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6 December 1991 $6.00
Vol. 254 ■ Pages 1425–1556

Primer Specificity Breakthrough.

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1. Nielson, K. and Mathur, E.J. (1990) Strategies 3:17-19.
2. Nielson, K. and Mathur, E.J. Manuscript in preparation.
3. Nielson, K. and Mathur E.J. (1989) U.S. patents filed.
4. Mullis, K.B., and Faloona, F.A. (1987) Meth. Enzymol. 155:335-350.

Figure Legend: A photograph of a 1% agarose gel stained with ethidium bromide representing reaction products from PCR amplifications using the GeneAmp™ Kit† from Perkin-Elmer Cetus according to manufacturer's instructions. The reactions were conducted with (lanes 1 and 3) and without (lanes 2 and 4) the inclusion of 1 unit Perfect Match polymerase enhancer. Lanes 1 and 2 represent 100 ng of human genomic DNA amplified with two 26-mer primers separated by 1400 nucleotides. Lanes 3 and 4 represent 100 ng of mouse genomic DNA amplified with two 23-mer primers separated by 550 nucleotides.

Figure 1 shows two examples of *in vitro* amplification reactions that are significantly enhanced by the addition of Perfect Match polymerase enhancer to the polymerase preparation. Note that in lanes 1 and 2, the desired PCR product cannot be detected unless Perfect Match polymerase enhancer is added to the amplification reaction. In lanes 3 and 4, Perfect Match polymerase enhancer not only increases the intensity of the desired amplification products, but dramatically reduces the background artifacts generated by non-specific priming events.

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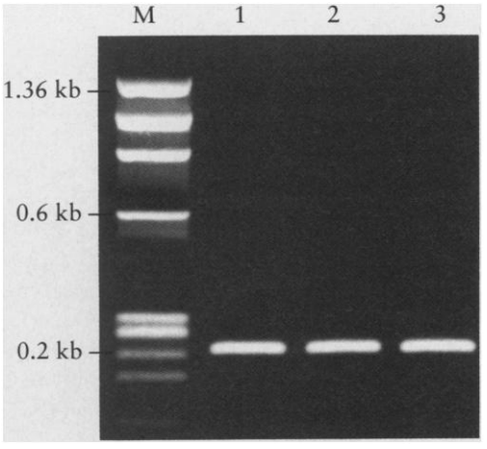
■ The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objectives are to further the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility, to improve the effectiveness of science in the promotion of human welfare, to advance education in science, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

COVER The Hawaiian sepiolid squid *Euprymna scolopes* uses the luminescence of bacterial symbionts in its nocturnal behavior. This ventral dissection (the squid is ~3.5 centimeters in length) reveals the light-emitting organ as a complex, bilobed structure in the center of the mantle cavity. Normal light-organ development is initiated by specific strains of *Vibrio fischeri*. See page 1491. [Photograph by William Ormerod, University of Southern California]

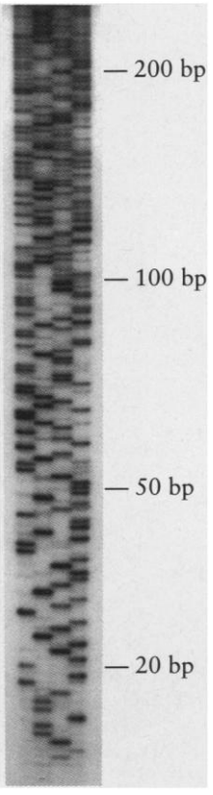
Book Reviews

Products & Materials

High-Quality PCR Sequencing



PCR† testing of stability of DNA Polymerization Mix. A target sequence in human genomic DNA was amplified using DNA Polymerization Mix which had been stored under various conditions. Lane 1, storage at -20°C for three months; lane 2, after 50 freeze/thaw cycles (-20°C to 37°C); and lane 3, stored at 37°C for three months. The marker (M) is φX-174 RF DNA-*Hae* III (27-4044-01).



Sequencing results obtained with column-purified PCR† products. A Miniprep Spun Column (27-5101-01, -02) was used to remove primers and unincorporated nucleotides from the amplified DNA prior to sequencing. The figures in the margin denote distance from the 5'-end of the sequencing primer.

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1 solution with 3 dNTPs (no dGTP); 10 µmol of each at 20 mM

Labelling Mix-dT 27-2099-01
1 solution with 3 dNTPs (no dTTP); 10 µmol of each at 20 mM

†PCR (polymerase chain reaction) is covered by U.S. Patents issued to Cetus Corporation. A license for the use of PCR for research and testing purposes may be obtained by purchase of Perkin-Elmer Cetus GeneAmp™ PCR Reagent Kits. Nothing in this advertisement should be construed as an authorization or implicit license to practice PCR under any patents held by Cetus Corporation.

