



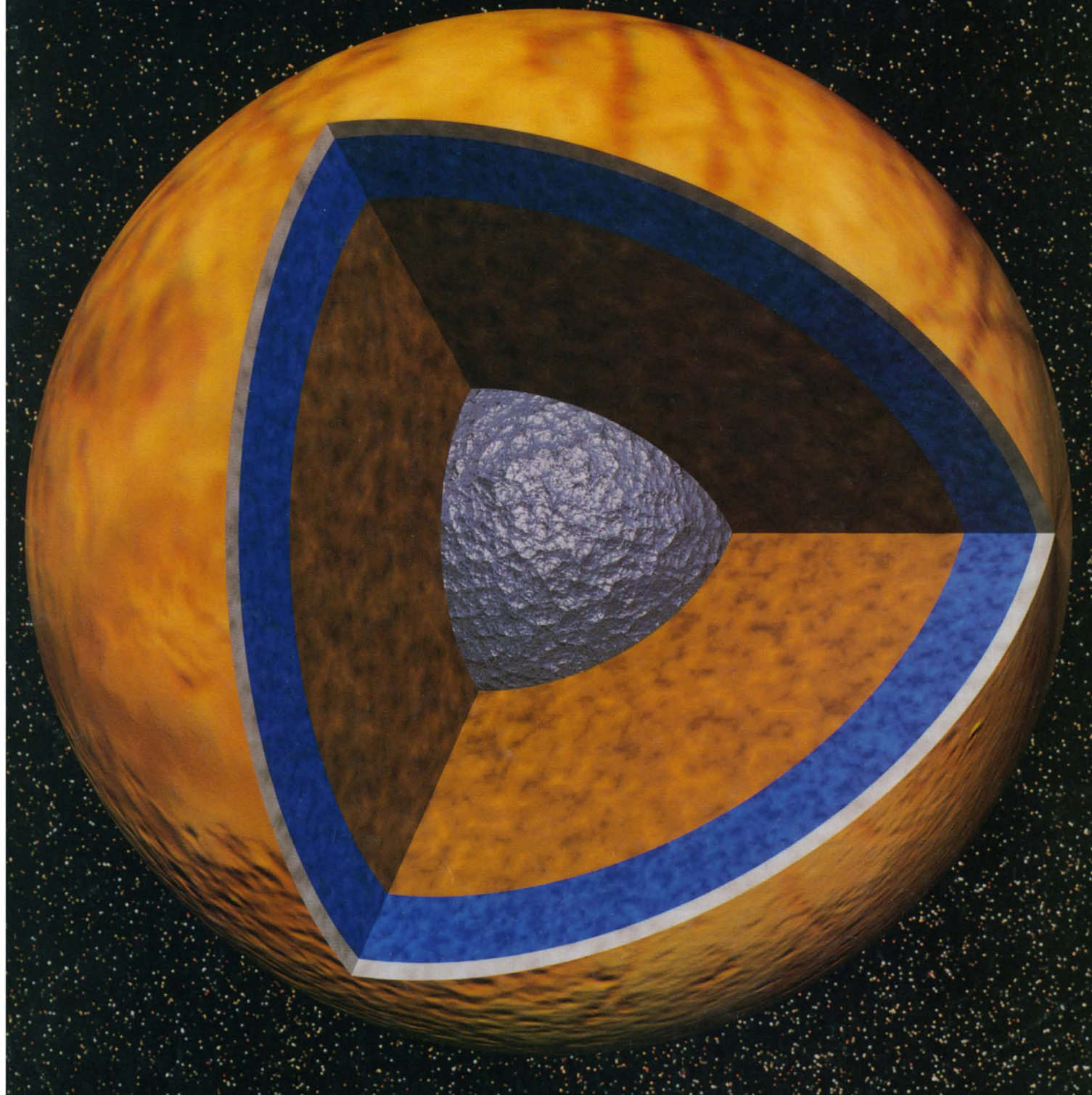
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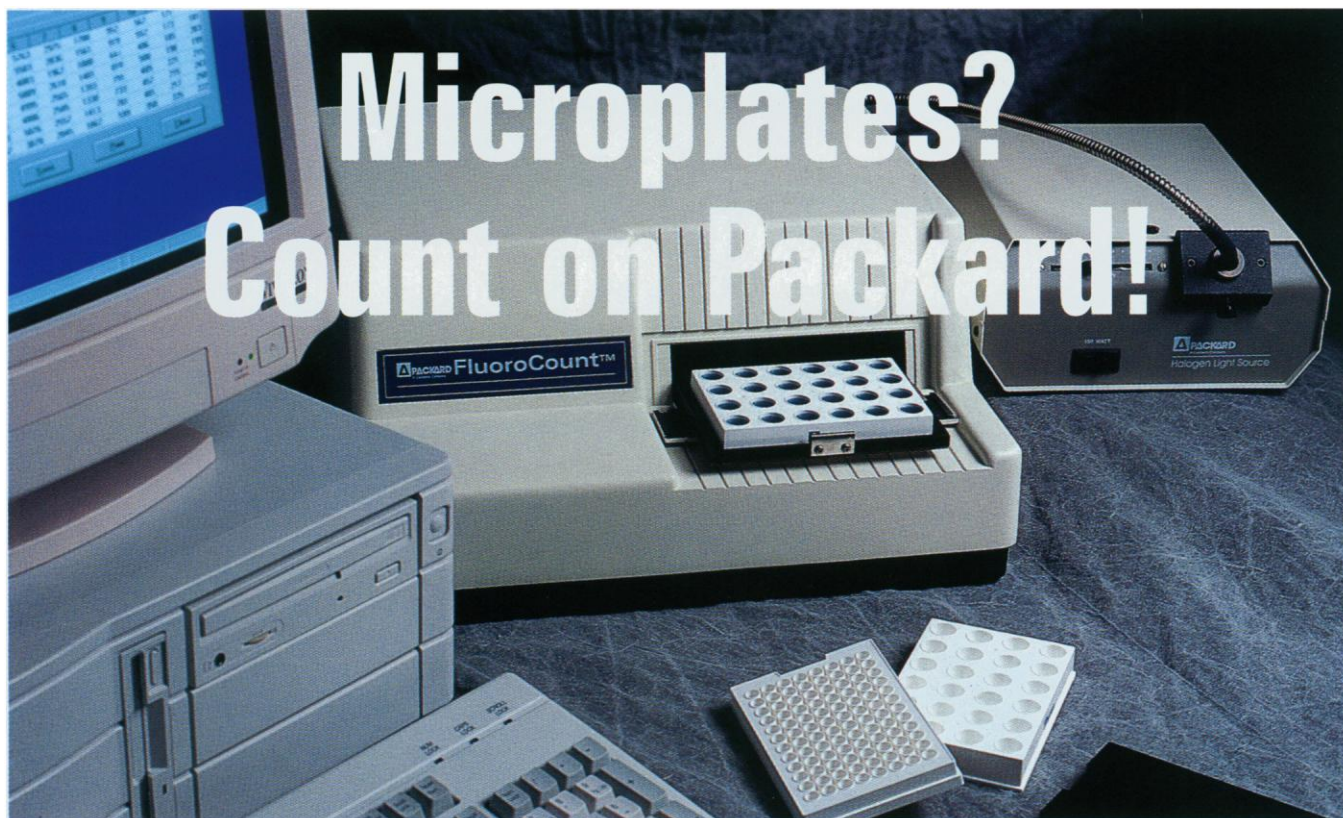
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