American Association for the Advancement of Science

# Science

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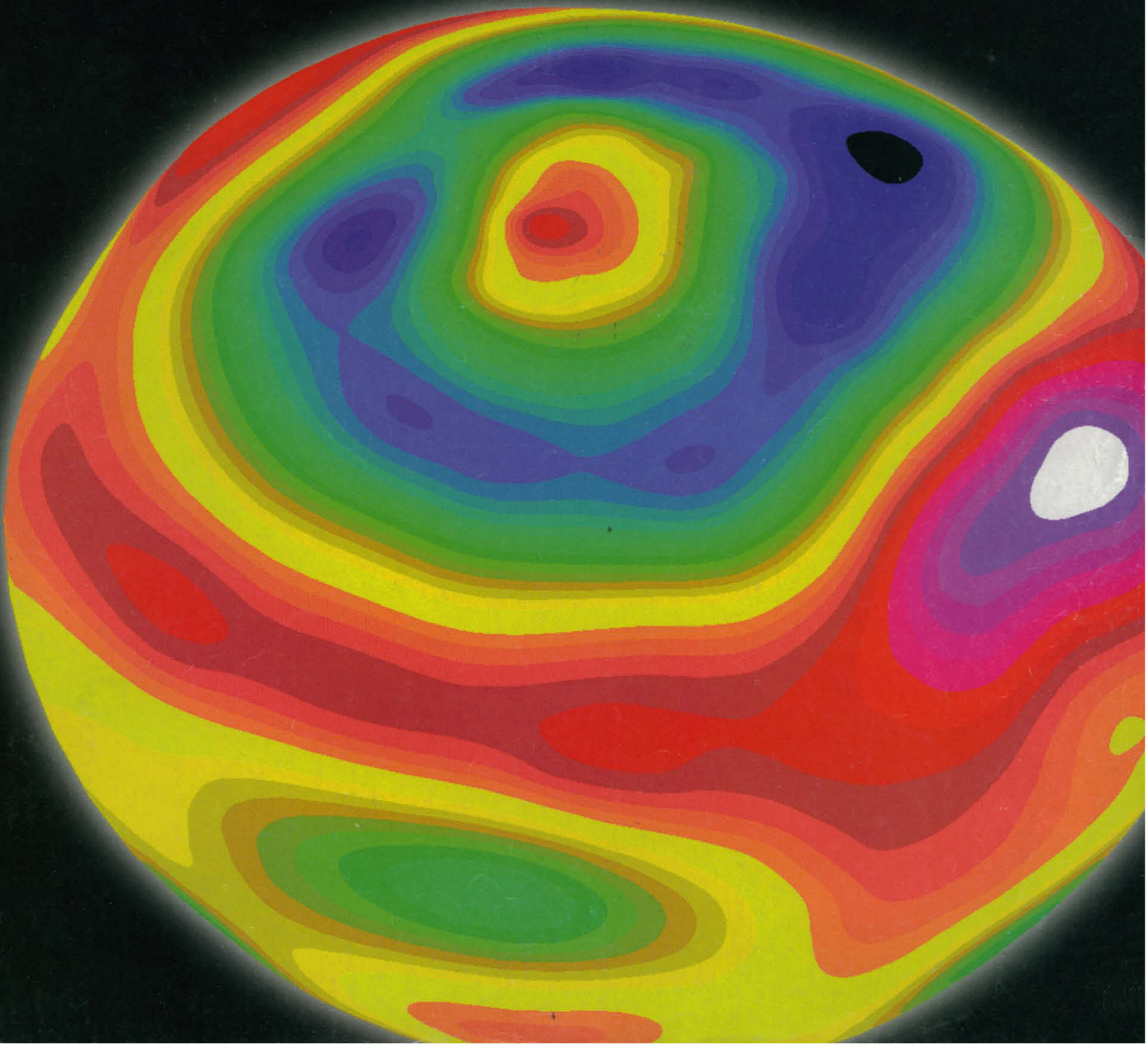