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This Week in
SCIENCE

Jerusalem waterworks

The ancient city of Jerusalem had only one nearby water source, the Gihon Spring, which issues from a cave. A system of subterranean waterworks, mentioned in biblical texts, allowed inhabitants to divert its water inside the city walls for defense. The underground water supply system, in particular Hezekial's Tunnel and Warren's Shaft, which were rediscovered in the 1800s, have puzzled archeologists because of the anomalies and apparent gross mistakes in engineering design. For the past 160 years, the subject has been much debated. Gill (p. 1467) describes a new geological survey that shows that the waterworks follow a natural network of conduits and shafts in a well-developed karst system.

Atomic economics

Efforts to develop synthetic methods in organic chemistry that are both highly selective and incorporate as much of the starting material into the final products as possible (that is, are economical in atom count) are described by Trost (p. 1471). Ring-forming reactions catalyzed by transition-metal complexes represent an important starting point toward this goal.

Vision and protein kinase C

An in vivo role for a protein kinase C (PKC) in a defined signaling cascade has been described by Smith *et al.* (p. 1478). Visual systems can respond to very weak light as well as to very intense light through the process of light adaptation. Eye-PKC, which is expressed exclusively in the visual system in *Drosophila*, is required for the normal calcium-dependent processes of recovery of the photoresponse after light stimulation and for attenuation of the photoresponse during a prolonged stimulus. Such normal processes could be restored to the *inaC* (*inactivation-no-afterpotential C*) mutant by introduction of a cloned eye-PKC gene. Retinal degeneration in the *rdgB* mutant also depended on eye-PKC, suggesting that *rdgB* is a downstream target of eye-PKC.

Orienting the dye

Dye molecules can be oriented in zirconium phosphate-phosphanate to form robust, multilayer films that maintain the orientation of the dye molecules up to 150°C. Solids containing oriented dye molecules can have potentially useful properties such as nonlinear optical and electrooptical activity, but if the dipoles randomize, such effects are usually lost. Katz *et al.* (p. 1485) describe a simple self-assembly procedure for making these films.

Tuning superconductors

Intercalated iodine has been used to tune the coupling between the CuO_2 sheets in the high-temperature superconductor $Bi_2Sr_2CaCuO_x$. Xiang *et al.* (p. 1487) used electron microscopy to show that the introduction of iodine atoms into the BiO bilayers could be varied from between every bilayer to every fourth bilayer. The expansion of each intercalated bilayer by 3.6 angstroms decoupled the CuO_2 sheets; comparison of the pristine material and these intercalation compounds suggests that coupling between adjacent blocks contributes ~5 K to the superconducting transition temperature in these compounds.

Beneficial infection

A common species of luminous bacteria, *Vibrio fischeri*, colonizes the developing light organ of the squid *Euprymna scolopes* (cover) in a mutually beneficial association. How they are initiated and develop is not well understood. McFall-Ngai and Ruby (p. 1491) have cultivated this squid in the laboratory and have thus been able to observe the development of the squid-bacteria mutualism. Each juvenile squid must obtain anew the bacterial symbionts, and juveniles appear to select specifically from among a subset of *Vibrio* species. After infection, structures on the squid's light organ that facilitated the movement of bacteria into the internal cavity regress; uninfected squid retain these structures, suggesting that the symbiotic process may influence normal development in this organism.

Targeted cuts

Any Eco RI site can be targeted for cutting large DNA segments in a system developed by Ferrin and Camerini-Otero (p. 1494). Numerous Eco RI sites are scattered throughout DNA; a known site can be selected by synthesizing a homologous oligonucleotide, generally 30 to 60 bases long, which can then be paired to the Eco RI site by RecA protein. This complex protects this particular site during methylation by Eco RI methylase. Cleavage of this one unprotected site by Eco RI forms large DNA fragments.

Protein delivery

The ability to provide constant, long-term doses of hormones or other cellular factors to the circulation of patients with such diseases as diabetes, dwarfism, or hemophilia would be a great advance for therapy. In separate reports, Dhawan *et al.* (p. 1509) and Barr and Leiden (p. 1507) show the power of using immature mouse muscle cells (myoblasts) as a delivery system for a foreign gene, human growth hormone (see news story by Hoffman, p. 1455). When these engineered cells were transferred intramuscularly to normal mice, the mice continued to produce human growth hormone for 3 weeks to 3 months at levels suggesting that the system could be clinically relevant for humans. The cells were able to differentiate and become part of the mouse muscle without losing their ability to secrete the hormone.

