach; Angela Matson, Bio Sciences; Inferring Historic Rates of Gene Flow Among Island Populations of the Caribbean Iguana, *Cyclura Carinata*, Using a Computational Population Genetics Approach; Tony Arick, Comp Science Engr., DataMiner: Annotation of Microarrays from TIGR Database to Enable Systems Biology Modeling.