AAAS
ADVANCING SCIENCE, SERVING SOCIETY

PROGRAM BOOK

2008 AAAS-SWARM Division 83rd Annual Meeting

MEETING TODAY'S CHALLENGES THROUGH

COLLABORATIVE

SCIENCE, ENGINEERING, AND TECHNOLOGY

9-12 April ❖ Albuquerque, New Mexico

THE UNIVERSITY of NEW MEXICO

Sandia National Laboratories

Hosted jointly by the

University of New Mexico and Sandia National Laboratories

Local Organizers of the 2008 AAAS SWARM Division Annual Meeting

John McIver, University of New Mexico
Rick Stulen, Sandia National Laboratories
Wendy Cieslak, Sandia National Laboratories
Denise Wallen, University of New Mexico
Dawne Settecerri, Sandia National Laboratories
Phillip Pohl, Sandia National Laboratories
Gretchen Jordan, Sandia National Laboratories
Cecelia Williams, Sandia National Laboratories
Randy Watkins, Sandia National Laboratories
Amy Matteucci, Sandia National Laboratories

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Zimmerman Library, University of New Mexico

Center for Integrated Nanotechnologies,
Sandia National Laboratories

Editor of the Proceedings:

David T. Nash

The contents of papers/posters presented at AAAS SWARM Division Meetings are the ideas of the authors and do not necessarily reflect the views of the AAAS or the SWARM Division.

PROCEEDINGS

2008 AAAS-SWARM DIVISION ANNUAL MEETING

Meeting Today's Challenges through Collaborative Science, Engineering, and Technology

9-12 April 2008 • Albuquerque, New Mexico
University of New Mexico Student Union Building

83rd Regional Meeting of the
American Association for the Advancement of Science
Southwestern and Rocky Mountain Division

Time and location of events are subject to change.
Please check with registration desk for the most up-to-date information.

AAAS SWARM DIVISION GOVERNANCE

AAAS BOARD OF DIRECTORS

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AAAS LIAISON TO SWARM DIVISION

Albert H. Teich, AAAS Director, Science and Policy Programs, 1200 New York Avenue, N.W., Washington, D.C. 20005.

AAAS BOARD MEMBERS

John E. Dowling, Harvard University; Lynn W. Enquist, Princeton University; Susan M. Fitzpatrick, James S. McDonnell Foundation; Alice Gast, Lehigh University; Linda Katehi, University of Illinois, Urbana-Champagne; Cherry Murray, Lawrence Livermore National Laboratory; Thomas D. Pollard, Yale University; Kathryn Sullivan, Ohio State University.

OFFICERS OF THE SOUTHWESTERN AND ROCKY MOUNTAIN (SWARM) DIVISION

Executive Director: David T. Nash

President: Wendy Cieslak, Sandia National Laboratories

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President-elect: Niall Shanks, Wichita State University

AAAS-SWARM MEMBERS OF THE EXECUTIVE COMMITTEE

Jay Golden, Arizona State University; Austin Cooney, Texas; Janet Haggerty, Tulsa University; Lawrence Todd, Colorado State University; Philip Pohl, Sandia National Laboratories; Brad Ericson, University of Nebraska at Kearney

DISCIPLINARY SECTIONS OF THE DIVISION

- Biological Sciences (including Agriculture, Horticulture, Entomology, Botany, Zoology and Microbiology)
- Biomedical Science (including Developmental and Molecular Biology)
- Environmental Sciences (including Ecology, Earth Sciences, Astronomy, Hydrology and Soils)
- General Poster Session
- Physical Sciences and Engineering (including Chemistry, Computer Sciences, Mathematics, Physics, and Statistics)
- Psychological Sciences
- Science Education
- Social Sciences (including History and Philosophy of Science, Women's Studies, Ethnic Studies, Anthropology, and Political Science)

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WELCOME TO THE 2008 AAAS SWARM DIVISION 83RD ANNUAL MEETING

Dear Colleagues,

On behalf of the Southwestern and Rocky Mountain Division of the American Association for the Advancement of Science, I would like to take this opportunity to welcome you to Albuquerque for the 83rd Annual Meeting of the SWARM Division of AAAS.

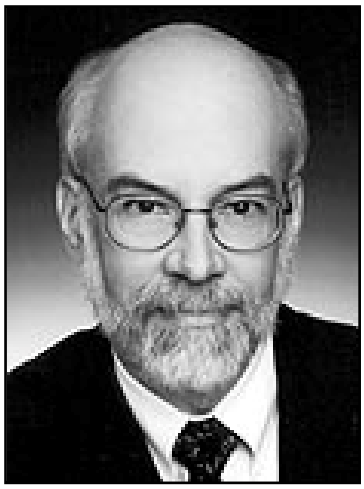
The theme for this year's meeting - Meeting Today's Challenges through Collaborative Science, Engineering, and Technology – emphasizes the importance of encouraging, exploring, creating, and celebrating collaboration at the intersections between disciplines and to witness the broad influence of science and technology on society. Attendees will have the opportunity to choose among a broad range of topics, including energy, sustainability, health, science education, collaboration, and nanotechnology. We hope you will take advantage of these wonderful opportunities and attend many of the lectures both within and outside your disciplinary boundaries.

The following pages present the highlights of the scientific program. The AAAS SWARM Division Annual Meeting reflects tremendous efforts from the SWARM Division Executive Committee and the local organizing committee, which I gratefully acknowledge. I also extend my personal thanks to all participants who helped organize symposia, workshops, and plenary lectures.

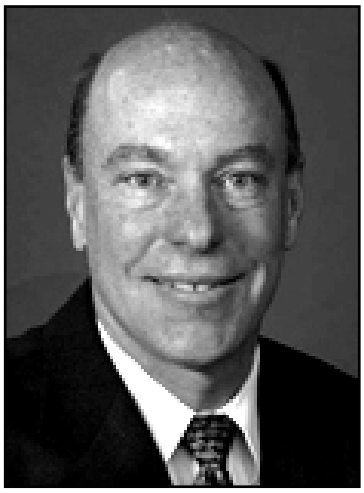
I sincerely hope that you will continue to support both the SWARM Division and AAAS in the future, as we continue our goals, "To advance science, engineering, and innovation throughout the world for the benefit of all people".

David T. Nash
Executive Director
AAAS SWARM Division

WELCOME TO ALBUQUERQUE



John (Jack) McIver
Interim Vice President for Economic Development
University of New Mexico



Rick Stulen
Chief Technical Officer and Vice President Research and Science, Technology and Research Foundations
Sandia National Laboratories

On behalf of the University of New Mexico and Sandia National Laboratories we are delighted to welcome you to Albuquerque, New Mexico and the 83rd meeting of the SWARM Division of AAAS. We are honored to be the co-chairs of this regionally recognized event.

Albuquerque offers an ideal setting for this multidisciplinary scientific meeting. New Mexico and the Albuquerque area are home to two national laboratories, several government research centers, innovative businesses ranging from large international corporations to small start-ups , and a diverse concentration of educational institutions. The Southwest culture and our sunny, mountainous terrain offer many exciting sight-seeing opportunities, museums and unique cuisine.

We are pleased to join AAAS SWARM Division Executive Director David Nash in welcoming you to your 83rd meeting and wishing you a most productive and stimulating experience.

ABOUT SANDIA NATIONAL LABORATORIES

Sandia is a multi-program laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration. Sandia's missions meet national needs in four key areas:

- Energy, Resources, and Nonproliferation - Enhancing the safety, security, and reliability of energy and water through the application of science and technology.
- Homeland Security and Defense - Helping Americans maintain their freedom, security, and quality of life in the face of worldwide terrorism and natural disasters and protecting our armed forces and their physical assets at home and abroad.
- Nuclear Weapons - Ensuring the nation's stockpile is safe, secure, reliable, and can support our nation's deterrence policy.
- Defense Systems and Assessments - Supplying advanced, engineered systems and assessment capabilities to the defense and national security communities.

Underpinning all of Sandia's mission areas is the drive to develop new understanding of relevant processes through mission-focused science, technology, and engineering and to integrate results to provide the necessary technology that supports engineering and product realization. Sandia's science, technology, and engineering efforts focus on these areas:

- Computational and Informational Sciences
- Engineering Sciences
- Materials and Process Sciences
- Microelectronics and Photonics
- Pulsed Power Sciences
- Biosciences and Technology

ABOUT THE UNIVERSITY OF NEW MEXICO

Founded in 1889, The University of New Mexico now occupies 600 acres along old Route 66 in the heart of Albuquerque, a city of more than 700,000 people. From the magnificent mesas to the west, past the banks of the historic Rio Grande to the Sandia Mountains to the east, Albuquerque is a blend of culture and cuisine, styles and stories, people, pursuits and panoramas.

Offering a distinctive campus environment with a Pueblo Revival architectural theme, the campus echoes the buildings of nearby Pueblo Indian villages. The nationally recognized Campus Arboretum and the popular Duck Pond offer an outstanding botanical experience in the midst of one of New Mexico's great public open spaces.

The University has branch campuses in Gallup, Los Alamos, Taos and Valencia County. UNM offers graduate and upper division programs in Los Alamos and Santa Fe and throughout the state. UNM's libraries, museums, galleries and Center for the Arts are a rich cultural resource for the state.

As a Hispanic-Serving Institution, the University represents a cross-section of cultures and backgrounds. In fall of 2006, 25,817 students attended main campus with another 6,530 students at branch campuses and education centers. The average UNM student is 27-years-old.

UNM boasts an outstanding faculty that includes a Nobel Laureate, two MacArthur Fellows, 35 Fulbright scholars and several members of national academies. Faculty publish in many professional journals including Scientific American, New England Journal of Medicine and Nature. The University is the state's flagship research institution. UNM research injects millions of dollars into New Mexico's economy, funds new advancements in healthcare, and augments teaching, giving students valuable hands-on training in state-of-the art laboratories.

Offering more than 210 degree and certificate programs, UNM has 94 bachelor's degrees, 74 master's degrees and 40 doctoral programs. The Health Sciences Center is the state's largest integrated health care treatment, research and education organization.

U.S. News and World Report's 2008 edition of "America's Best Graduate Schools" ranks the UNM School of Medicine 41 while specific areas also rank again among the top 10 (rural medicine, 2, and family medicine, 10). Additionally, in health disciplines, UNM's nursing/midwifery program is ranked 3. UNM School of Law is ranked 75, while ranking 3 for law school diversity and 6 in clinical training. UNM College of Fine Arts is ranked 51, with its photography program ranked 2 in the nation. UNM was the only New Mexico university to be ranked among the top 25 colleges and universities for Latinos by Hispanic Magazine. The University is ranked first among law schools by Hispanic Business magazine. The School of Engineering is ranked fifth and the School of Medicine sixth.

Among the University's outstanding research units are the High Performance Computing Center, Cancer Center, New Mexico Engineering Research Institute, Center for High Technology Materials, Design Planning Assistance Center, Environmental Law and Policy and the Center for Non-Invasive Diagnosis. During the fiscal year 2006-2007, the University received $72.6 million in private support. Budgeted consolidated revenues for 2007-2008 are $1.84 billion. In fiscal year 2006-2007, UNM faculty and staff generated more than $298 million in contracts and grants.

GENERAL INFORMATION

LOCATION

All Symposia, Workshops, Plenary Lectures, and Special Events will be held in the Student Union Building (SUB) on the campus of the University of New Mexico (map on last page of the Proceedings).

REGISTRATION

UNM SUB
Second Floor: SUB Ballroom Pre-Convention Hallway

Days and hours are:

Wednesday		
	9 April	NOON-4:00PM
Thursday		
	10 April	8:00AM-4:30PM
Friday		
	11 April	8:00AM-4:30PM
Saturday		
	12 April	8:00AM-NOON

All participants are required to check in at the registration tables, where you will sign in and receive meeting materials. Registrants are required to wear their badges at all times when attending the Annual Meeting. Anyone without a valid meeting badge may be denied entry to a session.

COFFEE BRAKS

Coffee/Tea and light snacks will be provided in the registration area at mid-morning (10:00am-10:30am) and mid-afternoon (3:00pm-3:30pm).

PRESENTER/SESSION CHAIR GUIDELINES

Please maintain the established schedule scrupulously in fairness to persons planning to attend sessions at specific times to hear particular speakers. Please pause for the period allotted if a scheduled speaker fails to appear.

MESSAGE BOARD

A bulletin board for attendees to post messages for other attendees is located in the registration area.

SPECIAL EVENTS

AAAS SWARM DIVISION NETWORKING/SOCIAL MIXER
Friday, 11 April **5:00pm-6:45pm**
UNM SUB **Room: Ballroom C**

Please join us in relaxing after a long day of meetings with food and refreshments and an opportunity to meet with other meeting participants. This event is free to all meeting registrants.

JOHN WESLEY POWELL MEMORIAL LECTURE: "AS INNOVATION GOES, SO GOES AMERICA"
NORMAN R. AUGUSTINE (RETIRED CEO LOCKHEED MARTIN)
Friday, 11 April **7:00pm-8:30pm**
UNM SUB **Room: Ballroom B**

Following the AAAS SWARM Division Networking/Social Mixer, please join us for this year's John Wesley Powell Memorial Lecture, presented by a man whose resume cannot easily be summarized. Norman R. Augustine is perhaps one of the few men best situated to speak on the topic of innovation and government policy. Of just a few of his notable positions, Mr. Augustine was Assistant Director of Defense Research and Engineering for the United States and Acting Secretary of the Army. He served as Chairman and CEO for Martin Marietta Corporation and President of Lockheed Martin Corporation. He was a Lecturer with rank of Professor at Princeton University School of Engineering and Applied Science. He has and presently serves on the Boards and in leadership positions of groups and organization as diverse as the American Red Cross, National Academy of Engineering, the American Institute of Aeronautics and Astronautics, the Boy Scouts of America, ConocoPhillips, Black & Decker, the Advisory Board to the Department of Homeland Security, and the Hart/Rudman Commission on National Security. He has also served on the President's Council of Advisors on Science and Technology.

This lecture is free to all registrants and open to the general public.

SWARM AWARDS BANQUET (TICKETS REQUIRED)
Saturday, 12 April **7:30pm-9:00pm**
UNM SUB **Room: Ballroom C**

If you did not pre-register to attend the Awards Banquet and are now interested in attending, please check with the registration table to see if there is still room available.

AWARDS NOTIFICATION

If you pre-registered to be judged for a presentation award, please check with the registration tables on Saturday to learn if you received an award. Winners of an award are entitled to a free ticket to the banquet, where they will be acknowledged and presented with their award.

STANDARDS OF CONDUCT

On April 14, 1978, the AAAS Board of Directors adopted the following position statement regarding standards of conduct at AAAS Meetings and the same standards apply to AAAS Divisional Meetings:

> *The Board takes it for granted that all who attend the Annual Meetings of the Association will conduct themselves with consideration for others and with particular for those who generously give their time and thought to the sessions. Differing opinions will continue to be heard and respected. We recognize that there are areas of science that are both controversial and troubling. The Annual Meeting can serve as an effective forum to consider such issues, so long as procedures of orderly debate and fairness are followed. Discourtesy and abusive behavior have no place in the Annual Meeting. When excesses occur, they do great injury to the Association and to the process of discussion. They cannot be condoned.*

DISCLAIMERS

Abstracts and synopses of material presented at the AAAS SWARM Division Annual Meeting or published in this volume reflect the individual views of the author and not necessarily those of the AAAS, the SWARM Division, its Executive Committee, or the views of the institutions with which the authors are affiliated. Presentation of ideas, products, or publications at the AAAS SWARM Division Meeting or the reporting of them in resulting news accounts does not constitute endorsement by AAAS and the SWARM Division. Abstracts are submitted by the authors and have not been edited. AAAS SWARM Division is not responsible for any of the abstracts. All questions regarding them should be directed to the authors.

CHRONOLOGICAL SUMMARY

WEDNESDAY AFTERNOON, 9 APRIL

REGISTRATION
Wednesday, 9 April — **Noon-4:00pm**
UNM SUB — **SUB Ballroom Pre-Convention Hallway**

THURSDAY MORNING, 10 APRIL

REGISTRATION
Thursday, 10 April — **8:00am-Noon**
UNM SUB — **SUB Ballroom Pre-Convention Hallway**

WELCOME AND OPENING REMARKS
Thursday, 10 April — **9:30am-9:45am**
UNM SUB — **Room: Ballroom A**

AAAS SWARM DIVISION PRESIDENTIAL ADDRESS
Thursday, 10 April — **9:45am-10:30am**
UNM SUB — **Room: Ballroom A**

Cieslak, Wendy (Sandia National Laboratories)
NO COUNTRY IS AN ISLAND: COLLABORATION IN THE 21ST CENTURY

SPECIAL TOPIC SYMPOSIUM: HUMAN MACROECOLOGY: EMERGENT PATTERNS AND PROCESSES IN LARGE-SCALE HUMAN ECOLOGY(PART I)

Thursday, 10 April **9:00am-NOON**
UNM SUB **Room: Santa Ana**

Session Chairs: Oskar Burger (University of New Mexico) and Bill Burnside (University of New Mexico)

9:00 Burger, Oskar* (University of New Mexico) and William Burnside (University of New Mexico)
ORIENTATION TO THE GOALS, MOTIVES, AND DEFINITION OF HUMAN MARCOECOLOGY

9:20 Brown, James (University of New Mexico)
TOWARD A METABOLIC THEORY OF HUMAN ECOLOGY

9:40 Burnside, William* (University of New Mexico) and Jordan Okie (University of New Mexico)
ECOLOGY OF RANGE SIZE AMONG TRADITIONAL HUMAN FORAGERS: MACROECOLOGICAL IMPLICATIONS FOR CULTURAL DIVERSITY PATTERNS

10:00 Todd, Lawrence C. (Colorado State University)
SCALE, BOUNDARIES, AND BRIDGES: HUMAN DIMENSIONS IN PALEOECOLOGY

10:20 Stiner, Mary C. (University of Arizona)
CHANGES IN THE 'CONNECTEDNESS' AND RESILIENCE OF PALEOLITHIC SOCIETIES IN MEDITERRANEAN ECOSYSTEMS

10:40 BREAK

11:00 Turchin, Peter (University of Connecticut)
DYNAMICAL FEEDBACKS BETWEEN POPULATION GROWTH AND SOCIOPOLITICAL INSTABILITY

11:20 Boyer, Alison (University of New Mexico)
HUMAN COLONIZATION AND PACIFIC ISLAND BIODIVERSITY

11:40 Davis, Helen Elizabeth* (University of New Mexico), Oskar Burger (University of New Mexico), Michael Gurven (University of California-Santa Barbara), and Hillard Kaplan (University of New Mexico)
PEOPLE AS ISLANDS: THE THEORY OF ISLAND BIOGEOGRAPHY AND PATTERNS OF DISEASE ACROSS HUMAN POPULATIONS

CONTRIBUTED PAPERS OF THE NATURAL PHILOSOPHY ALLIANCE: GRAVITY, GALAXIES, STARS AND PLANETS

Thursday, 10 April **9:45am-Noon**
UNM SUB **Room: Sandia**

9:45 Sven, Charles (NPA)
COSMOLOGY – THE FROZEN EMBRACE OF OUTLANDISH ASSUMPTIONS AND MYTHS

10:15 Fritzius, Robert (NPA)
SN 2006GY VIEWED FROM A MODIFIED RITZIAN PERSPECTIVE

11:30 Scarborough, Alexander Alan (NPA)
UNIFICATION OF THE BIG BANG AND THE LB/FLINE MODEL

PLENARY LECTURER: TECHNOLOGY MANAGEMENT: HOW TO COPE WITH CURRENT CHANGES
Thursday, 10 April **10:45am-12:15pm**
UNM SUB **Room: Lobo**

Kocaoglu, Dundar (Portland State University)

SPECIAL TOPIC SYMPOSIUM: BIG IMPACT OF SMALL RNAS
Thursday, 10 April **10:45am-12:15pm**
UNM SUB **Room: Mirage/ Thunderbird**

Session Chair: Austin Cooney (Baylor College of Medicine)

10:45 Cooney, Austin (Baylor College of Medicine)
BIG IMPACT OF SMALL RNAS

11:05 Gao, Xiolian (University of Houston)
TO LEARN THE MULTI-FACET PROPERTIES OF RNAS - METHODS AND MESSAGES

11:25 Gunaratne, Preethi (University of Houston)
ROLE OF MICRORNAS IN STEM CELL GENE NETWORKS

11:45 Ruby, Stephanie (University of New Mexico)
SMALL RNAS, DEXD/H-BOX PROTEINS AND NUCLEAR PRE-MRNA SPLICING

CONTRIBUTED PAPERS: PHYSICS AND MATHEMATICS
Thursday, 10 April **10:45am-12:15pm**
UNM SUB **Room: Spirit**

10:45 Slaughter, Maynard (Colorado School of Mines)
GENERAL RELATIVITY MADE EASY

11:15 Eskew, Russell (University of Texas-Austin)
TIME AND COMPLEX HYPERBOLIC TRIGONOMETRY

PLENARY LECTURE: INTERNATIONAL ASSESSMENT OF RESEARCH NEEDS FOR NANOTECHNOLOGY ENVIRONMENT, HEALTH AND SAFETY
Thursday, 10 April **11:15am-12:15pm**
UNM SUB **Room: Fiesta**

Kulinowski, Kristen (ICON/Rice University)

THURSDAY AFTERNOON, 10 APRIL

REGISTRATION
Thursday, 10 April **Noon-4:30pm**
UNM SUB **SUB Ballroom Pre Convention Hallway**

SPECIAL TOPIC SYMPOSIUM: EMERGING INFECTIOUS DISEASES
Thursday, 10 April **1:00pm-3:00pm**
UNM SUB **Room: Fiesta**

Session Chair: Jens Poschet (Sandia National Laboratories)

1:00 Carne, Eric (University of New Mexico), Sharon Master (University of New Mexico Health Science Center), De Anna Lopez (University of New Mexico), Vojo Deretic (University of New Mexico Health Science Center), C. Jeff Brinker (University of New Mexico/Sandia National Laboratories), and Graham Timmins* (University of New Mexico Health Science Center)
NANOSTRUCTURED CARRIER FOR LIVE VACCINES: EXTENDED VIABILITY OF TUBERCULOSIS VACCINE

1:20 Harrod, Kevin (Lovelace Respiratory Research Institute, LRRI)
SARS-CoV PATHOGENESIS: INSIGHTS INTO THE MOLECULAR MECHANISMS OF DISEASE

1:40 Carles, Elizabeth* (Sandia National Laboratories), Bryan Carson (Sandia National Laboratories), Jaclyn Murton (Sandia National Laboratories), Steve Branda (Sandia National Laboratories), Cathy Branda (Sandia National Laboratories), and Jens Poschet (Sandia National Laboratories)
ReIA TRANSLOCATION IN RESPONSE TO DIFFERENT LPS CHEMOTYPES IN MURINE

2:10 Holbrook, Michael (University of Texas Medical Branch-Galveston)
ANIMAL MODELS FOR HIGHLY PATHOGENIC TICK-BORNE FLAVIVIRUSES

2:30 Rebeil, Roberto (Sandia National Laboratories)
CHANGES IN FLEA MIDGUT ENVIRONMENT INDUCES THE TRANSMISSION PHENOTYPE OF YERSINIA PESTIS

SPECIAL TOPIC SYMPOSIUM: HUMAN MACROECOLOGY: EMERGENT PATTERNS AND PROCESSES IN LARGE-SCALE HUMAN ECOLOGY (PART II)
Thursday, 10 April **1:00pm-4:00pm**
UNM SUB **Room: Santa Ana**

Session Chairs: Oskar Burger (University of New Mexico) and Bill Burnside (University of New Mexico)

1:00 Walker, Robert* (Max Planck Institute for Evolutionary Anthropology), Michael Gurven, (University of California – Santa Barbara), Oskar Burger (University of New Mexico), and Marcus Hamilton (University of New Mexico)
THE TRADEOFF BETWEEN NUMBER AND SIZE OF OFFSPRING IN HUMANS AND OTHER PRIMATES

1:20 Hooper, Paul (University of New Mexico)
UNDERSTANDING THE EFFECTS OF BRAININESS ON PRIMATE AND HUMAN LIFESPAN EVOLUTION

1:40 Hamilton, Marcus J. (University of New Mexico)
SCALING THE METABOLISM OF HUMAN SOCIO-ECONOMIES FROM HUNTER-GATHERERS TO NATION STATES

2:00 Moses, Melanie* (University of New Mexico) and Horacio Samaniego (University of New Mexico)
CITIES AS ORGANISMS: ALLOMETRIC SCALING OF URBAN ROAD NETWORKS

2:20 Bettencourt, Luís (Los Alamos National Laboratory)
URBANIZATION, SOCIAL ADAPTATION AND SUSTAINABLE DEVELOPMENT

2:40 BREAK

3:00 ROUND TABLE DISCUSSION

CONTRIBUTED PAPERS OF THE NATURAL PHILOSOPHY ALLIANCE: GRAVITY, GALAXIES, STARS AND PLANETS
Thursday, 10 April **1:00pm-5:00pm**
UNM SUB **Room: Sandia**

1:00 Scarborough, Alexander Alan (NPA)
20 QUESTIONS and 20 ANSWERS YOU SHOULD KNOW ABOUT ORIGINS AND EVOLUTION OF UNIVERSAL SYSTEMS

1:30 de Hilster, David (NPA)
THE GROWING EARTH

2:00 Scarborough, Alexander Alan (NPA)
TWENTY SELECTED IDEAS

3:00 Klyushin, J. G. (Academy of Civil Aviation, St. Petersburg, Russia)
THE JOHN CHAPPELL MEMORIAL LECTURE AND DISCUSSION

4:00 Heaston, Robert J. (NPA)
WHY DID EINSTEIN PUT SO MUCH EMPHASIS ON THE EQUIVALENCE PRINCIPLE?

4:30 Meyers, Lawrence S. (NPA)
GRAVITY'S MYSTERIES

SPECIAL TOPIC SYMPOSIUM: BUSTING THROUGH: INTERDISCIPLINARY RESEARCH AND EDUCATION AT THE UNIVERSITY OF NEW MEXICO—A ROUNDTABLE
Thursday, 10 April **1:30pm-3:00pm**
UNM SUB **Room: Lobo**

Session Chair: Michael J. Dougher (University of New Mexico)

Participants:

Dougher, Michael J. (University of New Mexico)

Ross, Andrew (University of New Mexico)

Malloy, Kevin (University of New Mexico)

Valdez, Robert Otto (University of New Mexico)

Buelow, Steve (Los Alamos National Laboratory)

Kenkre, V. M. (University of New Mexico)

SPECIAL TOPIC SYMPOSIUM: GREEN DATA CENTER
Thursday, 10 April **1:30pm-3:00pm**
UNM SUB **Room: Acoma**

Session Chair: Tom Davis (Navajo Technical College)

1:30 Robinson, David G.* (Sandia National Laboratories), Joonyub Jun (Sandia National Laboratories), Alicen Kandt (Sandia National Laboratories), Peter Lilienthal (Sandia National Laboratories), and Doug Arent (Sandia National Laboratories)
RISK-BASED APPROACH TO INCORPORATING RENEWABLE ENERGY INTO CRITICAL FACILITIES PRESENTER

1:50 Arviso, Jason K.* (Navajo Technical College), Jarred Ribble (Navajo Technical College), Chris Yazzie (Navajo Technical College), Mark Trebian (Navajo Technical College), and Tom Davis (Navajo Technical College)
GREEN DATA CENTER DESIGN

2:10 Thomas, Timothy L. (University of New Mexico)
GREEN DATA CENTER CONSTRUCTION

2:30 Brothers, Heidi, S. (Weston Solutions, Inc.)
ARE GREEN ROOFS WORTH THE COST?

SPECIAL TOPIC SYMPOSIUM: TECHNOLOGY COMMERCIALIZATION
Thursday, 10 April **1:30pm-3:00pm**
UNM SUB **Room: Mirage/ Thunderbird**

Session Chair: George Friberg (Technology Ventures Corp.)

1:30 Friberg, George (Technology Ventures Corp.)

