Interdisciplinary Team Develops Novel Compounds for Cancer Research

A collaborative effort between the laboratories of Drs. Charles Shuster in the Department of Biology and Jeffrey Arterburn in Chemistry and Biochemistry has developed a set of novel probes for cancer research and detection. In a project funded by an Interdisciplinary Research Grant through the VPR’s office, Drs. Shuster and Arterburn have generated analogs of S-trityl-L-cysteine (STLC), a small molecule inhibitor of the molecular motor Eg5. Eg5 is critical for proper assembly of the mitotic spindle in dividing cells, and inhibition of this motor results in mitotic arrest and ultimately cell death. Drugs that target the mitotic spindle have been used for decades as the last resort for many aggressive cancers, but because these drugs also affect non-dividing cells, patients commonly suffer severe side effects such as neuropathy. Because Eg5 is only expressed in dividing cells, cancer drugs that selectively inhibit Eg5 may exhibit fewer side effects.

Using the parent molecule as a substrate, the Arterburn lab synthesized a series of analogs of STLC, systematically modifying each functional group in the hopes of altering the molecules’ solubility, membrane permeability, and inhibitory activity. Those analogs were then submitted to three levels of analysis in the Shuster lab. Using a biochemical assay, the Shuster lab analyzed the inhibitory activity of the analogs using purified Eg5 motor domain, and in parallel, measured their effects on spindle formation in cultured tumor cells. As a last level of analysis, the lab has started to test whether these compounds are effective in invertebrate cells. Since the majority of basic research on cell division is done in non-mammalian systems, it is important to find drugs for those investigators using insect or nematode model systems, and the lab is currently performing such a screen in Drosophila S2 cells. Continued on page 3
Vancomycin is considered a "last stand" antimicrobial for the treatment of serious infections caused by *S. aureus*, which is the most important agents of hospital infections, causing more than 25% of the 2 to 4 million hospital born infections each year in the United States.

The first vancomycin-intermediate *S. aureus* strains (VISA) were reported in Japan in 1997, and in 2002 vancomycin-resistant strains were isolated in US patients. hVISA strains produce subpopulations of VISA colonies upon exposure to vancomycin in vivo and in vitro. "My NMSU Ph.D. advisor John E. Gustafson was both excited and shocked by my discovery, and immediately suggested that we retest our isolates" said Delgado. "Since we have determined that numerous *S. aureus* strains isolated with the hVISA strain are clonal, in the future we hope to determine the mutations that lead to the hVISA phenotype using comparative genomic analysis," added Delgado. In addition, this work provides an important warning to physicians in our area who are experiencing no response in patients being treated for "golden staph" infections with vancomycin.

In a recent Journal of Clinical Microbiology article (J. Clin. Microbiol. 45:1325-1329), New Mexico State University Ph.D. student Alejandro Delgado and mentor John E. Gustafson published on the discovery of a hetero-vancomycin intermediate resistant strain of *Staphylococcus aureus* (hVISA) isolated from a Las Cruces area medical center, the first discovered in the Paso Del Norte Region. Vancomycin is considered a "last stand" antimicrobial for the treatment of serious infections caused by *S. aureus*, which is the most important agents of hospital infections, causing more than 25% of the 2 to 4 million hospital born infections each year in the United States.

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In 2003 Mr. Delgado was selected for a competitive NMSU-National Institutes of Health Research Initiative for Scientific Enhancement (NMSU-NIH-RISE) Scholarship thanks to an award to NMSU Professor and interim Biology Department Head Marvin H. Bernstein. "The NMSU-NIH-RISE program is designed for minority students and I have benefited immensely from the help of the NMSU faculty who have been awarded this grant from the NIH," said Delgado. "I have even stayed at NMSU for my Ph.D. coursework and research in part because of a good relationship with my mentor Dr. John E. Gustafson, but also because of the NMSU-NIH-RISE program.” For his undergraduate work, Mr Delgado was published in the Journal of Applied Microbiology (J. Appl. Microbiol. 98:364–372) and the Journal of Clinical Microbiology (J. Clin. Microbiol. 43:2969–2972) and is now poised to publish three more cutting edge articles with Mentor Gustafson and the Gram-positive typing and Research Laboratory in the Biology Department. In addition, Mr Delgado has presented his findings at the 105th, 106th and 107th American Society for Microbiology General Meetings.

