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30 MAY 1997
VOL. 276 • PAGES 1301–1464
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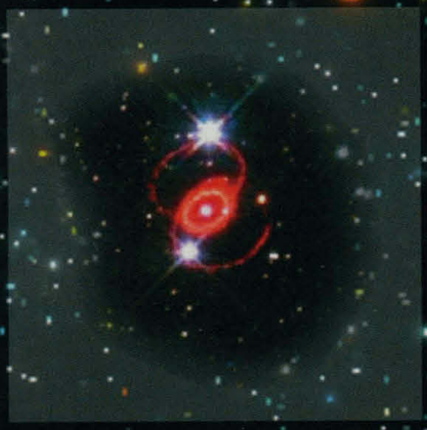

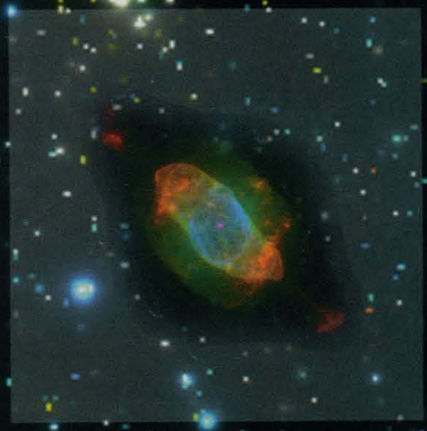

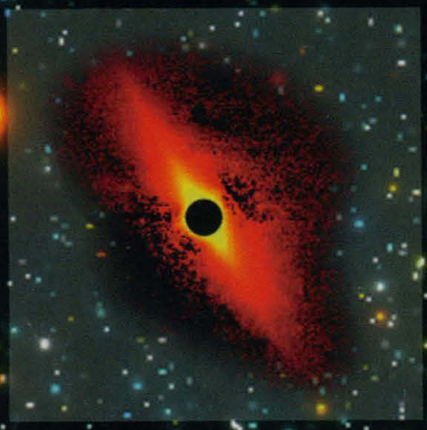

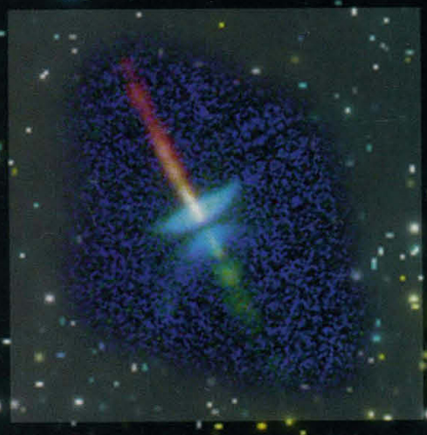

Stellar Birth & Death

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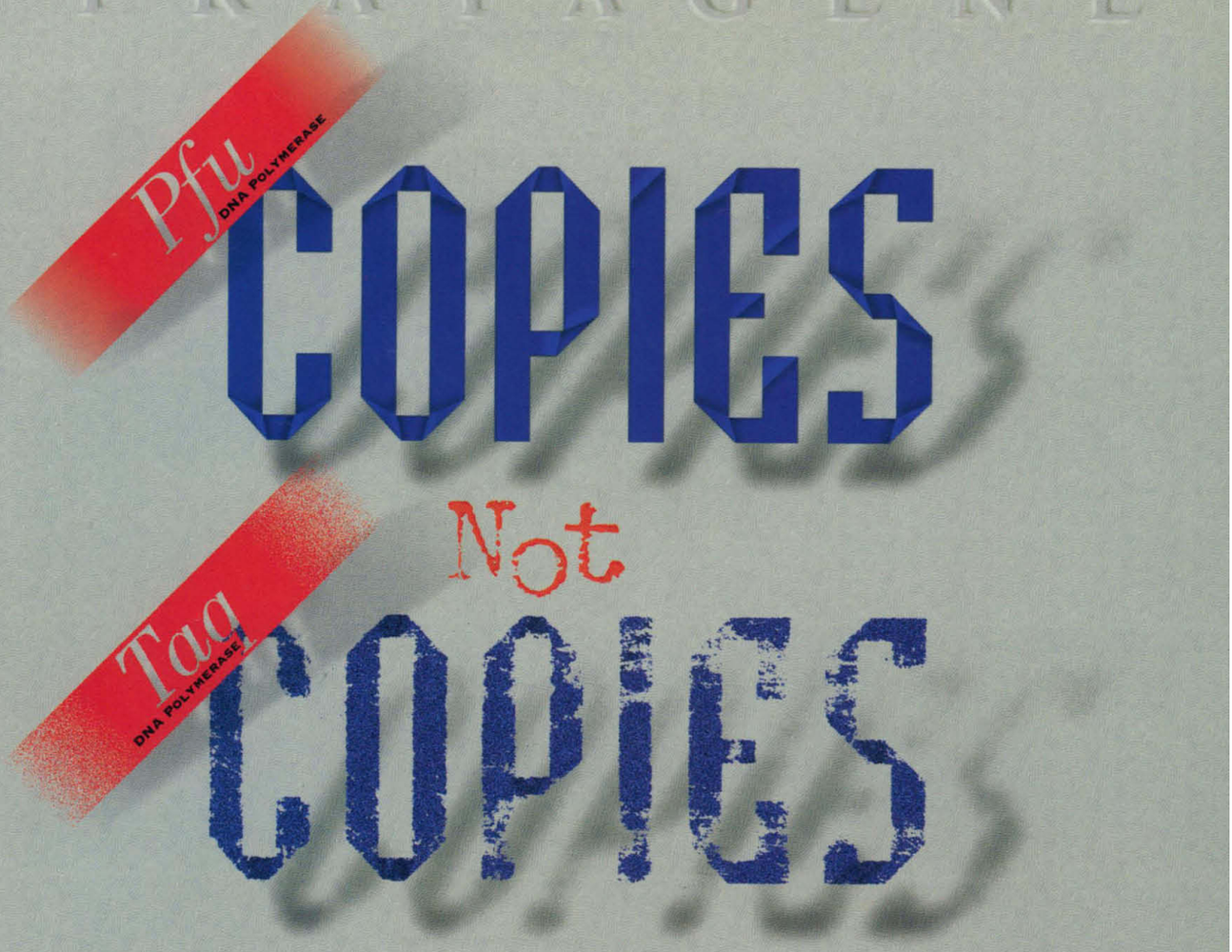

