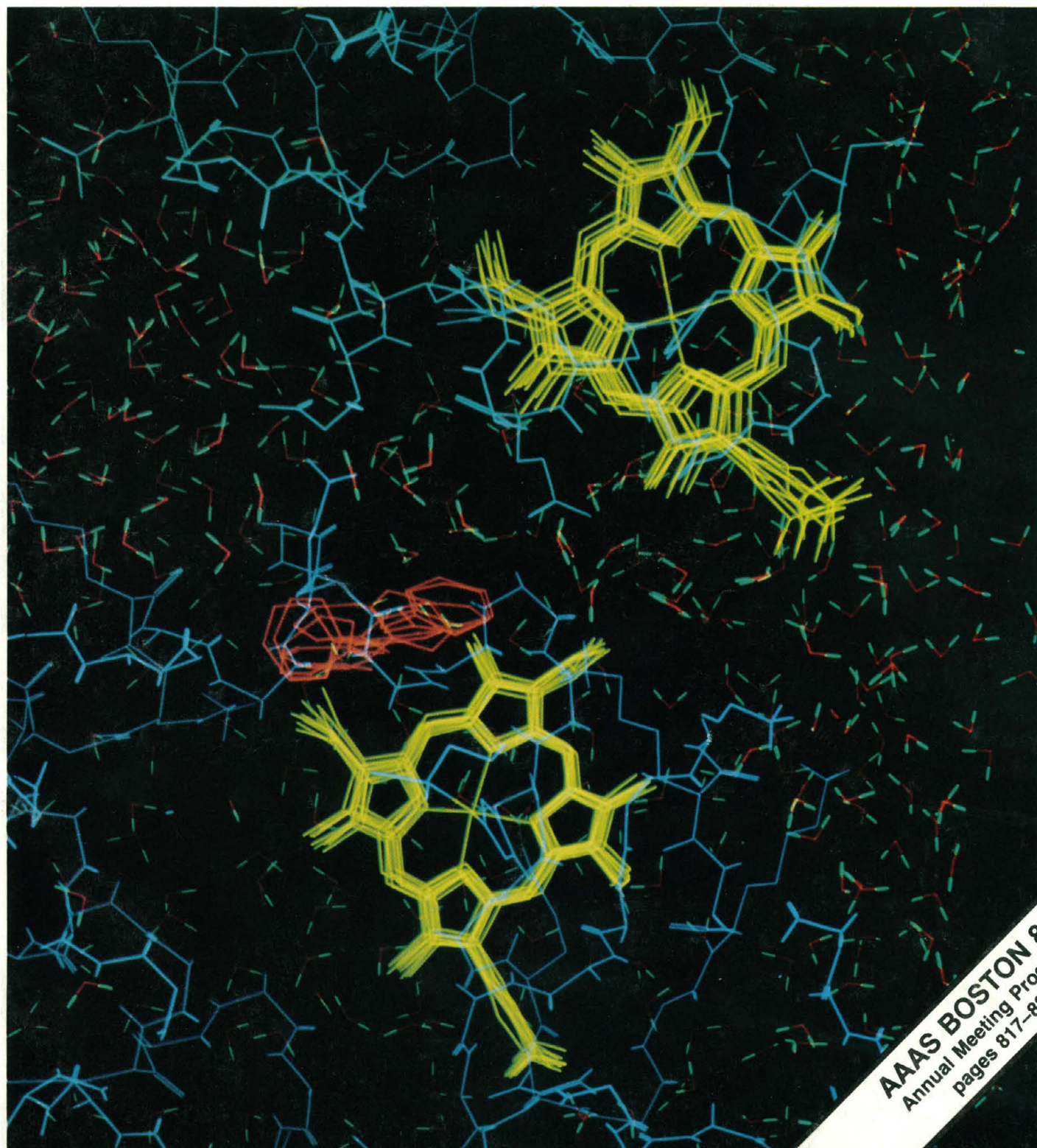


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COVER A molecular dynamics simulation of electron transfer complex formed between cytochrome c and cytochrome b₅. Dynamic motions of the cytochrome heme prosthetic groups and cytochrome c phenylalanine 82 are superimposed on a static snapshot of the polypeptide backbones and solvent water molecules hydrating the complex. See page 794. [Graphic output from MOLEditor by Richard Hilmer, Central Research and Development Department, E. I. du Pont de Nemours & Company, Wilmington, DE 19898]

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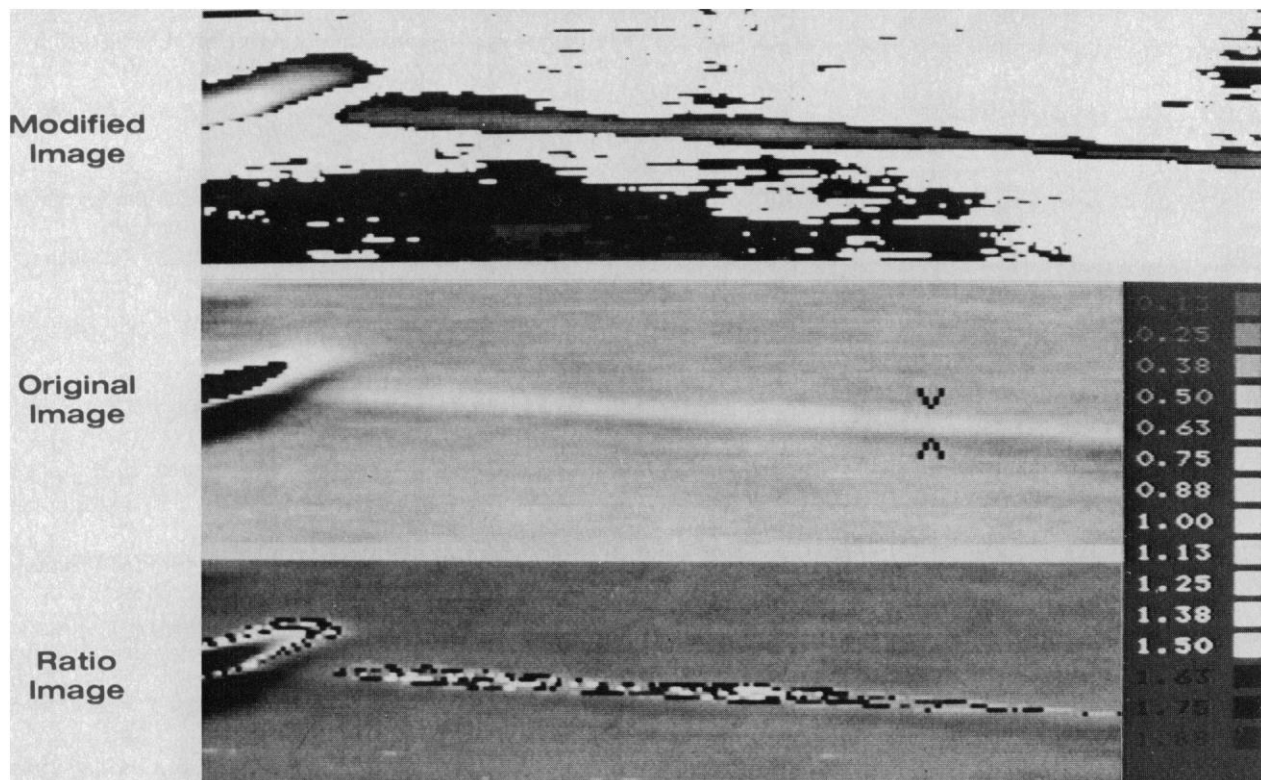
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This Week in SCIENCE

Environmental impact of oil exploration

AN important lesson has been learned from studies of changes that have taken place in an Alaskan wetland area where oil exploration has continued along the Arctic coast for 15 years: although the ecosystem was disturbed in ways that were predicted, these disturbances have induced widespread secondary damaging effects, not all of which were expected (page 757). Dust from road construction illustrates the point: it induced local thawing of the permafrost by a process called thermokarst, which can be self-perpetuating and has led to erosion and flooding. Alterations to the land have affected plant life. Development of other wetland regions is likely to induce changes similar to those seen at the Prudhoe Bay Oil Field; unforeseen problems probably will accompany exploration in drier areas. Walker *et al.* therefore recommend more extensive planning and consideration of the long-range and secondary impacts of development on regional flora and fauna before new projects—such as the Department of the Interior's plan to lease 1.5 million acres of the Arctic National Wildlife Refuge for oil exploration—are approved.

Surface solutions

AN understanding of how ions are partitioned at interfaces is of considerable importance in materials science, oceanography, electrical engineering, geochemistry, and other fields (page 783). Few techniques are available for investigating molecular structures at an interface between materials in two phases. Hayes *et al.* show that, with synchrotron-based x-ray absorption spectroscopy, technical difficulties at a solid-liquid interface can be overcome. The adsorption of selenite and selenate to the iron oxide goethite was studied in aqueous suspensions. Goethite is of significant geochemical interest, playing a role in the partitioning of solids and water at the earth's surface. The selenium atom of selenite

bonded directly with surface oxygen atoms of the oxide that were themselves bound to iron atoms; goethite and selenite thus formed a strongly bonded complex. In contrast, selenate retained an association with water molecules, bonding only weakly with goethite. The spectrographic results complement and clarify chemical experiments that also demonstrate differences in adsorption behavior of selenite and selenate.

Remembering odors

MEMORIES of odors are stored on one side of the brain in young rats but can be retrieved by sensory connections from either side of the body once the cross-brain physical connections (fiber systems) have been established (page 786). Kucharski and Hall studied the storage and retrieval processes by which a reward of milk is linked in the rat's memory with an odor; only one of the rat's nares was open during training and subsequent testing of its preference for scented or unscented shavings in its cage. In 6-day-old rats, the association could only be recalled if the trained naris was open; in 12-day-old rats, both trained and untrained nares could make the positive association. Bilateral retrieval at 12 days was possible whether training had taken place that day or at 6 days of age, indicating that new sensory connections can gain access to preexisting memories. The olfactory information was shown to remain localized only on the side of the brain where it was originally stored.

Development of immunocompetence

DIVERSE antibodies are generated from rearrangements of V (variable), D (diversity), J (joining), and C (constant) germline gene segments and subsequent mutation events (page 791). Through these mechanisms, an enormous repertoire of antibodies ultimately becomes available to an individual, even though there are

only small numbers of V, D, J, and C segments. The antibodies seem to arise in a programmed pattern such that, within a species, specific antibodies always are found by certain stages of fetal development. Schroeder *et al.* show that, in a 130-day human fetus, from 9 to 39 distinct V region genes are used for all antibodies that are made. This represents only a subset of the V genes that are available to the adult. One V gene that was found in several of the fetal antibodies was closely related to a V region that is found frequently in antibodies of fetal mice as well. This is evidence for systematic unfolding of the antibody repertoire and implies that the process may serve a functional or structural role: it might provide developing individuals with reactivity toward commonly encountered pathogens or might ensure that specific, productive rearrangements of genes will occur to generate functional V-D-J-C sequences.

Volcano ecology

RARE opportunities for studying how ecosystems develop and mature are provided by volcanic eruptions, because lava flows and volcanic ash destroy plants in their paths and a succession of new species can then grow on the lava beds (page 802). In Volcanoes National Park on the island of Hawaii, Vitousek *et al.* found heavy growth of an exotic tree, *Myrica faya*, in areas that had been cleared by volcanic cinders. *Myrica faya* had not been observed growing in the park before 1961, even though it was brought to Hawaii from the Canary Islands and the Azores in the late 19th century. Symbionts of the tree actively fix nitrogen in a biologically available form, increasing the fertility of the soil; this enrichment is likely to open the way for other trees and plants, ones that cannot grow on nitrogen-depleted soil, to return to populate the lava beds. Lewin discusses how invasions by *Myrica faya* and other flora have served as useful tools for analyzing the dynamic processes involved in conservation and ecology (p. 752).