2:00 Maxwell, Paul C. (Bi-National Sustainability Laboratory)
BUILDING BRIDGES, NOT WALLS—THE BI-NATIONAL SUSTAINABILITY LABORATORY

2:30 Murphy, Vince (Strategic and Learning Services)

CONTRIBUTED PAPERS: BIOLOGICAL SCIENCES
Thursday, 10 April **1:30pm-3:00pm**
UNM SUB **Room: Spirit/ Trailblazer**

1:30 Glenn, Gabrielle* (United States Air Force Academy) and Edward T. Unangst, Jr. (United States Air Force Academy)
WINTER USE OF MOUNTAIN MAHOGANY BY DEER ON THE AIR FORCE ACADEMY, A 10-YEAR ASSESSMENT (1990-2000)

1:45 Wilson, Kara R.* (United States Air Force Academy) and Michael Wilcox (United States Air Force Academy)
DIRECT CELL PERMEABILIZATION ON COMMAND OPENS NEW APPROACH TO CANCER TREATMENT

2:00 Gomez, Leo S.*, Cousins, John , Dorian, Constance J. , and Gomez, Stephen M.
NEW NON-INVASIVE TECHNOLOGY FOR THE EARLY DETECTION OF CANCER AT THE CELLULAR LEVEL

2:15 Martinez, Ulises A.* (University of New Mexico), Thomas C. Gamble (University of New Mexico), Gabriel P. Lopez (University of New Mexico), and Elizabeth Dirk (University of New Mexico)
NANOMETER-SCALE PATTERNED SURFACES FOR THE PRECISE CONTROL OF CELL ATTACHMENT

2:30 Bedell, J. L. (Rising Phoenix LLC., Biosphere Systems International)
THE NEED FOR DEVELOPMENT OF A MANAGEMENT LANGUAGE

2:45 Biel, Karl* (Institute of Basic Bio Problems), R. D. Gates (Department of Organismic Biology), and L. Muscatine (Department of Organismic Biology)
EFFECTS OF FREE AMINO ACIDS ON THE PHOTOSYNTHETIC CARBON METABOLISM OF SYMBIOTIC DINOFLAGELLATES

3:30 Miller, Beverly (University of New Mexico)
SCIENCE TECHNOLOGY FOR HIGH SCHOOL BIOLOGY AND ENVIRONMENTAL SCIENCE: INTEGRATING INTERNET RESOURCES INTO CLASSROOM INSTRUCTION FOR HIGH SCHOOL STUDENTS

4:00 Schaffer, Linda (University of New Mexico)
PRESERVICE TEACHERS' ALTERNATIVE CONCEPTIONS ABOUT THE USE OF BIOLOGICAL CLASSIFICATION SCHEMES

SPECIAL TOPIC SYMPOSIUM: INTERNATIONAL COLLABORATIONS: OPPORTUNITIES AND CHALLENGES FOR UNIVERSITIES

Thursday, 10 April **3:30pm-5:00pm**
UNM SUB **Room: Lobo**

Session Chair: Charles Crespy (University of New Mexico)

3:30 Crespy, Charles (University of New Mexico)

4:00 Di Gregorio, Dante (University of New Mexico)

4:20 Thomas, Doug (University of New Mexico)

4:40 De Gouvea, Paul (University of New Mexico)

SPECIAL TOPIC SYMPOSIUM: HEALTH, FOOD, AND BIOSECURITY

Thursday, 10 April **3:30pm-5:00pm**
UNM SUB **Room: Fiesta**

Session Chair: Michael Holbrook (University of Texas Medical Branch-Galveston)

3:30 Williams, Cecelia* (Sandia National Laboratories), Philip Pohl (Sandia National Laboratories), Malynda Aragon (Sandia National Laboratories), and Jeffery Danneels (Sandia National Laboratories)
CARVER+SHOCK: FOOD DEFENSE SOFTWARE DEVELOPMENT AND APPLICATION

4:00 Astuto Gribble, Lisa M.* (Sandia National Laboratories), E. Phipps (Sandia National Laboratories), J. Gaudioso (Sandia National Laboratories), and T. Zemlo (BioInformatics, LLC)
AN INTERNATIONAL SURVEY OF BIOSCIENCE RESEARCH AND BIOSECURITY PRACTICES

4:30 Holbrook, Michael (University of Texas Medical Branch-Galveston)
GALVESTON NATIONAL LABORATORY: OPPORTUNITIES FOR HIGH-CONTAINMENT RESEARCH AND COLLABORATION

CONTRIBUTED PAPERS: NANOTECHNOLOGY
Thursday, 10 April **3:30pm-5:00pm**
UNM SUB **Room: Mirage**

3:30 Greene, Adrienne C.* (Sandia National Laboratories), Amanda-Carroll Portillo (Sandia National Laboratories), and George D. Bachand (Sandia National Laboratories)
CONTROLLING NANOMATERIAL ASSEMBLY AND CARGO-SPECIFIC TRANSPORT BY GENETICALLY ENGINEERING A CHIMERIC KINESIN BIOMOLECULAR MOTOR

4:15 Peraza, Eduardo F. Herrera* (Centro de Investigación en Materiales Avanzados) Balter Trujillo Navarrete (Centro de Investigación en Materiales Avanzados), and Adrián Vázquez Gálvez (Centro de Investigación en Materiales Avanzados)
FRACTAL THEORY APPLIED TO AEROSOL EXPERIMENTAL DATA COLLECTED IN NORTH OF CHIHUAHUA CITY

SPECIAL TOPIC SYMPOSIUM: COLLABORATION: INTEGRATING RESEARCH TEAMS
Thursday, 10 April **3:30pm-5:00pm**
UNM SUB **Room: Acoma**

Session Chair: Gretchen Jordan (Sandia National Laboratories)

3:30 Jordan, Gretchen* (Sandia National Laboratories), Jerald Hage (Sandia National Laboratories), and Jonathon Mote (University of Maryland)
R & D INTEGRATION: HOW TO BUILD A DIVERSE AND INTEGRATED KNOWLEDGE COMMUNITY

4:00 Pennington, Deana D. (University of New Mexico)
ENABLING CO-EMERGENT INNOVATION THROUGH COLLABORATION BETWEEN SCIENCE AND TECHNOLOGY RESEARCHERS

4:30 Fisher, Deborah (University of New Mexico)
THE PHYSICS OF RESEARCH TEAMS

SWARM DIVISION EXECUTIVE COMMITTEE BUSINESS MEETING
Thursday, 10 April **4:30pm-5:30pm**
UNM SUB **Room: Cherry/Silver**

FRIDAY MORNING, 11 APRIL

REGISTRATION
Friday, 11 April **8:00am-Noon**
UNM SUB **SUB Ballroom**
Pre Convention
Hallway

PLENARY LECTURE: BUILDING THE FOUNDATIONS OF SUSTAINABILITY THROUGH TRANSDISCIPLINARY SCIENCE AND ENGINEERING
Friday, 11 April **8:30am-10:00am**
UNM SUB **Room: Lobo**

Hodges, Kip (Arizona State University)

SPECIAL TOPIC SYMPOSIA: BIOFUELS
Friday, 11 April **8:30am-10:00am**
UNM SUB **Room: Fiesta A**

Session Chair: Ron Pate (Sandia National Laboratories)

8:30 Hoodenpyle, Kyle (Pecos Valley Biomass Cooperative)
THE BROAD SCOPE FOR AGRICULTURE RENEWABLE ENERGY

8:50 Putt, Ron (Auburn University)
LOW COST ALGACULTURE FOR BIOFUELS

9:10 French, Todd* (Mississippi State University), R. Hernandez (Mississippi State University), J. Hal (Mississippi State University), A. Mondala (Mississippi State University), M. White (Mississippi State University), and G. Zhang (Mississippi State University)
WASTEWATER TREATMENT FACILITY BIOREFINERY FOR BIOFUELS

SPECIAL TOPIC SYMPOSIUM: EVALUATING MODELING AND SIMULATION PROGRAMS
Friday, 11 April **8:30am-10:00am**
UNM SUB **Room: Acoma**

Session Chair: Jeremy Horne (RhinoCorps, Ltd)

8:30 Horne, Jeremy (RhinoCorps, Ltd)
MODELING AND SIMULATING THE INTERNATIONAL BATTLE SPACE – PROBLEMS AND PROSPECTS OF HYBRID SYSTEMS ACTING ON THEIR OWN

8:50 Lattimore, Peter (RhinoCorps, Ltd)
SIMAJIN: AN EXAMPLE OF WHY CURRENT VV&A CANNOT BE USED TO ASSESS COMPLEX M&S PROGRAMS

9:10 Snell, Mark K. (Sandia National Laboratories)
ADDRESSING WEAKNESSES IN CURRENT DEFENSE- AND SECURITY-RELATED MODELING AND SIMULATION

9:30 Macias, Filiberto (Unmanned and Autonomous Systems, White Sands Missile Range, NM)
PROBLEMS WITH USING VV&A TO EVALUATE UAS

CONTRIBUTED PAPERS: ENERGY

Friday, 11 April **8:30am-10:00am**
UNM SUB **Room: Spirit**

8:30 Baca, A. Michael* (MDL Enterprises), Don Wichers (MDL Enterprises), and Luis Ortiz (MDL Enterprises)
UTILIZING SMALL FORM FACTOR, WIND DRIVEN, ELECTRICAL GENERATION DEVICES FOR RESIDENTIAL AND MOBILE APPLICATIONS

8:45 Axness, Carl (Sandia National Laboratories)
BUILDING AN OFF-GRID, PASSIVE AND PV SOLAR, SUSTAINABLE HOME IN RIO RANCHO, NM

9:00 Al-Shudeifat, Mohammad Ameen* (New Mexico State University) and A. B. Donaldson (Sandia National Laboratory)
TESTING TRAP-GREASE OIL IN 150KW GAS TURBINE

9:45 Gómez, Stephen M. (Pocagua Consulting)
BIODIESEL WITH UNIQUE PROPERTIES MADE FROM CASTOR OIL

9:30 Ibragimov, Ranis N. (New Mexico Institute of Mining and Technology)
EVOLUTION OF THE ENERGY SPECTRUM AMONG A LARGE NUMBER OF INTERNAL WAVES IN THE DEEP OCEAN

9:45 Dudziak, Martin J. (Golden Specialty Laboratory, Ltd.)
MULTIMODAL APPROACHES TO NEW ENERGY GENERATION INCORPORATING ARTIFICIAL PHOTOSYNTHESIS

SPECIAL TOPIC SYMPOSIUM: ENERGY & ENVIRONMENTAL SECURITY AND SUSTAINABILITY: THE ROLE OF ECONOMICS

Friday, 11 April **8:30am-10:00am**
UNM SUB **Room: Fiesta B**

Session Chair: Cecelia Williams (Sandia National Laboratories)

8:30 Baker, Arnie (Sandia National Laboratories)
ENERGY AND ENVIRONMENTAL SECURITY AND SUSTAINABILITY: SOME REAL TIME INSIGHTS FROM DYNAMIC SIMULATION MODELING

9:15 Kraus, Katherine (University of New Mexico)
AFFORDING SUSTAINABILITY: CONFRONTING THE ECONOMIC ISSUES

SPECIAL TOPIC SYMPOSIUM: NEW MEXICO NUCLEAR STUDY GROUP ROUNDTABLE

Friday, 11 April **8:30am-10:00am**
UNM SUB **Room: Mirage/ Thunderbird**

Session Chair: Andrew Ross (University of New Mexico)

Participants:

Andrew Ross (University of New Mexico)

Mark J. Mattox (Defense Nuclear Weapons School)

Joseph C. Martz (Los Alamos National Laboratories)

Paul C. White (Los Alamos National Laboratories)

Thomas H. Karas (Sandia National Laboratories)

Wendell B. Jones (Sandia National Laboratories)

CONTRIBUTED PAPERS OF THE NATURAL PHILOSOPHY ALLIANCE: MATHEMATICS
Thursday, 10 April **9:15am-Noon**
UNM SUB **Room: Scholars**

9:15 Briddell, Don (NPA)
STRUCTURAL SKEW TOPOLOGY AND FIELD STRUCTURE THEORY

9:45 Bryant, Steven (NPA)
COMPARATIVE ANALYSIS OF THE MODEL OF COMPLETE AND INCOMPLETE COORDINATE SYSTEMS

11:00 de Hilster, David (NPA)
CAREZANI FRAME REDUCTION

11:30 Saa, Diego (NPA)
FOUR-VECTORS IN ELECTROMAGNETISM

SPECIAL TOPIC SYMPOSIUM: HELP SHAPE THE FUTURE OF PULSED POWER DRIVEN FUSION ENERGY
Friday, 11 April **10:00am-Noon**
UNM SUB **Room: Fiesta**

Session Chair: J. Pace VanDevender (Sandia National Laboratories-Retired)

10:00 VanDevender, J. Pace (Sandia National Laboratories-Retired)
OPENING REMARKS

10:20 Baker, Arnie (Sandia National Laboratories)
ECONOMICALLY ADVANTAGEOUS REQUIREMENT

10:35 Hadjilambrinos, Constantine (University of New Mexico)
SOCIALLY ACCEPTABLE REQUIREMENT

10:55 Olson, Craig L. (Sandia National Laboratories-Retired)
SCIENTIFICALLY UNDERSTOOD REQUIREMENT

11:10 Rochau, Gary (Sandia National Laboratories)
TECHNOLOGICALLY ROBUST REQUIREMENT

11:40 Sawan, Mohammed E. (University of Wisconsin)

11:45 Mehlhorn, Tom (Sandia National Laboratories)
RAPPORTEUR

SPECIAL TOPIC SYMPOSIUM: NATIONAL LABORATORY/UNIVERSITY COLLABORATION MODELS: A CHANCE TO COMPARE AND CONTRAST LONG-STANDING MODELS TO A NEWER MODEL

Friday, 11 April **10:30am-Noon**
UNM SUB **Room: Lobo**

Session Chairs: Marie Garcia (Sandia National Laboratories) and Everett Springer (Los Alamos National Laboratory)

Participants:

Kimball, Barbara (University of New Mexico)

Shinn, Neal (Sandia National Laboratories)

Hammetter, William (Sandia National Laboratory)

Sauer, Nancy (Los Alamos National Laboratory)

SPECIAL TOPIC SYMPOSIUM: WATER SUSTAINABILITY

Friday, 11 April **10:30am-Noon**
UNM SUB **Room: Acoma**

Session Chair: Phillip Pohl (Sandia National Laboratories)

10:30 Groenfeldt, David (Santa Fe Watershed Association)
HEALTHY RIVERS AND WATER SECURITY

11:00 Passell, Howard* (Sandia National Laboratories), Sandra Postel (Sandia National Laboratories), Erik Peterson (Sandia National Laboratories), and Erik Webb (Sandia National Laboratories)
THE ECOLOGY OF NATIONAL SECURITY

11:30 Finley, Ray* (Sandia National Laboratories) and Hal Cardwell (USACE)
COLLABORATIVE MODELING PROCESS FOR WATER RESOURCE MANAGEMENT

CONTRIBUTED PAPERS: HEALTH SCIENCES I

Friday, 11 April **10:30am-12:10pm**
UNM SUB **Room: Mirage/ Thunderbird**

10:30 Dwyer, Bryan (Sandia National Laboratories)
ARSENIC TREATMENT IN WATER

10:50 Lauter, Judith (Stephen F. Austin State University)
NEUROCARDIOLOGY: NONINVASIVE FUNCTIONAL ASSESSMENT USING THE AXS TEST BATTERY

11:10 Taylor, Paul* (Sandia National Laboratories) and Corey Ford (University of New Mexico Health Sciences Center)
SIMULATION OF BLAST-INDUCED, EARLY-TIME INTRACRANIAL WAVE PHYSICS LEADING TO TRAUMATIC BRAIN INJURY

11:30 Wenger, Rachael C.* (United States Air Force Academy), Donald Veverka (United States Air Force Academy), and Candy Wilson (United States Air Force Academy)
ZINC SUPPLEMENTS TO REDUCE UPPER RESPIRATORY INFECTIONS IN AIR FORCE ACADEMY CADETS

11:50 McLean, Rebecca C.* (United States Air Force Academy), Brandon Doan (United States Air Force Academy), Michael Brothers (United States Air Force Academy), Mary Terry (United States Air Force Academy), Eric Kozlowski (United States Air Force Academy), Alfred Wile (United States Air Force Academy)
COMPARISON OF WIRED AND WIRELESS BIO-ELECTRICAL IMPEDANCE FLUID STATUS MONITORING DEVICES AND VALIDATION TO BODY MASS AND URINE SPECIFIC GRAVITY CHANGES FOLLOWING MILD DEHYDRATION

CONTRIBUTED PAPERS: INFORMATION TECHNOLOGY
Friday, 11 April **10:30pm-Noon**
UNM SUB **Room: Spirit**

10:30 Cromer, Donna (University of New Mexico)
WHY GOOGLE IS NOT ENOUGH: INFORMATION FLUENCY FOR SCIENTISTS AND ENGINEERS

11:15 Cohen, Zoe* (University of Arizona) and J. John Cohen (University of Colorado Medical School)
TWO STATES, TWO SCHOOLS, TWO COURSES, ONE BLOG

GENERAL POSTER SESSION
Friday, 11 April **10:30am-12:30pm**
UNM SUB **Room: Santa Ana**

(#1) Lucero, Adrianne* (University of New Mexico) and Heather E. Canavan (University of New Mexico)
OPTIMIZING THERMORESPONSIVE PNIPAM FILMS USING AN RF PLASMA REACTOR

(#2) Kooser, A.* (University of New Mexico), L. J. Crossey (University of New Mexico), D. E. Northup (University of New Mexico), M. N. Spilde (University of New Mexico), and L. A. Melim (Western Illinois University)
GEOCHEMICAL ENERGY CONSTRAINTS FOR MICROBIAL METABOLISM IN LECHUGUILLA CAVE, NM DETERMINED FROM HYDROCHEMICAL ANALYSIS

(#3) Kolb, D. Charles* (Fort Lewis College) and Julie Korb (Fort Lewis College)
IMPACT SURVEY OF CENTENNIAL ACTIVITIES ON THE ENDEMIC CLIFF PALACE MILKVETCH (ASTRAGALUS DETERIOR) ON THE SPRING HOUSE TRAIL IN MESA VERDE NATIONAL PARK

(#4) Hillesland, Heidi* (University of New Mexico), Amber Read (University of New Mexico), Bobban Subhadra (University of New Mexico), Ivy Hurwitz (University of New Mexico), Annabeth Fieck (University of New Mexico), Pradeep Das (RIMR, Patna, India), and Ravi Durvasula (University of New Mexico)
USE OF COMMERCIALLY DEPLOYED BACTERIA AS DELIVERY AGENTS FOR PARATRANSGENIC MANIPULATION OF KALA AZAR VECTOR, *P. ARGENTIPES*

(#5) Smith, Jacqueline* (Sandia National Laboratories), Susan Caskey (Sandia National Laboratories), Jennifer Gaudioso (Sandia National Laboratories), and Reynolds Salerno (Sandia National Laboratories)
BIOSAFETY RISK ASSESSMENT

(#6) Scheerer, Kim (Bosque Ecosystem Monitoring Program)
COMMUNITY ECOSYSTEM MONITORING: THE BOSQUE ECOSYSTEM MONITORING PROGRAM AS A MODEL FOR RESEARCH AND EDUCATION

(#7) Garcia, Daniel* (University of New Mexico), Ulises Martinez, Fan Yang, Marwan Al-Haik, Shane Trinkle, and Scott Miltenberger
NANOCHARACTERIZATION OF TOOTH-FILLING MATERIALS

(#8) Davenport, Justin* (University of Houston-Clear Lake) and Dennis Casserly (University of Houston-Clear Lake)
AN ANALYSIS OF AMBIENT OZONE CONCENTRATIONS AND ABSENTEEISM AT THREE HIGH SCHOOLS IN THE HOUSTON - GALVESTON AREA

(#9) Astuto Gribble, Lisa M.* (Sandia National Laboratories),E. Phipps (Sandia National Laboratories), J. Gaudioso (Sandia National Laboratories), and T. Zemlo (BioInformatics, LLC)
AN INTERNATIONAL SURVEY OF BIOSCIENCE RESEARCH AND BIOSECURITY PRACTICES

(#10) Vukomanovic, Jelena (University of Arizona)
APPLICATIONS OF REMOTE SENSING FOR CONSERVATION EASEMENT MONITORING

(#11) Liu, Zun* (Baylor University), Shikha Varshney (Baylor University), and Christopher M. Kearney (Baylor University)
RECOMBINANT EXPRESSION OF MAJOR MOUNTAIN CEDAR ALLERGEN JUN A 1 USING A TOBACCO MOSAIC VIRUS-BASED VECTOR

(#12) Haste, Turtle (Johns Hopkins Center for Talented Youth)
SCIENTISTS AND MIDDLE SCHOOL STUDENTS; LEARNING AND WORKING TOGETHER

(#13) Cron, Brandi* (University of New Mexico), Laura Crossey (University of New Mexico), and Diana Northrup (University of New Mexico)
GEOMICROBIOLOGY AND GEOCHEMICAL ENERGY FOR MICROBIAL METABOLISM IN CO2-RICH SPRINGS OF THE TIERRA AMARILLA ANTICLINE, NM

(#14) Pietrass, T.* (New Mexico Tech), A. Aceves (University of New Mexico), J. Bossert (Los Alamos National Laboratory), J. Fessenden (Los Alamos National Laboratory), T. Gray (New Mexico State University), P. Hunt (New Mexico State University), and T. Sterling (New Mexico State University)
NSF ADVANCE-PAID: PARTNERING FOR DIVERSITY AT NEW MEXICO INSTITUTIONS OF HIGHER LEARNING AND RESEARCH

FRIDAY AFTERNOON, 11 APRIL

REGISTRATION
Friday, 11 April **Noon-4:30pm**
UNM SUB **SUB Ballroom**
Pre Convention
Hallway

CONTRIBUTED PAPERS OF THE NATURAL PHILOSOPHY ALLIANCE: GENERAL RELATIVITY
Thursday, 10 April **1:00pm-2:00pm**
UNM SUB **Room: Scholars**

1:00 Spencer, Domina Eberle (University of Connecticut)
THE HOLOR REPRESENTATION OF RIGID BODY MOTION

1:30 Deen, Glen W. (NPA)
THE TIME OF PERIHELION PASSAGE AND THE LONGITUDE OF THE PERIHELION OF NEMESIS

PLENARY LECTURE: NEW MEXICO HIGH PERFORMANCE COMPUTING INITIATIVE
Friday, 11 April **1:30pm-3:000pm**
UNM SUB **Room: Lobo**

Bowles, Tom (State of New Mexico – Governor's Office)

CONTRIBUTED PAPERS: HEALTH SCIENCES (PART II)
Friday, 11 April **1:30pm-3:00pm**
UNM SUB **Room: Spirit**

1:30 Taheri, Saeid* (University of New Mexico) and Gary A. Rosenberg (University of New Mexico)
ANALYSIS AND CHARACTERIZATION OF SPATIO-TEMPORAL PATTERNS OF BLOOD BRAIN BARRIER (BBB) RESPONSE TO INJURIES USING DYNAMIC CONTRAST-ENHANCED MR IMAGING

1:50 Varma, Sameer* (Sandia National Laboratories), Susan B. Rempe (Sandia National Laboratories), and Dubravko Sabo (Sandia National Laboratories)
MECHANISMS OF ION RECOGNITION BY BIOLOGICAL MOLECULES

2:10 Gómez, Stephen M. (Pocagua Consulting)
CUTANEOUS UPTAKE OF FATTY ACID METHYL/ETHYL ESTERS

2:30 Hughes, John (University of Arizona)
LIMBIC CONNECTIONS AND EFFECTIVE COMMUNICATIONS

SPECIAL TOPIC SYMPOSIUM: SOLAR AND WIND ENERGY
Friday, 11 April **1:30pm-3:00pm**
UNM SUB **Room: Acoma**

Session Chair: Jose Zayas (Sandia National Laboratories)

1:30 Zayas, Jose (Sandia National Laboratories)
THE FUTURE OF SOLAR AND WIND ENERGY: A TECHNICAL AND MARKET PERSPECTIVE

1:50 Laird, Daniel (Sandia National Laboratories)
ADVANCEMENTS IN WIND ENERGY TECHNOLOGY

2:10 Baring-Gould, Ian (National Wind Technology Center, National Renewable Energy Laboratory)
APPLICATIONS OF WIND ENERGY TECHNOLOGY IN TODAY'S MARKET

2:40 Hanley, Charles (Sandia National Laboratories)
SOLAR ENERGY TECHNOLOGIES: MOVING INTO THE MAINSTREAM

SPECIAL TOPIC SYMPOSIUM: NANOMATERIALS AND NANOSTRUCTURES
Friday, 11 April **1:30pm-3:00pm**
UNM SUB **Room: Fiesta**

Session Chairs: Jeff Brinker and Hongyou Fan

1:30 Gin, Douglas (University of Colorado)
NANOSTRUCTURED POLYMERS FOR ENHANCED CATALYSIS AND SEPARATIONS BASED ON THE POLYMERIZATION OF LYOTROPIC LIQUID CRYSTAL ASSEMBLIES

2:15 Bachand, George D. (Sandia National Laboratories)
BIOMIMETIC SYSTEMS ENGINEERING – DEVELOPING DYNAMIC NANOMATERIALS AND FLUIDIC DEVICES

3:00 Huang, Jianyu (Sandia National Laboratories)
IN-SITU PLASTIC DEFORMATION OF CARBON NANOTUBES

3:45 Voyer, Normand (Laval University)
SYNTHESIS AND CHARACTERIZATION OF BIO-INSPIRED NANOSTRUCTURES DESIGNED FOR THERAPEUTIC AND SENSING APPLICATIONS

4:30 Rempe, Susan (Sandia National Laboratories)
ION DISCRIMINATION BY NANOSCALE DESIGN

SPECIAL TOPIC SYMPOSIUM: SUSTAINABLE AGRICULTURES
Friday, 11 April **1:30pm-3:00pm**
UNM SUB **Room: Santa Ana**

Session Chair: Cecelia Williams (Sandia National Laboratories)

1:30 Milne, Bruce (University of New Mexico)

2:00 Giacomelli, Gene A. (University of Arizona)
CONTROLLED ENVIRONMENT OPPORTUNITIES….IT'S NOT JUST TOMATOES, BUT A TECHNOLOGY PLATFORM THAT WILL ENHANCE THE QUALITY OF LIFE

2:30 Bell, Peter (Products, Inc.)
RENEWABLE FUEL PRODUCTS

WORKSHOP: COLLABORATIVE AND INTERDISCIPLINARY REU RESEARCH TO PREPARE STUDENTS FOR SCIENCE-BASED CAREERS

Friday, 11 April **1:30pm-3:00pm**
UNM SUB **Room: Mirage/Thunderbird**

Lisa Majkowski (New Mexico Tech), Michael J. Pullin (New Mexico Tech), and Barbara A. Austin (Northern Arizona University)

SPECIAL TOPIC SYMPOSIUM: SUCCESSES AND CHALLENGES OF COLLABORATIONS BETWEEN SCIENTISTS AND PUBLIC SCHOOLS

Friday, 11 April **3:30pm-5:00pm**
UNM SUB **Room: Mirage**

Session Chair: Kathleen Holt

3:30 Daniel, Mary Jo (New Mexico Public Education Department)

4:00 Wagner, Patricia (Albuquerque Public Schools)

4:30 Eisenstein, Robert (Santa Fe Alliance for Science, APS, NM Public Education Dept.)

SPECIAL TOPIC SYMPOSIUM: ENERGY-WATER NEXUS

Friday, 11 April **3:30pm-5:00pm**
UNM SUB **Room: Acoma**

Session Chair: Bruce Thomson

3:30 Stomp, John (ABCWUA)
PROVIDING A SUSTAINABLE WATER SUPPLY

3:50 Hightower, Michael (Sandia National Laboratories)

4:10 Pate, Ron (Sandia National Laboratories)
BIOFUELS FROM THE ENERGY-WATER NEXUS PERSPECTIVE

4:30 Webb, Erik (Sandia National Laboratories)
EVOLUTION OF POLITICAL SUPPORT FOR THE ENERGY-WATER NEXUS

SPECIAL TOPIC SYMPOSIUM: PUTTING GREEN INTO GREEN BUILDINGS

Friday, 11 April **3:30pm-5:00pm**
UNM SUB **Room: Santa Ana**

Session Chairs: Kuppu Iyengar and Phil Dekker

3:30 Mizner, Jack* (Sandia National Laboratories), Amy Coplen (Sandia National Laboratories), and Norion Ubechel (Sandia National Laboratories)
THE ECOLOGICAL FOOTPRINT OF SANDIA NATIONAL LABORATORIES

4:00 Fischer, Kurt T. (Weston Solutions, Inc.)
GREEN ROOFS: A DISCUSSION OF SYSTEMS, CONSTRUCTION, AND BENEFITS

4:30 Meléndrez, Michael Martin (Soil Secrets, LLC.)
TREES, SOILS AND THE SUSTAINABILITY ASPECTS OF BUILDING LANDSCAPES IN URBAN SETTINGS AS IT RELATES TO THE SOUTHWEST

WORKSHOP: FOCUSING YOUR LIMITED RESOURCES TO FIND PARTNERS AND GRANTS VIA DATA MINING TOOLS

Friday, 11 April **3:30pm-5:00pm**
UNM SUB **Room: Lobo**

Joel Sikora (Sandia National Laboratories)

WORKSHOP: THE MANY PATHWAYS TO A CAREER IN SCIENCE

Friday, 11 April **3:30pm-5:00pm**
UNM SUB **Room: Spirit**

Richard A. Weibl (Director, Center for Careers in Science and Technology, AAAS)

FRIDAY EVENING, 11 APRIL

AAAS SWARM DIVISION NETWORKING/SOCIAL MIXER

Friday, 11 April **5:00pm-6:45pm**
UNM SUB **Room: Ballroom C**

JOHN WESLEY POWELL MEMORIAL LECTURE: "AS INNOVATION GOES, SO GOES AMERICA"
NORMAN R. AUGUSTINE (RETIRED CEO LOCKHEED MARTIN)

Friday, 11 April **7:00pm-8:30pm**
UNM SUB **Room: Ballroom B**

SATURDAY MORNING, 12 APRIL

REGISTRATION

Saturday, 12 April **8:00am-NOON**
UNM SUB **Room: SUB Ballroom Pre Convention Hallway**

WORKSHOP: STEMS: UNM'S INTENSIVE POST BACCALAUREATE TEACHER EDUCATION PROGRAM

Saturday, 12 April **8:30am-9:30am**
UNM SUB **Room: Mirage**

Terry Dunbar (University of New Mexico)

PLENARY LECTURE: EXTREME BALL LIGHTNING RESEARCH BY INTERNATIONAL VOLUNTARY COLLABORATIVE

Saturday, 12 April **8:30am-10:00am**
UNM SUB **Room: Fiesta**

VanDevender, J. Pace (Sandia National Laboratories-Retired and VanDevender Enterprises)

WORKSHOP: REDUCING GENERATIONAL FRICTION TO INCREASE COLLABORATION

Saturday, 12 April **8:30am-10:00am**
UNM SUB **Room: Acoma**

Ken Beller (Near Bridge, Inc.)

WORKSHOP: CONTROLLED ENVIRONMENTS (CEA): FEEDING THE WORLD, SAVING THE WORLD, AND CREATING NEW WORLDS
Saturday, 12 April **8:30am-10:00am**
UNM SUB **Room: Lobo**

Gene Giacommelli (University of Arizona)

SPECIAL TOPIC SYMPOSIUM: RIPLEY'S BELIEVE IT OR NOT EDUCATION COLLABORATIVES SESSION
Saturday, 12 April **8:30am-10:00am**
UNM SUB **Room: Santa Ana**

Session Chair: Dominique Wilson (Sandia National Laboratories)

Participants:

Diane E. Burke (Central New Mexico Community College)

Carmen DiGregorio (West Mesa High School)

Claire Dudley (NM Wired)

Greg Nelson (Youth and Diagnostic Developmental Center)

WORKSHOP: IMPLEMENTING ELEMENTS OF THE SUPPLEMENTAL INSTRUCTION MODEL TO BUILD THE NEXT GENERATION OF THINKERS FOR STEM EDUCATION
Saturday, 12 April **9:45am-10:30am**
UNM SUB **Room: Mirage/ Thunderbird**

Nina Javaher (New Mexico State University)

PLENARY LECTURE: REAL WORLD CHALLENGES AND OPPORTUNITIES FOR GLOBAL HEALTH SURVEILLANCE
Saturday, 12 April **10:30am-Noon**
UNM SUB **Room: Lobo**

Sobel, Annette (Sandia National Laboratories and University of New Mexico)

SPECIAL TOPIC SYMPOSIUM: THE NATIONAL INSTITUE FOR NANO-ENGINEERING, A PROTOTYPE INNOVATION INSTITUTE
Saturday, 12 April **10:30am-Noon**
UNM SUB **Room: Fiesta**

Session Chair: Regan Stinnett (Sandia National Laboratories)

10:30 Stinnett, Regan (Sandia National Laboratories)
THE NATIONAL INSTITUTE FOR NANO-ENGINEERING, A PROTOTYPE INNOVATION INSTITUTE

11:00 Grondin, Bob (Arizona State University)
MICRO AND NANO TECHNOLOGY IN ASU'S INTEGRATIVE ENGINEERING PROGRAM

11:20 Stalford, Harold (University of Oklahoma)
NANOFUN EDUCATION

11:40 Dallas, Tim (Texas Tech University)
MICRO AND NANO DEVICE ENGINEERING (MANDE) PROGRAM FOR UNDERGRADUATES

WORKSHOP: AN OBSERVATORY TO STUDY THE DYNAMICS OF CHANGE IN GLOBAL ENERGY SYSTEMS
Saturday, 12 April **10:30am-Noon**
UNM SUB **Room: Acoma**

Rajan Gupta (Los Alamos National Laboratories)

WORKSHOP: SCIENCE CONTESTS IN ROBOTICS AND ELECTRICITY FOR GRADES 6-12
Saturday, 12 April **10:30am-11:30am**
UNM SUB **Room: Mirage/ Thunderbird**

Laura Lomas Tomlinson (New Mexico State University)
THE SHOCKING TRUTH ABOUT ELECTRICITY

Fabian Lopez (Inquiry Facilitators Inc) and Russ Fisher Ives (Inquiry Facilitators, Inc)
RAVE DIRECTORS

SPECIAL TOPIC SYMPOSIUM: SMALL BUSINESS ASSISTANCE - TECHNOLOGY COMMERCIALIZATION
Saturday, 12 April **10:30am-Noon**
UNM SUB **Room: Santa Ana**

Session Chair: Sul Kassicieh

10:30 Kassicieh, Sul (University of New Mexico)

11:00 Moore, Jackie Kerby (Sandia National Laboratories)

11:20 Johnston, Mariann (Los Alamos National Laboratories)

11:40 Walsh, Steve (University of New Mexico)

SPECIAL TOPIC PAPER: EVOLUTION OF AN EDUCATION OUTREACH PROGRAM
Saturday, 12 April **11:30am-Noon**
UNM SUB **Room: Mirage/ Thunderbird**

Cole, Rhonda (STARBASE LA LUZ ACADEMY)

SATURDAY EVENING, 12 APRIL

SWARM AWARDS BANQUET (TICKETS REQUIRED)
Saturday, 12 April **7:30pm-9:00pm**
UNM SUB **Room: Ballroom C**

SYMPOSIUM/WORKSOP/PLENARY LECTURE ABSTRACTS

(Listed in Chronological Order)

SPECIAL TOPIC SYMPOSIUM
THURSDAY, 10 APRIL: 9:00AM-NOON, 1:00PM-4:00PM (ROOM: SANTA ANA)

HUMAN MACROECOLOGY: EMERGENT PATTERNS AND PROCESSES IN LARGE-SCALE HUMAN ECOLOGY
Organizers: Oskar Burger (University of New Mexico) and William Burnside (University of New Mexico)

We define human macroecology, the study of emergent patterns in human-environment interactions across scales, and present findings related to human evolution, biogeography, and city growth. Research in these areas bridges historic disciplinary boundaries while building a more robust social science with improved ability to address the difficult issues of population growth, energy use, and environmental impact of the future.

