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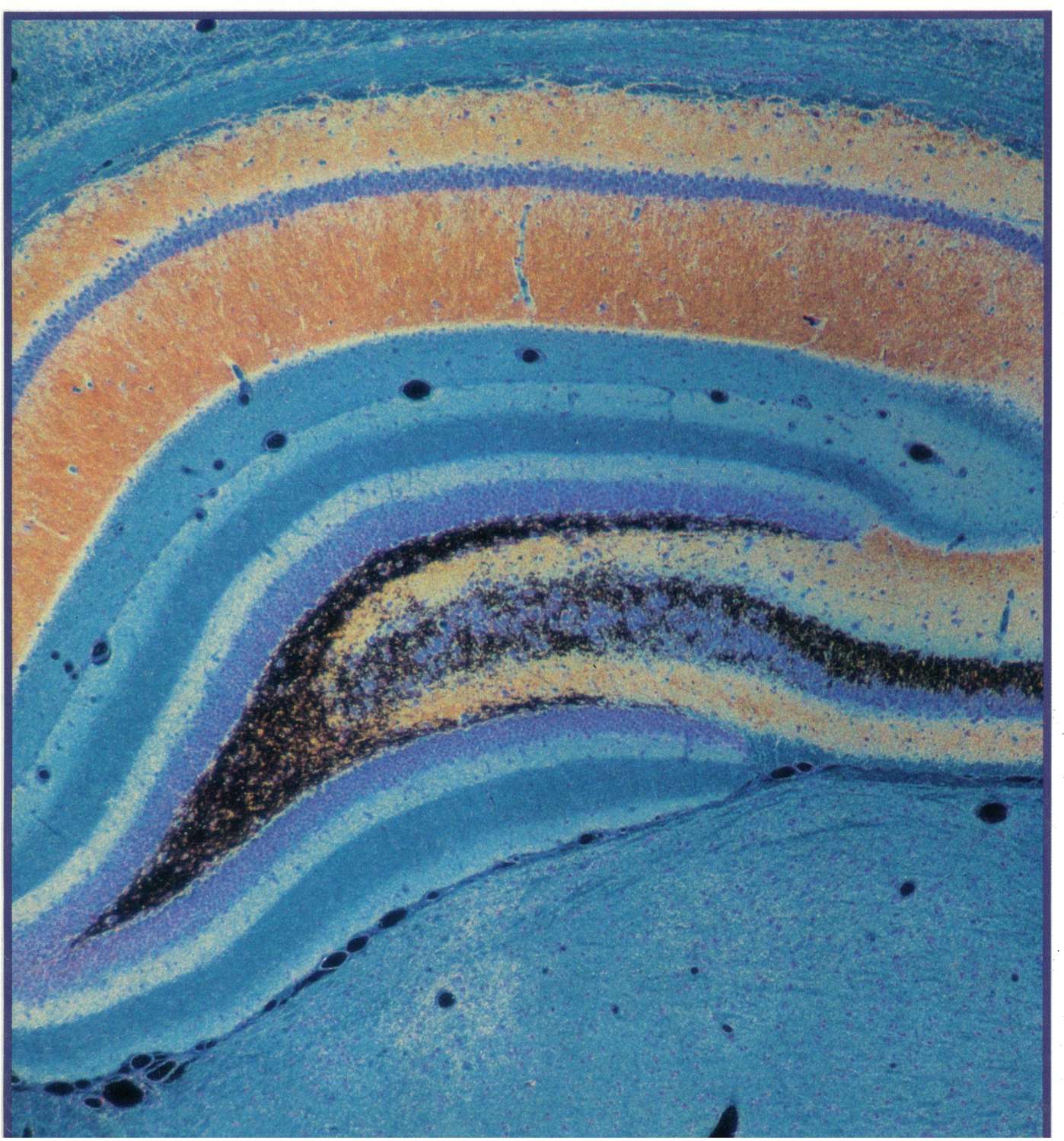

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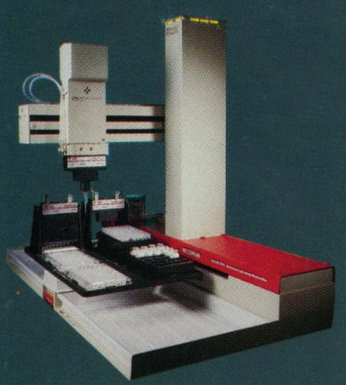

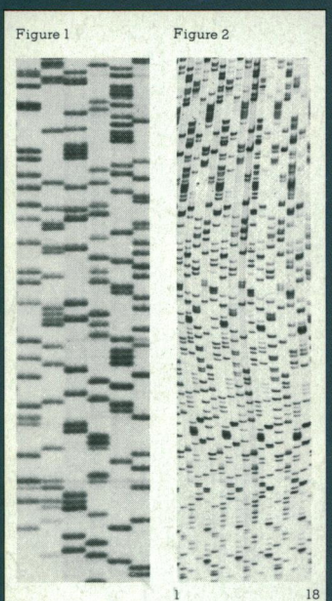

Figure 1. Autoradiogram of sequence analyses accomplished on the Biomek 1000 using GemSeq K/RT double-stranded DNA sequencing system and Riboprobe Gemini pGEM-3 vector, containing an insert of a known cDNA.

Figure 2. Autoradiogram of sequence analyses using M13mp18. Lanes 1-9 were performed manually, lanes 10-18 were performed on the Biomek 1000.

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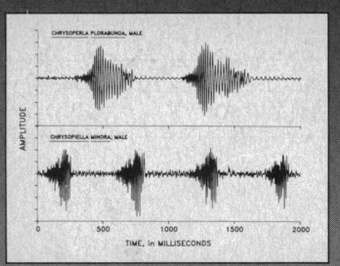

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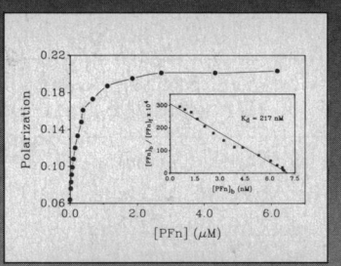

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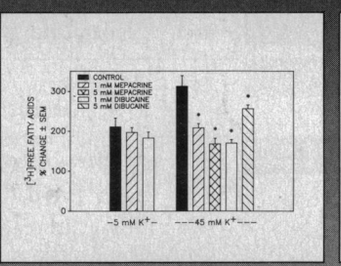

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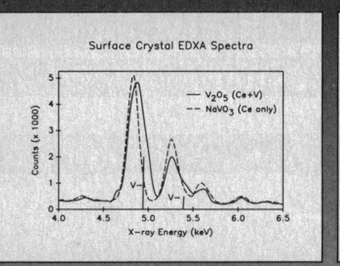

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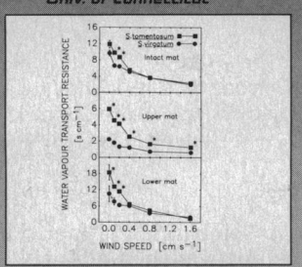

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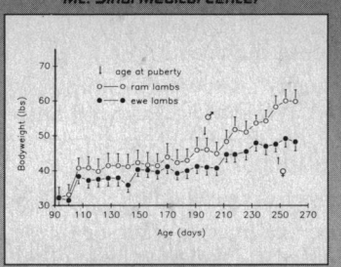

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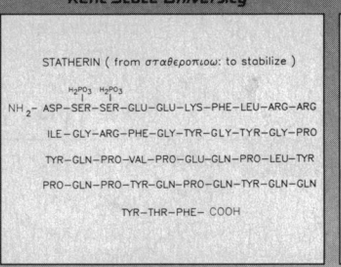

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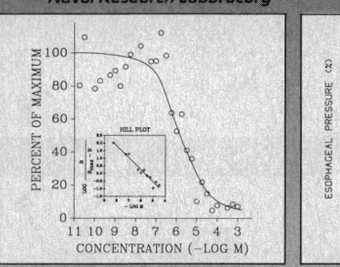

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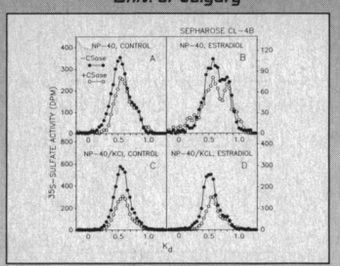