Enhancing Learning via Primary Historical Texts in Mathematics and Computer Science

New Mexico State University faculty are pioneering the enrichment of student learning in mathematics and computer science via an unlikely source, primary historical texts. Engaging students in study of the original writings of the creators of fundamental ideas is providing motivation, context, and direction to courses in finite mathematics, combinatorics, algorithm design, data structures, logic, abstract algebra, and automata theory, which are all subdisciplines that drive research in discrete structures in mathematics and the foundations of computer science.

Discrete mathematics studies separated, distinct, and finite objects, in contrast with the connected, smooth, and infinite spaces of the differential and integral calculus. As digital computers emerged in the past few decades, discrete mathematics has formed the underpinnings of computer science. Examination of original historical sources that compelled the development of these subjects enriches student understanding and perspective, and provides better preparation for subsequent courses. As biologist Stephen Jay Gould has said: “I can attest that all major documents of science remain chock-full of distinctive and illuminating novelty, if only people will study them-in full and in the original editions.” Through the student projects under development, NMSU learners can study and gain inspiration directly from seminal ideas in the development of deductive thought, the logic of digital computer programs, and counting arrangement of objects in patterns, as expressed in the words of some of the world’s great thinkers, like Alan Turing on computability, Gottfried Leibniz and John von Neumann on binary arithmetic, George Boole on symbolic logic, Blaise Pascal on counting in patterns, and Kurt Goedel on completeness and incompleteness of logical systems.

After initial development of this historical approach by NMSU mathematics faculty, and an interdisciplinary pilot program by faculty in mathematics and computer science funded by the US National Science Foundation, the NSF has recently awarded a four-year expansion grant for NMSU professors Guram Bezhanishvili, Hing Leung, Jerry Lodder, David Pengelley, Inna Pivkina, and Desh Ranjan to lead development into 20 other colleges and universities, in collaboration with professor Janet Barnett at Colorado State University, Pueblo. The project has also received graduate assistant support from NMSU’s Vice President for Research. The total monetary commitment to the project is $500,000.

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The Interdisciplinary Research Grant (IRG) award recipients conducting research at NMSU shared their progress report presentations with Dr. Chaitanya as well as the other PIs, Co-PIs and their student assistants.

On Thursday, September 20th, the Anderson Hall large conference room was filled with an audience eager to hear and see presentations on the interdisciplinary research projects that have been going on at NMSU for the past year. "The progress reports showed the PIs’ and their research teams’ enthusiasm towards their projects. I am pleased to see that some of the PIs are obtaining external funding for continuation of their research. Some are in the process of submitting proposals, and that these projects are leading to publications that will bring more exposure to NMSU research," said Vimal Chaitanya. "I would like to extend my congratulations to all the IRG teams and encourage all the faculty and researchers at NMSU to participate in interdisciplinary research," he added. The following is the list of faculty who presented their progress reports:

- Dr. Ou Ma
  Development of An Intelligent Robotic System for Neural Rehabilitation
- Joe Song
  Computational Modeling of Gene Regulation in the Development of Electric Organ for Muscle Cells in Electric Fish
- Nirmala Khandan
  Development of Microbial Fuel Cells for Electricity Production from Organic Solid Wastes
- Charles Schuster
  Development of Novel Small Molecule Inhibitors for Cancer Research
- Champa Gopalan
  Detection and Functional Analysis of Promoter Elements of Genes Involved in N Assimilation in Plant
- Shanna Ivey
  Influence of Fungal Endophyte Presence on the Attachment of Ruminal Microorganisms to Cellulosic Substrate
- Sangu Angadi
- Vincent Choo
  Large Section Cortical Bone Repair and Regeneration.
- Young Ho Park
  Multiscale Modeling of Core-Shell Nanostructures
- Joe Cecil
  Integrating Life Sciences and Mechanics in Bio-engineering Context

For more information about NMSU’s interdisciplinary projects visit: http://research.nmsu.edu/irg

"Interdisciplinary Team Develops Novel Compounds for Cancer Research" continued from page 1.