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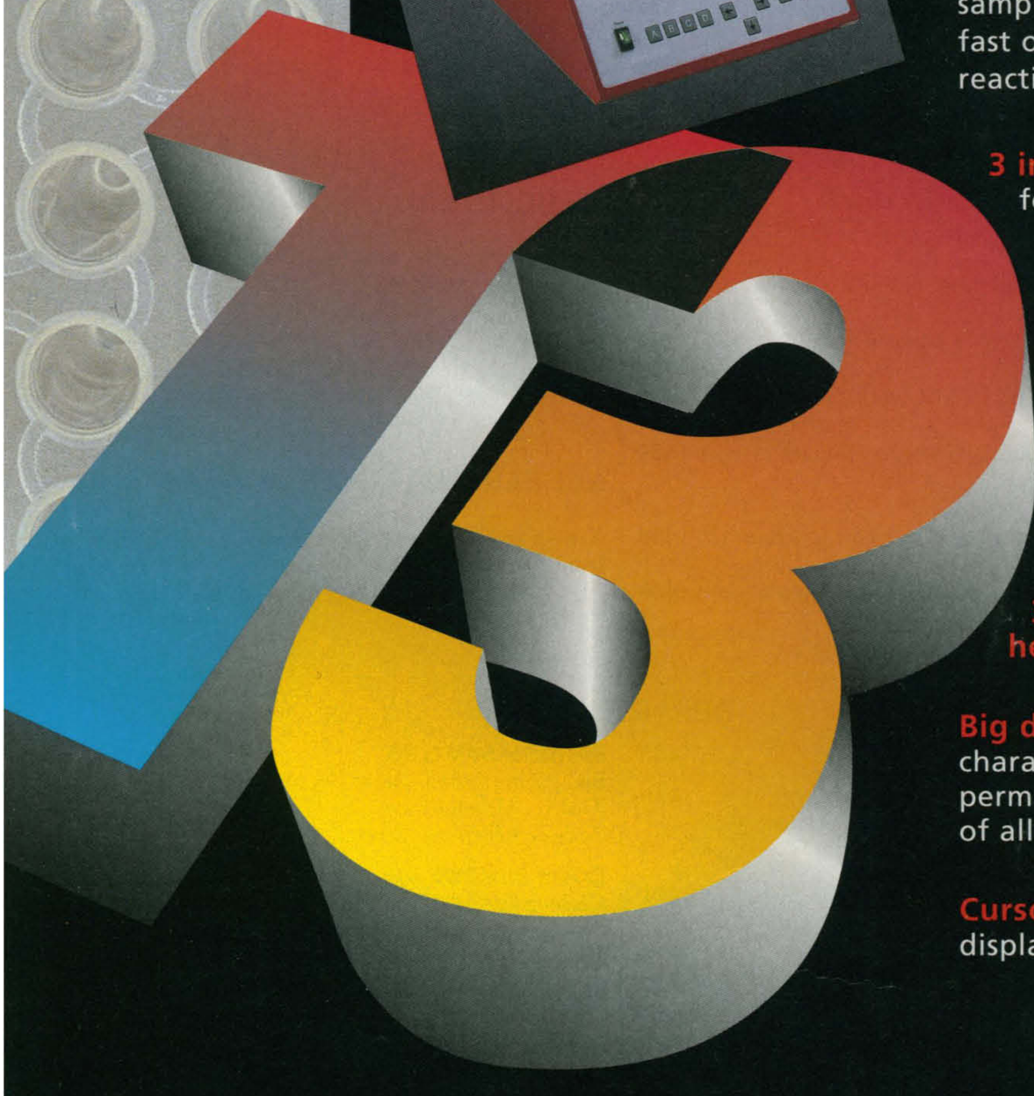

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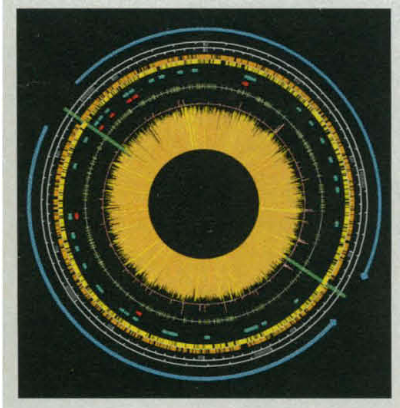

