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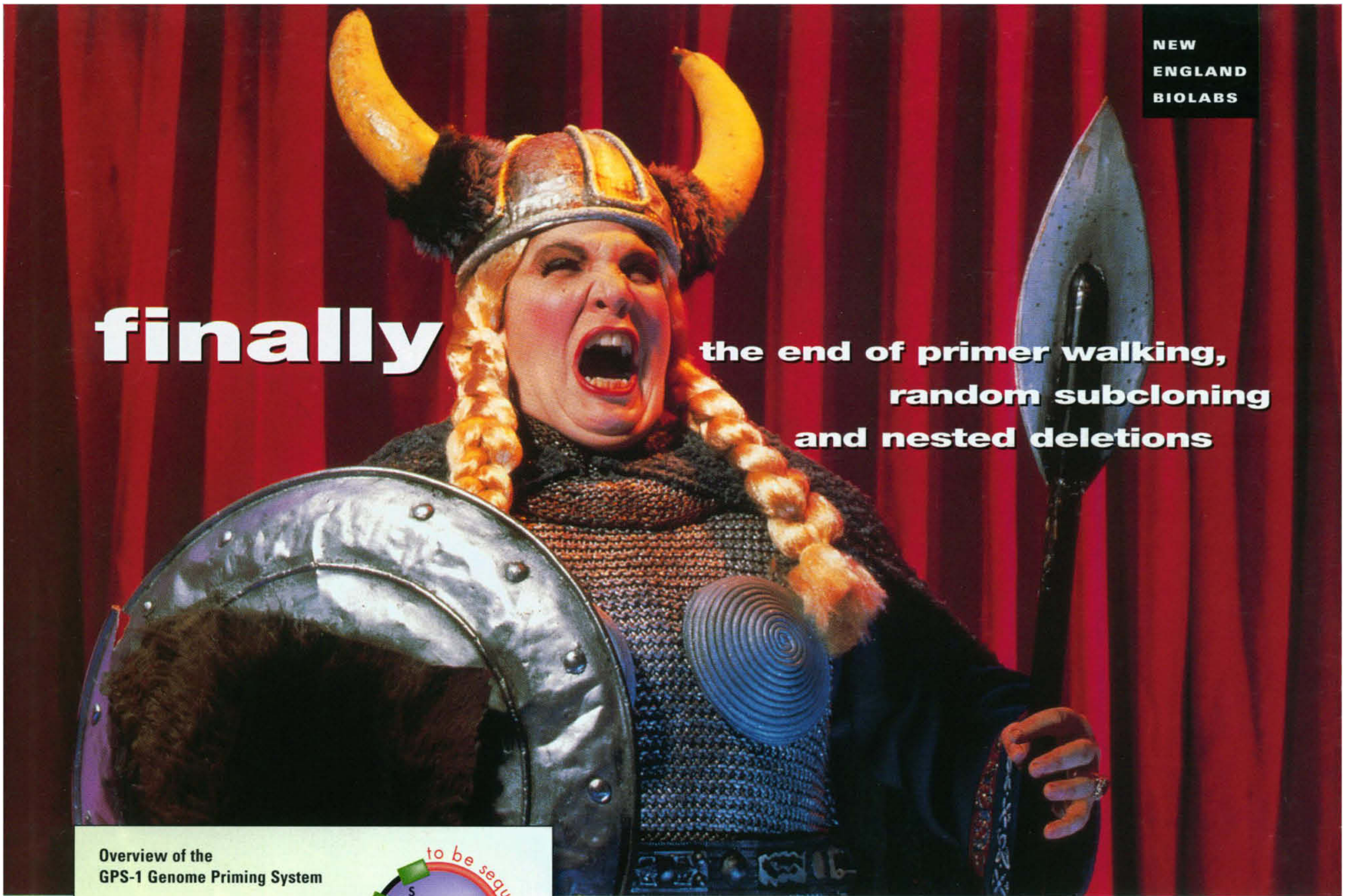