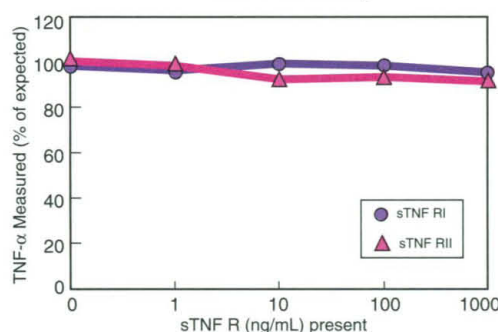
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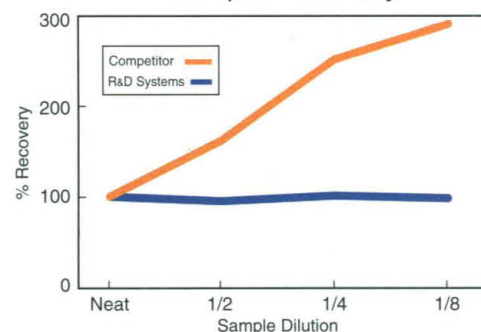
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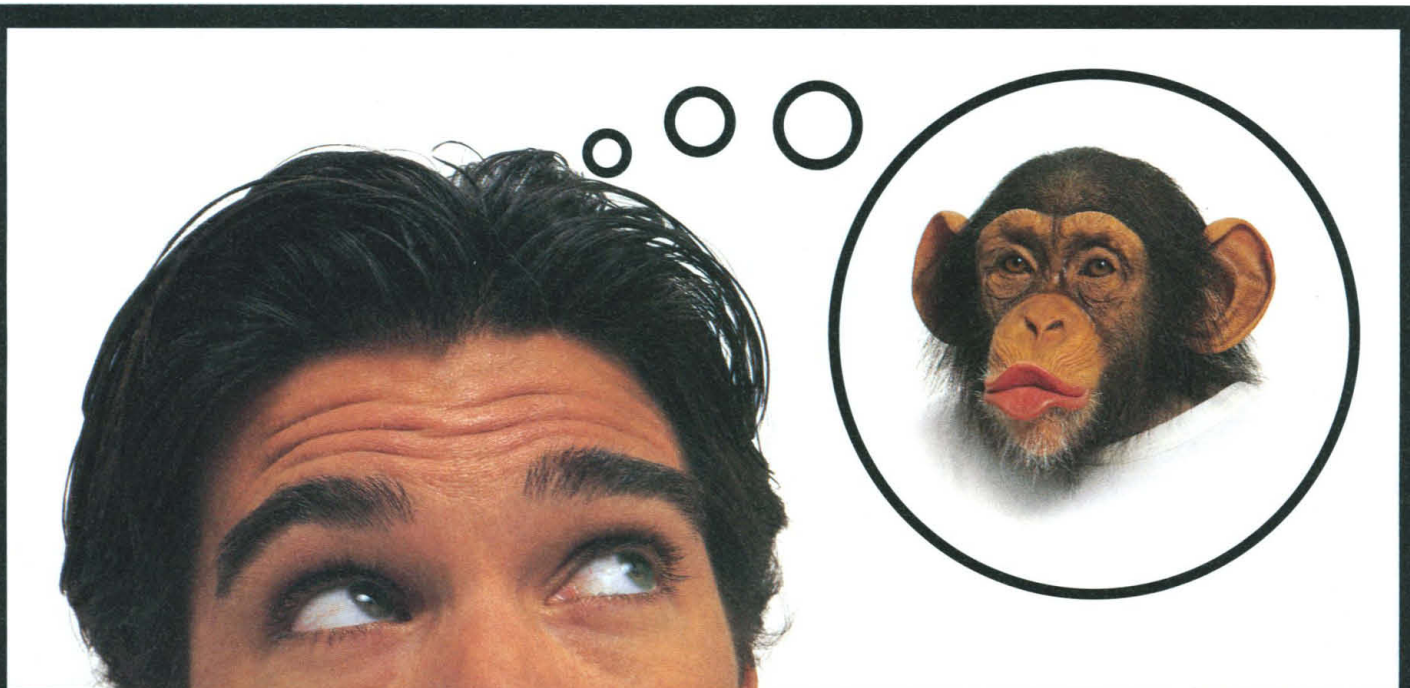
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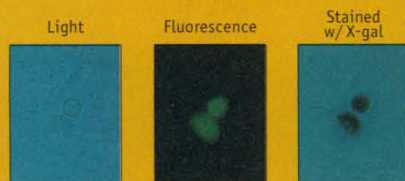