1432 & 1453
The *E. coli* genome

## NEWS & COMMENT



## RESEARCH NEWS



## PERSPECTIVES



## ARTICLE



## RESEARCH ARTICLE



## DEPARTMENTS





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COVER


A giant impact scar dominates the topography of asteroid 4 Vesta determined from Hubble Space Telescope images. The 460-kilometer-wide crater may be the site of origin for about 6 percent of all meteorites arriving at Earth. This image shows color-coded topography of Vesta dominated by the crater and its central peak [maximum relief shown is 24 kilometers from the crater floor (blue) to the surrounding rim (red, white)]. See page 1492. [Image: P. C. Thomas]

## REPORTS



## TECHNICAL COMMENTS





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# THIS WEEK IN SCIENCE

edited by PHIL SZUROMI

## Excess x-rays

Young stellar objects (YSOs) produce much greater x-ray emission than more evolved, young sunlike stars. Shu *et al.* (p. 1475) discuss how the time-dependent interaction of the magnetosphere of the YSO with a surrounding accretion disk could produce excess x-rays. They modified their "x-wind" model of this interaction to include fluctuations that will occur in the magnetic fields that connect the YSO and the accretion disk because of their differing rotation rates. Such processes would enhance x-ray flaring and also help explain the formation of chondrules (which requires repeated cycles of melting and cooling of the particles) and their abundances of short-lived radioactive element (created by x-ray bombardment).

## Cdc25 and the cell cycle

The cell division cycle is arrested when cells contain damaged DNA, and failure of this "DNA damage checkpoint" may contribute to the generation of cancerous cells. The phosphatase Cdc25 is a critical regulator of the cell cycle that dephosphorylates and activates the cyclin dependent kinase Cdc2. Three reports present evidence that signals initiated in response to DNA damage act to inhibit cell division by causing phosphorylation and inactivation of Cdc25 (see the Perspective by Weinert, p. 1450). Furnari *et al.* (p. 1495) studied the requirement for Cdc25 for cell cycle arrest in fission yeast exposed to irradiation, and implicated the protein kinase Chk1 as the enzyme that phosphorylates Cdc25. Peng *et al.* (p. 1501) found that human Cdc25C is regulated by phosphorylation of a specific serine residue. Mutants lacking this serine residue did not bind to 14-3-3 proteins (which may contribute to regulation of Cdc25 activity) and, when overexpressed, allowed cells to escape cell cycle arrest in response to DNA damage. Sanchez *et al.* (p. 1497) cloned the human Chk1 protein kinase. They show that it may mediate the direct phosphorylation of human Cdc25 and thus inhibit entry of cells into mitosis.

## Electrons over metals

Image potential states are excited electronic states above a metal surface; these are weakly bound electrons that have a relatively long lifetime. Höfer *et al.* (p. 1480; see the Perspective by Plummer, p. 1447) used two-photon photoemission spectroscopy on a femtosecond time scale to show that the periodic motions of these electronic states can be observed in real time. The observed dynamics reflect the isolated quantum states for low quantum states, and the coherent phenomena arise from simultaneous excitation of several states for higher quantum states. For these higher quantum states, oscillations with a period of 800 femtoseconds were observed, and the electrons could travel as far as 200 angstroms from the surface.

## Sulfur strands

Bacteria have recently been recognized to be particularly important in mineralization. Taylor and Wirsen (p. 1483) now describe a bacteria that produces long filaments of pure sulfur. Attachment of these strands may help the bacteria persist in areas where fluids are venting. The filaments may also explain the origin of abundant sulfur particles emitted at hydrothermal vents and sulfur mats.

## Big craters on little bodies

Vesta is one of the brightest and largest Earth-crossing asteroids. Its brightness is related to its distinctive composition for an asteroid: The basaltic surface of Vesta makes it a prime candidate for the source of the basaltic achondrite meteorites (such as howardites, eucrites, and diogenites). Thomas *et al.* (p. 1492; see the cover) observed Vesta during its 1996 closest approach to Earth with the Hubble Space Telescope and found a huge impact crater near its south pole that has a comparable diameter to the asteroid itself. This huge crater provides a probable source for the basaltic achondrites and a family of smaller basaltic asteroids that may be larger ejecta fragments from the impact event. In addition, these images of Vesta suggest that relatively small celestial bodies in our solar system can survive relatively large impacts.