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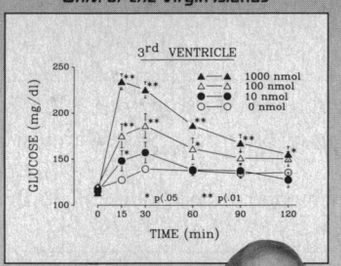

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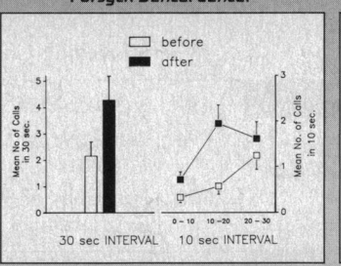

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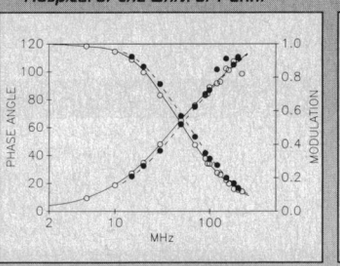

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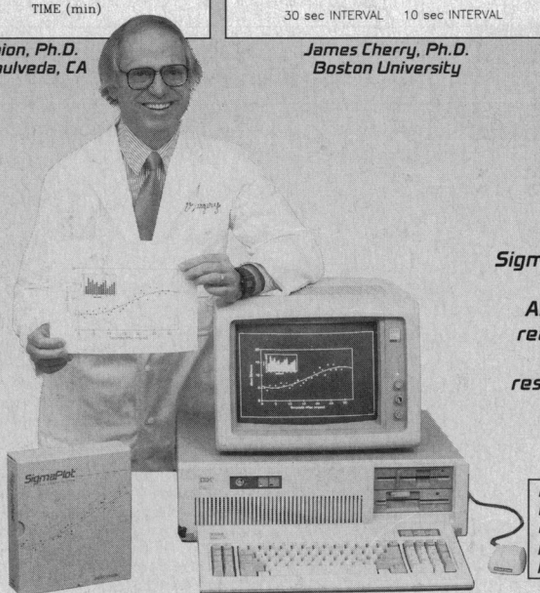

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COVER Darkfield micrograph of the normal Timm-stained rat hippocampus counterstained with cresyl violet. The granule cells, axons of which form the dark bands in the photograph, are the hippocampal neurons selectively lost after adrenalectomy. See page 535. [Photo by Robert S. Sloviter, Helen Hayes Hospital, New York State Department of Health, West Haverstraw, NY 10993]

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This Week in
SCIENCE

Gene rearrangement in development

UNDER stress, *Bacillus subtilis* form endospores. First, a sporangium is produced that gets partitioned into mother cell and forespore. Each compartment receives a copy of the same chromosome, but, in each, different genes are expressed. Ultimately, the forespore becomes a spore and produces progeny. The mother cell, which produces the protein shell that will encase the spore, is functional until the spore has matured; the mother cell then lyses and its chromosome is lost. The molecular bases for the differential maturation of these two cells have been studied by Stragier *et al.* (page 507) and Kroos *et al.* (page 526). In each compartment, sigma factors (σ^G in the forespore and σ^K in the mother cell) are associated with RNA polymerase activities and, in conjunction with other factors, influence what genes are expressed. The σ^K factor is encoded by two genes that are brought together at a specific time in sporulation to produce a composite σ^K regulatory gene. The mother cell is soon dispensed with, obviating the need for the chromosome to return to its native configuration. One-way chromosome rearrangements in genes like σ^K that encode transcription factors that directly affect cell morphogenesis might be regular events in terminally differentiating cells of developing microbial and eukaryote systems.

Isotopes in meteorites

RHENIUM and osmium are two metallic elements found in meteorites and in the earth. The abundances and ratios of various isotopes of these elements have been measured in whole-rock samples of carbonaceous chondrites (considered among the most primitive and least distorted of solar system materials), iron meteorites, and an ordinary chondrite (page 519). All of these rocks are estimated to have crystallized between 4 and 5 billion years ago. Walker and Morgan report that there are some important differences in the isotope compositions of the iron meteorites and the chondrites. These differences can be accounted for if this isotope system closed at different times during solar system evolution (for iron meteorites about 4.15 billion years ago and for chondrites about 4.55 billion years ago), if precursor materials in the early solar nebula were heterogeneous, or if rhenium was lost (through leaching) sometime after the rocks formed, producing rocks enriched in radiogenic osmium. The rhenium-osmium isotope system is providing new insights into the complex processes that have affected the evolution of the solar system.

Transgenic chickens

TRANSGENIC chickens are of interest both for research purposes and for use in the poultry industry. Bosselman *et al.* describe techniques for inserting new genes into germline cells of chicken embryos, for tracking such genes in developing chickens, and for transmitting the genes from transgenic animals to their progeny (page 533). A replication-defective reticuloendotheliosis virus vector was injected through holes in the shells of unincubated eggs into the subgerminal cavity of the blastoderm in order to infect developing germ cells. The vectors carried no viral structural genes but had two marker genes that could be monitored in the DNA of cells of blood and semen of mature chickens. Semen that was positive for the transgenes was used to inseminate females; in this way genes of interest were passed through the germline to the next generation.

Leucine zipper: a coiled coil

A number of DNA binding proteins contain a common structural motif, the leucine zipper. In this motif, the amino acid leucine occurs at every seventh position along a 30-residue stretch; the name "leucine zipper" was proposed to suggest that hydrophobic side chains of opposing leucines would interdigitate in zipper-like fashion and facilitate molecular dimerization. O'Shea *et al.* have synthesized a 33–amino acid peptide that corresponds to the leucine repeat region of a well-characterized yeast DNA binding protein (page 538). The synthetic peptides folded into stable dimeric α helices, but the helices were oriented in parallel and not antiparallel as predicted by the leucine zipper model. The peptides had characteristics of coiled coils —two right-handed (parallel) helices coiling around each other with a slight left-handed superhelical twist, a leucine appearing at every seventh residue, and a hydrophobic repeat within each heptad unit. The zipping up of the molecule therefore appears not to be brought about by pairs of interdigitating leucine residues but by leucines that have formed pairs with nonleucine hydrophobic residues situated on the opposite helix.

Blood pressure gene

SEVERAL genetic loci appear to contribute to the development of essential hypertension. In salt-sensitive Dahl rats, which serve as models of this heritable human disease, from two to four different loci are believed to determine blood pressure. One of these loci—the renin gene—has been identified and characterized by Rapp *et al.* (page 542). Restriction enzymes were used to cut the renin genes into pieces, and length and structure differences were observed in fragments of genes from homozygous salt-sensitive and homozygous salt-resistant Dahl rats. In crosses between the sensitive and resistant strains, the renin genotypes and blood pressure phenotypes cosegregated in animals of the second (F_2) generation: blood pressures of rats that had one sensitive renin allele were 10 mmHg higher than those of resistant animals; rats that had received two sensitive alleles had 20 mmHg higher blood pressures. Thus, the renin gene or a closely linked gene is one regulator of blood pressure in these animals.

