# *Forty-Second Annual Briefing NEW HORIZONS IN SCIENCE*

*November 7 through November 10, 2004*
*Radisson Hotel Fayetteville*
*Fayetteville, Arkansas*

CASW *Council for the Advancement of Science Writing, Inc.*

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Program by:
Ben Patrusky, Executive Director, CASW

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# *Saturday, November 6*
# *Noon to 5:15 p.m.*

The 2nd Annual NASW Fall Workshop

# *Sunday, November 7*
# *8:30 a.m. to 11:00 a.m.*

FORENSIC FRONTIERS
A session devoted to an exploration of new developments aimed at thwarting domestic terrorism and increasing the reliability of eyewitness testimony.

*THE NEW SCIENCE OF TERRORISM*
Brent L. Smith, Ph.D., Professor of Sociology and Criminal Justice and Director, Terrorism Research Center, University of Arkansas, Fayetteville

The latest findings from a first-of-its-kind investigation, by researchers with exclusive access to federal data on 500 terrorists from 60 different terrorist groups gathered between 1980 and 2002, promise to put the study of terrorism on a far more theoretical and empirical — i.e., scientific — footing than it has been to date and, in so doing, lay the groundwork for new strategies to forestall future attacks while helping prosecutors muster more effective cases at trial.

*REAL-TIME DETECTION OF THREAT*
Andrew H. Ryan, Jr., Ph.D., Chief of Research, Department of Defense Polygraph Institute, Fort Jackson, SC

Heightened concerns about homeland security have prompted efforts to develop several new "non-invasive" technologies for rapidly assessing the credibility of statements by individuals at airports, border crossings, secure facilities and a variety of other sensitive environments not conducive to prolonged interviews. Having demonstrated their effectiveness when matched against today's top polygraph standard in laboratory simulations, two of these experimental procedures —- thermal facial screening and eye tracking — have advanced to the point where they are now being readied for trials in the field.

*EYEWITNESS TESTIMONY: CRIMINAL JUSTICE AND SCIENCE AT A CROSSROADS*
Donald P. Judges, J.D., Ph.D., Ben J. Altheimer Professor of Legal Advocacy, University of Arkansas School of Law, Fayetteville

New questions are being raised as to whether certain laboratory-based recommendations now being adopted by some law enforcement agencies to reduce false eyewitness identification — e.g., simultaneous v. sequential line-ups — are ready for the real-world justice system. The tensions generated by the dramatic leap from lab trials to police practices has stimulated more fine-grained research into the mechanisms of false identification, suggested other ways to improve eyewitness accuracy, shed new light on the checkered relationship between witness confidence and accuracy, and intensified the search for more objective markers of witness accuracy.

# *Sunday, November 7*
# *11:15 a.m. to Noon*

OZARKIAN FORAY: SETTING THE SCENE
An introduction by our guides to the afternoon's dual-purpose sojourn to the Ozark Mountains of Arkansas.

*COPING WITH THE RED OAK BORER EXPLOSION*
Fred M. Stephen, University Professor, Department of Entomology, University of Arkansas, Fayetteville

In the past five years, oaks throughout the hardwood forests of northern Arkansas and southern Missouri have been dying in record numbers, a consequence largely of red oak borer infestation. Normally, not only are populations of these native beetles very low but the red oak borer has never previously been identified as a tree-killing species. Since 1999, however, their numbers have increased to unprecedented levels and estimated losses in excess of one billion dollars are expected as oak mortality from the epidemic continues to rise. Reasons for this unchecked growth remain unknown but intensive research efforts are underway to identify the cause(s) in hopes of developing counter-measures to stem the assault.

*TAKING GLOBAL STOCK OF SLIME MOLDS*
Steven L. Stephenson, Ph.D., Professor of Biological Sciences, University of Arkansas, Fayetteville

Frederick W. Spiegel, Ph.D., Associate Professor of Biological Sciences, University of Arkansas, Fayetteville

An international collection initiative has as its goal the assembly of a catalog of all extant species of slime mold on the planet. The venture, involving some 80 researchers scattered around the globe, is one of four planetary biodiversity projects being funded by the National Science Foundation. While the ecological roles of these fungus-like creatures are not entirely understood, there is considerable circumstantial evidence to suggest that they are critical components of the many food webs upon which small invertebrates and other organisms are highly dependent. Concerns about global change lend the effort a special sense of urgency.