## Conditional mutators in tumor development

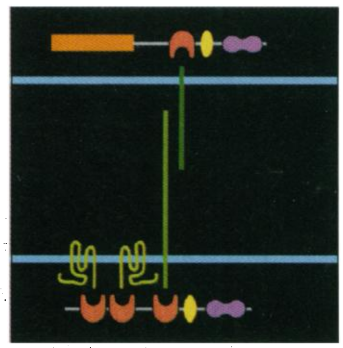
A subset of human cancers have defects in genes encoding mismatch repair (MMR) proteins. These defects have been postulated to generate a mutator phenotype that drives the accumulation of mutations required for tumor development. In studies of MMR-deficient tumor cell lines, Richards *et al.* (p. 1523; see the Perspective by Loeb, p. 1449) found that mutations accumulated at high frequency when the cells were maintained at high density but not when the culture conditions allowed rapid cell growth. This "conditional mutator" phenotype may be important in intact tumors, where the microenvironment often limits cell growth.

## Responses to estrogen

Estrogen therapy has been widely used to reduce the effects of menopause; however, hormone replacement has been implicated in increasing the chance of breast cancer. Some antiestrogens are used for the treatment of breast cancer, but these agents can increase the chance of other cancers. In an effort to better understand estrogen signaling, researchers have examined the transactivation properties of the two estrogen receptors, ER$\alpha$ and ER$\beta$. Paech *et al.* (p. 1508; see the news story by Pennisi, p. 1439) report that the two receptors signal in different ways, depending on the ligand and the promoter response element. This differential action suggests that the receptors participate in different regulation pathways and presents possibilities for future pharmacological research.

## Asymmetry across the synapse

The protein PSD-95 is found on the postsynaptic (receiving) side of synapses, the cell-to-cell communication ports between neurons. Three regions of the protein, the PDZ domains, hold other molecules at the synapse. Potassium channels, the *N*-methyl-D-aspartate (NMDA) receptor, and nitric oxide synthase bind to two of the PDZ domains; Irie *et al.* (p. 1511) now show that the third PDZ domain binds to neuroligins, a transmembrane protein whose extracellular portion binds to another transmembrane protein on other cells, neurexin. This interaction could provide the basis for the asymmetrical junction of the synapse.



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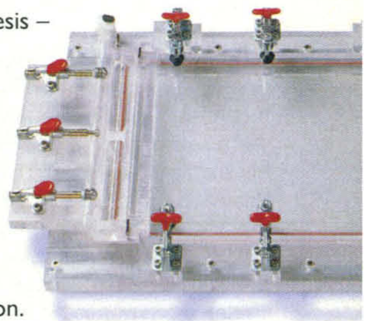

