Twenty-Sixth Annual Briefing NEW HORIZONS IN SCIENCE

November 27 through December 1, 1988
Clarion Harvest House, Boulder

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

Co-Chairmen:

Jerry Bishop, Science Reporter, Wall Street Journal
Ben Patrusky, Executive Director, CASW

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Institute of Food Technologists
Martin Marietta Astronautics
National Bureau of Standards
National Center for Atmospheric Research

Sunday, November 27
6:30 p.m. to 9:00 p.m.

Registration and Welcome Reception
Clarion Harvest House

Monday, November 28
8:30 a.m. to 11:30 a.m.

TROJAN HORSE THERAPIES

L. Michael Glode, M.D., Associate Professor of Medicine, Division of Medical Oncology, University of Colorado Health Sciences Center, Denver

It's the very latest in high-tech, wolf-in-sheep's clothing, infiltrate-and-destroy ploys for combatting disease — especially cancer. From work growing out of research on monoclonal antibodies and trials in transgenic mice, researchers now think they may be able to deliver engineered killer genes that knock off sick or unwanted cells while leaving others unaffected.

'ANTISENSE' RNA AND DNA

Douglas A. Melton, Ph.D., Professor of Biochemistry and Molecular Biology, Harvard University, Cambridge, MA

Another on-the-horizon, therapeutic strategem: Introduce short stretches of nucleic acid that bind to selective gene targets, thereby preventing the formation of aberrant or disease-provoking molecules. This hide-the-gene, blind-the-messenger approach holds promise against a variety of viral ills, herpes and AIDS among them. And because they block gene expression, these "antisense" molecules offer researchers a powerful new tool for seeking answers to basic questions about the role of specific genes in organism development.

Monday, November 28
2:30 p.m. to 5:30 p.m.

VISUALIZATION SCIENCE

Larry L. Smarr, Ph.D., Professor, Astronomy and Physics Departments, and Director, National Center for Supercomputing Applications, University of Illinois at Urbana-Champaign

It's a "microscope" unlike any other. It's show-and-tell of a whole different order. With the most powerful, supercomputer-based graphics capability ever, scientists can now peer into and dissect, in incredibly fine detail and at the most fundamental level, many hitherto unknowable physical processes. This remarkable, new-to-the-scene, painting-by-numbers prowess is opening the way to profound new insights in chemistry, cosmology, biology, physics and all manner of other scientific disciplines.

AGING AND MEMORY

Carol A. Barnes, Ph.D., Associate Professor of Psychology, Behavioral Neuroscience Program, University of Colorado, Boulder

Memory researchers have centered much of their attention on changes wrought by disease. But now, with the development of an experimental model for determining just how the ability to remember varies with age, investigators have a way of studying normal, chronological shifts in animal brain function. The novel set-up also offers means to assess the potential value of drugs aimed at treating memory deficiencies. Recent findings have, in fact, set the stage for launch of a trial in humans to gauge the worth of a much-heralded agent for slowing Alzheimer's-linked memory loss.

6:00 p.m.

Hospitality Suite open.
Free evening.

Tuesday, November 29
8:30 a.m. to 11:30 a.m.

HONEYBEE SOCIETY: A SPECIAL WINDOW ON EVOLUTION

Thomas D. Seeley, Ph.D., Associate Professor of Animal Behavior, Section of Neurobiology and Behavior, Cornell University, Ithaca, NY

The saga of evolution: first naked macromolecules, then macromolecules in cells, then cells in organisms, then organisms in society. Much remains to be unraveled about how each of these organizational transitions came to be. But, now, some key answers are beginning to emerge from study of the hives of honeybees. Reason: Each colony functions as a "super-organism"; individual members cannot make it on their own, although each has considerable decision-making latitude and independence. As such, hive goings-on — particularly food foraging by its denizens — provide a textbook example of the way in which evolution goes about the business of building biological complexity.

