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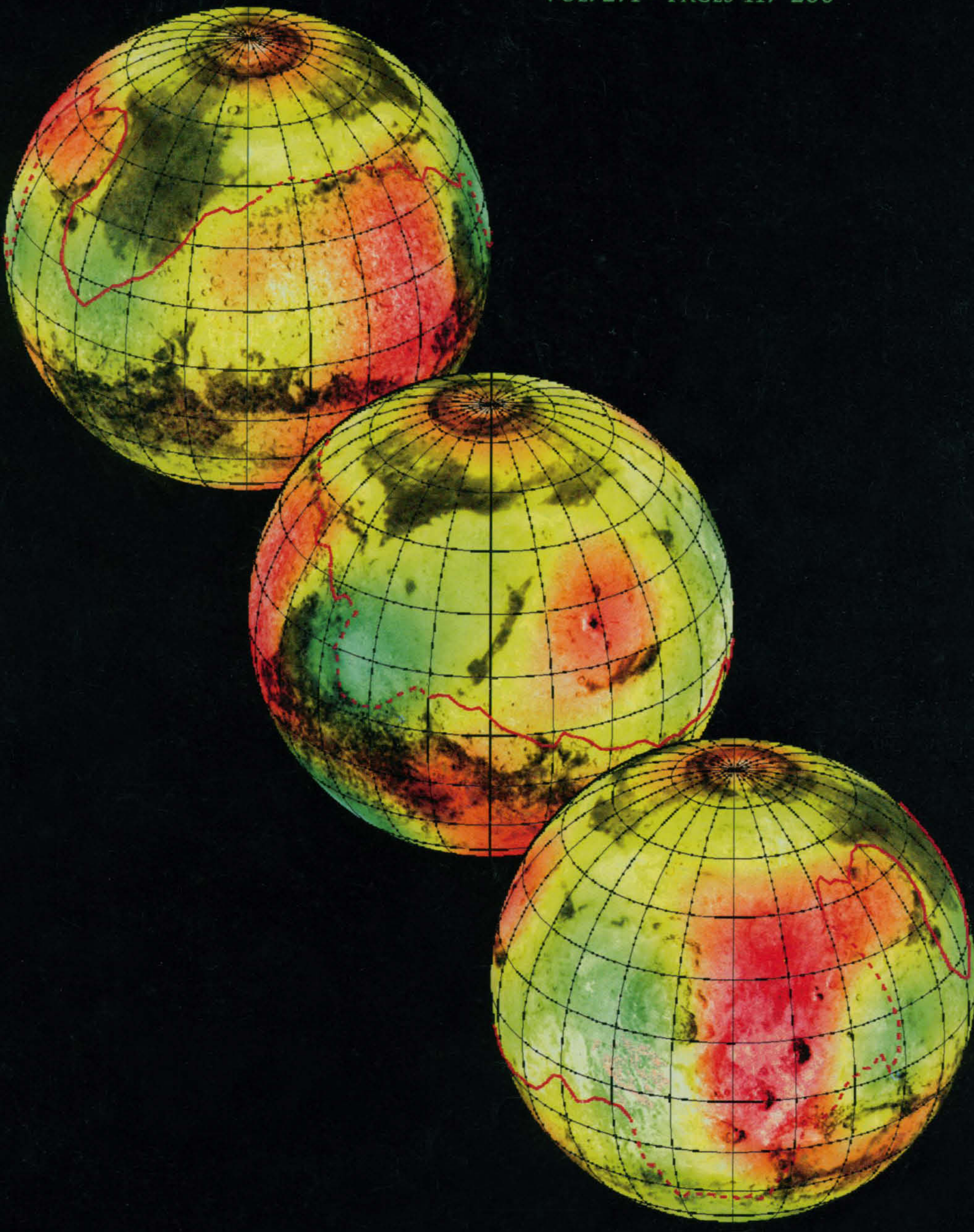


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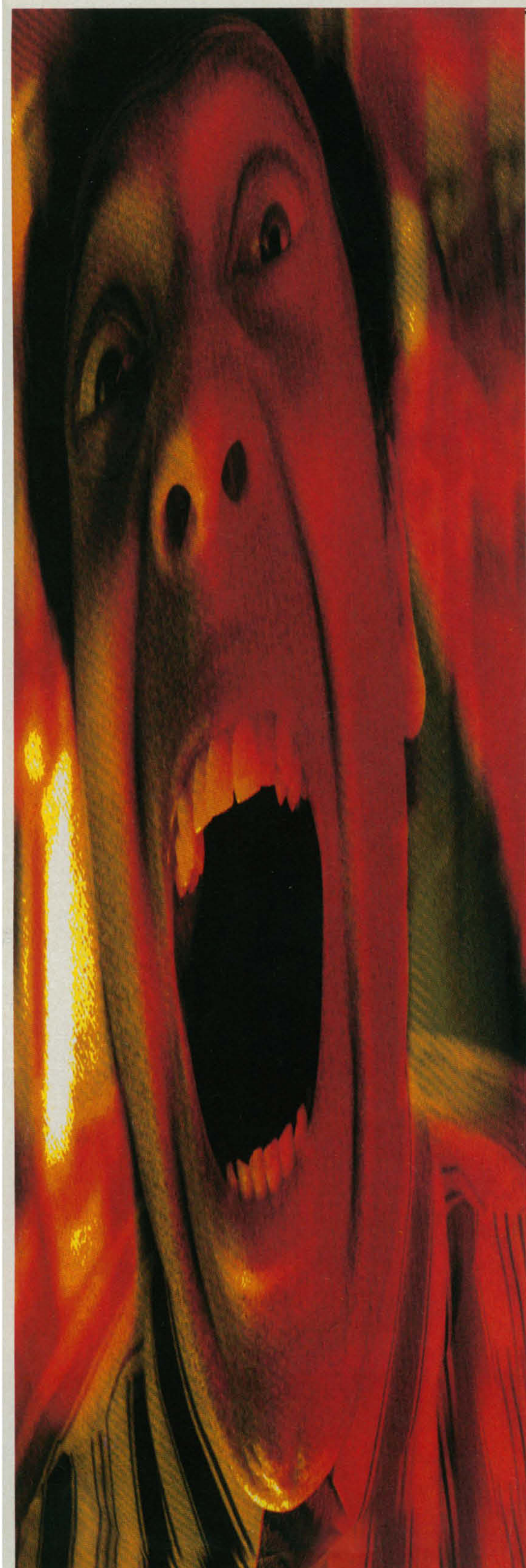

