

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

*October 30 through November 3, 1994*  
*The Concourse Hotel*  
*Madison, Wisconsin*

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*Sunday, October 30*  
*6:30 p.m. to 9:00 p.m.*

Registration and Welcome Reception  
The Concourse Hotel

*Monday, October 31*  
*8:30 a.m. to 11:30 a.m.*

**PLANT-FRIENDLY BACTERIA: THE AGRICULTURAL POTENTIAL**

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

Scientists have identified a soil bacterium that suppresses root diseases of crop plants through a variety of surprising pathogen-thwarting mechanisms, including production of a novel brand of antibiotic. They have now learned that soils everywhere contain one or another strain of this bacterial species, each specially adapted to its particular ecological niche. This latest discovery opens the way to a highly promising agricultural strategy — site-specific biocontrol — by which indigenous microorganisms are put to work protecting crops against assault by disease-causing bacteria and fungi on a precisely tailored, eco-zone by eco-zone basis.

**HYBRID ANTIBIOTICS**

C. Richard Hutchinson, Ph.D., Professor of Bacteriology and Medicinal Chemistry, University of Wisconsin, Madison

By swapping genes among actinomycetes, the most prolific microbial source of known drugs, researchers believe they may have found a way to manufacture novel antibiotics against human disease. As a group, these bacteria make use of several similar though non-identical genes in the multi-step biosynthetic process that leads to the finished product. What scientists have now thought to do, via recombinant technology, is create unique combinations of these intermediate, kindred genes in hopes that bacteria possessing such novel rearrangements would generate new, active antibiotic constructs of potential clinical value.

*Monday, October 31*  
*2:30 p.m. to 5:30 p.m.*

THE NEXT WAVE IN MAKING MOLECULES  
(IF MOLECULES IS WHAT THEY ARE)

George M. Whitesides, Ph.D., Professor of Chemistry, Harvard University,  
Cambridge

Historically, the business of chemistry has been to synthesize *molecules* (e.g. drugs, polymers, dyes). Now, based on lessons learned from both biology and materials science, chemists, in increasing numbers, are turning their attention to fashioning and exploring the behavior of a new class of compound, *non-covalent aggregates*, collections of atoms held together by a combination of conventional and unconventional bonding interactions. A number of synthetic strategies, including molecular self-assembly, have been devised to fabricate these exotic, potentially valuable chemical species. Among the promising applications: creation of a new generation of microchips; a new approach to rational drug design.

WATCHING EMBRYOS DEVELOP — LIVE AND IN 3-D

Russell E. Jacobs, Ph.D., Member of the Beckman Institute, California Institute of  
Technology, Pasadena

Development of a new magnetic resonance imaging technique has suddenly endowed biologists with the power to observe — live and in 3-D — the step-by-step development of individual embryos, a capability that will no doubt prove of immense importance in helping resolve critical mysteries about how egg becomes organism. Until now, to get a spatial and temporal sense of the story of how an organism comes to be, researchers have for the most part been obliged to piece together information from many embryos, each checked, fixed and sliced at a different stage of development for analysis under the light microscope. Much of the early work with this new technology, dubbed MRI microscopy, has been done on frog. Mouse and primate studies are in the offing.

*6:30 p.m.*

CHANCELLOR'S RECEPTION

Olin House, University of Wisconsin

Buses depart Concourse Hotel at 6:15 p.m.

*Tuesday, November 1*  
*8:30 a.m. to 11:30 a.m.*

#### REINVENTING THE IMMUNE SYSTEM

Polly Matzinger, Ph.D., Chief, Tolerance and Memory Section, Laboratory for Cellular and Molecular Immunology, National Institute of Allergy and Infectious Diseases, National Institutes of Health, Bethesda

For three quarters of a century immunologists have held to the fundamental belief that the primary function of the immune system is to discriminate between self and non-self. But in the wake of a plethora of immunological findings that fail to mesh with this traditional view, the time may now be at hand, some argue, to weigh in with another model. One new proposal has it that the immune system is far more concerned with recognizing "danger" (defined as anything that causes tissue stress or destruction) than with distinguishing self from non-self. Still in its infancy, this new hypothesis, if true, could lead to better understanding of autoimmune diseases, new tactics for tumor and gene therapy, and a new approach to transplantation.

#### GENETICALLY MODIFIED CANCER VACCINES

Eli Gilboa, Ph.D., Professor of Experimental Surgery, Duke University Medical Center, Durham

There's a growing sense of clinical promise surrounding the application of a form of gene therapy to combat a host of lethal diseases, from AIDS to cancer. A vaccine designed to forestall metastasis or recurrence of malignancy, for example, makes use of tumor cells from patients into which genes coding for proteins that "wake up" the immune system have been inserted. Reintroduced into the patient (after irradiation to remove any malignant potential), these genetically altered cells are meant to trigger not only a heightened assault on cancerous agents of a similar stripe elsewhere in the body, but also to induce a long-term immunological "memory" of the malignancy so as to stem any future incursion.

*Tuesday, November 1*  
*2:00 p.m. to 5:00 p.m.*

**TOWARD SAVING OUR BIO/CULTURAL RESOURCES**

A special session on emerging strategies designed to preserve and protect endangered wildlife, ecosystems and archaeological treasures.

**ENHANCING FERTILITY IN WILD MAMMALS**

John P. Hearn, Ph.D., Professor of Physiology and Director, Wisconsin Regional Primate Research Center, University of Wisconsin, Madison

As knowledge of behavioral and biological mechanisms that regulate fertility in mammals continues to grow, so too do the opportunities for putting that new-found wisdom to work increasing the reproductive potential of endangered species.