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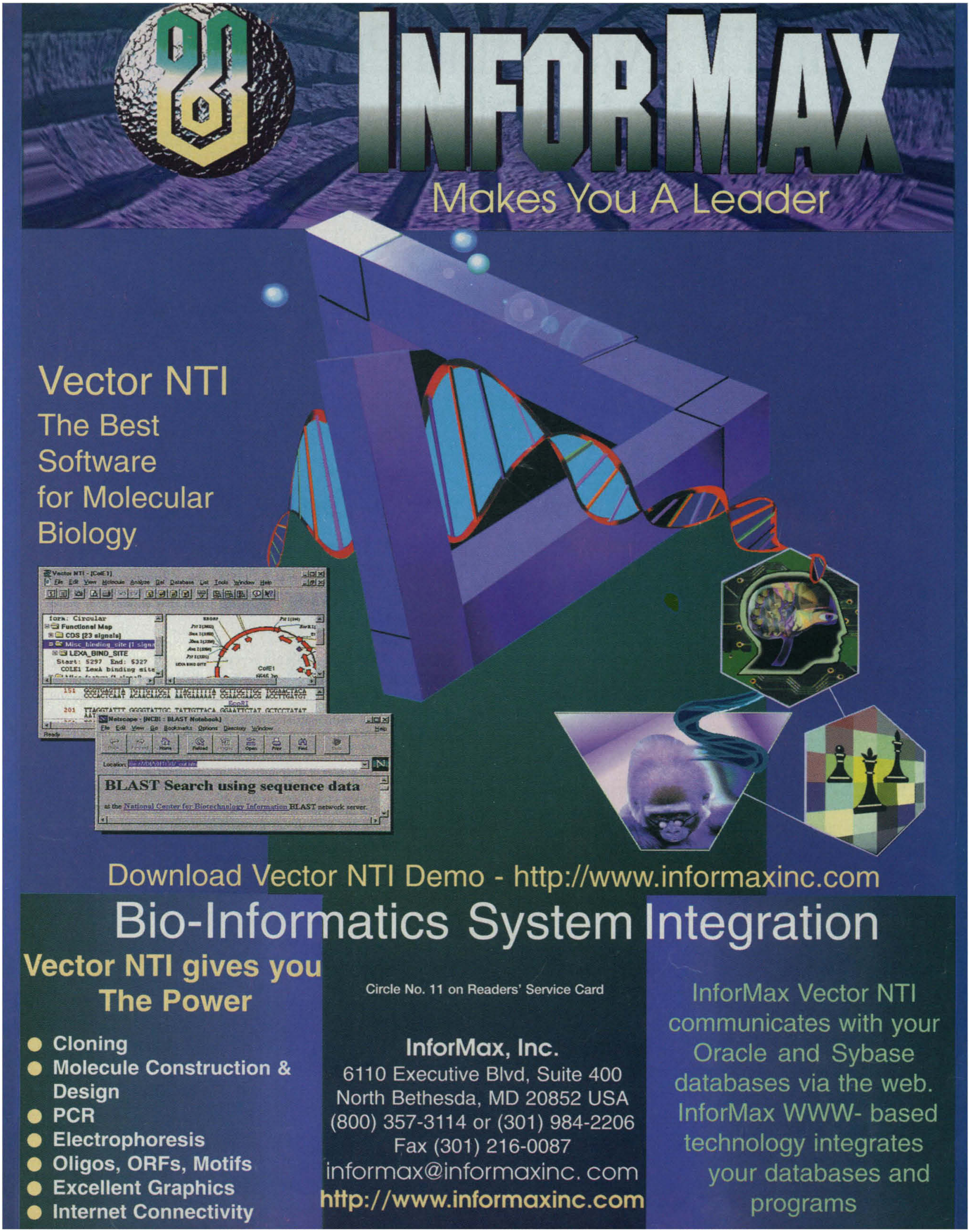
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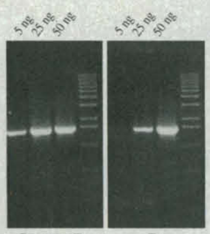


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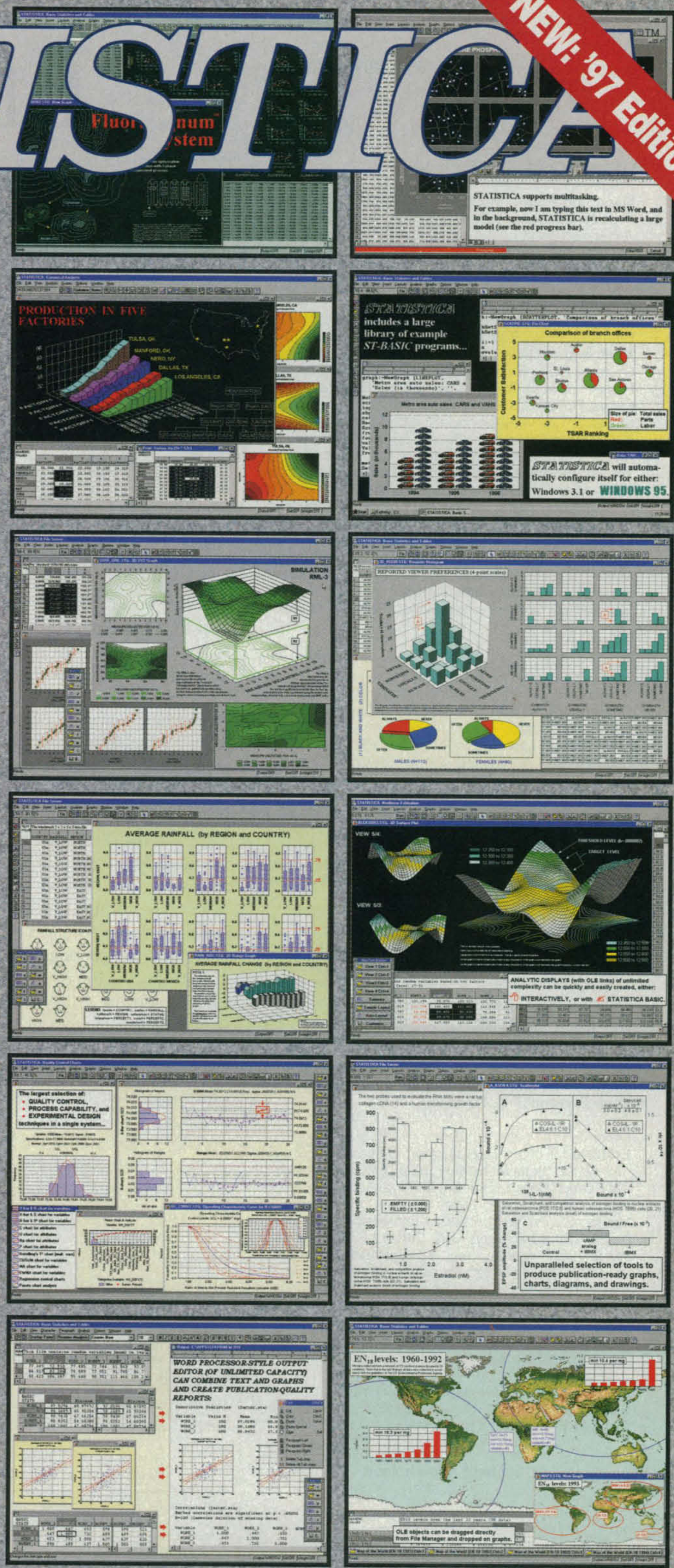
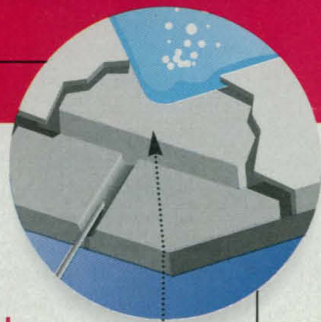