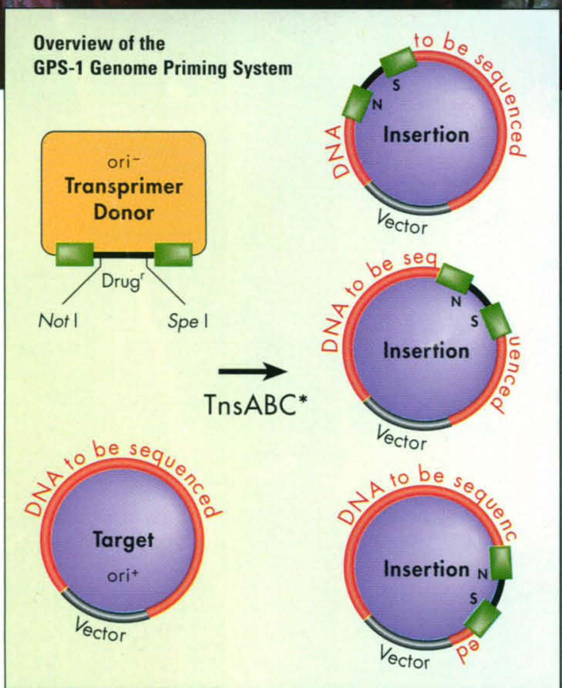

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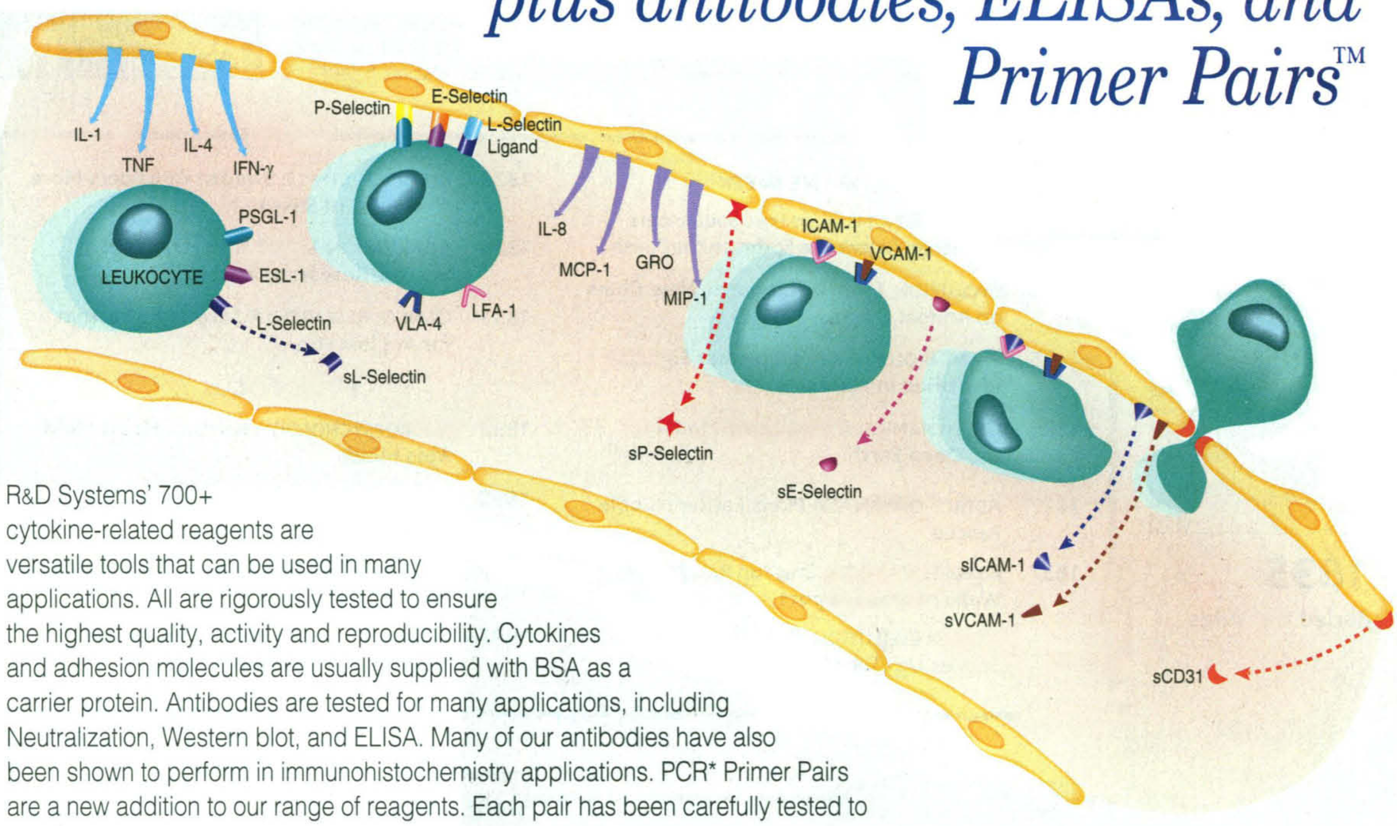

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ADHESION MOLECULES	Human ELISA	Recombinant human protein	Anti-human polyclonal antibody	Anti-human monoclonal antibody	PCR Primer Pairs
sICAM-1	✔	✔	✔	✔	✔
sVCAM-1	✔	✔	✔	✔	✔
sE-Selectin	✔	✔	✔	✔	✔
sL-Selectin	✔	✔		✔	✔
sP-Selectin	✔	✔		✔	✔
sCD31 (PECAM-1)	✔	✔		✔	