FUTURE CLIMATE/FUTURE LIFE

Ralph J. Cicerone, Ph.D., Director, Atmospheric Chemistry Division, National Center for Atmospheric Research, Boulder

Stephen H. Schneider, Ph.D., Head, Interdisciplinary Climate Systems Group, National Center for Atmospheric Research, Boulder

Slowly, inexorably, the earth grows warmer. But just how fast — and how far — will temperatures rise in response to the greenhouse effect? Questions abound about the sources and sinks of the various trace gases. These translate into significant uncertainties that continue to muddy the speculations of future-climate modelers. On tap are up-to-the-minute reports on: what we know and what we need to know if we are to better refine our assessment of planetary fate (well enough to advise lawmakers about policy decisions); how life on earth will likely change with changing climate. Also: an update on ozone.

Tuesday, November 29
2:30 p.m. to 5:30 p.m.

THE NEW BREEDER REACTOR

Charles E. Till, Ph.D., Associate Laboratory Director, Engineering Research, Argonne National Laboratory, Argonne, IL

Worry about greenhouse warming has rekindled interest in possible alternatives to fossil fuel. Among them: energy produced by a new brand of breeder reactor. A series of recent technological advances involving fuel sources, cooling elements, waste disposal and recycling — "evolutions that add up to a revolution" — make this next generation of reactors safe (from meltdown and hijacking of in-transit, bomb-quality plutonium), effective and, as the scientist leading this new thrust will argue, free of many of the woes that have plagued and thwarted nuclear-power development.

FREE-ELECTRON LASERS

Andrew M. Sessler, Ph.D., Staff Senior Physicist, Lawrence Berkeley Laboratory, University of California, Berkeley

Intense, coherent light can now be produced at wavelengths where no conventional lasers operate. Moreover, the radiation from free-electron lasers can be tuned, the wavelength varied, across a wide range. Such versatility is beginning to have impact in a host of scientific arenas, from physics to biology to chemistry, medicine to national defense. (Time permitting, our speaker stands ready to discuss several other frontiers, including the superconducting supercollider and new developments in the design of linear accelerators.)

6:00 p.m.

Hospitality Suite open.

7:00 p.m.

THE ANNUAL CASW BANQUET

Presentation of the 1988 National Association of Science Writers' Science-in-Society Journalism Awards.

Robert T. Bakker, Ph.D., Adjunct Curator of Paleontology at the University of Colorado Museum and author of "The Dinosaur Heresies," will speak on "Bones, Bible and Creation."

Wednesday, November 30

A day at the University of Colorado. Transportation departs the Clarion at 8:15 a.m. for the CU-Boulder Events/Conference Center. Continental breakfast will be available upon arrival at the campus.

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

SPACE TRAVEL: THE BIOLOGICAL SPINOFF

Marvin W. Luttges, Ph.D., Professor of Aerospace Engineering Sciences, and Director, Bioserve Space Technologies, University of Colorado, Boulder

With renewed visions of manned travel to celestial neighbors comes stepped-up research to devise self-contained systems (e.g. food production, waste removal) to make such journeys possible. Out of these efforts are emerging biology-based solutions to a host of terrestrial ills, from sewage disposal to treatment of osteoporosis to manufacture of proteins for construction of natural prosthetic devices.

THE OPTICAL 'THINKING' MACHINE

Kristina M. Johnson, Ph.D., Assistant Professor of Engineering, and Program Manager, Optoelectronics Computing Systems Center, University of Colorado, Boulder

Neural networks. Adaptive signal processing. Connectionism. By whatever name, it describes computer architecture modeled after the human brain that can engage in cognitive processing (required for such tasks as language acquisition and translation, pattern recognition). Current electronic digital machines are really not up to the challenge. Which explains why even the best of today's robots don't see, speak or move all that well. But now: instead of electrons, photons; instead of digital processors, an analog mesh. Result: an optical system with the potential to learn (and remember) by association, to make decisions, to daydream and to forget.

