Thirty-Ninth Annual Briefing NEW HORIZONS IN SCIENCE

November 4 through 8, 2001
Tempe Mission Palms Hotel & Convention Center
Tempe, Arizona

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

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Ben Patrusky, Executive Director, CASW

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Sunday, November 4
7:00 p.m.

WELCOME RECEPTION/REGISTRATION
Tempe Mission Palms Hotel

Monday, November 5
8:30 a.m. to 11:30 a.m.

UNIVERSAL LIFE
Is there – was there – life out there? A look at what's ahead in the ongoing search.

EXOLIFE: HOW WILL WE KNOW IT WHEN WE SEE IT?
Jack D. Farmer, Ph.D., Professor of Geological Sciences and Director, Astrobiology Program, Arizona State University, Tempe, AZ

By studying microbial life in extreme environments on Earth – ranging from subsurface and hydrothermal vents to ancient viable microorganisms from deep ice in the polar caps and permafrost – scientists have begun to define the markers, the tell-tale biosignatures, that speak unequivocally of biological processing (thus providing a much-needed template for the extraterrestrial quest).

SEEKING THE NEXT MARS LANDING SITE
Philip R. Christensen, Ph.D., Korrick Professor of Geology, Arizona State University, Tempe, AZ

Upon completing high-resolution mapping of the mineral make-up of the planet's surface, the remote thermal sensor aboard the 2001 Mars Odyssey spacecraft will provide the basis for selecting the landing site for the next Mars rover – but certainly not before some intense debate over how best to interpret this mineralogic data vis a vis the search for Martian life.

MARS AND EUROPA: THE COMING DECADE
Ronald Greeley, Ph.D., Regents' Professor of Geology, Arizona State University, Tempe, AZ

In the offing: for Mars, an international armada of orbiters and landers, culminating in a sample-return mission by the end of the decade – about the same time that the Europa Orbiter is slated to begin its interrogation of one of Jupiter's ice-crusted moons where subsurface environments favorable to life may exist.

THE PROMISE OF TITAN
Jonathan I. Lunine, Ph.D., Professor of Planetary Sciences and Chair, Theoretical Astrophysics Program, University of Arizona, Tucson, AZ

Methane-shrouded Titan, Saturn's largest moon, is certainly not the home of life today. But its organic chemical cycles may constitute a natural laboratory for some of the early steps leading to life – an analogue for prebiotic conditions on Earth. In three years the international Cassini-Huygens probe will peer beneath the dense smog to discover what this world can tell us about how life on Earth came to be.

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

RNA SILENCING

Vicki Vance, Ph.D., Professor of Biological Sciences, University of South Carolina, Columbia, SC

In the beginning (just over a decade ago) when the phenomenon of gene silencing first made its unexpected and frustrating presence known – by wreaking havoc on efforts to endow transgenic plants with novel traits – it generated considerable consternation among molecular biologists. But now that investigators have finally succeeded in discovering the underlying mechanism – dubbed RNA silencing or, alternatively, RNA interference (RNAi) – that thorn has been transformed, in the eyes of many, into a treasured rose. For what's become clear, as a result of the intense research scrutiny that the discovery has sparked, is that the capacity to silence gene expression via RNAi resides not only in plants, where it acts to defend against viral invasion, but also in a variety of other organisms, including perhaps mammals. Scientists now hope to exploit RNAi: as a new, near-effortless tool with which to explore gene function; as a means of enhancing molecular pharming; and one day, perhaps, as a novel vehicle for gene therapy.

THE EVOLUTION OF LANGUAGE: A NEW VIEW (IF THAT'S POSSIBLE)

Elizabeth Bates, Ph.D., Professor of Cognitive Science, Center for Research in Language, University of California, San Diego, La Jolla, CA

Scientists, it has been said, live in a dogma eat dogma world – an arena where theory, no matter how well entrenched, always remains grist for the mill. Currently under challenge is a doctrine most often associated with linguist Noam Chomsky, who, beginning with his first book in 1957, has been promulgating the idea that language is innate. In his view, and the many who have come to subscribe to it, the brain houses a fixed, localized "mental organ" devoted strictly to language. But, several converging lines of evidence have now all but established that no such entity exists, demonstrating instead that the neural circuits responsible for processing language are charged with carrying out any number of non-linguistic functions as well. As would be expected, such revisionism has provoked fierce controversy. If the new thinking takes root, however, it will almost certainly lead to major shifts in the way we perceive and treat language disorders, aphasia among them.

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

CASW ANNUAL RECEPTION AND DINNER

Old Main Carson Ballroom, Arizona State University. Buses leave hotel beginning at 6:30 p.m.

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

Featured speaker: Stephen J. Pyne, Ph.D., Professor of Biology and Society, Arizona State University, on "A Walk Through Wildfire."