CYTOKINES	Human ELISA	Recombinant human protein	Anti-human polyclonal antibody	Anti-human monoclonal antibody	PCR Primer Pairs
IFN-γ	✔	✔	✔	✔	✔
IL-1α	✔	✔	✔		✔
IL-1β	✔	✔	✔	✔	✔
IL-4	✔	✔	✔	✔	
IL-8	✔	✔	✔	✔	✔
MCP-1	✔	✔	✔	✔	✔
MIP-1α	✔	✔	✔	✔	
MIP-1β	✔	✔	✔	✔	
TNF-α	✔	✔	✔	✔	✔

*PCR is covered by US Patent Nos 4683195 and 4683202 assigned to Hoffmann-LaRoche

VOLUME 283 19 MARCH 1999 NUMBER 5409

Science

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COVER Molecular data indicate that acoel flatworms are not an order of the phylum Platyhelminthes, as previously thought, but are members of the earliest divergent Bilateria (hence an early evolutionary branch of triploblastic Metazoa). Acoels are characteristic in their lack of anatomical features, and few are as attractive as these, as yet unclassified, specimens (~6 mm long) found on coral at Ngerdwais, a coastal lagoon reef in Palau. [Image: Coral Reef Research Foundation, Palau]

1835
Buried treasures

NEWS

NEWS OF THE WEEK

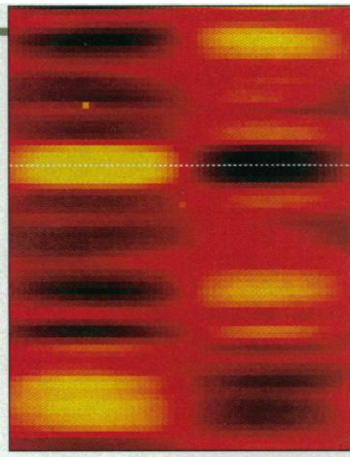
NEWS FOCUS

DEPARTMENTS

RESEARCH

RESEARCH ARTICLE

REPORTS



1905
Pumping electrons in mesoscopic systems

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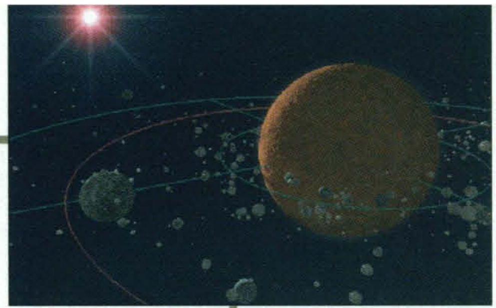

1861

Creation of the moon

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1911

Signals for developmental fate

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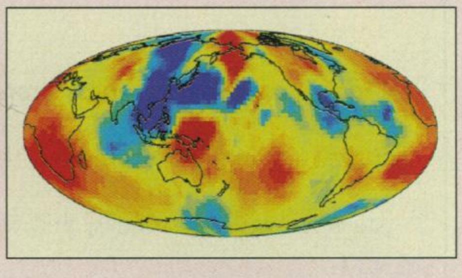
A SINKING SLAB OF CRUST?

Global tomographic models have revealed velocity anomalies in the mantle that may represent remnants of subducted slabs. Kaneshima and Helffrich (p. 1888) used short-period seismic waves to image a small-scale, low-velocity layer in the lower mantle beneath the Mariana and Izu-Bonin subduction zones in the Western Pacific. The authors suggest that this small, previously undetected dipping layer [about 500 kilometer (km) by 300 km in extent but only 8 km thick] is an undeformed fragment of oceanic crust that was subducted about 170 million years ago along the paleo-Indonesian subduction zone. This interpretation implies that mantle mixing was too weak to destroy this small, isolated slab remnant.

A DEEPER MANTLE BOUNDARY?

Geochemical data have implied that Earth's mantle is layered, with the boundary between an upper and a lower convective system marked by a change in seismic velocities at a depth of 660 kilometers. However, recent geophysical observations seem to show that subducted ocean crust penetrated this boundary and extended to much greater depths (see the news story by Kerr). Van der Hilst and Kárason (p. 1885) show that recent tomographic models imply that the seismic structure of the mantle changes at a much greater depth of 1600 kilometers. Kellogg *et al.* (p. 1881) present results from a series of models to argue that this depth may mark the convective boundary in the mantle.