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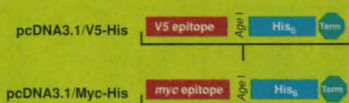


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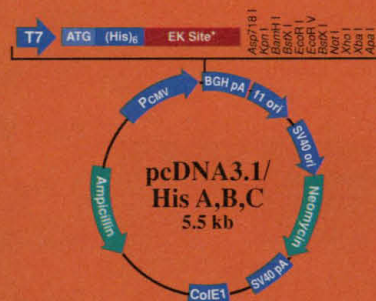
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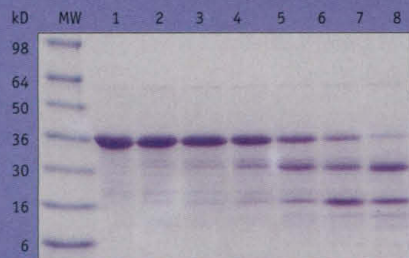
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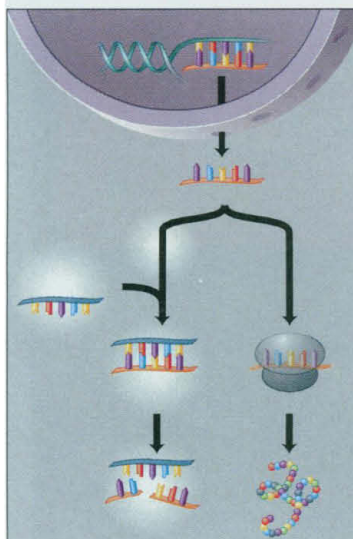
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## COVER

Cutaway view of the possible structure of Jupiter's moon Europa. The surface is a mosaic of Voyager images, and the interior characteristics are inferred from gravity-field and magnetic-field measurements by the Galileo spacecraft. A metallic core (gray) is surrounded by a mantle of

rock (brown) and an outer shell of water ice (blue and white), part of which could be liquid. Relative sizes of the regions are to scale. See the related Reports on pages 1236 and 1239. [Graphics: E. De Jong and Z. Gorjian, JPL Digital Image Animation Lab]



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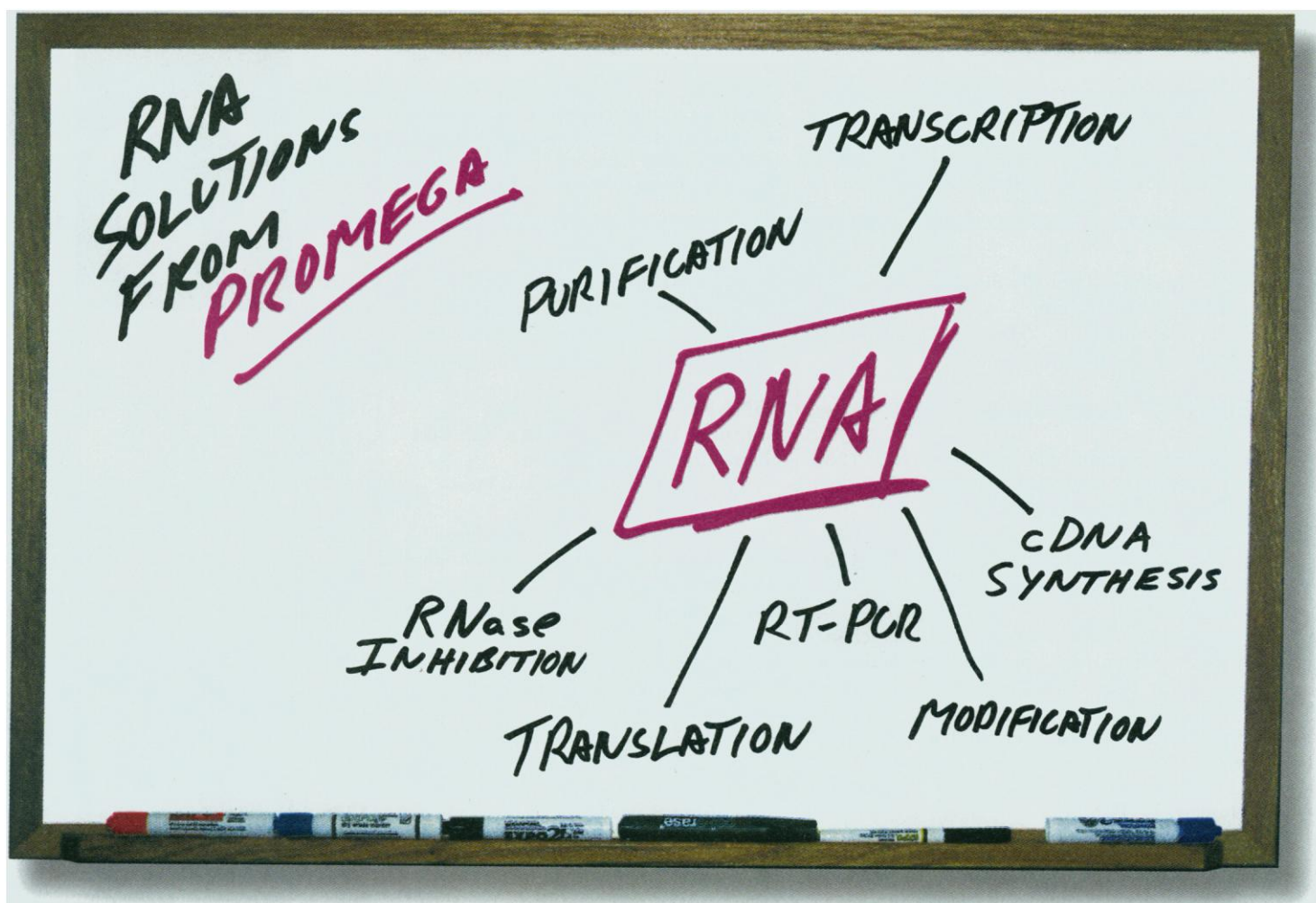
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# THIS WEEK IN SCIENCE