Tuesday, November 6
8:30 a.m. to 11:30 a.m.

VALUE-ADDED PHOTOSYNTHESIS

Neal W. Woodbury, Ph.D., Professor of Chemistry and Biochemistry, Arizona State University, Tempe, AZ

Devens Gust, Ph.D., Professor and Chair, Department of Chemistry and Biochemistry, Arizona State University, Tempe, AZ

Having spent decades teasing out the details of the process by which organisms convert sunlight to energy, researchers are now putting their hard-won knowledge to work creating new molecular-scale devices for a host of applications. By genetically modifying natural photosynthetic proteins, for instance, they have succeeded in fashioning "magic bullets" designed to home in on specific target molecules and then – and only then – emit fluorescent signals. Introduced into the body, such reporter proteins could, on a clinical level, act to monitor a patient's health status (e.g. glucose levels in the case of diabetics) and, on a basic level, offer investigators the means to map the activity and dynamics of individual cell molecules *in vivo.* Also coming: artificial versions of the natural photosynthetic apparatus to help meet the energy and transportation demands of the fast-growing nanoscale landscape as well as provide the substrate for tomorrow's communications networks.

THE GREAT AMPHIBIAN DIE-OFF: WHY?

James P. Collins, Ph.D., Ullman Professor and Chair, Department of Biology, Arizona State University, Tempe, AZ

The mystery remains: why, since 1989, such precipitous declines in amphibian populations worldwide? One tantalizing clue: many regions experiencing this great vanishing are conservation sites, lands presumably protected from exotic-species incursions and habitat destruction, which seems to eliminate two of the suspects. While there's still no "smoking gun," preliminary evidence now points to pathogenic agents – virus, fungus or both – as perhaps the main culprits in the killing game, abetted in some as-yet unexplained manner by environmental change. In search of definitive answers, an international research team has launched a bottom-to-top exploration of host-pathogen interactions – from the molecular to the ecosystem levels – and the way this interplay may have been affected by environmental assaults (e.g. chemical pollutants, UV radiation and/or global climate change) to the detriment of amphibia. Also, because amphibia play a pivotal role in the ecosystems they inhabit, the study will likely have much to tell us about larger-scale environmental consequences in the offing.

Tuesday, November 6
1:00 p.m.

Buses begin departing for ASU campus.

1:30 to 4:00 p.m.

CAMPUS EXPLORATIONS

As a follow-up to the session on astrobiology, an opportunity to pay a hands-on visit to: ASU's Meteorite Center, housing the largest university collection in the world, with Carlton Moore, Regents' Professor of Geology and Biochemistry and Director of the Meteorite Center, and Laurie Leshen, Associate Professor of Geology, serving as guides; and the new Mars Space Flight Center, in the company of its director, Philip Christensen.

You will also be offered special access to the College of Engineering and Applied Sciences/Bioengineering's Robotic Arm Laboratory, there to be briefed on recent advances related to the development of brain-controlled prosthetics for patients with paralyzed limbs.

4:15 p.m.

Buses depart the ASU campus for the Tempe Mission Palms.

6:00 p.m.

Hospitality Suite open.

Wednesday, November 7
8:30 a.m. to 11:30 a.m.

SOIL METAGENOMICS

Jo Handelsman, Ph.D., Professor of Plant Pathology, University of Wisconsin, Madison, WI

There's a widespread notion that soil microorganisms – a common source of antibiotics and other medicinal agents – have been all but mined out; that what was there to discover has already been discovered. Not so, say researchers. The yields have been poor of late, they contend, because traditional culturing techniques succeed only in recovering the same, well-characterized microbial species time and again. According to recent evidence, however, the cultivable group makes up only a very tiny fraction – between 0.1% and 1%– of the full complement of microfloral species in the soil. The likelihood then is that the as-yet unidentified populations harbor an unimaginably rich lode of potentially useful molecules. Better yet, the means to tap into this anonymous trove may now be at hand. The new strategy, metagenomics, calls for isolating and cloning in host cells, such as E. coli, DNA from soil samples and screening for biological activity and for the production of novel compounds.

LIFE, SUGAR-CODED

James C. Paulson, Ph.D., Professor, Department of Molecular Biology and Department of Molecular Experimental Medicine, The Scripps Research Institute, La Jolla, CA

The startling discovery that a mere 30,000 genes account for the complexity of the human organism does not undermine the central paradigm of molecular biology: that information flows from DNA to RNA to protein. But it does suggest just how much of a say other information brokers have in mammalian assembly and development. Thus, the sudden, heightened interest in carbohydrates and the critical roles these molecules play in many biological processes (e.g. fertilization, immune defense, cell growth, cell-cell adhesion as well as viral replication, parasitic infection and inflammation). Each cell type brandishes its own distinctive kind of surface sugars. These provide the zip-code-like information – sugar-coded, come-hither signals – to which other cells, via their surface-residing carbohydrate-binding proteins, selectively respond. Given the new impetus, a consortium of glycobiologists is set to undertake a novel initiative, called functional glycomics, that will seek to better define these sugar-protein interactions as prelude to development of new therapies against a variety of ills.