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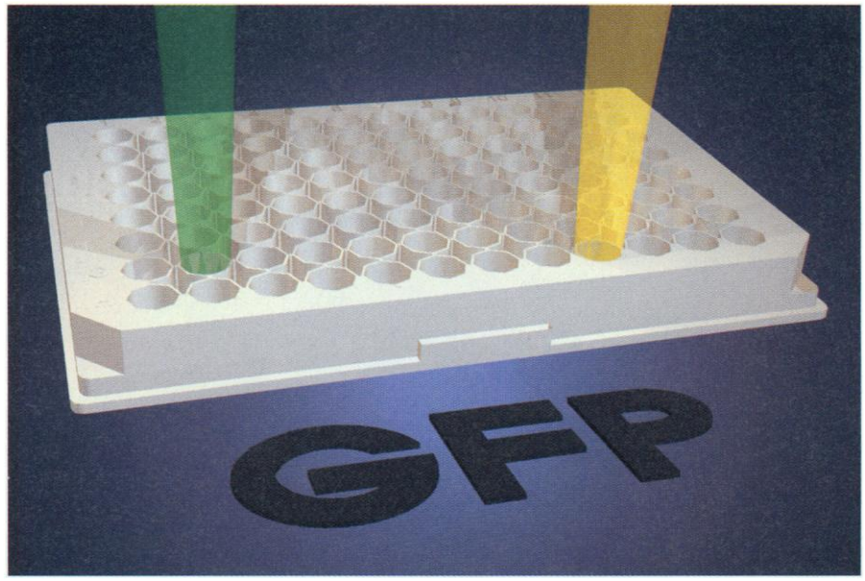

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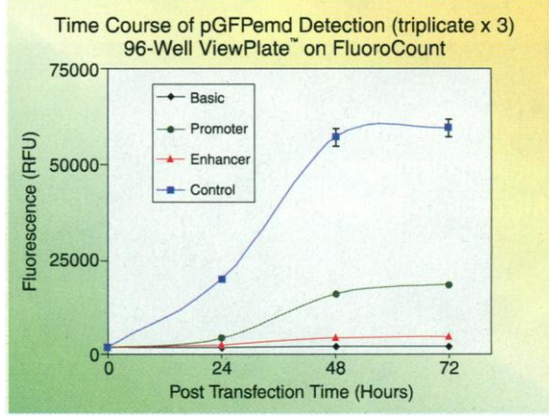

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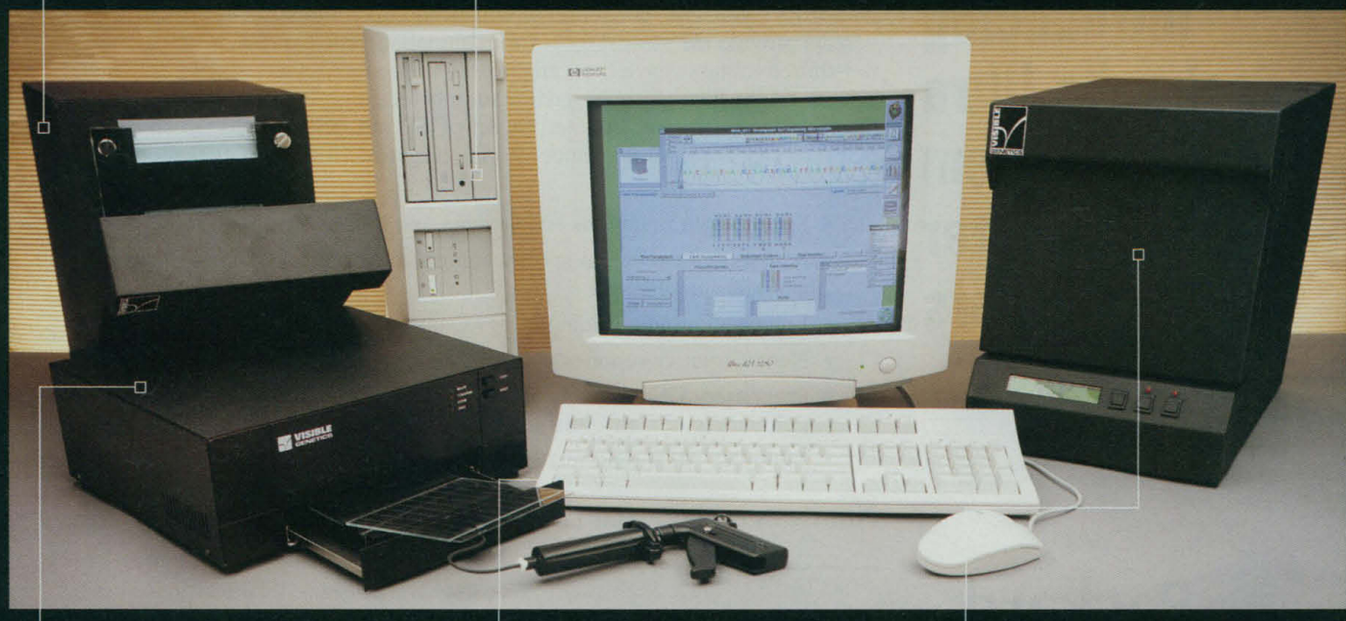

