AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SCIENCE

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T H E B E C K

M A N P L U S

GENE RESEARCH

Improve your PCR process!

Optimizing each part of the pre- and post-PCR* process — primers, sample preparation, and product detection — maximizes the speed and cost efficiency of the process as a whole. Now laboratories can complete their research faster, more economically and with reliable results, by improving the critical steps of the PCR process using products from Beckman.

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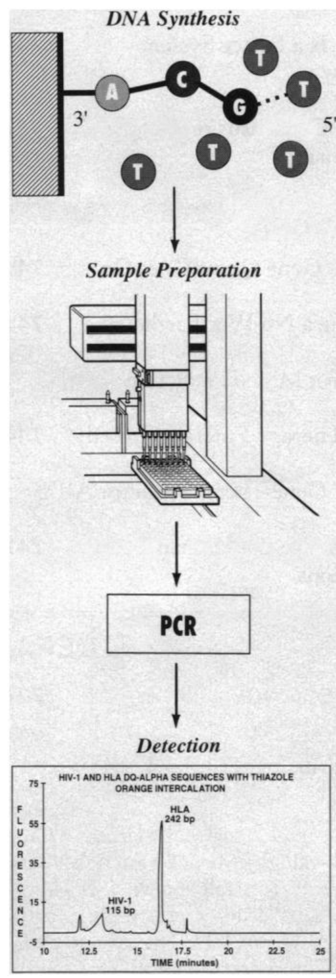

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* *PCR is covered by U.S. patents owned by Hoffman-La Roche Inc.*
[1] *Mark Holodniy, Mark A. Winters and Thomas C. Merigan. BioTechniques 1992, Vol. 12, a: 1, 36-39.*
[2] *Herbert E. Schwartz and Kathi J. Ulfelder. Anal. Chem. 1992, 1737-1740.*

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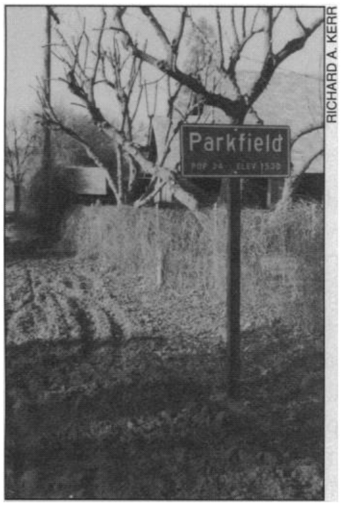


RICHARD A. KERR

742
The Parkfield earthquake puzzle

NEWS & COMMENT

RESEARCH NEWS

PERSPECTIVE

ARTICLES

RESEARCH ARTICLE

REPORTS

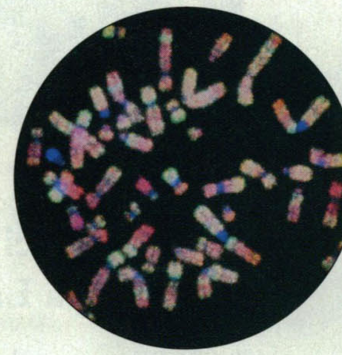
DEPARTMENTS

COVER

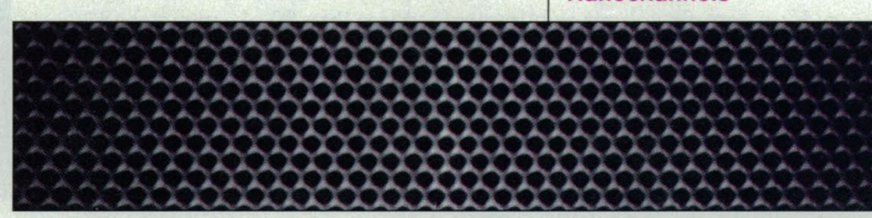
Several species of pitohui, songbirds endemic to New Guinea, contain the potent neurotoxin homobatrachotoxin, apparently as a chemical defense against predators. Chemical defenses have been known to be used by many organisms but not by birds. See page 799. As a possible antipredator adaptation, certain races (top) of the variable pitohui (*Pitohui kirhocephalus*) mimic the plumage of the hooded pitohui (*P. dichrous*; bottom), which contains the highest concentration of toxin. A nonmimetic subspecies of the variable pitohui is in the center. [Illustration: John C. Anderton]