**CONSERVATION IN THE FIELD: BRAZIL'S MURIQUI MONKEYS**

Karen B. Strier, Ph.D., Associate Professor and Chair, Department of Anthropology, University of Wisconsin, Madison

Recent findings on the woolly spider monkey, one of the most imperiled of the Brazilian Atlantic forest species, may provide the key to pulling this remarkable primate from the brink of extinction.

**CAN THE SERENGETI BE SAVED?**

Peter Arcese, Ph.D., Assistant Professor of Wildlife Ecology, University of Wisconsin, Madison

New studies suggest that without dramatic policy changes, the Serengeti, one of the great natural wonders of the world, will cease to function as an intact ecosystem within the next two decades.

**ECO-ARCHAEOLOGY IN RESCUE ARCHAEOLOGY**

George Burns, Ph.D., Emeritus Professor, Archaeometric Laboratory, Department of Chemistry, University of Toronto, Ontario

The call is for an interdisciplinary approach aimed at stemming further deterioration of ancient monuments, now occurring world-wide on a massive scale, and at safeguarding newly discovered, as yet unexcavated archaeological sites.

*6:45 p.m.*

**RECEPTION AND ANNUAL CASW BANQUET**

Great Hall of the Memorial Union, University of Wisconsin

Presentation of the 1994 National Association of Science Writers' Science-in-Society Awards.

Featured Speaker: Hugh H. Iltis, Ph.D., Professor Emeritus of Botany and Director of the Herbarium, University of Wisconsin on *Wild Corn, Wild Mountains, Wild Men: Botanical Explorations for Biodiversity*.

*Wednesday, November 2*  
*8:15 a.m.*

Buses depart for Engineering Hall, University of Wisconsin

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

**COSMIC ORIGINS: BINARY STARS AND DWARF GALAXIES**

Robert D. Mathieu, Ph.D., Associate Professor of Astronomy, University of Wisconsin, Madison

John S. Gallagher III, Professor of Astronomy, University of Wisconsin, Madison

A typical star it may be, but our Sun is also unusual in that it has only planets for neighbors. Most stars, by contrast, are orbited by at least one other star. Thus, the key to the riddle of star formation may well lie with binary systems. Now, in light of new observations of recently discovered young binary stars, researchers may be on their way to closing in on this stellar mystery. These young star pairs are also providing critical clues concerning the early evolution of our solar system and perhaps others elsewhere in the universe. Then there are the even more vexing conundrums related to the genesis, development, structure and fate of galaxies. Findings from study of recently discovered dwarf galaxies provide tantalizing clues that may also have critical bearing on the riddle of "missing" dark matter.

**PAST CLIMATES/FUTURE CLIMATE**

John E. Kutzbach, Ph.D., Professor of Atmospheric and Oceanic Sciences and Environmental Studies, Director of the Center for Climatic Research, University of Wisconsin, Madison

Prediction of the Earth's climatic future rests largely with general circulation models, which rely upon large computers to solve relatively straightforward physical equations. Applied to future scenarios, such as a doubling of atmospheric carbon dioxide, the several GCMs now in play give similar but far from identical answers. How accurate are these models? Are some more robust — i.e. better forecasters — than others? If so, why? One way of finding out is to ask competing GCMs to have a go at "foretelling" past climates — and then compare the results with true paleoclimates, as revealed by a world-wide harvest of botanical and geological data. An international effort aimed at doing just that is now underway.

*Wednesday, November 2*  
*12:30 p.m.*

Box Lunch

*1:30 p.m. to 4:00 p.m.*

TOURS OF UNIVERSITY OF WISCONSIN SCIENCE LABORATORIES

*6:30 p.m.*

GALA EVENING AT OLBRICH BOTANICAL CENTER

Hosted by the University of Wisconsin, with special access to Olbrich Conservatory on the shores of Lake Monona. Buses depart Concourse Hotel at 6:15 p.m.

*Thursday, November 3  
8:30 a.m. to 11:30 a.m.*

#### IN SEARCH OF THE HIGGS BOSON

Edward Witten, Ph.D., Professor, School of Natural Sciences, Institute for Advanced Study, Princeton

The grand theoretical construct known as the "standard model" has served particle physicists astonishingly well in their effort to elucidate the fundamental nature of matter. The story, however, is far from complete. A gaping hole remains. It concerns the mythical Higgs boson, an ingredient central to the model. Finding it offers the best hope of solving many mysteries having to do with, among other things, the masses of elementary particles and the curvature of the universe. The most promising avenue of discovery: the Large Hadron Collider at CERN, which is scheduled to become operational early in the next century. There's a chance, too, that a Fermilab Tevatron accelerator upgrade will set the stage for its detection before millennium's end.

#### THE ROAD TO CONTROLLED NUCLEAR FUSION: ARE WE ON IT?

Richard D. Petrasso, Ph.D., Principal Physicist, Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge

Since the inception of the quest in the early 1950s to harness the energy that powers the stars, an international community of scientists and engineers has achieved many notable milestones. But formidable challenges — both scientific and technological — remain. In the case of magnetic confinement, for instance, a key concern is whether alpha particles generated by the fusion reaction will act to provide the energy required to heat the plasma to "ignition" temperatures. This and a host of other unresolved issues have led some researchers to wonder if the International Thermonuclear Experimental Reactor (ITER), the next, and only, major magnetic-confinement device on the drawing board, represents the vehicle best suited for maximizing our chances of one day making controlled fusion a practical reality.

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