From these efforts, the team has found that STLC analogs with extensive modification of the carboxyl group retain inhibitory activity and membrane permeability. These results lay a foundation for the development of new agents that label Eg5 in living cells or identify rapidly dividing cells (such as tumors) in whole animal. Intravital imaging of tumors is currently performed using an indirect marker for cell division, and given that Eg5 is only expressed in dividing cells, Drs. Arterburn and Shuster hope to use these molecules to generate imaging probes that unambiguously mark dividing cells in whole animals or patients.

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War Is Thundering at Our Very Gates: Texas Newspapers During the Civil War

Mary Lamonica, Dept. of Journalism and Mass Communication has had a journal article accepted for publication: “War is Thundering at Our Very Gates: Texas Newspapers During the Civil War” will be published in Journalism History, April 2008. Lamonica also has four book chapters on Civil War correspondents from Texas in the forthcoming book: “Knights of the Golden Quill and Ink Stained Wretches.”

Mary (Cronin) Lamonica is in her third year of teaching in the Department of Journalism and Mass Communications at NMSU. She has been a professor since 1991, previously teaching at Washington State University and Bridgewater State College in Bridgewater, Massachusetts. Her research specialties include media history (especially U. S. Civil War reporting, women’s publications, and minority publications) and First Amendment issues.
NRI Funding for NMSU’s Cropping Systems Research

The idea of using cropping systems to improve forage quality and to conserve limited water resources got the attention of the U.S. Department of Agriculture Cooperative State Research Education and Extension Service’s National Research Initiative (NRI). The project “Water Conservation In Forage Production Systems by Sorghum-Legume Intercropping in the Southern High Plains” led by Dr. Sangu Angadi, an Assistant Professor in the Department of Plant and Environmental Sciences was awarded $398,109. The three year multidisciplinary project involves collaborators from College of Agriculture and Home Economics and USDA-ARS at Bushland, TX. It also supports training of graduate students and post-doctoral fellows. The research will be conducted at the Agricultural Science Center at Clovis, where Dr. Angadi is located, along with his NMSU collaborators Drs. Mark Marsalis and Robert Hagevoort.

Increasing demand for good quality forages by the fastest growing dairy industry, and the declining water resources are threatening the sustainability of highly productive irrigated agriculture in the Southern High Plains. Corn and alfalfa are the predominant forages in the region. However, the declining water resources cannot support their production for long. Lower water needs of forage sorghum compared to corn makes it a better alternative for the region. But, quality concerns are limiting adoption of forage sorghum. Novel approaches are needed to sustain the supply of quality forage without exhausting the available water resources.

Wide adaptability and a multitude of benefits to the cropping systems make many forage legumes well suited for forage quality improvement, but they are underutilized in the Southern High Plains. This project focuses on identifying shade tolerant forage legume crops for intercropping and developing a management practices to maximize the benefit on quality and moisture conservation. It also studies the effect of declining water resources on this forage production systems and estimates water conservation in the Southern High Plains by adopting the system.

Looking for crops or cropping systems alternatives for the region by Dr. Angadi was initiated by the Interdisciplinary Research Grant from the office of Vice-President for Research. Dr. Angadi is also collaborating on a two year USDA-CSREES funded project with Texas A&M University and Texas Tech University to improve the adaptability of canola, a potential biodiesel crop, to the Southern Great Plains.