edited by PHIL SZUROMI

## Third-order efforts

Symmetry effects limit the materials that can generate second-order harmonic signals (combining two photons, such as in frequency doubling). Such restrictions do not apply to third-order effects, which also have important uses in optics, but the second-order hyperpolarizability  $\gamma$  of most materials needed for third-order effects are usually quite small. Garito and co-workers have suggested a way to increase  $\gamma$  in organic molecules, and now Marder *et al.* (p. 1233; see the news story by Service, p. 1195) have tested these ideas experimentally. Linear  $\pi$ -conjugated molecules that had increasing intramolecular charge transfer showed enhanced three-photon resonances.

## Smoke signals

When wildfires burn across a natural landscape, the original vegetation may be completely destroyed, but new vegetation soon takes its place, usually with a predictable pattern. Keeley and Fotheringham (p. 1248; see the news story by Malakov, p. 1199) studied the germination of an annual plant typical of the California chaparral. Unlike some post-fire plants, whose germination is stimulated by high heat, seeds of *Emmenanthe* are stimulated by chemicals in the smoke. Whether the smoke is fresh or stale, the active components, which can independently induce germination of *Emmenanthe*, are nitrogen oxides.

## Europa, inside and out

The Galileo orbiter had two close encounters with Europa on 19 December 1996 (E4) and

## Warming the early Earth

Earth's atmosphere 4 billion years ago has been thought to have had a neutral oxidation state, and given estimates of the sun's energy output, the average surface temperature of Earth would have been near or below freezing for water. However, there is evidence that methanogens appeared on Earth's surface about 3.8 billion years ago, suggesting a warmer planet with liquid water. Sagan and Chyba (p. 1217; see the Perspective by Kasting, p. 1213) attempt to resolve this paradox by suggesting that Earth's early atmosphere was more reducing, and that gases such as methane created a greenhouse effect. Methane photolysis may have created an organic haze in Earth's upper atmosphere that shielded ammonia in the lower atmosphere from ultraviolet photodissociation.

on 20 February 1997 (E6). Kivelson *et al.* (p. 1239) analyzed perturbations in Jupiter's magnetosphere measured during E4 and suggest that Europa has a dipole moment of about 240 nanoteslas oblique to the jovian magnetosphere and possibly related to a core dynamo. Anderson *et al.* (p. 1236; see the cover) analyzed the external gravity field obtained during E4 and E6 and suggest that Europa has an icy to liquid water exterior shell of about 100 to 200 kilometers thick with a rocky to metallic interior. A metallic core is favored if Europa does have a magnetic field.

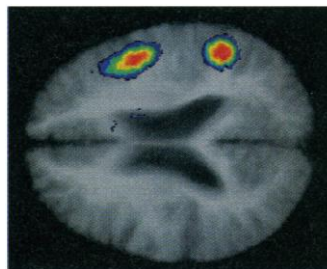
## Rab role

Transport of proteins within the cell occurs in vesicles that bud from one compartment and specifically recognize and fuse with another compartment. The recognition is mediated by vesicle proteins (called v-SNAREs) that interact with proteins in the target membrane (called t-SNAREs). The small guanosine triphosphatases known as Rabs are required in this process, but their precise role has been unclear. Lupashin and Waters (p. 1255; see the Perspective by Roth-

man, p. 1212) studied the process in yeast cells and obtained evidence that the t-SNARE is held in an inactive state (in which it cannot bind the v-SNARE) by another protein called Sly1p. The Rab protein then transiently interacts with the t-SNARE, which relieves the inhibitory effect of Sly1p and allows the formation of a t-SNARE-v-SNARE complex and subsequent fusion of the membranes.