EDITED BY PHILLIP SZUROMI

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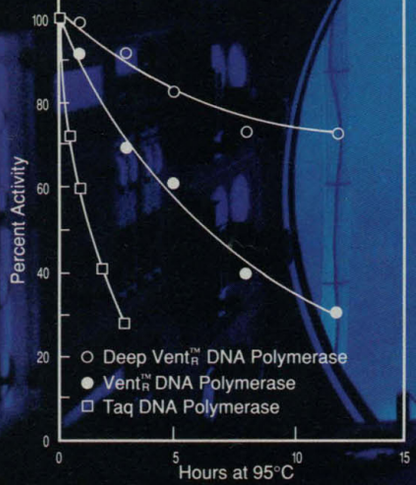
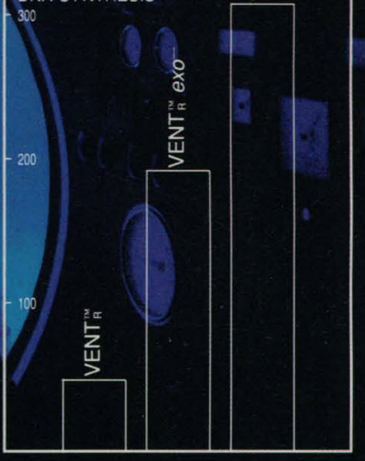


Heat stability of various thermal stable DNA polymerases. All were incubated at 95°C under standard assay conditions.

FEWER ERRORS

ERRORS MADE DURING DNA SYNTHESIS



Reversion frequency reflects error rate in DNA synthesis and was measured by the opal codon reversion assay. Kunkel et al. (1987) Proc. Natl. Acad. Sci. USA 84, 4865-4869. Mattila P. et al. (1991) Nucleic Acids Res.19, 4967-4973.

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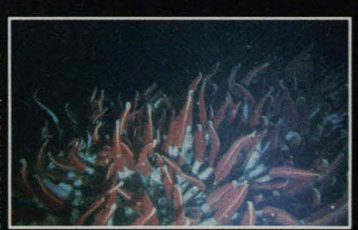

DR. H. JANNASCH, W.H.O.I.

Tube worms at 2010 meters around a hydrothermal vent where the native organism containing Deep Vent$_R$™ DNA Polymerase was isolated.

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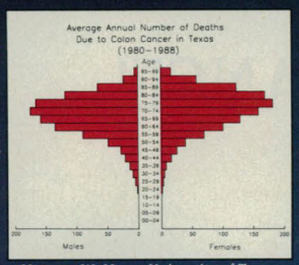

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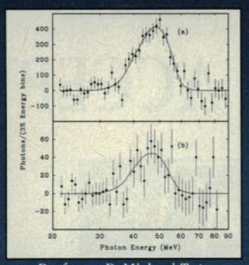

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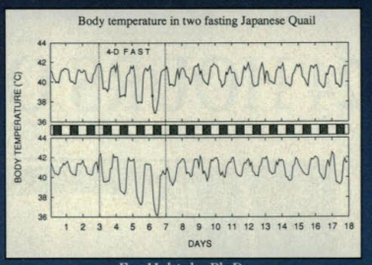

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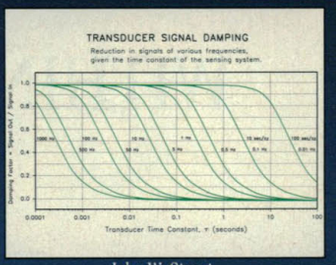

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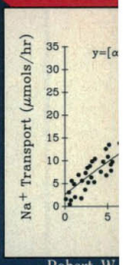

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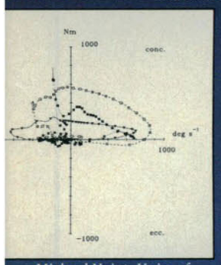

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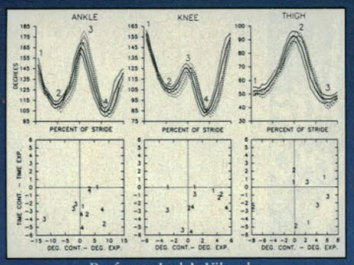

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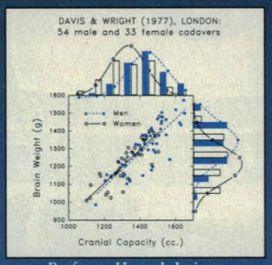