AAAS SWARM DIVISION PRESIDENTIAL ADDRESS
THURSDAY, 10 APRIL: 9:45AM-10:30AM (ROOM: BALLROOM A)

NO COUNTRY IS AN ISLAND: COLLABORATION IN THE 21ST CENTURY
Cieslak, Wendy (Sandia National Laboratories)

The presidential address will set the stage for the meeting theme of "Meeting Today's Challenges through Collaborative Science, Engineering, and Technology." Key scientific and technological advances require interdisciplinary collaboration, multi-institutional partnerships and international engagement. Such extensive partnering does not come easily, even in today's interconnected world. This presentation will explore the issues, challenges, and potential rewards in overcoming the barriers to collaboration.

SPECIAL TOPIC SYMPOSIUM
THURSDAY, 10 APRIL: 10:45AM-NOON (ROOM: MIRAGE/THUNDERBIRD)

BIG IMPACT OF SMALL RNAS
Organizer: Austin Cooney (Baylor College of Medicine)

Small non coding RNAs have been known for decades to play important roles in translation of proteins and the splicing of genes. However in the last few years after the discovery of functional regulatory micro RNAs (miRNAs), that was recognized recently with awarding Nobel prizes, there has been an explosion of research in this area, that has major implications for bioscience and health. These miRNAs play regulatory roles in gene expression by either targeting RNA for degradation or inhibiting translation. Genomic-wide analysis of miRNA expression and function has required collaborative multidisciplinary teams in chemistry, bioinformatics, genomics and biology to come together to attack such simple questions but on a massive scale. In this symposium we will have talks that focus on the contribution of each of these aspects to the field of small RNA analysis.

PLENARY LECTURE
THURSDAY, 10 APRIL: 10:45AM-12:15PM (ROOM LOBO)

TECHNOLOGY MANAGEMENT: HOW TO COPE WITH CURRENT CHANGES
Kocaoglu, Dundar F. (Portland State University)

The society is changing rapidly. The forces that shaped the world in previous centuries are no longer the dominating forces. Technology has become the driving force as the world has entered the knowledge era in the late 20th century. This presentation describes the changes taking place in the knowledge era, and discusses the role of technology management in those changes.

PLENARY LECTURE
THURSDAY, 10 APRIL: 11:15AM-12:15AM (ROOM: FIESTA)

INTERNATIONAL ASSESSMENT OF RESEARCH NEEDS FOR NANOTECHNOLOGY ENVIRONMENT, HEALTH AND SAFETY
Kulinowski, Kristen (ICON/Rice University)

The unique properties and potential mobility of engineered nanoparticles along with the lack of mobile monitors to detect their presence pose significant challenges to the development of best practices for nanomaterial handling throughout the lifecycle. Extrapolating from health and safety data available for a larger scale material may fail to capture the nanoscale analog's interactions. Nanoparticles' diversity and tunability make it difficult to predict their behavior. The interaction of an engineered nanoparticle with a cell, for example, can change dramatically with small changes in size, shape or surface properties, such as may occur during the nanoparticle's incorporation into a product or as a result of introduction into the body, even if the chemical composition of the base nanoparticle is constant. Testing each different variant of a nanoparticle, even if limited to those of commercial relevance, is impractical. A better understanding is needed of the structure-activity relationships of nanoparticles themselves, particularly those with potential for high exposure or high-volume application in current and future products, so that we can proceed with greater confidence that the EHS issues have been identified and can be managed. The presentation will review the outcomes of two international workshops that considered the research needed to predict nanoparticle interactions with living systems and the environment.

SPECIAL TOPIC SYMPOSIUM
THURSDAY, 10 APRIL: 1:00PM-3:00PM (ROOM: FIESTA)

EMERGING INFECTIOUS DISEASES
Organizer: Jens Posche (Sandia National Laboratories)

ABSTRACT NOT AVAILABLE

SPECIAL TOPIC SYMPOSIUM
THURSDAY, 10 APRIL: 1:30PM-3:00PM (ROOM: LOBO)

BUSTING THROUGH: INTERDISCIPLINARY RESEARCH AND EDUCATION AT THE UNIVERSITY OF NEW MEXICO—A ROUNDTABLE
Organizer: Michael J. Dougher (University of New Mexico)

Traditional disciplinary preserves are no longer sacrosanct. Knowledge knows no boundaries. Increasingly, cutting-edge research and educational programs violate boundaries long held dear. Scientists, engineers, and social scientists are trespassing upon

one another's turf and—of all things!—collaborating. This roundtable will highlight interdisciplinary research and education initiatives at the University of New Mexico.

SPECIAL TOPIC SYMPOSIUM
THURSDAY, 10 APRIL: 1:30PM-3:00PM (ROOM: ACOMA)

GREEN DATA CENTER
Organizer: Tom Davis (Navajo Technical College)

ABSTRACT NOT AVAILABLE

SPECIAL TOPIC SYMPOSIUM
THURSDAY, 10 APRIL: 1:30PM-3:00PM (ROOM: MIRAGE/THUNDERBIRD

TECHNOLOGY COMMERCIALIZATION
Organizer: George Friberg (Technology Venture Corp.)

ABSTRACT NOT AVAILABLE

SPECIAL TOPIC SYMPOSIUM
THURSDAY, 10 APRIL: 3:30PM-5:00PM (ROOM: LOBO)

INTERNATIONAL COLLABORATIONS: OPPORTUNITIES AND CHALLENGES
Organizer: Charles Crespy (University of New Mexico)

The Anderson School has many collaborative agreements with universities in Canada, Mexico and Brazil. The faculty responsible for these agreements will discuss these four collaborative efforts, how they were constructed and issues related to the opportunities and problems in these agreements. Crespy will explore the advantages of integrating new public sector actors such as CONACYT, the Mexican Commission on Science and Technology, into the more the traditional university to university agreements. De Gouvea will discuss the exchange agreements that led to trade missions organized with universities and federal agencies in the US and Brazil. Di Gregorio will examine the issues surrounding the Department of Education Title VI B grant and the collaboration with universities in New Brunswick, Dalhousie, Chihuahua and Monterrey. Thomas will discuss the advantages of faculty-led, collaborative study abroad programs versus traditional exchange agreements. The model currently being used at the Anderson School of Management is lower cost, involves a higher number of students, and requires less time-consuming approval processes yet results in a stronger collaborative agreement than traditional exchange agreements.

SPECIAL TOPIC SYMPOSIUM
THURSDAY, 10 APRIL: 3:30PM-5:00PM (ROOM: FIESTA)

HEALTH, FOOD, AND BIOSECURITY
Organizer: Michael Holbrook (University of Texas Medical Branch-Galveston)

ABSTRACT NOT AVAILABLE

SPECIAL TOPIC SYMPOSIUM
THURSDAY, 10 APRIL: 3:30PM-5:00PM (ROOM: ACOMA)

COLLABORATION: INTEGRATING RESEARCH TEAMS
Organizer: Gretchen Jordan (Sandia National Laboratories)

ABSTRACT NOT AVAILABLE

PLENARY LECTURE
FRIDAY, 11 APRIL: 8:30AM-10:00AM (ROOM: LOBO)

BUILDING THE FOUNDATIONS OF SUSTAINABILITY THROUGH TRANSDISCIPLINARY SCIENCE AND ENGINEERING
Hodges, Kip (Arizona State University)

While most pundits agree that efforts to build sustainable societies in the face of rapid environmental change will require contributions from many fields (e.g., architecture, economics, public policy), they frequently add science to the list only as an afterthought. If science has triumphed in convincing the world that anthropogenic climate change is a serious threat to human societies, is it now time to thank the climate science cavalry for their valuable contributions and call in the regular troops of economists and policy makers to fight the war? Perhaps a smarter strategy recognizes that building a sustainable future for human societies means finding a way to co-evolve with a dynamic Earth system that we do not yet fully understand. With a focus on no less than survival of our species, the time is ripe for a new kind of science, one that transcends conventional disciplinary boundaries and embraces an intellectual continuum between science and engineering. Grounded in complexity theory and a rapidly developing understanding of Earth history, we now need to deploy technologies on a global scale to monitor earth system evolution. Only then can we judge the effectiveness (or ineffectiveness) of developing strategies for the mitigation of and adaptation to environmental changes that threaten our future. Ultimately, we must also recognize that the Earth system is not isolated and thus subject to catastrophic events (such as asteroid collisions) that may disrupt the global ecosystem in ways that are impossible to overcome. This suggests that sustainability research also should include studies of the Moon and nearby planets to provide a context for human exploration and colonization. Given the high stakes, the quest for sustainable societies may be driving a transformative integration of disciplinary approaches into the science of human survival.

SPECIAL TOPIC SYMPOSIUM
FRIDAY, 11 APRIL: 8:30AM-10:00AM (ROOM: FIESTA A)

BIOFUELS
Organizer: Ron Pate (Sandia National Laboratories)

ABSTRACT NOT AVAILABLE

SPECIAL TOPIC SYMPOSIUM
FRIDAY, 11 APRIL: 8:30AM-10:00AM (ROOM: FIESTA B)

ENERGY AND ENVIRONMENTAL SECURITY AND SUSTAINABILITY: THE ROLE OF ECONOMICS
Organizer: Cecelia Williams (Sandia National Laboratories)

ABSTRACT NOT AVAILABLE

SPECIAL TOPIC SYMPOSIUM
FRIDAY, 11 APRIL: 8:30AM-10:00AM (ROOM: ACOMA)

EVALUATING MODELING AND SIMULATION PROGRAMS
Organizer: Jeremy Horne (RhinoCorps, Ltd)

Increasingly, modeling and simulation (M&S) are being used to guide decision making, as exemplified by the U.S. Department of Defense (DoD) and the Department of Energy. Both rely upon Verification, Validation, and Accreditation (VV&A) to assess the quality of M&S programs. Contradictory to this is the concern about emergence, or unexpected behavior of a system. Such was expressed in a Broad Agency Announcement issued by the Office of Secretary of Defense (OSD) in 12 December 2006 as, "…unacceptable and unpredictable outcomes that can be detrimental to the UAS [Unmanned and Autonomous Systems], humans/systems …". Current VV&A, because of its closed systems approach, is not adequate for determining if open systems will perform as expected. This seminar will examine the foundations of and problems associated with M&S integrity and serve as an opportunity to form a working group to provide input into the DoD/DOE VV&A standardization process so as to accommodate open systems.

SPECIAL TOPIC SYMPOSIUM
FRIDAY, 11 APRIL: 8:30AM-10:00AM (ROOM: MIRAGE/THUNDERBIRD

NEW MEXICO NUCLEAR STUDY GROUP ROUNDTABLE
Organizer: Andrew Ross (University of New Mexico)

The New Mexico Nuclear Study Group was founded in 2007 to bring together scientists, engineers, and social scientists from Los Alamos National Laboratory, Sandia National Laboratories, the Defense Nuclear Weapons School, the University of New Mexico and other New Mexico institutions to assess a range of U.S. nuclear strategy, force structure, and infrastructure alternatives. Participants in this proposed 90-minute roundtable will focus on a set of four questions: (1) What role have nuclear weapons played? (2) What role do nuclear weapons now play? (3) What role can nuclear weapons play? and (4) What role should nuclear weapons play in the future?

SPECIAL TOPIC SYMPOSIUM
FRIDAY, 11 APRIL: 10:00AM-NOON (ROOM: FIESTA)

HELP SHAPE THE FUTURE OF PULSED POWER DRIVEN FUSION ENERGY
Organizer: J. Pace VanDevender (Sandia National Laboratories-Retired)

The world needs future sources of energy that meet at least six categories of requirements--scientifically understood, technologically robust, economically advantageous, environmentally sustainable, socially acceptable and fundable. Recent advances in the science and technology of high-energy-density matter on Sandia National Laboratories' Z-Machine Pulsed Power Facility have stimulated planning for Pulsed Power Driven Fusion Energy—the focus of this session. The audience will hear how this future energy option might meet the requirements and provide feedback to the planners on the requirements and on the relative strengths and weaknesses of Pulsed Power Driven Fusion against the five requirements. Audience participation is sought through oral, written, and electronic feedback.

SPECIAL TOPIC SYMPOSIUM
FRIDAY, 11 APRIL: 10:30AM-NOON (ROOM: LOBO)

NATIONAL LABORATORY/UNIVERSITY COLLABORATION MODELS: A CHANCE TO COMPARE AND CONTRAST LONG-STANDING MODELS TO A NEWER MODEL
Organizers: Marie Garcia (Sandia National Laboratories) and Everett Springer (Los Alamos National Laboratory)

More and more many of our institutions are engaging in a partnerships strategy that is based on a foundation of research—that is, conducting world-class research to support mission needs that emphasizes partnering to solve problems that neither institution would be able to solve alone. Another part of the strategy focuses on talent—educating next generation scientists and engineers as well as learning how to retain and develop our own employees. This session highlights the more successful models currently deployed within New Mexico between its universities and national laboratories. This is an opportunity to take away valuable lessons learned and apply them at your own institutions. This panel will address:
• Experimental Program to Stimulate Competitive Research (EPSCoR): Barbara Kimbell, Associate Director, NM EPSCoR/University of New Mexico
• Center for Integrated Nanotechnologies (CINT): Dr. Neal Shinn, CINT User Program Manager, Sandia National Laboratories
• Advanced Materials Lab (AML): Dr. William (Bill) Hammetter, AML, Sandia National Laboratories
• Los Alamos National Laboratory Institutes: Dr. Nancy Sauer, Institutes Director, Los Alamos National Laboratory.

SPECIAL TOPIC SYMPOSIUM

FRIDAY, 11 APRIL: 10:30AM-NOON (ROOM: ACOMA)

WATER SUSTAINABILITY
Organizer: Philip Pohl (Sandia National Laboratories)

ABSTRACT NOT AVAILABLE

PLENARY LECTURE
FRIDAY, 11 APRIL: 1:30PM-3:00PM (ROOM: LOBO)

NEW MEXICO HIGH PERFORMANCE COMPUTING INITIATIVE
Bowles, Tom (State of New Mexico - Governor's Office)

The New Mexico Computing Applications Center is leading an effort to establish one of the world's most powerful computer systems in New Mexico. This move will allow the state to partner with private businesses on research and development projects, attract top academic researchers and help communities solve complex problems. The world is entering into a new era of computing. This means that explosive growth in computing power and dramatic reductions in cost allows researchers to model problems with a great deal of confidence in predicted outcomes. This allows companies, universities and governments to quickly and efficiently make decisions about their futures. Supercomputers allow companies to model new airplane designs and life-saving drugs. They allow governments to model more efficient traffic flows to cut fuel costs. And supercomputers attract many of the best scientists and researchers in the world.

SPECIAL TOPIC SYMPOSIUM
FRIDAY, 11 APRIL: 1:30PM-3:00PM (ROOM: ACOMA)

SOLAR AND WIND ENERGY
Organizer: Jose Zayas (Sandia National Laboratories)

ABSTRACT NOT AVAILABLE

SPECIAL TOPIC SYMPOSIUM
FRIDAY, 11 APRIL: 1:30PM-5:00PM (ROOM: FIESTA)

NANOMATERIALS AND NANOSTRUCTURES
Organizers: Jeff Brinker (Sandia National Laboratories) and Hongyou Fan (Sandia National Laboratories)

ABSTRACT NOT AVAILABLE

SPECIAL TOPIC SYMPOSIUM
FRIDAY, 11 APRIL: 1:30PM-3:00PM (ROOM: SANTA ANA)

SUSTAINABLE AGRICULTURES
Organizer: Cecelia Williams (Sandia National Laboratories)

ABSTRACT NOT AVAILABLE

WORKSHOP
FRIDAY, 11 APRIL: 1:30PM-3:00PM (ROOM: MIRAGE/THUNDERBIRD)

COLLABORATIVE AND INTERDISCIPLINARY REU RESEARCH TO PREPARE STUDENTS FOR SCIENCE-BASED CAREERS
Lisa Majkowski (New Mexico Tech), Michael J. Pullin (New Mexico Tech), and Barbara A. Austin (Northern Arizona University)

Modern scientific research addresses complex problems through an interdisciplinary and collaborative approach. However, undergraduates in the sciences are typically taught in lecture and lab courses that emphasize individual effort and a single-discipline focus. This may leave students unprepared for graduate school and future careers in science. In an effort to address this problem, we've established Interdisciplinary Science for the Environment, an NSF-funded Research Experience for Undergraduates (REU) program at New Mexico Tech. This program allows undergraduates to participate in an intensive summer research experience as members of an interdisciplinary and collaborative team. The research projects span a range of topics, but are all motivated by environmentally-related topics or issues. Project teams include two or more faculty members, graduate students, and undergraduate participants, all from different departments and/or academic majors. Program goals include increasing the participant's knowledge and excitement about science and the nature of scientific research as well as exposing the participants to an interdisciplinary and collaborative research environment. Assessment data for the participants indicate that the collaborative and interdisciplinary nature of the program was a key to its success in reaching these goals. All the students discussed the value of incorporating other disciplines in solving problems in their own field, something they hadn't been exposed to as undergraduates. Most students reported that collaboration with other participants and project faculty was very important for their understanding of their project and for its successful completion.

SPECIAL TOPIC SYMPOSIUM
FRIDAY, 11 APRIL: 3:30PM-5:00PM (ROOM: MIRAGE)

SUCCESSES AND CHALLENGES OF COLLABORATIONS BETWEEN SCIENTISTS AND PUBLIC SCHOOLS
Organizer: Kathleen Holt (Sandia National Laboratories)

ABSTRACT NOT AVAILABLE

SPECIAL TOPIC SYMPOSIUM
FRIDAY, 11 APRIL: 3:30PM-5:00PM (ROOM: ACOMA)

ENERGY-WATER NEXUS
Organizer: Bruce Thomson (Sandia National Laboratories)

ABSTRACT NOT AVAILABLE

SPECIAL TOPIC SYMPOSIUM
FRIDAY, 11 APRIL: 3:30PM-5:00PM (ROOM: SANTA ANA)

PUTTING GREEN INTO GREEN BUILDINGS
Organizers: Kuppu Iyengar (Sandia National Laboratories) and Phil Dekker (Sandia National Laboratories)

ABSTRACT NOT AVAILABLE

WORKSHOP
FRIDAY, 11 APRIL: 3:30PM-5:00PM (ROOM: LOBO)

FOCUSING YOUR LIMITED RESOURCES TO FIND PARTNERS AND GRANTS VIA DATA MINING TOOLS
Joel Sikora (Sandia National Laboratories)

Business and competitive intelligence make it easier to identify collaborations based on areas of mutual interest and complementary capabilities. This session will provide an overview of business and competitive intelligence tools and techniques used at Sandia National Laboratories to support collaborations. The application of these tools will be demonstrated through several recent case studies. The case studies will include patent portfolio analysis, text and data mining and data visualization.

WORKSHOP
FRIDAY, 11 APRIL: 3:30PM-5:00PM (ROOM: SPIRIT/TRAILBLAZER)

THE MANY PATHWAYS TO A CAREER IN SCIENCE
Richard A. Weibl (Director, Center for Careers in Science and Technology, AAAS)

Shaping a career in science has never been a solitary experience. Collaborating with mentors and advisors can teach us a great deal. AAAS has a collection of resources and guides that can help aspiring scientists to make the right moves as they navigate the pathways towards a successful career in science. This session, for all students, will demonstrate those resources and the wide range of places where science, engineering, and technology are practiced today.

JOHN WESLEY POWELL MEMORIAL LECTURE
FRIDAY, 11 APRIL: 7:00PM-8:30PM (ROOM: BALLROOM B)

AS INNOVATION GOES, SO GOES AMERICA
Norman R. Augustine, Normal R. (Retired, CEO Lockheed Martin)

The Gathering Storm report prepared under the auspices of the national Academies concluded that America's ability to create jobs in the future will depend upon the nation's ability to innovate—particularly in areas related to science and engineering. The considerable wage disparity between American workers and workers in developing countries, coupled with various self-imposed burdens, will need to be overcome through the creation of new scientific knowledge, the application of new knowledge to the creation of new products and services, and the introduction of those new products and services into the global marketplace through superior entrepreneurship. Taken together, these three elements form the basis of innovation—upon which America's economy, security and quality of life of its citizens will increasingly depend. There are, of course, many barriers to innovation; however, there are also many lessons that have been learned from past efforts that can have important and positive bearings on future undertakings. Some of the more important of these lessons are discussed during this lecture.

[*] Norman R. Augustine is the retired Chairman and CEO of Lockheed Martin, a former Under Secretary of the Army and former Chairman of the National Academy of Engineering. He has been a Trustee of MIT, Princeton and Johns Hopkins, and served on the faculty of Princeton as a Lecturer with the Rank of Professor. He has been a member of the President's Council of Advisors on Science and Technology for 16 years and is a recipient of the National Medal of Technology.

SPECIAL TOPIC SYMPOSIUM
SATURDAY, 12 APRIL: 8:30AM-9:30 AM (ROOM: MIRAGE)

STEMS: UNM'S INTENSIVE POST BACCALAUREATE TEACHER EDUCATION PROGRAM
Organizer: Terry Dunbar (University of New Mexico)

The presenter will lead a symposium on STEMS, an intensive UNM post-baccalaureate teacher education program. Participants earn a NM teaching license in 16 months.

PLENARY LECTURE
SATURDAY, 12 APRIL: 8:30AM-10:00 AM (ROOM: FIESTA)

EXTREME BALL LIGHTNING RESEARCH BY INTERNATIONAL VOLUNTARY COLLABORATIVE
J. Pace VanDevender (Sandia National Laboratories and VanDevender Enterprises)

For the last six years, an international team of volunteers has been collaborating to study extreme ball lightning--a natural phenomenon characterized by a glowing ball of light that lasts for 1 to > 1000 s. Although experiments have produced lowing balls of light that fade in <1 s after external power is removed, self-sustaining, energetic ball lightning is not understood. The energetic ball lightning event of August 6, 1868, in County Donegal, Ireland, and reported to the Royal Society by M. Fitzgerald has stimulated a new inquiry. It lasted for 20 minutes and excavated a total of ~100,000 kg of water saturated peat. We found and characterized the site and show that the geomorphology and carbon dating support the account by M. Fitzgerald. The excavation is not consistent with chemical, nuclear, or electrostatic forces but is consistent with magnetic induction by a ~1-MHz electromagnetic field from a > 20,000 kg compact floating object. The weight and emissions suggest a mini black hole that could coexist with normal matter as the gravitational equivalent of an atom (GEA). Such an object should be detectable by its electromagnetic emissions. We have found about fifty 1s to >1000-s bursts of electromagnetic energy

between 3 MHz and 350 MHz recorded by the FORTE satellite in October of 1997. Ground-based time-synchronized observations should help identify the origin of the FORTE-like emissions and may help find and understand modern energetic ball lightning events to move us beyond glowing balls of light.

WORKSHOP
SATURDAY, 12 APRIL: 8:30AM-10:00AM (ROOM: ACOMA)

REDUCING GENERATIONAL FRICTION TO INCREASE COLLABORATION
Ken Beller (Near Bridge, Inc.)

Drop a team of American scientists into a technology meeting in Tokyo or Russia without a translator and little collaboration is likely to occur. Effective team collaboration requires effective communication and effective communication requires a common language and an understanding of each other's values. Surprisingly, most of us face a challenge similar to this every day without even realizing it. Today's workforce is made up of more diverse generational values than at any time in history—and these generations communicate, view the world, and make decisions very differently. For effective communication and collaboration to occur, these differing values must be understood and respected. Traditional age-based demographic research analyzes past behavior in the attempt to predict future behavior. Unfortunately, this analysis method is seriously flawed, because past behavior does not drive future behavior. Behaviors are not drivers; they are responses to emotions that are activated by a person's consistent and lasting set of core values. Based on the highly praised book, *The Consistent Consumer: Predicting Future Behavior Through Lasting Values,* this session will present the results of four-years of research into the core values of age-based demographic groups and will examine the socio-cultural themes and icons that have shaped five generations termed "Value Populations." At the end of this session, participants will understand the values and intergenerational differences held by each unique Value Population and will be able to reduce intergenerational friction between team members, work more closely with each other, and produce effective collaboration and bottom-line results.

WORKSHOP
SATURDAY, 12 APRIL: 8:30AM-10:00AM (LOBO)

CONTROLLED ENVIRONMENTS (CEA): FEEDING THE WORLD, SAVING THE WORLD, AND CREATING NEW WORLDS
Gene Giacommelli (University of Arizona)

Plant production in CE (Controlled Environments) is extending beyond the traditional greenhouse regions to harsher climates, including arid and semiarid regions. Along with this rapid development and "migration" of greenhouse controlled environment agriculture (CEA), new technologies are evolving, and supportive operational information is being developed. Achieving sustainable greenhouse applications will require an interdisciplinary and multi-dimensional approach to solutions, which combines both science and engineering expertise. CEA applications are no longer limited to traditional food and floral crop production, but are now poised to capitalize on plant processes for biopharmaceuticals, bioactive compounds, bioremediation, and bio-energy. It is therefore a critical time for researchers, educators, developers, and the industry to work together for the enhancement of society with CEA-based technologies. CE systems will be developed to help feed the world, while utilizing energy, labor and water resources effectively, and CE will become the platform for applications of new technologies using plant photosynthetic and plant physiological processes for fuel source [biomass energy]; for space colonization life support [recycling all resources]; for remediation of air [carbon sequestration] and water [salts, heavy metals]; and for phtyochemicals and plant-made pharmaceuticals [lycopene,

vaccines]. The timing is critical for educating young people about the science and engineering of CE and hydroponic food support systems, and the other CE applications. Outreach and educational programs must be developed to promote the benefits of CE for food production for modern agriculture, as well as, the new technologies of CE for enhancing, restoring, and maintaining critical earth life systems and human quality of life scenarios.

SPECIAL TOPIC SYMPOSIUM
SATURDAY, 12 APRIL: 8:30AM-10:00 AM (ROOM: SANTA ANA)

RIPLEY'S BELIEVE IT OR NOT EDUCATION COLLABORATIVES SESSION
Organizer: Dominique Wilson (Sandia National Laboratories)

This session showcases innovative educational partnerships amongst interrelated – or not – target sectors and public-private partnerships. See how the DOL fosters entrepreneurship, generates talent, and pilots innovative partnership via the WIRED grant. Be awestruck by the seamless transition in and out of the academic arena from high school to Ph.D. level in the optics and photonics arena. Uncover the secrets to successful high school technology academies where kids are guaranteed math and science proficiency. Cheer on workforce development and skills standards certification -- as well as a future -- for formerly incarcerated youth. Indulge in optimism for America's competitive future and turbo-charged innovation engine via Discovery Science & Engineering Innovation Institutes, such as the National Institute for Nano-Engineeering. All this on a Saturday morning, all in New Mexico + dialogue too!

WORKSHOP
SATURDAY, 12 APRIL: 9:45AM-10:30AM (MIRAGE/THUNDERBIRD)

IMPLEMENTING ELEMENTS OF THE SUPPLEMENTAL INSTRUCTION MODEL TO BUILD THE NEXT GENERATION OF THINKERS FOR STEM EDUCATION
Nina Javaher (New Mexico State University)

Supplemental Instruction (SI) is a student academic assistance program that has traditionally targeted academically difficult classes such as Biology, Chemistry, Math, and engineering. The SI model has been shown to increase academic performance and retention among all students specially underrepresented minority students through its use of collaborative learning strategies. This round table session will present elements of the SI model that can be implemented in any class, including test analysis, problem solving, time management, learning style profile, and many more.

PLENARY LECTURE
SATURDAY, 12 APRIL: 10:30AM-NOON (LOBO)

REAL WORLD CHALLENGES AND OPPORTUNITIES FOR GLOBAL HEALTH SURVEILLANCE
Annette Sobel (Sandia National Laboratories and University of New Mexico)

Real World Challenges and Opportunities for Global Health Surveillance will be discussed in the context of U.S. National Security. Some of the most challenging environments globally present the greatest opportunities for stability and security. For example, the global threats of narco-terrorism have surfaced as international challenges fostering the emergence of novel infectious disease threats and threatening the stability of international economies, trade, health and security. The recent stand-up of Department of Defense's (DoD's) AFRICOM will highlight the unprecedented challenges of co-locating US troops in regions of Africa previously uninhabited and threats unmitigated by conventional force

protection methods. In addition, there is an expanding interest in partnerships with Non-Government Organizations (NGOs) to expand US humanitarian missions and build/re-build coalitions and partnerships for peace. These emerging challenges will be wickered together by the ever challenging political, military, cultural, and technical challenges of information sharing and common understanding of infectious disease threats that respect no geographic boundaries or institutions.

SPECIAL TOPIC SYMPOSIUM
SATURDAY, 12 APRIL: 10:30AM-NOON (ROOM: FIESTA)

THE NATIONAL INSTITUTE FOR NANO-ENGINEERING, A PROTOTYPE INNOVATION INSTITUTE
Organizer: Regan Stinnett (Sandia National Laboratories)

In this 90 minute session we will present ideas for Nano-Micro Technology Education including the NINE Program at Sandia and other programs involved in pioneering efforts in Nano-Micro Education.

WORKSHOP
SATURDAY, 12 APRIL: 10:30AM-NOON (ACOMA)

AN OBSERVATORY TO STUDY THE DYNAMICS OF CHANGE IN GLOBAL ENERGY SYSTEMS
Rajan Gupta (Los Alamos National Laboratories)

The world's energy infrastructure stands on the brink of a major revolution. Much of the large power generation infrastructure in the industrialized world will need replacement over the next two to three decades while in the developing world, including China and India, it will be installed for the first time. Concurrently, the risks of climate change and unprecedented high prices for oil and natural gas are transforming the economic and ethical incentives for alternative energy sources leading to growth of nuclear and renewables, including solar, wind, biofuels and geothermal technologies. The transition from today's energy systems, based on fossil fuels, to a future decarbonized or carbon-neutral infrastructure is a socio-technical problem of global dimensions, but one for which there is no accepted solution, either at the international, national, or regional levels.