TECHNICAL COMMENTS

818
Technique assesses gene copy number



783
Nanochannels



◪ Indicates accompanying feature

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edited by PHIL SZUROMI

Submicrometer glass

Ultrasmall glass structures are the basis of two reports this week. Optical fibers with tips as small as 0.1 micrometer have been modified with pH-sensitive dyes to produce submicrometer pH sensors. Tan *et al.* (p. 778) incorporated these dyes into copolymers that were covalently attached to the tip by photopolymerization. These sensors respond rapidly to changes in signal, and their low sample volume requirements allow intracellular measurements to be made. Arrays of submicrometer-scale channels in glass have been made by Tonucci *et al.* (p. 783). An acid-etchable glass fiber is covered with an inert glass cladding and drawn into a fine filament. These filaments are bundled and drawn again, a process that can be repeated until the desired size is achieved. Channels as small as 33 nanometers have been made.

Pollen dynamics

Angiosperms have developed many schemes to optimize pollination; one is andromonoecy, in which plants display both staminate flowers that do not develop fruit and hermaphroditic flowers. Podolsky (p. 791) shows that in a tropical, hummingbird-pollinated shrub, *Besleria triflora*, the staminate flowers help attract more pollinators and hence more pollen to the fertile flowers. Such pollen dynamics may be advantageous if the risk of receiving insufficient pollen is high.

Intrusive magnetism

As new oceanic crust forms and cools at mid-ocean ridges, it attains a magnetic signature reflecting the orientation of Earth's magnetic field. Because the field has reversed often in the past, this remnant magnetism can be either parallel or opposite to Earth's current field so that linear anomalies are produced that mark oceanic crust of equal age. The primary region of the magnetism in the crust, which includes basalt and intrusive rocks (gabbros), has been uncertain, however. Kikawa and Ozawa (p. 796), by studying a drill hole through the oceanic crust, show that the gabbros, modified in part by hydrothermal metamorphism, account for a significant part of the remnant magnetic intensity.

Following phase transitions

Phase transitions in solids can be thought in terms of ions or molecules moving along a microscopic pathway to new positions in the lattice. Such a pathway may be a displacive transition, in which the potential energy minimum shifts as temperature increases, or an order-disorder transition, which is characterized by "hopping" between several equivalent minima. Vibrational spectroscopy methods such as Raman spectroscopy have been used to try to distinguish between these two limiting cases, but the increased width of the potential energy minima near the phase transition decrease or "soften" the vibrational frequencies and make them difficult to study. Dougherty *et al.* (p. 770) circumvent these difficulties by doing Raman spectroscopy in the femtosecond time domain; specific vibrational modes can be selectively excited and their response followed. Their studies of two perovskite crystals that undergo ferroelectric phase transitions, $KNbO_3$ and $BaTiO_3$, rule out relaxational soft modes and support the "eight-site" model for the movement of the central ion.

Pretty toxic

Many vertebrates, but not birds, have been known to contain or to secrete toxic or noxious chemicals for defensive purposes. Dumbacher *et al.* (p. 799) report that three species of the genus *Pitohui* found in New Guinea contain or secrete the toxic substance homobatrachotoxin, which is concentrated in the skin and feathers of these brightly colored birds (cover) but is also found in muscles and several organs. This toxin has previously been found in nature only in the poison dart frogs, *Phyllobates*.

T cell commitment and selection

Two important steps in T cell development are the commitment of progenitor cells to become T cells and the selection of the right T cells in the thymus. Georgopoulos *et al.* (p. 808) cloned a zinc finger protein, called Ikaros, that activates an enhancer of a gene that encodes an early T cell differentiation antigen, CD3δ. Ikaros, which has an unusual pattern of cysteine-histidine repeats similar to that of the *Drosophila* developmental protein Hunchback, is first expressed in the developing liver and thymus. Sherman *et al.* (p. 815) show that the interaction of the CD8 surface antigen with class I major histocompatibility (MHC) molecules can affect the selection process. Positive selection of T cells requires some affinity of their T cell receptors for self. In transgenic mice with human MHC molecules, the interaction with mouse CD8 was lessened and allowed T cells with higher affinity for self to survive the negative selection process.