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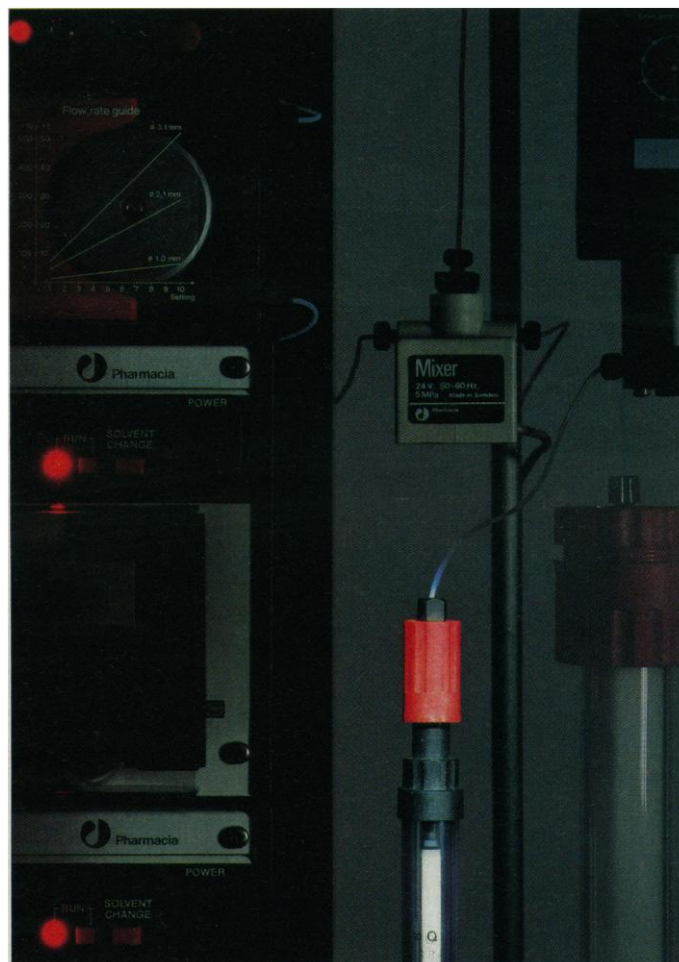
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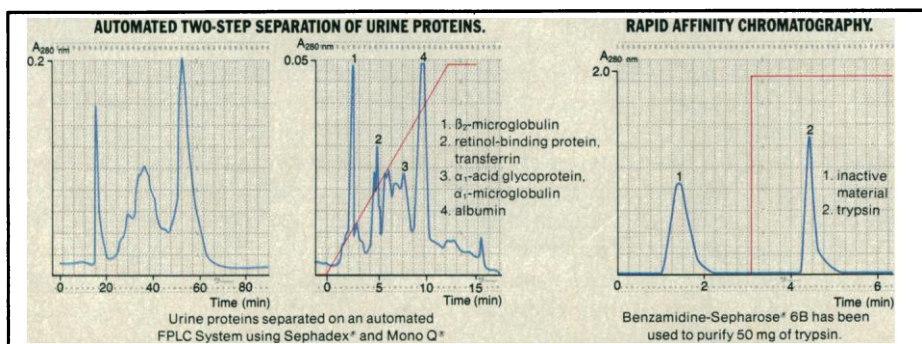
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Retroactive Prophets

Periodically society is confronted with a crisis in which new phenomena appear puzzling or incomprehensible when viewed through existing concepts. Each such crisis generates its own crop of self-appointed experts with fresh hypotheses and pathways to salvation. Whether it be Bhopal or Chernobyl or the crash of the stock market, one can expect sober-looking individuals to announce solemnly that the crisis could have been avoided if the world had listened to their analysis. The pronouncements each sound so reasonable and the solutions so simple that the listener wonders how responsible authorities could have failed to heed such sage advice. Yet, the different experts, with equally passionate conviction, advocate highly divergent solutions. The stock market crisis is a case in point. One group of financial experts says confidently, "The deficit caused it"; others point the finger at trade imbalance, computers, arbitrageurs, the strong (or weak) dollar, or high (or low) interest rates. How should society distinguish between the true expert with a vision of the future and the false prophets who are reciting hindsight?

When new dichotomies confront existing concepts in science, experts in the area attempt to explain them from existing theory and, if unsuccessful, postulate new hypotheses. Since there are frequently competing hypotheses, ability to predict the outcome of experiments is usually the criterion by which the true prophet is selected and the correct theory verified. From atomic structure to genetic inheritance to the germ theory of disease, science has advanced by the sequence of confrontation, hypothesis, prediction, verification.

In applying the scientific method to the stock market crisis, the first question should certainly be the ability to predict. And the criterion for expertise should depend on the answer to, "What did you do with your stocks before black Monday?" Retroactive predictions of the "I told you so" variety coupled with simplistic solutions would be acceptable only if they had been acted upon before the trend became obvious. Otherwise, the listener could correctly conclude that the situation is more complex or less comprehensible than the "expert" is claiming. A less dramatic version of this criterion is even easier to apply: after a particularly passionate exhortation for a specific course of action, the questioner could ask, "What do you predict will happen to the market tomorrow?" In fact, many interviewees in the current crisis answered, "I can't tell" or "No one knows," essentially nullifying the oversimplified solutions they were advocating.

The predictive criterion could be applied to many other social enterprises. Diagnosis of infectious disease is an area in which experts are almost invariably successful and nonexperts do not know where to begin. Parole boards could be tested with case histories of known criminals and asked to predict courses of conduct of these known parolees. Their predictions could then be compared with the actual outcomes to generate a "predictive quotient," like batting averages in baseball are computed to evaluate competence. Cost estimators for public projects, psychiatric experts who commit mental patients, legal experts who predict trial outcomes, and transportation experts who predict usage of public transportation systems are a few of the categories that instantly spring to mind for similar treatment. The day might come when one could look on the wall of a physician's office and see the predictive quotient of the ability to diagnose illness. Judges seeking office might have to produce their predictive quotients on cases in which they gave "good risks" suspended sentences or drunken drivers one more chance. (Asking editors to post track records on the great papers that they rejected is, however, going too far.)

This, at first, may seem utopian, but it is not only feasible but also appropriate for society to evaluate those who claim to be experts.

De Toqueville noted that the public will choose to believe a simple lie in preference to a complicated truth. Sometimes we must face the fact that a situation is so complex that we cannot extract the causes immediately and devise simple solution. In other cases the cause will be sufficiently understood by experts so that certain courses of action are more likely to have good outcomes than others. Issues such as the dangers of microorganisms in the environment, immigration policy, nuclear arms control, surrogate motherhood, and the use of animals in research are some of the complex dilemmas in which some people are better at predicting the future than others. A track record in real prophecies that proved to be correct may help us select those who have a true vision of the future from those who are merely describing the past.—DANIEL E. KOSHLAND, JR.

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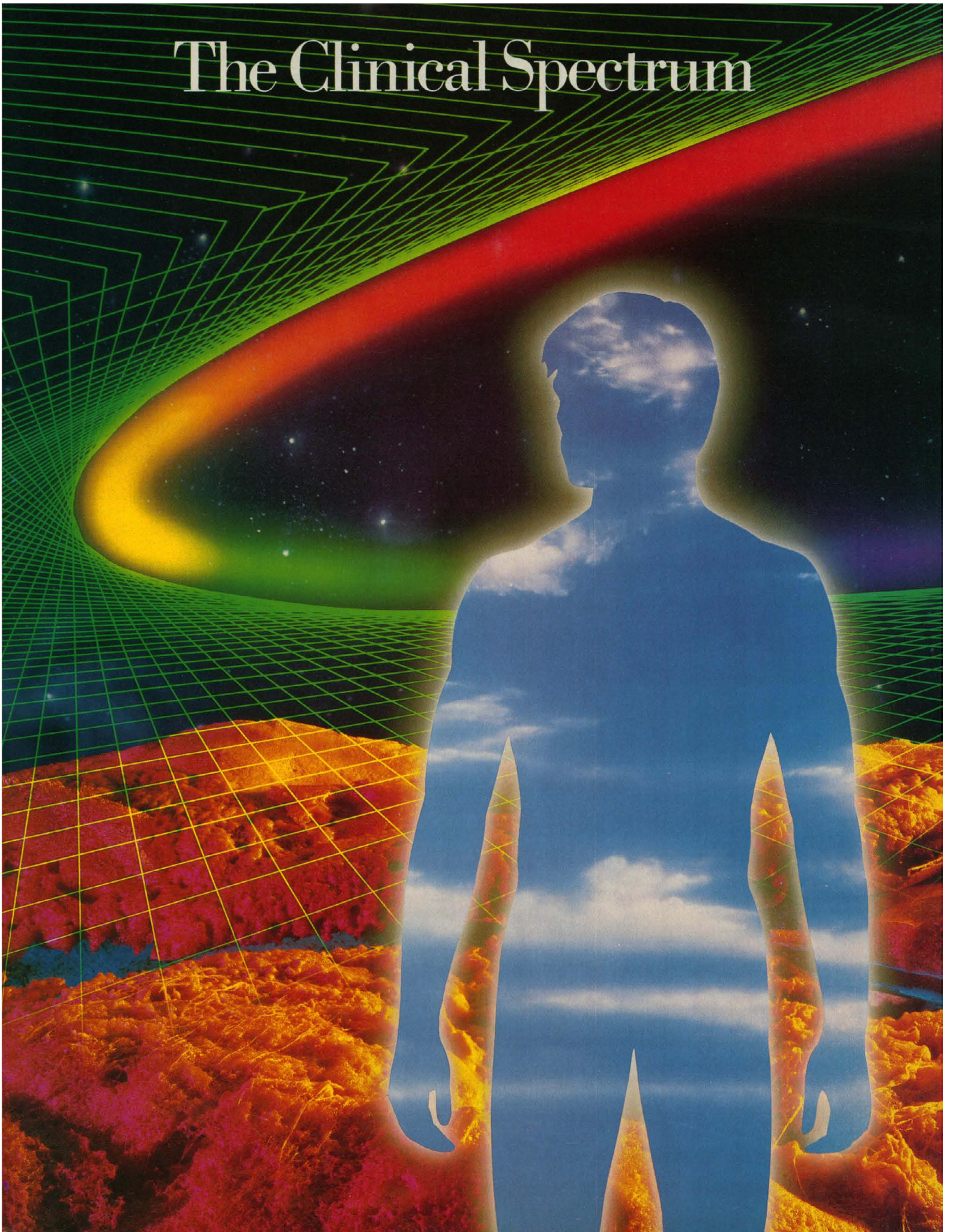
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Medical diagnoses sometimes depend on the ability to trace or detect minute amounts of biological species. Now researchers at the General Motors Research Laboratories have developed a method of spectrometry using a tunable diode laser that could lead to simpler, less costly, non-invasive diagnostic techniques.

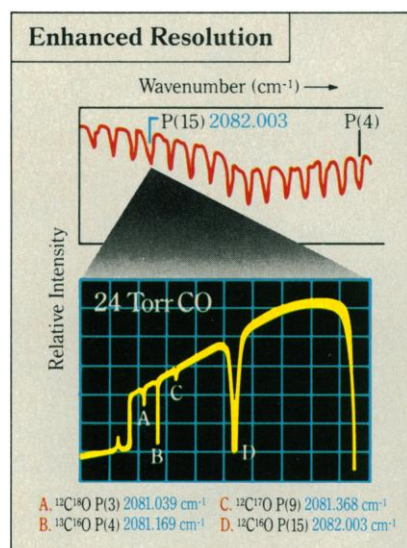
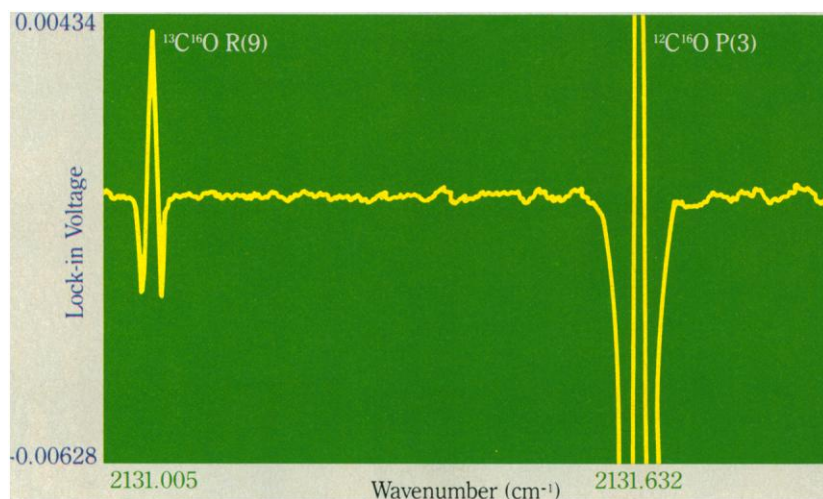


Figure 1: (Top) The absorption spectrum of CO obtained with a conventional spectrometer showing the P series rotation-vibration transitions separated by about 4 cm^{-1} . (Bottom) The diode laser spectrum centered at $^{12}\text{C}^{16}\text{O}$ P(15) region showing the complete resolution of $^{12}\text{C}^{17}\text{O}$ P(9), $^{12}\text{C}^{18}\text{O}$ P(3) and $^{13}\text{C}^{16}\text{O}$ P(4) transitions.