WORKSHOP
SATURDAY, 12 APRIL: 10:30AM-11:30AM (MIRAGE/THUNDERBIRD)

SCIENCE CONTESTS IN ROBOTICS AND ELECTRICITY FOR GRADES 6-12

THE SHOCKING TRUTH ABOUT ELECTRICITY
Laura Lomas Tomlinson (New Mexico State University)

The Shocking Truth About Electricity is a hands-on, interactive workshop designed for educators who teach 5th grade through high school, middle school and high school students, and anyone interested in learning about electricity. Topics will cover the different types of electricity, resistors, and how light bulbs work. There will be some basic engineering challenges that will develop a deeper understanding of electron flow and the development of equations. This workshop is sponsored by Southern New Mexico Science, Engineering, Mathematics, and Aerospace Academy based at New Mexico State University which is dedicated to encouraging K-12 students into the STEM fields.

RAVE DIRECTORS
Fabian Lopez (Inquiry Facilitators Inc) and Russ Fisher Ives (Inquiry Facilitators, Inc)

The RoboRAVE International is a twice-a-year robotics competition, with the spring competition in southern New Mexico and the fall competition in the northern part of the state. The RAVE promotes Science, Technology, Engineering and Mathematics awareness and concepts via robotics competitions which combine science and fun in a unique, fast-paced, engaging and valuable learning experience. The competitions are focused on grades 6-12. These students can compete in three categories in teams of two to four students for cash prizes that range from $5 to $500 for teams that finish in the top three places. Our motto "Today's Play, Tomorrow's Pay."

SPECIAL TOPIC SYMPOSIUM
SATURDAY, 12 APRIL: 10:30AM-NOON (ROOM: SANTA ANA)

SMALL BUSINESS ASSISTANCE – TECHNOLOGY COMMERCIALIZATION
Organizer: Sul Kassicieh (University of New Mexico)

Sandia National Laboratories and Los Alamos National Laboratory support small businesses through grants that are used to provide technical and/or business expertise to solve particular challenges faced by the company. The Management of Technology program at The Anderson School has been collaborating with Sandia and Los Alamos to offer different management of technology and entrepreneurship solutions to these companies. The panel will describe the nature of the programs, the collaborative efforts involved, the type of projects performed for these small businesses as well as the difficulties and successes faced in these collaborations.

MAKE FASTER, BETTER AND MORE EFFECTIVE DECISIONS THAT ACTUALLY STICK
Ketch, Ken (GroupMind Express)

Desired results from decisions, plans, or initiatives are often not achieved. The causes for poor results are numerous, but too frequently include; the decision was rushed or came from a too narrow or biased solution set, the decision process was not designed, implications of the decision were not fully understood by those who were asked to implement, clear ownership and behavioral norms were not established, and a process for capturing results to apply to future decision making was not established. Based on 15 years of decision support work with teams of all sizes from startups to Fortune 100 companies, this session will identify and examine ten principals for turning your team's collective intelligence into decisions that really stick. Examples will show:
1) How you can tap your teams collective intelligence for better decision-making and implementation, 2) How to gain alignment and support for your initiatives, and 3) How to make progress reviewable by all team members for peer support. This interactive session will also explore the market landscape for collaboration tools. We will identify how you can choose and deploy tools to support your decision and initiative processes to improve your results.

ABSTRACTS

Al-Shudeifat, Mohammad Ameen (New Mexico State University) and A. B. Donaldson (Sandia National Laboratories)

TESTING TRAP-GREASE OIL IN 150KW GAS TURBINE

The performance parameters and emissions of dewatered trap grease and diesel fuel were tested in a turbine generator at the same operation conditions. The viscosity of trap-grease was recorded experimentally at different sample temperatures using a viscometer. It was found that the trap-grease oil should be heated to nearly 80°C before running the unit in order to match the viscosity of diesel fuel. Heating values of both fuels were measured using the bomb calorimeter to facilitate calculation of brake specific fuel consumption. The gas turbine fuel system was modified to operate with both diesel and heated trap grease. The results have shown that the trap grease has less NOx emission at higher loads compared to diesel fuel, whereas CO and CO2 emissions are slightly higher than those of diesel fuel. At low loads the CO emission become considerably higher for trap grease fuel compared to that of diesel fuel. The results of both performance parameters and emission tests support the possibility of using trap-grease oil in turbine generator units at full load.

Arviso, Jason K. (Navajo Technical College), Jarred Ribble (Navajo Technical College), Chris Yazzie (Navajo Technical College), Mark Trebian (Navajo Technical College), and Tom Davis (Navajo Technical College)

GREEN DATA CENTER DESIGN

Data needs and management is growing exponentially. This means that the data center industry is taking up an increasing share of the world's energy consumption. In 2006 1.5% of U.S. energy production went to managing data centers. We expect within five years 4% of the nation's energy consumption will be used by the industry or the energy needs of 5.8 million U.S. households. In 2006 data centers spent 4.5 billion dollars on energy costs. By 2011 this cost should, minimally, double. Hear about ways to decrease this cost.

Axness, Carl (Sandia National Laboratories)

BUILDING AN OFF-GRID, PASSIVE AND PV SOLAR, SUSTAINABLE HOME IN RIO RANCHO, NM

The author has recently built an off-grid, passive and PV solar home in Rio Rancho and is presently working toward reducing his dependence on non-solar energy sources and exterior (non-harvested) water sources as much as possible. In this talk he will discuss his motivation for building off-grid (mostly economical), lessons learned in the design and construction of the home, lifestyle changes that help to economize energy and water costs and changes in local regulations that would help to promote more energy and water-efficient homes in NM. Included in the presentation is an approximation of the annual energy and water costs for this family of three and approximate house temperature fluctuations during typical (sunny) and atypical (cloudy) days. Finally, the author will discuss the second phase of construction to be carried out next fall (a garage, guest room, and covered open patio) and how this will further reduce his dependence on non-harvested water sources.

Baca, A. Michael (MDL Enterprises), Don Wichers (MDL Enterprises), and Luis Ortiz (MDL Enterprises)

UTILIZING SMALL FORM FACTOR, WIND DRIVEN, ELECTRICAL GENERATION DEVICES FOR RESIDENTIAL AND MOBILE APPLICATIONS

Technologies have existed for a number of years that use wind power to create electricity. MDL is continuing to develop a wind-driven, electric generation device that utilizes a relatively small form factor that can supplement or sustain the needs of a single family residential unit or can be used to supplement the power requirements for hybrid and or electric vehicles. The systems' architecture is relatively simple. It is designed in such a way that electrical power is generated more efficiently from wind using a much smaller footprint, with fewer moving parts. A cowling captures the wind and directs it into the air path. The passageway contains vanes designed to direct the captured air into a spiraled air flow and focus it directly onto the generator blades. This unique design thereby efficiently creates more rotational speed of the generator for optimal power output with wind speed conditions typically experienced external to the system. The mobile unit can be installed in an electric or hybrid vehicle. Installation under the hood, on the body, or the frame would allow for adequate air flow to operate the unit. Alternative design variations, including the use of an intake duct and bypass and multiple generators in one unit, are being developed that generate much greater power to meet the demands of an electric or hybrid vehicle, thereby potentially increasing the mileage that the vehicle may be driven in between full recharges. Utilizing small form factor, wind driven, electrical generation devices for residential and mobile applications.

Bachand, George D. (Sandia National Laboratories)

BIOMIMETIC SYSTEMS ENGINEERING - DEVELOPING DYNAMIC NANOMATERIALS AND FLUIDIC DEVICES

Biological systems exploit the stochastic interaction of energy-dissipating and thermodynamic processes to assemble nanostructures and systems that are capable of responding to physiological signals and/or external stimuli. Active transport systems, consisting of a class of proteins known as biomolecular motors, are fundamental to the non-equilibrium nature of these interactions, and offer a powerful model system for systems engineering at the nanoscale. Current research in my laboratory is focused on (1) understanding how active transport systems drive the assembly of complex materials and systems, and (2) exploiting mimetic approaches to engineering nanomaterials and devices with novel functionality. I will discuss our efforts in developing dynamically assembled nanocomposites and integrated nanoscale sensors using Nature's active transport systems.

Baker, Arnie (Sandia National Laboratories)

ENERGY AND ENVIRONMENTAL SECURITY AND SUSTAINABILITY: SOME REAL TIME INSIGHTS FROM DYNAMIC SIMULATION MODELING

Global energy, economic and environmental issues are complex and interrelated. Sandia National Laboratories has developed several dynamic simulation learning tools to help public policy makers and others think through the complexities and sort out the key issues. Several of these tools will be used real time to: 1) help frame the global energy and carbon problem; 2) examine U.S. electric power nuclear, coal and renewables electricity and environmental cost trade-offs; 3) consider U.S. prospects for hydrogen transportation fuel-vehicle systems in 2020; and 4) consider relative cost of biofuels compared to conventional gasoline and diesel, as well as for diesel made from natural gas and coal.

Baker, Arnie (Sandia National Laboratory)
ECONOMICALLY ADVANTAGEOUS REQUIREMENT

ABSTRACT NOT AVAILABLE

Baring-Gould, Ian (National Wind Technology Center, National Renewable Energy Laboratory)
APPLICATIONS OF WIND ENERGY TECHNOLOGY IN TODAY'S MARKET

ABSTRACT NOT AVAILABLE

Bedell, J. L. (Rising Phoenix, LLC.) and K. Y. Biel (Biosphere Systems International)
THE NEED FOR THE DEVELOPMENT OF A MANAGEMENT LANGUAGE

The focus of this presentation is to bring forth the questions that we as a scientific community have failed to give our full attention and responsibility to. It is not intended as an indictment but, rather an attempt to get us to re-focus on our responsibilities and where we might be spending our research monies and time. It is an attempt to have us all accept and recognize our responsibility to each other and our Biosphere. We must develop the "we" concept as to the sharing of our intellect and research so our World will survive. We must leave the "I" concept for the politicos and CEO's, their interest is "short term". We are not developing any new knowledge that is not readily available. But rather seeing the need for a centralizing of the knowledge already researched but place in storage and isolated from the "main stream". We must also address how we will distribute this knowledge without the interpretation and misuse by others in our geo-political, media and socio-economic sectors.

Bell, Peter (Renewable Fuel Products, Inc.)
RENEWABLE FUEL PRODUCTS

This paper will present a discussion of energizing rural communities using the Multi Functional Rural Fuel Platform. The MFRFP (Multi Functional Rural Fuel Platform) is a micro municipality bringing electric power and clean water to rural communities. Using vegetable oil seed crops as the raw material, rural communities can earn money selling a community produced, renewable diesel fuel. The oil seed protein meal byproduct, electricity generated and the ability to clean water are some of the other benefits provided by the MFRFP, enabling poor, rural communities to free themselves from the cycle of poverty.

Bettencourt, Luís (Los Alamos National Laboratory)
URBANIZATION, SOCIAL ADAPTATION AND SUSTAINABLE DEVELOPMENT

The problem of creating solutions for sustainable development is increasingly predicated on the management of the resource demands of social economic life in cities. Urbanization is the most conspicuous social force at play worldwide today. Developing countries such as China and India are less that 50% urban, but are expected to reach the levels observed in developed nations (80-90%) in the next 3-4 decades. The consequences of urbanization for human demands on natural ecosystems is somewhat ambivalent. While certain forms of consumption (energy, changes in diet) per capita certainly increase on average, urbanization can partially liberate land from human occupation while increasing the efficiency with which a dense population can be serviced. Quantifying these potentially contradictory trends has been a challenge in the past. We show however that scaling, i.e. the analysis of the systematic variation of urban properties with population size reveals scale invariant statistical regularities that capture systematically and predict the course of cities as their population sizes change. We use these insights to frame the discussion of a transition to sustainability in terms of the consumption of several resources used to quantify human footprint, and show how urbanization may be compatible, and even

accelerate, the achievement of continued economic growth that is compatible with the preservation of the Earth's support systems.

Biel, Karl (Institute of Basic Bio Problems), RD Gates (Dept. of Organismic Biology), and L. Muscatine (Dept. of Organismic Biology)

EFFECTS OF FREE AMINO ACIDS ON THE PHOTOSYNTHETIC CARBON METABOLISM OF SYMBIOTIC DINOFLAGELLATES

Synthetic host factor (SHF) was used in parallel with crude cnidarian's host factor (CHF) to investigate their effects on photosynthetic carbon metabolism in the symbiotic dinoflagellates Symbiodium purchrorum of the sea anemone Aiptasia pulchella. Several species have been studied, namely, sea anemone A. pulchella, reef coral Pocillopora damicornis, and green alga Chlamydomonas reinhardii. Both short-term and long-term experiments with radioactive carbon have shown a higher rate of the alga 14C photoaccumulation with host factor(s) than of dinoflagellates located in artificial sea water (ASW) alone. In dinoflagellates incubated with both ASW and CHF, 14C-labeled glycerol was detectable after 15 s of alga illumination. In dinoflagellates isolated from P. damicornis and incubated in CHF and SHF and in dinoflagellates isolated from A. pulchella and incubated in CHF, a higher percentage of 14C was found in the glycerol as compared to the ASW trial. At the same time, in ASW trial the radioactive label was primarily located in ethanol-soluble lipid fraction. Similar results were observed when dinoflagellates isolated from P. damicornis were incubated with aspartate or glutamate. But there was no effect with taurine, serine, valine, glycine, or lysine. C. reinhardii, incubated in salt-free CHF, partitioned a greater percent of 14C into the glycerol and less into the ethanol-soluble lipids as compared to the corresponding control incubations. Host factors appeared to provide an optimum environment to sustain maximum metabolic efficiency. A biochemical model, based on the quantitative and qualitative assessment of carbon pathways in dinoflagellates incubated both in host factor and sea water alone, is presented.

Boyer, Alison (University of New Mexico)

HUMAN COLONIZATION AND PACIFIC ISLAND BIODIVERSITY

Human arrival on every landmass around the world has been associated with elevated extinction probability in the native fauna, which has been a major contributor to biodiversity loss and global change. Human impacts, through direct predation, habitat change and the introduction of exotic species, have been implicated as extinction drivers, but aside from one or two well-analyzed locations, the relative roles of these environmental impacts are much debated. Regression trees built on zooarcheological data from over 40 islands were used to assess the relative importance of these extinction drivers in island bird extinctions across the tropical Pacific. Prehistoric extinctions showed a strong bias toward larger body sizes and flightless, ground-nesting species, even after accounting for preservation bias, indicating a significant human predation component. In many cases endemism was also associated with extinction, possibly through impacts of exotic predators and habitat destruction. Human societies on small, isolated islands can be thought of as replicated microcosms which provide crucial information on the dynamic interplay between humans and biodiversity in natural communities.

Briddell, Don (NPA)

STRUCTURAL SKEW TOPOLOGY AND FIELD STRUCTURE THEORY: PART TWO

Field Structures generated by Structural Skew Topology relate to fundamental particles and explain mass & energy values. Action loops at Planck scale build a Sierpinski triangle fractal from which mass values can be derived. Particle mass values are measured and weighed outside of the natural hierarchy from which they are formed. Mass values inside the hierarchy are determined in terms of loops of action. When hierarchy decay occurs, hierarchy loop numbers are subtracted to obtain mass values for the stand-alone particles.

Without knowing the mass values of the particles IN the hierarchy, particle mass values on their own appear unrelated. Inside the hierarchy particles share energy and have greater mass. Outside the hierarchy they cannot sustain the higher energies and decay. The structure of both bosons and fermions are modeled and explained, along with the mechanics of energy exchanges. FST views particles as the product of interacting loops which produce fields in which particles arise. FST delineates the topology of fields. Energy bosons are twists of the action loops of the field while mass fermions are a count of the action loops (circuits) in field. Loops are linked to twist in a fixed relationship accounting for the mass/energy relation in E = mc2.

Brothers, Heidi S. (Weston Solutions, Inc.)
ARE GREEN ROOFS WORTH THE COST?

The presentation will begin with background information on green roofs to include a description, history, types and uses. The documented advantages and disadvantages for green roofs will be provided. Topics include typical energy savings from green roofs, stormwater reduction results and the impact on stormwater quality. Recent industry data on energy savings from green roofs will be included. Other advantages of green roofs include heat island reduction and qualification for specific LEED (Leadership in Energy and Environmental Design Green Building System) credits. Green roofs can increase the life span of the building roof, provide noise reduction potential for building occupants, and benefit local air quality and the carbon footprint of the facility. Presentation will include typical costs for green roofs, maintenance requirements and the impacts on aesthetics and wildlife habitat. Examples will be used to include the new green roof installed on the Wing Headquarters building at Peterson Air Force Base in Colorado Springs, CO. The project includes installation of ~20,000 sf of a modular green roof and a study of the energy savings.

Brown, James (University of New Mexico)
TOWARD A METABOLIC THEORY OF HUMAN ECOLOGY

The developing metabolic theory of ecology (MTE) uses metabolism – the uptake, transformation, and allocation of energy and materials by organisms – to conceptualize, synthesize, and unify diverse environmental sciences. Since ecological interactions involve exchanges of energy, matter, and information, it is possible to use first principles (e.g., conservation of mass and energy, second law of thermodynamics, chemical stoichiometry) and biological processes (e.g., scaling of metabolic rate with body size and temperature, and dependence of resource use, life history, demography, and species diversity on metabolic rate) to build models and test their predictions. The principles, models, and approaches of MTE are directly applicable to human ecology. In collaborations among colleagues and students in biology and anthropology, we have begun to compile 'macroecological' data and to apply MTE. Our goal is to understand how energy and material resources are acquired, transformed, and allocated by aboriginal hunter–gatherers and modern technological societies. Preliminary results highlight the potential to use metabolism as well as genetics to cross the interdisciplinary interfaces between the natural and social sciences.

Bryant, Steven (Primitive Logic, Inc.)
COMPARATIVE ANALYSIS OF THE MODEL OF COMPLETE AND INCOMPLETE COORDINATE SYSTEMS

The continued mathematical validity of the Einstein and Lorentz transformation equations has been mathematically challenged based on namespace analysis and on apparent violations of the rules of algebraic substitution. In addition, the Einstein-Lorentz Special Relativity equations do not properly incorporate frequency into the derivation because they overlook its bi-directional nature and do not account for superposition of waves principle.

Furthermore, both Einstein and Lorentz use their equations to transform points instead of lengths. He we compare and contrast the essential characteristics of the Einstein-Lorentz models with the model of Complete and Incomplete Coordinate Systems, which introduces a revised set of length-based transformation equations, addresses the bi-directional nature of frequency, and adheres to the superposition of waves principles. The model of Complete and Incomplete Coordinate Systems is a wave medium (aether) based model that is generalize to apply to oscillating phenomena and moving systems, does not suffer from the same mathematical problems as the Einstein-Lorentz derivations, and uses equations that yield equal or better results that the existing Einstein-Lorentz equations.

Burger, Oskar (University of New Mexico) and William Burnside (University of New Mexico)
ORIENTATION TO THE GOALS, MOTIVES, AND DEFINITION OF HUMAN MACROECOLOGY

We present the definition and rationale behind the developing field of human macroecology. We emphasize the interdisciplinary and collaborative nature of this approach to social science by outlining its connections to a wide range of other areas of research that also focus on big picture dynamics in human systems. In doing so, we present some of the more salient emergent patterns that have been examined empirically and discuss some of their likely underlying mechanisms. Additionally, we provide framework for the symposium by highlighting commonalities in theme and approach among the papers which follow.

Burnside, William (University of New Mexico) and Jordan Okie (University of New Mexico)
ECOLOGY OF RANGE SIZE AMONG TRADITIONAL HUMAN FORAGERS: MACROECOLOGICAL IMPLICATIONS FOR CULTURAL DIVERSITY PATTERNS

Indigenous human cultures display consistent geographic patterns of ethnic and linguistic diversity and group and territory size. As with biological species, cultural groups are more concentrated in the tropics. In species and populations generally, the geographic range reflects foraging ecology and energy requirements. We hypothesize that similar forces constrain range sizes of human societies: 1) environmental productivity will decrease territory size by supporting given populations with less land, while 2) reliance on hunting will increase territory size because energy is lost ascending food chains. Using a database of 339 traditional foraging societies, we used OLS regressions to test correlations between range size and climate; range size and mobility; and range size and foraging mode (gathering, hunting, fishing). We develop mathematical theory to explain the resulting macroecological patterns, guided by the effects of temperature on productivity and kinetics, or the rates of biological reactions and ecological interactions. Analyses of datasets on both traditional foraging societies and global indigenous cultural diversity support our theory. Combining macroecological analyses of ethnographic data with mechanistic ecological theory helps explain general patterns of human foraging ecology and cultural diversity.

Carles, Elizabeth (Sandia National Laboratories), Bryan Carson (Sandia National Laboratories), Jaclyn Murton (Sandia National Laboratories), Steve Branda (Sandia National Laboratories), Cathy Branda (Sandia National Laboratories), and Jens Poschet (Sandia National Laboratories)
RE1A TRANSLOCATION IN RESPONSE TO DIFFERENT LPS CHEMOTYPES IN MURINE MACROPHAGES

LPS is a major component of the outer membrane of Gram-negative bacteria, acting as an endotoxin and eliciting a strong immune response. LPS binds to the TLR4 receptor complex and initiates the secretion of pro-inflammatory cytokines. One important step in the TLR4 signal transduction cascade is the translocation of the nuclear factor NF954;B protein into the nucleus. NF954;B is a member of a large family of eukaryotic transcription factors which share a highly conserved Rel DNA-binding/dimerization domain. In

macrophages, RelA (p65) dimerizes with p50 and activates transcription. NF954;B is normally bound to an inhibitory factor IkB and held inactive in the cytoplasm. Following TLR4 activation, IkB kinase (IKK) phosphorylates IkB, leading to its degradation and the release of NF954;B. NFkB stimulation also triggers the transcription of IkB, thus down-regulating its own activity by inhibiting NF954;B translocation. These complex feedbacks can create oscillations that have previously been observed in EMSA assays and in live cells. Previous live-imaging studies used RelA-dsRed fusion proteins in HeLa and SK-N-AS cells. In order to better understand RelA oscillations and their importance in innate immunity, we created mouse macrophage cell lines stably expressing RelA-GFP. Single cell time-lapse imaging of RelA localization showed oscillations following LPS challenge. Macrophage response to different LPS chemotypes was also tested and different oscillation patterns were observed.

Carne, Eric (University of New Mexico), Sharon Master (University of New Mexico Health Science Center), De Anna Lopez (University of New Mexico), Vojo Deretic (University of New Mexico Health Science Center), C. Jeff Brinker (University of New Mexico/Sandia National Laboratories), and Graham Timmins (University of New Mexico Health Science Center)

NANOSTRUCTURED CARRIER FOR LIVE VACCINES: EXTENDED VIABILITY OF TUBERCULOSIS VACCINE

The provision of live mycobacterial vaccines against TB, in countries where refrigeration is not available, remains problematic and a major hindrance. We have used a lipid-inorganic nanostructured matrix to extend the viability of the vaccine strain of TB, M. bovis BCG. Nanostructures were made, held at 37oC, and viability assessed. We hypothesized the unique non-repliactive persistence induced by this matrix would enhance viability. Our data indicate that viability in the matrix can exceed 50% after 18 months aging. This approach may form the basis of programs delivering live TB vaccines worldwide for TB elimination programs.

Cohen, Zoe (University of Arizona) and J. John Cohen (University of Colorado Medical School)

TWO STATES, TWO SCHOOLS, TWO COURSES, ONE BLOG

Is it possible for students in different courses, at different academic levels, and at different Universities, to learn cooperatively using the Internet? In the same semester we taught a colloquium on inflammation for undergraduates at Arizona and a lecture course in immunology for graduate students at Colorado. Students in these programs only get to see each other in class, being otherwise scattered about large campuses, so there is little time for discussion and peer interactions. Instead of requiring the usual essays and term papers, we decided to set up a single blog (an online discussion group), for the two courses, and required all students to post as well as comment on other posts. We felt that this would encourage a dialog, and introduce peer influences on student writing, which is normally directed at a single reader, the instructor. Furthermore, we were interested in observing the interactions between the 33 Colorado students, who were older and in many cases experienced professionals, and the 20 younger Arizonans. We used a blog (http://inflammablog.blogspot.com) because it is essentially impossible to enroll two classes in a single courseware site. The undergraduates, who posted on assigned topics, were hesitant to engage freely in discussion; they said they did not feel they had enough knowledge. The graduate students posted on anything of interest, and their comments reflected their expertise. In addition, their influence positively affected the undergraduate's level of scholarship. We believe this approach, with refinements, can turn into much more than a simple information exchange.

Cole, Rhonda (STARBASE La Luz Academy)
EVOLUTION OF AN EDUCATION OUTREACH PROGRAM

This paper will discuss the evolution of the STARBASE® La Luz Academy, an education outreach program sponsored by the Air Force Research Laboratory (AFRL) at Kirtland Air Force Base (KAFB) and managed by New Mexico Tech. Our goal is to generate student interest in science, technology, engineering, and mathematics (STEM) through unique hands-on experiences for students in grades 5 through 12. The program started in 1994 with the implementation of two high school activities and, over fourteen years, has evolved to include five distinct "flights". Most recently, we added the Intro to Systems Engineering Flight to introduce 8th grade students to the concept of systems engineering through computer programming and robotics. The planned evolution of the STARBASE® La Luz Academy, as well as the development of each individual flight, occurred using a systems engineering methodology. This approach has resulted in a program that provides a variety of STEM activities that are cohesive, flexible, and continually improving. As part of our evolution, we have collaborated with several individuals and programs that have strengthened the quality and impact of our program.

Cooney, Austin (Baylor College of Medicine)
BIG IMPACT OF SMALL RNAS

Small non coding RNAs have been known for decades to play important roles in translation of proteins and the splicing of genes. However in the last few years after the discovery of functional regulatory micro RNAs (miRNAs), that was recognized recently with awarding Nobel prizes, there has been an explosion of research in this area, that has major implications for bioscience and health. These miRNAs play regulatory roles in gene expression by either targeting RNA for degradation or inhibiting translation. Genomic-wide analysis of miRNA expression and function has required collaborative multidisciplinary teams in chemistry, bioinformatics, genomics and biology to come together to attack such simple questions but on a massive scale. In this symposium we will have talks that focus on the contribution of each of these aspects to the field of small RNA analysis.

Cromer, Donna (University of New Mexico)
WHY GOOGLE IS NOT ENOUGH: INFORMATION FLUENCY FOR SCIENTISTS AND ENGINEERS

Many students and even experienced scientists and engineers use a haphazard approach to finding the background information needed for projects and research. There are excellent research tools available, but too many people don't know about them. They sometimes think they already know about all the important literature in their area or rely on Google or their friends, sure that they won't miss important material in their interest area. After all, everything is available on the Internet, right? This presentation will focus on the many excellent sources of information in science and engineering available, both free and for a fee.

Cron, Brandi (University of New Mexico), Laura J. Crossey (University of New Mexico), and Diana Northup (University of New Mexico)
GEOMICROBIOLOGY AND GEOCHEMICAL ENERGY FOR MICROBIAL METABOLISM IN CO2-RICH SPRINGS OF THE TIERRA AMARILLA ANTICLINE, NM

Deep-sea hydrothermal vents and volcanic environments are a consequence of tectonic forces and fluid circulation near earth's surface. Along the Tierra Amarilla Anticline there are CO2-rich mound springs that are also a consequence of interactions between deeply sourced ("endogenic") fluids and the extensional character of the earth's surface. Archaeal communities similar to those found in Yellowstone National Park are known to utilize

chemical species within the Tierra Amarilla Anticline for metabolic processes. In this study we prepared oligotrophic media to culture microorganisms from both water and iron and sulfide rich muds at the Tierra Amarilla Anticline. We also sampled the springs for gas and water chemistry and established an analytical geochemistry dataset. This dataset provided us with useful thermodynamic constraints used in a geochemical computer code. The values from the computer code were then used to build a comprehensive list of potential metabolic reactions. We were able to predict energy available to fuel specific fungal and bacterial species found at the Tierra Amarilla site. There is a flora of microbial life in these springs, and knowledge of the microbial bioenergetics in these systems is limited. By establishing how this location acts thermodynamically, we can come one step closer to defining the relationship between microbial and geochemical interactions in extreme environments by providing pertinent information that will help predict microbial growth parameters in other CO2-rich springs.

Dallas, Tim (Texas Tech University) and Toni Sauncy (Angelo State University)
RESEARCH EXPERIENCE FOR UNDERGRADUATES IN MICRO AND NANO DEVICE ENGINEERING (MANDE)

The MANDE program provides undergraduates with knowledge and training needed to make research contributions to Microelectromechanical Systems (MEMS) and advanced materials. Through a ten-week summer program, students develop the technical background and research training needed to compete for future industrial internships and encourages students to attain advanced degrees and employment in important technology areas. In the first summer, seven men and three women, representing four universities, participated in research projects at TTU and ASU. Projects included using a digital micromirror device for holographic data storage, designing an array of MEMS devices for education, biomedical applications, sensing, and micro-positioning systems, applications of nanoscale coatings, and fabrication of nanoporous structures. Each student was responsible for the progress of an independent project, supervised by faculty mentors. The program began with an eight hour MEMS short-course at TTU. Additional tutorials were provided for design tools required to utilize Sandia's SUMMiT MEMS process and finite element simulation tools. Students acquired hands-on experience with basic fabrication techniques using a MEMS-in-a-Box kit. Field trips were taken to a semiconductor foundry (X-Fab), the TTU Nano Tech Center and electron microscopy facility. The program concluded with a day long conference that featured student research presentations, mock interviews, and a review of the program by the external advisory board. A student-advisory board meeting and a faculty-advisory board assessment session were valuable in identifying program areas which can be improved and expanded. The consensus of the external advisors, faculty, and students was that MANDE was a valuable experience that will shape future education and career choices.

Daniel, Mary Jo (New Mexico Public Education Department)
SUCCESSES AND CHALLENGES OF COLLABORATIONS BETWEEN SCIENTISTS AND PUBLIC SCHOOLS

In 2007, the New Mexico Legislature created the Math and Science Advisory Council (MSAC), comprised of representatives from public schools, higher education, and STEM businesses. This group meets regularly to provide leadership and guidance to the Public Education Department in the improvement of math and science education throughout the state. The MSAC drafted an ambitious statewide strategic plan and is actively supporting its implementation. This presentation will highlight the major components of the statewide plan and the roles scientists from academia and industry play in systemic improvement on a statewide scale.

Davenport, Justin (University of Houston-Clear Lake) and Dennis Casserly (University of Houston-Clear Lake)

AN ANALYSIS OF AMBIENT OZONE CONCENTRATIONS AND ABSENTEEISM AT THREE HIGH SCHOOLS IN THE HOUSTON - GALVESTON AREA

Continuous ozone measurements were collected at three high schools (Clear Brook, Clear Lake, Clear Creek) using EPA reference instruments. Statistical analyses were conducted utilizing daily peak 1-hour and daily maximum 8-hour ozone values at the three sites over a sample period of < 905 days in which all three stations were operational. During the study period, the 1-hour standard (0.12 ppm) was met or exceeded on 15 days and the 8-hour standard (0.08 ppm) was met or exceeded on 62 days. The analyses indicated no statistically significant difference among the sites using the 1-hour or 8-hour average values. The ozone concentrations at the three sites were highly correlated ($r > 0.911$), with $r = 0.984$ for the Clear Lake and Clear Creek stations. The peak 1-hour and 8-hour concentrations were also highly correlated ($r > 0.959$) with the 8-hour values averaging 0.8 of the 1-hour values. Data plots showing the temporal trend in ozone concentrations illustrate the strong relationships. Attendance records for the 2006-2007 school year were also collected and used to calculate an absentee rate (AR) expressed as a percent of the total student population for each school and were analyzed relative to the corresponding ozone concentrations using lag periods of 0, 1 and 2 days. Correlation and regression analyses indicated no consistent significant relationship between absenteeism and ozone concentrations at any of the three schools, so that the ozone concentrations observed were not sufficient to result in acute health effects as reflected in absentee rates of high school students.