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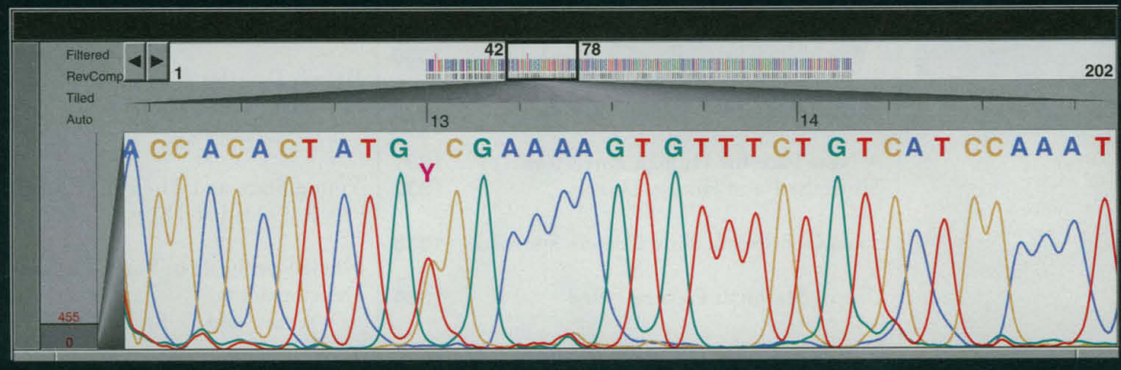

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ISSN 0036-8075
30 MAY 1997
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NUMBER 5317

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

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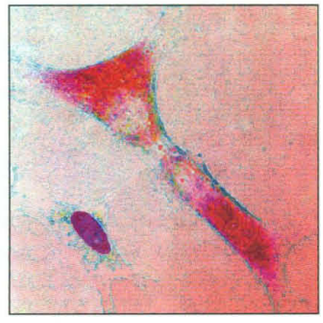
■ **SCIENCE (ISSN 0036-8075) is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1200 New York Avenue, NW, Washington, DC 20005.** Periodicals Mail postage (publication No. 484460) paid at Washington, DC, and additional mailing offices. Domestic individual membership and subscription (51 issues): $105 ($58 allocated to subscription). Domestic institutional subscription (51 issues): $260. Foreign postage extra: Mexico, Caribbean (surface mail) $55; other countries (air assist delivery) $90. First class, airmail, student, and emeritus rates on request. Canadian rates with GST available upon request, GST #1254 88122. IPM #1069624. **Printed in the U.S.A.**

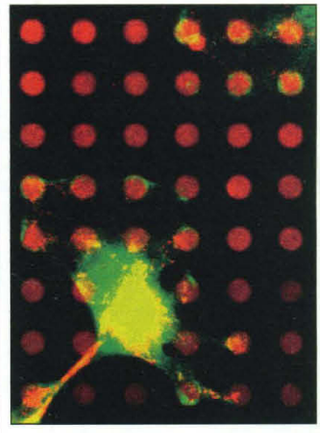
COVER

Collage of stellar birth (lower three panels) and death (upper two panels) related to the special section beginning on p. 1350 (and the News story on p. 1336). Clockwise from upper left: Supernova SN 1987A (see Chevalier, p. 1374), planetary nebula NGC 7009 (see Weinberger and Kerber, p. 1382), the young star Ori 182-413 within a cloud (see O'Dell and Beckwith, p. 1355), the young star HH 30 (*ibid.*), and β Pictoris (P. Kalas and D. Jewitt). The background is a synthesized color image of the x-ray sky around Orion (Röntgen X-ray Satellite image from Max-Planck-Institut für extraterrestrische Physik, Germany, K. Dennerl, W. Voges, R. Neuhäuser). See p. 1391 for more details.

REPORTS



1412
Helicase A and retrovirus-mediated RNA transport



1345 & 1425
Stretching extends life

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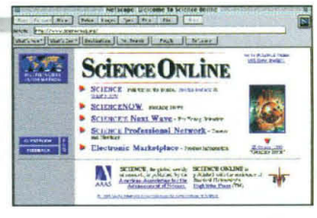


THE MJ RESEARCH NOTEBOOK

Volume VII...No. 2 *A Bulletin of Technological Advance in Molecular Biology* *Spring 1997*

DNA Engine with interchangeable Alpha™ blocks. The one mounted on the cycler has a motorized Power Bonnet™ heated lid; the other Alphas—both dual and single block models—have manual Hot Bonnet™ heated lids.

DNA Engine & Tetrad Set New Standards for Thermal Cyclers

UNPARALLELED PERFORMANCE, PARTICULARLY IN SOFTWARE

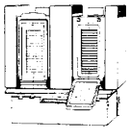
Intuitive Programming Especially Easy

WATERTOWN, Mass. — In late 1994, MJ RESEARCH introduced a revolutionary new line of thermal cyclers for PCR* and cycle sequencing. Called the "DNA Engine™" line, this new design builds upon experience the company had gained manufacturing its pioneering PTC-100™ and MiniCycler™ instruments. Improvements included increased speed of ramping, higher precision and greater accuracy—as well as a new "swappable" block format. But perhaps the most significant advances were in the software, for these allowed easier user interface and better thermal control—as well as communication between cyclers and other digital devices.

The new software was the culmination of years of effort by engineers Joe Pacatte and Andrea Wolga. Building upon the intuitive concepts of PTC-100 software, they managed to create a powerful new system that allows for expansion, revision, and network communications via IEEE-488 or RS-232 ports—features that would impress any engineer. But they concentrated their efforts on the needs of users, creating a whole host of features to allow smoother functioning in the lab. These include the ability to store programs in individual folders, edit one program while another is running, choose from 3 different methods of thermal control, and calculate total run time from entered parameters. These and many other software features make DNA Engines a joy to use.