Figure 2: The second harmonic detection of the $^{13}\text{C}^{16}\text{O}$ and $^{12}\text{C}^{16}\text{O}$ as naturally present in exhaled human breath.



Carbon monoxide in exhaled human breath.

The scale has been expanded to show the excellent signal-to-noise ratio for $^{13}\text{C}^{16}\text{O}$. Other than removal of water vapor, no specific sample preparation or separation was needed.

In the process of living and growing, the body routinely takes in chemicals in the air we breathe and the food we eat, uses them, and converts them into other chemicals. These chemical activities, therefore, are often very good indicators of the health of the body or of its individual systems. The detection and measurement of particular chemical species is also of value in environmental, scientific and engineering studies.

Radioactive isotopes of elements in these chemicals have been extensively used as tracers. Many investigations, however, preclude their use either because no suitable radioisotope is available, or because radiation exposure raises health or environmental concerns.

The use of stable, non-radioactive isotopes for detection and tracing predates that of radioisotopes. But routine application of stable isotopes has been hindered by the lack of a detection method as versatile

and simple as the scintillation counting used for radioisotopes. Mass spectrometry is the traditional method of detection of stable isotopes, but it requires extensive sample preparation, expensive equipment, and a highly trained operator to distinguish and measure chemically different molecules of the same nominal mass—nitrogen gas $^{14}\text{N}^{14}\text{N}$ and carbon monoxide $^{12}\text{C}^{16}\text{O}$, for example.

It was this need for high resolution and greater versatility that prompted Dr. Peter S. Lee and Richard F. Majkowski to develop a system for stable isotopic tracer analysis based on the molecular absorption of infrared light. A tunable, single-mode diode laser, developed originally by the Physics Department of the General Motors Research Laboratories to measure automobile exhaust gases, was used as the IR emitting source in what has proved to be a remarkably sensitive spectrometer.

The infrared absorption spectrum of molecules normally consists of transitions between series of vibration-rotation energy levels. When an atom in a molecule is replaced by an isotope of the same element, there is a shift in the energy levels due to a change in mass. The resulting frequency shift in the transitions forms the basis of the laser spectroscopic analysis system.

In the case of carbon monoxide, for example, there are six possible forms of the molecule involving stable isotopes: $^{12}\text{C}^{16}\text{O}$, $^{12}\text{C}^{17}\text{O}$, $^{12}\text{C}^{18}\text{O}$, $^{13}\text{C}^{16}\text{O}$, $^{13}\text{C}^{17}\text{O}$, and $^{13}\text{C}^{18}\text{O}$. Consequently, there would be six sets of overlapping spectral lines. Within a region of 1 cm^{-1} , there can be lines from several isotopic molecules, with as little as 0.1 cm^{-1} or

less between adjacent lines.

This adjacency presents no problem for a diode laser system. The spectral resolution (the laser linewidth) is typically better than 10^{-4} cm^{-1} , which is orders of magnitude less than the isotopic line spacings. Since the diode laser is tunable, it can be centered in a region where the absorption lines of several isotopic molecules can be scanned within a single longitudinal laser mode (Figure 1).

In the initial experimental system, the source of the monochromatic IR radiation was a diode laser, made out of a single crystal containing layers of doped lead telluride and a lead-europium-selenium-telluride alloy. The IR light was collimated through a cell containing the sample to be studied and then focused onto an IR detector.

The cell was designed to have two optical path lengths that can be varied so that isotopic molecules with vastly different abundances can be determined from the measurement of the incident and transmitted laser intensities. U.S. Patent 4,684,805 covers this spectroscopic detection system.

The laser system can be made extremely sensitive using wave-length modulation and harmonic detection. Figure 2 shows the detection of $^{13}\text{C}^{16}\text{O}$ in exhaled human breath, where $^{13}\text{C}^{16}\text{O}$ is naturally present at a typical level of 1 to 10 parts per 100 million.

The present system can be used to measure stable oxygen isotopes in biological and organic samples that can be converted into CO . However, the method is applicable to any sample that can be converted

into a gas with a suitable IR absorption spectrum.

"The use of radioisotopes as tracers is already well established," says Dr. Lee. "The potential is just as great for stable isotopes if more versatile analytical methods are made readily accessible.

"Packaged as a simpler, relatively inexpensive instrument, a tunable laser IR system could be adapted to many clinical tests—for fat malabsorption, ileal dysfunction, small-intestine bacterial overgrowth, alcoholic cirrhosis and liver function, lung function, nutritional assessment, and diabetes, to name a few.

"Diabetes could be diagnosed from the lung exhalate of a subject who had been fed a stable isotopically tagged sugar sample. No taking blood, no long waits, no radiation health and safety concerns.

"Simpler isotopic tracer measurements could broaden the scope of tracer methodologies, could supplement some of the radioisotope studies now common, and could have significant economic implications."

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THE MEN BEHIND THE WORK

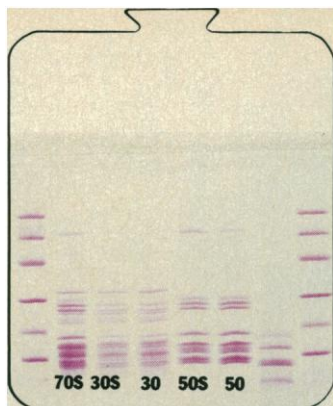


Dr. Peter S. Lee (right) is a Senior Staff Research Scientist in the Biomedical Science Department at the General Motors Research Laboratories. He received his undergraduate degree in Chemistry from the National Taiwan University. Dr. Lee also holds a Ph.D. in Physical Chemistry from the University of Illinois at Urbana-Champaign. His current research interests at GMRL include the study of biosensors and laser spectroscopy along with his work in stable isotopes. Dr. Lee came to GM in 1977 from the University of Illinois Medical Center in Chicago.

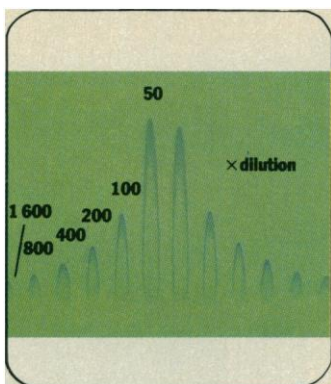
Richard F. Majkowski was, at the time of the work described here, a Staff Research Scientist in the GMRL Physics Department. Both his B.S. and M.S. degrees are from the University of Detroit in Physics and Mathematics. His research interests have included emission spectroscopy, coherent optics, holography and laser spectroscopy. Dick joined General Motors Research Laboratories in 1955 and retired in September, 1987, to become a Professor of Physics at Lawrence Institute of Technology.

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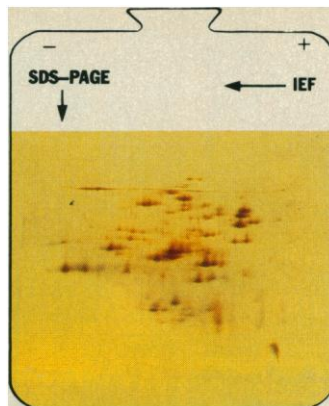




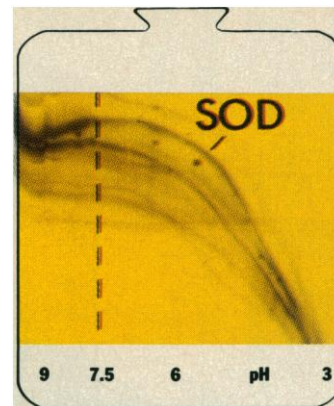
Analysis of *E. coli* ribosomal proteins by SDS-PAGE with subsequent coomassie staining. Sample to result: 60 min.



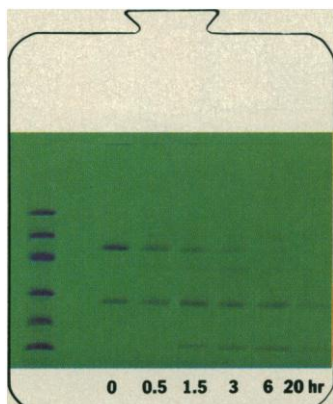
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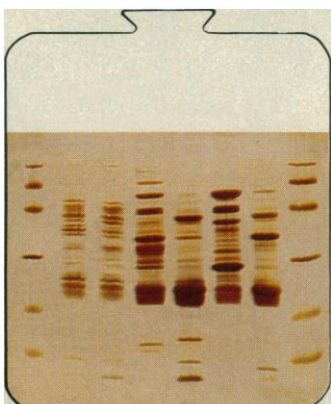
Analysis of *E. coli* proteins by 2D PAGE with subsequent silverstaining. Sample to result: 2.5 hr.



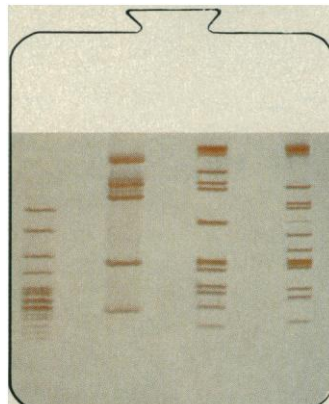
Characterization of a clarified cell homogenate by electrophoretic titration prior to purification. Sample to result: 90 min.



Optimizing a pepsin digest of Murine IgG Mab with SDS-PAGE. From sample to result: 60 min.



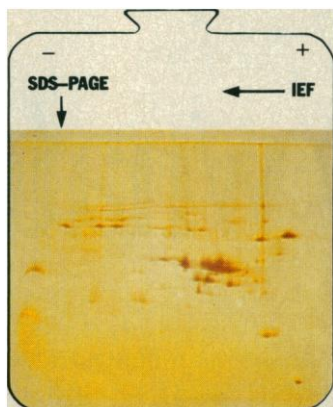
Analysis of peptides from an early step in the production of rH-growth hormones by SDS-PAGE. Sample to result: 90 min.



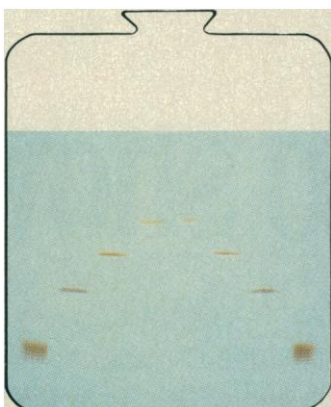
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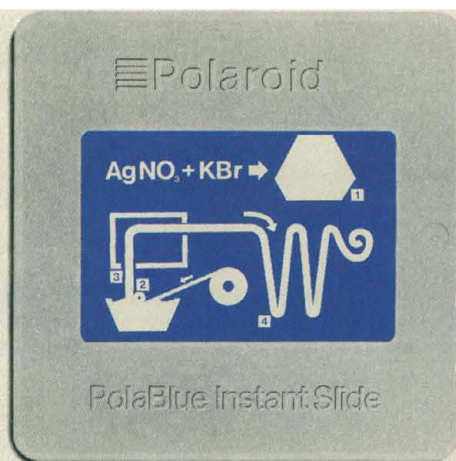
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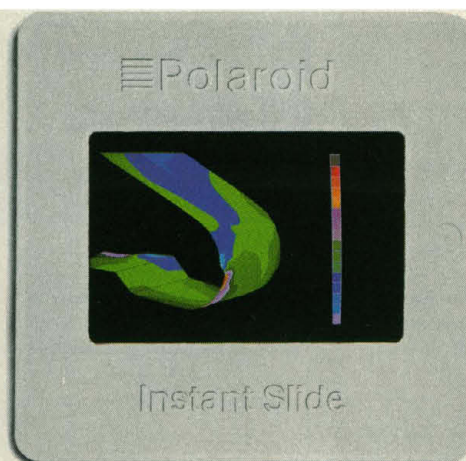
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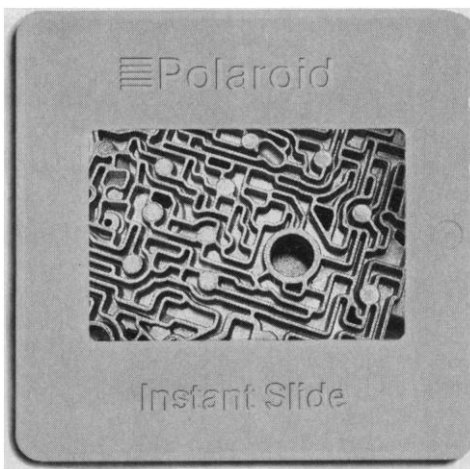
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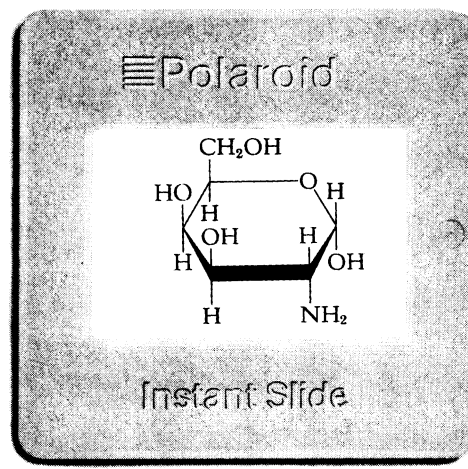