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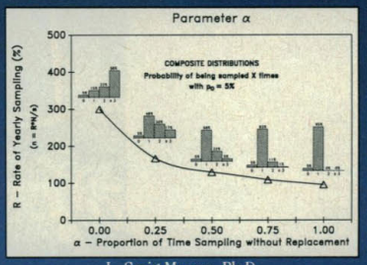

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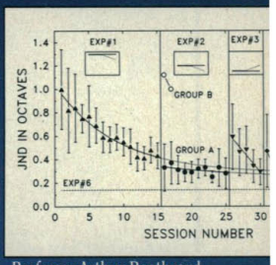

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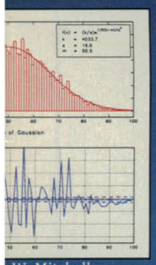

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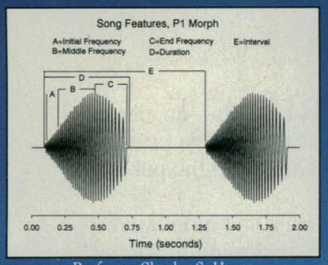

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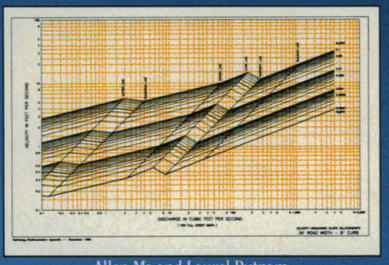

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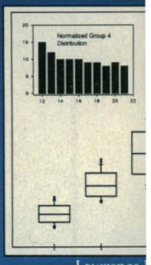

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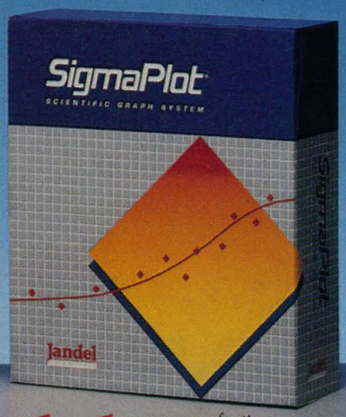

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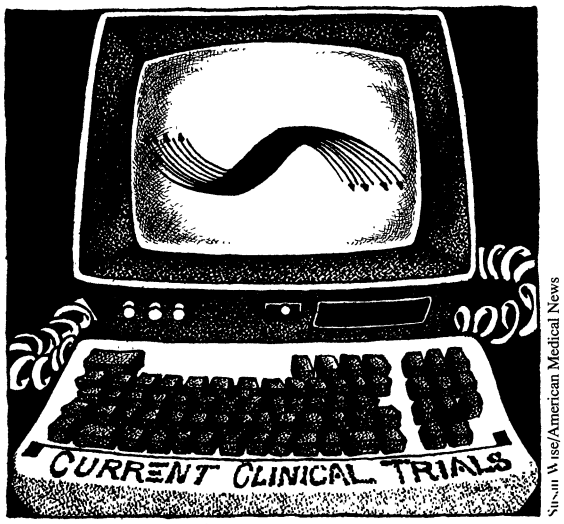