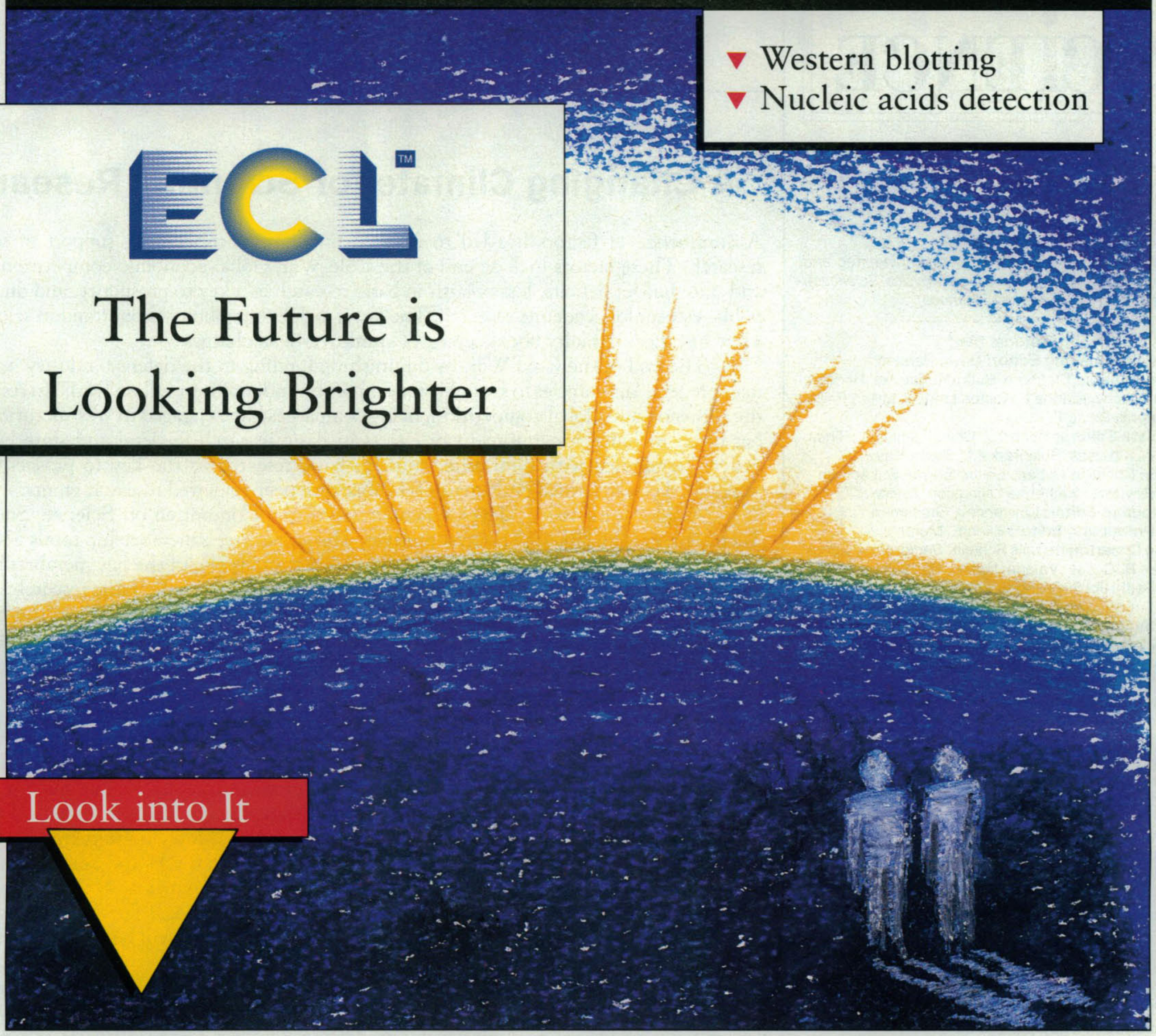
Inhibitor insights

The small guanosine triphosphate (GTP)–binding proteins of the Ras family act as molecular switches that control many biological processes. The Ras-like proteins are activated when they bind GTP and are inactivated when they hydrolyze GTP to guanosine diphosphate (GDP). Other proteins interact with members of the Ras family and influence activation or inactivation. Hart *et al.* (p. 812) found that a protein that was known to inhibit dissociation of GDP from CDC42Hs, a human Ras-like protein, also inhibits hydrolysis of GTP by CDC42Hs. The interacting protein appears to inhibit cycling of CDC42Hs between the active and inactive states and to hold CDC42Hs in either the active or inactive form.