Wednesday, November 7
2:30 p.m. to 5:30 p.m.

NEW EYES ON THE HEAVENS

Jeremy Mould, Ph.D., Director, National Optical Astronomy Observatory, Tucson, AZ

David S. De Young, Ph.D., Senior Research Scientist, National Optical Astronomy Observatory, Tucson, AZ

During the last five years, the world's constellation of stargazers has made dazzling headway in their pursuit of the narrative describing the evolution of the universe. But major gaps in the tale remain, let alone inconvenient facts in need of resolution. The remedy: a series of land- and space-based observatories now in the pipeline or planning stages, including *MAP, SIRTF, SAFIR, IRIS, FAME, SIM, FIRST, NGST, ALMA, GSMT* and *LSST.* Collectively, this acronymic olio will provide many of the details required to help complete the once and future celestial saga. Problem is, these facilities, once in play, will generate frightfully huge data streams. To make the most of such astronomically huge acquisitions, scientists have come up with a revolutionary concept – the Virtual Observatory. According to its proponents, the VO will enable astronomers to carry out innovative research by "mining" data in this colossal archive in hitherto-unimaginable ways – all, mind, from the comfort of home or office. As such, the VO may forever alter the way in which much of observational astronomy will be conducted in the future.

NEUTRINO PHYSICS: NEW VISTAS

Giorgio Gratta, Associate Professor of Physics, Stanford University, Stanford, CA

First of its kind, KamLAND (Kamioka Liquid scintillation Anti-Neutrino Detector) is about to make its debut. Built by a U.S.-Japanese consortium in the underground site that once housed the pioneering Kamiokande project, KamLAND promises to open new windows of investigative opportunity in a host of disciplines, from astrophysics and cosmology to particle physics and geophysics. It's primary mission, however, is to bring a new dimension to the exploration of the properties of neutrinos emitted by the Sun and the nuclear reactions that give rise to them. KamLAND's ideally situated to do that: in a mine on the island of Honshu, where it lies exposed to an intense barrage of low-energy neutrinos – solar-neutrino surrogates – generated by Japan's proximate commercial nuclear reactors. In a related development, researchers propose putting miniature versions of KamLAND to work safeguarding nuclear reactors against illicit tampering (e.g. diversion of fissile material by would-be terrorists).

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

SOUTHWEST BASH

A gala evening of fun and frolic co-hosted by ASU, General Dynamics and the Motorola Integrated Information Systems Group at the Heard Museum, one of the world's premier centers of Native American culture and art. Buses depart the hotel beginning at 6:30 p.m.

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

OIL (ETC.) FROM ALGAE

Milton R. Sommerfeld, Ph.D., Professor of Plant Biology and Associate Dean, College of Liberal Arts and Sciences, Arizona State University, Tempe, AZ

The latest oil crisis (however real) has rekindled interest in renewable energy resources. Lured back into the prospecting game is a small cadre of microbiologists in quest of organisms capable of *measurably adding* to fuel reserves. Having screened hundreds of candidates, they have now centered their attention on a few species of photosynthetic microalgae – varieties found to be 20 times more productive than corn as a potential energy source. More to the point, the algae-made, energy-laden lipids (unlike ethanol from corn) can be readily refined into gasoline and diesel fuel using conventional technology. There's also a zero-sum environmental payoff: the amount of atmospheric CO_2 consumed by the algae in the process of manufacturing lipids offsets that subsequently generated by consumption of the resultant fuel. Yet another promising bonus: tapping the algae (genetically enhanced perhaps) for harvestable yields of vitamins and other health-benefiting nutraceuticals.

DIGITAL RENAISSANCE: IT 2001±50

Stephen L. Squires, Ph.D., Chief Science Officer and Vice President, Hewlett-Packard Company, Palo Alto, CA

Think of it this way: in one era, out the other. The *it,* in this instance: information technology. One scientist very much in the know makes a compelling argument that we are now at the juncture of just such an era-to-era transition. As he sees it, two bracketing events define the earlier era: the invention of the transistor in 1947 and the emergence, 50 years later, of the existing global Internet, which depends largely on transistor-based "bulk" quantum technology (technology now approaching fundamental scaling limits – the end of the developmental line, if you will). As for the genesis of the newer era, the turning point came early this year, he says, marked by the invention of molecular switching technology based on a deeper understanding of quantum effects at the atomic scale. What beckons, as a result: a refashioned Internet pegged more and more to atom- and molecule-sized devices and capable, ultimately, unlike the current incarnation, of reaching each and every one of Earth's six billion people.

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