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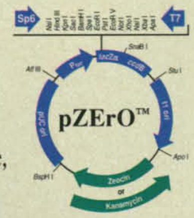

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1. Bernard, P. *et al.* (1993) *J. Mol. Bio.* **234**: 534-541

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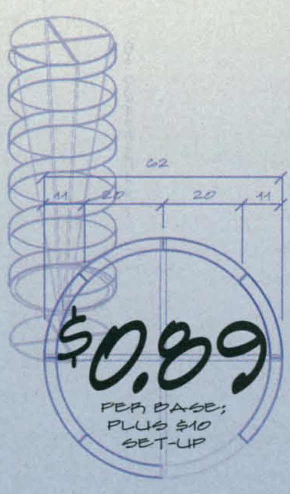

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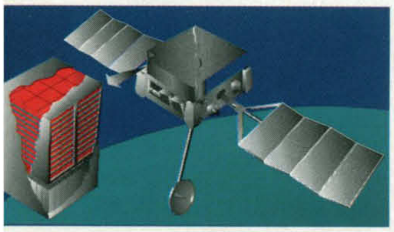

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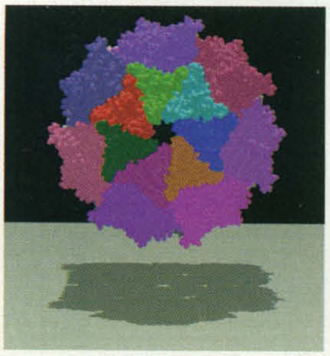

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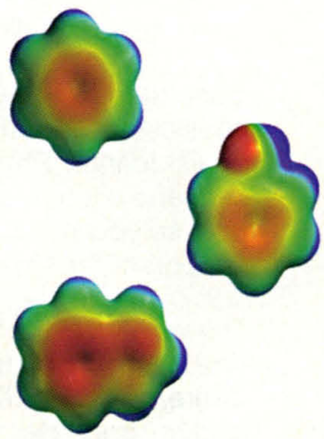
Cover

The shape of Mars relative to an ellipsoid: reds are highs and greens are lows. The red line indicates the geologic boundary between the distinctive northern and southern hemispheres and is solid where a scarp has been mapped. The differences in ellipsoidal heights (that is, the highs and lows) do not correlate with the geologic boundary. See page 184. [Image: G. A. Neumann and M. T. Zuber]



◪ Indicates accompanying feature

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NOMINATIONS FOR THE 1997 LOUIS-JEANTET PRIZE FOR MEDICINE

Nominations are being sought for the 1997 Louis-Jeantet Prize for medicine. One to three prizes will be awarded. They will amount to a maximum of 2 million Swiss Francs (approximately 1.6 million US Dollars) in 1997. These prizes will provide substantial funds for the support of biomedical research projects (fundamental or clinical) of the highest quality. Candidacies in clinical research are strongly encouraged.

Candidates (either individuals or research groups) must be nominated by scientists, physicians or institutions having detailed knowledge of the candidates' research. The Louis-Jeantet Prize for medicine is not intended to honour past accomplishments but to help and encourage the winners' continued research activity. Candidates shortlisted for the final selection will therefore be asked to provide a research project to which the financial support of the Prize could give decisive impetus.

The winners of the ten previous Louis-Jeantet Prizes for medicine have been **Sidney Brenner**, **Walter Gehring** and **Dominique Stehelin** in 1987, **Bert Sakmann**, **John Skehel** and **Rolf Zinkernagel** in 1988, **Roberto Poljak**, **Walter Schaffner** and **Greg Winter** in 1989, **Nicole Le Douarin**, **Harald Von Boehmer** and **Gottfried Schatz** in 1990, **Pierre Chambon**, **Frank Grosveld** and **Hugh Pelham** in 1991, **Paul Nurse**, **Christiane Nüsslein-Volhard** and **Alain Townsend** in 1992, **Jean-Pierre Changeux**, **Richard Henderson** and **Kurt Wüthrich** in 1993, **Thierry Boon**, **Jan Holmgren** and **Philippe Sansonetti** in 1994, **Dirk Bootsma** and **Jan Hoeijmakers**, **Peter Goodfellow** and **Robin Lovell-Badge**, and **Peter Gruss** in 1995, **Björn Dahlbäck**, **Ulrich Laemmli** and **Nigel Unwin** in 1996.

The following general points should be noted:

1. The Prize is intended for researchers working in European countries, members of the Council of Europe. The candidates need not, however, be themselves nationals of any of these countries.
2. Applications must be submitted, confidentially, on the official forms only. These are obtainable from:

   The Secretary of the Science Committee
   The Louis-Jeantet Foundation for medicine
   P.O. Box 277
   CH – 1211 GENEVA 17
   Switzerland

   Further information will be sent with the nomination form.
3. The deadline for applications is February 15, 1996.