## Not easily fooled

Learning at times can seem effortless, but how does it happen? Berns *et al.* (p. 1272) imaged areas of the brain that were activated when subjects were first trained on a number se-



quence based on a definite grammar and then confronted with a second, slightly different grammar—so slight that the subjects are not consciously aware of the difference. Activ-

ity in one of these areas, the ventral striatum, peaked during learning of the first grammar, and then peaked at a significantly higher level during training on the second. Other studies have suggested that the striatum participates in encoding probabilistic expectations, and these results suggest that it may do so through detecting novelty beneath awareness.

## Tired cats

Why do we fall asleep? Porkka-Heiskanen *et al.* (p. 1265) demonstrate that, in cats, adenosine mediates the inclination toward sleep brought on by prolonged wakefulness. The extracellular concentration of adenosine increases in proportion to the duration of wakefulness and diminishes during subsequent periods of recovery sleep. Neuronal circuits known to support arousal, as measured by electroencephalograms, are known to be inhibited by adenosine, which is a by-product of metabolic activity.

## Cell profiles

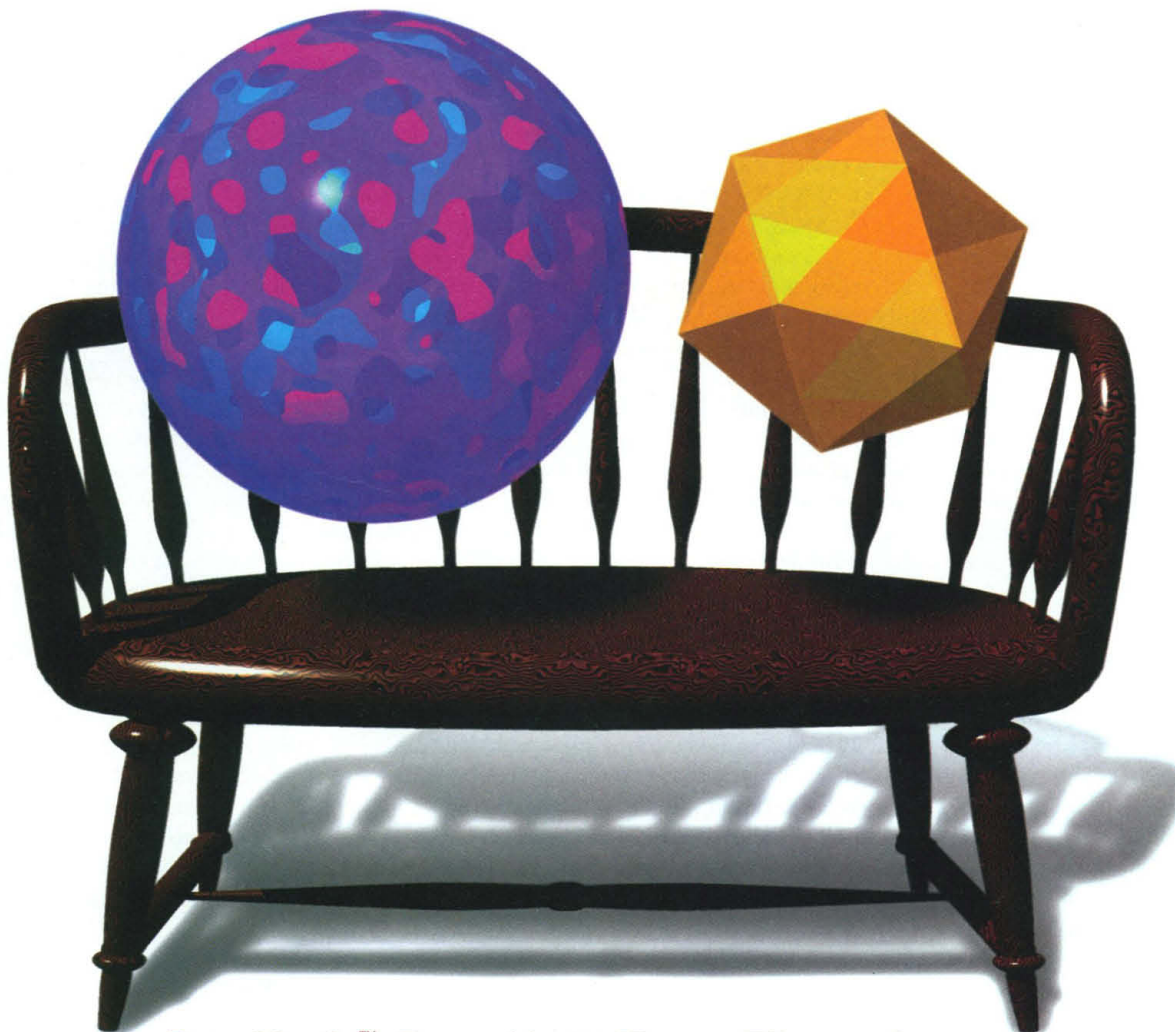
Understanding the differences between cancer cells and normal cells will not only add to our fundamental knowledge of cancer, but it can also lead to new therapeutics and markers to aid in diagnosis. Zhang *et al.* (p. 1268) used the technique they had previously developed, serial analysis of gene expression (SAGE), to examine more than 300,000 transcripts from 45,000 genes. More than 500 transcripts were expressed at significantly different levels in neoplastic cells from gastrointestinal tumors as compared to normal cells.