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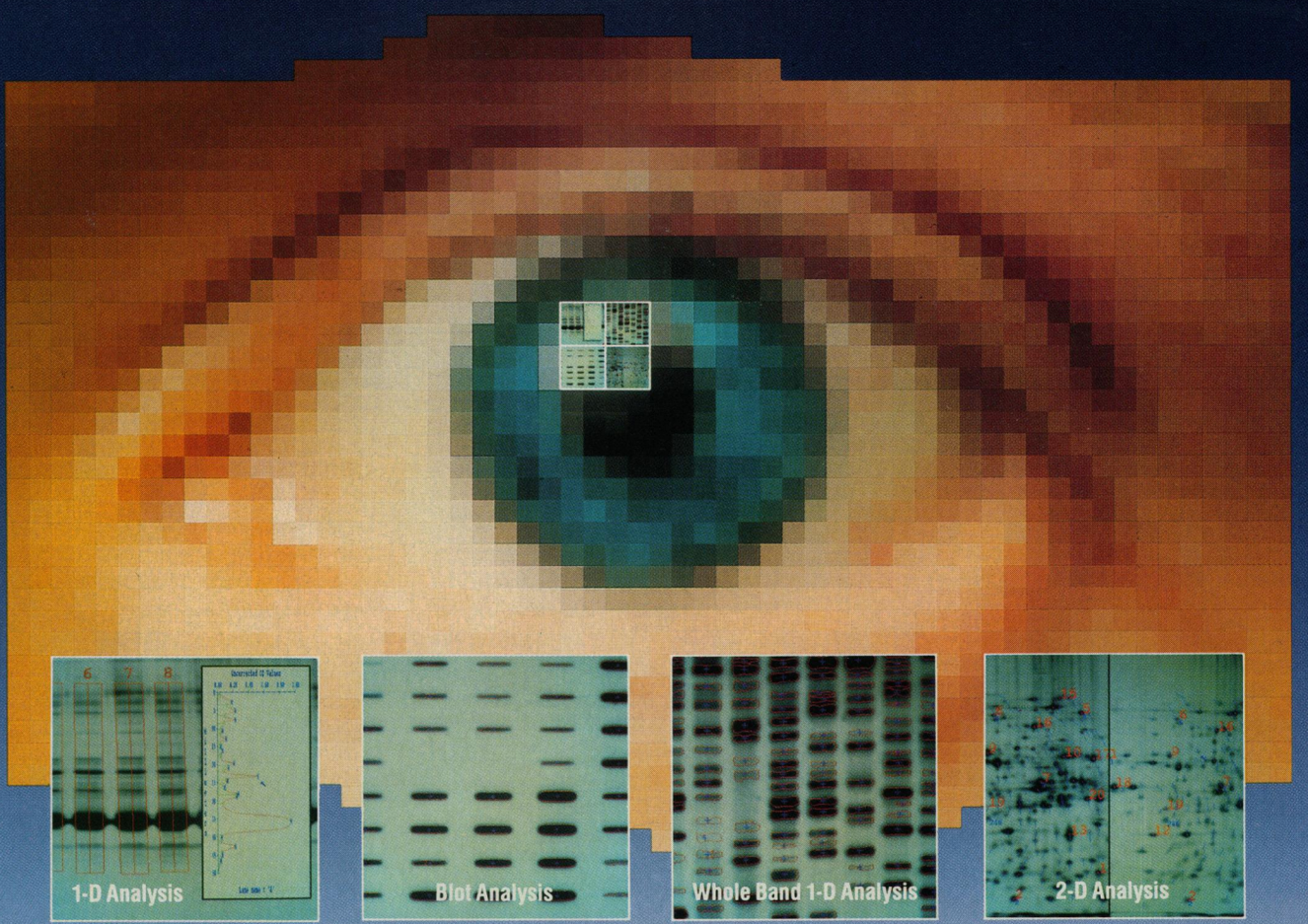

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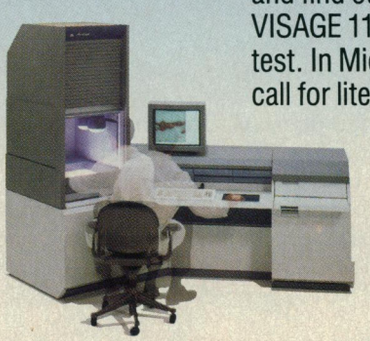

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Climate and Water

Last summer's above-average temperatures and the Midwest drought were widely interpreted as scary consequences of a greenhouse effect. But in the cold light of wintry days, the prospect of a little added warmth does not seem so menacing. Moreover, there is leisure to look at past records of weather and climate fluctuations. In particular, abnormally high temperatures and drought were characteristic of the dust bowl days of the 1930's. A careful study covering the years 1901 to 1984 by the National Oceanic and Atmospheric Administration and involving 1219 stations indicates that there has not been a long-term upward trend in average temperatures in the 48 contiguous states, although there has been an increase in the average minimum temperature.* In a recent article in *Science* (K. E. Trenberth *et al.*, 23 Dec., p. 1640), the 1988 drought was related to an exceptionally large amplitude in the Southern Oscillation, which gives rise to El Niño and other effects. The authors reminded readers, "Little difference in the radiative effects of greenhouse gases is expected between this year and last. . . . [T]he greenhouse effect may tilt the balance such that conditions for droughts and heat waves are more likely, but it cannot be blamed for an individual drought."

Scientists are not unanimous in believing that increases in greenhouse gases will necessarily result in the kind of temperature increases (2° to 5°C) that some modelers predict. Skeptics can point out that weather predictions for only the next several days are often wrong. Nevertheless, it is a fact that humans are conducting a great geophysical experiment. A continuing increase in greenhouse gases seems virtually guaranteed as developing countries seek to achieve standards that the developed world enjoys.

A practical approach to climate uncertainty is the activity of the AAAS Committee on Climate, chaired by Roger Revelle. Their initiatives have led to a book on climate and water that will be published later this year.† The committee and a substantial group of interdisciplinary experts have examined what the probable impacts of a 2° to 5°C rise in temperature would be on supplies of water in the contiguous 48 states. Some areas of the United States would be wetter than at present; other areas, drier. Computer simulations of a future greenhouse climate show drier summers in the interior of North America. Effects would be greatest in the arid West, where a small change in precipitation makes a relatively big change overall. Warming would make it difficult to maintain present irrigation in the West. In the East, where water would continue to be abundant, the area under irrigation is expected to increase. Everywhere the increase in CO_2 would make plants grow faster and reduce the amount of water that would escape from leaves.

The report includes some comments designed for planners. Present storage systems for water are likely to be inadequate in some places. As seasonality changes, snow would melt earlier and the floods would fill reservoirs at new seasons. Fluctuations could be damped by larger reservoirs and advantage should be taken of storage in aquifers that are not subject to evaporative loss.

The report calls for further studies to delineate more accurately the problems likely to arise and improved means of coping with them. For the present, however, the authors are guardedly optimistic about practical actions being taken concerning water. They state, "Despite a flurry of publicity, the managers of urban water systems, for example, testify climate change is not yet on their lists of worries. . . . A place is more likely won if the problem is considered serious like AIDS; if it is considered certain like the link between smoking and cancer; if it is considered soon like a flood from a weakened dam; soluble like finding a substitute for CFC's; and if the villain can be identified like the dumper of barrels leaking poison. . . . Proposal of feasible solutions enhances the chance of winning a place. . . . The proposals for arresting climate change are many and hard to manage. Those pertaining to water resources, like water banks or conserving irrigation water, seem more manageable because they can be done bit by bit and they extend present policies rather than require changes in the way we live."—PHILIP H. ABELSON

*T. R. Karl, R. G. Baldwin, M. G. Burgin, "Time series of regional season averages of maximum, minimum, and average temperature, and diurnal temperature range across the United States: 1901–1984" (NOAA, Asheville, NC, March 1988). †P. E. Waggoner, Ed., *Climate and Water* (Wiley, New York, in press).

pothesis can produce conflicting predictions depending on what particular branch of evolutionary biology is used. Thus they "predict" violence by husbands against young wives (on the basis of intermale sexual rivalry over females), whereas an evolutionary hypothesis could also predict violence against older wives—on the basis of their lower reproductive value.

Again the point is not to argue for my explanation instead of theirs. In fact, I am fairly sure that some of Daly and Wilson's explanations are correct. However, in a field as sensitive as the one they address, which many will perceive as the subject of genetic control of predispositions to homicide, sociobiologists surely have a duty to be far more circumspect in their presentation of such potentially divisive hypotheses? If they are not, understanding of human behavior will suffer as sociologists, anthropologists, psychiatrists, and psychologists ignore as irrelevant what they see as the overly simplistic theories of sociobiology.

A. H. HARCOURT
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Response: Readers of our article will not find case-by-case pseudo-explanations of homicides, as in George's caricature. What they will find is a number of novel hypotheses about demographic and circumstantial correlates of fatal conflict within families, derived from consideration of how selection is likely to have acted upon social psychologies, as well as various analyses showing that the hypothesized correlates are indeed powerful predictors of homicide risk. Risks to stepchildren, for example, had never been assessed before an evolutionary model of parental inclinations inspired us to make the relevant comparisons. Our discovery that such children are several dozen times more likely to be slain than genetic offspring seems to us to warrant serious concern rather than dismissal as "storytelling."