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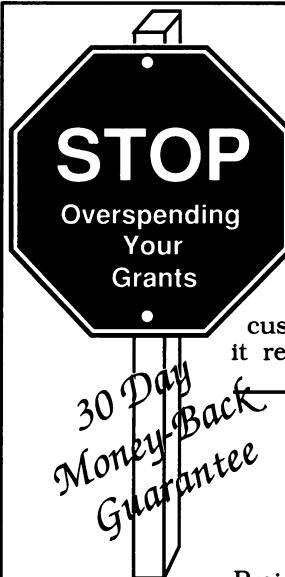
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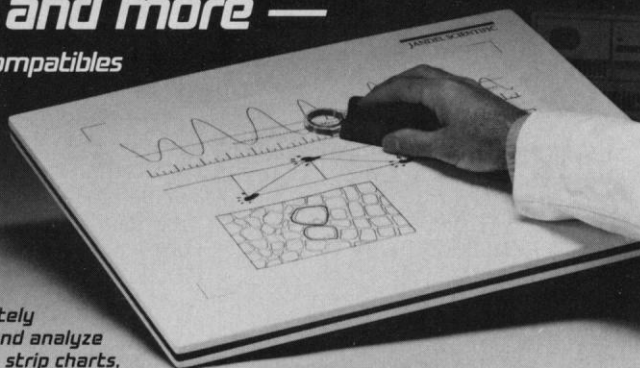
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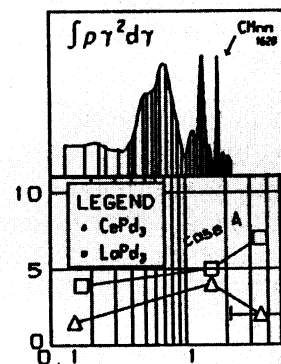
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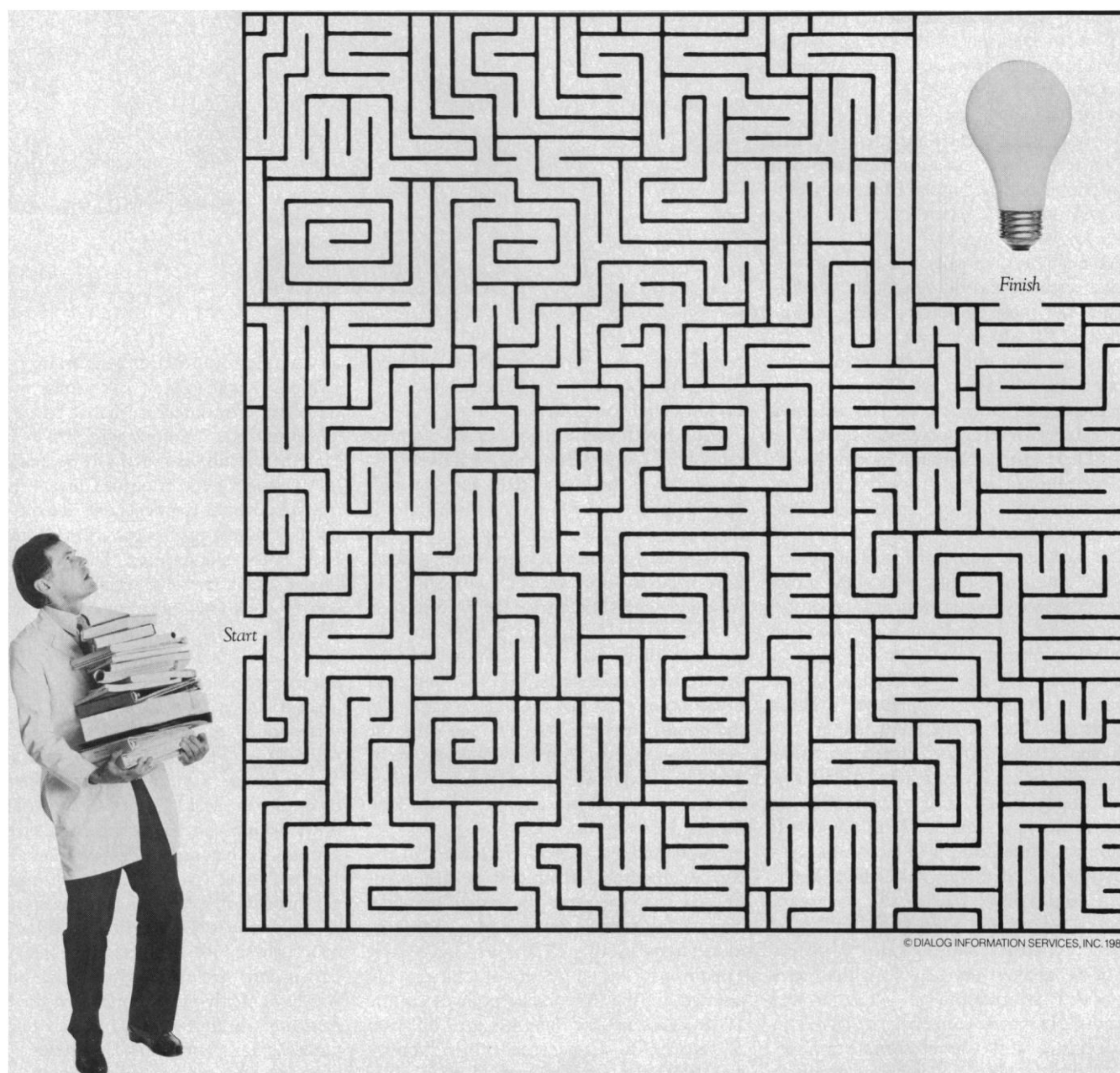
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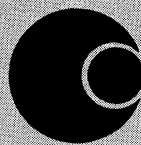
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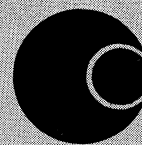
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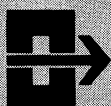
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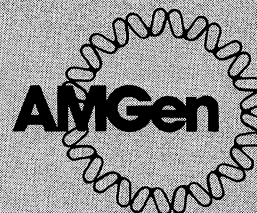


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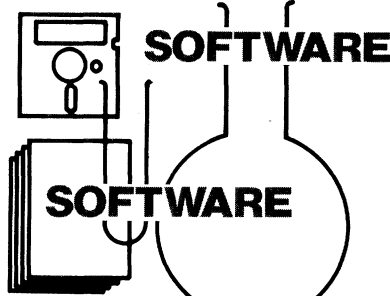
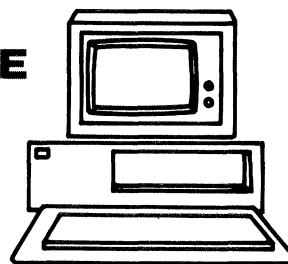
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A collection of radioligand binding analysis programs. Version 3.0 with improved data handling etc. Now available for Apple Mac and IBM PC

Kinetic by G A McPherson calculates association and dissociation rate constants for radioligands using a weighted non-linear iterative curve fitting technique.

EBDA by G A McPherson and LIGAND by P J Munson and D Rodbard (modified by G A McPherson) are for analysing equilibrium studies. EBDA performs the preliminary analysis of both saturation and competition studies, including conversion of dpm into concentrations, graphical transformation of data to provide initial estimates required by LIGAND and a number of other data analysis functions.

LIGAND then uses disk files created by EBDA to obtain final parameter estimates using weighted non-linear curve fitting techniques.

LOWRY by G. A McPherson calculates protein concentrations measured by the standard technique of Lowry *et al.* (1951). A hyperbolic equation is used to fit the standard curve and calculate concentrations of unknown samples.

All these programs have been described in *J Pharmacol Methods* 14; 213, 1985.

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Hill equation

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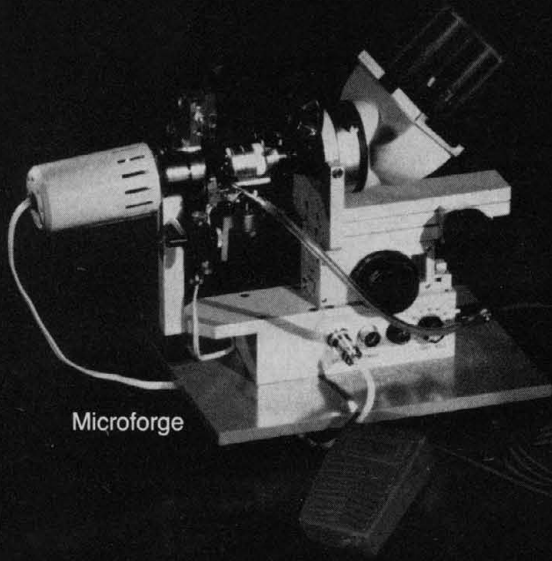
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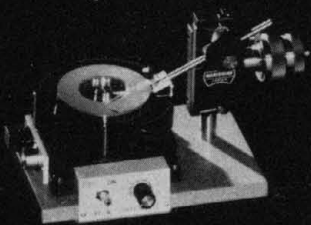
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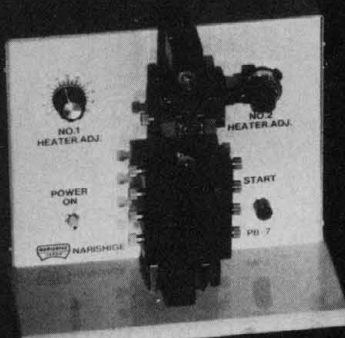
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The 1987 Contest Year is 1 November 1986 — 31 October 1987. All entries must be postmarked before midnight, 13 November 1987.

The 1987 Awards will be presented at the National Association of Science Writers' banquet during the Annual Meeting of the American Association for the Advancement of Science in Boston in February 1988.

The Awards are administered by the American Association for the Advancement of Science under a grant from the Westinghouse Educational Foundation.

For further information and entry forms, contact the AAAS Office of Communications, 1333 H Street, N.W., Washington, D.C. 20005 or call (202) 326-6440.

AAAS Annual Meeting

Boston, 11–15 February 1988

Preliminary Program

It's all here. Everything you always wanted to know about science but didn't know who to ask. Major lectures deal with molecular biology, human generation, unemployment, AIDS, proteins, marine ecosystems, mathematics, and gene mapping, and related social and scientific issues. More than a hundred symposia in all the major disciplines summarize the latest results on the frontiers of the physical, life, and social sciences and focus on

the implications of science for society. Seminars provide in-depth discussions of cutting-edge research in reproductive biology, the protein folding problem, and marine ecosystems. Workshops provide information about how to communicate science to various audiences and about nuclear arms and AIDS overseas.

It's all here in what has been called the World Series of Science. And, if you will permit me to mix my metaphors, the ball is in your court. Come

to Boston and learn what's going on at the frontiers of mathematics, physics, astronomy, geology, and many other fields. Hear what's happening in agriculture, psychology, and anthropology. Listen to discussions about arms control, ethical issues in science, problems of world hunger, and issues in scientific education. Bring your questions and get some answers. Expand your disciplinary knowledge and your personal horizons as you consider the world of science and its relationship with society.

For your comfort and convenience, all meeting activities will be held in two immediately adjacent facilities, the Sheraton Boston Hotel and the newly remodeled Hynes Convention Center, both just a short distance from Boston's Copley Place. You can reserve a room at the Sheraton Boston or the nearby Boston Marriott at the special AAAS meeting discount, travel to the meeting via American or Piedmont airlines at special low fares, and spend a week in February basking in the warmth of intellectual stimulation. Just fill out the forms at the end of this program section. We'll see you in Boston!