The name(s) of the winner(s) of the 1997 Louis-Jeantet Prize for medicine will be announced in January 1997. The Prize Ceremony will take place in Geneva (Switzerland) in April 1997.

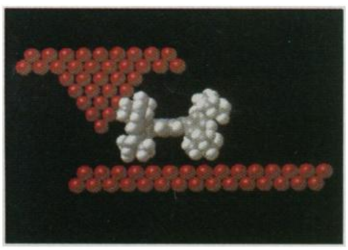
edited by PHIL SZUROMI

Designed to second order

A number of inorganic and organic optical materials can be used to double the frequency of incident light. In these materials, the crystal or molecular structure is asymmetric, and thus electrons set up polarization waves, in response to the incident light, that oscillate at higher harmonics. Rosencher *et al.* (p. 168) review another approach to creating asymmetric potentials. Heterojunction quantum wells can be constructed by semiconductor epitaxy techniques in such a way that the wells are asymmetric. These structures can create large nonlinearities and may allow the creation of new optical devices.

Pushed into place

Molecules have been arranged into patterns on a metal surface with a scanning tunneling microscope at room temperature. Jung *et al.* (p. 181) attached bulky hydrocarbon groups to a flat aromatic core that stabilizes the molecule against thermal diffusion. The interactions are still weak enough that the tip can push the molecule and translate it in a controlled fashion.



Sustaining a height

Like a ship or iceberg floating by displacing water, many of Earth's mountain ranges seem to be supported by a root of crustal material that extends into the mantle. Wernicke *et al.* (p. 190) report recent geophysical and geochemical data that imply that the southern Sierra Nevada of California lack such a root of thick crust. The data indicate that the high elevations are supported by density variations in the mantle and suggest that the range may have been subsiding over the last several million years.

Ancient waterways

A key step in the evolution of terrestrial plants and angiosperms was the development of vessels, which are perforated cells that facilitate conduction of water through the plant. Li *et al.* (p. 188) report the discovery of fossil vessels dating from the Late Permian, about 260 million years ago, predating the origin of angiosperms by many millions of years. The fossil stems are similar to those in vines, and may be from Gigantopteridales, a group of Permian plants with large leaves.

Thymic ligand

T cell precursors originate in the bone marrow before moving to the thymus. There, as thymocytes, they divide, mature, and undergo selection. The exiting thymocytes are "single-positive" (that is, either $CD4^+$ or $CD8^+$) T cells. A critical—but poorly understood—early intrathymic event is the differentiation of "double-negative" ($CD4^-CD8^-$) to "double-positive" ($CD4^+CD8^+$) thymocytes. Boismenu *et al.* (p. 198) show that CD81, a molecule expressed in the outer cortex of fetal thymus, is required for the generation of double-positive thymocytes. Similarities between the developmental effects promoted by CD81 and the pre–T cell receptor (pre-TCR) hint that CD81 is the ligand for the pre-TCR.

Feast or famine

When yeast are starved of phosphate, the PHO4 transcription factor induces transcription of PHO5, a secreted acid phosphatase. The transcription of PHO5 is repressed when yeast are grown in phosphate-rich medium. O'Neill *et al.* (p. 209) examined the regulation of PHO4 activity and found that the cellular localization of PHO4 is regulated. PHO4 is nuclear when yeast are phosphate-starved and cytoplasmic when yeast are grown in phosphate-rich medium. PHO4 localization depends on phosphorylation by the PHO80/PHO85 cyclin-CDK kinase complex.