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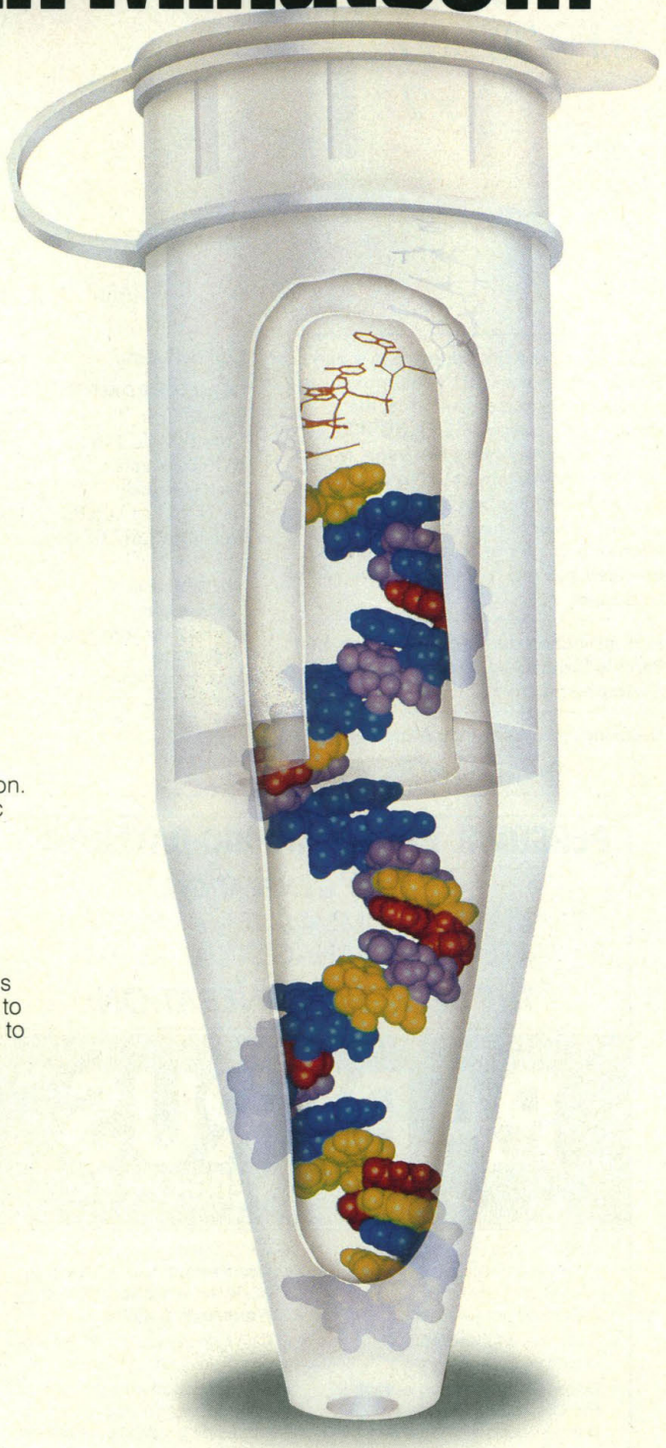

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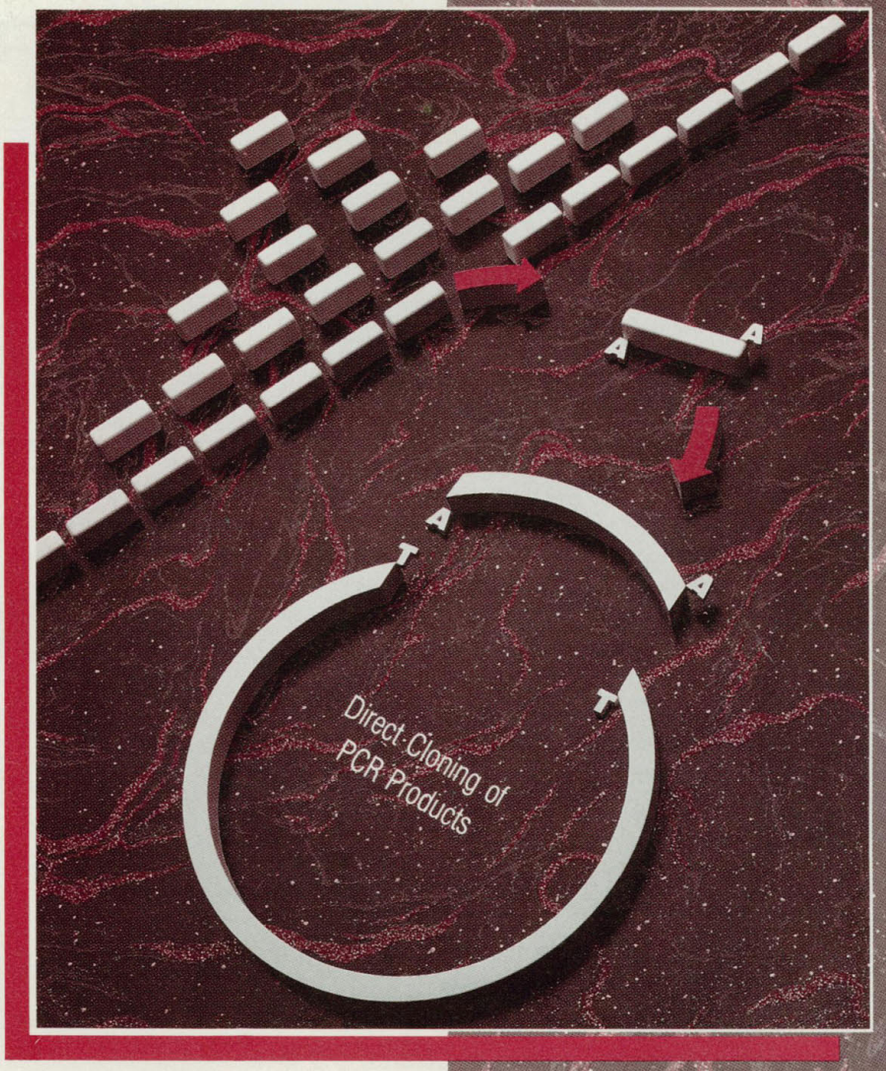