# *Noon*

Lunch

# *12:45 p.m. to 4:45 p.m.*

ECOJOURNEY TO THE OZARKS
Buses will depart the Ozarks for the return to Fayetteville at 3:45 p.m.

# *6:30 p.m. to 8:30 p.m.*

WELCOME RECEPTION
University House. Buses depart the Radisson at 6:15 p.m.

# *Monday, November 8*
# *8:30 a.m. to 11:30 a.m.*

## REPROGRAMMING CELLS

Jay D. Keasling, Ph.D., Professor, Department of Chemical Engineering, University of California, Berkeley, and Head, Synthetic Biology Department, Lawrence Berkeley National Laboratory

Here's what participants in the newly emergent, fast-growing movement called synthetic biology are seeking to do: piece together novel genetic circuits — made up of ensembles of functionally linked genes (borrowed from an assortment of different species if need be) — which, when installed in living cells, prompt predictable, exploitable alterations in normal cellular behavior. The lure: a long list of hitherto unattainable applications related to tissue engineering, hazardous-waste bioremediation, biosensing and once-impossible-to-synthesize pharmaceutical products. Also this: microbes that home in on malignancies and once there commence manufacture and release of anti-cancer agents. And this: bacteria-turned-microscopic-robots to be sent on exploration and engineering expeditions to Mars. Not surprisingly, the promise of this dazzling technology brings with it major concerns about potential perils. Which is why researchers spearheading the field say it's not too early to convene a meeting to consider the dangers associated with the enterprise, a gathering modeled after the Asilomar conference held three decades ago at the dawning of recombinant DNA technology.

## TISSUE-SPECIFIC IMMUNITY

Polly Matzinger, Ph.D., Head, Section on T-cell Tolerance and Memory, Ghost Lab, Laboratory for Cellular and Molecular Immunology, National Institute of Allergy and Infectious Diseases, National Institutes of Health, Bethesda, MD

A decade ago, a new hypothesis was put forth that took issue with the longstanding belief that the primary function of the immune system is to distinguish self from non-self. It held that the immune system is far more concerned with recognizing and responding to "danger" (defined as any insult that induces tissue stress or damage) than with discriminating between self and non-self. Now the author of the controversial danger model, which in the intervening years has gathered a large and still-growing number of adherents, has taken matters a step further. Where the original proposal tackled the question of "whether" to respond, the expanded version deals with the next question, namely "what kind" of response to mount. The decision, she argues, actually rests with the individual tissues and not, as prevailing wisdom contends, with the immune system. Tissue-specific immunity, if borne out by ongoing experimental studies, will change the way medical experts design vaccines, treat tumors and transplants and, perhaps, lead to new therapies against autoimmunity, many parasites, allergy and asthma.

# *Monday, November 8*
# *2:30 p.m. to 5:30 p.m.*

### THE COMING REVOLUTIONS IN PARTICLE PHYSICS

Chris Quigg, Ph.D., Senior Scientist, Theoretical Physics Department, Fermi National Accelerator Laboratory, Batavia, IL

As construction of the Large Hadron Collider at CERN nears completion — and with a variety of other instruments in the offing — particle physicists are set to probe the frontiers of high energy, infinitesimal distances and subnuclear phenomena of exquisite rarity. What's coming as a consequence of gaining access to the "magical" 1-TeV (one billion electron-volt) energy realm, they say, is a new era of discovery and long-sought answers to looming questions that speak to our understanding of the everyday world. To wit: Why are there atoms? Why chemistry? Why are there stable structures? What makes life possible? Also answers to profound mysteries surrounding the most fundamental aspects of matter: What makes an electron an electron, a neutrino a neutrino, a top quark a top quark? Why do these particles have mass? And why do different particles — leptons and quarks — have different masses? What the LHC reveals will likely provide a menu of new challenges to be addressed when a next-generation linear collider and a (muon-storage ring) neutrino factory come on line.