Graduate Psychology Education Grant

Eve Adams and Luis Vazquez, in the Department of Counseling and Educational Psychology, in collaboration with the School of Social Work and the Southern New Mexico Family Practice Residency Program, have received a $340,000 grant to continue the Graduate Psychology Education Program for the next three years. The program, made possible by the Health Resources and Services Administration of the U.S. Department of Health and Human Services, will provide students studying counseling psychology, family practice medicine, and social work with hands-on experience in integrative, multicultural health care to clientele living in medically underserved communities. This program will support the collaboration of mental and physical health practices and encourage students in mental health professions to seek job opportunities in medical settings. The three-year program will provide community-based experiences in family practice centers such as Memorial Medical Center, school-based student Health Centers, Camino de Vida, La Clinica de Familia, and other local agencies.

NMSU Review Panel is now accepting proposals for FY09 Federal Initiatives. The deadline for submitting initiatives is at 12 pm October 12, 2007. Submission guidelines are available at:

http://research.nmsu.edu/fi
Office of Strategic Initiatives

The Office of the Vice President for Research, Graduate Studies, and International Programs (OVPRGI) is pleased to announce the creation of the Office of Strategic Initiatives (OSI), which will provide services that support faculty and staff in successfully pursuing and obtaining external funding. New Mexico State University’s current strategic plan, Living the Vision, has set forth as one of its goals. To be nationally and internationally recognized in research and creative activities. In order to help fulfill this goal, the OSI is charged with improving the funding success of large, interdisciplinary, multi-institutional, or strategic proposals, as well as enhancing the visibility of capacities and achievements of faculty and staff engaged in research.

OSI will provide a range of services related to identifying and pursuing potential external funding opportunities. Any college, department, or team of faculty and/or staff members working on multidisciplinary funding opportunities, whether addressed to a federal funding agency, state agency, business or industry client, or private foundation, may request support from OSI. Services already identified include the following:

- Targeted distribution of funding opportunities
- Up-to-date information for opportunities, workshops, and conferences
- Identification and pursuit of strategic initiatives (evaluating opportunities and helping identify partners)
- Proposal management activities (gathering information about competition, supporting development of proposal strategies, themes, and plans)
- Technical editing
- Database of faculty capacities and interests
- Collection of boilerplate documents and data useful for proposal, brochure, and presentation development
- Coordination of limited submission opportunities
- Workshops on response to program announcements.

In addition, OSI will assist the VPRGI with identification of strategic opportunities that the university should target and pursue. In the case of such strategic opportunities, OSI will provide support in putting together a team of interested faculty and staff and help in coordinating proposal development.

To obtain more information about OSI services or to request support, please contact Sudha Murthy at 646-9279 or smurthy@nmsu.edu.

NMSU Faculty Advance Decision Support Analysis for Water Policy

NMSU faculty publish results of decision support capabilities for improved water policy. NMSU Agricultural Economics/Agricultural Business professor Frank A. Ward and co-author Manuel Pulido-Velazquez, a recent visitor to NMSU from Spain, have a paper coming out soon in the journal Ecological Economics.

Paper Title: Efficiency, Equity, and Sustainability in a Water Quantity: Quality Analysis for the Rio Grande Basin

Paper Summary: Integrated hydrologic and economic optimization models at the basin scale provide a framework for policy design, implementation, and evaluation in water stressed basins. Despite the considerable potential that basin scale analysis offers, few basin wide studies have examined tradeoffs among efficiency, equity, and sustainability when analyzing the design of water resource programs.

This paper develops a basin scale framework to identify hydrologic and economic impacts of alternative water pricing programs that comply with environmental regulations for protecting water quality. Key issues are examined that confront integrated hydroeconomic basin models: linking water and economics, spatial and temporal scale integration, and quantity quality relationships. Economic efficiency is defined and measured for each of two urban water pricing arrangements that comply with urban water quality protection regulations. Alternative measures of equity are analyzed in both spatial and temporal dimensions.