George asserts that anything could be "predicted by the theory" with the implication that "the theory" is vacuous. The only general theory informing our article is that of evolution by selection, and his complaint is nothing more or less than the amply refuted old chestnut that the theory of evolution can explain everything and therefore is not science. There are many models within modern behavioral ecology, some of them mutually contradictory. Some will turn out to apply to certain species or circumstances but not others, and some will fail completely. George apparently believes that the recognition of complexities arising from multiple causal factors (such as the countervailing pressures for nepotistic discrimination and for reciprocity with nonrelatives) constitutes a sort of post hoc waffling. Unfortunately, social phenomena are complex and multiply determined. They will not be elucidated by single-factor models nor by doctrinaire hostility to the use of evolutionary reasoning to generate testable hypotheses about human psychology and action.

Of course, any of our particular hypotheses might have failed. They did not, and so we discovered several previously unidentified risk factors for homicide. George suggests sarcastically that if we had found that people typically discriminate against their own offspring, we would claim to have predicted that, too. The truth is that such a discovery would be very surprising in any animal species, but would not constitute reason to disinter Darwin from Westminster before one had made serious efforts to generate potential evolutionary explanations of the unusual case, with testable corollaries.

Finally, by the narrow equation of science with "experiment," George would banish by fiat not only all studies of homicide but virtually all of sociology, epidemiology, economics, and astronomy.

Harcourt's complaint that we "make no attempt" to test our hypotheses against alternatives is baffling. We derived and tested

detailed alternative predictions, such as (i) the distinct gender contingencies in filicides and parricides to be expected under particular psychoanalytic versus evolutionary models of parent-offspring conflict, and (ii) the patterns of kinship among participants in homicides expected under a "nepotism" model versus those expected under the only alternative in the criminological literature, namely that relationship-specific rates of violence reflect differential opportunity. Elsewhere, limited by available space, we clearly referred readers to other such tests, as for example in citing research showing that differential violence by stepparents versus genetic parents is "independent of risk attributable to low socioeconomic status, maternal youth, family size, or personality characteristics of the abusers."

It is a shame that Harcourt chose not to "spell out" the alternative "economic hypothesis" that can "explain all the trends" we describe. It is far from obvious why "small children being easier to kill than older ones" would apply to their parents but not to nonrelatives or how the "costs and benefits of the homicidal act itself and of the participants to one another" would account for stepparents being vastly more likely to kill their wards than genetic parents, or why Canadian men are more likely to kill younger than older wives when they are also more severely penalized for doing so (*1*). But the more general point is that Harcourt's contrasting of "an economic analysis" with what he calls "the evolutionary hypothesis" represents a category error: economic explanations of the acts of individuals invoke unanalyzed utilities (subjective costs and benefits), while evolutionary psychology addresses the questions of what social and other "resources" are likely to have utility at all, and why species-typical utility functions take one form rather than another.

Perhaps Harcourt's mistaken belief that good science would pit a monolithic "evolutionary hypothesis" against "alternatives" such as "economics" also explains his complaint about our exploring the implications of diverse evolutionary arguments. Why else can he not fathom the "logic" of invoking life history theory when considering life historical variables, sexual selection theory when discussing sexual rivalry, and kinship theory when discussing nepotistic discrimination? As for the possibility of generating alternative hypotheses within an evolutionary framework, we have elsewhere discussed the same example as Harcourt (*1*, p. 13)

> . . . in using selection thinking as an heuristic for generating psychological hypotheses and predictions about homicide, we do not pretend to be "testing" some monolithic "Darwinian theory." On the contrary, imaginations informed by evolutionary theory often generate *alternative* hypotheses about how selection might have shaped mind and behavior. At what age would you expect wives to be maximally at risk of homicide by their husbands? Selection thinking suggests the hypothesis that postmenopausal women will be least valued by men and therefore most at risk, but it also suggests an alternative, namely that wife-murder is the tip of the iceberg of the coercive violence that men employ to control the *most* reproductively valuable women. . . . There is nothing embarrassing or "unscientific" about the fact that imaginations informed by evolutionary theory can generate alternative scenarios. Selection thinking is not merely "a theory," but a paradigm, and it suggests fresh lines of inquiry. (To the best of our knowledge, no previous student of homicide had ever thought to inquire whether the risk of spouse-murder might be systematically related to the parties' ages.)

Our article documented major variations in family homicide rates in relation to demographic and circumstantial variables. We discovered these risk factors only because we considered the social psychology of interpersonal conflict from an evolutionary perspective, using homicides as an extreme but exceptionally valid assay of such conflict. Others may devise truly alternative explanations for some of the phenomena we have discovered and may demonstrate their superiority. That is science and we will applaud any such progress.

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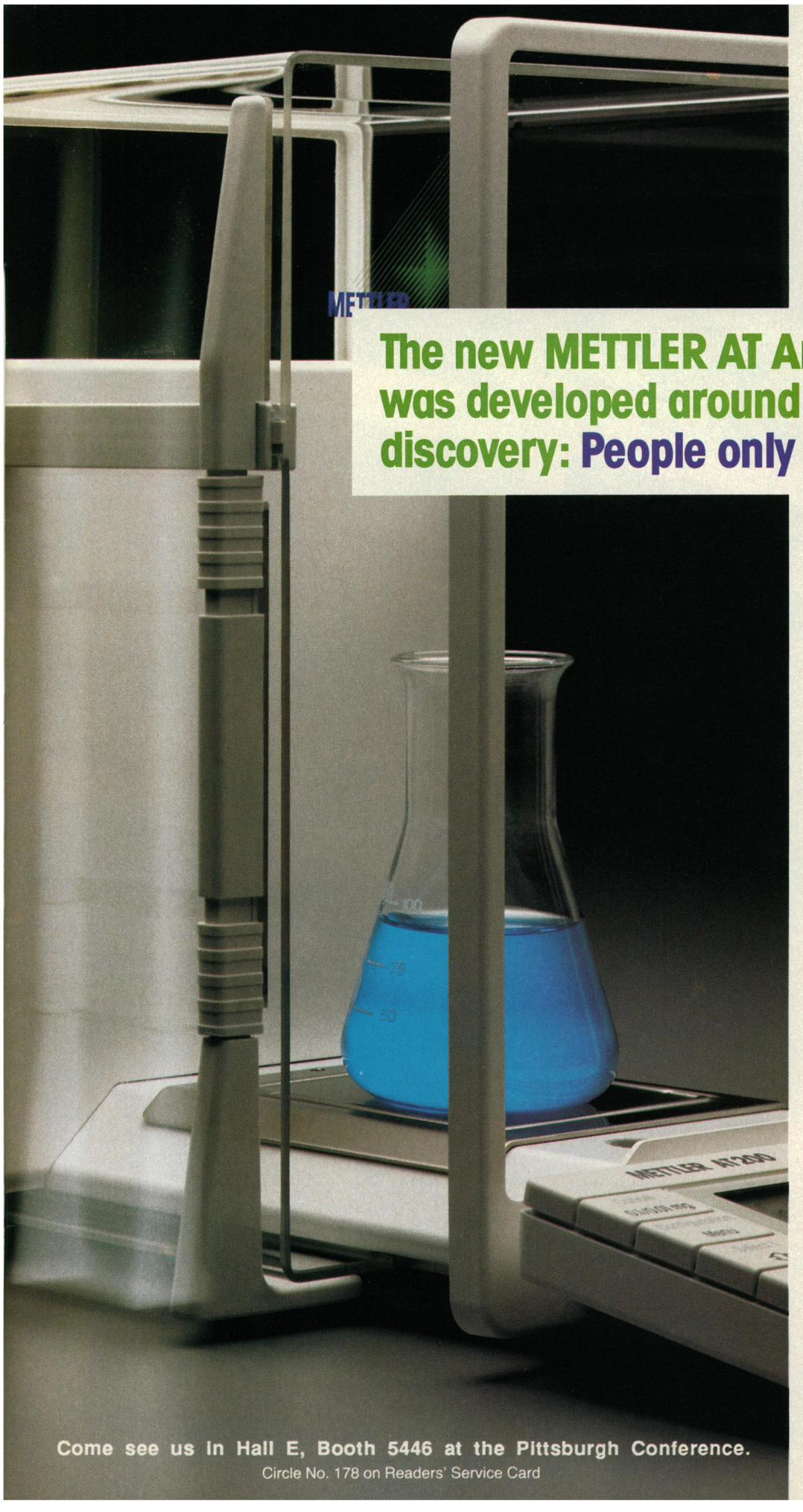
REFERENCES