12:00 Noon

Lunch at the Events/Conference Center.

1:00 p.m.

An opportunity to visit the aging-and-memory experimental facility and/or the Optoelectronics Center for some live demonstrations.

Wednesday, November 30

2:00 p.m.

ORIGIN OF LIFE/ORIGIN OF THE GENETIC CODE

Thomas R. Cech, Ph.D., Professor of Chemistry and Biochemistry, University of Colorado, Boulder

Michael J. Yarus, Ph.D., Professor of Molecular, Cellular and Developmental Biology, University of Colorado, Boulder

Nucleic acids are information molecules; proteins act as enzymes to catalyze chemical reactions required for cellular metabolism. Both functions were required for genesis, for the evolution of a self-reproducing biological system. But which came first, protein or nucleic acid, function or information? Or did both co-evolve? Resolution of that long-standing, often-heated debate may finally be at hand, given the discovery that RNA holds both information-carrying and catalytic capacity. In the wake of these recent observations, there is also now new evidence to explain just how the genetic code came to be — why certain sequences of nucleotides specify certain amino acids.

3:30 p.m.

Buses leave for the Clarion.

5:30 p.m.

Cocktail reception at the National Center for Atmospheric Research. Transportation will depart the hotel at 5:15 p.m.

7:15 p.m.

We travel yet again — this time for dinner at the Flagstaff House, Boulder's most prestigious and most scenic restaurant. Hosted by the University of Colorado. Return to Clarion scheduled for about 10:00 p.m.

Thursday, December 1
8:30 a.m. to 11:30 a.m.

SEEDING GENES

Winston J. Brill, Ph.D., Vice President of Research and Development, Agracetus, Middleton, WI

Scientists have been stymied in efforts to genetically engineer new plants without first going through the tissue-culture stage — sometimes called "black-box biology" because of its unpredictability and, hence, commercial uncertainty. But now, for the first time, they have succeeded in inserting new genes into seed-derived cells which, when planted directly, grow into fully developed, sexually mature, transgenic plants. Most important: The new technique has been shown to work in staple crops — e.g. corn, soybean — that had proved recalcitrant to cell-culture regeneration.

NEW MESSAGES FROM THE EARLY UNIVERSE

Paul L. Richards, Ph.D., Professor of Physics, University of California, Berkeley

Recent discovery of previously undetectable wavelengths of the "cosmic background radiation" opens a new window on the universe. These submillimeter emanations stem from a very large energy release related, perhaps, to early star and galaxy formation or the decay of exotic particles (or cosmic strings) left over from the Big Bang. With several new space experiments planned for next year, it is likely that "background" astronomy will soon have much more to tell us about the early history of the cosmos and, as a consequence, its current state and future fate.

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About the Speakers/ CASW New Horizons '88

ROBERT T. BAKKER graduated from Yale in 1968 and earned his doctorate at Harvard University in 1976. He joined the geology faculty of Johns Hopkins University, where he remained until 1983. He currently serves as adjunct curator of paleontology at the University of Colorado Museum. His research interests include dinosaurs, mass extinctions and the tempo of evolutionary change. His articles have appeared in *Science, Nature, Scientific American, Audubon, Natural History* and *Evolution.* He is the author of *The Dinosaur Heresies,* published in 1986. (303/492-8069)

CAROL A. BARNES received her B.A. degree from the University of California at Riverside (1971) and her Ph.D. (psychology) from Ottawa's Carleton University (1977). In 1982, after completing post-doctoral training in neuropsychology (Dalhousie University, Halifax), in biophysics (Institute of Neurophysiology, Oslo) and in neurophysiology (University College, London), she joined the psychology faculty at the University of Colorado, where she currently holds an associate professorship. In 1984, Dr. Barnes received a five-year Research Career Development Award from the National Institute of Aging. (303/492-7641)