Sustainability is evaluated physically for protecting the water supply and financially for long-term revenue viability. The approach is illustrated from results of a dynamic nonlinear programming optimization model of water use in North America’s Rio Grande basin.

The model optimizes the net present value of the basin’s total economic benefits subject to constraints on equity, sustainability, hydrology, and institutions. It is applied to assess impacts of a two tiered pricing program that complies with recently implemented drinking water quality standards for the basin’s two largest U.S. cities: Albuquerque, New Mexico, and El Paso, Texas. Results suggest that two tiered pricing of urban water supply has considerable potential to perform well in meeting the aims of efficiency, equity, and sustainability. Findings provide a general framework for designing water pricing programs that comply with environmental regulations.
In recognition of the need to create more institutions that have competitive research programs to recruit more underrepresented individuals to cancer research, and to increase the attention to cancer health disparities research, National Cancer Institute has awarded a new U54 partnership project to expand the collaboration between New Mexico State University and the Fred Hutchinson Cancer Research Center (Seattle, WA). The total award of ~$10M will be shared by the two institutions as they conduct collaborative research, training, and outreach projects. This project, led by Regents Professor Mary O’Connell at NMSU and Beti Thompson, President of the University of New Mexico, was awarded a U54 award from NCI that has just ended.

At NMSU, in year one, the award supports seven cancer projects and programs led by faculty in three colleges. In years two through five additional collaborative research, training and outreach projects will be added so that over the course of the award, ~16 different collaborative pilot and full projects will be supported. A call for additional proposals will be made in early 2008; Ms. Helena Loest, the program coordinator (hloest@nmsu.edu) will send out more information. An innovative aspect of the NMSU/FHCRC collaboration is the intent to develop cancer outreach efforts in the state by collaborating with the existing network of Cooperative Extension Service offices. This approach is modeled after the CES HEROES program currently under discussion in New Mexico.

This cancer health disparities program will expand on a long-standing partnership in cancer research training and education. Programs include: “Undergraduate training and education program in cancer,” Mary O’Connell, Plant and Environmental Sciences and Michele Shuster, Biology, NMSU and FHCRC; “Graduate training in cancer research,” Mary O’Connell, Plant and Environmental Sciences and Maxine Licon, Health Sciences, NMSU and FHCRC; “Discovery of gene regulatory networks in Drosophila during metamorphosis using the linear discrete dynamic model”, Joe Song, Computer Science-NMSU and Bruce Edgar, FHCRC; “How does metabolic rate affect age-induced genomic instability?”, Wayne Van Voorhis, Molecular Biology, NMSU and Dan Gottschling, FHCRC.

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Gloria Coronado and Karen Peterson, FHCRC; “Graduate training in cancer research,” Mary O’Connell Plant and Environmental Sciences and Hugo Vilchis-Licon, Health Sciences, NMSU and Maxine Licon and Steve Schwartz, FHCRC.

Finally, an outreach program will evaluate a way to bring public health intervention to communities suffering from cancer health disparities: “Promotora outreach for cervical cancer screening,” Hugo Vilchis-Licon, Health Sciences, NMSU and Beti Thompson, FHCRC.

Serendipitous Backyard Hybridization And the Origin of Crops

Dr. Donovan Bailey’s laboratory in NMSU’s Department of Biology, along with colleagues from the United Kingdom, recently completed research focused on identifying evidence for potential mechanisms involved in early crop domestication that was published in Proceedings of the National Academy of Science in September.