# PIERCE

EVERYTHING IS POSSIBLE...WITH THE RIGHT TOOLS.®

Sample Handling



# Your sample is invaluable – dialyze it using a product you can trust not to leak.


NEW! Other MWCOs coming soon!

**The Slide-A-Lyzer® Dialysis Cassettes from Pierce offer the following advantages:**

- Our unique silicone-like gasket inside the cassette, ensures the sample will not leak out after it is injected and the syringe is removed
- Require approximately half the time of dialysis tubing – and produce sample volume recoveries of more than 95%
- Disposable cassettes are more convenient than tubing – hydrate in one minute or less
- Maintain the highest possible sample integrity
- Ideal for removing low molecular weight contaminants, performing buffer exchange, desalting and concentration

1. Remove a cassette from the protective pouch. Fill the cassette cavity with your sample through one of the guide ports on the top of the gasket. With the syringe still inserted into the cavity, draw up on the syringe to remove air.
2. Attach a flotation buoy and dialyze. Each buoy serves as an effective flotation device and also as a convenient bench-top stand for the cassette. There is no need to worry about dialysis bag suspension.
3. Inject the cassette chamber with air, and withdraw your dialyzed sample from the cassette. And that's that!

Each kit includes 10 Cassettes, 10 Buoys, 10 Syringes and 18-gauge Needle Accessories.

**Slide-A-Lyzer® 2K MWCO Dialysis Cassettes***

| Product# | Description | MWCO | Capacity |
|---|---|---|---|
| 66206 | Dialysis Kit | 2,000 | 1-3 ml |
| 66207 | Dialysis Kit | 2,000 | 3-15 ml |

**Slide-A-Lyzer® 3.5K MWCO Dialysis Cassettes***

| Product# | Description | MWCO | Capacity |
|---|---|---|---|
| New! 66335 | Dialysis Kit | 3,500 | 0.1-0.5 ml |
| New! 66332 | Dialysis Kit | 3,500 | 0.5-3 ml |

**Slide-A-Lyzer® 10K MWCO Dialysis Cassettes***

| Product# | Description | MWCO | Capacity |
|---|---|---|---|
| 66408 | Dialysis Kit | 10,000 | 0.1-0.5 ml |
| 66406 | Dialysis Kit | 10,000 | 0.5-3 ml |
| 66407 | Dialysis Kit | 10,000 | 3-15 ml |

**U.S. Patent No. 5,503,741.*

Note: Slide-A-Lyzer® Dialysis Cassettes (in all sizes) and accessories can also be purchased separately. See your 1997 Pierce Catalog for additional information.