The shape of Mars

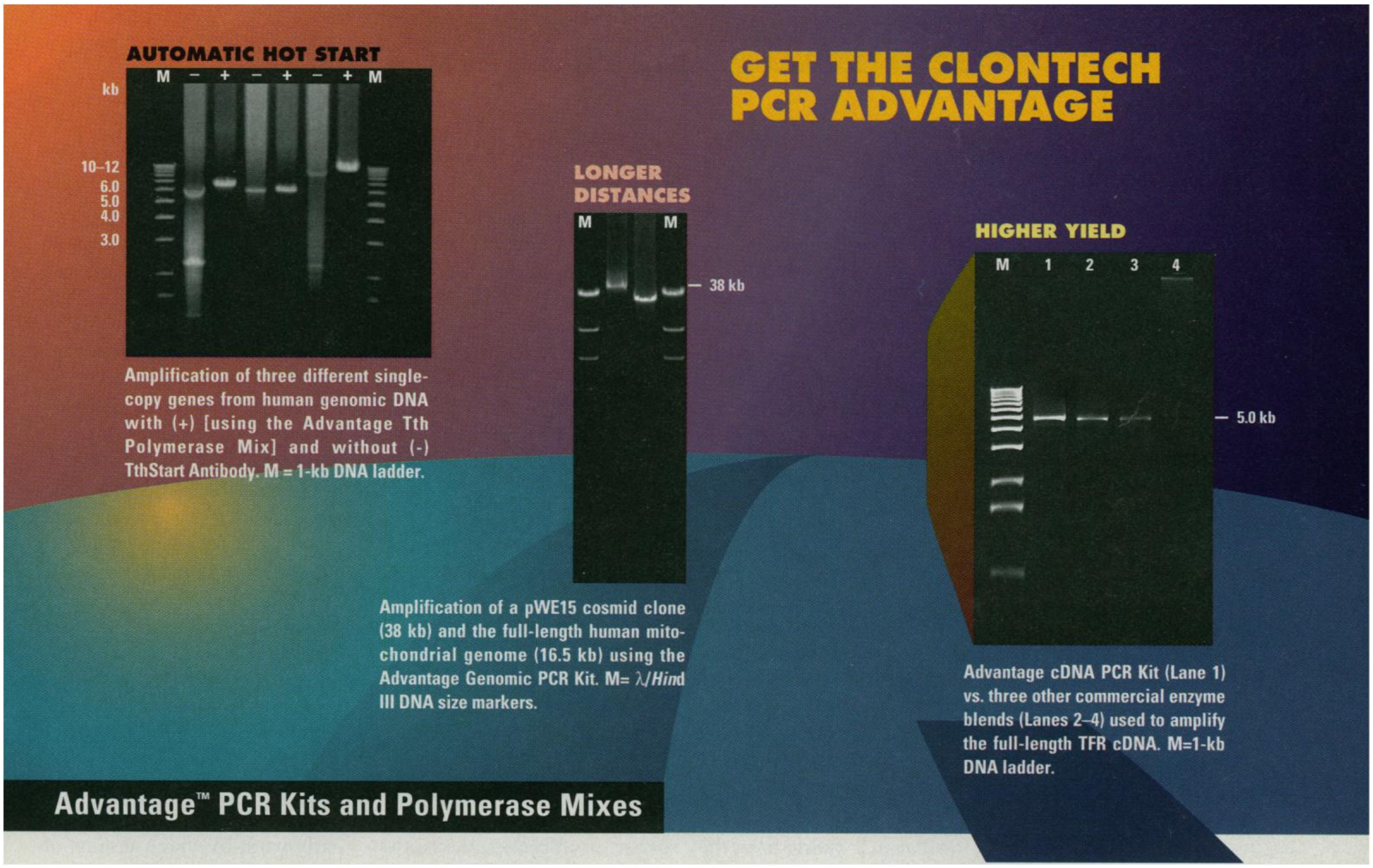
Why does the surface of Mars appear to be different in the northern hemisphere where the terrain is younger, less heavily cratered, and overall has a lower elevation than the southern hemisphere? Possible explanations include a large northern hemisphere impact that produced a partial magma ocean or internal mantle processes. Smith and Zuber (p. 184; see cover) reanalyzed occultation data and combined these results with more recent Earth-based radar measurements to conclude that the observed, broad, hemispheric topography variation is due to a 3-kilometer offset between the center of mass and center of figure of Mars.

Sleep circuitry

Falling asleep seems so easy at times and so hard at others, yet the underlying neuronal mechanisms have not been elucidated, nor is the neuronal circuitry well described. Sherin *et al.* (p. 216) identified a group of cells located in the ventrolateral preoptic (VLPO) region of the rat hypothalamus. These cells were active in proportion to the amount of sleep enjoyed, and this relation could be dissociated from the circadian light-dark cycle. Furthermore, these cells project to a region of the posterior hypothalamus that is known to be involved in wakefulness, suggesting that the VLPO cells, when activated, may inhibit arousal-promoting neurons. These findings explain early work in which lesions of the VLPO region produced insomnia and also helped to delineate the circuitry responsible for sleep.

Malaria detox

For part of its life cycle, the malaria parasite exists within red blood cells. To survive, it must detoxify heme, which it does by polymerizing it to form hemozoin, an insoluble crystal. Once begun, polymerization proceeds spontaneously, but what initiates the process? One possibility, raised by Sullivan *et al.* (p. 219), is that histidine-rich proteins (HRPs) are responsible. Purified and recombinant HRPII and recombinant HRPIII possess heme polymerase activity; furthermore, HRPII and IV have been localized to the digestive vacuole. Although HRPs may be attractive new candidates for therapeutic intervention, the parasite may have additional detoxification strategies, as essential functions are notoriously redundant.