1. M. Daly and M. Wilson, *Homicide* (de Gruyter, Hawthorne, NY, 1988).



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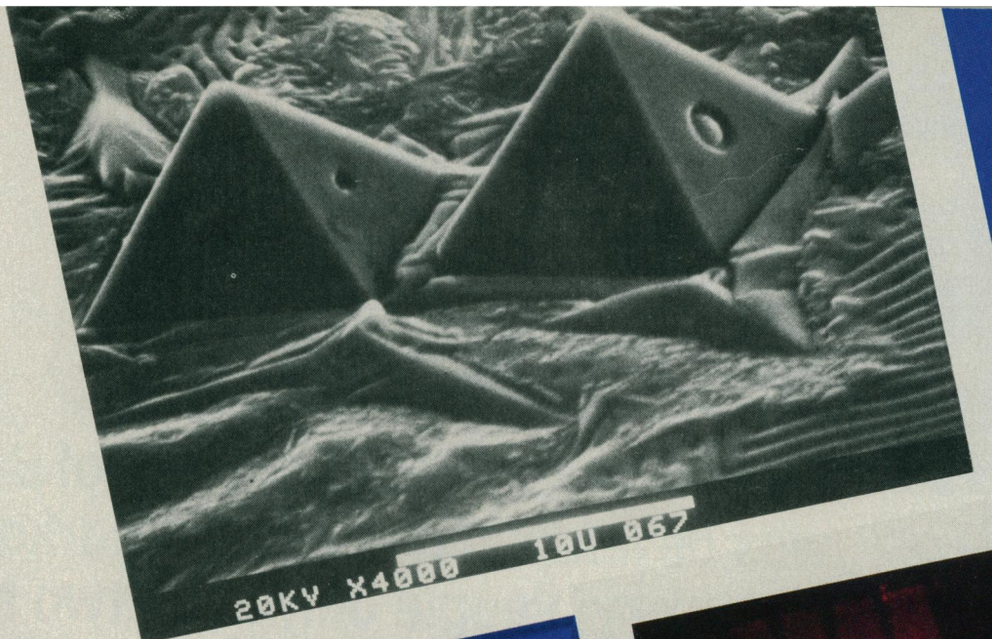

Fig. 1

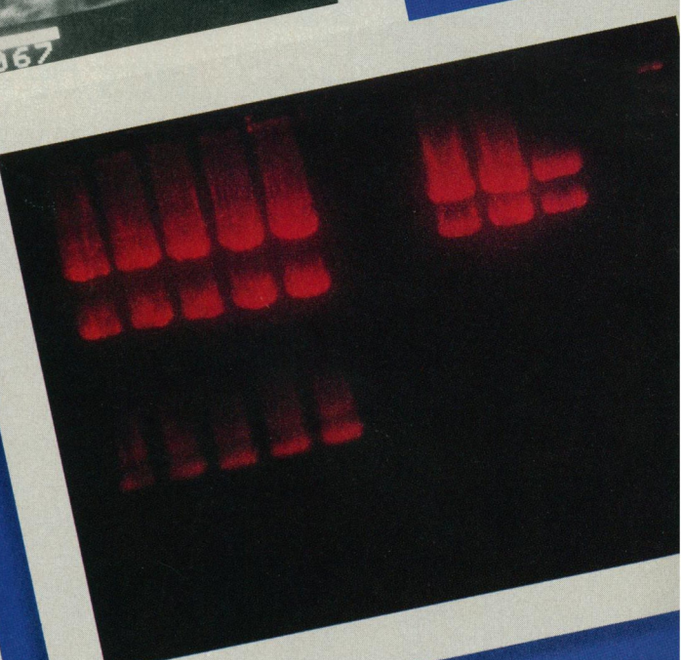

Fig. 2

Fig. 3

Fig. 4

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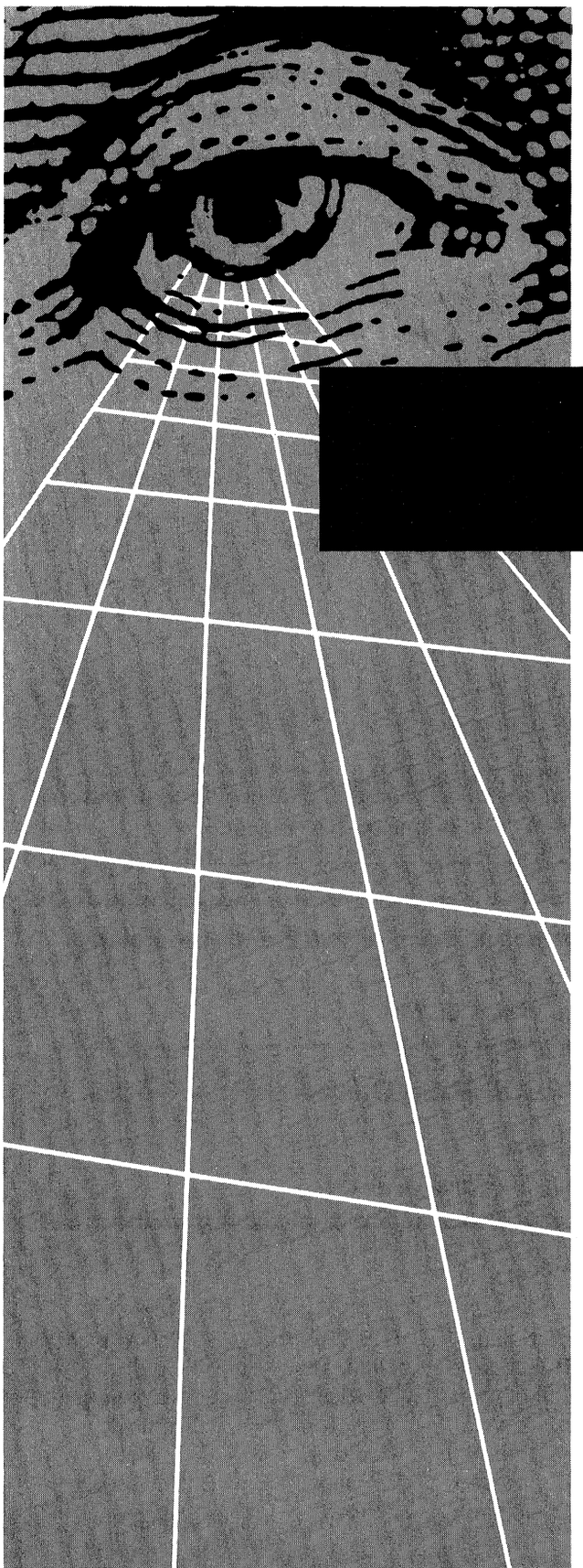

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1989

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Locations and dates noted in this list may change; titles and addresses have been abridged.

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Prof. AL LASKAR, Clemson Univ., Physics & Astron. Dept., Clemson, SC 29631, USA
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SULFUR-CENTERED REACTIVE INTERMEDIATES
Dr. C CHATGILIALOGLU, CNR, 40064 Ozzano Emilia, Bologna, Italy
18 - 30 June 1989 : Maratea, Italy 264/88

HIGH TEMPERATURE SUPERCONDUCTORS - PHYSICS AND MATERIALS SCIENCE
Dr. R KOSSOWSKY, Eng. Materials Dept., Penn. State Univ., POB 30, State College, PA 16804, USA
13 - 26 August 1989 : Bad Windsheim, Germany 285/88

OPTIMISATION AND DECISION SUPPORT SYSTEMS IN CIVIL ENGINEERING
Dr. BHV TOPPING, Civil Eng. Dept., Heriot-Watt Univ., Riccarton, Edinburgh EH14 4AS, UK
25 June - 6 July 1989 : Edinburgh, UK 287/88

ACTIVE PERCEPTION AND ROBOT VISION
Dr. AK SOOD, Computer Sc. Dept., George Mason Univ., 4400 Univ. Drive, Fairfax, VA 22030, USA
16 - 29 July 1989 : Maratea, Italy 470/88

VIBRATION AND WEAR DAMAGE IN HIGH SPEED ROTATING MACHINERY
Prof. J MONTALVAO E SILVA, CEMUL/IST, Technic. Univ., Ave. Rovisco Pais, 1096 Lisbon Codex, Portugal
10 - 22 April 1989 : Troia, Portugal 612/88

CARBON FIBERS AND FILAMENTS
Prof. JLC FIGUEIREDO, Chemical Eng. Dept., Fac. de Engenharia, University, 4099 Porto Codex, Portugal
15 - 27 May 1989 : Alvor, Portugal 714/88