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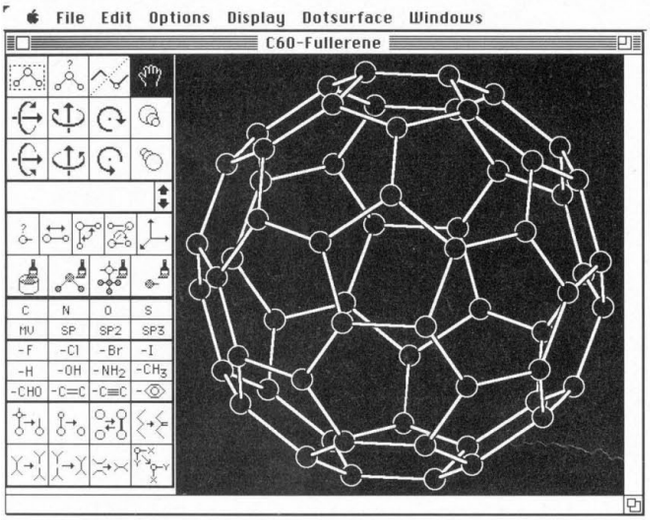

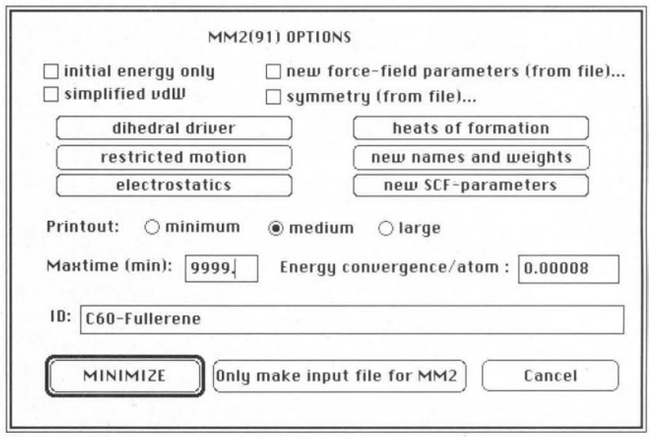

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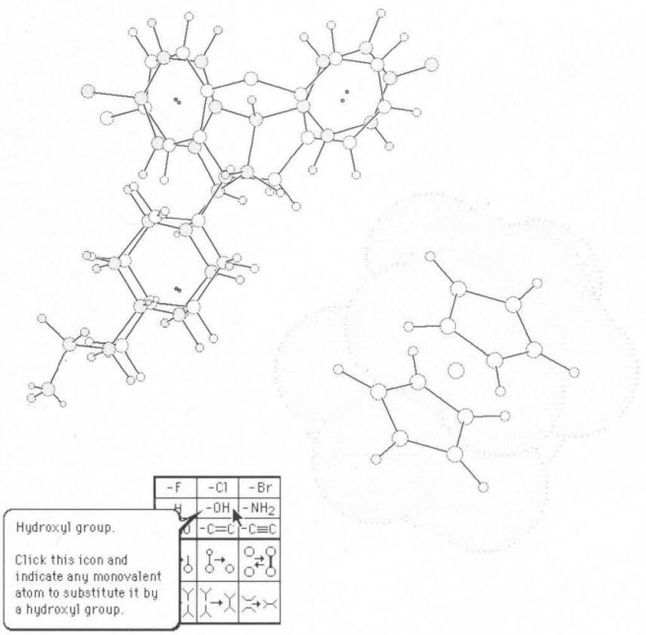

