Twenty-Eighth Annual Briefing NEW HORIZONS IN SCIENCE

November 4 through 8, 1990
Penn Tower Hotel, Philadelphia

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

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Sunday, November 4
6:30 p.m. to 9:00 p.m.

Registration and Welcome Reception
The Penn Tower Hotel

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

ANTIBIOTIC-RESISTANT BACTERIA: AN UNDERESTIMATED PERIL?

Alexander Tomasz, Ph.D., Professor and Head, Laboratory of Microbiology, The Rockefeller University, New York, NY

Once easily controlled by a variety of antibiotics, pathogenic bacteria have become resistant to many of these agents. Also, resistance mechanisms formerly confined to one kind of microbe have apparently been acquired by other species. The bacteria have learned to rebuild their penicillin-binding proteins to lower their vulnerability to the antibiotics; they have managed to change the chemical structure of their cell surface; they have learned to import foreign DNA molecules bearing traits that are useful in evading the killing effects of antimicrobial compounds. The resistant bacterial strains have now spread worldwide and their incidence in some locales have reached alarmingly high levels.

TRANSCRIPTION FACTORS: THE ULTIMATE REGULATORS OF BIOLOGICAL FORM AND FUNCTION

Steven L. McKnight, Ph.D., Howard Hughes Research Laboratories, Department of Embryology, Carnegie Institution of Washington, Baltimore, MD

How are genes turned on and off? Regulation stems from an interplay between select stretches of DNA sequences (termed promoters, enhancers and silencers) and proteins (transcription factors) that bind preternaturally to these regulatory sequences. Molecular biologists have recently stepped up efforts to delineate just how these proteins throw the switch on gene activity — research that is likely to lead, on the basic level, to further unraveling of the egg-to-organism developmental conundrum and, on the clinical level, to new strategies for fending off viral infections, herpes and AIDS among them.

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

THE BUSINESS OF HIGH RISK

Karlene H. Roberts, Ph.D., Professor of Business Administration, Walter A. Haas School of Business, University of California, Berkeley, CA

Bhopal. Chernobyl. Exxon Valdez. The environmental-debacle list is sure to lengthen as the number of organizations engaged in activities with high catastrophic potential increases. But now there is pathbreaking research underway that seeks to prevent or reduce the incidence of man-made disasters by studying in minute detail the design and management of organizations involved in enterprises with a high-risk component but which, nevertheless, have succeeded in operating nearly error-free for very long periods of time. Some important, readily applicable lessons have already been drawn.

SEEING MORE BY SEEING LESS

Richard N. Zare, Ph.D., Marguerite Blake Wilbur Professor of Chemistry, Stanford University, Stanford, CA

By carrying out chemical separations in glass-like capillaries having openings no larger than the diameter of a human hair, scientists have begun to achieve unprecedented separation efficiencies, allowing resolution of remarkably similar biomolecules even in the tiniest samples. Called capillary electrophoresis, this extraordinary technology is now being put to work analyzing single cells or parts of a cell in efforts to understand the chemical basis of memory and how living cells communicate. And, as a result of yet another piece of technological wizardry and experimental ingenuity, investigators are able for the first time to "see" the actual collisions that make chemical reactions go.

6:00 p.m.

Hospitality Suite open
Free evening

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

THE BIOLOGY OF 'SELF' VS. 'NON-SELF'

Polly E. C. Matzinger, Ph.D., Head, Section on T-cell Tolerance, Laboratory for Molecular and Cellular Immunology, National Institutes of Health, Bethesda, MD

With new technology, scientists are now finally equipped to tackle experimentally some longstanding questions relating to the immune system's ability to discriminate between foreign invaders and molecules of "self." It now seems clear that cells of the immune system, the T and B lymphocytes, are made tolerant to self by at least two processes: clonal deletion, which eliminates cells that would produce an anti-self response; clonal anergy, which causes immune-cell inactivation. Further definition at the molecular level of how tolerance happens will almost certainly lead to development of new, exquisitely precise measures to protect against organ-transplant rejection and to combat autoimmune diseases.

MITOCHONDRIAL DNA: SMALL GENOME, BIG SURPRISES

Douglas C. Wallace, Ph.D., Woodruff Professor of Molecular Genetics, Emory University School of Medicine, Atlanta, GA

Human mitochondrial DNA (mtDNA) represents less than 1/100,000 of the human genome, but recent discoveries indicate that mutations in its vital energy-producing genes play a role in hereditary blindness, retinal deterioration, epilepsy, dementia, movement disorders, a variety of degenerative diseases and may even contribute significantly to aging. In addition to providing new insight into disease processes, mtDNA is also proving to be a powerful anthropologic tool, helping to shed light on prehistoric human migration patterns.

Tuesday, November 6
2:30 p.m. to 5:30 p.m.

THE SOCIAL LIFE OF PRIMATES

Frans B. M. de Waal, Ph.D., Associate Scientist, Wisconsin Regional Primate Research Center, University of Wisconsin, Madison, WI

In a break with tradition, scientists studying the social behavior of monkeys and apes — i.e. how the animals work to improve relationships and reduce the undermining effects of conflict — have now taken to interpret animal interactions in terms of "intentionality" and "motivation." This growing willingness to ascribe human-like attributes to primates devolves from recent evidence indicative of behavior that smacks of justice and morality. The animals exchange favors and retaliate against members of the colony who fail to reciprocate. Beyond that, it is now also apparent that they cut deals and actively strive to keep the peace. And there's evidence that the animals, macaques in particular, strive to match their young offspring with "upscale" playmates.