Quick copy number

Genetic changes such as deletions associated with solid tumors can be difficult to map. Kallioniemi *et al.* (p. 818) have developed a method, comparative genomic hybridization, for the rapid assessment of changes in DNA copy number throughout the genome. Differentially labeled DNA probes derived from mutant and wild-type DNA are simultaneously hybridized to wild-type chromosome metaphase spreads. The ratio of the wild-type and mutant hybridization signals for any chromosomal region indicates the copy number of that region.

LIGHT BASED DETECTION OF BIOLOGICAL MOLECULES



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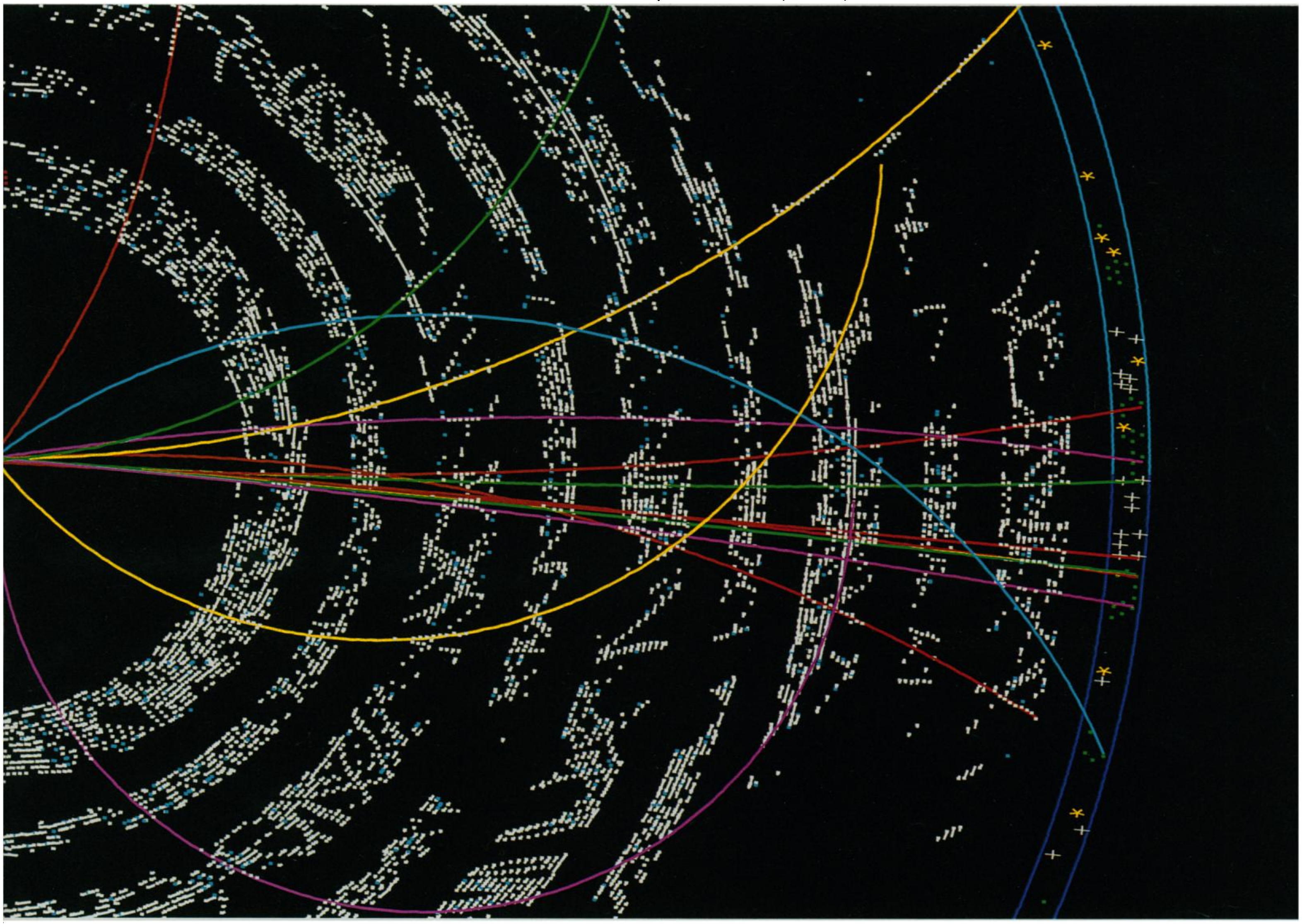
Computer reconstruction of proton/anti-proton collision at Fermilab.