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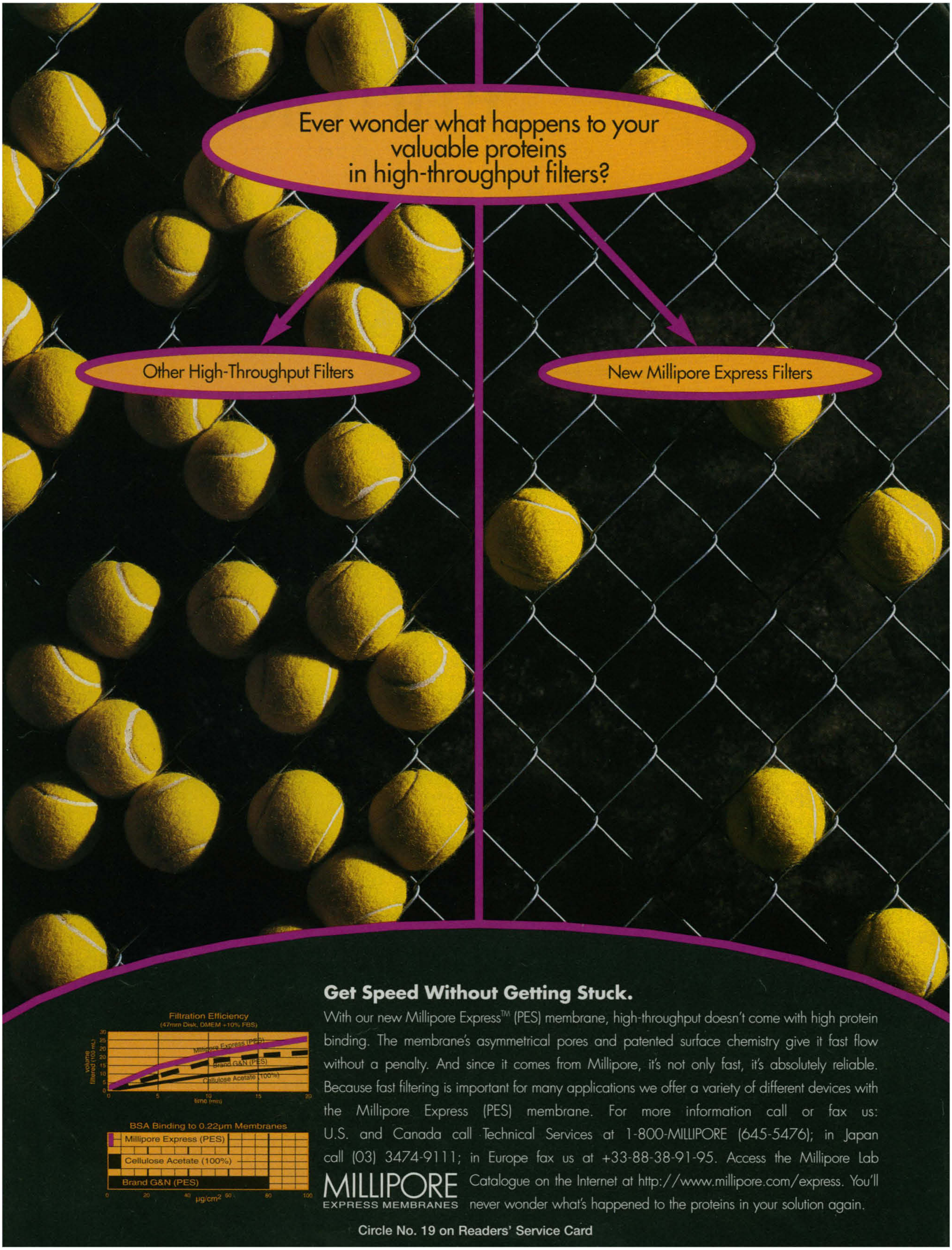

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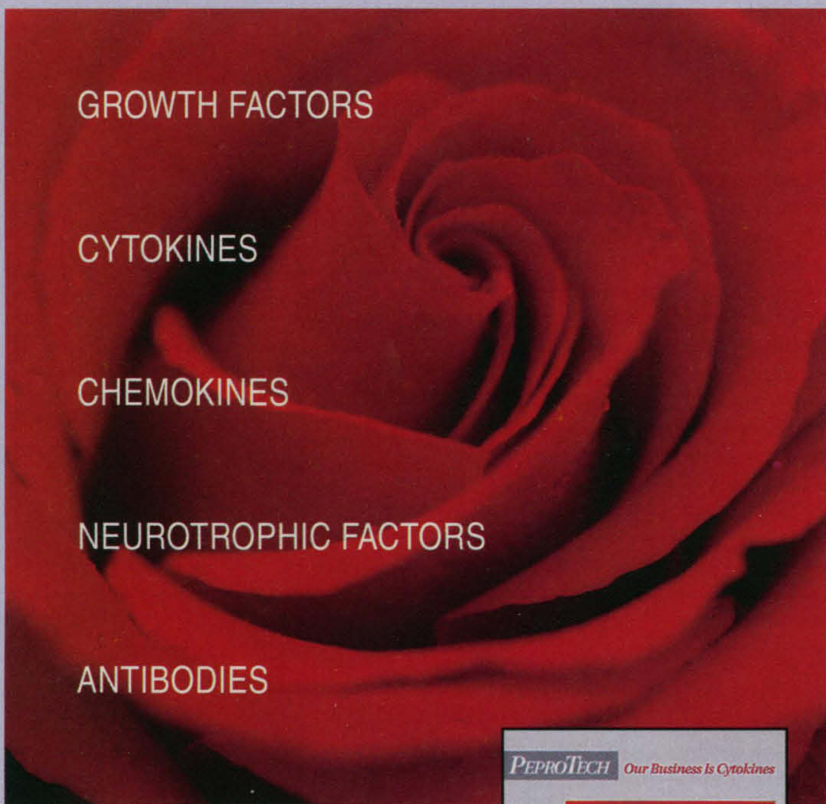