GAMMA RAY SKY

Trevor C. Weekes, Ph.D., D.Sc., Astrophysicist, Harvard-Smithsonian Center for Astrophysics, Whipple Observatory, Amada, AZ

An intense exploration of the last frontier in astronomy, the vast region of the electromagnetic spectrum labeled "gamma ray" is about to commence. Coming on line: telescopes with vastly improved sensitivity that cover the entire gamma-ray energy range. The expectation: wholesale discoveries of new sources within the next few years. The most dramatic advance comes with the March, 1991 launch of the Gamma Ray Observatory. Subsequent ground-based observations in Arizona, New Mexico, Utah and the South Pole will act further to put this nascent discipline on a firm footing.

7:00 p.m.

THE ANNUAL CASW BANQUET

Presentation of the 1990 National Association of Science Writers' Science-in-Society Journalism Awards.

Speaker: Daniel H. Janzen, Ph.D., Professor of Biology, University of Pennsylvania, on "Mining Biodiversity."

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

'INTELLIGENT' MATERIALS

Craig A. Rogers, Ph.D., Associate Professor of Mechanical Engineering and Director, Center for Intelligent Materials Systems and Structures, Virginia Polytechnic Institute and State University, Blacksburg, VA

Materials continue to get "smarter" as a new and growing coalition of investigators — physicists, chemists, material engineers, aerospace researchers and hosts of others — accelerates efforts to develop inanimate objects that mimic biological organisms. Such structures incorporate sensors that monitor changes in the environment, assuming a role akin to that of the nervous system. Other components, actuators, act as the musculature, allowing the ensemble to respond as necessary — by altering shape, for example. And now there's talk of structures that learn and evolve, able as a result to adjust to far more permanent influences, such as aging.

HOW THE BRAIN CONSTRUCTS REALITY

Leif H. Finkel, M.D., Ph.D., Associate Member, Institute of Neurological Science, Assistant Professor of Bioengineering, University of Pennsylvania, Philadelphia, PA

Recent discoveries in neuroscience — especially in computational neuroscience — argue that reality, as we know it, is hardly an inherent property of the external world but rather an "illusion" generated by the nervous system. Visual information, for example, enters the cortex, gets split up according to function (shape, color, depth, distance, motion), but never gets put back together again in any one place. The picture we "see" is not a single, re-creation somewhere inside our brain, but rather the consequence of a dynamic integration process carried out in distributed fashion in many cortical areas. And now, as a result of perhaps the most elaborate simulation ever of brain function, new techniques are beginning to emerge for fathoming many other mysteries of human behavior.

Wednesday, November 7

2:00 p.m. to 3:30 p.m.

A NEW SENSE OF TASTE AND SMELL

Richard L. Doty, Ph.D., Director, Smell and Taste Center, University of Pennsylvania School of Medicine, Philadelphia, PA

Gary K. Beauchamp, Ph.D., Director, Monell Chemical Sense Center, Philadelphia, PA

A constellation of new discoveries have given scientists a new appreciation and deeper insight into the mechanisms of taste and smell. Some biochemists, for example, think they are finally closing in on the senses-triggering molecular receptors. Other recent studies point to a striking relationship between genes that give rise to individual odors and those of the immune system that help specify "self," a phenomenon that may serve as the basis for diversity in nature. And there's growing evidence that decreased olfactory function may be among the first signs of Alzheimer's disease and certain forms of Parkinsonism — observations that may prove useful in early diagnosis and that lend credence to the hypothesis that these disorders stem, in part, from entry of airborne agents into the central nervous system.

3:45 p.m. to 4:45 p.m.

OPTIONAL TOUR OF PENN RESEARCH CENTERS

5:45 p.m.

GALA RECEPTION AND DINNER

Hosted by and at The Franklin Institute. Buses depart the Penn Tower Hotel at 5:30 p.m. At 6:30 p.m., after cocktails, a private showing of a new film, "To The Limit," in the Omniverse Theater. At dinner, remarks by Dr. Paul C. Lauterbur of the University of Illinois, the 1990 recipient of the $293,000 Bower Award, presented annually by the Franklin Institute to a scientist who best exemplifies the spirit of Benjamin Franklin. And following dinner, a tour of the newly opened, widely acclaimed Futures Center.

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

THE HYPERINFLATED COSMOS

Paul J. Steinhardt, Ph.D., Mary Amanda Wood Professor of Physics, University of Pennsylvania, Philadelphia, PA

Introduced more than a decade ago as an elegant solution to longstanding puzzles related to the Big Bang, the "inflation" theory — involving a triflingly brief period of faster-than-light cosmological expansion at the beginning of time — soon ran into serious trouble. The original model, and subsequent revisions, offered no way to end inflation, didn't gibe with astrophysical observations, or — in one of the more recent attempts at "fine tuning" — invoked unnatural, and ultimately unsatisfactory, assumptions. But now a new proposal has been advanced that appears to make inflationary cosmology truly viable at last.

WHAT INFANTS REALLY KNOW

Patricia J. Bauer, Ph.D., Assistant Professor of Child Psychology, Institute of Child Development, University of Minnesota, Minneapolis, MN

Conventional wisdom, based largely on the work of Jean Piaget, held that until near the second year of life, infants and young children are unable to engage in "higher cognitive functions" — i.e. to think, reason, make inferences and to plan and organize action. Rather, the widely accepted belief was that they live in the "here and now," in a world of experiences they cannot represent symbolically and, hence, cannot manipulate or preserve. But with the recent development of methods for working with infants and young children who have few or no language skills, researchers now find themselves compelled to revise traditional theory.

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