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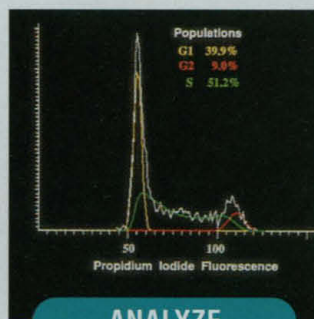
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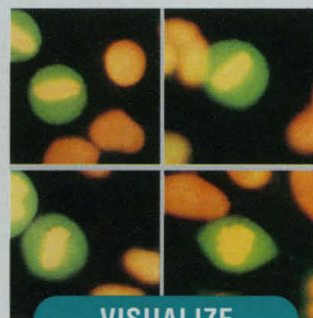
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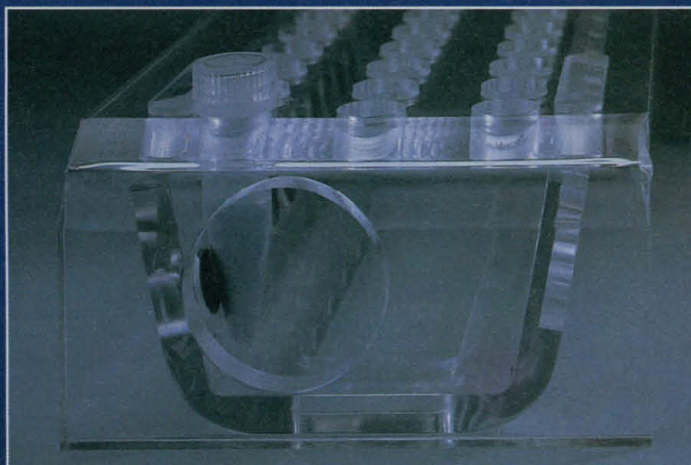
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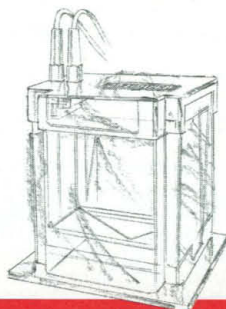
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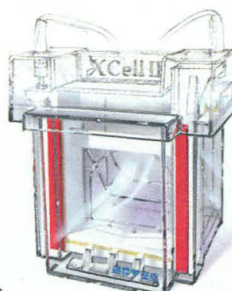
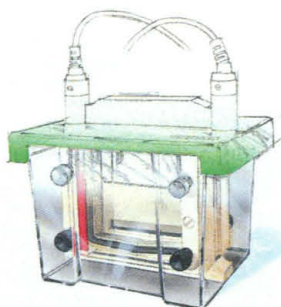
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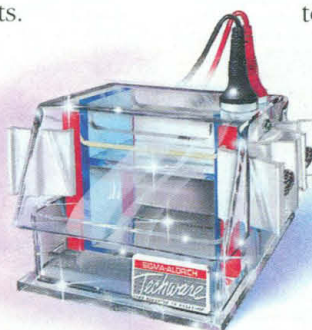
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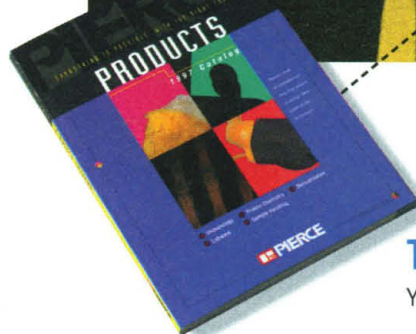
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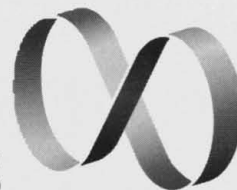
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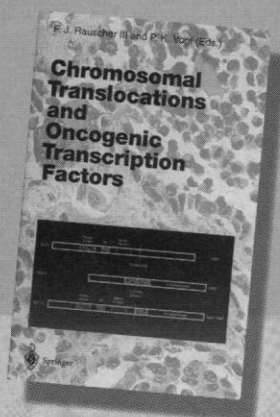
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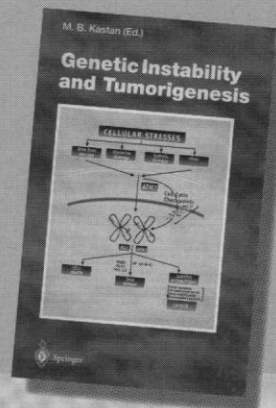