MEMBRANE FILTRATION : THEORY AND APPLICATIONS
Prof. A HUYGHEBAERT, Food Techn. & Chem., Fac. of Agric. Sc., Coupure Links 653, 9000 Gent, Belgium
7 - 21 September 1989 : Maratea, Italy 722/88

TRANSPORT PROCESSES IN POROUS MEDIA
Prof. MY CORAPCIOGLU, Washington State Univ., Civil Eng. Dept., Pullman, WA 99164-3001, USA
9 - 18 July 1989 : Pullman, Washington, USA 882/88

ELECTROCHEMICAL AND OPTICAL TECHNIQUES FOR THE STUDY AND MONITORING OF METALLIC CORROSION
Prof. MGS FERREIRA, Chem. Eng. Dept., IST, Av. Rovisco Pais, 1096 Lisbon Codex, Portugal
2 - 14 July 1989 : Sintra, Portugal 900/88

NOVEL SILICON BASED HETEROSTRUCTURES
Dr. RA LEVY, AT&T Bell Labs., Murray Hill, NJ 07974, USA
17 - 28 July 1989 : Boca Raton, Florida, USA 903/88

ELECTRONIC PROPERTIES OF MULTILAYERS AND LOW DIMENSIONAL SEMICONDUCTOR STRUCTURES
Prof. L EAVES, University of Nottingham, Physics Dept., Nottingham NG7 2RD, UK
11 - 22 September 1989 : Castera Verduzon, France 924/88

SOCIAL & BEHAVIOURAL SCIENCES

SCIENCES SOCIALES ET DU COMPORTEMENT

MANAGING SCIENCE IN A STEADY STATE
Mr. P. HEALEY, Science Policy Support Group, 160 Great Portland St., London W1N 6DT, UK
1 - 13 October 1989 : Il Ciocco, Italy 290/88

SPEECH PRODUCTION AND SPEECH MODELLING
Dr. A MARCHAL, Inst. de Phonétique, 29 Ave. R. Schuman, 13621 Aix-en-Provence, France
17 - 29 July 1989 : Bonas, France 471/88

SIXTY-TWO YEARS OF UNCERTAINTY - HISTORICAL, PHILOSOPHICAL & PHYSICS INQUIRIES INTO THE FOUNDATIONS OF QUANTUM MECHANICS
Prof. AI MILLER, Dept. of Physics, Harvard University, Cambridge, MA 02138, USA
20 - 31 July 1989 : Erice, Sicily, Italy 947/88

Advanced Research Workshops

LIFE SCIENCES

SCIENCES DE LA VIE

GENERAL AND APPLIED ASPECTS OF HALOPHILIC MICROORGANISMS
Dr. F RODRIGUEZ-VALERA, Microbiology Div., Alicante Univ., Apdo. 99, Alicante, Spain
18 - 22 September 1989 : Alicante, Spain 586/87

PHARMACEUTICAL APPLICATIONS OF CELL AND TISSUE CULTURE
Dr. G WILSON, CIBA-GEIGY Pharmaceuticals, Wimblehurst Rd., Horsham, West Sussex RH12 4AB, UK
4 - 9 September 1989 : Bendor, France 952/87

SIGNAL PERCEPTION AND TRANSDUCTION IN HIGHER PLANTS
Dr. R RANJEVA, Ctr. de Phys. Veg., Univ. P. Sabatier, 118 Rte de Narbonne, 31062 Toulouse Cedex, France
2 - 7 July 1989 : Toulouse, France 260/88

EVOLUTION OF THE FIRST NERVOUS SYSTEMS
Dr. PAV ANDERSON, Whitney Laboratory, 9505 A1A South, St. Augustine, FL 32086, USA
2 - 5 July 1989 : St. Andrews, UK 272/88

DEVELOPMENTAL NEUROPATHOLOGY OF SCHIZOPHRENIA
Dr. SA MEDNICK, Univ. Southn Califor., Social Sc. Res. Inst., DRB-101, Los Angeles, CA 90089-1111, USA
29 August - 2 September 1989 : Il Ciocco, Italy 295/88

PENICILLIUM AND ASPERGILLUS
Dr. RA SAMSON, Centraalbureau voor Schimmelcultures, P.O.B. 273, 3740 AG Baarn, Netherlands
8 - 12 May 1989 : Amersfoort, Netherlands 308/88

THE EFFECT OF TIN UPON MALIGNANT CELL GROWTH
Prof. M. GIELEN, VUB, TW-AOSC-Room 86512, Pleinlaan 2, 1050 Brussels, Belgium
17 - 20 July 1989 : Brussels, Belgium 474/88

CONTROL OF METABOLIC PROCESSES
Dr. A CORNISH-BOWDEN, Ctre de Bioch.& Biol. Moléc., 31, Chem. J-Aiguier, 13402 Marseille Cedex 9, France
9 - 15 April 1989 : Il Ciocco, Italy 475/88

MOLECULAR BIOLOGY OF AUTOIMMUNE DISEASE
Prof. AM McGREGOR, Dept. of Medicine, King's College Hosp. Med. Schl., Denmark Hill, London SE5 8RX, UK
16 - 20 April 1989 : Athens, Greece 479/88

RECENT ADVANCES IN DEVELOPMENT AND GERMINATION OF SEEDS
Dr. RB TAYLORSON, USDA, ARS, PSI, WSL, Rm. 38, Bldg. 001, BARC-West, Beltsville, MD 20705, USA
6 - 11 August 1989 : Williamsburg, Virginia, USA 570/88

CLINICAL AND PATHOPHYSIOLOGICAL ASPECTS OF INHERITED METABOLIC DISORDERS
Dr. F ÖZKARAGÖZ, Ministry of Health and Social Welfare, Sihiye, Ankara, Turkey
8 - 11 March 1989 : Antalya, Turkey 620/88

CONJUGATED POLYMERIC MATERIALS : OPPORTUNITIES IN ELECTRONICS, OPTO-ELECTRONICS AND MOLECULAR ELECTRONICS
Dr. J-L BREDAS, Serv. Chimie des Mat. Nouveaux, Univ. de l'Etat, Av. Maistriau, 21, 7000 Mons, Belgium
10 - 15 September 1989 : Mons, Belgium 852/88

SENSORY ABILITIES OF CETACEANS
Dr. JA THOMAS, Naval Ocean Systems Ctr., POB 997, Kailua, HI 96734-0997, USA
23 - 25 August 1989 : Rome, Italy 864/88

THE NEOCORTEX -- ONTOGENY AND PHYLOGENY
Prof. BL FINLAY, Cornell Univ., Psychology Dept., Uris Hall, Ithaca, NY 14853, USA
27 August - 2 September 1989 : Col d'Olen, Italy 886/88

HEALTH RELATED EFFECTS OF PHYLLOSILICATES
Dr. J. BIGNON, INSERM U.139, CHU H. Mondor, 94010 Creteil, Cedex, France
16 - 17 March 1989 : Paris, France 890/88

SELECTIVE ACTIVATION OF DRUGS BY REDOX PROCESSES
Prof. GE ADAMS, MRC Radiobiology Unit, Chilton, Didcot, Oxon OX11 0RD, UK
28 August - 1 September 1989 : Fermo, Italy 892/88

REGULATION OF EXTRAVASCULAR FIBRINOLYSIS IN NERVOUS SYSTEM DEVELOPMENT
Dr. BW FESTOFF, Veterans Admin. Medical Ctr., 4801 Linwood Blvd. Kansas City, MI 64128, USA
23 - 29 July 1989 : Bellagio, Italy 896/88

DEMOGRAPHICAL, PHYSIOLOGICAL, GENETICAL AND BEHAVIORAL ASPECTS OF POPULATION BIOLOGY OF PASSERINE BIRDS
Dr. J BLONDEL, CNRS, Ctr. L. Emberger, BP 5051, 34033 Montpellier Cedex, France
3 - 8 October 1989 : Evisa, Corsica, France 923/88

EVOLUTIONARY BIOGEOGRAPHY OF THE MARINE ALGAE OF THE NORTH ATLANTIC
Dr. GR SOUTH, Huntsmen Marine Sc. Ctr., Brandy Cove Rd., St. Andrews, New Brunswick, E0G 2X0, Canada
3 - 6 September 1989 : New Brunswick, Canada 931/88