Other engineers did their jobs well too. In particular, the modular design of swappable blocks (called "Alphas") allows configuration for different vessels—96 or 384-well plates, 0.2 or 0.5ml tubes, for example. Last but not least, two available sizes of chassis—one holding 1 Alpha and the other 4—allows maximum flexibility in planning, purchase, and expansion.

Twin Tower *In Situ* Alpha Fits DNA Engines & Tetrads



The versatility of the DNA Engine system is well illustrated by the Twin Tower™ *in situ* Alpha. Two new methods of DNA amplification—*in situ* PCR* and PRINS—have recently come to common usage, but they usually require a specialty thermal cycler that processes only glass slides.

But not with the DNA Engine or Tetrad. Instead, a "swappable" dual block, called the Twin Tower, can be put into either chassis, and each Alpha cycles 2 x 16 glass slides rapidly, accurately, and precisely.

Accuracy & Data Export Needed for Diagnostics

Medicine is on the cusp of a new era when diagnosis of disease will be based increasingly upon the analysis of amplified DNA. But the thermal cyclers that actually do the amplification must be of specific and certifiable quality.

The College of American Pathologists and the NCCLS have chosen to focus upon two criteria for particular attention: accuracy and the recording of thermal data from every run. Each DNA Engine has NIST-traceable & field-verifiable accuracy. Thermal data may be continuously reported via serial or GPIB ports, or sent to a printer for hard copy, in order to record data.

Tetrads Lead the Charge into Genomics

High-Capacity Yet Compact—Cycler Holds Four 96 or 384-well Plates

A recent development in biology is an unrelenting surge of interest in genomics. Already increasing knowledge of the human and other genomes has had major influence upon the biotech, pharmaceutical, and medical industries, and Wall Street seems to be betting on further advances. According to a recent series of articles in *Science* (275, 767-782, 7 Feb 97) the pharmaceutical industry alone has invested at least $1 billion into genomics companies.

And what is the thermal cycler of choice among these companies? Why, the MJ RESEARCH Tetrad. This thermal cycler has all the features of the DNA Engine—and it also offers 4 independent blocks in one compact chassis. It fits easily inside robots, it can be controlled manually from its keypad or digitally through its ports, and when fitted with Power Bonnets, it can be operated without manual intervention.

Tetrad cycler with four swappable blocks

* PCR is covered by patents owned by Hoffmann-La Roche, Inc. & F. Hoffmann-La Roche Ltd. Users should obtain license to perform the reaction.

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edited by PHIL SZUROMI

Glasses for lithium batteries

Lithium batteries offer many advantages, including lighter weight, but lithium itself is not used as the anode of rechargeable batteries for safety reasons. Recharging produces microscopic lithium particles that can explode upon contact with oxygen, and anodes in which lithium is intercalated into carbon materials have been used instead. Idota *et al.* (p. 1395) present the operational characteristics of an alternative anode. A tin-based amorphous oxide was made with a specific capacity for lithium storage that is more than 50 percent greater than that of carbon-based materials after cycles of charging and discharging.

Holey polymers films

Extending lithographic patterning of electronic devices will require ever finer masks. Park *et al.* (p. 1401) spin-coated films of diblock copolymers onto a silicon-nitride–coated silicon wafer. The films phase-separated to produce domains of hexagonal arrays of one component polymer surrounded by the other. The array component (polybutadiene) could be selectively removed with ozone, and the resulting mask of polystyrene could be used to etch 20-nanometer holes 40 nanometers apart in the underlying silicon nitride.

Sound and light

Gas bubbles in water, when hit by ultrasonic waves, can produce bright flashes of visible and ultraviolet light, an effect called sonoluminescence (SL). Such experiments have not been simple to understand and have spawned numerous theories. Moss *et al.* (p. 1398; see the Perspective by Crum and Matula, p. 1348) present a model of bubbles undergoing SL that can account for its chemical specificity (the bubbles need to contain some noble gas) and the lack of afterglow from these picosecond light pulses. The collapsing bubble produces a shock wave that creates a thermally conducting, partially ionized plasma of ions and electrons. Electrons produce the SL flash, and changes in transparency of the plasma limit the pulse duration. The dynamics are sensitive to bubble size, which could explain the variability of experimental results.

Familiar old faces

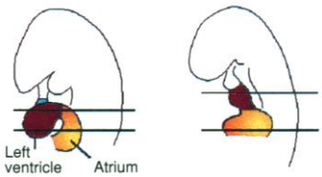
The origin and evolution of the Neandertals—prominent in Europe during the Pleistocene—and their relation to modern humans has been uncertain. Hominid fossils that may represent the earliest Europeans about 800,000 years ago have been recently found at Atapuerca, Spain. Analysis of about 80 fossil remains by Bermúdez de Castro *et al.* (p. 1392; see the news story by Gibbons, p. 1331) indicates that the hominids had a face that looked remarkably like that of modern humans. Hominids having a modern face were thought to have evolved, only much later, on the basis of fossils from Africa. The Atapuerca hominids may, thus, have been ancestors to both the Neandertals and modern humans.

Fibronectin connection

Uteroglobin (UG) is a secreted mammalian protein found in many tissues, the blood, and the urine. Although UG inhibits inflammation, soluble phospholipase A_2, and chemotaxis, its true physiologic function has remained unknown. Zhang *et al.* (p. 1408) made mice that were deficient in UG and found that they developed severe kidney disease characterized by the deposition of fibronectin (Fn) in the kidney. In vitro studies indicate that UG may normally bind to Fn, thereby preventing the Fn-Fn interaction that is deleterious and initiates kidney damage. These findings may provide insight into a form of human fibronectin-deposit hereditary glomerular disease.