Davis, Helen Elizabeth (University of New Mexico), Oskar Burger (University of New Mexico), Michael Gurven (University of California-Santa Barbara), and Hillard Kaplan (University of New Mexico)

PEOPLE AS ISLANDS: THE THEORY OF ISLAND BIOGEOGRAPHY AND PATTERNS OF DISEASE ACROSS HUMAN POPULATIONS

Infectious disease plays a major role in human population dynamics. Here we investigate host-parasite interactions across space and time using data collected among the Tsimane, a traditional forager-horticulturalist society in lowland Bolivia. Community ecology and human macroecology models are used to address the co-evolution of hosts and disease with respect to parasite virulence and spread, and human infection and re-infection rates. GIS mapping provides a spatial distribution pattern for 17 helminth and protozoa infections across the population (n=3,000). Application of MacArthur and Wilson's (1967) theory of island biogeography allows us to identify disease reservoirs and analyze their contribution to population dynamics and disease spread. Counter-intuitively, higher population density (nodes) did not correlate with parasite density, suggesting that other factors such as wealth and immune system integrity are important. Particular attention is given to children's health, with cognitive performance correlating significantly with parasitic burden and a measure of immune system integrity (IgE). Finally, we discuss the relationship of pathogen load across human populations and how these patterns have global significance.

Deen, Glen W. (NPA)

THE TIME OF PERIHELION PASSAGE AND THE LONGITUDE OF THE PERIHELION OF NEMESIS

If Nemesis, a hypothetical brown dwarf star, passed through the inner solar system in pre-historic times, it should have disturbed the orbits of the inner planets. If the star's orbit is inclined by 90 degrees, the planet orbit changes could have been minimal if they were all on the opposite side of the Sun during the passage unless a substantial mass was transferred from the star to the Sun. In that case their orbital elements should have been changed by

the sudden increase in the Sun's mass. The new longitudes of their perihelia should have lined up with Nemesis's perihelion at the time of passage, and the inner planets should have all been at their new aphelia at the time of passage. J.L. Simon, et. al. [1994], gave sixth-order polynomial formulas for the computation of the mean elements of the planets over time. This alignment of the inner planet polar longitudes with each other and with their own major axes occurred for Mercury, Earth, and Mars on 14 November, 21122 BCE (-21120.13 CE = JD -5993070.36). Venus's orbit is too circular to have a well-defined perihelion longitude. If Mercury's classical perihelion longitude is used, the standard deviation for the major axis alignment is 1.37 degrees. If the conventional relativistic advance of 43.0 arcseconds per century is used for the longitude of Mercury's perihelion, the standard deviation is 0.074 degrees. For an advance of 45.27 arcseconds per century, the standard deviation is 0.027 degrees. The mean polar longitude (the true anomaly plus the longitude of the perihelion) of the three planets is 217.10 degrees, and the standard deviation is 4.64 degrees on this date, and this is a minimum. Their mean major axis longitude is 217.10 degrees (aphelia for Mercury and Earth; perihelion for Mars), and the standard deviation is 0.027 degrees, and this is also a minimum. This alignment is unique in history. The longitude of perihelion of Nemesis is 217.10 – 180.00 = 37.10 degrees. The paper offers an explanation as to why Mars's major axis is inverted.

de Hilster, David (NPA)
THE GROWING EARTH

It is quite obvious to most casual observers that South America and Africa were at one time joined. But it is quite unknown to al-most all that Asia, Australia and the Americas also were at one time joined. This evidence leads to only one conclusion: 200 million years ago, the earth's continents were all together on a much smaller orb and since then, the earth has been growing significantly. There is strong visual evidence that other bodies in the universe are also growing including other planets and moons. Although there currently is no one accepted mechanism that causes this growth, there are a number of scientists proposing mechanisms although it will probably take some time for these to be confirmed experimentally. In the mean time, evidence is mounting that the earth has grown including in the areas of geology, paleontology, flora and fauna fossil records, GPS, and simple physics that clearly show that the earth's diameter and mass have been increasing and continues to do. This evidence points to the most important question in science today: what is the mechanism that causes this growth? Although not covered in this paper, this mechanism must necessarily span the subatomic to the macro structures such as galaxies and everything in between.

de Hilster, David
CAREZANI FRAME REDUCTION

In the early 1940s, Ricardo Carezani, an Argentinean engineering student who later received his doctoral in physics, found that more than one frame in the Lorentz Systems in Relative Motion's derivation was, one of them, mathematically, and physically redundant. The removing the redundant frame and using a single one resulted in a new set of equations that are, conceptually in motion, Newtonian, have a logical explanation, even does not blow up at the velocity "c", and presents no paradoxes. The new "Autodynamics" equations have been subsequently used to improve current mainstream equations such as the Compton Effect, to derive Bohr's Atom without the need for wave equations, and to describe subatomic interactions without the need for the neutrino, etc. The math behind the redundant frame will be shown, the derivation of the new Autodynamics equations, as well as the mismatching exponent form Einstein's attempt to generate the Lorentz equations from special relativity.

Dudziak, Martin J. (Golden Specialty Laboratory, Ltd.)
MULTIMODAL APPROACHES TO NEW ENERGY GENERATION INCORPORATING ARTIFICIAL PHOTOSYNTHESIS

Research in artificial photosynthesis is increasingly promising along two fronts – capture of CO2 for production of fuels, O2 and reduction of atmospheric CO2, and generation of electric power. This paper examines some advantages of linking artificial photosynthesis (AP) with other technologies that can be employed to optimize, even maximize, the value of the air and light available to a large-surface installation such as a “synthetic tree” or “artificial forest” for providing clean air and power. The combination of AP with conductive polymer based photovoltaics and infrared-based PV power generation, within the exposed operational surfaces of an AP system, is one path for maximizing the utility of both sunlight and warm cloudy skies. Additionally, there is the value of employing, as part of the engineering for “leaf” and “branch” structures, a hybrid of carbon-based composite materials that will provide both flexibility and rotational properties, enabling the energetic surfaces of the structure to change positions in manners that will increase the exposure to sunlight and heat. Additionally, use of complex dynamical systems theory will aid the design of synthetic tree power plants and air cleaning structures, providing behavior and operation more like natural trees than traditional man-made towers, improving both operation and structural stability. Finally, there are important values to consider in the integration of wind power generation with an AP-based synthetic tree or forest. The same structures, built with newly emerging composites and offering greater mobility and flex to wind forces, may provide power and air cleaning that comes also from turbine systems that in turn generate power by more traditional methods.

Dwyer, Brian (Sandia National Laboratories)
ARSENIC TREATMENT IN WATER

Small water systems (~ 75 connections or less) with ambient arsenic (As) levels of 11-20 ppb might achieve low cost compliance with the new US arsenic limit of 10 ppb by using in-tank arsenic filtration. In-tank filtration utilizes a pump to re-circulate As-laden water through a small vessel containing commercially available arsenic adsorption media. Theoretical calculations, pilot and field testing indicate that for small water systems in-tank arsenic removal is substantially more efficient and less costly than conventional arsenic removal approaches primarily because it requires a significantly smaller installation and less operation and maintenance. Media utilization (water volume treated per media unit weight) is also potentially two to three times greater than conventional arsenic removal systems.

Eisenstein Robert (Santa Fe Alliance for Science, APS, NM Public Education Dept.)
SUCCESSES AND CHALLENGES OF COLLABORATIONS BETWEEN SCIENTISTS AND PUBLIC SCHOOLS

Dr. Robert Eisenstein, founder of the Santa Fe Alliance for Science, will present his perspective as a community member and retired scientist. The Santa Fe Alliance for Science (www.sfafs.org) was created almost three years ago as a means of involving Santa Fe's very large community of engineers, mathematicians, and scientists in K-12 science education. Now comprising about 75 volunteers, Alliance members provide content expertise in several areas of science and in math. They do this via student interactions (subject tutoring, longer-term project mentoring, one-of-a-kind appearances in science classes, advising on science fair projects, teaching science courses, providing career advice), as well as interactions with teachers (providing professional development content expertise, helping in classrooms, and judging science fairs). About once every 6 weeks we hold an evening "Science Cafe' for Young Thinkers", featuring an expert presenter in a discussion Q&A format. Average attendance has been about 60 kids at each event. The

Alliance website serves as a central coordinating point for SFAFS activities, providing convenient access to local science events, math and science content information, and a convenient way for students and teachers to ask science questions directly. SFAFS activities and plans are quite similar to those of precursor groups such as the SciAd programs originating at Sandia National Labs and in Las Cruces. The activities of the SFAFS are carried out under a formal partnership with the Santa Fe Public Schools.

Eskew, Russell Clark (University of Texas-Austin)
TIME AND COMPLEX HYPERBOLIC TRIGONOMETRY

At the April, 2007 SWARM Eskew presented the original "Time and Complex Hyperbolic Trigonometry." What makes this revision possible is a thorough re-doing of the data for space and time. Beginning with an alternative to Euler's formula, a hyperbolic rendition of complex numbers challenges the very way trigonometry is presented. Its application to Science and Technology may be understood as an electromagnetic "propulsion system" in the way we formulate the near universe. We change from the standard Poincare model to a geodesic model of hyperbolic geometry pertaining to complex numbers. Newton's "force equals mass times acceleration" is reduced to three Galileo-like accelerations which describe Time using electromagnetic frequencies and radian wavelengths of light-speeds. Understood algebraically, our mathematics is built around special relativity, quantum mechanics, even possibly string theory, consistently. The data of the electromagnetic spectrum near universe resembles Gauss's experiment of measuring hyperbolic distance atop three mountain peaks with mirrors. The distances of "Time..." are based on the measurements of the astronomical Parallax parsecs of the near universe stars. The paper represents Eskew's combinative work of science, technology and mathematics expressed in 19 pages. The geometer H. S. M. Coxeter influenced Eskew's interest in geodesics. Advanced theories of hyperbolic geometry such as Poincare's disk or Mobius transformations are simplified with computer-derived.

Finley, Ray (Sandia National Laboratories) and Hal Cardwell (USACE)
COLLABORATIVE MODELING PROCESS FOR WATER RESOURCE MANAGEMENT

Water resource management requires collaborative solutions that cross regional, state, and federal judicial boundaries. As a key technical contributor to solving critical resource and security problems on a national scale, Sandia National Laboratories is well positioned to team with local, state, and federal water experts to model growing water concerns in the country. Unlike the traditional approach of compartmentalization of tasks and expertise, Sandia uses a collaborative modeling method that is inclusive, multidisciplinary, quantitative, and transparent to all interested parties. Furthermore, in support of the collaborative approach, a system dynamics (SD) methodology is adopted for creating validated hydrologic models that can be linked with other systems such as economics and/or energy use to support in multi-objective decision making. This presentation outlines three collaborative modeling projects that Sandia has developed in New Mexico and in Oregon. In New Mexico, Sandia scientists have worked with water management stakeholders to develop decision support tools using system dynamics in two important basins: the Middle Rio Grande Basin and the Gila-San Francisco Basin. Teaming with the Institute for Water Resources (IWR) and water managers in the Willamette River Basin, Sandia also developed a tool to address reservoir and outfall management options to comply with the total maximum daily load for temperature in the basin. In all cases, the collaborative modeling process lead to better understandings to both the public and the scientists of the intricate coupling between water resources and demand and the impacts to human and ecological health.

Fischer, Kurt T. (Weston Solutions, Inc.)
GREEN ROOFS: A DISCUSSION OF SYSTEMS, CONSTRUCTION, AND BENEFITS

Green roof technologies are well established in many countries throughout Europe, and are gaining momentum in several regions of the United States. This presentation will introduce the concept of green roofs, summarize the types and construction of green roofs, and describe the qualitative and quantitative benefits attributed to these systems. Some of the many advantages of green roofs include lengthening the life of the waterproofing system, increasing building thermal efficiency, reducing the urban heat island effect, controlling storm water runoff quantity and quality, providing sound attenuation, promoting biodiversity, and increasing property values. When taken together, these benefits can yield a financial incentive to the owner that can offset the higher initial cost of green roof implementation. The content of this discussion will be based primarily on modular green roof systems due to their added advantages. The presentation will also touch on unique challenges to designing and implementing green roofs in various climatic regions; and the potential for collaboration and integration of green roofs with other green building technologies such as building water management systems and photovoltaic arrays.

Fisher, Deborah (University of New Mexico)
THE PHYSICS OF RESEARCH TEAMS

Effective group work is a critical component of any high-performing research collaboration, and any group of people attempting to partner is essentially a human system. That human system can often become damaged, demonstrating, disengagement, disillusionment, and outright disruptive actions by participants, eliminating any hope of high performance. Such a systemic problem requires a systemic and quantitative solution. In this session, an engineering faculty member and a former engineer from Intel will demystify the behavioral aspects of human systems and present a pragmatic, quantitative and structured approach to maximize team performance.

Fritzius, Robert (NPA)
SN 2006GY VIEWED FROM A MODIFIED RITZIAN PERSPECTIVE

Supernova 2006gy, which is reputed to be the “brightest stellar explosion ever recorded,” is generally considered to be associated with spiral galaxy NGC 1260, some 240 million light years from the solar system. On the other hand, three astrometrically determined positions for the supernova are radically inconsistent with the calculated distance to the spiral galaxy. Walter Ritz’s (1908) ballistic emission theory (which predicts apparent time modulation for close binary stars) as modified by J.G. Fox’s (1965) extinction theorem, is used to explain the kinematics of the apparent proper motion anomalies for the supernova. Ritzian relativity predicts that the progenitor of SN 2006gy will eventually be found not to be the death of an extremely massive star but rather a (1913) de Sitter binary star whimsical image, and it will be an nearby neighbor to the solar system.

French, Todd (Mississippi State University), R. Hernandez (Mississippi State University), J. Hall (Mississippi State University), A. Mondala (Mississippi State University), M. White (Mississippi State University), and G. Zhang (Mississippi State University)
WASTEWATER TREATMENT FACILITY BIOREFINERY FOR BIOFUELS

The United States is heavily dependent on foreign oil and this dependence on such a large volume of fuel that is largely supplied by foreign entities is a threat to national security. A better alternative would be to domestically produce this fuel. Unfortunately, this alternative is limited by current reserves and production rates that cannot support civilian needs. If domestic sources of fuel are to replace those from foreign sources, alternative fuels will be a factor in reaching that objective. Lignocellulosic biomass is a feedstock from

which fuels could be produced. Current research in the US has focused on the production of ethanol from lignocellulose but this work has many obstacles to overcome. Work at Mississippi State University has identified an alternative process for the production of a fuel from lignocellulose. Using oleaginous microorganisms, those microbes capable of producing greater than 20% of their dry mass in triacylglycerides, hexoses and pentoses contained in lignocellulosic biomass can be converted to triacylglycerides. This triacylglycerides, i.e. biocrude, can be converted to a biodiesel, green diesel, or JP-8 fuel using an abiotic catalyst. Work with these oleaginous microorganisms has shown that they can accumulate as much as 40% of their dry body weight in biocrude when grown on artificial acid hydrolysate and 26% of their dry body weight when feed an acid hydrolyzate from switch grass. Additional work has also shown that municipal wastewater is an excellent growth medium for the cultivation of these oleaginous microorganisms. Using the known volumes of wastewater generated yearly in the US it is possible to generate ~7 billion gallons or biocrude. This is enough biocrude to significantly reduce the amount of foreign oil derived fuel.

Gao, Xiolian (University of Houston)
TO LEARN THE MULTI-FACET PROPERTIES OF RNAS - METHODS AND MESSAGES

Rich information on RNA molecules has been accumulated over a long period time of studies. Now, new findings are heard every day about new types and new functions of RNAs, many researchers spend an extensive amount of resources and effort to study what are found. The results of these studies are extended to many application areas such as small RNA-based target-specific intervention of biological activities. Fundamentally, the behavior and interactions of these molecules are ruled by their inherent properties; it is therefore revealing that the new findings can be understood at a basic level. We will discuss our use of a microfluidic based highly flexible oligonucleotide microarray platform and a broad range of biophysical and biochemical tools to examine the molecular aspects of ncRNA molecules and to explore methods for better understanding the complex roles of miRNA and ncRNA in biological systems.

Garcia, Daniel (University of New Mexico), Ulises Martinez, Fan Yang, Marwan Al-Haik, Shane Trinkle, Scott Miltenberger
NANOCHARACTERIZATION OF TOOTH-FILLING MATERIALS

This study utilizes novel characterization techniques for testing both the human enamel and dentin together with three biocompatible dental filling materials; epoxy nanocomposite, silver amalgam, and glass ionomer. Nanoindentation tests were performed to obtain accurate hardness and reduced modulus values for the materials. We utilized Nanoscratch tests to obtain critical load in scratch test and resistance to sliding wear. The novel characterization techniques utilized might assist in better understanding the mechanical behavior of the dental fillers and thus facilitate the design of robust fillers with excellent mechanical properties.

Giacomelli, Gene A. (University of Arizona)
CONTROLLED ENVIRONMENT OPPORTUNITIES….IT'S NOT JUST TOMATOES, BUT A TECHNOLOGY PLATFORM THAT WILL ENHANCE THE QUALITY OF LIFE

Controlled Environment Agriculture (CEA) also known as Protected Agriculture is defined as an integrated science and engineering-based approach to establish the most favorable environmental conditions for plant productivity while optimizing resources including water, energy, space, capital and labor, and thereby to provide the desired plant product or biological processes under controlled and predictable conditions. The Greenhouse is well-known as a CEA facility for plant production, yet it has much untapped potential, and is being transitioned from a strictly agricultural use structure to a societal structure for

unique and even critical applications. CEA is evolving into CE, or simply, Controlled Environments, because it possesses the capability and flexibility to do so, and it has the potential for success. CE systems are presently helping to feed the world with CEA technologies, while utilizing energy, labor and water resources effectively. However in the future society will employ CE as the platform for applications and implementation of new technologies and their industries which utilize plant physiological processes for: Energy generation [biomass fuels, photovoltaics]; Space colonization life support [recycling all resources]; Remediation of the biosphere, including the atmosphere [carbon sequestration] and water [phytoremediation of salts, heavy metals]; Production of phtyochemicals for improved human health [lycopene]; and Plant-made proteins [for biopharmaceuticals, agro- and industrial pharmaceuticals]. The CEAC (Controlled Environment Agriculture Center) and The University of Arizona in collaboration with ITDC [Innovative Technologies Development Center] have joined expertise and are dedicated to the development of CE technologies and worldwide applications, through the education of young people about the science and engineering of CE and hydroponic plant support systems. ITDC is a not-for-profit corporation dedicated to integrating local resources for developing sustainable systems and global commerce to enhance the vitality of Arizona. Together, we are creating a pipeline of opportunities (example is Sonora Transplants) that utilize the CE technology platform for the 21st century.

Gin, Douglas (University of Colorado)

NANOSTRUCTURED POLYMERS FOR ENHANCED CATALYSIS AND SEPARATIONS BASED ON THE POLYMERIZATION OF LYOTROPIC LIQUID CRYSTAL ASSEMBLIES

Liquid crystal (LC) molecules have the ability to self-organize into a variety of ordered architectures that are ideal for the design of nanostructured organic materials and investigating the effect of small-scale organization on bulk properties. The focus of our research program is the design of polymerizable LC starting materials as a means of forming robust nanostructured materials with enhanced function. One of the most important goals in this work is the design of LCs that can carry or accommodate polymerization reactivity, as well as an orthogonal functional property of general interest. Through appropriate molecular design, these LC monomers self-assemble into supramolecular assemblies with predictable nanoscale geometries. These LC phases are then photopolymerized into robust polymer networks with preservation of their small-scale structures. This approach allows us to investigate the effect of nanometer-scale architecture on bulk properties, as well as to engineer chemical environments on the nanometer-scale for several application areas. In this talk, functional polymer systems based on the cross-linking of lyotropic (i.e., surfactant) LC assemblies formed in water will be presented. In particular, the inverted hexagonal LC phase, which contains ordered cylindrical aqueous nanochannels, will be presented as one example of our general approach using lyotropic LCs as a materials synthesis platform. Issues in the design, derivatization, and photopolymerization of functional amphiphilic monomers that adopt this LC architecture will be discussed. The use of the resulting polymers in two areas of application will be presented: (1) as size-selective heterogeneous catalysts, and (2) as nanoporous membranes for molecular size-based separations. Issues pertaining to the contribution of nanoscale architecture to the performance of these systems will be highlighted. More recently, second-generation cross-linked lyotropic LC materials based on a bicontinuous cubic phase have been developed that contain a 3-D interconnected water layer manifold system with a uniform gap size of 0.75 nm. These lyotropic LC membranes are able to cleanly size-exclude hydrated salt ions from water in aqueous separations and small organic solutes <1 nm in size from water vapor in gas barrier applications. Opportunities for tailoring the nanoscale chemical environment and controlling the nanopore size in these materials through molecular design will be presented.

Glenn, Gabrielle (United States Air Force Academy) and Edward T. Unangst, Jr. (United States Air Force Academy)

WINTER USE OF MOUNTAIN MAHOGANY BY DEER ON THE AIR FORCE ACADEMY, A 10-YEAR ASSESSMENT (1990-2000)

The Air Force Academy encompasses 19500 acres and supports a viable mule and white-tail deer population. These resident herds rely heavily on mountain mahogany for its winter food source. To assess deer impact on this resource, we evaluated mountain mahogany growth and production at numerous locations, combined with deer browse use at these locations over a 10-year period (1990-2000).

Gomez, Leo S. (Biomoda, Inc.), John Cousins (Biomoda, Inc.), Constance J. Dorian (Biomoda, Inc.), and Stephen M. Gomez (Biomoda, Inc.)

NEW NON-INVASIVE TECHNOLOGY FOR THE EARLY DETECTION OF CANCER AT THE CELLULAR LEVEL

Biomoda, Inc., a development stage medical diagnostics company headquartered in Albuquerque, New Mexico, is developing in-vitro diagnostics for non-invasive testing for cancer at the cellular level. Detecting cancer at its earliest stages allows for early treatment and offers the best chance for long-term survival and/or cure. Biomoda's technology is based on a patented porphyrin molecule that preferentially binds to cancerous or aberrant cells extracted from the body as sputum, blood, or urine. Cancerous or aberrant cells that bind porphyrin glow red under ultraviolet light. Non-cancerous cells do not fluoresce. The technology, which was developed at Los Alamos National Laboratory, will first be applied to early detection of lung cancer, which is the leading cause of cancer-related deaths in the United States. Bladder cancer, cervical cancer, breast cancer, and prostate cancer, among others, can also be diagnosed at a very early stage with Biomoda's technology. Biomoda seeks to team with researchers at other institutions on further research and in the conduct of clinical trials. Biomoda is seeking international partners interested in taking advantage of the advances in world-wide electronic communications to collaborate in the development and use of Biomoda's non-invasive early-stage cancer detection technology.

Gómez, Stephen M. (Pocagua Consulting)

BIODIESEL WITH UNIQUE PROPERTIES MADE FROM CASTOR OIL

The United States was the world's leading producer of castor oil between World War II and 1970. At the height of production there were almost one million acres in cultivation producing about 175,000,000 lbs of castor oil annually. West Texas and southeastern New Mexico accounted for 1/5 of the total production, with 26 crushing mills in Texas alone. In southern Texas farmers were able to get four crops per year with average yields of 1,000 lbs oil/acre/crop. Today, there are no mills for crushing castor beans in the US and less than 40,000 acres are in production in Texas. US production disappeared due to new competition from Brazil, China and India and liability concerns about the toxin, ricin, present in the plants and seeds. Castor oil is currently used in the production of over 700 products from cosmetics to bullet-proof glass and is listed as a strategic material in the Agriculture Materials Act of 1984. The properties that make castor oil useful for so many products also make it an attractive source as feedstock for biodiesel. Castor bean is 14 times as efficient as soybean in water use, 11 times as efficient in phosphorus use and produces 6 times as much oil/acre. Fatty acid methyl esters made from castor oil do not oxidize, are anti-microbial and don't freeze until -30°F. However, although legal, the current anti-terrorist fears make it impossible to cultivate castor bean in the US. The properties of castor-diesel and attempts to remove the toxins from the plant will be discussed.

Gómez, Stephen M. (Pocagua Consulting)
CUTANEOUS UPTAKE OF FATTY ACID METHYL/ETHYL ESTERS

It has been claimed than biodiesel (fatty acid methyl esters; FAME or fatty acid ethyl esters FAEE) are “less toxic than table salt”. FAME and FAEE have no accute or subacute oral toxicity, are “generally recognized as safe” and have been approved for use as food additives by the FDA . FAME/FAEE are metabolized in the intestine and are readily hydrolyzed to the corresponding alcohol and fatty acid. FAME and FAEE are given to infants with fatty acid uptake disorders, because they cause less irritation than fatty acids themselves. FAME and FAEE cause no irritation in skin and eye studies and are neither mutagenic or tumorigenic. However, it has been known for several years that FAEE’s are cytotoxic non-oxidative metabolites of ethanol and can damage mitochondria. FAEE are the causative agent of cirrhosis of the liver and of acute alcohol-induced pancreatitis. In alcoholics, FAEE possibly contribute to hemolysis of red blood cells and may also contribute to cardiomyopathy. The skin of biodiesel producers and mechanics is chronically exposed to FAME or FAEE. Anecdotal evidence suggests that FAME are absorbed through the skin. There have been no studies to date on chronic skin exposure to FAME or FAEE in humans or animals. It is known that FAEE are transported in the blood by albumin and LDL. It is unknown if FAME or FAEE absorbed through the skin are transported to the same organs damaged by FAEE in alcoholics. It is proposed that in the future, long-term biodiesel workers may be subject to organ damage similar to alcoholics.

Greene, Adrienne C. (Sandia National Laboratories), Amanda-Carroll Portillo (Sandia National Laboratories), and George D. Bachand (Sandia National Laboratories)
CONTROLLING NANOMATERIAL ASSEMBLY AND CARGO-SPECIFIC TRANSPORT BY GENETICALLY ENGINEERING A CHIMERIC KINESIN BIOMOLECULAR MOTOR

Living systems use energy-driven processes to direct the assembly of materials within a nanofluidic environment. Biomolecular motors, specifically kinesin, utilize the complex microtubule cytoskeleton to transport and assembly macromolecular material. These active transport systems rely on complex signaling pathways to control motor function and the transport of molecules. Integration of the kinesin-microtubule transport system into hybrid, nanoscale systems for materials assembly is possible, but requires two essential elements: (1) the ability to regulate motor function, and (2) ability to selectively transport cargo. We have demonstrated the ability to control kinesin motor function using a genetically engineered chemical switch, while maintaining the energy supply in the system (i.e. ATP). A zinc-binding site was engineered into the neck-linker region of kinesin to regulate motor functionality. Kinesin motility was completely inhibited in the presence of divalent zinc cations; motor function resumed fully upon chelation of the zinc. The mutant kinesin demonstrated stability to several sequential inhibition and restoration motility cycles. To address the second requisite element, we have begun engineering a chimeric kinesin motor that contains both the chemical on/off switch in the neck-linker region and a cargo-specific binding site at the tail domain. The biotin carboxyl carrier protein subunit (BCCP) gene from Escherichia coli was genetically engineered into the C-terminus of the kinesin switch mutant. This site will create a biotin-avidin interaction site on the tail of the switchable mutant kinesin. Once completed, this novel kinesin motor will be controllable through on/off switching and will selectively transport cargo within nanofluidic systems.

Gribble, L. Astuto (Sandia National Laboratories), E. Phillips (Sandia National Laboratories), J. Gaudioso (Sandia National Laboratories), and T. Zemlo (BioInformatics, LLC)
AN INTERNATIONAL SURVEY OF BIOSCIENCE RESEARCH AND BIOSECURITY PRACTICES

In the past decade, the United States has enacted extensive federal legislation to regulate the possession, use, and transfer of dangerous biological agents and toxins. Unfortunately,

few international laboratories have implemented similar safeguards. Limited data is available concerning the types of pathogens researched in non-US laboratories, and the biosecurity practices employed to maintain those agents. To address these knowledge gaps, a survey was administered to 765 scientists from 86 countries in Asia, Eastern Europe, Latin America, and the Middle East. Methods: In 2005, BioInformatics, LLC conducted a 30-question online survey to members of The Science Advisory Board, an international community of more than 28,000 scientists, physicians, and healthcare professionals who actively study infectious diseases and/or toxins. Survey questions pertained to the types of pathogens used in the laboratory, as well as laboratory biosafety and biosecurity measures, risks, and perceptions. Results: Survey results revealed that participants are actively engaged in research with a wide variety of biological agents. Most respondents in Asia, Eastern Europe, and the Middle East study bacteria more frequently than viruses; Latin American researchers report studying viruses more commonly. Some of the most commonly studied agents include *S. typhi, E. coli* O157:H7, *M. tuberculosis*; HIV, HPAI, Japanese encephalitis, botulinum and toxin and *S. aureus* toxin. Overall, respondents in all regions reported using only simple physical security, such as posted guards (53.5%), locked doors (51.1%) and cabinets (49.5%), all the time. Information security and material accountability were fairly robust in all regions; however, most admitted to poor personnel biosecurity. Breaches of security were generally not feared; accidental rather than deliberate contamination was a more significant concern. Conclusion: This survey provided unique insight into the variety of dangerous agents studied worldwide and uncovered a consistent weakness in laboratory biosecurity and biosafety. Because many of these facilities are located in volatile areas of the world, these findings indicate a significant risk and future actions are warranted to improve the safe and secure handling of biological agents internationally.

Groenfeldt, David J. (Santa Fe Watershed Association)
HEALTHY RIVERS AND WATER SECURITY

Global warming is expected to reduce snow pack levels in the Southwest and increase the likelihood of multi-year droughts. The emerging debate about how to respond focuses on increasing water supplies through dams and related infrastructure and/or decreasing demand through conservation and managed growth (NRDC 2007). This paper suggests an alternative approach based on river ecosystem restoration to enhance aquifer storage while incentivizing water conservation efforts. The case of the Santa Fe River, designated as the most endangered river in America in 2007, provides an illustration. The dry river is a result of impounding the entire stream flow for municipal water supply, which still needs to be supplemented with groundwater to meet demand. The City is pursuing a two-pronged strategy towards water security: (1) diverting Rio Grande water and pumping to the city, and (2) water conservation. A simultaneous effort to restore in-stream flow can be seen as a third water security strategy. Regular stream flows will augment groundwater recharge and provide a buffer which can be tapped during droughts. A flowing river can also serve as a rationale for serious conservation efforts which impinge on customary behaviors (e.g., banning irrigated lawns or mandating rooftop water harvesting). With the right mix of outreach, leadership, and community involvement, a revived river can inspire a shift in cultural values from favoring river exploitation to protection. Such a shift is a critical but often overlooked condition for genuine water security.