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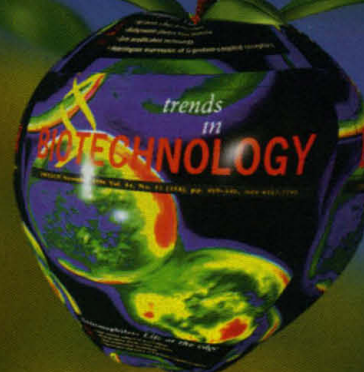
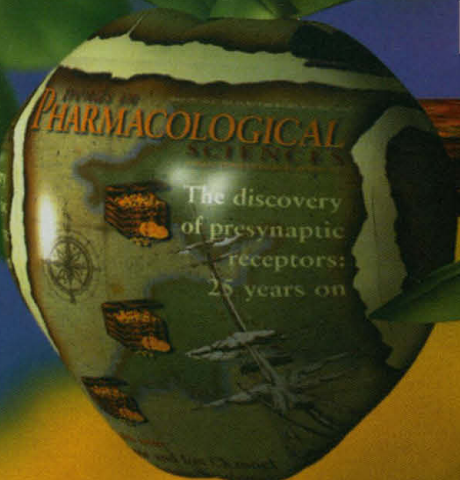


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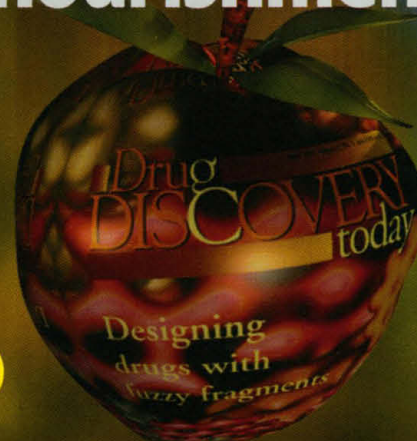
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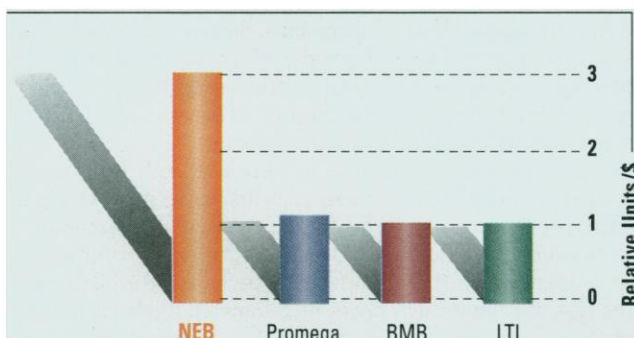
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