Using archaeological, ethno-botanical, geographical, and genetic data, Dr. Bailey and colleagues investigate the extent and significance of predomestication cultivation, backyard sympathy, and spontaneous hybridization for the legume tree Leucaena, which is used as a food crop throughout south-central Mexico. They show that predomestication cultivation was widespread, involved numerous independent transitions from the wild to cultivation, and related in extensive artificial sympathy of 2–6 species locally and 13 species in total. Using several independent DNA sequence loci, they demonstrate that hybridization in Leucaena has been extensive and complex, spawning a diverse set of novel hybrids as a result of juxtaposition of species in cultivation. The scale and complexity of hybridization in Leucaena is significantly greater than that documented for any other Mexican plant domesticates so far. However, there are striking parallels between Leucaena and the other major Mexican perennial domesticates Agave and Opuntia, which show very similar domestication via backyard hybridization pathways. Ultimately the results suggest that backyard hybridization has played a central role in Mesoamerican crop domestication and demonstrate that the simple step of bringing species together in cultivation can provide a potent trigger for domestication.
A Nexus of Research, Teaching, and Distance Learning Outreach to Tribal Communities

An NMSU and SIPI (Southwest Indian Polytechnic Institute) partnership sponsored The Digital Pathways Conference: Facilitating Distance Education for American Indian Communities, August 6-7, 2007. Conference participants identified a desire for a thorough distance education needs assessment of New Mexico tribes. In addition to a survey-type study, Grace Ann Rosile (NMSU Management Department) suggested a qualitative study, with in-depth interviews of tribal members. David Boje, who teaches qualitative research methods at NMSU, volunteered to assist with interviews, and to coordinate NMSU graduate student involvement. This needs assessment research will aid in reaching out to New Mexico’s Native American Indians in their home communities with a customized tribal-focused option within the Management major at NMSU. College of Business Associate Dean Kathy Brook, Management Department Head Bonnie Daily, as well as faculty member Sam Gray and Ph.D. student Joe Gladstone are working with Rosile to develop these distance education courses for Fall 2008. If you are interested in being interviewed, or want to join the research group, contact Grace Ann Rosile at garosile@nmsu.edu, or call 505-532-1693. This outreach effort is supported by the Digital Pathways grant from the Alfred P. Sloan Foundation, under P.I. Carmen Gonzales and Don Pepion.

Global Warming: Fishery Department Assistant Professor Attends Oxford Round Table

Dr. Mark Andersen of the Department of Fishery and Wildlife Sciences attended an Oxford Round Table August 13-17 at Oxford University in England. The Oxford Round Table is a series of unique multidisciplinary forums to discuss both technical and policy aspects of important current issues. Dr. Andersen presented a paper entitled "Global Change and Biodiversity Conservation: The Potential Contribution of Ecological Risk Assessment" at a forum on "Global Warming and Sustainability: Governing a Crisis."

The forum was attended by leading environmental scholars from a variety of institutions; attendees included scholars in the fields of law, political science, engineering, economics, biology, atmospheric science, chemistry, physics, business, architecture, and the humanities, as well as artists and religious leaders. Dr. Andersen’s presentation argued that current biodiversity conservation strategies are not capable of dealing with future challenges due to climate change and land-use shifts; he also showed how future conservation strategies may deal with these challenges by adapting current paradigms from conservation biology and ecological risk assessment. The proceedings of the Round Table will be published in the journal "Forum on Public Policy;" a committee of attendees is also working on a position statement and press release to appear this fall.

Math Professor Invites World Speakers to Meeting of the American Mathematical Society in Albuquerque

David Finston is organizer of the Special Session on Affine Algebraic Geometry at the Western Regional Meeting of the American Mathematical Society, October 13-14, 2007 in Albuquerque. The session will feature 13 speakers from the US, France, the Netherlands, and Japan. Several of the speakers will visit the department before and after the conference for research collaborations. One of them, Arno van den Essen will deliver a public lecture on Benjamin Franklin’s Magic Squares on Thursday, October 11 at 5 PM in the Corbett Center Ballroom. These activities are supported by the Department of Mathematical Sciences, the College of Arts and Sciences, the Honors College, the Vice President for Research, the US Department of Education, and the Alfred P. Sloan Foundation.

The NMSU RESEARCH NEWS is published by the Office of Vice President for Research, Graduate Studies, and International Programs. Comments are always appreciated. You can submit NMSU research news items online at:

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