CHAOS IN THE OUTER SOLAR SYSTEM

Previous numerical simulations have showed that orbits could be chaotic for bodies in the outer solar system, but the mechanism for producing chaos was not determined and it was also possible that the simulated chaos was a numerical artifact. Murray and Holman (p. 1877) derived an analytical solution to the problem and showed in numerical simulations that chaos in the outer solar system can be caused by interactions between the orbits of Jupiter, Saturn, and Uranus or of Saturn, Uranus, and Neptune. The simulated chaotic zones are very narrow, so there is about a 20% chance that the jovian planets are currently in a chaotic zone.

MOLECULAR CHAINS

Dipolar molecules might be expected to align and form chains if dipole-dipole interactions dominate. However, other forces, such as van der Waals forces, would favor the formation of more compact structures. Nauta and Miller (p. 1895) show that when the strongly dipolar hydrogen cyanide molecules self-assemble inside cold, superfluid liquid helium droplets, linear chains of up to eight molecules form. In the gas phase, such clusters are known to form more compact cyclical structures. It is unlikely that the weak interactions with the superfluid helium "solvent" change the relative stabilities of the structures significantly. Rather, the formation of structures that do not represent the global energy minimum is attributed to their assembly mechanism, which is strongly influenced by the dipole-dipole interactions.

AN ELECTRON HEART

A bias voltage is generally used to create electron currents in devices. Switkes *et al.* (p. 1905; see the Perspective by Altshuler and Glazman) abandon this usual method of bias-driven electron flow and report on a mechanism in which the electrons are pumped between two electron reservoirs by means of a periodic asymmetric deformation of an intervening quantum dot. In this system, the flow of electrons is not quantized but depends on the magnitude and frequency of the deformation.

AN INSULATOR FOR GALLIUM ARSENIDE

Gallium arsenide (GaAs) has several properties that make it superior for optoelectronics compared to silicon (Si), including higher charge carrier mobilities and a wider, direct band gap that allows high-temperature operation. However, GaAs-based devices are less commonly used than their Si counterparts because of the notorious difficulties in fabricating defect-free insulating oxide barriers on GaAs. Hong *et al.* (p. 1897) describe the successful growth by molecular beam epitaxy of a thin (~15 angstroms) gadolinium-based oxide on GaAs that has a low density of interface states, exhibits low leakage currents across the interface, and is stable against surface stress.

LESS ASSEMBLY REQUIRED

The familiar liquid-crystal displays of laptop computers are often the costliest component because of the numerous steps associated with their fabrication. Vorflusev and Kumar (p. 1903) show that some steps could be eliminated by preparing liquid-crystal films through phase separation in a polymer–liquid-crystal mixture induced by ultraviolet illumination. In particular, the alignment of the liquid crystal can be achieved with a single substrate, whereas two are usually required. In addition, the resulting cells switched their display state faster than conventional cells and exhibited a gradation in their optical response.

FORMING YOUNG MINDS

The formation of appropriate connections between neurons in the brain, for example, in the visual cortex, is influenced by a blend of nature (molecular specifications of neighbors) and nurture (incoming visual input after birth), but what of the connections between areas of the brain? Paus *et al.* (p. 1908) present structural magnetic resonance imaging data from a sample of 111 children, ages 4 to 17, and describe age-related changes in interareal fiber tracts, which were assessed as increases in white matter density. Maturation of the fronto-temporal pathway was significantly greater in the left hemisphere than in the right, a result consistent with the maturation of brain areas involved in language.

PEPTIDES PATTERN FLOWERS

The pattern of petals in a flower, and even the pattern of flowers in a cluster, is determined by the development of the shoot meristems. In the plant *Arabidopsis*, the *CLAVATA1* gene, which encodes a receptor-like molecule, and the *CLAVATA3* gene are both expressed during development of the meristem but in different layers of cells. Fletcher *et al.* (p. 1911; see the news story by Barinaga) show that the *CLAVATA3* gene encodes a

CONTINUED ON PAGE 1815

CONTINUED FROM PAGE 1813

small protein that may serve as a messenger between cells, perhaps signaling to the *CLAVATA1* protein found in neighboring cells. Thus, a peptide signal may be critical to pattern formation of tissues derived from the meristem.

MHC MIMIC

How similar to a major histocompatibility complex (MHC) class I protein does a molecule have to be in order to look like one? Sánchez *et al.* (p. 1914) analyzed the crystal structure of ZAG, a protein that stimulates lipolysis in fat cells. Although only 30 to 40% identical in sequence, and unable to bind the class I light chain β_2-microglobulin or peptides, ZAG retains the same general tertiary structure, down to a pocket available for ligand binding. This finding illustrates the versatility of the basic structure and raises questions about the function and evolution of the ancestral protein.