Grondin, Bob (Arizona State University)
MICRO AND NANO TECHNOLOGY IN ASU'S INTEGRATIVE ENGINEERING PROGRAM

ABSTRACT NOT AVAILABLE

Hadjilambrinos, Constatine (University of New Mexico)
SOCIALLY ACCEPTABLE REQUIREMENT

ABSTRACT NOT AVAILABLE

Hanley, Charles (Sandia National Laboratories)
SOLAR ENERGY TECHNOLOGIES: MOVING INTO THE MAINSTREAM

ABSTRACT NOT AVAILABLE

Hamilton, Marcus J. (University of New Mexico)
SCALING THE METABOLISM OF HUMAN SOCIO-ECONOMIES FROM HUNTER-GATHERERS TO NATION STATES

Like all biological species, human socio-economies are embedded within complex ecosystems that are structured by the fluxes and flows of energy and information between organisms and their environments. To meet energy demands, humans harvest resources from their environments by tapping into these flows thus creating nonlinear feedbacks between human and ecological systems. In this paper I use scaling theory to quantify the rate at which humans extract, distribute, and expend energy and information within different socio-economies, from hunter-gatherers to nation states. Preliminary data from over 1,030 human cultures show that human energy use scales at approximately the same sublinear rate across the range of human socio-economies. These results suggest a potential scaling law for human energy use, and the implications for understanding human evolution and ecology are discussed.

Harrod, Kevin (LRRI)
SARS-COV PATHOGENESIS: INSIGHTS INTO THE MOLECULAR MECHANISMS OF DISEASE

The SARS-CoV outbreak of 2002-2003 highlighted the potential for rapid zoonotic transmission to humans and the ease of global spread in today's world. In the absence of understanding the contributing factors to human transmission, little public health intervention has been accomplished, thus making future outbreaks a real possibility. Furthermore, the SARS-CoV outbreak has heightened awareness for the role of other coronaviruses in human disease. An understanding of the molecular mechanisms of SARS-CoV pathogenesis has yet to be elucidated, in part due to the lack of animal models that recapitulate hallmark features of human disease. Current development of new disease models has yielded novel hypotheses of SARS-CoV disease. In particular, specific viral tropism for distinct pulmonary epithelial lineages leads to a persistent infection of distal lung compartments. Interestingly, the initiation of cellular repair programs in the lung during infection lead to further cellular lineages that contribute to viral replication and persistence. Thus, a reiterative infection cycle is engaged as the damaged pulmonary tract seeks to remodel and repair. Systems biology approaches are currently being utilized to delineate global molecular changes leading to SARS-CoV pathogenesis at the cellular, tissue, and organ level. Elucidation of molecular targets may yield opportunities for intervention for SARS-CoV and other respiratory viruses leading to severe disease. The SARS-CoV outbreak of 2002-2003 highlighted the potential for rapid zoonotic transmission to humans and the ease of global spread in today's world. In the absence of understanding the contributing factors to human transmission, little public health intervention has been accomplished, thus making future outbreaks a real possibility. Furthermore, the SARS-CoV outbreak has heightened awareness for the role of other coronaviruses in human disease. An understanding of the molecular mechanisms of SARS-CoV pathogenesis has yet to be elucidated, in part due to the lack of animal models that recapitulate hallmark features of human disease. Current development of new disease models has yielded novel

hypotheses of SARS-CoV disease. In particular, specific viral tropism for distinct pulmonary epithelial lineages leads to a persistent infection of distal lung compartments. Interestingly, the initiation of cellular repair programs in the lung during infection lead to further cellular lineages that contribute to viral replication and persistence. Thus, a reiterative infection cycle is engaged as the damaged pulmonary tract seeks to remodel and repair. Systems biology approaches are currently being utilized to delineate global molecular changes leading to SARS-CoV pathogenesis at the cellular, tissue, and organ level. Elucidation of molecular targets may yield opportunities for intervention for SARS-CoV and other respiratory viruses leading to severe disease.

Haste, Turtle (Johns Hopkins Center for Talented Youth)
SCIENTISTS AND MIDDLE SCHOOL STUDENTS; LEARNING AND WORKING TOGETHER

Johns Hopkins University's Center for Talented Youth students enrolled in the Dynamic Earth class come from all over the world to study earth systems. Investigating plate action, crustal formation, glaciers, currents, weathering and atmospheric interactions, students develop a strong ability to identify the forces that continually change the landscape and the interconnectedness of the atmosphere, hydrosphere and lithosphere. As part of their regular course work, students work with a variety of cooperating scientists. US Geological Survey staff assists students in examining sand samples and exploring monitoring research on invasive foraminiferas in San Francisco Bay. Gulf of the Farallones National Marine Sanctuary and Mavericks Surf Ventures staff help students explore the off shore submarine formations of a storm swell at Half Moon Bay that develops into a world-class big wave. Students met a big wave surfer who described the ride and shared surf stories. A wave forecaster helped students use modeling software to create real-time forecasts. In the final project students assist faculty of University of Texas at Austin, Institute of Geophysics using cruise reports, project abstracts, and bathymetry images, in evaluating a series of submarine features in the Ross Sea, Antarctica. Students develop proposals and present their ideas in a seminar format, attended by cooperating scientists. Students have an opportunity to work with current scientists and learn how classroom "stuff" is used. One student commented, "I felt like I could talk with them about what they were doing and actually understand what they were talking about." Another stated, "I didn't know you could learn so much from forams. I always thought paleontology was about dinosaurs." As a result of the class, students understand the relevance of their learning, scientists like working with kids, and educators get excited about science. To evaluate program outcomes, the staff holds regular meetings with scientists as students begin the sessions. Faculty and scientists work collaboratively to develop activities students will be engaged in and that relates to the scientists' work. Students and faculty complete evaluations. A report is generated at the close of the summer outlining plans for the next season, detailing successes, and areas of improvement.

Heaston, Robert J. (NPA)
WHY DID EINSTEIN PUT SO MUCH EMPHASIS ON THE EQUIVALENCE PRINCIPLE?

Einstein considered the discovery of the equivalence principle as “die glückichste Gedanke” in his life. Whether translated as “the happiest thought”, “luckiest thought,” or “the most fortunate thought,” Einstein formulated the equivalence principle as the result of an epiphany he experienced in October or November 1907. He regarded the equivalence principle as the beginning step in adding gravitation to the special theory of relativity to create general relativity. Why? James Prescott Joule published a paper “On the Mechanical Value of Heat” in 1850 and started an avalanche of interest in the equivalence of different forms of energy. Equivalence was the hot new addition to the 19th century physics paradigm. Heat was also considered then as a mode of motion that led to the kinetic theory of gases, statistical analysis, Avogadro’s number, the motion of atoms and molecules and

Einstein's paper on Brownian motion. Einstein could not help but be aware of the significant meaning of equivalence to physics. An overly simplistic interpretation of the equivalence principle is that "gravitation is acceleration." But there is much more to this interpretation because the equivalence principle is at the heart of the derivation of the field equations of general relativity. Various definitions of the equivalence principle in the literature are analyzed and put into perspective. Recognition of the overall importance of the equivalence principle leads to a dramatically new understanding of the general theory in the 21st century physics paradigm.

Hightower, Michael (Sandia National Laboratories)
ENERGY-WATER NEXUS

ABSTRACT NOT AVAILABLE

Hillesland, Heidi (University of New Mexico), Amber Read (University of New Mexico), Bobban Subhadra (University of New Mexico), Ivy Hurwitz (University of New Mexico), Annabeth Fieck (University of New Mexico), Pradeep Das (RIMR, Patna, India), and Ravi Durvasula (University of New Mexico)
USE OF COMMERCIALLY DEPLOYED BACTERIA AS DELIVERY AGENTS FOR PARATRANSGENIC MANIPULATION OF KALA AZAR VECTOR, *P. ARGENTIPES*

The leishmaniases, a group of sandfly-mediated parasitic diseases, are a leading cause of mortality in the world. Kala-azar, is caused by Leishmania donovani and remains a leading cause of morbidity in eastern states such as Bihar. In the absence of a vaccine, control of this disease has focused on vector eradication through pesticide use. Large-scale efforts have targeted the elimination the Indian kala-azar vector, P. argentipes. However, widespread resistance amongst P. argentipes along with prohibitive costs and environmental toxicity limit the effectiveness of pesticides. Paratransgenic manipulation of arthropod vectors has emerged as a possible strategy for disease control. This approach involves isolation of bacteria resident in the arthropod, transformation of the bacteria to produce molecules that neutralize the parasite and delivery of the transformed bacteria to field vector populations. We have recently completed a microbiological survey of peri-domestic P. argentipes in 4 endemic districts of Bihar. Two commercially deployed bacteria, Bacillus megaterium and Brevibacterium linens, were amongst the microbes identified from the sandfly gut. These bacteria are used extensively for soil remediation and dairy processing and could serve as delivery agents for paratransgenic manipulation of sandflies in Bihar. Here, we describe the transformation of B. megaterium with the shuttle plasmid pMDWK6. This plasmid contains the gene encoding a murine single chain antibody fragment that binds progesterone (rDB3) and a kanamycin resistance marker. Expression of this single chain antibody by transformed B. megaterium was demonstrated by Western analysis, while ELISA and competitive ELISA further confirm functionality. This use of this recombinant B. megaterium as a putative delivery agent for paratransgenic manipulation of P. argentipes is currently underway and will be presented.

Holbrook, Michael (University of Texas Medical Branch-Galveston)
ANIMAL MODELS FOR HIGHLY PATHOGENIC TICK-BORNE FLAVIVIRUSES

The tick-borne encephalitis serocomplex of flaviviruses includes viruses that primarily cause encephalitis in humans. Three viruses, however, are associated with hemorrhagic disease. The objective of this project is to examine the host response to infection in order to identify host mechanisms that are related to either encephalitic disease or hemorrhagic disease. For this project we have focused on Russian spring-summer encephalitis virus (RSSEV), a neurotropic virus that causes severe encephalitis, and Omsk hemorrhagic fever virus (OHFV, a viscerotropic virus that can cause hemorrhagic fever. To date we have found that these viruses cause markedly different disease in the mouse model and that the

disease seen in mice correlates reasonable well with that seen in humans. We have also identified several disease characteristics that appear to be related to the host response to infection. The long-term goal of the project is to identify specific points of intervention that could be targeted for development of therapeutics.

Holbrook, Michael (University of Texas Medical Branch-Galveston)
GALVESTON NATIONAL LABORATORY: OPPORTUNITIES FOR HIGH-CONTAINMENT RESEARCH AND COLLABORATION

The Galveston National Laboratory (GNL) at The University of Texas Medical Branch is a shining star in the United States Biodefense network. This laboratory contains more than 30,000 square feet of high- and maximum-containment research space and will expand an already extensive Biodefense and Emerging Infectious Disease research program at UTMB. This presentation is designed to familiarize scientists with the UTMB research program and containment capabilities. As a National Laboratory, our objective is to facilitate both internal and external projects, specifically for research programs that do not have containment facilities. The GNL is also designed to allow completion of GLP or "GLP-like" research studies for vaccine and therapeutic development.

Hoodenpyle, Kyle (Pecos Valley Biomass Cooperative)
THE BROAD SCOPE FOR AGRICULTURE RENEWABLE ENERGY

The U.S. possesses a large and diverse network of agri-industrial facilities which consolidate and process large quantities of agriculture materials into their value-added products. These agri-industrial facilities typically consume large amounts of energy, water and have significant waste streams. The Pecos Valley Biomass Cooperative is constructing an integrated system and processes to utilize waste streams from dairy and other associated agri-industries for production of energy, biofuel, and other co-products. The integrated "biorefinery" center concept brings together systems and processes that include a complementary mix of anaerobic digestion and gasification for production of bio-methane, process heat, and/or electric power, coupled with the system enhancement of implementing algae-based production of biofuels and coproducts using nutrient-rich effluent. Associated benefits are reduction in water consumption, adverse environmental impacts and regulatory compliance costs for waste stream management and providing greenhouse gas (GHG) emissions mitigation services and offset green credits.

Hooper, Paul (University of New Mexico)
UNDERSTANDING THE EFFECTS OF BRAININESS ON PRIMATE AND HUMAN LIFESPAN EVOLUTION

Explaining variation in animal lifespans is a central goal in life history theory and the metabolic theory of ecology. Understanding why primates in general, and humans in particular, are especially long-lived for their body size is a particularly relevant problem in this area. While previous life history approaches have taken adult mortality rates (and thus adult lifespan) as given, it has become apparent that lifespan should be treated as a partially endogenous decision variable, mediated by investments in mortality reduction throughout life (e.g. cellular maintenance and repair). The goal of this paper is to evaluate the conceptual continuity between two life history models—Kaplan & Robson 2002 and Charnov 2001—in which investment in survival is an endogenous decision variable. I show that Kaplan & Robson's result—that a more learning-intensive niche leads to greater investment in longevity—can be replicated within Charnov's framework using a numerical example. I then briefly discuss these results with respect to the allometry of mammalian and primate life history variables.

Horne, Jeremy (RhinoCorps, Inc.)
MODELING AND SIMULATING THE INTERNATIONAL BATTLE SPACE – PROBLEMS AND PROSPECTS OF HYBRID SYSTEMS ACTING ON THEIR OWN

Modern war gaming centers on highly technologically based modeling and simulation (M&S) of battlefields worldwide. In a fashion similar to an increasing reliance upon computers to diagnose and treat patients (the output of machines often directing the course of treatment), M&S systems are increasingly being used to assess battlefield situations and provide suggested solutions. Here results a synthetically-based war, where the dynamics between human consciousness and a possible "artificial consciousness" in the M&S program (marked by emergent behavior) can result in global-wide conflicts assuming a life of their own and beyond the control of the persons relying upon the M&S program to help manage the conflict. The U.S. Department of Defense has offered Verification, Validation, and Accreditation (VV&A) as the way of ensuring that M&S will do what is expected. However, formal logical analysis indicates otherwise and that the central issue rests with the nature of representation of reality. This paper will be the backdrop for reviewing the nature of M&S and the M&S integrity-checking problem.

Huang, Jianyu (Sandia National Laboratories)
IN-SITU PLASTIC DEFORMATION OF CARBON NANOTUBES

Transmission electron microscopy (TEM) is a powerful tool for structural characterization of materials. However in-situ studies of the mechanical and electrical properties of materials at a nanometer scale are still challenging. A scanning probe microscopy (SPM), including scanning tunneling microscopy (STM), atomic force microscopy (AFM), and nano-indentor, explores the physical and mechanical properties of materials down to a single atom level but without internal structural information. A combined TEM-SPM platform, which integrates a fully functional SPM into a TEM, takes advantage of both the SPM and the TEM capabilities and provides unprecedented opportunities to probe the structural, mechanical, electrical, and thermal properties of materials in-situ down to a nanometer scale. This allows for direct correlation of the physical and mechanical properties to the atomic-scale microstructure. In this talk, I will review our recent progress in using the TEM-SPM platform to probe the electrical and mechanical properties of carbon nanotubes [1]. First, individual multiwall carbon nanotubes are peeled off layer-by-layer by electric breakdown inside the TEM. This provided new insights into the transport property of nanotubes. Second, plastic deformation, such as superplasticity, kink motion, dislocation climb, and vacancy migration, was discovered in nanotubes for the first time. Emerging directions of using the TEM-SPM platform to conduct cutting edge research in nanoscience and nanotechnology will be highlighted.

Hughes, John (University of Arizona)
LIMBIC CONNECTIONS AND EFFECTIVE COMMUNICATIONS

The vast expansion of knowledge in science and technology calls for effective interdisciplinary communications to bring about beneficial social impact. This applies to newer communications tools as well as traditional forms of written and oral communications. It is not uncommon in meetings addressing highly specific aspects of science and technology for there to be poor connectedness between presenters and recipients. This is seen as well in other settings where the bias of recipients blocks the acquisition of new insights or knowledge. Furthermore, there may be bias in the mode of presentation of which the presenter is unaware. Self Determination Learning Theory has focused on the recipient. Furthermore, it is noted that the limbic brain deals with the emotional content of messages sent and received. This is commonly recognized in the human in the form of tempered speech and facial expressions. These areas along with examination of the process of enhancing imaginative thought are being studied in children

in 1st, 2nd, and 3rd grade in the Amphitheater School District in Tucson, Arizona with focus on improving the instruments for measurement of progress. We are a part of a consortium based at the New England Conservatory of Music in Boston. An argument will be presented that, by incorporating recent understanding of the function of the limbic brain, we can enhance bridge building between the arts and sciences as well as a number of other areas of incomplete interdisciplinary communications.

Ibragimov, Ranis N. (New Mexico Institute of Mining and Technology)

EVOLUTION OF THE ENERGY SPECTRUM AMONG A LARGE NUMBER OF INTERNAL WAVES IN THE DEEP OCEAN

Internal waves are generally accepted to be responsible for a large fraction of mixing in the deep ocean. Internal waves can interact with one another and exchange energy among themselves. This is possible because of the nonlinear advective terms in the governing equations of motion for a stratified medium in a rotating coordinate system. The nonlinear interactions between the waves lead to a nonlinear coupling and energy transfer from large to small vertical scales, end eventually to dissipation. Away from direct forcing, the oceanic internal wave-field appears to be remarkably uniform and described by the Garrett-Munk (GM) spectrum which quantifies the observed distribution of wave energy in wave number and frequency space. While empirical knowledge of internal wave processes and their spectra is now reasonably complete, the dynamical underpinnings are still uncertain. A convincing approach to deriving the internal wave spectrum is still elusive. So far the energy distribution is well understood for the case of a single resonant triad only. At present there are still no any detailed enough theoretical studies of this process for two resonant triads. This work represents a novel way to describe the internal wave-spectrum and its evolution. We propose a mathematical model consisting of arbitrarily large number of waves to investigate the evolution of the energy spectrum and energy transfer in the internal wave field. The results are based on physics of internal waves and do not depend on “black-box” modeling. As an illustration to the model, we consider 100000 resonant triads and we initialize the energy spectrum with the GM spectrum. We solve the system of 200000 evolution equations to determine the temporal evolution of the energy distribution among the various possible wave numbers and frequencies. The model involves internal waves with frequencies spanning the range of possible frequencies, i.e., between a maximum of the buoyancy frequency N for horizontal wave vectors (vertical motion) to a minimum of the inertial frequency f for vertical wave vectors (horizontal motion) [two limiting cases]. Because of the inclusion of high- frequency waves we don’t make the hydrostatic approximation. The goal of this model is to investigate the evolution of the wave's amplitudes to predict the evolution of the internal wave energy spectrum.

Jordan, Gretchen (Sandia National Laboratories), Jerald Hage (University of Maryland), and Jonathon Mote (University of Maryland)

R&D INTEGRATION: HOW TO BUILD A DIVERSE AND INTEGRATED KNOWLEDGE COMMUNITY

Stokes advocated the benefits of uniting basic and applied research as a way to facilitate research breakthroughs. Recently, the U.S. Department of Energy launched an initiative designed to foster better integration in research and technology development (R&D), such as the concurrent application of scientific and engineering knowledge. This paper suggests that in basic and applied research-- two arenas in the production of knowledge-- there are difficulties in integrating them because of two somewhat disparate barriers: (1) cognitive distance among the researchers and (2) structural differentiation in the idea innovation network. This paper discusses these two barriers in greater depth and explains why these barriers are increasing. The larger issue is to build a diverse and integrated knowledge community via the following kinds of mechanisms: complex charters, visionary team leadership, recruitment from diverse sources, multiple team and network integration

mechanisms, and diverse sources of funding. These ideas emerge from not only the recent literature but more critically from a case study of a transformational research organization that built an international knowledge community in biomedicine, the Institut Pasteur.

Jun, Joonyub (Sandia National Laboratories), Alicen Kandt (Sandia National Laboratories), Peter Lilienthal (Sandia National Laboratories), and Doug Arent (Sandia National Laboratories)

RISK-BASED APPROACH TO INCORPORATING RENEWABLE ENERGY INTO CRITICAL FACILITIES

This presentation provides a summary of a cooperative effort between Sprint/Nextel, the National Renewable Energy Laboratory and Sandia National Laboratories to assess the optimal combination of bulk power and renewable energy resources to compensate for the disruption of utility power in the event of a terrorist attack or natural disaster. Power generation and transmission, coupled with telecommunications, form a critical core of our national infrastructure. Individually, both are critical, but they are also tightly inter-dependent technologies. Successful operation of the power grid depends on communication between control centers. Alternatively, operation of telecommunication nodes (e.g. mega-center, cell-site) depend on the availability of power. Risk of intentional disruption of the grid and telecommunications systems remains at a high threat level. In addition, the changing global climate has resulted in increasing uncertainty in the number and severity of weather events. To assist the decision-maker in making an informed decision, dominant uncertainties in the problem are characterized and incorporated into the analysis. These uncertainties include utility power availability and repair-time, as well as operational characteristics of alternative energy technologies. This presentation focuses on the assessment of various types and configurations of natural gas turbines, proton-exchange membranes, and solar panels. A number of potential energy resource portfolios for each communications site are explored and the results presented in terms of the predicted operational risk. *This project was funded by the U.S. Department of Energy, Energy Efficiency and Renewable Energy, through the Office of Planning, Budget, and Analysis. The DOE Project Manager is Dr. Allan Hoffman.*

Klyushin, J. G. (Academy of Civil Aviation, St. Petersburg, Russia)

THE JOHN CHAPPELL MEMORIAL LECTURE AND DISCUSSION

ABSTRACT NOT AVAILABLE

Kolb, Charles D. (Fort Lewis College) and Julie Korb (Fort Lewis College)

IMPACT SURVEY OF CENTENNIAL ACTIVITIES ON THE ENDEMIC CLIFF PALACE MILKVETCH (ASTRAGALUS DETERIOR) ON THE SPRING HOUSE TRAIL IN MESA VERDE NATIONAL PARK

Cliff Palace Milkvetch (Astragalus deterior) is an endemic plant to Mesa Verde NP and is vulnerable to disturbance due to its shallow roots and preference of sandy soils. Park Centennial activities allowed the public access to Spring-House Trail, generally closed to the public, which runs directly through the largest populations of A. deterior. Park managers were interested in quantifying the impact of opening this trail for Centennial activities on A. deterior. We hypothesized that human impact would have a short-term detrimental effect on A. deterior. Trailside populations of A. deterior were quantified by a stem count of all individuals within three feet of the trail and then compared them to data using the exact methodology conducted by the park staff the previous year. There was no significant change in A. deterior populations due to Centennial activities indicating limited human use of the trail does not impact this endemic population. In addition, this study investigated the diversity and abundance of non-native species in relation to the presence of the trail. Stem counts were collected on all vegetation within 32 separate 1.0x0.5m quadrats located in four discrete plant communities on the Spring-House Trail to quantify

the impact of the trail on the presence of non-natives. Half of the quadrats were located directly adjacent to the trail and the other half were located 50 m off trail. There was no significant difference between species richness or abundance between plots near and away from the trail (p=>0.05). In contrast there was significantly higher non-native species richness and abundance near the trail than away from the trail for all four plant communities (p=<0.001). The higher abundance and diversity of non-native species adjacent to the trail indicates a negative impact related to trail presence.

Kooser, A, (University of New Mexico), L. J. Crossey (University of New Mexico), D. E. Northup (University of New Mexico), M. N. Spilde (University of New Mexico), and L. A. Melim (Western Illinois University)

GEOCHEMICAL ENERGY CONSTRAINTS FOR MICROBIAL METABOLISM IN LECHUGUILLA CAVE, NM DETERMINED FROM HYDROCHEMICAL ANALYSIS

Lechuguilla Cave (LC) is a hypogenic cave created by the action of sulfuric acid in the Guadalupe Mountains, NM. It extends to depths exceeding 450 m, and provides a relatively pristine environment in which to study chemolithoautotrophic bacteria, cave precipitates, and groundwater as it moves through the cave system. The connection between microbial communities and their chemical environment is especially strong in 'extreme' environments (e.g. extreme pH, salinity, temperature, presence/absence of light, and low nutrient conditions). Pool water range in composition with bicarbonate values from 140-700 ppm, magnesium from 20-6,120 ppm, sodium spanning three orders of magnitude, and sulfate from 16 – 25,175 ppm. Oxygen availability as well as presence of trace gases also varies. Bacterial communities utilize chemical species present in the cave environments for metabolic processes. We use available water data from the literature and calculations of Gibbs free energy available from equilibrium considerations to identify the energetically-favored metabolic pathways. Most metabolically-important reactions involve oxidation-reduction reactions among chemical (gas, aqueous and mineral) forms of hydrogen, nitrogen, carbon, sulfur, iron and manganese. The combination of thermodynamic analysis and field observations (minerals forming in cave environments and identified microbial communities) further refine the list of potential metabolic reactions. These predictions guide further investigation into the ways in which microbial species participate in the formation of cave precipitates.

Kraus, Catherine (University of New Mexico)

AFFORDING SUSTAINABILITY: CONFRONTING THE ECONOMIC ISSUES

The first issue that economists must confront with respect to sustainability is defining it. An economics-based definition of sustainability would include the assurance that future generations will enjoy the same quality of life that we enjoy today. That is, we would imagine the problem as one of sustaining the capacity to provide an acceptable level of health, comfort, perhaps convenience….all of the components that contribute to quality of life. This does not require maintaining a static consumption level, but would require consideration of what life would be like for future generations under different scenarios. We would then measure the costs and the benefits of achieving those outcomes. To economists the true cost of any action or policy is the value of the alternative given up in order to achieve an end. Thus we would ask what we would forgo today in order to provide an acceptable environment in the future. One difficulty that arises is that those costs are borne in the present time period, but the benefits accrue to future generations. This introduces a great deal of uncertainty: uncertainty about future technologies, about future demographics, and even about the preferences of people living far in the future. It also introduces an incentives problem, as people may be more interested in their own well-being than in the well-being of people living far into the future. Finally, we must confront the economic status quo. Our economy is built on established infrastructure. Certainly if we could start over from scratch we might change the ways our cities sprawl and the modes of

transportation used to move goods and people from one place to another, but we cannot start over. Given these sunk costs, what next steps are appropriate?

Laird, Daniel (Sandia National Laboratories)
ADVANCEMENTS IN WIND ENERGY TECHNOLOGY

ABSTRACT NOT AVAILABLE

Lattimore, Peter (RhinoCorps, Ltd)
PROBLEMS AND PROSPECTS OF HYBRID SYSTEMS ACTING ON THEIR OWN

ABSTRACT NOT AVAILABLE

Lauter, Judith L. (Stephen F. Austin State University)
NEUROCARDIOLOGY: NONINVASIVE FUNCTIONAL ASSESSMENT USING THE AXS TEST BATTERY

The relatively new science of neurocardiology, positing links between brain and heart, has several implications. These include not only new insights into normal cardiac function, but also novel objective physiological techniques for diagnosis and evaluation of treatment efficacy in a variety of cardiac disorders. This presentation describes use of a relatively inexpensive test battery (Lauter 2000) to study correlated physiological responses in heart, voice (both the domain of cranial nerve X), ear (cranial nerve VIII), and cortex. Three separate experiments were conducted employing the cold pressor test as a challenge to the autonomic nervous system. Different combinations of dependent variables for each experiment were selected from the following: 1) heart rate; 2) diastolic blood pressure; 3) systolic blood pressure; 4) otoacoustic emissions (OAE) amplitude; 5) OAE repeatability; 6) timing of a phonetic cue requiring laryngeal action; 7) several variables based on spectral measures of power and coherence collected over right- and left-side cortex. Results reveal patterns of correlated responses among peripheral measures (heart, voice, ear), and also between periphery and cortex. These patterns exhibit marked individual differences, a positive finding regarding the sensitivity required for normal as well as clinical studies. The results are promising for future collaborative applications in clinical cardiology, to serve goals such as: a) identifying individuals at risk for neurocardiological problems; b) customizing treatment based on individually-specific physiological patterns linking cortex and heart; and c) evaluating results of treatment, whether pharmaceutical, surgical, or behavioral.

Liu, Zun (Baylor University), Shikha Varshney (Baylor University), and Christopher M. Kearney (Baylor University)
RECOMBINANT EXPRESSION OF MAJOR MOUNTAIN Cedar ALLERGEN JUN A 1 USING A TOBACCO MOSAIC VIRUS-BASED VECTOR

Mountain cedar (Juniperus ashei) pollen causes severe allergies in Texas and the central USA. Jun a 1 is the dominant allergen protein of mountain cedar pollen and is homologous to pectate lyases. Jun a 1 protein has not been successfully expressed in a heterologous system, though repeated attempts have been made. We expressed Jun a 1 in Nicotiana benthamiana using an agroinfection-compatible tobacco mosaic virus vector. Jun a 1 structure resembles pectate lyases, but no enzymatic activity has yet been detected. In our work, mutations were created in order to test a structural hypothesis for the enzymatic inactivity of Jun a 1. A his203 to ala mutant was created in order to remove the histidine-aspartate bridge which is thought to cover the putative catalytic site. Truncation mutants were made by eliminating first 38 amino acids which are also posited to inhibit enzymatic activity via steric hindrance. All nontruncated clones of Jun a 1 were successfully expressed in N. benthamiana, but with severe necrosis and sudden death of infected

plants, suggesting pectate lyase activity. Truncation mutants were able to infect plants but none of the infected plants had necrosis or sudden death. To rescue the leaves from severe necrosis, inoculated leaves were vacuum infiltrated with 50mM mannitol. The leaf morphology was maintained. Protein expression on such leaves is being investigated.

Lucero, Adrianne (University of New Mexico) and Heather E. Canavan (University of New Mexico)

OPTIMIZING THERMORESPONSIVE PNIPAM FILMS USING AN RF PLASMA REACTOR

Poly(N-isopropyl acrylamide) (pNIPAM) undergoes a sharp property change in response to a moderate thermal stimulus at physiological temperatures. This has generated great interest in the biomaterials community, and pNIPAM is being investigated as a “smart” biofouling and release coating to harvest intact cell monolayers. Currently, many techniques are used to deposit pNIPAM, including electron beam irradiation and solution deposition (e.g., silanes and self-assembled monomers). Recently, we constructed a radio frequency (rf) plasma reactor for plasma polymerization of NIPAM from the vapor phase based on a previous design. Plasma polymerization is a sterile, solvent-free, and compatible with surfaces of any geometry or chemistry. These factors make plasma polymerization extremely useful for cell and tissue culture, which often rely on plastic tissue culture plates. Due to the inherently energetic conditions of the plasma, it is extremely important to characterize the impact that parameters such as maximum rf wattage, pressure of deposition, and location/position of the samples in the chamber have on the resulting films. In this work, pNIPAM films resulting from those varying conditions are characterized using X-ray photoelectron spectroscopy (XPS) for film composition, interferometry for film thickness, contact angles for thermoresponse, and cell detachment for cell releasing properties.

Macias, Filiberto (UAS, White Sands Missile Range, NM0

PROBLEMS WITH USING VV&A TO EVALUATE UAS

ABSTRACT NOT AVAILABLE

Martinez, Ulises A. (University of New Mexico), Thomas C. Gamble (University of New Mexico), Gabriel P. Lopez (University of New Mexico), and Elizabeth L. Dirk (University of New Mexico)

NANOMETER-SCALE PATTERNED SURFACES FOR THE PRECISE CONTROL OF CELL ATTACHMENT

The understanding of cell-material interactions is important for the development of materials for biomedical applications such as tissue engineering. Cells attach to substrates through complex nanometer-sized molecular structures called focal adhesions. It is through the focal adhesions that the cells sense their physical surroundings and relay information about their surroundings to the nucleus. We hypothesize that by controlling focal adhesion density through the use of substrates with discrete nanometer sized cell-adhesive patches, cellular functions can be regulated. In this work, interferometric lithography was used to create patterned substrates with nanometer-scale cell adhesion patches surrounded by a non-cell adhesive substrate. The substrate patches were visualized with a scanning electron microscope after incubation with gold-labeled anti-fibronectin antibodies. After sterilization via 70% ethanol, the substrates were seeded with MC3T3-E1 cells. After 12 hours, cell viability was assessed using an immunofluorescence live/dead assay. 91.54% ± 4.23%, of the cells attached on the substrates with a pitch of 350 nm were viable, 83.68% ± 7.87% were viable on the substrates with a 450 nm pitch, compared to the 94.01% ± 3.99% viability of the attached cells on the glass positive controls. These results indicate that we were able to fabricate surfaces with nanometer scale cell adhesive patches. Cells attached to these surfaces and viability was varied with the distance between patches. The ability to

precisely control the distance between focal adhesions may be important for regulating cellular function for biomedical applications.