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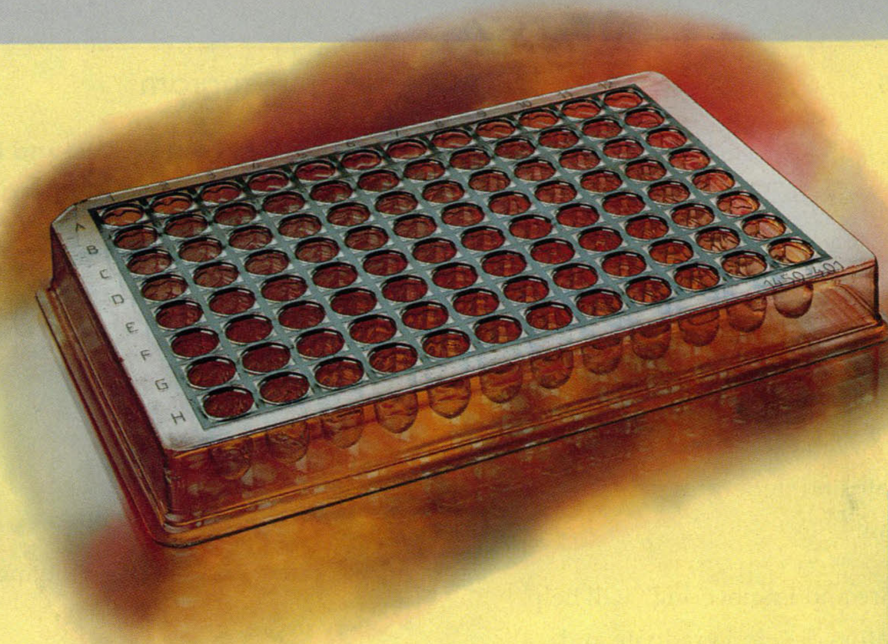
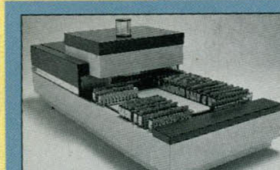
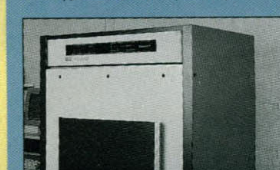


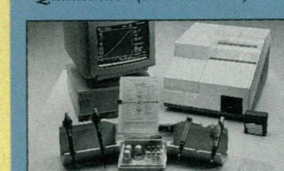
The Company.



1st rack-based counters - RackGamma (LKB-Wallac, 1975), RackBeta™ (1977)



1st ultra low-level liquid scintillation counter - Quantulus™ (LKB-Wallac, 1984)



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Seminar Organizers

Stephanie J. Bird, *Massachusetts Inst of Technology*
Penny J. Gilmer, *Florida State Univ*
Terrell W. Bynum, *Southern Connecticut State Univ*

Seminar Overview

As ethical concerns associated with science and engineering become more visible, the need to address these issues at the graduate and undergraduate level has never been more important.

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Lectures, symposia, discussion groups, demonstrations, and workshops are designed to provide educators in various fields with theoretical foundations and practical tools for addressing issues of professional ethics in graduate and undergraduate education. Sessions will facilitate discussion within and across disciplines, and provide the opportunity both to clarify issues and to learn about teaching strategies, techniques, and tools that have been developed.