RNA 3' END FORMATION
Dr. JL MANLEY, Columbia Univ. 713 Fairchild Ctr., New York, NY 10027, USA
13 - 17 September 1989 : Oxford, UK 933/88

MOLECULAR SIGNALS IN MICROBE-PLANT SYMBIOTIC AND PATHOGENIC SYSTEMS
Prof. EJJ LUGTENBERG, Univ., Botanical Laboratory, Nonnensteeg 3, 2311 VJ Leiden, Netherlands
21 - 26 May 1989 : Flevohof, Netherlands (CCS) 851/86

RECOGNITION AND RESPONSE IN PLANT-VIRUS INTERACTIONS
Dr. RSS FRASER, IHR-Littlehampton, Worthing Rd., Littlehampton, West Sussex, BN17 6LP, UK
12 - 16 April 1989 : Chichester, UK (CCS) 920/87

TRANSDUCING PATHWAYS - ACTIVITATION AND DESENSITIZATION
Prof. TM KONIJN, Univ. Zoological Lab., Postbox 9516, 2300 RA Leiden, Netherlands
24 - 27 May 1989 : Noordwijkerhout, Netherlands (CCS) 921/87

INFORMATION PROCESSING OF CHEMICAL SENSORY STIMULI IN BIOLOGICAL AND ARTIFICIAL SYSTEMS
Dr. D SCHILD, Humboldtallee 23, 3400 Göttingen, Germany
23 - 26 July 1989 : Göttingen, Germany (CCS) 359/88

PARALLELS IN CELL TO CELL JUNCTIONS IN PLANTS AND ANIMALS
Dr. AW ROBARDS, Inst. for Appl. Biology, University of York, York YO1 5DD, UK
2 - 7 July 1989 : York, UK (CCS) 605/88

CELLULAR AND MOLECULAR BIOLOGY OF MYELINATION
Dr. G JESERICH, Universität, Dept. Biology/Chemistry, Barbarastr. 7/11, 4500 Osnabrück, Germany
28 August - 2 September 1989 : Osnabrück, Germany (CCS) 907/88

MECHANISM OF FERTILIZATION -- PLANTS TO HUMANS
Dr. B DALE, Stazione Zoologica, Villa Communale, 80121, Naples, Italy
Spring 1989 : Sorrento, Italy (CCS) 921/88

PHYSICS AND CHEMISTRY — *PHYSIQUE ET CHIMIE*

FROM GEOMETRY TO THERMODYNAMICS -- COMMON PROBLEMS OF QUASI-CRYSTALS, LIQUID CRYSTALS AND INCOMMENSURATE INSULATORS
Dr. J-C TOLEDANO, C.N.E.T., 196, Av. H. Ravera, 92220 Bagneux, France
4-8 September 1989 : Preveza, Greece 269/88

RADIATIVE CORRECTIONS - RESULTS AND PERSPECTIVES
Dr. N DOMBEY, Physics Div., Univ. of Sussex, Brighton BN1 9QH, East Sussex, UK
9-14 July 1989 : Brighton, UK 524/88

THE PHYSICS AND CHEMISTRY OF ARBIDES, NITRIDES AND BORIDES
Dr. R FREER, Materials Science Ctre, UMIST, Grosvenor St, Manchester M1 7HS, UK
18-22 September 1989 : Manchester, UK 571/88

NUCLEAR MATTER AND HEAVY ION COLLISIONS
Dr. M SOYEUR, Serv. de Phys. Théorique, CEN-SACLAY, 91191 Gif-sur-Yvette, Cedex, France
7-16 February 1989 : Les Houches, France 595/88

BIO-MECHANICAL TRANSPORT PROCESSES
Prof. F MOSORA, Univ. de Liège, Inst. de Physique, 4000 Sart-Tilman par Liège 1, Belgium
9-14 October 1989 : Cargèse, Corsica, France 617/88

ION BEAMS MODIFICATION AND PROCESSING IN HIGH-Tc SUPERCONDUCTORS -- PHYSICS AND DEVICES
Dr. CA ENGLISH, Materials Development Div. B 393, Harwell, Oxen OX11 ORA, UK
10-12 April 1989 : Minster Lovell, UK 908/88

SEMICONDUCTORS
Prof. P HIRSCH, Oxford Univ., Metallurgy Dept., Parks Rd., Oxford OX1 3PH, UK
5-8 April 1989 : Oxford, UK 909/88

DYNAMICS OF POLYATOMIC VAN DER WAALS COMPLEXES
Dr. N HALBERSTADT, Univ. Paris-Sud, Lab. de Photoph/Molec., Btm. 213, 91405 Orsay, France
21-26 August 1989 : Bonas, France 928/88

RELATIONSHIP BETWEEN THE PHYSICOCHEMICAL PROPERTIES OF ZEOLITIC SYSTEMS AND THEIR LOW DIMENSIONALITY
Dr. D BARTHOMEUF, Lab. de Réactivité de Surface & Structure, Univ. P&M Curie, 75252 Paris Cedex 05, France
24-28 April 1989 : Chantilly, France (CSLD) 622/87

SPECTROSCOPY OF SEMICONDUCTOR MICROSTRUCTURES
Dr. G FASOL, Cavendish Lab., Madingley Rd., Cambridge CB3 OHE, UK
9-13 May 1989 : Venice, Italy (CSLD) 655/88

KINETICS OF ORDERING AND GROWTH AT SURFACES
Prof. MG LAGALLY, Univ. Metall. & Mineral Eng. Dept., 1509 University Av., Madison, WI 53706, USA
18-22 September 1989 : Sesimbra, Portugal (CSLD) 865/88

SCIENCE AND ENGINEERING OF 1- AND 0-DIMENSIONAL SEMICONDUCTORS
Dr. SP BEAUMONT, Univ. of Glasgow, Electronics & Electr. Eng. Dept., Glasgow G12 8QQ, UK
4-7 April 1989 : Cadiz, Spain (CSLD) 950/88

SELF TRAPPING OF VIBRATIONAL ENERGY IN PROTEIN
Prof. PL CHRISTIANSEN, Lab. of Appl. Mathemat. Physics, Tech. Univ., Bldg 303, 2800 Lyngby, Denmark
30 July-5 August 1989 : Thisted, Denmark (COP) 672/88

NONLINEAR EVOLUTION OF SPATIO-TEMPORAL STRUCTURES IN DISSIPATIVE CONTINUOUS SYSTEMS
Prof. FH BUSSE, Universität, Physik. Inst., Postfach 10 12 51, 8580 Bayreuth, Germany
24-29 September 1989 : Streitberg, Germany (COP) 932/88

NONLINEAR WAVE PROCESSES IN EXCITABLE MEDIA
Dr. AV HOLDEN, Physiology Dept., University of Leeds, Leeds LS2 9NQ, UK
11-15 September 1989 : Leeds, UK (COP) 937/88

ASTRONOMY AND ASTROPHYSICS — *ASTRONOMIE ET ASTROPHYSIQUE*

THE NUMERICAL MODELLING OF NONLINEAR STELLAR PULSATIONS -- PROBLEMS AND PROSPECTS
Prof. JR BUCHLER, Physics Dept., Univ. of Florida, Gainsville, FL 32611, USA
20-24 March 1989 : Les Arcs, France 297/88

THEORY OF ACCRETION DISKS
Dr. F MEYER, MPI f. Physik und Astrophysik, Karl-Schwarzschild-str. 1, 8046 Garching, Germany
6-10 March 1989 : Garching, Germany 478/88

PHYSICAL PROCESSES IN HOT COSMIC PLASMAS
Dr. W BRINKMANN, MPI für Extraterr. Physik, 8046 Garching, Germany
15-19 May 1989 : Sicily, Italy 667/88

MATHEMATICS — *MATHEMATIQUES*

LATTICE GAS METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS - THEORY APPLICATIONS AND HARDWARE
Dr. G DOOLEN, Los Alamos National Lab., MS-B258, Los Alamos, NM 87545, USA
5-9 September 1989 : Santa Fe, New Mexico, USA (COP) 944/88

EARTH SCIENCES — *SCIENCES DE LA TERRE*

THE PHYSICAL OCEANOGRAPHY OF SEA STRAITS
Dr. LJ PRATT, Clark-3, Oceanographic Inst, Woods Hole, MA 02543, USA
10-15 July 1989 : Les Arcs, France 713/88