— ARTHUR HERSCHMAN

Plenary Lectures

Keynote Address: Molecular Biology Reaches Maturity (2/11, Thu/8:30pm)

David Baltimore (Director, Whitehead Institute for Biomedical Research and Professor of Biology, MIT)

Human Generation: Fact, Foible, and Fable (2/12, Fri/1pm)

John D. Biggers (Professor of Physiology and Biophysics and Member, Laboratory of Human Reproduction and Reproductive Biology, Harvard Univ. Medical School)

The Economics of Unemployment (2/12, Fri/1pm)

Lawrence H. Summers (Professor of Economics, Harvard Univ.)

Current Issues in AIDS (2/12, Fri/8:30pm)

C. Everett Koop (Surgeon General, Deputy Assistant Secretary of Health, and Director of the Office of International

Health, U.S. Public Health Service, U.S. Dept. of Health and Human Services)

Origami of Proteins (2/13, Sat/1pm)

Jane Richardson (Medical Research Associate Professor, Depts. of Biochemistry and Anatomy, Duke Univ. Medical Center, Durham, NC)

Scaling Pattern and Process in Marine Ecosystems (2/13, Sat/1pm)

Robert E. Ricklefs (Professor, Dept. of Biology, Univ. of Pennsylvania, Philadelphia)

George Sarton Memorial Lecture (2/13, Sat/8:30pm)

Stephen Jay Gould (Professor of Geology, Agassiz Museum of Comparative Zoology, Harvard Univ.)

Soviet Science (2/14, Sun/1pm)

Yevgeny Velikhov (Vice-President,

Academy of Sciences of the USSR, Moscow)

Mathematics and Physics: Uneasy but Preordained Collaborators (2/14, Sun/1pm)

Raoul H. Bott (Professor of Mathematics, Harvard Univ.)

AAAS President's Address: Voices from the Pipeline (2/14, Sun/8:30pm)

Sheila E. Widnall (AAAS President and Abby Rockefeller Mauze Professor of Aeronautics and Astronautics, MIT)

Gene Mapping and the Study of Disease: "Reverse" and "Forward" Genetics of Chronic Granulomatous Disease (CGD) (2/15, Mon/1pm)

Stuart H. Orkin (Leland Fikes Professor of Pediatric Medicine, Harvard Univ. Medical School and Division of Hematology, Children's Hospital, Boston)

Don't Miss the AAAS Science & Technology Exhibition

AAAS Annual Meeting ♦ Hynes Convention Center ♦ Boston

Discover new products and services. See on-line demonstrations, examine new textbooks and resource materials, and meet face-to-face with representatives from more than 50 publishing companies, computer software manufacturers, government agencies, scientific associations, and other science-oriented organizations.

Friday, 12 February 10:00am–4:00pm & 5:30pm–7:30pm*

Saturday, 13 February 10:00am–4:00pm

Sunday, 14 February 10:00am–3:00pm

While in the exhibit hall, be sure to see the special demonstrations of the new *high temperature superconductors*—compliments of Argonne National Laboratory.

* AAAS invites all Annual Meeting registrants to attend a reception in the exhibit hall on Friday evening from 5:30 to 7:30. Refreshments will be served.

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I Physical Sciences & Technology

10. Frontiers of the Physical Sciences

10-1. **Frontiers of the Physical Sciences, 1988** (2/13, Sat/am-pm). Number theory; climate change; particle physics; life processes; cosmic strings; remote sensing.

10-2. **Soviet Science** (2/14, Sun/am).

11. Mathematics

11-1. **American Mathematics Entering Its Second Century** (2/13, Sat/am-pm; 2/14, Sun/am-pm). Mathematical modeling; groups, symmetry, and randomness; spaces of dimensions two, three, and four; mathematics and the physical sciences.

12. Computing; Intelligent Systems

12-1. **Logic Programming: PROLOG and Beyond** (2/12, Fri/pm). Current systems; extensions of Horn Logic; implementation; semantic frameworks.

12-2. **Expert Systems and the Law** (2/13, Sat/am). Risk assessment, management, and allocation; responsibility.

12-3. **Expert Systems in Development: Advances and Applications** (2/13, Sat/pm). Agrotechnology transfer; university curricula; data base access; water/sanitation budgets; medical diagnosis.

12-4. **The Role of Uncertainty in Computer Performance Modeling** (2/14, Sun/pm). Probabilistic modeling of workloads; optimization of work-scheduling algorithms and data structures.

12-5. **Cognitive Engineering: Understanding Human Behavior in Complex Worlds** (2/15, Mon/am). Modeling human performance; safety; supervisory control; workstation design concept.

12-6. **Technology and the Social Context: A New Partnership** (2/15, Mon/pm). Educational software; computer-supported collaboration; social aspects of long-distance networks.

13. Physics

13-1. **The New Atomic, Molecular, and Optical Physics and Its Impact on Society** (2/13, Sat/am-pm). Hydrogen bonds; lasers in medicine, propulsion, and surface science; femtosecond and nonlinear optics; directed energy weapons.

13-2. **Nuclear Physics: From Quarks to Supernovae** (2/14, Sun/am). Electromagnetic structure; hadronic matter; heavy-ion collisions; supernova collapse.

13-3. **New Facilities for Condensed Matter Physics** (2/14, Sun/pm). Synchrotron, advanced neutron, low-temperature, and high magnetic field facilities.

13-4. **The New Superconductivity** (2/15, Mon/am-pm). Chemistry; superconductivity theory; small- and large-scale applications.

14. Astronomy; Space Science

14-1. **International Cooperation on Large-Scale Space Ventures** (2/12, Fri/am). Manned Mars expeditions; lunar base; political routes.

14-2. **Supernova 1987a: A New Star for Astrophysics** (2/12, Fri/pm). Light; neutrinos.

14-3. **The New Big Eyes** (2/13, Sat/am). Design; funding; construction plans.

14-4. **Our Home Galaxy: Exploring the Milky Way** (2/13, Sat/pm). Age; formation; core power.

14-5. **The Solar-Terrestrial System** (2/15, Mon/am). Solar activity; interplanetary medium; magnetosphere, atmosphere, and ionosphere responses.

15. Geology & Paleontology

15-1. **Earth in the Universe: Extraterrestrial Effects on Our Planet** (2/14, Sun/am-pm). Astrophysical influences; catastrophic bombardment.

15-2. **Decade of North American Geology: New England and Maritime Canada Highlights** (2/15, Mon/am). Appalachians; seismicity; continental shelf.

15-3. **The Dawn of Animal Life; or, Aliens Here on Earth? Paleobiology of the Ediacaran Fauna** (2/15, Mon/pm). Taxonomy; preservation of specimens; community trophic structure.

16. Atmospheric & Hydrospheric Sciences

16-1. **Prospects for Mitigating Climatic Warming by Carbon Dioxide Control** (2/12, Fri/am). Nuclear process heat; emissions reduction; global reforestation; enhanced biological productivity.

16-2. **Antarctic Ozone Depletion** (2/12, Fri/pm). Three decades of observation; aircraft and satellite use; chemical processes; environmental policy implications.

16-3. **The Arctic Ocean and Its Global Context** (2/13, Sat/am).

16-4. **Prediction in Atmospheric Sciences and Relations to Other Disciplines** (2/13, Sat/pm). Prediction capabilities for atmospheric and oceanic events; comparison with models and methodologies from other disciplines.

17. Arms Control & National Security

17-1. **Directed Energy Weapons** (2/12, Fri/am). Reports from the American Physical Society, Office of Technology Assessment, and Strategic Defense Initiative Organization; architectural issues; particle beam weapons.

17-2. Arms Control at the Crossroads (2/12, Fri/pm). Crisis stability; Strategic Defense Initiative; peace strategies; armament reductions.

17-3. The New Force Reduction Negotiations in Europe: Problems and Prospects (2/13, Sat/am). After INF; West German perspectives; French role; U.S. goals.

17-4. China and Arms Control (2/13, Sat/pm). Strategic forces modernization; nuclear strategy; attitudes toward international arms control efforts; China as a nuclear supplier.

17-5. Nuclear Risk Reduction Centers: An Operational Evaluation of Their Potential Effectiveness (2/14, Sun/am).

17-6. Defenses Against Nuclear Weapons: Strategic Defense Initiative, Anti-Tactical Ballistic Missile, and Air Defense Initiative (2/14, Sun/pm). Ballistic missile defense; tactical missile defense in the Middle East and Europe; air-launched strategic nuclear weapon defense.

17-7. From MaRVs to Microwaves:

Future Nuclear Weapons and the Arms Race (2/15, Mon/am). Mobile missile survivability; feasibility of effective ballistic missile defenses; new war-head designs; third-generation nuclear weapons.

18. Science & Technology Policy

18-1. Science in Chile: A New Phase (2/12, Fri/am). U.S.-Chile scientific cooperation in biomedical research, seismology, marine science, arid lands, minerals, biotechnology, and micro-computer education.

18-2. Science Advice to the Next President of the United States (2/13, Sat/am-pm). Function and qualifications; relation to the President and Congress; liaison with universities, industry, and the science community.

18-3. Public Participation in Decision Making for Science and Technology: Methods, Opportunities, and Pitfalls (2/14, Sun/am-pm). Nuclear power; international efforts; biotechnology;

mediation; state science academies; museums.

19. Popular Science

19-1. Chemistry Is Fun! (2/12, Fri/am). Interactive and classic classroom demonstrations.

19-2. Science and Humor (2/12, Fri/pm). Origin; acceptability; women in science.

19-3. Technological Competition and the America's Cup: Pushing Back the Frontiers of Sailing (2/13, Sat/am). Design principles; fluid mechanics; computer performance predictions; instrumentation; meteorology.

19-4. The Face of New England: A Geologist's View (2/13, Sat/pm). Mountains; valleys; coastline; glaciation.

19-5. Science for the Naked Eye; or, The Physics of Everyday Experience, XV (2/14, Sun/am-pm). Cetacean communication; human anatomy; physics of dance; cosmology; photographic image; violins.

II Life Sciences & Technology

20. Frontiers of the Life Sciences

20-1. Frontiers of the Life Sciences (2/14, Sun/am). Cancer ontogeny; neural basis of memory; plant resistance mechanisms; genetic basis of biological rhythms.

21. Frontiers of Reproductive Biology

21-1. Seminar: Frontiers of Reproductive Biology (2/12, Fri/am-pm; 2/13, Sat/am-pm; 2/14, Sun/am-pm). (See

description in the Seminar section of this issue, pp. 824.)

22. The Protein Folding Problem

22-1. Seminar: The Protein Folding Problem (2/12, Fri/am-pm/eve; 2/13, Sat/am-pm; 2/14, Sun/am-pm). (See description in the Seminar section of this issue, pp. 824.)

23. Frontiers in Marine Ecosystem Research

23-1. Frontiers in Marine Ecosystem Research (2/12, Fri/am-pm; 2/13, Sat/

am-pm; 2/14, Sun/am-pm). (See description in the Seminar section of this issue, pp. 825.)

24. AIDS

24-1. AIDS: An Overview (2/12, Fri/am). Epidemiology; legal issues; economics; education strategies; ethics; international and U.S. aspects.

24-2. AIDS Virology (2/12, Fri/pm). HIV genetics, molecular biology, and pathogenetic mechanisms; host responses; vaccine development; simian models.

24-3. The Epidemiology of HIV Infection: Transmission and Natural History (2/13, Sat/am). Homosexual, heterosexual, perinatal, and indirect transmission.

24-4. Clinical Management of HIV Infection and AIDS (2/13, Sat/pm). Patient management; associated infections; antiviral therapy; challenges to the health care system.

24-5. Modeling the Spread and Demographic Impact of AIDS (2/14, Sun/am). Epidemic models and statistics; prospective African impact; a decade of U.S. experience; evaluating prevention and control strategies.

24-6. Applying Behavioral Science to Control the AIDS Epidemic (2/14, Sun/pm).

24-7. The Social Consequences of AIDS (2/15, Mon/am). Impacts on schools and communities; federal policies; gender relations; effects on African societies.

24-8. A National Strategy for AIDS (2/15, Mon/pm). Education and prevention; health care provision and financing; public policy and public health.

25. Biomedical Sciences

25-1. Stress and Immunity (2/12, Fri/am). Endocrine control; immunopotential; behavioral modification; methionine-enkephalin; psychological disorders.

25-2. Impact of Chemical Research Towards the Discovery of Modern Medicine (2/12, Fri/pm). Infectious disease; cardiovascular, allergy, and inflammation therapeutics; enzyme inhibition.

25-3. Analysis of Human Genetic Disease (2/13, Sat/am-pm). Localizing genes responsible for genetic disease; understanding cystic fibrosis.

25-4. Mapping the Human Genome (2/15, Mon/am-pm). Methods and approaches; applications to diagnosis—genetic disorders, muscular dystrophy, cancer; completion by the year 2000.