Preliminary Program

Major Ethical Issues in Science and Engineering
Wednesday, 10 February, 1:30 pm–3:00 pm

Concurrent Afternoon Sessions
Wednesday, 10 February, 3:30 pm–5:00 pm

- ✦ Authorship and Intellectual Property
- ✦ Conflict of Interest
- ✦ Data Selection/Research Design
- ✦ Privacy and Confidentiality
- ✦ Misconduct and Whistle-blowing
- ✦ Safety in Design
- ✦ Discrimination and Sexual Harassment
- ✦ Implications of Funding Sources for Research
- ✦ Animals in Research
- ✦ Human Subjects in Research

Panel on Professional Ethics and Codes of Ethics
Thursday, 11 February, 8:30 am–10:00 am

Concurrent Morning Sessions with Disciplinary Focus
Thursday, 11 February, 10:30 am–Noon

- ✦ Physical Sciences
- ✦ Life Sciences
- ✦ Social Sciences
- ✦ Information Sciences
- ✦ Engineering

Demonstrations
Thursday, 11 February, 2:00 pm–3:00 pm

Closing Panel
Thursday, 11 February, 3:30 pm–4:30 pm

Register Now!
Use the form on the facing page.

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Seminar Registration Form

Teaching Ethics ✧ 10–11 February ✧ Boston

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Institution/company (will appear on badge, subject to abbreviation)

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If registering at postdoctoral or K–12 teacher rate, indicate the name and number of your chairperson or principal:

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K–12 Teacher[2]	❑ $ 50
Retired	❑ $ 50

Important Notes

[1] **Seminar fee** covers admission to Teaching Ethics in Science & Engineering, but does not include admission to any other AAAS☆93 sessions. Registrations received after 22 January 1993 will not be processed, but you may register on site beginning 11 February. On-site rates are $30 higher than advance rates for regular registration, $10 higher for students, $20 higher for all others.

[2] **Special rates:** To qualify for student rate, you must attach a copy of your student ID card. To qualify for postdoc or K–12 teacher rate, you must provide the name and phone number of your department chairperson or principal in the space provided. *Registrations received without appropriate verification will be charged at the regular rates.*

[3] Cancellations must be received in writing by 22 January 1993. No refunds will be made for cancellations received after this date. Refunds are subject to a $25 cancellation charge and will be processed after the seminar. E F

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- ✦ Reservation changes and cancellations must be made directly with the hotel.
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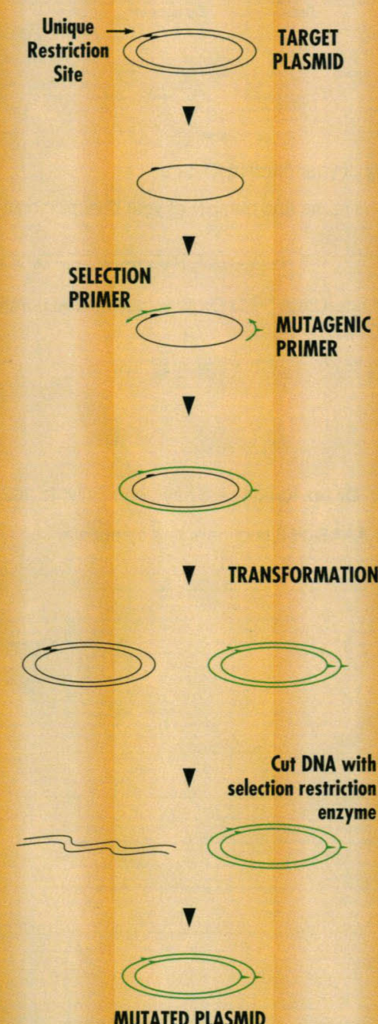

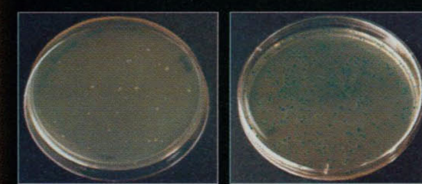

E. coli transformed by control plasmid pUC19M. At left: The plasmid has not been mutated and all colonies contain "unmutated" plasmids (white). At right: pUC19M mutated with the Transformer Site-Directed Mutagenesis Kit results in 93% of successfully mutated colonies (blue).

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