Maxwell, Paul C. (The Bi-National Sustainability Laboratory)
BUILDING BRIDGES, NOT WALLS--THE BI-NATIONAL SUSTAINABILITY LABORATORY

The Bi-National Sustainability Laboratory (BNSL) is perhaps best described by its mantra, "Building Border Businesses", where it looks to harness advanced and emerging technologies to promote economic development in the border region. Perhaps, equally pertinent is the corollary vision: "Building Bridges, Not Walls" as we look to make a paradigm shift in the border's economic culture and landscape. Current debate on the U.S. southern border and illegal immigration for a variety of reasons has focused almost entirely on physical security—boots on the ground, fences/barriers (walls), surveillance and technology, etc—and ignores opportunities for economic, cultural and social security, security that only comes with a populace that enjoys a high quality of life, one with good jobs and good wages. While certainly we need to invest in physical security we must also invest in those strategies that address the root causes bringing literally millions of Hispanics into the US. As such we think building economic bridges, not walls is a strategy that must be adopted if we are truly to be secure at the border. We believe the BNSL provides the model for beginning that process, a model that can be applied elsewhere in the world. This presentation gives some specific examples of technology based business growth in the border region and other opportunities for bi-national sustainable collaboration.

McLean, Rebecca C. (United States Air Force Academy), Brandon Doan (United States Air Force Academy), Michael Brothers (United States Air Force Academy), Mary Teny (United States Air Force Academy), and Eric Kozlowski (United States Air Force Academy)
COMPARISON OF WIRED AND WIRELESS BIO-ELECTRICAL IMPEDANCE FLUID STATUS MONITORING DEVICES AND VALIDATION TO BODY MASS AND URINE SPECIFIC GRAVITY CHANGES FOLLOWING MILD DEHYDRATION

A method for rapid, non-invasive detection of hydration changes in military operations is needed to prevent dehydration. The ZOE2 is an FDA approved product used to measure fluid status in the clinical environment. The ZOE wireless (ZOEW) is intended for field use. Each system measures thoracic bio-electrical impedance. The purpose of this study was to compare the two monitors, determine the test-retest reliability of the ZOEW, and to evaluate the sensitivity and validity of both models to detect post-exercise hydration status changes in a field setting. Nude body weight, urine specific gravity, ZOE2 and ZOEW measurements were taken in 32 wrestlers before and after a typical 90-minute collegiate wrestling practice. There were significant correlations between the two monitors for pre- to post-practice difference ($r = 0.94$, $p < 0.001$), pre-practice ($r = 0.98$, $p < 0.001$) and post-practice ($r = 0.96$, $p < 0.001$) values as well as test-retest reliability for each device ($r = 0.95$-0.98, $p < 0.001$). Body weight significantly ($p < 0.05$) decreased 2.0% and urine specific gravity increased ($p < 0.05$) 0.3% from pre- to post-practice. No significant differences were detected between pre- to post-practice values for ZOE2 or ZOEW. Based on the results of this investigation, the monitors can be used interchangeably, easily, and reliably for the same biological variables. However thoracic bio-electrical impedance as measured in this study was not a valid measure of mild, post-exercise hydration status change in a field environment as compared to body weight and urine specific gravity.

Meléndrez, Michael Martin (Soil Secrets, LLC)
TREES, SOILS AND THE SUSTAINABILITY ASPECTS OF BUILDING LANDSCAPES IN URBAN SETTINGS AS IT RELATES TO THE ARID WEST

Water is an issue that is not going away and historically we built landscapes that needed a great deal of water. The use of plant material was based on the availability of plant

material produced by growers somewhere else who could not cater to the needs of our regions climate and soils. This contributed to plant material and landscape designs that are not sustainable or appropriate! Trees take the longest to provide lasting value in a landscape since they are larger and slower growing than shrubs and ground covers. Therefore it's important to make correct choices when selecting trees for a landscape. With that in mind it's important to know that research will show that the average life expectancy of trees in an urban setting in the United States is only 13 years, not good when you are striving for future value from these plants. I'll explore the reasons for this short life expectancy problem and discuss the solutions and protocols to building more sustainable landscapes by fixing the biology of soils and the terrestrial biosphere beneath our landscapes. Concerning the soil biology, I'll address the latest information on how fungi and bacteria play a critical and essential role in growing landscapes that can endure the rigors and stresses of an arid climate.

Miller, Beverly (University of New Mexico)
SCIENCE TECHNOLOGY FOR HIGH SCHOOL BIOLOGY & ENVIRONMENTAL SCIENCE: INTEGRATING INTERNET RESOURCES INTO CLASSROOM INSTRUCTION FOR HIGH SCHOOL STUDENTS

This presentation will address practical instruction for grade 9 - 12 teachers to integrate Internet technology into every day instruction. Participants will receive sample lesson ideas that include technology as part of the instruction and evaluation of the science curriculum. Websites and interactive simulations target primarily the biology and environmental science standards. Participants can expect a fun time of exploring what is available to enhance instruction as well as learning how to incorporate images and videos.

Milne, Bruce (University of New Mexico)

ABSTRACT/TITLE NOT AVAILABLE

Mizner, Jack (Sandia National Laboratories), Amy Coplen (Sandia National Laboratories), and Norion Ubechel (Sandia National Laboratories)
THE ECOLOGICAL FOOTPRINT OF SANDIA NATIONAL LABORATORIES

Sandia National Laboratories, New Mexico (SNL/NM) is developing an Ecological Footprint Model (EFM) to evaluate and monitor environmental impacts and to cultivate objectives and measurable targets to mitigate those impacts. The EFM determines the area of land needed to support SNL/NM operations by considering the total environmental impact, from resource extraction to the influence of waste streams, on the assimilation capacity of the Earth’s biosphere. The EFM generates an ecological footprint representing the relative area of biologically productive land required to reproduce the natural resources SNL/NM consumes. SNL/NM’s Carbon Footprint Model (CFM) is a subset of the EFM that translates fossil-energy usage into green house gas emissions and calculates the biologically productive land area needed to sequester emissions. The net measurement of the CFM and the EFM will establish a baseline ecological footprint for FY05. A preliminary assessment of SNL/NM’s ecological footprint determined that energy use made the largest contribution to the ecological footprint, accounting for more than half. Emissions from landfill waste decomposition, natural gas usage, employee commuting, and airline travel made significant contributions. Future EFM development will include formalizing the methodology for calculating the ecological footprint each fiscal year and tracking the size of the footprint to determine if SNL/NM is successfully mitigating its environmental impact. The EFM is a tool to champion emission and resource reduction strategies prioritized on the Federal level and has the potential to serve as an information body to support other government projects and missions.

Moses, Melanie (University of New Mexico) and Horacio Samaniego (University of New Mexico)

CITIES AS ORGANISMS: ALLOMETRIC SCALING OF URBAN ROAD NETWORKS

Just as the cardiovascular network distributes energy and materials to cells in an organism, urban road networks distribute energy, materials and people to locations in cities. Understanding the topology of urban networks that connect people and places leads to insights into how cities are organized. We study statistics of road networks and traffic patterns across 425 US cities and show that urban road networks are much less centralized than biological vascular networks. As a result, per capita road capacity is independent of the spatial extent of cities. In contrast, driving distances depend on city area, although not as much as is predicted by a completely centralized model. This intermediate pattern between centralized and decentralized extremes may reflect a mixture of different travel behaviors. The approach presented here offers a novel macroscopic perspective on the differences between small and large cities and on how road infrastructure and traffic might change as cities grow.

Myers, Lawrence S. (NPA)

GRAVITY'S MYSTERIES

A FUNDAMENTAL REVOLUTION IN SCIENCE, presented in Tulsa, OK, in 2006, demolished the nebular hypothesis of Immanuel Kant that has misled scientists for 250 years, and replaced it with ACCREATION (creation by accretion) that accurately reflects the slow process of creation of the Solar System and its planets. This cosmology leads to further discoveries in the fundamentals of physics, both conventional and quantum. Gravity's mechanism intrigued me after discovering that spherical shape enables gravity to focus on the exact center of any planetary body. Observation that falling water drops become spherical, just as molten lead forms cannon balls when dropped from a height, suggests the mechanism of gravity is INTERNAL and the power of gravity is determined by the collective mass, or total (atomic?) weight of all atoms in any body. A corresponding gravitational effect may exist in the cloud of gas, dust, meteoroids and asteroids orbiting the Sun, but spacing of planets in the plane of the ecliptic suggests a collective gravitational power is projected in all directions, the intensity determined by the size and gravity of each body. This leaves unanswered the internal workings of the atom. Current theories of gravitons, electromagnetism, "weak" and "strong" forces, as somehow related to gravity are matters requiring much thought and experimentation. Also, the Hubble redshift as an indicator of increasing velocity at the outer edges of an Expanding Universe is illogical—the speed of light should be constant throughout the Universe. Logic suggests the red shift is a metric of distance.

Olson, Craig L. (Sandia National Laboratories – Retired)

SCIENTIFICALLY UNDERSTOOD REQUIREMENTS

ABSTRACT NOT AVAILABLE

Passell, Howard D. (Sandia National Laboratories), Sandra Postel (CSIS), Erik Peterson (CSIS), and Erik Webb (Sandia National Laboratories)

THE ECOLOGY OF NATIONAL SECURITY

The study of complex systems shows us that future emergent behaviors can be strongly affected by minor changes to initial, critical parameters. A shift like the ecological revolution could change everything about the way we live.

Pate, Ron (Sandia National Laboratories)
BIOFUELS FROM THE ENERGY-WATER NEXUS PERSPECTIVE

Biofuels for both ground and aviation transportation use are of growing interest in the United States and globally for a variety of reasons. A key motivation is the desire to reduce dependency on petroleum imports that represent an increasingly large fraction of the U.S. trade deficit and are also subject to growing cost volatility and supply disruption risks for both the military and commercial sectors of the economy. Expanding the domestic production of biofuels are also seen by many as attractive opportunities for local investment and economic development over the coming decades that also offer the potential for reducing greenhouse gas emissions by displacing the use of fossil-based fuels. The national build-up of biofuel production to the significant volumes desired must address some critical issues to be sustainable and avoid adverse environmental, social, and economic impacts. One of the key issues is the impact that greatly expanded biofuel production will have on water supplies. This presentation provides an overview of the water implications of biofuels and suggests directions that need to be further investigated for addressing future biofuel production demands on fresh water supplies.

Pennington, Deana (University of New Mexico)
ENABLING CO-EMERGENT INNOVATION THROUGH COLLABORATION BETWEEN SCIENCE AND TECHNOLOGY RESEARCHERS

Many of the most difficult problems confronting society require collaboration between experts with deep knowledge from multiple disciplines. Collaborative teams are faced with the problem of simultaneously generating innovative ideas in these multiple arenas – innovative applications must emerge at the same time as innovative technology that supports the application. This is a sociotechnical problem requiring choreography of people, tools, interactions, and the flow of information in such a way that creative ideas co-emerge across disciplines. This presentation will discuss *processes* by which scientific communities can effectively integrate new and emerging technologies into their research, and development of *collaboration theories* that enable cross-disciplinary collaborations between scientists and technical experts. Outcomes from a prototype National Science Foundation CI-Team project will be presented, in which a hypothesized model of collaboration is being employed. The scientists on the team are engaged in research on the impact of climate, population, and land cover/land use change on human, biotic, and abiotic processes in the American Southwest. They are partnered with computer scientists and informatics specialists researching and developing cyberinfrastructure in support of scientific applications. Based on preliminary results from the first year of the project, the hypothesized collaboration model is very effective at enabling cross-disciplinary collaboration and the simultaneous emergence of innovative ideas.

Peraza, Eduardo F. Herrera (Centro de Investigación en Materiales Avanzados) Balter Trujillo Navarrete (Centro de Investigación en Materiales Avanzados), and Adrián Vázquez Gálvez (Centro de Investigación en Materiales Avanzados)
FRACTAL THEORY APPLIED TO AEROSOL EXPERIMENTAL DATA COLLECTED IN NORTH OF CHIHUAHUA CITY

Studies of multi-scaled atmospheric particles are based in different mechanisms of nano-particles growing. These mechanisms depend of many variables such as chemical composition, gas phase concentration; meteorological variables etc. and have been the indirect cause of different pulmonary diseases. Epidemiology studies have indicated an association between the mortality and the incidence of decease due to the concentration mass of atmospheric fine particles generated by the combustion. The area of surface of aerosol particles, is the site that involves the interactions gas-particle, that increases to the toxicity of the particles (Ku and Maynard 2005; Wentzel et al., 2003). Nevertheless, the

chemical specific mechanisms and/or physical, relating the effects of the health to the aerosol haven't been understood yet (Linak et al., 2007). For the understanding of these mechanisms it is necessary detailed studies of the morphology and the chemical composition of particles (Wentzel et al., 2003; Filippov et al., 2000). The morphology has been described by different methods based on the contour or density of the particle, example of them is: form factors; chain codification; dimension fractal and functions of contour example the transformation of Fourier and wave (Kindratenko et al., 1997; Kindratenko et al., 1995; Kindratenko 2003). There isn't sufficient information for the possible modifications of the size variables and forms of the different particle, with respect to the environmental and temporary conditions. The use of multivariate techniques sets out to know the structures interdependence of the size, forms and atmosphere. Results of the calculations of different form-factor parameters, Lacularity, and Hurts coefficients are exposed in this work with using the measurements of particles obtained with MOUDI (Micro orifice Uniform Deposit Impactor) (Marple et al. 1991), with particles cuts until 100 nm , collected in north of the City of Chihuahua during the campaign of March and April of 2007.

Pietrass, T. (New Mexico Tech), Aceves, A. (University of New Mexico), Bossert, J. (Los Alamos National Laboratory), Fessenden, J. (Los Alamos National Laboratory), Gray, T. (New Mexico State University), Hunt, P. (New Mexico State University), Sterling, T. (New Mexico State University).

NSF ADVANCE-PAID: PARTNERING FOR DIVERSITY AT NEW MEXICO INSTITUTIONS OF HIGHER LEARNING AND RESEARCH

A large body of research findings over the past 20 years have documented the need for institutional transformation of academe to bring about diversity at all levels of the U.S. science and engineering (STEM) workforce. Diversity, in terms of sex and race/ethnicity, among STEM faculty has yet to be achieved despite significant gains in the "pipeline" in many STEM disciplines. In recognition of the slow pace at which women's representation among STEM faculty was increasing, the National Science Foundation implemented the ADVANCE-Institutional Transformation (IT) program in 2001. New Mexico State University (NMSU) is a successful ADVANCE-IT institution (2002-2007) which has doubled the percentage of women hired into STEM faculty positions during the ADVANCE award period. However, despite the strides by this program in increasing female STEM faculty representation, New Mexico's doctoral-granting Universities require further progress. The University of New Mexico, New Mexico Tech, and NMSU have 14.9, 11.6, and 19.3% female, respectively, and 5.1, 2.1, and 7.7% minority STEM faculty, respectively. The Earth & Environmental Sciences Division of Los Alamos National Laboratory (LANL) has 19.4% females and 6.0% minorities in staff scientist positions. In 2006, the National Science Foundation awarded NMSU a three-year, $0.5 mi Partnerships for Adaptation, Implementation, and Dissemination (PAID) grant. Approaches in the first year of the grant to extend the work of the NMSU-ADVANCE best practices of mentoring, promotion and tenure, and department head training as well as improve the transition to the professoriate for students and postdoctoral fellows will be presented.

Putt, Ron (Auburn University)

LOW COST ALGACULTURE FOR BIOFUELS

Micro-algae cultivation has the potential for providing a large percentage of the transportation fuels used in the U.S., owing to the high growth rates and lipid contents of certain strains; annual productivities of up to 3,000 gallons of lipid per acre should be achievable in the near future. Efforts towards realizing this potential during the past 50 years or more have been stymied by high costs, and algae cultivation has therefore been limited to production of nutritional supplements and fine chemicals, where algae production costs of several dollars per pound can be tolerated. We have recently made

progress in developing a low-cost approach to algaculture, which is projected to achieve solid profitability when the algal lipid and meal are priced considerably below those for soy. This approach takes advantage of the excellent natural resources of the southeastern United States, including millions of acres of pond-capable land, abundant fresh water aquifers, excellent solar insolation, and a long growing season. In our system design we have addressed three key contributors to the historically-high cost of algaculture, namely the source of the nutrients, the installed and operating costs of the ponds, and the harvesting process, and we have developed viable approaches to each of them.

Rebeil, Roberto (Sandia National Laboratories)
CHANGES IN FLEA MIDGUT ENVIRONMENT INDUCES THE TRANSMISSION PHENOTYPE OF YERSINIA PESTIS

Transmission of Yersinia pestis, the causative agent of Plague, is dependent on the formation of a biofilms in the flea midgut. To date, most genetic factors involved in Plague transmission from flea to mammal have been found to be regulated by the temperature shift from mammalian temperature to flea temperature, 37 and 21-26 °C respectively. Analyses performed, now indicate that changes in flea-bloodmeal during digestion also induce changes in the Y. pestis phenotype relevant to transmission.

Rempe, Susan (Sandia National Laboratories)
ION DISCRIMINATION BY NANOSCALE DESIGN

Natural systems excel at discriminating between molecules on the basis of subtle differences. Membrane-spanning protein channels, for example, are exquisitely designed to differentiate between Na+ (sodium) and K+ (potassium) ions despite their identical charges and only sub-Angstrom differences in size. Consequently nearly all cells can selectively transport these ions across their membranes, a process that underlies such diverse physiological tasks as nerve cell signaling, heart rhythm control, and kidney function. While scientists have long known that ion selectivity lies in the ability of the channel to satisfy or frustrate ion solvation requirements, the persistent question revolves around how channels and other biological structures give rise to such a subtle effect between Na+ and K+. By understanding ion discrimination in natural systems, we can potentially gain insight into the fundamental workings of neural circuitry and biological filters, and facilitate the development of drugs that leave functioning channels in the heart unharmed or counter channel malfunctions, such as channel blockage caused by neurotoxins. Furthermore, by understanding how protein structures lead to such a remarkable level of discrimination, we can also potentially harness nature's design principles in nano-scale devices that mimic biological function for the purpose of fast, efficient water desalination and implantable electric energy sources to power artificial retinas. Here we present a novel explanation for ion discrimination in the celebrated potassium-selective protein channels, we contrast this explanation of natural ion discrimination with the unexpectedly antithetical mechanism found in a natural potassium-selective ion carrier, and finally we describe current work toward implementing ion selectivity in synthetic channels.

Robinson, David G. (Sandia National Laboratories), Joonyub Jun (Sandia National Laboratories), Alicen Kandt (Sandia National Laboratories), Peter Lilienthal (Sandia National Laboratories), and Doug Arent (Sandia National Laboratories)
RISK-BASED APPROACH TO INCORPORATING RENEWABLE ENERGY INTO CRITICAL FACILITIES

This presentation provides a summary of a cooperative effort between Sprint/Nextel, the National Renewable Energy Laboratory and Sandia National Laboratories to assess the optimal combination of bulk power and renewable energy resources to compensate for the

disruption of utility power in the event of a terrorist attack or natural disaster. Power generation and transmission, coupled with telecommunications, form a critical core of our national infrastructure. Individually, both are critical, but they are also tightly inter-dependent technologies. Successful operation of the power grid depends on communication between control centers. Alternatively, operation of telecommunication nodes (e.g. mega-center, cell-site) depend on the availability of power. Risk of intentional disruption of the grid and telecommunications systems remains at a high threat level. In addition, the changing global climate has resulted in increasing uncertainty in the number and severity of weather events. To assist the decision-maker in making an informed decision, dominant uncertainties in the problem are characterized and incorporated into the analysis. These uncertainties include utility power availability and repair-time, as well as operational characteristics of alternative energy technologies. This presentation focuses on the assessment of various types and configurations of natural gas turbines, proton-exchange membranes, and solar panels. A number of potential energy resource portfolios for each communications site are explored and the results presented in terms of the predicted operational risk. This project was funded by the U.S. Department of Energy, Energy Efficiency and Renewable Energy, through the Office of Planning, Budget, and Analysis. The DOE Project Manager is Dr. Allan Hoffman.

Rochau, Gary (Sandia National Laboratories)
TECHNOLOGICALLY ROBUST REQUIREMENT

ABSTRACT NOT AVAILABLE

Ruby, S. W. (University of New Mexico)
SMALL RNAS, DEXD/H-BOX PROTEINS AND NUCLEAR PRE-MRNA SPLICING

In order for most genes to be expressed in eukaryotic cells, an RNA copy of the gene is made and processed in the nucleus, exported to the cytoplasm and then used as a template to synthesize a protein. One of the nuclear RNA processing events is splicing. Splicing occurs in a ribonucleoprotein complex called the spliceosome. The spliceosome is composed of 5 small nuclear RNAs (snRNAs) and over 300 proteins, making it one of the largest complexes in a eukaryotic cell. Spliceosomal activity and accuracy have major medical implications: it is estimated that 50-60% of mutations in humans lead to disease by disrupting splicing. Several DExD/H-box proteins are important for spliceosomal function. These proteins catalyze conformational changes that activate the spliceosome for splicing and that monitor splicing accuracy. We are currently analyzing one of these proteins, Prp5p, in the early events of spliceosome formation during which pre-mRNA associates with the spliceosome. Our data indicate that Prp5p binds both pre-mRNA and the U2 snRNP. The results suggest Prp5p acts on the U2 snRNP to catalyze an ATP-dependent conformational change necessary for U2 to bind to pre-mRNA and for monitoring splicing accuracy. We have also identified a novel motif that may be responsible for linking RNA binding to ATPase activity in Prp5p's helicase core, and therefore responsible for the RNA stimulation of ATPase activity. Our recent results may establish the molecular mechanism by which Prp5p acts as a monitor of splicing accuracy.

Saa, Diego (NPA)
FOUR-VECTORS IN ELECTROMAGNETISM

A new mathematical structure intended to formalize the classical 3D and 4D vectors is briefly described. This structure is evidenced to be more appropriate, for its use in Physics and the sciences in general, than any of the other mathematical structures of geometric origin, such as the Hamilton (or Pauli or Dirac) quaternions, tensors, geometric algebra (GA) and space-time algebra (STA). The application of four-vectors in electromagnetism is demonstrated, where current concepts are reproduced, in some cases, corrected, in other

cases, and new concepts are discovered, such as the following: It is suggested the need of an electromagnetic scalar, the Lienard and Wiechert potentials are suggested to be incorrect and also to have an incorrect origin, new equations for the handling of energy-momentum are proposed with which it is proved that mass and momentum have to satisfy the wave equation. Several other physical variables are also proved to satisfy the wave equation, which gives a strong argument to conclude that our universe is of electromagnetic constitution. Maxwell's equations are reduced to a simple four-vector equation. As a byproduct, new values and units for the dielectric permittivity and magnetic permeability of vacuum are proposed. Then the electric and magnetic units are expressed only in terms of mechanical units so there is no need for the former.

Sawan, Mohammed (University of Wisconsin)
HELP SHAPE THE FUTURE OF PULSED POWER DRIVEN FUSION ENERGY

ABSTRACT NOT AVAILABLE

Scarborough, Alexander Alan (NPA)
TWENTY SELECTED IDEAS

Twenty Selected Ideas Fundamental to the LB/FLINE Model of Universal Origins. Twenty ideas underpinning the revolutionary LB/FLINE concepts are selected for brief discussions to emphasize their crucial roles in understanding how our Solar System (and all solar systems) form(ed) dynamically, and why they are self-sustaining entities. Ideas include the Five Laws (FL) of Planetary Motion and Internal Nucleosynthesis (IN) that drive all planetary Evolution (E). Another highlight of the concept is the scientifically valid explanation of why Earth is slowly and continuously expanding, and consequently, why species come and go as functions of time. The new model definitively explains the abiogenic origin, evolution and intimate relationship of the hydrocarbon fuels (gas, oil, coal): ongoing nuclear and chemical processes of Earth's interior.

Scarborough, Alexander Alan (NPA)
UNIFICATION OF THE BIG BANG AND THE LB/FLINE MODEL

The proposed BB/LB/FLINE Concept: Unifying a modified BB with the LB/FLINE model of origins of Universal Systems. Due to lack of a viable alternative, the unsubstantiated BB concept has become well-entrenched in scientific literature. While most scientists recognize its mythical (Sagan) and conjectural (Hawking) status, they are forced to interpret their amazing discoveries in the BB perspective. Since myth begets myths, futility is too often the reason that science remains stymied in spite of such brilliance. However, most, if not all, discoveries do fit precisely into the revolutionary LB/FLINE model of origins of universal systems. This paper presents a viable alternative that offers a way out of the maze. Altering the initial stage of the BB via elimination of the impossibility of all universal energy/matter being contained in a very small mass will enable science to get back on the right train of thought. Once past the initial stage of the BB inflation, the LB/FLINE will take control via its processes of creating black spheres of space-time, the densest form of energy, the source of all galaxies, each containing billions of stars embedded in hot gaseous dust-clouds. The smaller stars eventually evolve into planets of various sizes through five readily observable stages of evolution via Internal Nucleosynthesis. The LB/FLINE model is soundly based on the five laws of planetary motion that offer substantial evidence for definitive solutions to planetary and, eventually, all universal anomalies.

Schaffer, Linda (University of New Mexico)
PRESERVICE TEACHERS' ALTERNATIVE CONCEPTIONS ABOUT THE USE OF BIOLOGICAL CLASSIFICATION SCHEMES

The effect of pre-service teachers' prior ideas on their understanding of classification concepts was investigated using the identification of insects. The teachers were not able to apply the scientific concepts they had learned throughout their schooling. Rather, they used their pre-instructional concepts formed through their relationships with family, friends, and through television and books. While they cited school most often for their concept formation, they thought that their instruction had been mostly ineffective. The students considered biological taxonomic structures as flexible ideas that need only to fit loosely in order to group and name animals.

Scheerer, Kim (Bosque Ecosystem Monitoring Program)
COMMUNITY ECOSYSTEM MONITORING: THE BOSQUE ECOSYSTEM MONITORING PROGRAM AS A MODEL FOR RESEARCH AND EDUCATION

The Bosque Ecosystem Monitoring Program (BEMP) is long-term ecological research using volunteers (mainly K-12 teachers and their students) to monitor key indicators of structural and functional change in the Middle Rio Grande riparian forest, or "bosque". Started with fewer than 200 students in 1997, BEMP now has over 3,500 students participating in field data collection, lab processing, and follow-up classroom activities – all helping to increase their understanding and appreciation of science and the riparian ecosystem and all supporting science education reform efforts.

Slaughter, Maynard (Colorado School of Mines)
GENERAL RELATIVITY MADE EASY

In 1915, Einstein introduced General Relativity as the alteration of space-time by and in the gravitational field of a massive body, such as a star. The alteration was depicted in the popular literature, and even in equations, as a permanent halo of deformed space-time around massive bodies, with deformation decreasing smoothly and asymptotically away from the bodies. Bodies in such gravitational fields altered speed and direction contrary to Newton's gravitational expression. Einstein ascribed the altered behavior of bodies in the halo of deformed space-time to induction. A quark model of proton, neutron and electron just published permits induction of one body moving through the gravitational field of another body, with consequent alteration of the gravitational properties of both bodies in accordance with Einstein's view of deformed space-time: The quark structure of the common particles yields an a priori derivation of the gravitational constant G, with gravity resulting from an unquantized quark angular momentum, allowing no antigravity. The gravitational constant becomes variable, as suggested as early as 1937. Gravitational induction changes the frequency of quark motion mainly among degenerate, quantized, quark energy states, and eliminates the concept of a permanent halo of distorted space-time about masses. With induction, the masses of interacting bodies become variable, although only slightly so. Happily, the mathematics of induction is simpler than Einstein's field equations. Restructured General Relativity yields solutions to three recent enigmatic cosmic observations: unaccounted for slowing of Pioneer spacecraft "sling shot" around the Sun, acceleration of masses in the outer reaches of the universe, and the recently reported reduced mass of hydrogen far out in the universe. Restructured General Relativity sheds new light on Einstein's calculations and astronomer's numerous observations of the bending of starlight passing near the Sun.

Smith, Jacqueline (Sandia National Laboratories), Susan Caskey (Sandia National Laboratories), Jennifer Gaudioso (Sandia National Laboratories), and Reynolds Salerno (Sandia National Laboratories)

BIOSAFETY RISK ASSESSMENT

Risk assessment is the foundation of a good biosafety program, yet there is no widely accepted set of qualitative or quantitative tools to help biosafety professionals conduct such assessments in a consistent, repeatable, and well-informed manner. In addition, critical information that is pertinent to biosafety risk assessments is often hard to find and is not consolidated anywhere. The 2nd International Biorisk Management Workshop at the Canadian Science Center for Human and Animal Health in Winnipeg identified the need for such tools and information resources. One outcome of that workshop was the concept of a Biosafety Risk Assessment Wiki. A wiki is a website for facilitating collaboration between peers to produce a consensus text. Wikis also provide a central point for sharing information and discussing ideas in the form of text, links and references. This poster will introduce the Biosafety Risk Assessment Wiki. It is our hope that the website, www.BiosafetyRiskAssessment.org, becomes a repository of risk assessment data, publications, and links for the biosafety community. The site is designed to help biosafety professionals achieve successful risk management by providing a resource to help understand the biohazards involved in laboratory work. The site has sections devoted to agent hazards, laboratory procedure hazards, hazard mitigation measures, and resources. The site is publicly available but editing privileges are given only to members. The poster will present example sections from the website and we hope conference participants will provide us with constructive feedback on the concept.

Snell, Mark K. (Sandia National Laboratories)

ADDRESSING WEAKNESSES IN CURRENT DEFENSE- AND SECURITY-RELATED MODELING AND SIMULATION

We have entered an age where it is easier to create a model or simulation than it is to worry about whether that creation is helpful to a customer or whether it is ready to be used. This problem has been exacerbated by three developments: 1) the use of high-resolution graphics that tends to suspend critical judgment, especially among decision makers, about the technical content driving those graphics; 2) the incorporation of behavioral models to model human behavior that seem to be based more on convenience than solid research and development; and 3) the purported need for “agile” software development that somehow obviates the need for traditional requirements definition, verification, validation, and accreditation. All of these factors have tended to cause modeling and simulation (MS) practitioners to solve the wrong problem or to create software tools that present large, unknown risks to those who would apply them. This paper will examine the effects of these factors on several current examples of military- and security-related MS problems. It will then go on to suggest ways to inject more honesty and integrity into this process, so that the right problems are being solved in ways that help the customer and do not skip over important steps in the MS process.