26. Public Health

26-1. Cancer Risk Assessment and Government Regulation to Protect Public Health (2/12, Fri/am). Risk assessment methodology; EPA policies; legal challenges; communicating to the public.

26-2. U.S. Infant Mortality from Different Perspectives (2/12, Fri/pm). Medical, social-demographic, health care, and legislative/public policy perspectives.

26-3. Engineered Organisms in the Environment: Progress Towards Biotechnology Assessment (2/14, Sun/am). Risk assessment; federal regulation; media controversy.

26-4. Effects of Intensive Exercise on Female and Male Reproduction: Mechanisms and Significance (2/14, Sun/pm). Hypothalamic dysfunction; estrogen metabolism; reproductive defects; reduced cancer risk.

27. Ethical Issues in Bioscience

27-1. Employee Drug Testing: Scientific and Legal Perspectives (2/12, Fri/am-pm). Drug-screening techniques; federal and industry perspectives; potential medical, policy, and legal problems.

27-2. Ethicality and Bioethics in Dentistry (2/13, Sat/pm). Education; practice; administration; research.

27-3. Health Services for the Treatment of Torture and Trauma Survivors (2/14, Sun/am). Treatment and rehabilitation programs in the United States, Canada, and England; medical and psychiatric diagnosis.

27-4. Human Linkage Testing: The New Ethical Issues (2/14, Sun/pm). Clinical uses; ethical, legal, and theological issues.

27-5. Science, Engineering, and Ethics: The State of the Art (2/15, Mon/am-pm). Educational efforts—precollege to professional; ethics research in engineering, social science, medicine, the environment, and publishing.

28. Ecology & Ecosystems

28-1. The Central Role of Soils in the Biosphere (2/12, Fri/am). Biological processes; water quality; landscape analysis; ecosystem science.

28-2. Biological Diversity: The Quantification and Maintenance of Genetic Resources (2/12, Fri/pm). Genetic resource studies from forest, crop plant, and animal populations.

28-3. Biology and Impact of the Africanized Honeybee: Implications for the United States (2/13, Sat/am). Biol-

ogy, management, and economic impact in Latin America and Africa; predictions for the United States.

28-4. Landscape Corridors: Structure and Function (2/13, Sat/pm). Structure and function as biological, physical, and human perception/management entities.

28-5. Microbial Ecology: A Useful Base for Regulating Genetically Engineered Microbes (2/14, Sun/am-pm). DNA probes; rhizobium model; LacZY marker; synergism/antagonism; regulatory requirements.

29. Agriculture

29-1. Advances in Nonbiomedical Biotechnology (2/13, Sat/am). Agriculture; novel bioprocess techniques; pollution control; bioengineering.

29-2. The Study of Agrarian Systems: Standardizing Measurement and Minimum Data Sets (2/13, Sat/pm). Climate; soils; crops; labor; economics; regional-level data.

29-3. Alternative Approaches to a More Sustainable Agriculture (2/14, Sun/am). Physical/biological aspects and economic viability in the United States and the Third World; U.S. agricultural policy.

29-4. The Long-Term Viability of U.S. Agriculture: People, Resources, and Policy in a Global Context (2/14, Sun/pm). Social and institutional shifts; resource and environmental impacts; economics; technology development.

29-5. Application of Biotechnology to Biological Control of Plant Pathogens and Pests (2/15, Mon/am). Insect resistance; rhizosphere competence; fungal and bacterial antagonists.

Poster Sessions

Friday–Sunday

12–14 February

Come to Exhibition Hall A in the Hynes Convention Center between 11am and 3pm for informal discussions with poster session contributors.

III Behavioral & Social Sciences

30. Frontiers of the Social Sciences

30-1. **Current Controversies in Science and Technology: Late-Breaking News** (2/14, Sun/pm).

30-2. **Frontiers in the Social Sciences: Negotiation In, About, and For the Resolution of Conflict in the Classroom** (2/15, Mon/am). Discipline; negotiation; bullies; peer groups.

31. Brain System Processes

31-1. **High-Level Vision: Interdisciplinary Approaches to Object Recognition** (2/12, Fri/am). Selective attention; spatial relations; computational models; invariant visual primitives; pictorial descriptions.

31-2. **Neurobiological Approaches to an Understanding of the Dementias** (2/12, Fri/pm). Diagnosis; cognitive studies; neurobiology and molecular pathology and genetics of Alzheimer's disease.

31-3. **Surgical Treatment of Epilepsy: Basic and Clinical Mechanisms** (2/13, Sat/am). Anterior temporal lobectomy; neurochemistry of the epileptic focus; positron emission tomography.

31-5. **The Role of Affect in Cognition and Behavior** (2/14, Sun/am). Emotional processes; social development; cognition hypothesis.

31-6. **Neurobiological Bases of Personality** (2/14, Sun/pm). Neurogenetic adaptive mechanisms; appetitive/aversive motivation; cerebral glucose correlates; genetic and social causes.

31-7. **Memory Functions of the Hippocampus** (2/15, Mon/am). Human memory storage mechanisms; memory deficits during aging; Alzheimer's disease.

31-8. **Literacy: Clues to Brain Function** (2/15, Mon/pm). Dyslexia; brain organization and processing management; Brain Electric Activity Mapping.

32. Psychology

32-1. **Human Factors for Scientists with Disabilities** (2/12, Fri/am). Electronic messaging; speech recognition; hearing-impaired communication; personal projections with colleagues.

32-2. **Gender and Cognitive Skills: Cross-Cultural and Ecological Perspectives** (2/12, Fri/pm). International differences; mathematics achievement; spatial ability.

32-3. **Cross-Cultural Comparisons of Mathematics Education and Achievement** (2/13, Sat/am). Teaching practices, cultural traditions, and attitudes in the United States, Japan, China, and Taiwan.

32-4. **Nonverbal Communication: What Do We Know?** (2/13, Sat/pm). Evolutionary approach to expressive behaviors; emotion communication; interaction structure; hand gestures.

33. Anthropology & Archaeology

33-1. **The Ethology and Ethnography of Aggression and Nonaggression in Primates** (2/12, Fri/am-pm). Perspectives from anthropology, biology, psychology, and sociology; play groups; dominance hierarchies; sports.

33-2. **The Evolution of Human Diet** (2/13, Sat/am). Paleolithic-Neolithic variation; ecological, nutritional, genetic, and sociocultural factors.

33-3. **Cognitive Ethnography of Industrialized Society** (2/14, Sun/am). Mental arithmetic; folk models; decision

making and use of technology by social groups.

33-4. **Hunting and Scavenging in Early Human Evolution** (2/14, Sun/pm). Archaeological evidence; ecological and physiological consequences of meat eating; subsistence strategies; predation costs.

33-5. **Issues in the Scientific Study of Religions: Pathways to Self-Transformation in American Life** (2/15, Mon/am). Fundamentalist and evangelical sects; twentieth-century Blacks; addicted teenagers; retirement.

34. Sociology & Political Science

34-1. **A Multidisciplinary View of Distributive Justice** (2/12, Fri/am). Democracy; game theory; historical decisions; taxation.

34-2. **Polling and the 1988 Elections** (2/12, Fri/pm). Reliability; electoral dynamics; comparison with the 1960 election; media impacts.

34-3. **Understanding Extreme Poverty and Homelessness** (2/13, Sat/am). Estimating numbers; popular characterizations.

34-4. **The Integration of Law and Science in Alternative Dispute Resolution** (2/13, Sat/pm). Role of the scientist; issue solution through negotiation; mediation.

35. Economics & Industry

35-1. **Assessing Scientific and Technical Capabilities in Foreign Countries: Competition and Cooperation** (2/12, Fri/am). Business intelligence in R&D planning and corporate strategy; new product introductions; India and Japan.

35-2. **Technological Advance and the Services Industries** (2/12, Fri/pm). Role in U.S. economy; operations research; commercially strategic industries; R&D.

35-3. **Science, Engineering, and Technology Centers: Policy Issues and Future Directions** (2/14, Sun/am-pm). Viewpoints of government, universities, and industry; history, planning, and design.

36. Food Resources & Hunger

36-1. Food Security in Arid Lands: Strategies and Development (2/12, Fri/pm). Prehistoric solutions; international trade and the global food economy; remote sensing; biotechnological solutions.

36-2. The Future of Hunger (2/14, Sun/am). History of human hunger; demography; the "Green-Gene" revolution; environmental and resource threats; Africa's future.

36-3. Scientific Disagreements About World Hunger: Narrowing the Differences (2/14, Sun/pm). Debates on threat of soil erosion and limitations of the green revolution.

36-4. The Paradox of World Hunger and Grain Surpluses: The Role of World Trade (2/15, Mon/am). IIASA trade model; trade liberalization effects; policy measures.

37. Science History & Philosophy

37-1. The Edges of Science (2/12, Fri/am). Anthropic principle; Gaia hypothesis; anomalous phenomena.

37-2. Science as a System (2/12, Fri/pm). Economic, ethical, aesthetic, and political interaction.

37-3. History and Current Status of Mathematical Modeling in Science (2/13, Sat/am). Population ecology; semiconductor physics; hydrologic processes; earth's structure.

37-4. The Role of Hypotheses in Science (2/13, Sat/pm). Inference; Bayesianism; probabilification.

37-5. Quality Assurance in the Performance of Science (2/15, Mon/am). Avoiding common pitfalls in research design; improving peer review.

38. Science & Technology Education

38-1. The Roots of Scientific Literacy: Adolescent Socialization to Science and Mathematics (2/12, Fri/am-pm). Im-

pacts of television, computer usage, and museums; career aspirations; measurement of U.S. scientific and mathematics achievement; AAAS and NSF programs.

38-2. Informal Science Learning: Processes and Impacts (2/13, Sat/am). Books; television; science-technology centers; NSF study results.

38-3. Hands-on Science Museum Media: Exhibition and Discussion (2/13, Sat/pm). Arousing curiosity; translating for laypersons; collaboration between scientists and popularizers.

38-4. Persistent Problems in Science Testing (2/14, Sun/am). Science achievement test quality; representation of science disciplines; science education objectives.

38-5. Demonstration Models That Enhance Technological Literacy (2/14, Sun/pm).

38-6. The Great Debate: Should Science Teachers Be Prepared at Undergraduate or Graduate Level? (2/15, Mon/am). Perspectives of the classroom teacher, science supervisor, professional association, and university educator.

W. Workshops

W-1. Cultural Factors in AIDS Overseas (2/11, Thu/am-pm). Focusing on AIDS in the Caribbean, South America, and Africa, this workshop looks at populations at risk, education programs, and ethnographic data sources.

W-2. Workshop for Science Books & Films Reviewers (2/12, Fri/am). Designed to give current—and potential—reviewers for the AAAS magazine, *Science Books & Films*, an overview of the journal and the science book and film production industry.

W-3. An Examination of Psychosocial Variables That Facilitate Career Success Among Minority Persons with Disabilities (2/12, Fri/pm). Builds on findings of a national study to focus on resources and strategies to increase successful educational programming and employment among disabled minority persons.

W-4. Standards for School Mathematics (2/13, Sat/am). An opportunity

to hear and comment on draft recommendations from the Commission on Standards for School Mathematics.

W-5. Communicating with Policy Makers: Strategies for Scientists and Engineers (2/13, Sat/am-pm). Offers practical advice by reviewing the federal budget and legislative cycles, regulatory decision making, and points and timing for effective access to policy makers.

W-6. Middle School Math: Years of Choice (2/13, Sat/pm). Describes programs around the country to expand out-of-school mathematics education opportunities for middle-school students.

W-7. Precollege Education in Atmospheric Science (2/14, Sun/pm). Describes programs that have developed instructional materials to assist science teachers.

W-8. Responding to the Need for Improvement in Science Education: A Leadership Role for Academies of Science (2/14, Sun/pm). An opportunity to hear about model science education programs at several state academies of science.

W-9. Workshop on Communicating Science to the Public: So You Want to Be on TV? Scientists Face the Cameras (2/14, Sun/pm). Presents the ABCs of how to make a good appearance on television and how to get your message across to the public.

W-10. The Public, the Soviets, and Nuclear Arms (2/15, Mon/pm). Describes the Brown University–Public Agenda Foundation project on U.S.–Soviet relations and nuclear risk, involving research on American attitudes, restructuring of the policy debate, and a massive public outreach program.

W-11. Communicating Science to the Public: Writing Strategies for Scientists and Engineers (2/15, Mon/am). Writing strategies, information packaging for nonscientists, and hands-on practice at writing a newspaper science story in small group settings under the tutelage of experienced mass media science writers.