BECOMING AN ANIMAL

The evolution of animals from protozoans involved several radical changes, including the formation of multicellular structures, the shift from radial to bilateral symmetry, and the development of digestive cavities. Ruiz-Trillo *et al.* (p. 1919; see the cover and the news story by Pennisi) have used molecular analyses to clarify the position of certain curiously primitive worms in this family tree. Previously thought to be secondarily simplified flatworms of the Platyhelminthes order, worms of the Acoela group are now seen to represent the earliest step in evolution of bilaterally symmetrical organisms.

SWITCHING PRION STATES

The human prion protein, implicated in neurodegenerative disorders, is found in a nonpathological soluble conformation rich in α-helix and in a pathological, fibrillar conformation rich in β sheet. Jackson *et al.* (p. 1935) have identified conditions in vitro that allow soluble human prion protein to switch between an α-helix rich conformation and a β sheet rich–conformation. The retention of the "pathological" conformation in solution may be important in understanding both the pathology and the biochemistry of this important protein.

DENDRITE AND NEURITE DYNAMICS

As a neuron develops, one of its neurites elongates to become the axon, and the others become dendrites. Bradke and Dotti (p. 1931) found that neurites that had growth cones with low levels of assembled actin were most likely to become axons, and that by locally breaking down the actin cytoskeleton in a dendrite, could be induced to form an axon. Subsequent electrical activity can change the morphology and topology of the remaining dendrites. Maletic-Savatic *et al.* (p. 1923; see the Perspective by Smith) present evidence from two-photon scanning imaging, which shows that, after brief periods of high-frequency synaptic stimulation, the dendrites of postsynaptic neurons start to grow new filopodia. This sprouting requires stimulation at high frequencies and can be antagonized by blocking *N*-methyl-D-aspartate receptors, which links this response to activity-dependent neuronal development and functional plasticity.