### THE NEXT INFORMATION AGE?

Carl J. Williams, Ph.D., Chief, Atomic Physics Division, National Institute of Standards and Technology, Gaithersburg, MD

Just as computers, lasers and the technology of the Internet transformed the late 20th Century, many of the best scientific minds now believe that quantum information will prove the linchpin of dramatic, as yet undreamt of societal change in the 21st, its potential impact rivaling if not exceeding that of the full-out promise of the Human Genome Project. Still in its infancy, the new technology — the confluence of two revolutionary developments of the last century, information science and quantum mechanics — seeks to exploit the exotic behavior (known as "superposition" and "entanglement") of quantum particles, e.g., single atoms and single photons of light. Among the beckoning applications, once researchers succeed in mastering the rules: unbreakable cryptographic systems, allowing the secure exchange of information over widely distributed networks without danger of interception; sugar-cube-sized quantum computer processors capable of performing tasks currently impossible even with all the most sophisticated supercomputers in existence running in concert for a million years.

# *6:30 p.m. to 9:45 p.m.*

### CASW ANNUAL RECEPTION AND DINNER

Fayetteville Town Center, within walking distance of the Radisson

Presentation of the Victor Cohn Prize for Excellence in Medical Science Reporting

Featured speaker: Al Seckel, Ph.D., Research Fellow, California Institute of Technology, on "A Journey Through the Mind's Eye: The World's Most Powerful Optical Illusions".

# *10:00 p.m.*

Hospitality Suite

# *Tuesday, November 9*
# *8:00 a.m.*

Buses depart Radisson for University of Arkansas campus

# *9:00 a.m. to 11:15 a.m.*

## HUMAN ORIGINS

New comparative studies of genotype and phenotype are shedding important light on the evolution of *Homo*.

### *GENETIC DIFFERENCES BETWEEN HUMANS AND GREAT APES: IMPLICATIONS FOR HUMAN EVOLUTION (AND DISEASE)*

Ajit Varki, M.D., Professor of Medicine and Cellular and Molecular Medicine, Co-Director, Glycobiology Research and Training Center, and Coordinator, Project of Explaining the Origin of Humans, University of California-San Diego, La Jolla, CA

At the level of individual protein sequences, humans appear to be more than 99% identical to the great apes, our closest evolutionary kin, even after five-million-plus years of divergence from the last common ancestor. So then, what were the agents of change? Recent completion of the draft sequence of the chimpanzee genome should go a long way toward speeding efforts to unearth the genetic alterations that help account for bipedalism, large brain and other key insignias of the human phenotype. A number of candidates have already been identified, among them certain genes that affect the biology of cell surface molecules called sialic acids. Aside from the evolutionary implications, the knowledge gained in understanding the differences between chimpanzee and human sialic acid biology promises to offer new insight into a host of human medical disorders, including infectious diseases, autoimmunity, heart disease and cancer.

### *EVOLUTION'S BITE*

Peter Ungar, Ph.D., Professor of Anthropology, University of Arkansas, Fayetteville

Eerily enchanting, the images make for landscapes of a special kind, products of a new laser scanning technique for generating high-resolution, 3-D models of topographic features in conjunction with geographic information system software for precisely measuring every physical aspect of the terrain, every groove, slope and hollow. The surfaces under scrutiny: that of teeth, the fossil remains of early human ancestors. By comparing contours of worn molars from various hominid groups at different stages of human evolution, and between these lineages and like specimens from wild apes and other living primates, biological anthropologists are beginning to draw a more complete picture of the dietary adaptations of our predecessors and the habitats in which they dwelt. Case in point: new findings from a study of matching samples from *Australopithecus afarenis* (the 3.7 - 3.0 million-year-old "Lucy"species) against those of early African *Homo* (from about 2.4 - 1.2 million years ago) provide important clues about their differing dining habits and the paleoecological surround that gave rise to them.