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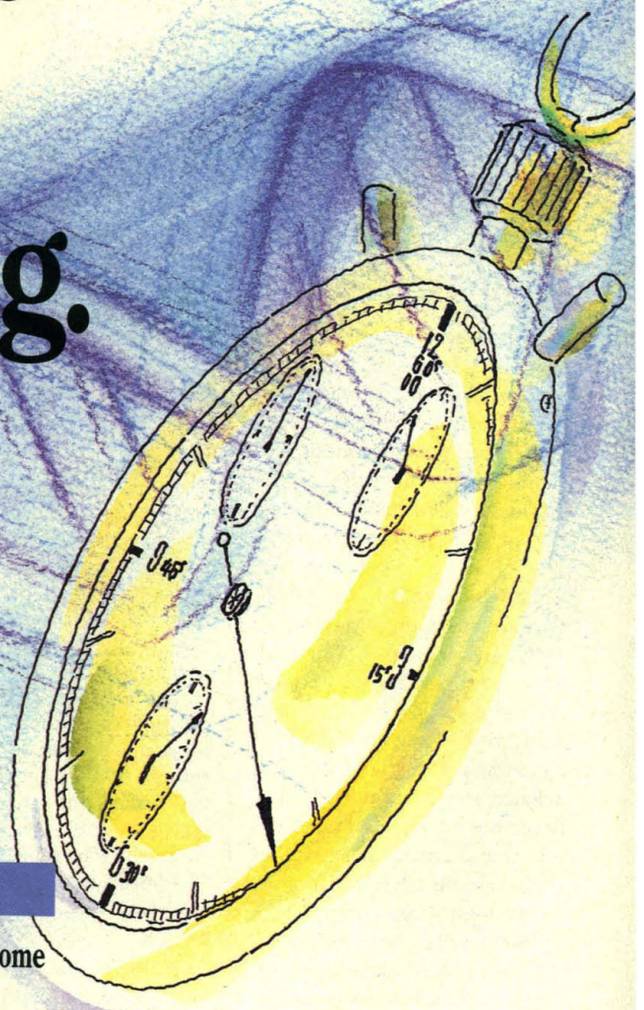

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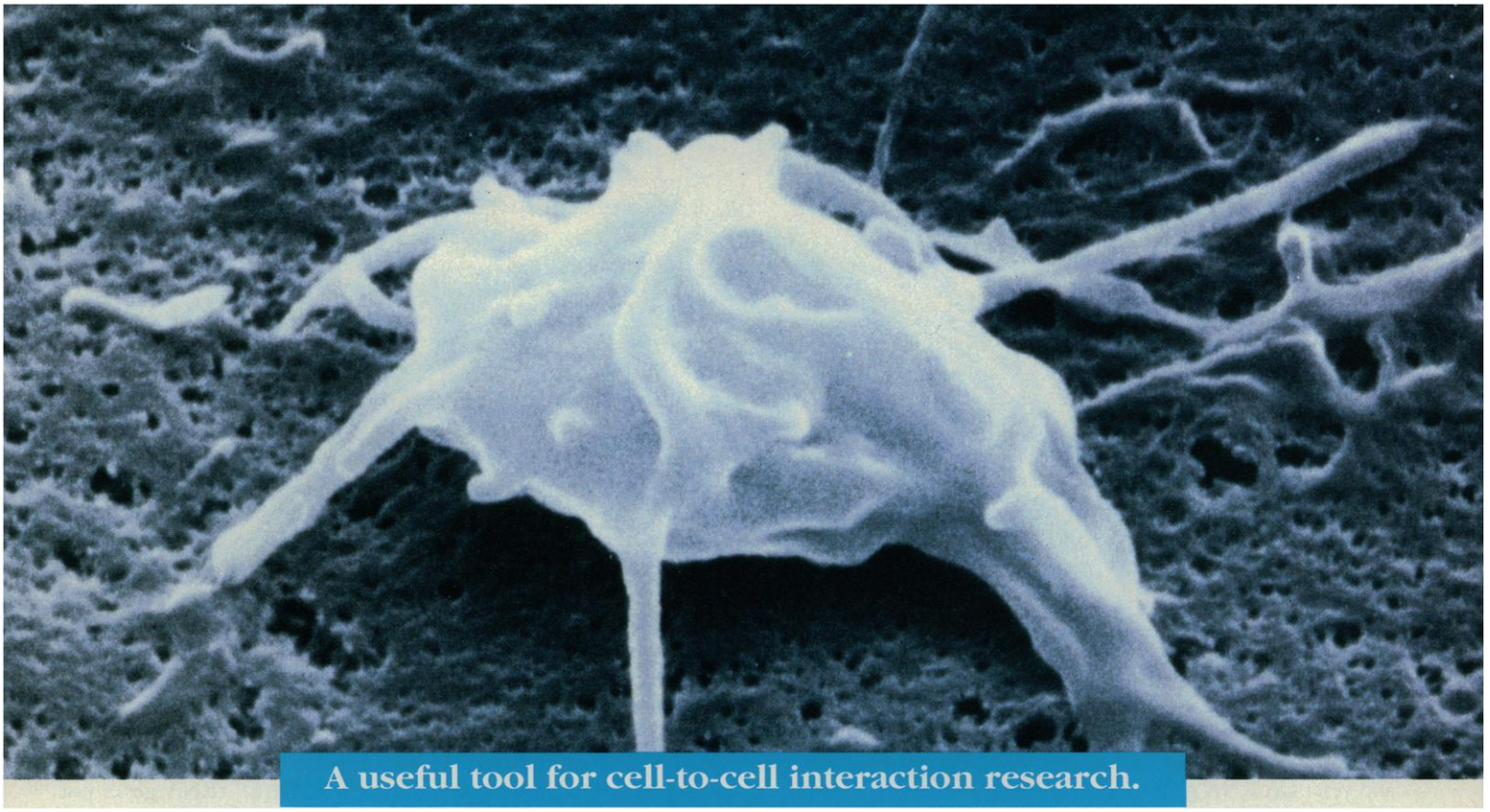