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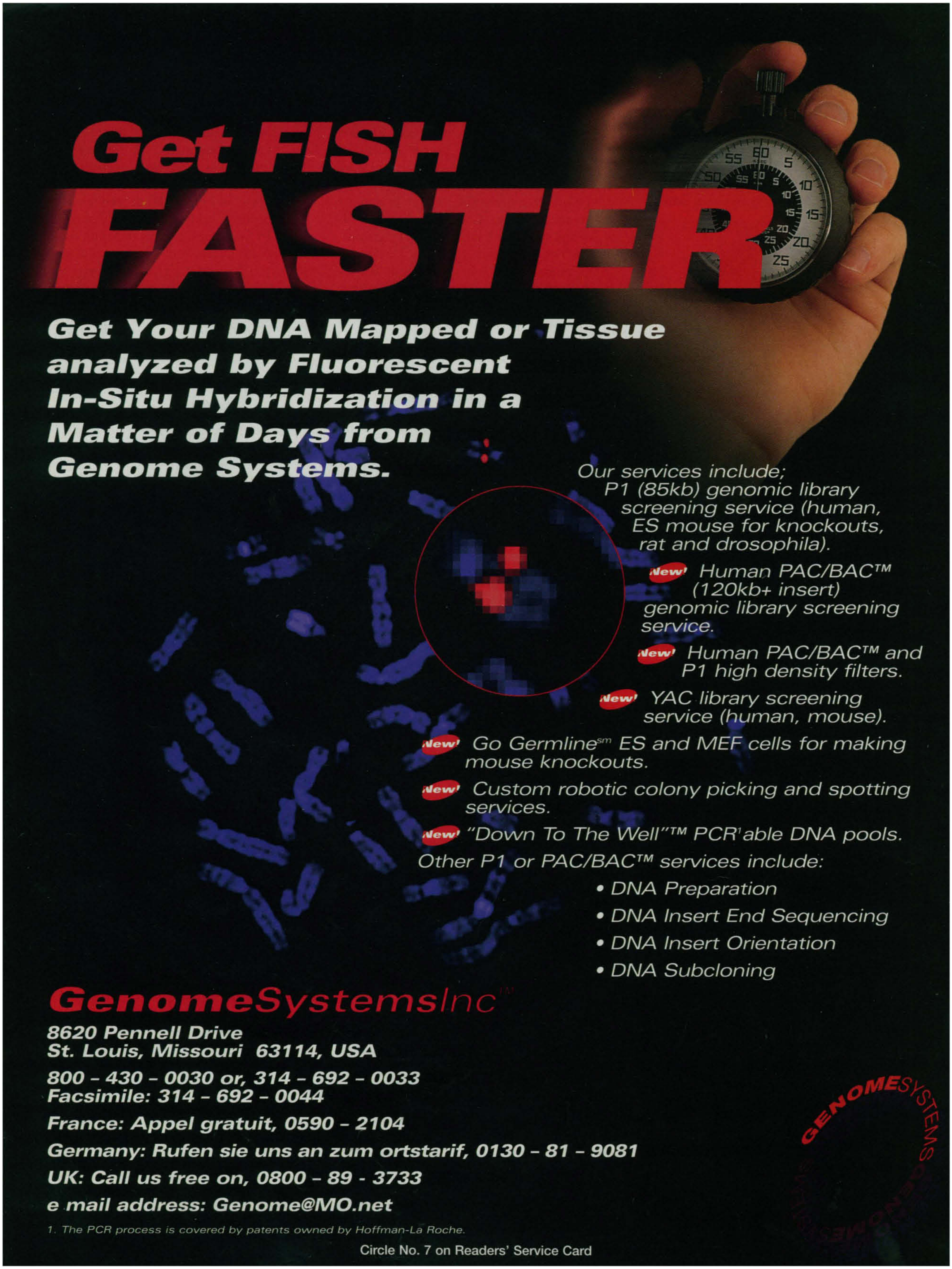
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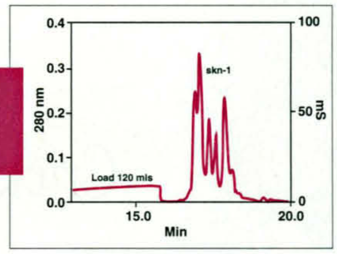

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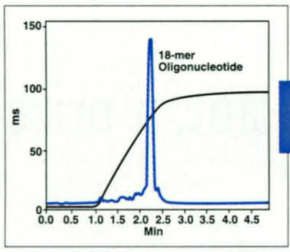

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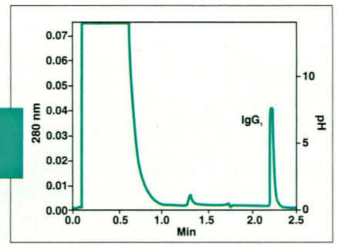

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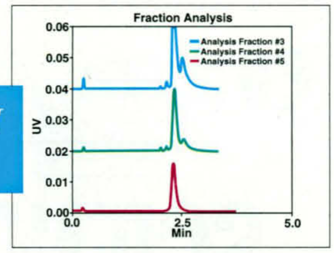