# *Tuesday, November 9*
# *11:30 a.m. to 12:30 p.m.*

BUILDING THE NEXT NANOWONDERS FROM SCRATCH
Laurent Bellaiche, Ph.D., Associate Professor of Physics, University of Arkansas, Fayetteville

First came this surprising discovery: that a class of ferroelectric materials, which convert mechanical to electrical energy (and vice versa) and lie at the very heart of much of today's most advanced technology, retain this treasured piezoelectric property even when present in ultra-tiny — i.e., nanoscale — amounts (the quantum domain where different rules were presumed to apply). And now there's this: follow-up computer modeling trials have provided researchers with the architectural blueprints for constructing these nanoferroelectrics, atom layer by atom layer, from the ground up so as to endow this nanomatter with greatly enhanced ("fantastic," some call it) piezoelectric response as well as new, technologically useful characteristics. The complex manufacturing facility required to assemble these quantum dots, thin films and superlattices is about to begin operations, prelude, researchers predict, to the rapid evolution of a new order of ultra-miniaturized marvels. Military demands — eavesdrop-proof communication capabilities, sharper night vision, sonar that can "see" farther than current systems — will likely command initial attention.

# *12:30 p.m.*

Lunch

# *1:30 p.m. to 5:00 p.m.*

CAMPUS EXPLORATIONS
On the eve of the 20th anniversary of the deadly Bhopal disaster and as a follow-up to the NASW workshop session on chemical terrorism, a tour *cum* demonstration of the world's largest ultra-low-speed wind tunnel for modeling the consequences of toxic gas release. Also on the schedule: an opportunity to visit the university's extraordinary, ultra-high-tech laboratory devoted to assessing consumer-pleasing attributes of food.

# *7:00 p.m. to 10:00 p.m.*

ROCK-N-ROLL AT UARK BOWL
An evening of fun and frolic hosted by the University of Arkansas. Buses depart Radisson at 6:45 p.m.

# *Wednesday, November 10*
# *8:30 a.m. to 11:30 a.m.*

## COSMIC DAWN

Paul R. Shapiro, Ph.D., Professor of Astronomy, The University of Texas at Austin, Austin, TX

Fueled by a plethora of astronomical discoveries that confirm theoretical predictions considered purely speculative just a few years ago, the race is on to pierce the last, great, unobserved window of cosmic time: the Dark Epoch, the period during the first billenium, between a million and a billion years after the Big Bang, when the inchoate universe was cold and devoid of stars and other luminous objects. Now, with the imminent advent of a slew of new tools — ranging from the soon-to-be-launched SWIFT probe (in the hunt for early-universe gamma ray bursts) to a variety of ground-based radio-antenna arrays currently under development, including SKA (Square Kilometer Array), LOFAR (Low Frequency Array) and PAST (Primeval Space Telescope) — cosmologists are on the verge of catching their first direct glimpses of these dark ages and how the first tiny galaxies, seedbeds of the first stars, and ultimately of the cosmos as we know it, came to be.

## CLIMATE CHANGE: NOW FOR THE HARD PART

Gerald M. Stokes, Ph.D., Director, Joint Global Change Research Institute, College Park, MD

The past 15 years of climate research have delivered incontrovertible answers to two major questions. One: yes, global warming is upon us and human activity is at least partially responsible. Two: if we're to do anything about it, there will have to be a drastic shift in the way we get the energy needed to satisfy the demands of development and economic well-being. But those were the easy questions. Now come the really hard ones: Just how sensitive is climate to human influence? How fast can society act to either mitigate greenhouse emissions or adapt to the consequences? Answers to the first should begin appearing within a year, now that researchers finally have the computational wherewithal to resolve the large, lingering uncertainty related to the role of clouds on climate. As for the second, a number of new-technology remedies — e.g., carbon sequestration — have been proposed. Whether corrective steps are taken anytime soon depends on how the fierce debate, between analysts who worry about the possibility of rapid or even abrupt climate change and those who cling to notions of a less sensitive climate system subject to far slower transitions, plays out.




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