DYNAMICS, TRANSPORT AND PHOTOCHEMISTRY IN THE MIDDLE ATMOSPHERE OF THE SOUTHERN HEMISPHERE
Dr. A. O'NEILL, Met. Office, Met O 20, London Rd., Bracknell, Berks RG12 2SZ, UK
15-17 April 1989 : San Francisco, USA 906/88

COMPUTER AND SYSTEMS SCIENCES — *INFORMATIQUE ET SCIENCES DES SYSTEMES*

SUPERCOMPUTING
Prof. JS KOWALIK, Boeing Computer Services, PO Box 24346, M.S. 7L-24, Seattle, WA 98124, USA
19-23 June 1989 : Trondheim, Norway 480/88

NEURO COMPUTING -- ALGORITHMS, ARCHITECTURES AND APPLICATIONS (NCA 3)
Dr. F FOGELMAN, Univ. de Paris 5, Htes Etudes en Informatique, 45 rue des Sts Pères, 75006 Paris, France
28 February-4 March 1989 : Les Arcs, France 889/88

REAL-TIME INTEGRATION METHODS FOR MECHANICAL SYSTEM SIMULATION
Dr. RC DEYO, Evans & Sutherland, 580 Arapeen Drive, Salt Lake City, UT 84108, USA
7-11 August 1989 : Snowbird, Utah, USA 926/88

ROBOTS AND BIOLOGICAL SYSTEMS
Dr. P DARIO, Scuola Sup. di S. Anna, V. Carducci 40, 56100 Pisa, Italy
26-30 June 1989 : Il Ciocco, Italy (ROB) 483/88

MULTISENSOR FUSION FOR COMPUTER VISION
Dr. JK AGGARWAL, Univ. of Texas, Elec. & Computer Eng., ENS. 519, Austin, TX 78712-1084, USA
24-28 August 1989 : Grenoble, France (ROB) 525/88

DESIGNING HYPERTEXT FOR LEARNING
Prof. DH JONASSEN, Univ. of Colorado, 1200 Larimer Str., Campus Box 106, Denver, CO 80204, USA
17-21 July 1989 : Jutland, Denmark (AET) 960/88

COMPUTER-SUPPORTED COLLABORATIVE LEARNING
Dr. C. O'MALLEY, Open University, IET, Walton Hall, Milton Keynes MK7 6AA, UK
September 1989 : Florida, USA (AET) 961/88

GUIDED DISCOVERY TUTORING
Dr. M ELSOM-COOK, Open University, IET, Walton Hall, Milton Keynes MK7 6AA, UK
July 1989 : Location to be announced (AET) 963/88

MULTI-MEDIA INTERFACE DESIGN
Dr. M BAKER, Open University, IET, Walton Hall, Milton Keynes MK7 6AA, UK
September 1989 : Location to be announced (AET) 965/88

APPLIED SCIENCES AND ENGINEERING — *SCIENCES APPLIQUEES ET INGENIERIE*

URBAN WATER INFRASTRUCTURE
Mr. KE SCHILLING, US Army Corps of Engin., Water Res. Inst., Casey Bldg., Fort Belvoir, VA 22060-5586, USA
22-28 June 1989 : Douglas, Isle of Man, UK 261/88

TOPOLOGICAL NETWORK DESIGN - ANALYSIS AND SYNTHESIS
Prof. J MACGREGOR SMITH, Industrial Engin. Dept., Univ. of Massachusetts, Amherst, MA 01003, USA
19-23 June 1989 : Gentofte, Denmark 271/88

HOLLOW CATHODE-HOLLOW ANODE GLOW SWITCHES
Prof. MA GUNDERSEN, Electr. Eng. Dept., Univ. of S. Calif., Los Angeles, CA 90089-0484, USA
17-21 July 1989 : Lillehammar, Norway 473/88

SEMICONDUCTOR DEVICE RELIABILITY
Prof. A CHRISTOU, Univ. of Crete, Physics Dept., Box 470, Heraklion, Crete, Greece
5-9 June 1989 : Crete, Greece 853/88

WATER WAVE KINEMATICS
Prof. A TØRUM, SINTEF/NHL/NTH, 7034 Trondheim, Norway
22-25 May 1989 : Molde, Norway 894/88

GEOHYDROLOGIC MANAGEMENT OF SEA LEVEL AND MITIGATION OF DROUGHT
Prof. R PAEPE, Earth Technology Inst., Pleinlaan 2, 1050 Brussels, Belgium
1-7 March 1989 : Fuerte Ventura, Spain 914/88

TRADITIONAL AND NON-TRADITIONAL ROBOTIC SENSORS
Prof. TC HENDERSON, Computer Science Dept., Univ. of Utah, Salt Lake City, UT 84112, USA
28 August-1 September 1989 : Maratea, Italy (ROB) 522/88

SENSORY SYSTEMS FOR ROBOTIC CONTROL
Prof. A PUGH, Dept. of Electr. Eng., Univ. of Hull, Hull HU6 7RX, UK
30 October-3 November 1989 : Il Ciocco, Italy (ROB) 724/88

MAPPING AND SPATIAL MODELLING FOR NAVIGATION : CONTRIBUTIONS OF IMAGE PROCESSING AND ARTIFICIAL INTELLIGENCE TO ROBOT NAVIGATION
Prof. LF PAU, Bldg. 348, EMI, Techn. University, 2800 Lyngby, Denmark
21-25 August 1989 : Denmark (ROB) 851/88

SOCIAL & BEHAVIOURAL SCIENCES — *SCIENCES SOCIALES ET DU COMPORTEMENT*

BEHAVIOURAL MECHANISMS OF FOOD SELECTION
Dr. RN HUGHES, Animal Biol. Schl., University, Bangor, Gwynedd LL57 2UW, UK
17-21 July 1989 : Gregynog, UK 477/88

STATE INTERVENTION ON BEHALF OF CHILDREN AND YOUTH
Prof. J HUDSON, Soc. Welf., Univ. of Calgary, Suite 300, 8625-112 Str., Edmonton, Alberta, T6G 1K8 Canada
20-24 February 1989 : Maratea, Italy 526/88

THE EARLIEST HUMAN OCCUPATION IN EUROPE
Dr. E BONIFAY, Lab. de Géol. du Quaternaire, Fac. des Sc. de Luminy, 13288 Marseille Cedex 9, France
3-8 April 1989 : Paris et Le Puy en Velay, France 598/88

SENSORY-MOTOR ORGANIZATION AND DEVELOPMENT IN INFANCY
Prof. H BLOCH, EPHE-CNRS, 41 rue Gay-Lussac, 75005 Paris, France
2-7 July 1989 : Normandy, France 924/88

ECONOMETRIC MODELING OF THE WORLD TRADE IN GROUNDFISH
Dr. WE SCHRANK, Memorial Univ. of Newfoundland, Dept. of Economics, St John's, Newfoundland, Canada
14-18 August 1989 : Newfoundland, Canada 935/88

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NATO, B - 1110 Brussels, Belgium

similar to the human protein (*6*). In addition, there are some striking molecular differences between cnidarians and other animals, including the structure of mitochondrial DNA. This is a very conservative feature in animal phyla, where it exists as a small circular genome. On the other hand, in hydra and other cnidarians the mitochondrial DNA is present as a linear DNA genome (*7*), as it is in ciliates and some other protists (*8*).

It is clear from our data that Cnidaria are very distant from other animals. We do not, however, argue forcefully for Cnidaria having an independent origin from other animals. The inferences drawn from the bootstrap analysis of 18*S* rRNA sequences discussed above indicate that these organisms should be placed either on a separate branch from true metazoans or very deep within the metazoan branch. We believe that the issue remains to be resolved. Although all of the data, both molecular and nonmolecular, taken together may agree best with a deep origin of Cnidaria within the metazoan clade (as a sister group to the Bilateria), the independent origin of Cnidaria is a possibility that must still be considered and further investigated by accumulation of additional sequence data, not only for rRNAs.

The inference of deep phylogenies from molecular sequence data is a new and exciting endeavor. The 18*S* rRNA sequence data have allowed us to address some important problems in metazoan phylogeny and to define the first large-scale molecular-based phylogenetic tree for this group. We have provided concrete answers to some major questions; we have revealed some major rapid radiations; and we have explored the strengths and limitations of using rRNA sequence data for resolving relationships among animal phyla. These results will hardly be the last word, but they both provide more focused questions and outline a new approach to systematics.

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