Heartfelt loss

The myocyte enhancer factor–2 (MEF2) transcription factors bind to a DNA sequence found in cardiac muscle genes and are expressed in the early stages of heart development. Lin *et al.* (p. 1404) generated mice deficient in one of these factors, MEF2C. The homozygous mutant mice died in utero, and analysis of the



mutant embryos revealed severe morphological defects in the heart tube, including the loss of the segment that gives rise to the right ventricle, as well as altered expression of a subset of cardiac muscle genes. These results indicate that MEF2C is a key participant in the regulation of right ventricular development.

Getting a grip

Cells that are a part of complex tissues, such as capillaries, need to be attached to the extracellular matrix, or they are more prone to die. Is this because the matrix is determining the shape of the cell and the degree that it is stretched out, or is it because the receptors that bind to the matrix (various integrins) are transmitting life-sustaining signals to the interior of the cell when they are engaged? Chen *et al.* (p. 1425; see the Perspective by Ruoslahti, p. 1345) found that the former is the case. When cells are given precise areas upon which to attach (contact areas), adhesion is important, but if the contact regions of the substrate are broken up to the size of focal adhesions (that contain the integrins on the cell surface) and are spread over a larger area, then DNA synthesis (a measure of cell health) scaled directly with the total cell area and not with the cell-substrate contact area.

Tuberculosis target

Members of the *Mycobacterium* genus, which includes the bacterium that causes tuberculosis, are coated with a thick outer cell wall dominated by covalently linked mycolic acids that serve as a protective barrier. Belisle *et al.* (p. 1420) cloned the enzymes that transesterify mycolic acids and found that they are identical to well-known *M. tuberculosis* exported proteins called the antigen 85 complex. Interfering with these three enzymes with competitive inhibitors for the substrates in the transesterification reactions inhibited the synthesis of the final mycolic acid cell wall and viability.

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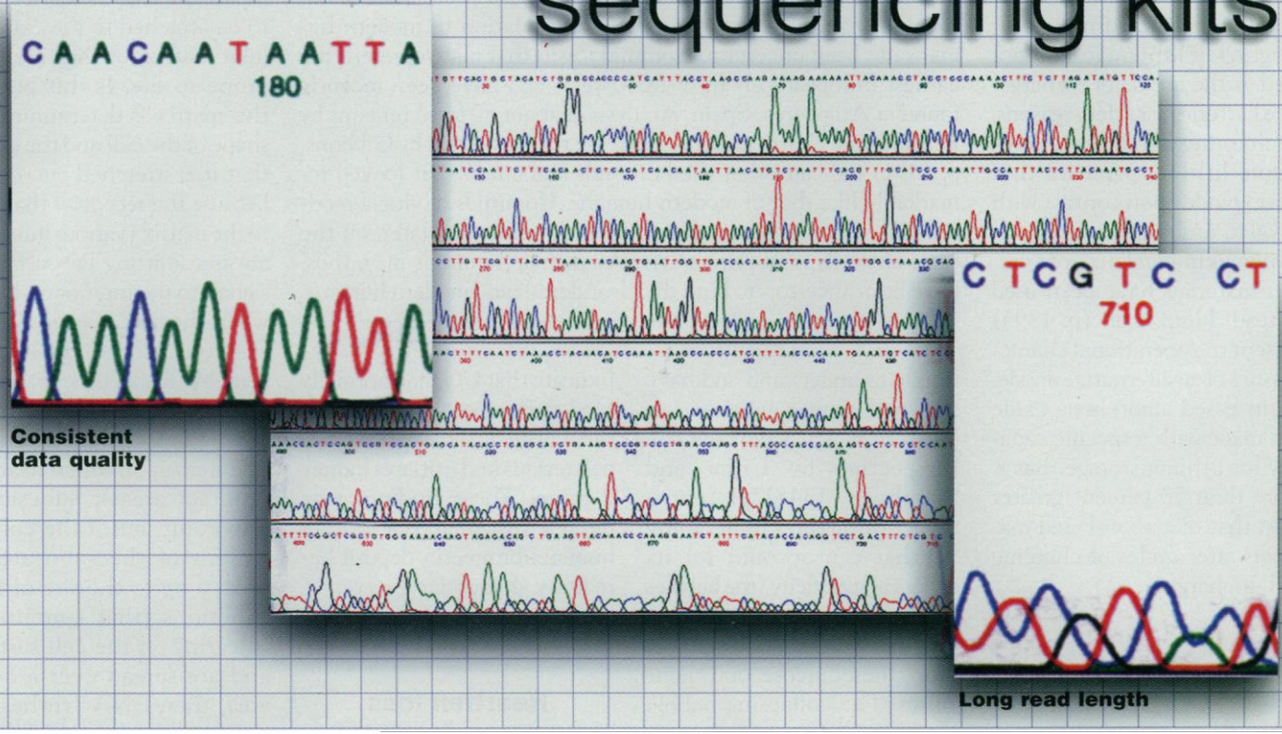