WINSTON J. BRILL, a native of London, England, completed his undergraduate work at Rutgers University in 1961. He earned his Ph.D. in microbiology from the University of Illinois in 1965. In 1967, after postdoctoral work at M.I.T., he joined the faculty of the University of Wisconsin, where he continues as adjunct professor of bacteriology. He is vice-president of Agracetus, an agricultural biotechnology firm. Author of more than 150 papers, he has served on the editorial board of several biotechnology journals and many advisory bodies concerned with genetic engineering applications. (608/836-7300)

THOMAS R. CECH was born in Chicago in 1947. He received his B.A. from Iowa's Grinnell College and his Ph.D. in chemistry from the University of California, Berkeley. In 1978, after postdoctoral work in Cambridge, Massachusetts, he joined the faculty at the University of Colorado, where he and his colleagues, as a result of experiments on single-celled organisms, discovered self-splicing RNA — the first exception to the long-held rule that biological reactions are always catalyzed by proteins. Dr. Cech currently holds an American Cancer Society professorship and a Howard Hughes Medical Institute investigatorship. (303/492-8606)

RALPH J. CICERONE was born in 1943 in New Castle, Pennsylvania. He received his B.S. degree from M.I.T. in 1965. He was awarded his Ph.D. in physics and electrical engineering by the University of Illinois in 1970. His research interest lies in the chemistry of the atmosphere and its connections with biological processes and the earth's climate. He is past editor of the *Journal of Geophysical Research* and is currently a reviewing editor for *Science.* Since 1980, he has served as senior scientist and director of Atmospheric Chemistry at the National Center for Atmospheric Research. Earlier, he held research posts at the Scripps Institution of Oceanography and at the University of Michigan. (303/497-1434)

L. MICHAEL GLODE, after undergraduate work at the University of Nebraska, received his M.D. degree from Washington University in St. Louis in 1972. After completing his training stint at Parkland Hospital, Dr. Glode became a research associate at the National Institutes of Health. He then spent two years at Boston's Dana Farber Cancer Institute training in medical oncology. Since joining the University of Colorado Health Sciences Center, Denver, he has been involved in a number of cancer research efforts, including, most recently, a transgenic approach to tumor destruction. (303/270-4757)

KRISTINA M. JOHNSON received her B.S., M.S., and, in 1983, her Ph.D. (in electrical engineering) from Stanford University. She was a NATO postdoctoral fellow at Trinity College in Dublin, Ireland. In 1985, shortly after her arrival at the University of Colorado, she was named a Presidential Young Investigator by the National Science Foundation. As program manager at the Optoelectronics Computing Systems Center, she directs a research team that seeks to take advantage of the parallelism inherent in optical systems to construct the optical equivalents of neural networks. (303/492-1835)

MARVIN W. LUTTGES received his Ph.D. in biological sciences from the University of California, Irvine, in 1968, and completed a postdoctoral fellowship at Northwestern University Medical School the following year. Since then, he has been at the University of Colorado, where he has served as chairman of the department of aerospace engineering sciences and currently directs Bioserve Space Technologies, a NASA center for the commercial development of space. He is the author or co-author of more than 150 papers on biomedical engineering, unsteady fluid dynamics, acoustics and space design, and the recipient of numerous research and teaching awards. (303/492-7613)

DOUGLAS A. MELTON received his B.S. degree from the University of Illinois (1975), and his B.A. (1977) and his Ph.D. (molecular biology, 1980) from Cambridge University. He joined the Harvard University faculty as assistant professor of biochemistry and molecular biology in 1981. In 1988 he was named a full professor. Dr. Melton is the recipient of many academic honors, including the Max Perutz Prize (1981), the Camille and Henry Dreyfus Award (1981), and the Searle Scholar Award (1983-1986). He serves on the editorial boards of *Development* and *Trends in Genetics*. (617/495-1812)

