Thirty-Eighth Annual Briefing NEW HORIZONS IN SCIENCE

October 29 through November 2, 2000
The Warwick Hotel
Houston, Texas

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

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Sunday, October 29
6:30 p.m. to 9:30 p.m.

WELCOME RECEPTION/REGISTRATION
Murat Room, The Warwick Hotel

Monday, October 30
8:30 a.m. to 11:30 a.m.

'BIOSMART' POLYMERS

Antonios G. Mikos, Ph.D., John W. Cox Professor of Bioengineering and Chemical Engineering, Director, John W. Cox Laboratory of Biomedical Engineering, Rice University, Houston, TX

Jennifer L. West, Ph.D., T. N. Law Assistant Professor of Bioengineering, Rice University, Houston, TX

The era of synthetic-polymer medicine is rapidly coming of age. Among applications that beckon: guided tissue/organ regeneration; DNA delivery for gene therapy; blood clot prevention; and eye cell transplantation. Take organ regeneration. One idea is to mold the polymer into a prescribed shape (a nose, say), salt it with appropriate biological precursors (donor cells, perhaps genetically engineered, along with appropriate growth factors) and implant the ensemble in the patient (to replace diseased or malformed organs). As the system builds, the biodegradable scaffolding disappears, leaving a viable neo-organ in its stead. Harder to fabricate are structures with rich blood supplies. But major progress is being made too in polymer-based synthesis of small blood vessels, which could also be put to work in coronary bypass surgery.

GENE REPLENISHMENT: NEW STRATEGIES

Mariano A. Garcia-Blanco, M.D., Ph.D., Associate Professor of Genetics, Microbiology and Medicine, Duke University Medical Center, Durham, NC

Gary H. Karpen, Ph.D., Associate Professor, The Salk Institute, La Jolla, CA

Most human genes consist of exons (coding) and introns (non-coding stretches of DNA). Instructions for making protein are relayed by exons-only strands of messenger RNA, fashioned from pre-mRNA primary transcripts. The intron-excision process falls to molecular assemblages called spliceosomes. Researchers have now learned how to exploit this complex editing machinery for the purpose of repairing defective genes and crafting toxic DNA constructs that selectively act to kill tumor cells. On a related front, scientists are fast closing in on basic questions regarding chromosomal inheritance and the formation of centromeres (elements critical to proper cell division) as prelude to the creation of artificial human mini-chromosomes capable of taking up independent, functional residence in the nuclei of cells.

Monday, October 30
2:30 p.m. to 5:30 p.m.

MILLENNIAL VACCINES

Stephen Albert Johnston, Ph.D., Professor of Internal Medicine and Biochemistry, Eugene Tragus Chair in Molecular Cardiology and Director, Center for Biomedical Inventions, University of Texas-Southwestern Medical Center, Dallas, TX

Researchers think the time's finally at hand to heed the call for a large-scale, industrial-strength Millennial Vaccine Initiative aimed at developing permanent protection against mankind's three most serious health scourges – AIDS, tuberculosis and malaria – let alone a variety of other infectious ills. Several convergent advances account for the optimistic outlook: availability of genome sequences for a fast-growing body of human pathogens; a powerful, new technology – expression library immunization – for rapidly screening large numbers of microbial, parasitic and viral genes for their ability to trigger strong, effective immune responses; deeper understanding of and, from it, novel strategies for favorably tweaking critical elements of the body's defense system, particularly antigen-presenting dendritic cells.

MAKING ANTIMATTER

Gerald Gabrielse, Ph.D., Professor and Chair, Department of Physics, Harvard University, Cambridge, MA

It's one of the great unsolved riddles of modern science: Why is it that any matter at all survived the post-Big Bang cool down, given the fact that the moment of cosmic birth would reasonably have produced, in light of current theory, matter and antimatter in equal abundance? If that were the case, then, over time, chance encounters of matter and anti-matter should have all but annihilated each other, essentially voiding the universe. But here we are awash in matter, with antimatter in extremely short supply. Perhaps now, however, with the completion of the new antiproton decelerator facility at CERN, which brings with it the means to create and quantitatively measure the properties of antihydrogen (full-fledged antiatoms, mind, not just elementary antiparticles), the way may be open, at last, to solving this lingering mystery.