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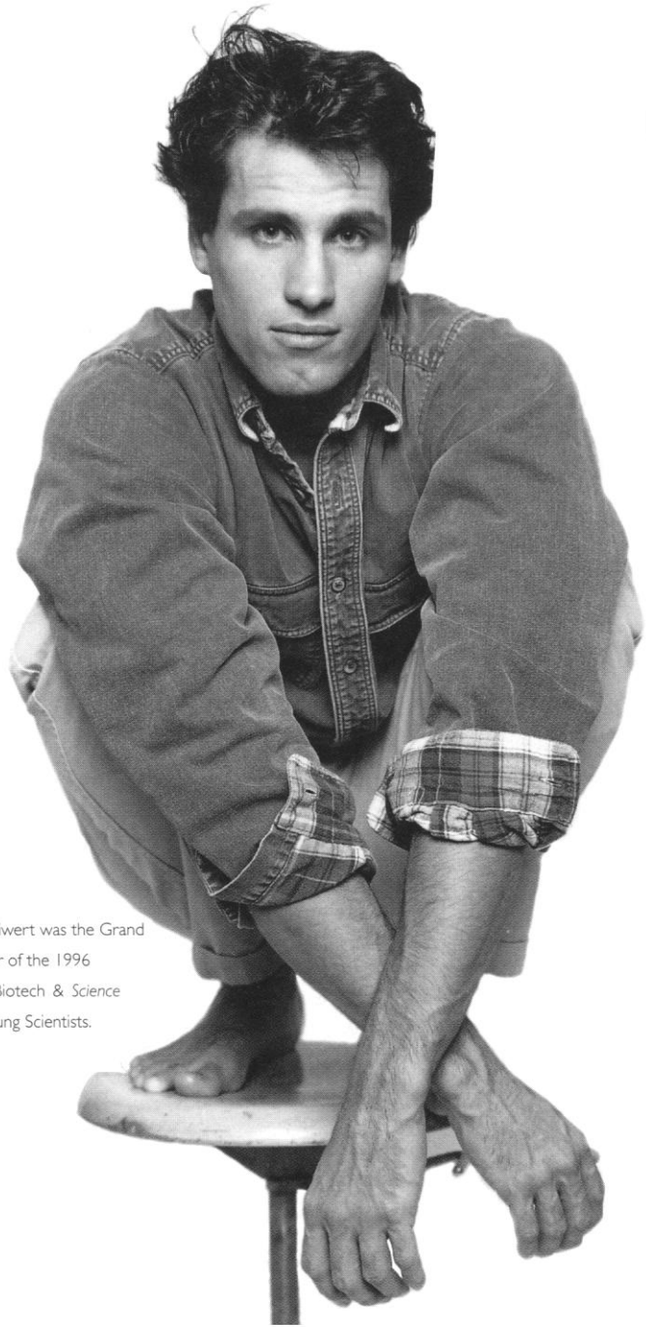

Dr. Scott Seiwert was the Grand Prize winner of the 1996 Pharmacia Biotech & *Science* Prize for Young Scientists.

If you're a recent Ph.D. graduate whose thesis work was in molecular biology, we'd like to congratulate you. We'd also like to give you a little recognition for a job well done. All you have to do is enter an essay based on your graduate thesis to the 1997 Pharmacia Biotech & *Science* Prize for Young Scientists.

Your essay will be reviewed by a panel of distinguished scientists—whom will then select one Grand Prize winner and up to seven other winners.

The Grand Prize winner will receive the rewards mentioned above; all other winners will receive $5,000 each and a free trip to Sweden to attend the award ceremony.

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To be eligible, you must have received your Ph.D. between 1 January and 31 December 1996. Your thesis work must have been in the field of molecular biology. To enter, you must submit a 1,000 word essay which describes your thesis work and places it in perspective with regard to the field of molecular biology. The essay may be submitted in either English, French, German, Spanish, Japanese, or Chinese (Mandarin).

The closing date for entries is 30 June 1997. All prizes will be presented in Sweden in December 1997. Full details and the required entry form can be collected from:

- the administrator of the Award Committee at the address below
- within the *Science* homepage at http://www.aaas.org/science/prize.htm
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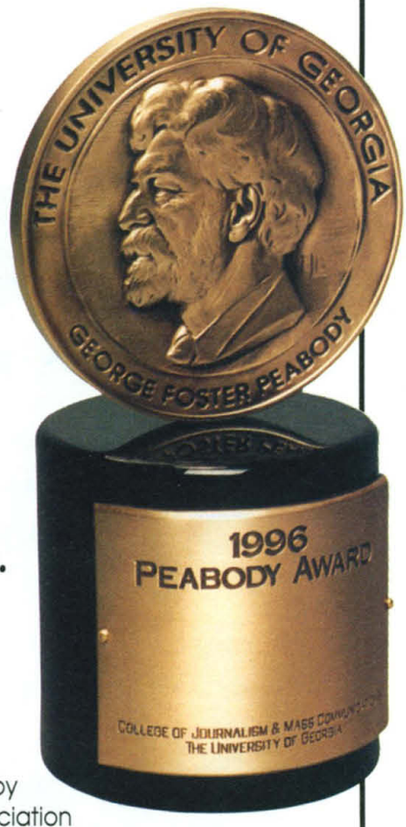

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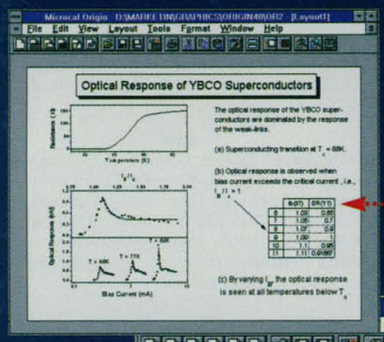

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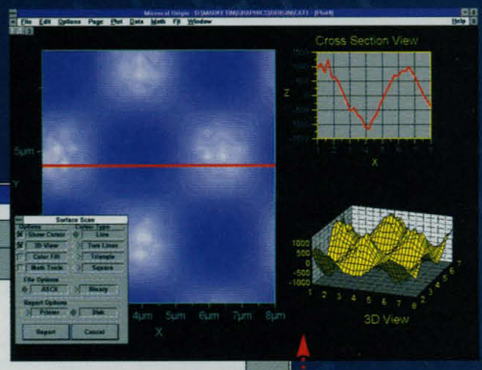