W-12. Testifying with Impact (2/14, Sun/am). Role playing and videotaping will be used to show scientists and engineers how to effectively deliver testimony at legislative hearings.

Seminars

These seminars require a separate fee in addition to the Annual Meeting registration. See the Advance Registration Form for price information.

21. Frontiers of Reproductive Biology

Organized by a faculty committee of the **Laboratory of Human Reproduction and Reproductive Biology, Harvard Medical School, John D. Biggers** (Chair).

Session I: Gametogenesis (2/12, Fri/am)

Anthony R. Bellvé (Columbia Univ. College of Physicians & Surgeons), **Richard M. Schultz** (Univ. of Pennsylvania), and **Anne N. Hirshfield** (Univ. of Maryland School of Medicine)

Session II: Fertilization and Egg Activation (2/12, Fri/pm)

David Epel (Stanford Univ., Hopkins Marine Station), **Paul M. Wassarman** (Roche Institute of Molecular Biology), and **Janet Rossant** (Mt. Sinai Hospital and Univ. of Toronto)

Plenary Lecture by John D. Biggers

Session III: Implantation (2/13, Sat/am)

Dale J. Benos (Univ. of Alabama), **Allen Enders** (Univ. of California, Davis), and **R. Michael Roberts** and **Kazuhiko Imakawa** (Univ. of Missouri, Columbia)

Session IV: Molecules Regulating Reproduction (2/13, Sat/pm)

R.L. Brinster (Univ. of Pennsylvania), **William W. Chin** (Harvard Univ. Medical School), and **Benita S. Katzenellenbogen** (Univ. of Illinois)

Session V: Neuroendocrinology (2/14, Sun/am)

Frederick Naftolin (Yale Univ.), **Ernst Knobil** (Univ. of Texas Health Science

Center, Houston), and **Wylie Vale** (The Salk Institute)

Session VI: Reproductive Technology (2/14, Sun/pm)

Neal L. First (Univ. of Wisconsin), **Barry D. Bavister** (Univ. of Wisconsin), and **Kurt Benirschke** (Univ. of California, San Diego)

22. The Protein Folding Problem

Organized by **Jonathan A. King** (MIT) and **Lila M. Gierasch** (Univ. of Texas Health Science Center, Dallas)

Session I: Structural Themes in Native Proteins (2/12, Fri/am)

George D. Rose (Hershey Medical Center, Pennsylvania State Univ.), **Cyrus Chothia** (Medical Research Council, Cambridge, England), **Martha M. Teeter** (Boston College), and **Barbara Brodsky** (Univ. of Medicine and Dentistry of New Jersey)

Session II: Interactions and Conformations of Amino Acids in Peptides (2/12, Fri/pm)

Daniel S. Kemp (MIT); **Isabella L. Karle** (Naval Research Laboratory); **Susan Marqusee** and **Robert L. Baldwin** (Stanford Univ. Medical School); **Peter E. Wright**, **H. Jane Dyson**, and **Richard A. Lerner** (Research Institute of Scripps Clinic); **James T. Sparrow** and **Antonio M. Gotto, Jr.** (Baylor College of Medicine); and **Lila M. Gierasch**, and **C. James McKnight**, **David Hoyt**, and **Maria Rafalski** (Univ. of Delaware)

Session III: Recovering Active Proteins (2/12, Fri/6:30pm)

Peter Kim (Whitehead Institute for Biomedical Research); **Stephen Anderson** (Genentech, Inc.); **Terrence G. Oas** (Whitehead Institute for Biomedical Research) and **Peter Kim**; **David N. Brems** (Upjohn Co.); **Jeff Stock** (Princeton Univ.); and **Michel E. Goldberg**, **Anne Murray-Brelier**, and **S. Blond** (Pasteur Institute)

Session IV: Intermediates in Protein Folding and Unfolding (2/13, Sat/am)

C. Robert Matthews (Pennsylvania State Univ.); **William DeGrado**, **James D. Lear**, **Zelda Wasserman**, **Lynne Regan**, and **Siew Peng Ho** (E.I. du Pont de Nemours & Co.); **Alfred Holtzer**, **Marilyn Emerson Holtzer**, and **Jeffrey Skolnick** (Washington Univ.); **David P. Goldenberg** (Univ. of Utah); and **Barry T. Nall** (Univ. of Texas Health Science Center, San Antonio)

Plenary Lecture by Jane Richardson

Session V: Protein Folding in vivo (2/13, Sat/pm)

Linda L. Randall (Washington State Univ.); **Jonathan A. King**, **Ben Fane**, **Cameron Haase-Pettingell**, and **Robert Villafane** (MIT); **Joseph F. Sambrook**, **Karen McCammon**, **Mark Segal**, **Pat Gallagher**, and **Mary Jane Gething** (Univ. of Texas Health Science Center, Dallas), and **Janet Hearing** (SUNY, Stony Brook); **Peter H. Byers** (Univ. of Washington); and **Alfred L. Goldberg** (Harvard Univ. Medical School)

Session VI: Modeling Protein Folding and Structure (2/14, Sun/am)

Fred E. Cohen, **Lydia Gregoret**, **Donald Kneller**, **Irwin D. Kuntz**, and **Fernando Bazar** (Univ. of California, San Francisco); **Arnold T. Hagler**, **Frank Avbelj**, **David H. Kitson** (The Agouron Institute), and **John Moult** (Univ. of Alberta); **Robert E. Brucoleri**, **Jiri Novotny**, and **Edgar Haber** (Massachusetts General Hospital); **David Eisenberg**, **Morgan Wesson**, and **Mason Yamashita** (UCLA); **Carl O. Pabo** (Johns Hopkins Univ. Medical School); and **Larry L. Smarr** (National Center for Super Computing Applications and Univ. of Illinois)

Session VII: Protein Design: What Can We Get Away With? (2/14, Sun/pm)

Daniel S. Kemp and **Benjamin Bowen** (MIT); **James A. Wells**, **Paul Carter**, **Brian C. Cunningham**, **David B. Powers**, **John Burnier**, **Richard R. Bott**, **Mark M. Ultsch** (Genentech, Inc.), **Colin Mitchinson**, **Robert M. Caldwell**, **Thomas P. Graycar**, and **David A. Estell** (Genencor, Inc.); **Jon Beckwith**, **Dana Boyd**, **Karen McGovern** (Harvard Univ. Medical

School), **Colin Manoil** (Univ. of Washington), **Jose Luis San Milan** (Centro estal Ramon Y Cagal, Spain), **Susan Froshauer** (Yale Univ. Medical School), and **Neil Green** (Univ. of California, San Francisco); **Peter Schultz** (Univ. of California, Berkeley); and **Thomas E. Creighton** (Medical Research Council, Cambridge, England)

23. Frontiers of Marine Ecosystem Research

Organized by **Kenneth Sherman** (NOAA/NMFS Northeast Fisheries Center), **Judith P. Grassle** (Marine Biological Laboratory, Woods Hole, MA), and **Barry D. Gold** (AAAS Office of International Science)

Session I: Recruitment, Dispersal, and Gene Flow (2/12, Fri/am)

Christopher T. Taggart (Dalhousie Univ. and Bedford Institute of Oceanography); **Cheryl Ann Butman** (Woods Hole Oceanographic Institution) and **Judith P. Grassle**; **Joachim Bartsch** and **Jan Backhaus** (Univ. of Hamburg, West Germany); **James E. Eckman** (Skidaway Institute of Oceanography); and **Jerry A. Coyne** (Univ. of Chicago)

Session II: Recruitment, Dispersal, and Gene Flow (2/12, Fri/pm)

Cheryl Ann Butman; **Montgomery Slatkin** (Univ. of California, Berkeley); **Andrew E. Dizon** (NOAA/NMFS Southwest Fisheries Center); **Richard K. Koehn** (SUNY, Stony Brook); **David Policansky** (National Research Council); **Hal Caswell** (Woods Hole Oceanographic Institution); and **William E. Evans** (NOAA)

Session III: Recruitment, Dispersal, and Gene Flow (2/13, Sat/am)

Judith P. Grassle; **David S. Wethey** (Univ. of South Carolina); **Richard B. Forward, Jr.** (Duke Univ. Marine Laboratory); **Richard K. Grosberg** (Univ. of California, Davis); **Robert D. Burke** (Univ. of Victoria); and **Steven D. Gaines** (Brown Univ.) and **Jonathan Roughgarden** (Stanford Univ.)

Plenary Lecture by **Robert E. Ricklefs**

Session IV: Biodynamics of Large Marine Ecosystems (2/13, Sat/pm)

Brian J. Rothschild (Univ. of Maryland Chesapeake Biological Laboratory); **Thomas D. Dickey** (Univ. of Southern California); **Thomas R. Osborn** and **Yidekatsu Yamazaki** (Johns Hopkins Univ.); **Dennis A. Powers** and **Thomas T. Chen** (Johns Hopkins Univ.); **Gene C. Feldman** (NASA-Goddard Space

Flight Center); **Jeffrey B. Frithsen** and **Candace A. Oviatt** (Univ. of Rhode Island Graduate School of Oceanography); and **Geoff C. Laurence** (NOAA/NMFS Northeast Fisheries Center)

Session V: Perturbation and Yield of Large Marine Ecosystems (2/14, Sun/am)

Kenneth Sherman; **Gotthilf Hempel** (Alfred Wegner Institut fur Polarforschung, West Germany); **Anatoly A. Elizarov** and **V.M. Borisov** (VNIRO, USSR); **Snorre Tilseth** (Institute of Marine Research, Norway); **Vagn Hansen** (Danmarks Fiskeri-og Havundersogelser, Denmark); **Keith Sainsbury**, **P. Craig**, and **C. Crossland** (Commonwealth Scientific and Industrial Research Organisation, Division of Fisheries Research, Australia); and **Mark Berman** (NOAA/NMFS Northeast Fisheries Center)

Session VI: Theory and Management of Large Marine Ecosystems (2/14, Sun/pm)

Lewis M. Alexander (Univ. of Rhode Island); **Simon A. Levin** (Cornell Univ.); **Nicholas J. Bax** and **Taivo Laevastu** (NOAA/NMFS Northwest and Alaska Fisheries Center); **Kenneth Sherman**; and **Martin Belsky** (Albany Law School)

Call for Seminar Papers

Deadline for Abstracts: 4 January 1988

Presenting a contributed paper at a seminar poster session is **open only to registrants of that seminar**. For each accepted paper, a bulletin board will be provided for display of text and graphics. Abstracts of papers, if prepared in the format described, will be copied and distributed to all seminar registrants. **Preparation of abstracts:** ■ Copy must be typed on white paper to fit within a 5" square. Use typewriter or letter-quality printer. ■ Indent, space, underline, and capitalize as in the example; do not double-space text. ■ Use reproducible black ink for all hand-lettering. ■ Do not box abstract or cut and paste it onto another piece of paper. **Transmittal:** ■ Outside the 5" square, type the seminar's title and your complete name, mailing address, and phone number. ■ Send original plus 2 copies **with your advance registration form** to: Seminars, AAAS Meetings Office, 1333 H Street, NW, Washington, DC 20005.

5 inches (12.7 cm)

Indent Five Spaces and Type Title in Upper and Lower Case Letters and Underline. AUTHOR'S NAME IN UPPER CASE (Institution Name in Upper and Lower Case), SECOND AUTHOR (Institution).*

Double-space and type abstract. The full width of the column of typed material should be 5 inches (12.7 cm) and must not extend beyond that. The total length of the material, from top of title to bottom of footnotes must not exceed 5 inches (12.7 cm). Abstracts which exceed these parameters will be returned. All special symbols and signs which must be hand lettered (e.g., π) should be rendered in reproducible black ink as clearly and carefully as possible. The entire submission should be of camera-ready quality so that it can be photographed, turned into a plate, and printed. The printed abstract will be about 2/3 the size of the typed version. Avoid paragraphing as this wastes space. However, you may use your allotted space to neatly letter in equations and diagrams as you deem necessary.

$$r_{\lambda\nu}^{\mu} = \frac{1}{2} g^{\mu\sigma} \left(\frac{\partial g_{\sigma\lambda}}{\partial x^{\nu}} + \frac{\partial g_{\sigma\nu}}{\partial x^{\lambda}} - \frac{\partial g_{\lambda\nu}}{\partial x^{\sigma}} \right)$$

$$R_{\mu\nu} = \frac{\partial r_{\lambda\mu}^{\lambda}}{\partial x^{\nu}} - \frac{\partial r_{\lambda\nu}^{\lambda}}{\partial x^{\mu}} + r_{\lambda\mu}^{\sigma} r_{\sigma\nu}^{\lambda} - r_{\lambda\nu}^{\sigma} r_{\sigma\mu}^{\lambda}$$

as indicated in this example.