TECHNICAL COMMENT SUMMARIES

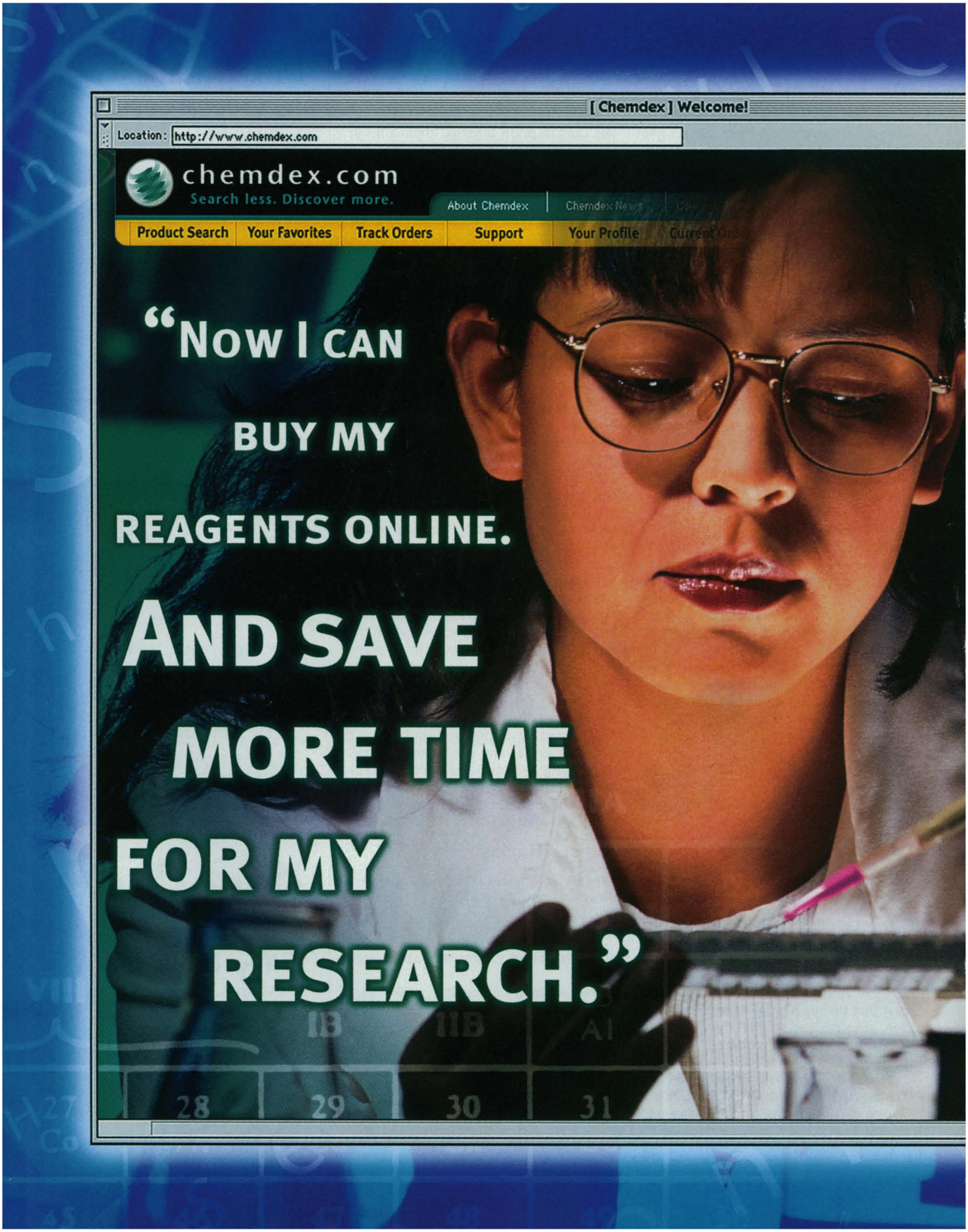
North American Carbon Sink

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/283/5409/1815a

S. Fan *et al.* (Reports, 16 Oct., p. 442) used "atmospheric and oceanic carbon dioxide data and models" to estimate "the spatial distribution of terrestrial carbon dioxide uptake." They concluded that North America "is the best constrained continent," with a large "carbon sink."

E. A. Holland and S. Brown comment that "direct estimates of forest C uptake" suggest that the report may have overestimated the magnitude of the sink. C. S. Potter and S. A. Klooster also studied the question using "newly derived terrestrial C fluxes" predicted from "forward modeling" simulations and arrived at "merely a transient C sink pattern in North America."

Fan *et al.* respond with an "intercomparison" between recent studies of C uptake. They state that, unlike their report, the comments "estimate terrestrial C uptake by invoking specific causes. The difference between [the various] estimates is the subject of intense research and may be resolved by a growing network of atmospheric and ecological observations."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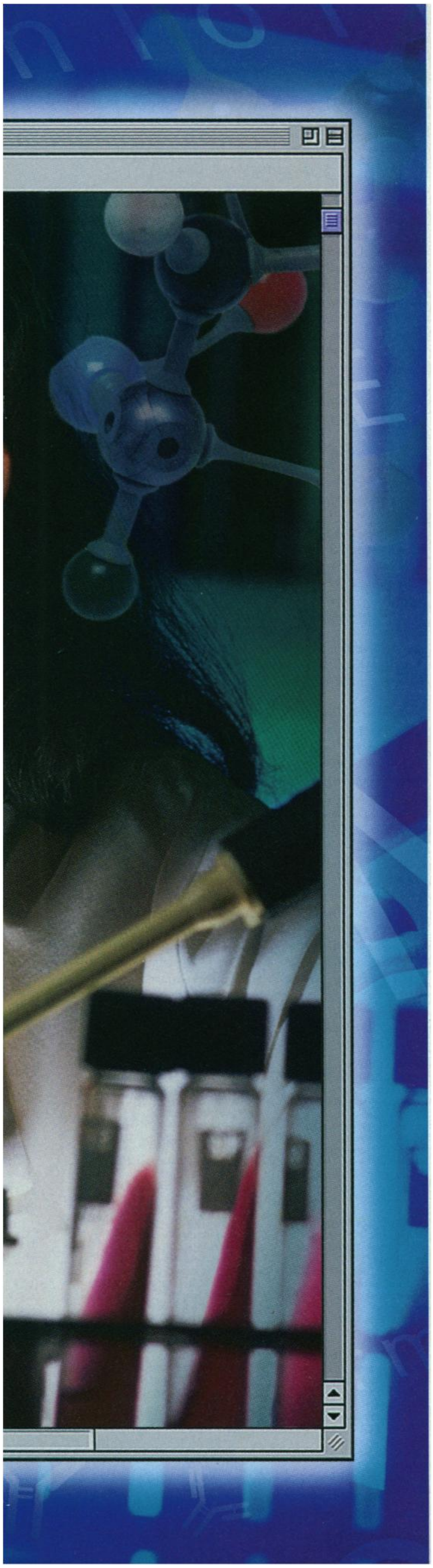