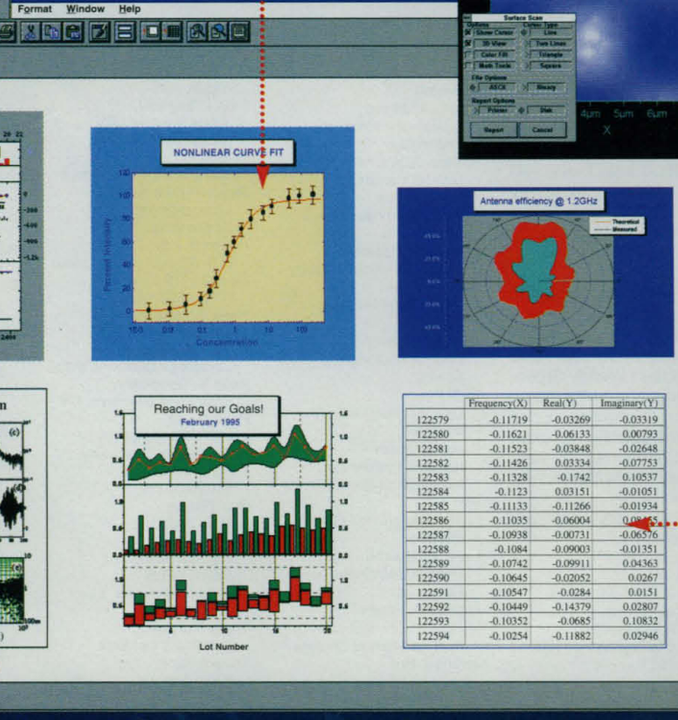

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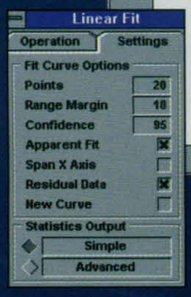

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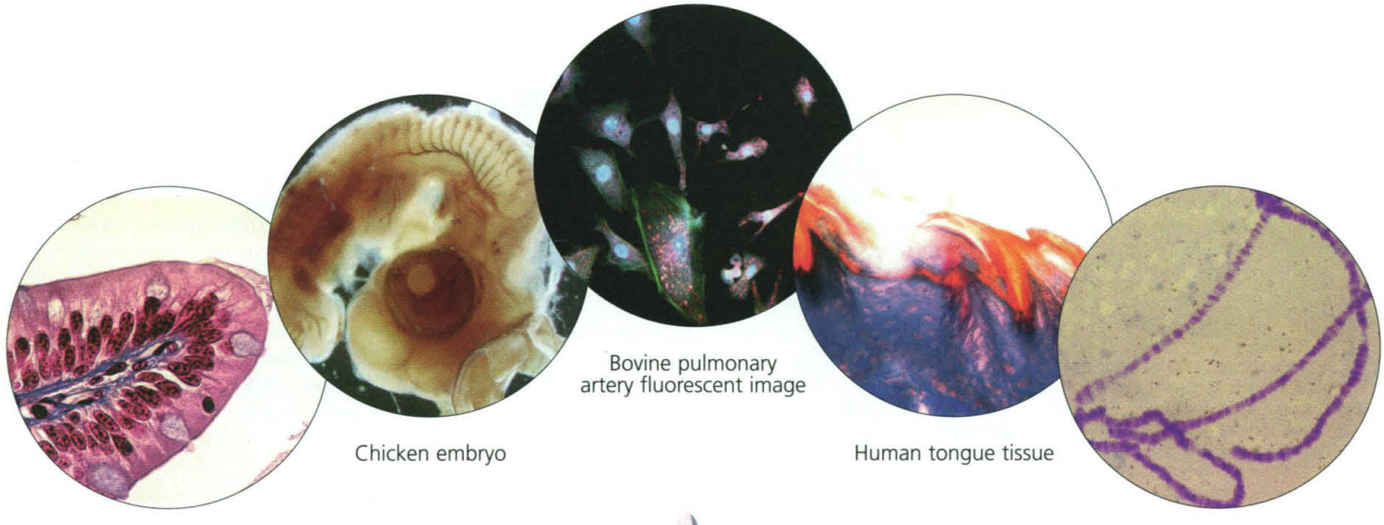

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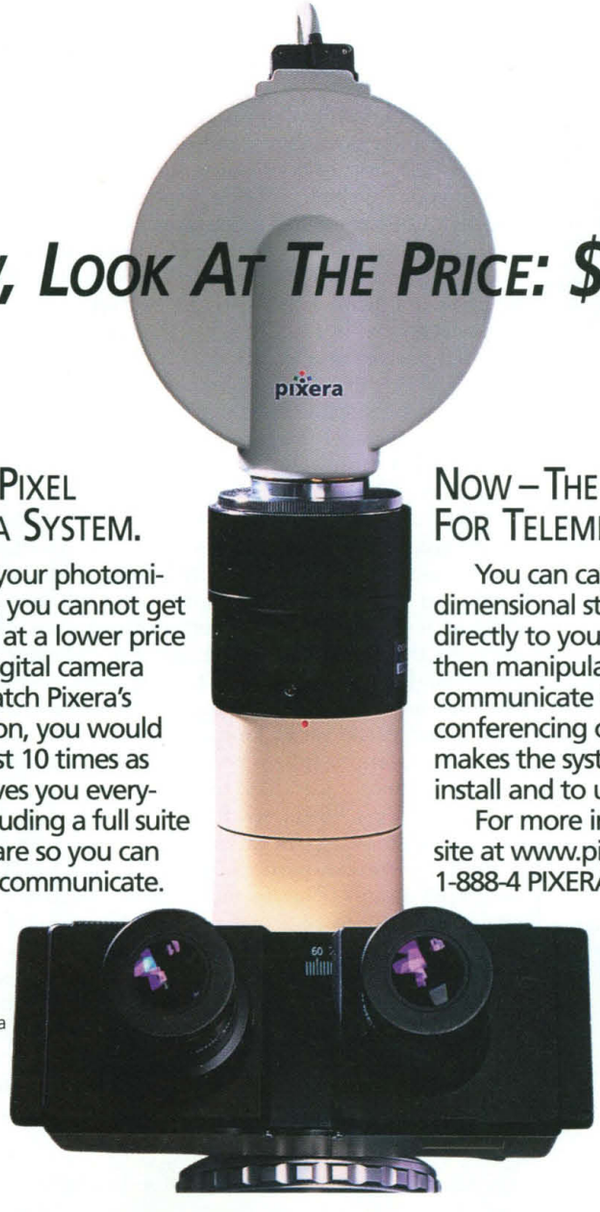