Sobel, Annette (Sandia National Laboratories and University of New Mexico)

REAL WORLD CHALLENGES AND OPPORTUNITIES FOR GLOBAL HEALTH SURVEILLANCE

Real World Challenges and Opportunities for Global Health Surveillance will be discussed in the context of U.S. National Security. Some of the most challenging environments globally present the greatest opportunities for stability and security. For example, the global threats of narco-terrorism have surfaced as international challenges fostering the emergence of novel infectious disease threats and threatening the stability of international economies, trade, health and security. The recent stand-up of Department of Defense's

(DoD's) AFRICOM will highlight the unprecedented challenges of co-locating US troops in regions of Africa previously uninhabited and threats unmitigated by conventional force protection methods. In addition, there is an expanding interest in partnerships with Non-Government Organizations (NGOs) to expand US humanitarian missions and build/re-build coalitions and partnerships for peace. These emerging challenges will be wickered together by the ever challenging political, military, cultural, and technical challenges of information sharing and common understanding of infectious disease threats that respect no geographic boundaries or institutions.

Spencer, Domina Eberle (University of Connecticut)
THE HOLOR REPRESENTATION OF RIGID BODY MOTION

The forces on a rigid body can always be expressed as the sum of a sliding vector and a rotation. This paper shows how the sum of any set of forces acting on a rigid body can be described by a bivalent alternating holor, and can be decomposed into a single sliding vector plus a single rotation. This problem was first studied by Study (Geometrie der Dynamen, Leipzig, 1901). The holor representation of rigid body motion was developed after tensor calculus had been developed by this author ["Geometric Figures in Affine Space", J. Math. Phys. 23, 1 (1944) and "The Tensor Interpretation of the Figures of Study's "Geometrie der Dynamen", J. Math Phys 23, 103 (1944)], and is now included in the recent text Theory of Holors by Moon and Spencer (Cambridge University Press, 1986, paperback 2005).

Stalford, Harold (University of Oklahoma)
NANOFUN EDUCATION

ABSTRACT NOT AVAILABLE

Stiner, Mary C. (University of Arizona)
CHANGES IN THE 'CONNECTEDNESS' AND RESILIENCE OF PALEOLITHIC SOCIETIES IN MEDITERRANEAN ECOSYSTEMS

Human predator-prey relationships changed dramatically in the Mediterranean Basin between 250,000 to 9,000 years ago. Many of these changes can be linked to increases in Paleolithic human population densities. Small game species are particularly diagnostic of increases in human hunting pressure and are a major source of evidence for demographic change after 40-45,000 years ago. Biomass-corrected data on prey choice also indicate increasing use of those species that possess higher reproductive efficiencies. Step-wise, apparently irreversible shifts in human predatory niche are apparent in the Mediterranean Basin, beginning with the earliest Upper Paleolithic in the east and spreading westward. Evidence of demographic pressure and greater use of resiliant prey populations is followed by technological innovations to exploit these animals more efficiently. The zooarchaeological findings suggest that Middle and Lower Paleolithic reproductive units probably were not robust at the micropopulation scale, due to the rather narrow set of behavioral responses that characterized social groups at the time, and that localized extinctions at the micropopulation level were likely to have been common. Upper Paleolithic groups were the quintessential colonizers and, in addition, uniquely good at holding on to habitat gained. Upper Paleolithic archaeological "cultures" have shorter histories of existence than those of earlier periods, but they were even more widespread geographically. The demographic robustness of the Upper Paleolithic systems may stem from wholesale strategies for evening-out or sharing risk and volatility in technology. Micropopulations were larger and often denser on landscapes, more connected via cooperative ties, and thus more robust.

Stomp, John (ABCWUA)
PROVIDING A SUSTAINABLE WATER SUPPLY

ABSTRACT NOT AVAILABLE

Sven, Charles (NPA)
COSMOLOGY – THE FROZEN EMBRACE OF OUTLANDISH ASSUMPTIONS AND MYTH

Today, the findings of modern technology as published by NASA, Stanford Labs, SDSS, Super Kamiokande Studies, and 2dF along with other equivalent research, easily refute the early uncritical observations and assumptions used to imperfectly describe 20th century cosmology, assumptions that persist with such tenacity that many believe they are fact, including a Hindu myth. The foundations of 20th century cosmology as contributed by de Sitter, Lemaître, Friedmann and Milne are noted, dated, documented, and then refuted, negated, and countered with specific above noted modern observations

Taheri, Saeid (University of New Mexico) and Gary A. Rosenberg (University of New Mexico)
ANALYSIS AND CHARACTERIZATION OF SPATIO-TEMPORAL PATTERNS OF BLOOD BRAIN BARRIER (BBB) RESPONSE TO INJURIES USING DYNAMIC CONTRAST-ENHANCED MR IMAGING

Blood-brain barrier (BBB) is a series of interfaces between the blood and brain tissues that restricts and regulates the movements of substances into the central nervous system. The BBB protects brain cells from exposure to neurotoxic agents. Disruption of the BBB occurs in brain inflammation, leading to brain edema in stroke, multiple sclerosis and other neuroinflammatory conditions. Accurate in vivo quantification of BBB defects is important in predicting and measuring the response of BBB to injury and to monitor therapy. In the past decade research has been conducted to quantify the disruption of BBB and to extract in vivo information about the BBB response to therapy by non-invasive measurement techniques, such as PET and MRI. Contrast-enhanced dynamic MRI (CE-DMRI), using compartmental modeling and sampling the passage of an exogenous contrast agent, quantifies transport of substances across the BBB. We have improved the accuracy of CE-DMRI for BBB permeability calculations, and established a method able to generate accurate pixel-by-pixel permeability maps. Then, we have used the improved CE-DMRI method to measure BBB transfer constants in a rat stroke model, using a 4.7T/40cm bore Bruker magnet. Transient opening of the BBB as function of time was recorded at 3 and 48 hours after the onset of reperfusion. Data was recorded as three dimensional time series. Statistical methods have been employed to discover the spatial correlation within the time series data. We have been able to predict the evolution of BBB opening for different anatomical regions of interest.

Taylor, Paul (Sandia National Laboratories) and Corey Ford (University of New Mexico Health Sciences Center)
SIMULATION OF BLAST-INDUCED, EARLY-TIME INTRACRANIAL WAVE PHYSICS LEADING TO TRAUMATIC BRAIN INJURY

We have conducted a modeling and simulation study to establish the role of stress wave interactions in the genesis of traumatic brain injury (TBI) from exposure to explosive blast. A high resolution (1 mm3 voxels), 5 material model of the human head was created by segmentation of color cryosections from the Visible Human Female dataset. Tissue material properties were assigned from literature values. The model was inserted into the shock physics wave code, CTH, and subjected to a simulated blast wave of 1.3 MPa (13 bars) peak pressure from anterior, posterior and lateral directions. Three dimensional plots of maximum pressure, volumetric tension, and deviatoric (shear) stress demonstrated significant differences related to the incident blast geometry. The calculations revealed

focal brain regions of elevated pressure and deviatoric stress within the first 2 milliseconds of blast exposure. Calculated maximum levels of 15 KPa deviatoric, 3.3 MPa pressure, and 0.8 MPa volumetric tension were observed before the onset of significant head accelerations. Doubling the blast strength changed the resulting intracranial stress magnitudes but not their distribution. We conclude that stress localization, due to early time wave interactions, may contribute to the development of multifocal axonal injury underlying TBI. We propose that a contribution to traumatic brain injury from blast exposure, and most likely blunt impact, can occur on a time scale shorter than previous model predictions and before the onset of linear or rotational accelerations traditionally associated with the development of TBI 2,3.

Thomas, Timothy L. (University of New Mexico)
GREEN DATA CENTER CONSTRUCTION

ABSTRACT NOT AVAILABLE

Todd, Lawrence C. (Colorado State University),
SCALE, BOUNDARIES, AND BRIDGES: HUMAN DIMENSIONS IN PALEOECOLOGY

One of the more difficult hurdles for research that examines multi-scale, transdisciplinary ecological processes can be the widespread perception that human actions and cultural transmission of information preclude inclusion of our species. One approach that makes this partition more permeable uses human paleoecology and archaeology as a basis for placing human behaviors within a framework of macroecological analysis. Fundamental to this approach is the effort to refocus archaeological research toward an integrated study of landscapes in which human actions are approached in ways that can be investigated in concert with other biological and physical processes. This approach emphasizes that only the most reductionist of research programs can investigate ecological relationships that do not consider aspects of all three domains of landscape formation and evolution (i.e., the cultural, the biological, and the physical). Examples for the Greybull River Sustainable Landscape Ecology project (GRSLE) in northwester Wyoming's Greater Yellowstone Ecosystem are used to illustrate the basic components of this approach, which is referred to as "landscape taphonomy." Investigations of this sort help bridge the unfortunate gap between research in the social and natural sciences.

Turchin, Peter (University of Connecticut)
DYNAMICAL FEEDBACKS BETWEEN POPULATION GROWTH AND SOCIOPOLITICAL INSTABILITY

Most preindustrial states experienced recurrent waves of political collapse and internal warfare. One possible explanation of this pattern, the demographic-structural theory, suggests that population growth beyond the means of subsistence leads to state instability and breakdown, which in turn causes population decline. In several cases (e.g., early modern England and ancient China) we have data on both population dynamics and sociopolitical instability that can be analyzed using standard time-series approaches. Such analyses confirm that periods of sustained and vigorous population growth are followed, with a time lag, by waves of instability. Industrialization was made possible by rapid gains of agricultural productivity, and the general expectation is that the Malthusian component of the demographic-structural theory should lose relevance. Nevertheless, a survey of industrializing states (Western Europe, the U.S., Russia, and Japan) shows that periods of popular immiseration (proxied by declines in the average body height) were also followed, after a time lag, by waves of instability.

Varma, Sameer (Sandia National Laboratories), Susan B. Rempe (Sandia National Laboratories), and Dubravko Sabo (Sandia National Laboratories)
MECHANISMS OF ION RECOGNITION BY BIOLOGICAL MOLECULES

Biological molecules possess the remarkable ability to distinguish between two equivalently charged ions, Na+ and K+, which differ in size by less than 0.4 Å. As a consequence of this ability, virtually all cells can transport these ions selectively and regulate their concentration gradients across membranes. Preferential binding of one of these ions over the other also affects activities of several other globular protein and RNA enzymes. Selective ion permeation and binding ultimately enable a wide variety of high-level physiological tasks to be accomplished; from nutrient uptake and volume control in cells, to generation and propagation of nerve signals, maintenance of rhythmic heart rates, vision and dialysis in eukaryotes. Among biomolecules that differentiate between these two ions, some selectively bind K+, while others bind Na+. What drives selectivity in favor of a particular ion? Here we present results of our theoretical studies on two different biological molecules that select K+ over Na+ ions: (a) the celebrated potassium channels that perform the task of tightly regulating K+ ion gradients across cell membranes, and (b) a bacterial toxin molecule, valinomycin, that disrupts K+ ion gradients across cell membranes. Our quantum chemical studies reveal the specific chemical and structural elements present in these molecules that make them selective for K+ ions, consequently bringing to light for the first time the fundamental mechanistic differences between these molecules.

Voyer, Normand (Laval University)
SYNTHESIS AND CHARACTERIZATION OF BIO-INSPIRED NANOSTRUCTURES DESIGNED FOR THERAPEUTIC AND SENSING APPLICATIONS

Through evolution, Nature has developed amazing functional nanoscale devices that allow living systems to survive and to replicate. Among all biopolymers, it is noteworthy of mention that Nature selected polypeptides as the fundamental material for the construction of molecular systems, such as enzymes and antibodies that performs many vital cellular "jobs" with exquisite specificity and efficiency. Advances in the past 30 years in automated solid-phase synthesis, purification techniques, molecular modelling, and spectroscopic methods provide synthetic chemists with the opportunity to conceive from scratch artificial proteins and enzymes of nanometer scale with tailor-made properties. Furthermore, chemists can used unnatural amino acids giving them an edge over Nature. Inspired by the fascinating properties of enzymes and proteins, this lecture will present our approach in the design, the synthesis, and the characterization of peptide nanostructures mimicking the membrane transport properties of ion channel proteins. More specifically, we will described our general strategy towards a family of functional peptide nanostructures that incorporate six crown ether modified amino acids. When adopting an alpha-helical conformation, the crown ether side chains lined up to form a channel that allows the passage of monovalent ions across a bilayer membranes. Such artificial systems could be used as molecular components in single molecule biosensors or as nanoscale therapeutics. We will also try to illustrate potential applications of such peptide nanostructures.

Vukomanovic, Jelena (University of Arizona)
APPLICATIONS OF REMOTE SENSING FOR CONSERVATION EASEMENT MONITORING

Conservation easements are voluntary agreements with private landowners, in which land trusts or government agencies acquire and hold interests in property in order to restrict land use in perpetuity. Although the use of compensatory easements as a land protection measure has grown dramatically over the past 25 years, it has not been an unqualified success and questions about the efficiency and efficacy of easements have surfaced. Despite their growing use, there is very little quantitative data available on conservation easements and very little is known about the ecological outcomes of these arrangements at

landscape or regional scales. Ecological monitoring can provide important information on species and habitat persistence on easement lands, as well as hydrological and successional changes, but this data is generally very limited. Ecological monitoring by land trusts is limited by funding, technical expertise, staff time and, in some cases, a preference for allocating resources to conservation acquisition over monitoring. Remote sensing is a powerful tool for determining land cover and vegetative changes over large areas and applications of this technology for easement monitoring are currently being explored. Many of these studies are in forest systems. This poster describes some of the current applications of remote sensing to conservation easement monitoring, as well as potential applications in rangeland systems. The general limitations, as well as special limitations related to arid or semi-arid rangeland systems, of remote sensing for ecological monitoring are also discussed.

Wagner, Patricia (Albuquerque Public Schools)
SUCCESSES AND CHALLENGES OF COLLABORATIONS BETWEEN SCIENTISTS AND PUBLIC SCHOOLS

Dr. Patricia Wagner, Albuquerque Public Schools Science Curriculum Coordinator, will share her insights as an administrator of a large district with a long history of scientist/school collaborations.

Walker, Robert (Max Planck Institute for Evolutionary Anthropology), Michael Gurven, (University of California – Santa Barbara), Oskar Burger (University of New Mexico), and Marcus Hamilton (University of New Mexico)
THE TRADEOFF BETWEEN NUMBER AND SIZE OF OFFSPRING IN HUMANS AND OTHER PRIMATES

Life-history theory posits a fundamental trade-off between number and size of offspring that structures the variability in parental investment across and within species. We investigate this 'quantity–quality' trade-off across primates and present evidence that a similar trade-off is also found across natural-fertility human societies. Restating the classic Smith–Fretwell model in terms of allometric scaling of resource supply and offspring investment predicts an inverse scaling relation between birth rate and offspring size and a -1/4 power scaling between birth rate and body size. We show that these theoretically predicted relationships, in particular the inverse scaling between number and size of offspring, tend to hold across increasingly finer scales of analyses (i.e. from mammals to primates to apes to humans). The advantage of this approach is that the quantity–quality trade-off in humans is placed into a general framework of parental investment that follows directly from first principles of energetic allocation.

Webb, Erik (Sandia National Laboratories)
EVOLUTION OF POLITICAL SUPPORT FOR THE ENERGY WATER NEXUS

ABSTRACT NOT AVAILABLE

Wenger, Rachael C. (United States Air Force Academy), Donald Veverka (United States Air Force Academy), and Candy Wilson (United States Air Force Academy)
USE OF ZINC SUPPLEMENTS TO REDUCE UPPER RESPIRATORY INFECTIONS IN AIR FORCE ACADEMY CADETS

As a dietary essential, zinc plays a number of important roles within the body. Although known primarily for its antioxidant function, zinc is also an important and integral part of the immune system. Zinc appears to be an important modulator for the production of immune cells as well as ensuring the proper action of various leukocytes such as neutrophils, monocytes, macrophages, B and T lymphocytes. To investigate this effect in

healthy young subjects, a seven- month randomized, double blind, placebo-controlled trial involving 40 USAFA cadets was implemented to evaluate zinc's effectiveness in reducing the risk of contracting upper respiratory infections (URIs) within the cadet wing. The primary objective for the study was to compare incidence of URIs between supplemented (zinc capsules) and non-supplemented (corn-starch placebo) groups. Preliminary data revealed equivocal difference between groups in terms of reported visits to physicians for more severe symptoms and medical intervention. Self reported symptoms as recorded by a web site survey revealed a much different result in that non supplemented participants reported more cold and flu symptoms than did those in the supplemented group. While administration of 15 mg/day of zinc gluconate did not appear to result in any change in incidence of more severe infections between groups ($p = 055$), participants with milder symptoms (runny nose, cough, headache, nasal congestion, and malaise.) were significantly reduced in the supplemented group ($p < 0.05$). Higher levels of zinc may be warranted to confer a protective effect under more challenging immunological conditions.

Williams, Cecelia (Sandia National Laboratories), Philip Pohl (Sandia National Laboratories), Malynda Aragon (Sandia National Laboratories), and Jeffrey Danneels (Sandia National Laboratories)

CARVER+SHOCK: FOOD DEFENSE SOFTWARE DEVELOPMENT AND APPLICATION

The CARVER+Shock software was developed by Sandia National Laboratories for the Food and Drug Administration and United States Department of Agriculture to establish an easy to use tool for defending food production against malevolent attacks. The software uses the Criticality Accessibility Recognizability Vulnerability Effect Recuperability and Shock methodology to identify vulnerable critical components in a food production process and then recommends mitigative steps to reduce vulnerability. The software is programmed in visual basic and uses the Windows environment. The case study presented demonstrates hypothetical processes. Examples of the analysis and results are shown along with the scoring options.

Wilson, Kara R. (United States Air Force Academy) and Michael Wilcox (United States Air Force Academy)

DIRECT CELL PERMEABILIZATION ON COMMAND OPENS NEW APPROACH TO CANCER TREATMENT

A new, selective cell-permeabilization method allows large molecules directly into the cytoplasm using a photodynamic mechanism with no immediate cell death and no attrition over many weeks in cell culture. The pore-size induced in the membrane is large enough to allow fluorescently labeled albumen, enzymes and nucleic acids to enter the cell. Gene therapy requires selective introduction of genetic material into the cell to achieve stable transfection. Photodynamic methods have been used in the past to damage cell membranes and induce organelle mediated uptake of material, contributing to low rates of stable gene expression. Our approach provides direct entry to the cytoplasm without using dangerous, low-yield permeabilization methods like electroporation to open the membrane to solutes in the extracellular medium and does not require a viral vector to deliver the genetic payload. Porphyrin dyes have been used to kill cancerous cells but they are partially lipid soluble, only one of 4 derivatives of hematoporphyrin is photodynamic and sensitizers diffuse out of the cell. Our sensitizer has permanent negative charge from pH 0-10 and persists inside cells without apparent dilution for weeks. Our method is ready for animal testing on inoperable cancer without use of radiation or chemotherapy. Once the sensitizer is introduced to the cell cytoplasm, it can be used to kill the cell at any time but our goal is to introduce and express genes that can revert cell phenotype from a cancerous entity to a physiological state.

Zayas, Jose (Sandia National Laboratories)

THE FUTURE OF SOLAR AND WIND ENERGY: A TECHNICAL AND MARKET PERSPECTIVE

ABSTRACT NOT AVAILABLE

THE JOHN WESLEY POWELL MEMORIAL LECTURES

The John Wesley Powell Memorial Lectures were established by the Southwestern Division in 1929. Under present arrangements, a lecture is delivered at each annual meeting of the Division by a distinguished investigator in some field of science, upon a topic of his/her own selection. The roll of lecturers and the fields they represented are as follows:

1929 William Morris Davis, Harvard University: Geology

1930 Rodney H. True, University of Pennsylvania: Botany

1932 Max Pinner, Desert Sanitorium of Southern Arizona: Medicine

1933 Aldo Leopold, University of Wisconsin: Forestry

1934 Otto Struve, University of Chicago: Astronomy

1935 Edgar L. Hewitt, University of New Mexico: Archaeology

1936 John C. Merriam, Carnegie Institution: Paleontology

1937 Andrew E. Douglass, University of Arizona: Astronomy

1938 E.R. Hedrick, University of California at Los Angeles: Mathematics

1939 A.H. Compton, University of Chicago: Physics

1940 D.T. MacDougal, Carnegie Institution: Botany

1941 Bernadotte E. Schmitt, University of Chicago: Modern History

1942 Howard W. Blakeslee, Associated Press: Science Writing

1947 John H. Manley, Los Alamos: Nuclear Physics

1948 Edwin F. Carpenter, University of Arizona: Astronomy

1949 John Charles Kelley, University of Texas: Archaeology

1950 Edwin D. McKee, University of Arizona: Geology

1951 E.J. Workman, New Mexico School of Mines: Meteorology

1952 Karl P, Schmidt, Chicago Museum of Natural History: Zoology

1953 Emil W. Haury, University of Arizona: Anthropology

1954 Roger J. Williams, University of Texas: Biochemistry

1955 Paul B. Sears, Yale University: Ecology

1956 Seth B. Nicholson, California Institute of Technology: Astronomy

1957 W.M. Stanley, University of California at Berkeley: Biochemistry

1958 Victor Regener, University of New Mexico: Physics

1959 H.K. Mitchell, California Institute of Technology: Biochemistry

1960 Knox Millsaps, Holloman Air Force Base: Mathematics

1961 Dael Wolfle, AAAS: Psychology

1962 Glenn T. Seaborg, U.S. Atomic Energy Commission: Chemistry

1963 Kirtley F. Mather, Harvard University: Geology

1964 Eugene Shoemaker. U.S. Geological Survey: Astrogeology

1965 Marx Brook, New Mexico Institute of Mining and Technology: Physics

1966 Donald B. Lawrence, University of Minnesota: Botany

1967 Walter Orr Roberts, National Institute for Atmospheric Research: Astronomy

1968 Eugene P. Odum, University of Georgia: Ecology

1969 Joe Ben Wheat, University of Colorado: Anthropology

1970 Carl Kraenzel, University of Texas at El Paso: Sociology

1971 Klaus Keil, University of New Mexico: Astronomy

1972 Jimmye Hillman, University of Arizona: Agricultural Economics

1973 Katherine Esau, University of California at Santa Barbara: Botany

1974 Henry Eyring, University of Utah: Chemistry

1975 Philip D. Thompson, National Laboratory for Atmospheric Research: Meteorology

1976 Arthur W. Galston, Yale University: Botany

1977 William Dick-Pettie, New Mexico State University: Botany

1978 Paul S. Martin, University of Arizona: Anthropology

1979 James R. Plasker, U.S. Geological Survey: Cartography

1980 Michael H. Glantz, National Center for Atmospheric Research: Meteorology

1981 Robert H. Hohlfelter, University of Colorado: Archaeology

1982 Harvey O. Banks, Camp, Dresser and McKee, Inc.: Engineering

1983 William A. Nierenberg, Scripps Institution of Oceanography: Oceanography

1984 Mary K. Seely, Desert Research Station, Namibia, SW Africa: Ecology

1985 Peter H. Raven, Missouri Botanical Garden: Ecology

1986 David M. Prescott, University of Colorado: Biology

1987 Lawrence B. Slobodkin, SUNY at Sunnybrook: Ecology

1988 Donald B. McIntyre, Pomona College: Geology

1989 Gerald W. Thomas, New Mexico State University: Agriculture

1990 Loren D. Potter, University of New Mexico: Ecology

1991 Richard S. Westfall, Harvard University: History of Science

1992 Carl Sagan, Cornell University: Space Research

1993 Roger Anderson, University of New Mexico: Climatology

1994 Mark F. Meier, University of Colorado

1995 William B. Krantz, University of Colorado: Biology

1996 Stephen Thompson, Colorado State University: Chemistry

1997 Jack Grisham, Oklahoma City Zoo

1998 Holmes Rolston, III, Colorado State University: Philosophy

1999 Carl Goodpasture, Naturalist

2000 Oliver Sacks, Neurologist

2001 Richard Machalek, University of Wyoming

2003 Philip Kitcher, Columbia University: Philosophy

2004 Milford Wolpoff, University of Michigan: Paleoanthropology

2005 Bert Hölldobler, Arizona State University: Entomology

2006 Maureen Raymo, Boston University

PRESIDENT'S AWARD

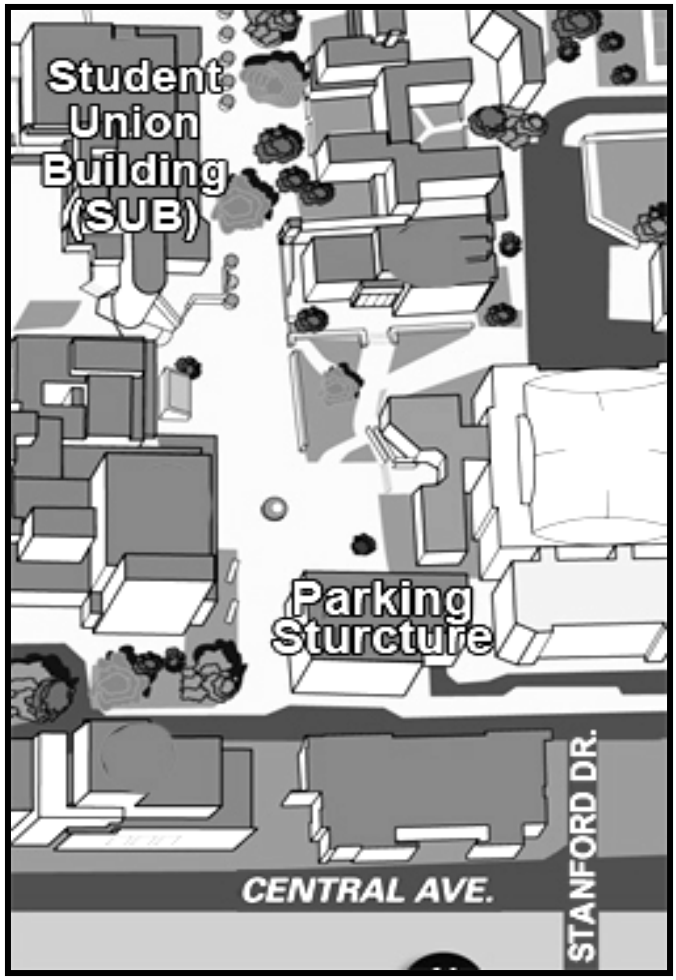
The President's Award was inaugurated in 1987 by President Russell D. Larsen. It is given for exemplary service and leadership to and in the SWARM Division, AAAS. Recipients are:

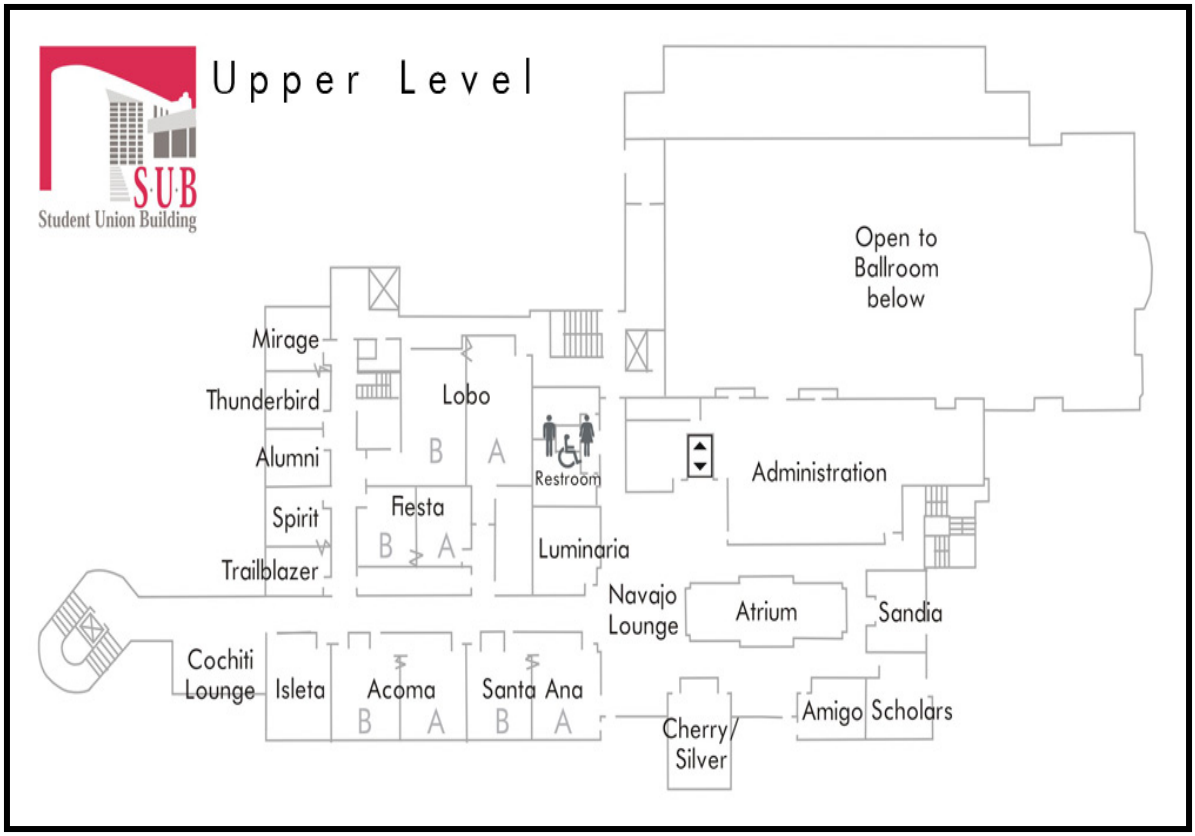
1988 M. Michelle Balcomb
1989 Klaus D. Timmerhaus
1990 Lora M. Shields
1991 Donald J. Nash
1992 Loren D. Potter
1993 Newell A. Youngren
1994 Raymond C. Jackson
1995 Robert A. Wright
1996 Sallie A. Watkins
1998 David Hsi
1999 William B. Krantz
2003 R. Steven Ackley
2004 Martin Hulce
2005 John Obringer
2007 John Hughes

BALCOMB AWARD

The award was begun in 1990 as an Incentive for community college faculty to participate in the SWARM Division meetings. It is given to a community college faculty member for service and leadership in science education and/or exemplary teaching of science in a community or junior college. Recipients are:

1990 Anne Wolff, Laramie County Community College
1993 Steve Zeiser, Austin Community College
1994 Donna Hobbs, San Juan College
1995 Jane Barrett, Oklahoma City Community College
1996 Carol Crowder, North Harris College
1997 Mary Durant, North Harris College
1998 Barbara Obringer, Pikes Peak Community College
1999 Seth Abrahamson, Sante Fe Community College
2000 Mary Teresa Brandon, New Mexico State University, Dona Ana Branch
2001 Michael Huddleston and Jean Ann Lanier
2004 Todd Carter, Seward County Community College
2005 LisaWerner, Pima County Community College
2007 Brian Schmaefsky, Longwood College


Student Union Building (SUB)
Parking Sturcture
CENTRAL AVE.
STANFORD DR.


S·U·B
Student Union Building
Upper Level
Open to Ballroom below
Mirage
Thunderbird
Alumni
Spirit
Trailblazer
Lobo
B A
Restroom
Fiesta
B A
Luminaria
Administration
Navajo Lounge
Atrium
Sandia
Cochiti Lounge
Isleta
Acoma
B A
Santa Ana
B A
Cherry/ Silver
Amigo
Scholars

Plan to Attend AAAS SWARM's 84th Annual Meeting

at

Tulsa University
Tulsa, OK

April 1-4, 2009

Hosted by Tulsa University

Pre-registration begins Oct. 1, 2008