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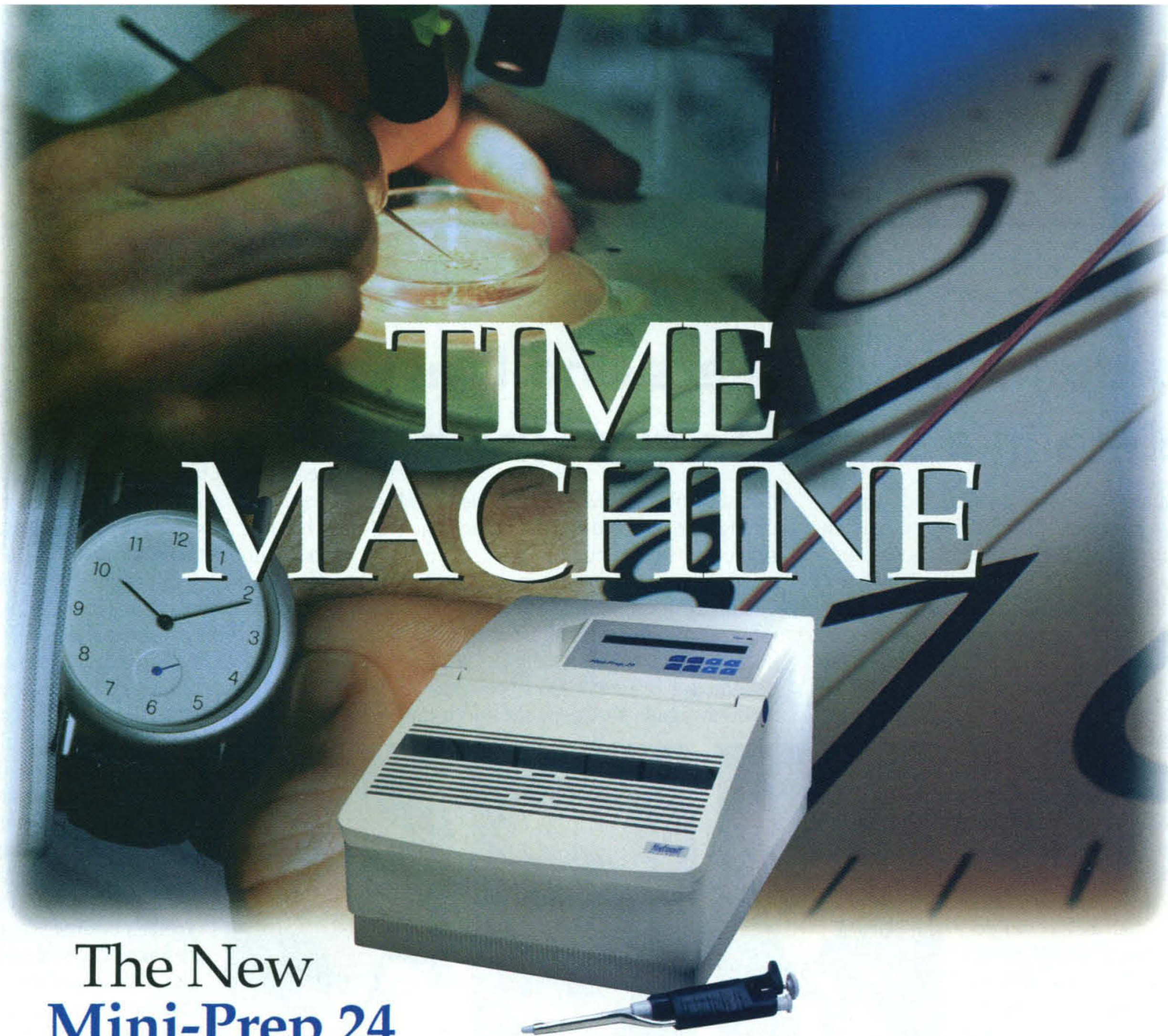
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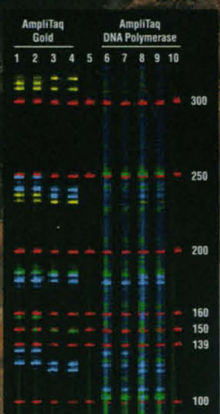
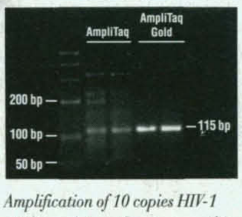


Co-amplification of 8 human STR loci. L1, 2: male control DNA; L3, 4: female control DNA; L5: AmpliTaq negative control; L6, 7: male control DNA; L8, 9: female control DNA; L10: negative control.