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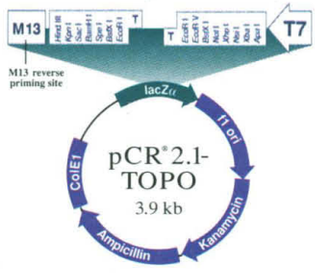

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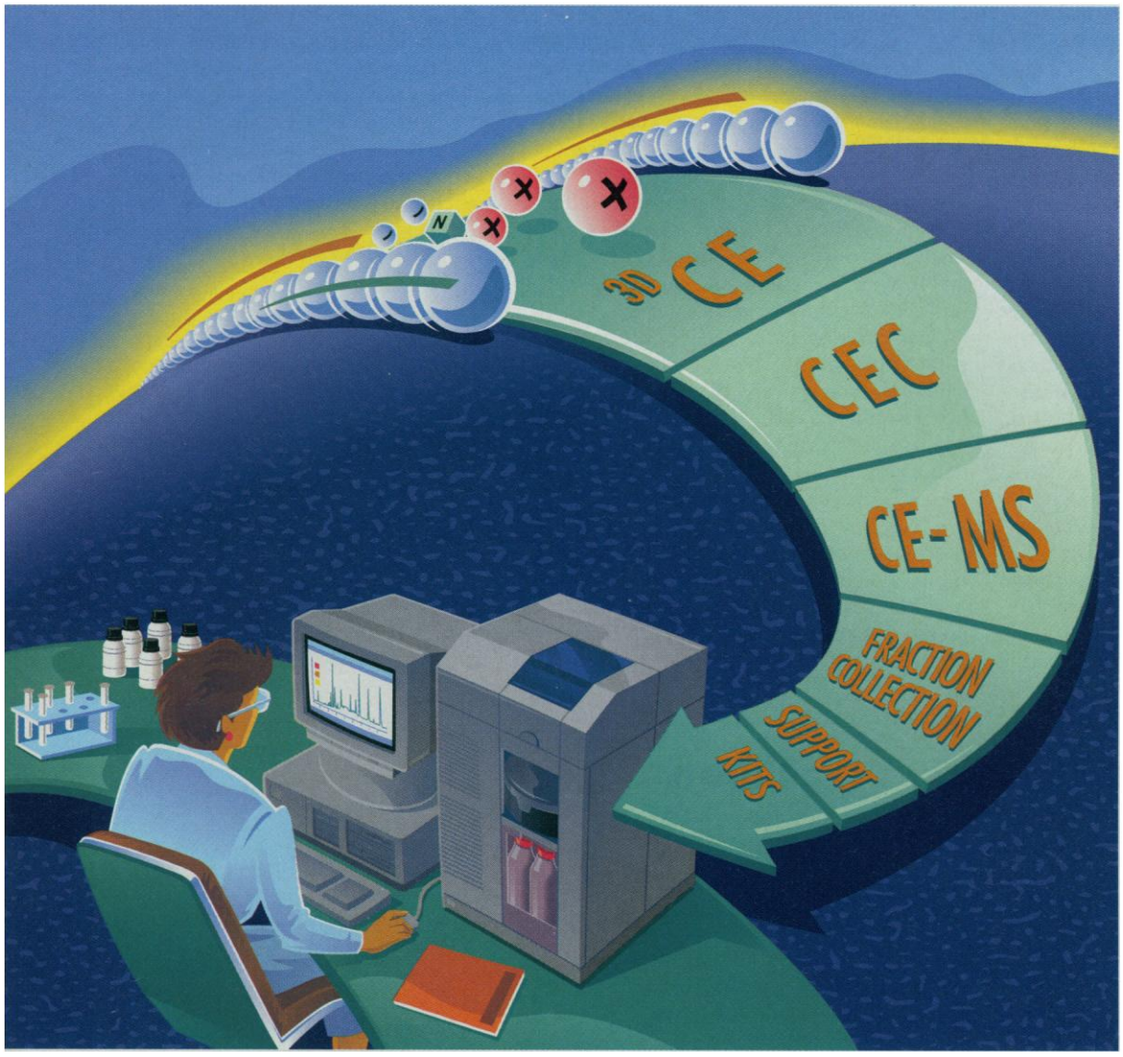

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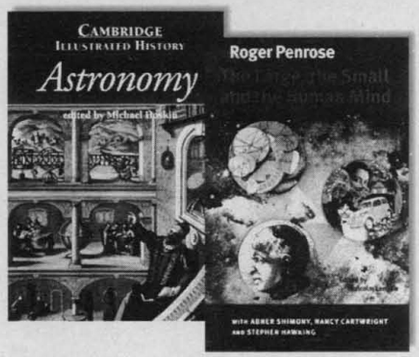

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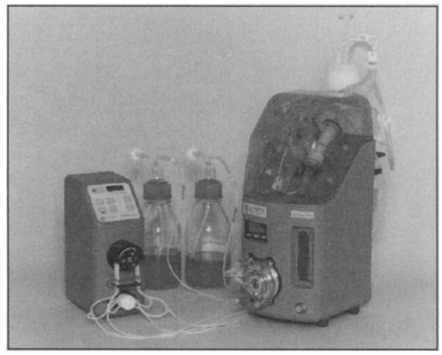

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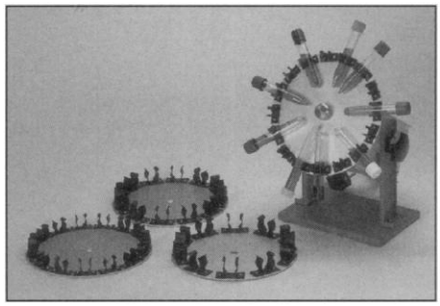

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