*Double-space and type footnotes.

Meeting Information

Meeting Location

The 1988 Annual Meeting will be held at the **Sheraton Boston Hotel**, 39 Dalton Street, and the **Hynes Convention Center**, 900 Boylston Street. The two facilities are adjacent to each other in the Prudential Center complex. All Annual Meeting activities are scheduled in the Sheraton and the Hynes.

Hotels and Hotel Reservations

The AAAS has reserved guestrooms at reduced convention rates at the **Sheraton Boston Hotel** (39 Dalton Street, telephone 617/236-2000) and at the **Boston Marriott – Copley Place** (110 Huntington Avenue, telephone 617/236-5800). These special rates are guaranteed only when reservations are made **before 20 January 1988** by using the official housing form appearing on the facing page. **Please complete the form and mail it directly to the AAAS Housing Bureau, P.O. Box 490, Boston, MA 02199.**

Do not be a “No Show”! If you have made a hotel reservation and find that you cannot keep your commitment, please call (or write to) the Housing Bureau, or, after 20 January, the hotel, and cancel.

Meeting Registration

Advance Registration. AAAS members registering by 20 January 1988 receive a 30% discount on registration fees. Fees may be charged to **VISA** or **MasterCard**; no other credit cards are accepted. Please see the registration form on the facing page for categories and fees; note that there is no discount for the Seminars.

In early January, advance registrants will receive a badge and registration receipt, a preliminary program, and a voucher for the registration packet. The voucher may be exchanged at the Advance Registrants' Desk at the Hynes Convention Center (Plaza Foyer) for the full program and abstracts books

and other meeting materials. The registration area will be open Thursday through Sunday (11 – 14 February), 8:00 a.m. to 6:00 p.m. and Monday (15 February), 8:00 a.m. to 12 noon.

One-Day Registration. Members and nonmembers may register on-site—not in advance—for one day at the following rates: regular, \$35; students, retirees, high school teachers, and spouses, \$15. There is no one-day rate for the Seminars.

Registration Refunds. The AAAS will refund advance registration fees for all cancellations received by letter or telegram prior to 20 January 1988. **No refunds will be made on cancellations received after that date.** Refunds will be mailed from the AAAS Washington offices after the Annual Meeting.

Resource Center

Services for Disabled Registrants. The AAAS is making every effort to make the Annual Meeting fully accessible to disabled individuals. In addition to accessible meeting and hotel rooms, the following services will be provided through the Resource Center located in the Sheraton Boston Hotel: transportation to and from airports, train stations, and bus terminals; interpreters for the hearing-impaired at all plenary lectures and for other sessions on request; audiotaped program highlights for the visually impaired; assistance in moving within and between the meeting facilities and hotels; and emergency repair for wheelchairs.

Persons needing special services and accommodations are strongly urged to so indicate on the registration and housing forms. **Your early response will help us serve you better. For additional information, contact the AAAS Project on Science, Technology, and Disability, 1333 H Street, NW, Washington, DC 20005 (telephone 202/326-6667).**

Member Information. AAAS members seeking general information about the

Association's many activities or who have questions about their membership will find assistance in the Resource Center.

Resources for Minority Scientists.

The Resource Center provides an opportunity for the exchange of information and printed materials relevant to the participation of racial and ethnic minorities in the sciences and in the activities of the AAAS. Materials on education, employment, research, and organizations will be displayed.

Discount Air Fares

The AAAS has arranged with **American Airlines** and **Piedmont Airlines** for discounted air fares for travel to the Annual Meeting. These fares are available for round-trip travel to Boston between 8 February and 17 February 1988. For reservation information, see the special announcement on the second page of this preliminary program section.

Ground Transportation

Airport Buses. Logan Airport is located about 3 miles from the meeting hotels. Three bus companies operate between the airport and the Sheraton Boston Hotel: **Airways Transportation**, **Gray Line Airport Transportation**, and **Brush Hill Hotel Transportation**. The Marriott operates its own shuttle bus; it is marked “Copley Marriott.” Buses to both hotels stop at all terminals and run between 7:00 a.m. and 7:00 p.m., every hour on the hour. Fares range between \$5 and \$6.

Taxis. Rates are \$1 for the first $\frac{2}{7}$ mile, 20¢ for each additional $\frac{2}{7}$ mile. The fare from Logan Airport to the meeting hotels is about \$12. Travel time is approximately 20 minutes, longer during rush hour.

Public Transit. The Massachusetts Bay Transit Authority (MBTA) operates the subway and surface transit systems. Fares: Subway, 60¢; bus, 50¢. “Massport” shuttle bus stops at all airport terminals and provides free transportation to the Airport Station subway stop. Auditorium Station and Prudential Station are closest to the

Continued on page 828

Advance Registration Form

S1

AAAS Annual Meeting ♦ Boston ♦ 11 – 15 February 1988

Please Print or Type

Name of registrant _____
(Last) (First & initial)

Name of spouse registrant _____
(Last) (First & initial)

Institution/Company _____
(To be printed on badge)

(Spouse registrant)

Mailing address _____
(Street)

(City/State)

(Zip code)

(Telephone number)

Convention address _____
(Where you can be reached) (Hotel and/or telephone number)

Check days on which you will attend meeting: Thu ☐ Fri ☐ Sat ☐ Sun ☐ Mon ☐

☐ Check here if you need special services due to a handicap. We will contact you before the meeting.

20 January deadline: ■ Register by this date at the advance discount (fees will be higher after 20 January), and we will mail to you in advance your registration badge, receipt, preliminary program, and voucher for the full program and abstracts. ■ Registrations received after 20 January will not qualify for the discount, and materials will be held at the Advance Registrants' Desk at the Hynes Convention Center. ■ Refund requests must be made by letter or telegram to the address below by 20 January and will be honored after the Meeting. **No refunds will be made for cancellations received after 20 January.**

Mail to: AAAS, Annual Meeting Registration
1333 H Street, NW, Washington, DC 20005

Advance Registration Fees:

Annual Meeting (advance discount fees through 20 January 1988¹)

	Regular	Student ²	
AAAS Member	☐ \$65	☐ \$35	\$ _____
Nonmember ³	☐ \$95	☐ \$50	\$ _____
Special category ⁴	☐ \$35	—	\$ _____

Seminars (requires fee in addition to registration fee above)

Reproductive Biology	☐ \$85	☐ \$40	\$ _____
Protein Folding	☐ \$85	☐ \$40	\$ _____
Marine Ecosystems	☐ \$85	☐ \$40	\$ _____
TOTAL ALL LINES			\$ _____

1. After 20 January: Member and nonmember, regular, \$95; student, \$50.
2. Full-time undergrad. and grad. students only.
3. Nonmember registration fee includes introductory 6-month membership with 25 issues of *Science*.
4. Retirees, high school teachers, and spouses may register at this special rate (does not include introductory membership).

☐ Check enclosed ☐ VISA ☐ MasterCard
(No other cards accepted)

Card number _____ Expires _____

Signature _____

Hotel Reservation Form

AAAS Annual Meeting ♦ Boston ♦ 11 – 15 February 1988

Send confirmation to:

Name _____
(Last) (First & initial)

Mailing address _____
(Street)

(City/State)

(Zip code)

(Telephone number)

Other occupant(s) of room: _____
(Name) (Name)

Indicate special housing needs due to a handicap:

☐ wheelchair accessible room ☐ Other _____

Charge my major credit card (card type): _____

Card No. _____ Expires _____

Signature _____

Arrival date _____ Time _____

Departure date _____ Time _____

Please list definite arrival and departure dates and times. Rooms will be held only until 6 p.m. unless guaranteed with a credit card. The Housing Bureau will not accept checks.

■ Reservations must be sent to the AAAS Housing Bureau (address below) on this official form by **20 January 1988**. Reservations received after this cut-off date are conditional on space availability.

■ Confirmations will come directly from the hotels. Changes and cancellations must be sent to the Housing Bureau until the cut-off date; after 20 January, deal directly with the hotel.

■ Rollaway bed or extra person in room: Sheraton, \$10; Marriott, \$15.

■ Children free of charge in same room with parents: Sheraton to age 17; Marriott to age 18.

Hotel Rates (add 9.7% tax): Indicate 1st and 2nd choice of hotel; check appropriate box for type of room desired.

Choice	Hotel	Single	Double	Suites
_____	Sheraton Boston:			
	☐ Standard	☐ \$ 65	☐ \$ 75	☐ \$175 & up
	☐ Tower	☐ \$125	☐ \$150	☐ \$200 & up
_____	Boston Marriott	☐ \$ 79	☐ \$ 99	☐ \$225 & up

Mail to: AAAS Housing Bureau
P.O. Box 490
Boston, MA 02199

Meeting Information*continued from page 826*

hotels; ask for directions and transfer information.

Parking. At the Sheraton Boston Hotel, registered guests pay \$12 per 24 hours with in/out privilege; others pay between \$9 and \$13 (no in/out) depending on length of time parked. The Marriott has valet parking for registered guests at \$15 per 24 hours with in/out privilege; the self-parking

fee is \$14 per 24 hours, no in/out privilege.

Additional Services

Child Care. Concierges at the Sheraton Boston Hotel or the Boston Marriott – Copley Place can make arrangements with a licensed child care agency for guests needing that service. Both hotels request 24-hour advance notice.

Message Center. A message center will be operated during registration hours in

the AAAS registration area at the Hynes Convention Center. Call 617/262-8000 and ask for the AAAS Message Center to leave telephone messages.

Employment Information. A bulletin board for posting "positions wanted" and "positions open" notices will be located in the registration area. AAAS does not coordinate interactions between prospective employers and applicants.

AAAS BOSTON 88

Register Now!

AAAS Boston 88

HHMI-NIH Research Scholars at the National Institutes of Health

The Howard Hughes Medical Institute (HHMI) and the National Institutes of Health announce that applications will be accepted for the fourth class (1988-1989) of Research Scholars to start in the summer of 1988. HHMI-NIH scholars are selected from medical schools, usually after the first two years, for a year of laboratory research at the NIH in Bethesda. Scholars must be United States citizens or permanent residents attending medical school in the United States or Puerto Rico. They will be paid as employees of HHMI and housed on the NIH campus. Applications must be received by January 15, 1988. Candidates will be notified of the results by April 1, 1988.

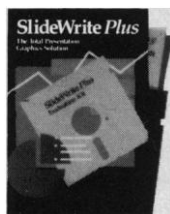
Application kits and brochures have been mailed to the deans' offices of all medical schools. Additional kits and brochures can be obtained from:

Howard Hughes Medical Institute
1 Cloister Court
Bethesda, Maryland 20814-1460
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Ref: Suva, et al. (1987) *Science* 237, 893-896

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(High Vmax, low Km substrate)
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5 mg US \$340
Ref: House, et al. (1987) *J. Biol. Chem.* 262, 772-777

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NEUROCHEMICALS FOR THE NEUROSCIENTIST

Adenosine Neurochemicals

Iodotubercidin
XAC
8-Cyclopentyl-1,3-dipropylxanthine

Adrenergic Blocking Agents

Propranolol, S(-), R(+)
Chloroethylclonidine

Dissolution Enhancing Excipient

Hydroxypropyl-β-cyclodextrin

Cholinergic Neurochemicals

Scopolamine methyl bromide,
(-), (+)
Vesamicol (AH-5183), (±), (-)
QNB, QNX

Excitatory Amino Acid Receptor

Ligands

2-Amino-4-phosphonobutyric
acid, (±)
2-Amino-7-phosphonoheptanoic
acid, (±)
AMPA
CPP, (±)

Dopamine Neurotoxins

2-Methyl MPTP
MPTP

GABA Neurochemicals

t-Butyl-bicyclophosphorothionate
(TBPS)
Baclofen, (±)

Selective Dopamine Neurochemicals

Butaclamol, (+) (-)
Eticlopride, (-)
SKF-83566, (±)
Sulpiride, (-), (+)
SCH-23390, (+), (-)
SKF-38393, (±), (+), (-)
3PPP, (+), (-)

Serotonin Neurochemicals

8-Hydroxy-DPAT, (±)
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PAPP (LY 165,163)

Radioreceptor Assay for Atrial Natriuretic Factors

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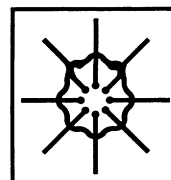
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