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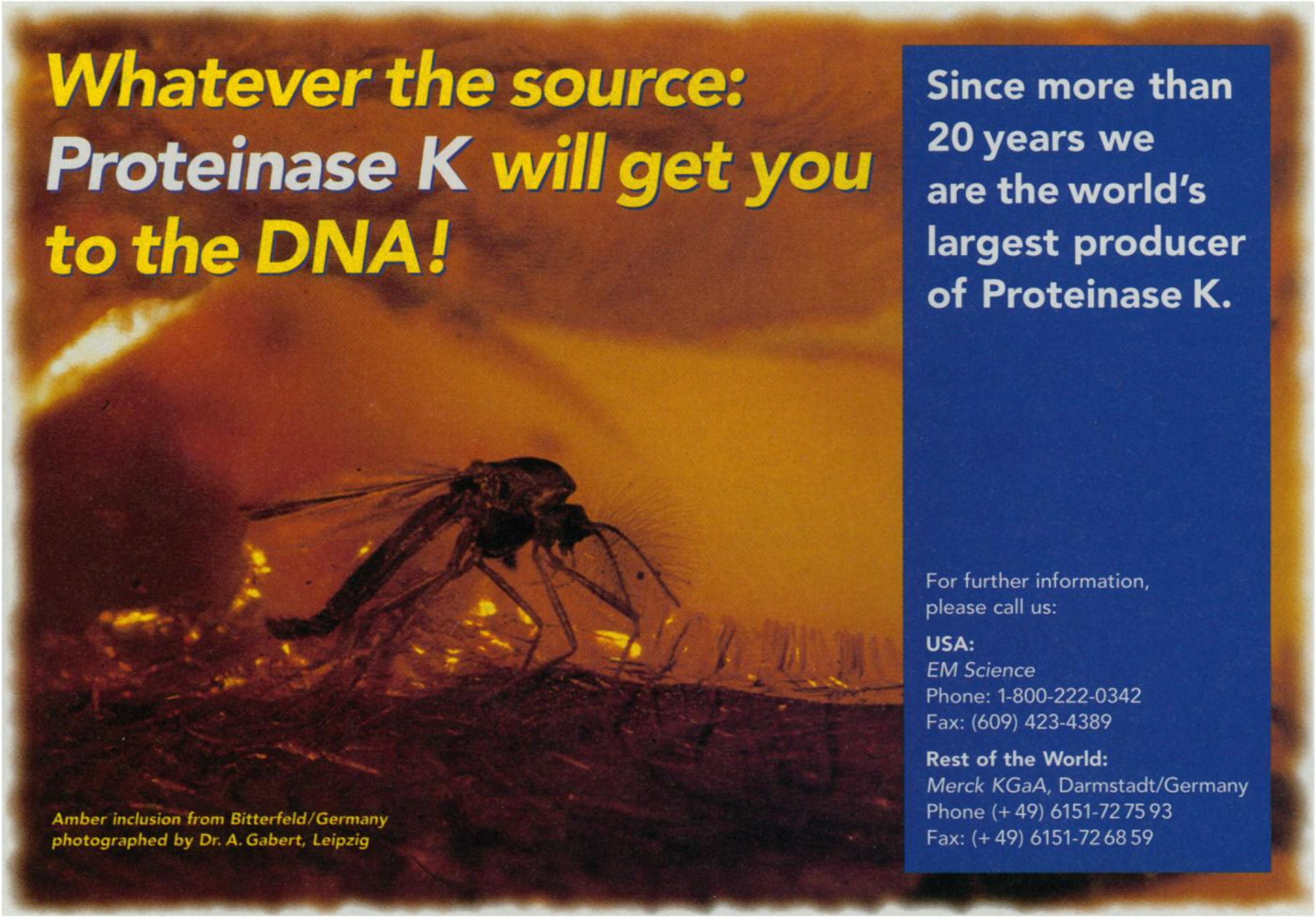

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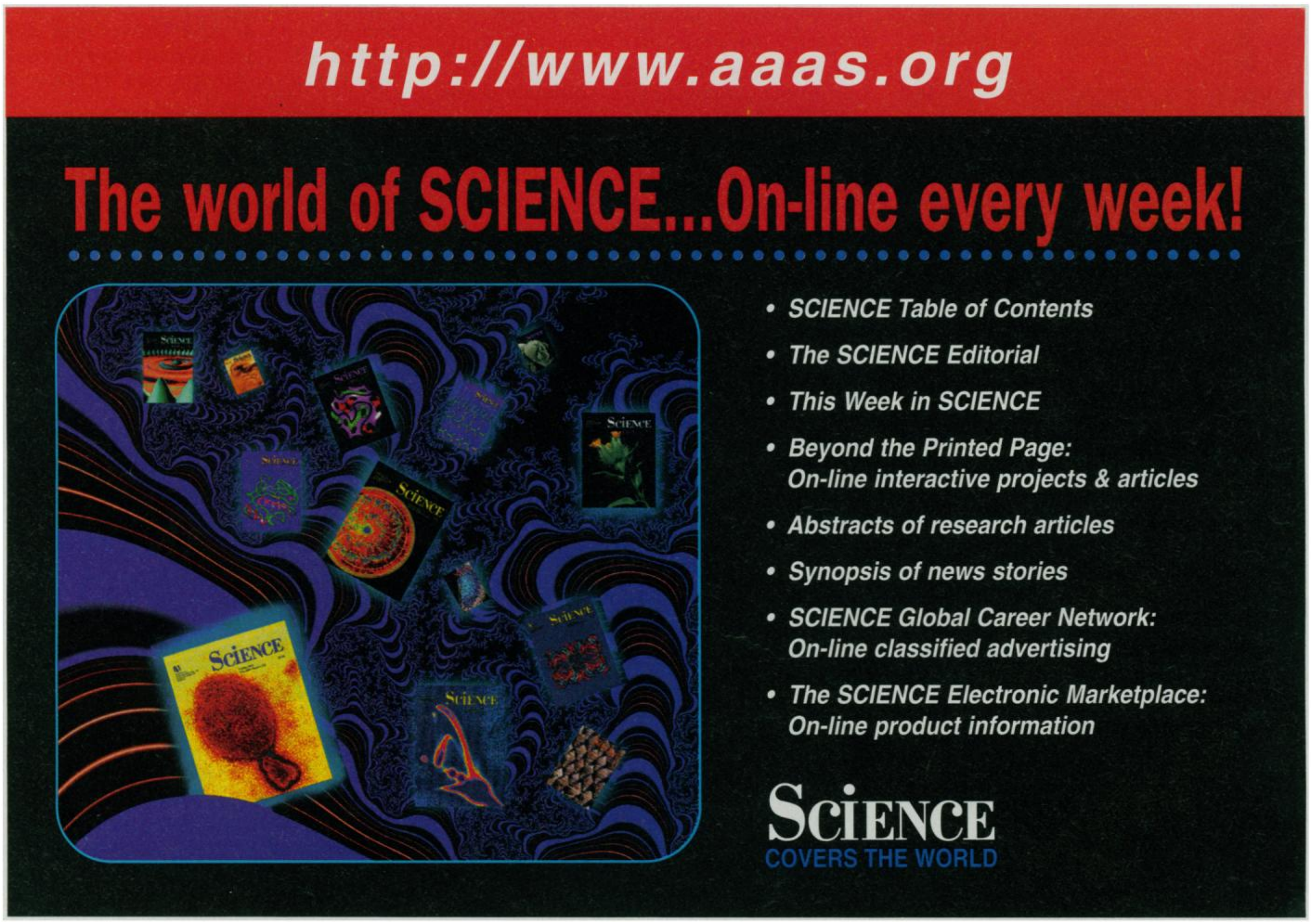