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

VICTOR COHN PRIZE RECEPTION AND DINNER

Rice University Faculty Club, Cohen House. Presentation of inaugural Victor Cohn Prize for Excellence in Medical Science Reporting. Featured speaker: Robin Forman, Professor and Chair, Department of Mathematics, Rice University. Bus service to the Rice campus will begin departing The Warwick Hotel at 6:30 p.m.

Tuesday, October 31
8:00 a.m.

Buses begin departing for Rice University where continental breakfast will be available.

9:00 a.m. to 12:00 Noon

BUCKYTUBES AND BUCKYBALLS

Richard E. Smalley, Ph.D., Gene and Norman Hackerman Professor of Chemistry, Professor of Physics and Director, Center for Nanoscale Science and Technology, Rice University, Houston, TX

Lon J. Wilson, Ph.D., Professor of Chemistry, Rice University, Houston, TX

Since their discovery in 1991, carbon nanotubes – the ultra-thin, hollow-piped descendants of soccer-ball-shaped buckyballs – have been the subject of intense, occasionally florid, speculation about imminent applications, all due to their purported mechanical and electronic properties. Now that those properties have been experimentally demonstrated, and given the recent development of a process for making buckytubes of near-endless length and in commercial abundance, the way seems clear to realizing the long-anticipated bonanza. To wit: ultra-strong structural materials; exquisite conductors; as catalyst for a new branch of organic chemistry. And what of their much-ballyhooed progenitors, buckyballs? As it happens, they too are about to show their stuff: as medical "cages" for safe, targeted delivery into the body of therapeutic and diagnostic agents.

PROTEINS: EXPLOITING THE FUNCTION OF MOTION

George N. Phillips Jr., Ph.D., Professor of Biochemistry and Computer Sciences, University of Wisconsin, Madison, WI

For more than a decade now, researchers have been applying knowledge gained from the analysis of 3-D structures of bodily proteins to the design of therapeutic agents. These static "snapshots," however, as derived from X-ray diffraction, fail to reflect what's really happening in nature, where, because of thermal agitation and other conformational disturbances, protein shapes are forever in flux – movements that may well be critical to function. With the advent of new experimental and simulation techniques, scientists are learning how to incorporate these potentially critical dynamic features into the development of a new generation of pharmaceuticals (e.g., blood substitutes and anti-HIV protease inhibitors) as well as novel industrial catalysts.

Tuesday, October 31
Noon to 1:30 p.m.

Lunch. During this period, science writers will have an opportunity to visit and experience the new protein-cum-motion simulation facility at Rice.

1:30 p.m.

Buses depart Rice for the short trip to the Texas Medical Center.

2:00 p.m. to 5:00 p.m.

TEXAS MEDICAL CENTER HOUSE CALL
A chance to explore the world's largest medical center and to meet with leading researchers to learn about a host of medical advances being made at the various institutions that make up this extraordinary complex.

5:00 p.m.

Buses depart the Texas Medical Center for The Warwick Hotel.

7:00 p.m. to 11:00 p.m.

A HAUNTING HALLOWEEN FIESTA
Magnolia Ballroom in Downtown Houston. Hosted by Rice University.
Shuttle service will be available to and from The Warwick Hotel throughout the evening, beginning at 6:30 p.m.

Wednesday, November 1
8:30 a.m. to 11:30 a.m.

MOLECULAR COMPUTERS AND NANOTRUCKS

James M. Tour, Ph.D., Chao Professor of Chemistry, Center for Nanoscale Science and Technology, Rice University, Houston, TX

It's a heady idea: to build computers in which individual molecules or clusters of molecules take the place of the transistors, wires and other components central to today's microcircuits. Ultra-tiny computers that operate at incredible speeds, far in excess of anything solid-state devices could ever hope to achieve. The effort to create such marvels is proceeding apace, spurred by recent advances (e.g., production of molecular switches, wires and memory elements). But daunting challenges remain. Chief among them: figuring out how to connect the various sub-units. Meanwhile, in another bit of techno-derring-do, the same researchers are also at work building nanoscale trucks – single-molecule semis with chassis, loading-bay, bumpers, axles, wheels – for hauling atom– and molecule-sized loads (en route to the bottom-up assembly of any desired object).