**Call 800-874-3723 for product information or 815-968-0747 for the name of your local distributor.**

Please see us at ASBMB booths 426 & 428

PIERCE

ISO 9001 QUALITY SYSTEM CERTIFIED

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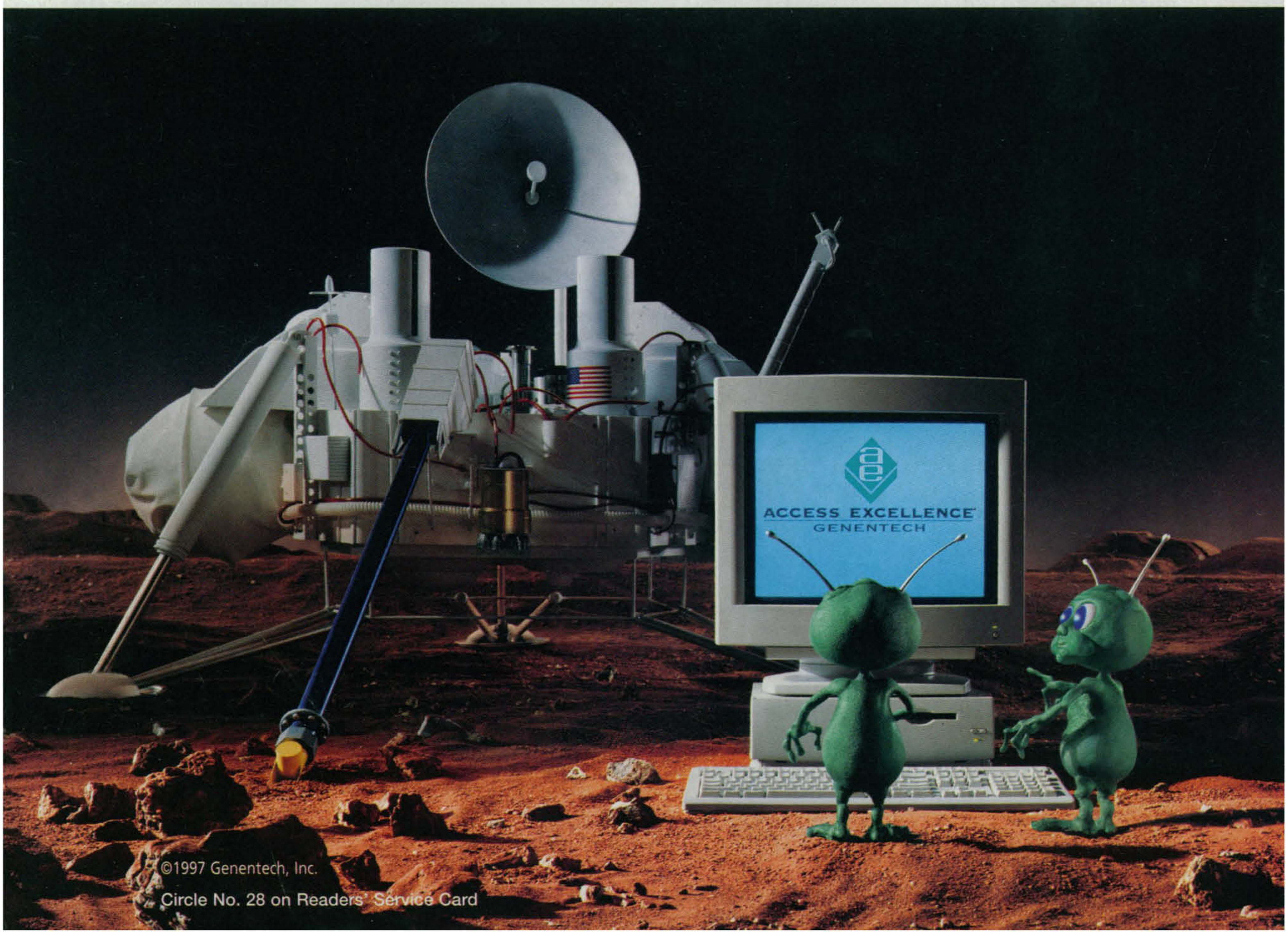

SCIENCE

# The Genome of *Escherichia coli*