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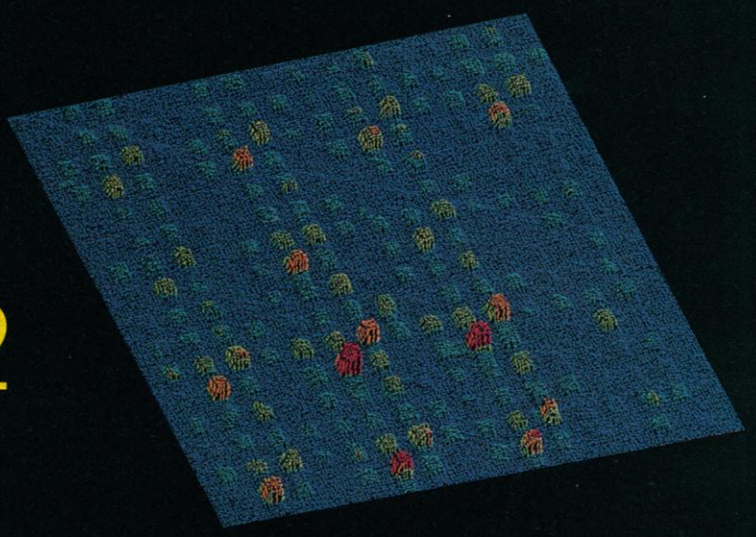

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PROGRAM

Seminar program organized by:
J. Phillip Bowen, *University of Georgia*

FRIDAY, 7 FEBRUARY

Computational Chemistry
(8:30am–11:30am)

Overview and Introduction to Computer-Assisted Molecular Modeling, **J. Phillip Bowen,** *University of Georgia*

Macromolecular Modeling, **Peter Kollman,** *University of California at San Francisco*

Quantum Methods, **Ernest Davidson,** *Indiana University*

Drug Design *(2:30pm–5:30pm)*

Active Analog Approach, **Garland Marshall,** *Washington University, St. Louis*

CoMFA Analysis, **Richard Cramer,** *Tripos Associates*

SYBYL Demonstration

SATURDAY, 8 FEBRUARY

Rational Molecular Design
(8:30am–11:30am)

Drug Lead Design, **James P. Snyder,** *Searle*

Polymer Modeling, **Willis Hammond,** *Allied Signal*

Molecular Modeling of DNA Minor Groove-Binding Agents, **Michael Cory,** *Burroughs Wellcome Company*

Molecular Simulations *(2:30pm–5:30pm)*

Monte Carlo Simulations in Bio-organic Chemistry, **William L. Jorgensen,** *Yale University*

Molecular Dynamics: A Tool for Understanding Biophysical Processes, **Charles Brooks,** *Carnegie Mellon University*

Polygen Demonstration of Quanta

SUNDAY, 9 FEBRUARY

Three-Dimensional Databases *(8:30am–11:30am)*

Overview of 3-D Searching: A New Technique for Computer-Assisted Molecular Design, **Robert Pearlman,** *University of Texas at Austin*

Automated Compound Design Based on CoMFA and 3-D Searching, **Yvonne Connolly Martin,** *Abbott Labs*

Advance registration fees: Regular members, $265; regular nonmembers, $315; student members, $125; student nonmembers, $150; postdoc members, $155; postdoc nonmembers, $180. Deadline for advance registration is 10 January 1992. On-site fees are $25 higher for regular members and regular nonmembers and $10 higher for all others. Fee includes access to the seminar and to all AAAS☆92 general sessions.

For a registration form and a complete AAAS☆92 meeting program, see the 15 November 1991 issue of *Science* or call 202-326-6450.

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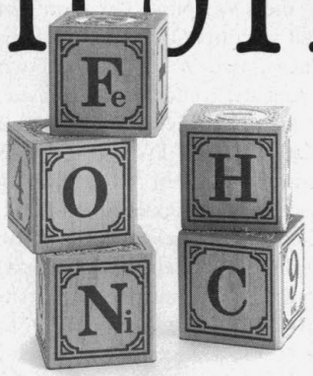

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