SPACE-STATION ESCAPE

Tayfun E. Tezduyar, Ph.D., James F. Barbour Professor in Engineering, Chairman, Department of Mechanical Engineering and Materials Science, Rice University, Houston, TX

Normally, astronauts will travel to and from the International Space Station on the space shuttle. In the event of a sudden emergency, however, with no time to send a shuttle to the rescue, what then? The plan is for a getaway via the crew return vehicle, which will be affixed to the station. In its rendezvous with the Earth, the CRV will depend on the deployment of a sequential array of parachutes, first to slow its descent through the atmosphere, then to glide it to the landing area and finally to land it softly. However, there is no easy way to perform the full range of laboratory trials necessary to assess the mechanical and aerodynamic responses of the massive chutes required to land such a large object. One answer: a new, highly advanced computer simulation approach, dubbed virtual reality testing.

Wednesday, November 1
2:30 p.m. to 5:30 p.m.

BIOCONTROL AND BIOMIMETICS

Alan S. Rudolph, Ph.D., M.B.A., Defense Sciences Office, Defense Advanced Research Projects Agency (DARPA), Washington, DC

There are two parts to this daring surrogates program: getting them to do it *and/or getting* them to teach us how to do it (by way of biomimetic mechanical replicants). The "them" of the enterprise: geckos, cockroaches, beetles, honeybees and lobsters. The "it": a wide range of military- and defense-related expeditions, including detection of unexploded ordnance (e.g., landmines) as well as agents of chemical and biological warfare; search and rescue missions in complex terrain; and environmental surveillance (for pollutants and such). Launched two years ago under the auspices of DARPA, the collaborative effort, involving some two dozen institutions, is beginning to yield highly promising albeit still-preliminary results.

EXTRA-LARGE-DIMENSION UNIVERSE

Savas Dimopoulos, Ph.D., Professor of Physics, Stanford University, Stanford, CA

Why is the force of gravity so much feebler than the weakest of the three other fundamental forces of nature? Now, thanks to a stunningly novel hypothesis, this long-standing cosmological perplexity may be on the road to resolution. In brief, the new string-theory-derived model holds that there exists a large, unseeable, extra dimension beyond the four known dimensions of the universe – "space outside of space"; and that of the ordinary matter and energy making up the known universe only gravity can reach into this new spatial realm, thereby causing it to lose strength in "local" space. What's special about this proposal – why it has the physics community abuzz – is that it is testable (via tabletop experiments currently underway and in trials to be conducted in the next generation of particle accelerators, such as the Large Hadron Collider at CERN).

6:00 p.m.

Hospitality Suite open.

Thursday, November 2
8:30 a.m. to 11:30 a.m.

ICE-AND-SNOW CHEMISTRY: UNEARTHING THE SECRETS

Paul B. Shepson, Ph.D., Professor of Atmospheric Chemistry, Purdue University, West Lafayette, IN

"Nobody knew anything about snowpack chemistry because no one had thought to look," says a member of an international Arctic scientific team that finally decided to do just that. What the researchers have now uncovered is the explanation for a string of once–baffling observations. Such as: evidence gathered in the mid-1980s showing that when the polar sun rises in mid-March or April levels of ground-level ozone drop sharply; and, more recently, detection of other chemical surprises both above and within the snowpack. Conclusion: in the presence of sunlight the ostensibly chemically laid-back snowpack becomes a highly reactive medium. That discovery may call into question certain ice-core-based interpretations regarding long-term composition of the atmosphere and, with up to 40% of Earth snow-coated, also require major changes in atmospheric-ozone modeling.

CLIMATE, HISTORY AND HUMAN ACTION

Roderick J. McIntosh, Ph.D., Professor of Anthropology, Rice University, Houston, TX

Begun more than two decades ago, his groundbreaking exploration of the roots of West African civilization continues unabated. But recently, in part as an outgrowth of this effort and in league with archeological and anthropological colleagues, he has set out on a new mission, one that could – and in his view should – bear mightily on the on-going debate over global warming and climate change. As he sees it, the most important issue – the manner in which people have responded *historically* to climate change – has been all but absent from the debate. As he puts it in a newly published book: "By ignoring the great laboratory of the millennia … we condemn ourselves to reinventing a very complex wheel in the face of one of humanity's greatest challenges." It's a situation he and his colleagues mean to rectify.

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