PAUL L. RICHARDS was educated at Harvard (B.A., 1956) and at the University of California, Berkeley (Ph.D., solid state physics, 1960). He was a postdoctoral fellow at Cambridge University (1959-60), joined the technical staff of the Bell Telephone Laboratories in 1960, and the Berkeley physics faculty in 1966. Dr. Richards has published more than 200 papers on infrared and millimeter wave spectroscopy, including new measurement techniques and their application to superconductivity, magnetic resonance, biophysics, surface science, and background astronomy at millimeter and submillimeter wavelengths. He is a member of the National Academy of Sciences and the American Academy of Arts and Sciences. (415/642-3027)

STEPHEN H. SCHNEIDER, a native New Yorker, received his B.S. (1966), M.S. (1967) and Ph.D. (mechanical engineering and plasma physics, 1971) from Columbia University. He then joined the National Center for Atmospheric Research, where he now heads the Interdisciplinary Climate Systems Section. He is co-author of *The Coevolution of Climate and Life*, and editor of the journal *Climatic Change*. He has written or co-written over 130 scientific papers, proceedings, legislative testimonies and book chapters and has been a member of national and international committees on climate and related environmental and societal issues. His current research includes modeling of paleoclimates and human impact on climate. (303/497-1630)

THOMAS D. SEELEY earned his B.A. degree from Dartmouth College in 1974 and his Ph.D. (biology) from Harvard University in 1978. Aided by a fellowship from Harvard's Society of Fellows, he spent two years living in the mountain jungles of Thailand and studying the behavior of honeybees in the environment in which their societies originally evolved. For the next six years he taught biology at Yale University. Two years ago he was appointed associate professor of animal behavior at Cornell University. (607/255-6574)

ANDREW M. SESSLER received his A.B. from Harvard in 1951 and his Ph.D. in theoretical physics from Columbia University in 1953. In 1961, after six years on the physics faculty of Ohio State University, he joined the Lawrence Berkeley Laboratory, where he currently holds rank as senior scientist and where he continues his research, primarily in accelerator physics. From 1973 to 1980, he served as director of the laboratory. He is chairman of the American Physical Society's Panel on Public Affairs. In 1982, he chaired the APS' Committee on International Freedom of Scientists. (415/486-4992)

LARRY L. SMARR was awarded a B.A. and M.S. by the University of Missouri in 1970. In 1972, he received another M.S. from Stanford University and went on to earn his Ph.D. in physics from the University of Texas at Austin in 1975. In 1978, following research appointments at Princeton, Yale and Harvard, he joined the astronomy and physics departments at the University of Illinois at Urbana-Champaign. In 1985, he was named full professor and assumed the directorship of the National Center for Supercomputing Applications. He is the recipient of numerous honors, and has served on several federal-level science and technology committees. (217/244-0077)

CHARLES E. TILL received his Ph.D. in nuclear engineering from the Imperial College, University of London, England. He has worked on a variety of reactor concepts, including the U.K. gas-cooled reactor, the Canadian heavy water reactor, and the U.S. light water reactor. Since 1963, when he joined the Argonne National Laboratory, he has been deeply involved in the development of the fast breeder reactor. Dr. Till currently directs all engineering research at Argonne. (312/972-4863)

MICHAEL J. YARUS, a native of Pikeville, Kentucky, obtained his B.A. in 1960 at Johns Hopkins University and his Ph.D. in biophysics at the California Institute of Technology in 1965. In 1967, having "discovered the delights of gene expression" as a postdoctoral fellow with Paul Berg at Stanford, he joined the faculty of the University of Colorado where he has been studying various aspects of genetic-code translation. He is the author of more than 60 original research papers. He was a member of the editorial board of *Nucleic Acids Research* and has served as manuscript reviewer for several other eminent journals, including *Gene, Proceedings of the National Academy of Sciences* and the *Journal of Molecular Evolution*. (303/492-8376)