livorous abilities. A related aspect of colobine diet that caught the attention of early workers was their ability to detoxify plant poisons, strychnine in particular. McCann (1928) quoted Blanford as stating that langurs eat the fruits and leaves of the tree *Nux vomica*, from which that poison is extracted, and that substantial amounts of strychnine can be given to langurs without effect, while the same dose will kill a macaque. *Colobine Monkeys* is a collection of papers that touches on some of the same issues as these early reports by emphasizing the central importance of diet and feeding behavior for understanding colobine ecology. The book is not one-dimensional, however, and touches on many other aspects of the paleontology, anatomy, geographical distribution, and social behavior of colobines. The novel conclusion is that we must no longer look upon colobines as simply leaf-eaters: there must also be seeds.

Introductory chapters place colobines in a systematic and historical context. Delson surveys the evolutionary history of colobine monkeys and outlines adaptive scenarios to explain the origin of some of their distinctive anatomical features, especially the "bilophodont" tooth pattern. He reminds us of the interesting contrast between cercopithecoid and hominoid species richness: in the early Miocene of Africa hominoids were far more common and diverse than cercopithecoids, whereas the reverse is the case today. Delson favors an ecological explanation for this contrast according to which early cercopithecoids were adapted to more open environments than hominoids. With a shift in the middle Miocene to a preponderance of such habitats these monkeys diversified into the modern subfamilies. This in turn facilitated a migration out of Africa to Europe and Asia in the late Miocene (8 to 5 million years ago) when open environments prevailed.

There follow several well-organized and informative accounts of the taxonomy, distribution, and socioecology of all the living species of colobines by Oates, Bennett, and Davies. These authors emphasize that colobines are not just leaf-eaters; seeds are identified as another major food source, a point that is revisited in several papers on colobine anatomy and physiology.

The distinctive bilophodont molar structure of colobines is described by Lucas and Teaford. They make a useful contribution to understanding how bilophodont teeth work and argue that the physical properties of seed coats may explain the structural design of colobine teeth just as well as adaptations for folivory.

Chivers also takes up the seed-eating theme. He notes that while digestion of structural carbohydrates in leaves is importantly linked to the complex stomach morphology of colobines, there is still a great degree of variation in this morphology that must be accounted for. Chivers sees seed-eating as a crucial link in the evolutionary transition from frugivory to folivory and the specialized gut tube that goes with it. Seeds are protected by a seed coat, which, once digested, yields a rich source of nutrients. Perhaps the enlarged, specialized foregut of colobines evolved initially as a fermentation chamber to assist the digestion of seed coats; once developed, the expanded foregut was further modified for the digestion of leaves in many colobines.


The red-shanked douc (*Pygathrix nemaeus nemaeus*). [From Oates, Davies, and Delson's chapter in Colobine Monkeys; photograph by Noel Rowe]

Interesting chapters by Kay (not this reviewer), and Davies and by Waterman and Kool bring us up to date on colobine digestive physiology and food selection in relation to plant chemistry. These authors review the factors that influence colobines' ability to digest complex carbohydrates and detoxify secondary compounds. Several such factors are body size, nutrient quality, metabolic rate, food passage time, and daily activity budgets. What is surprising here is how little we know about the digestive physiology of colobines *per se* and how much we must infer from the physiology of ruminants. This work does not strongly support the seed hypothesis and raises the possibility that foregut fermentation was selected as a means to detoxify plant parts.

Davies rounds out the volume by arguing that food supply is what limits the size of colobine populations, but he recognizes that this is far from a complete story.

So, we are left with the sense that colobine ecology is driven by a specialized diet but that seed-eating, not just leaf-eating, is a very important component of the story. This well-integrated set of papers that demonstrates how far we have traveled toward understanding the interactions among diet, anatomy, demographics, and social behavior. One regrettable aspect of the book is the absence of data on ontogeny, positional behavior and its anatomical correlates, or brain evolution. Why do colobines have such small brains for their body sizes compared with cercopithecines? Is it a structural limitation of the folivorous diet, as has sometimes been proposed? If not, what other factors come into play?

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Vignettes: Meanings

A common definition of a weed as "a plant out of place" is rather naive and ignores some of the main features of what makes a weed, a weed. In the first place, who is to judge if a plant is out of place? This is a matter of opinion or prejudice; as a matter of fact, many weeds are so much in place that they cost us dearly in control measures. How can a plant so well-adapted to human-made habitats be out of place? These habitats are its place. Weeds are organisms adapted to human disturbance and the definition need not be confined to plants. There are weedy animals too. Consider the house sparrow, starling, pigeon, house mouse, sewer rat, *Drosophila*, house fly, etc. And while we are about it, what about *Homo sapiens*?

—*Jack R. Harlan*, in *The Living Fields: Our Agricultural Heritage* (Cambridge University Press)

Among the set of meanings we've attached to the natural world, perhaps the most overarching and powerful is that nature is *not* a shifting set of human meanings. It's tangible, secure, rocklike, stable, self-evident, definable, real. In a word, it's natural.

—*Jennifer Price*, in *Uncommon Ground: Toward Reinventing Nature* (William Cronon, Ed.; Norton)