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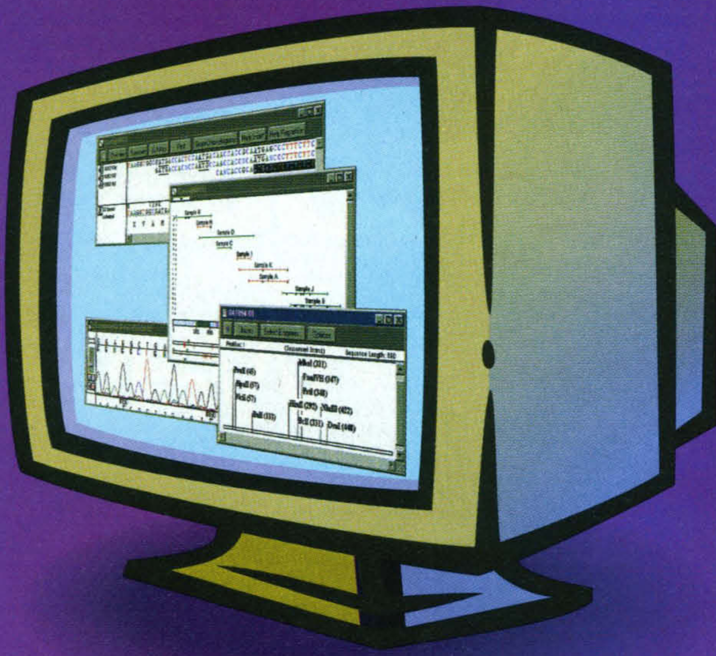

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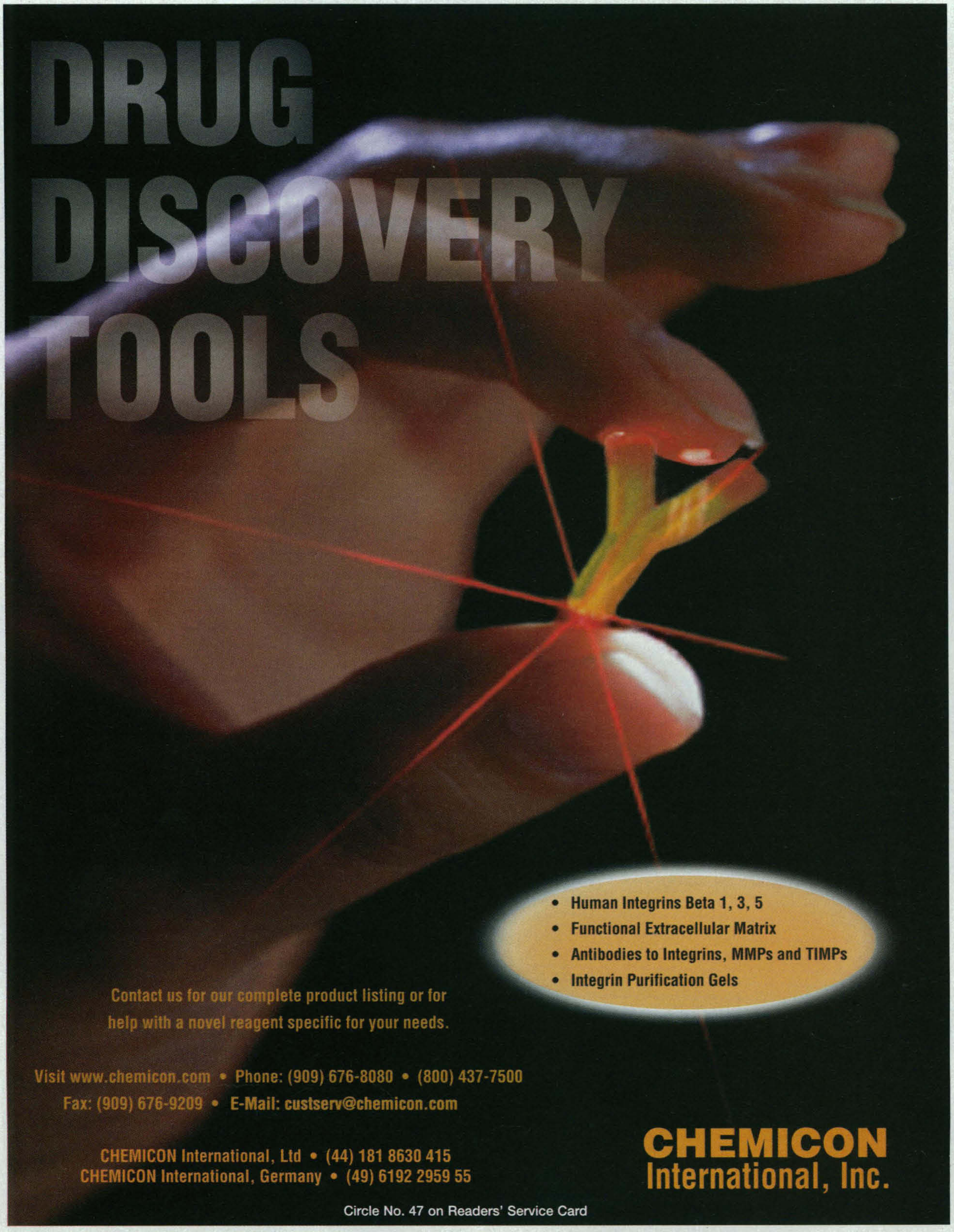
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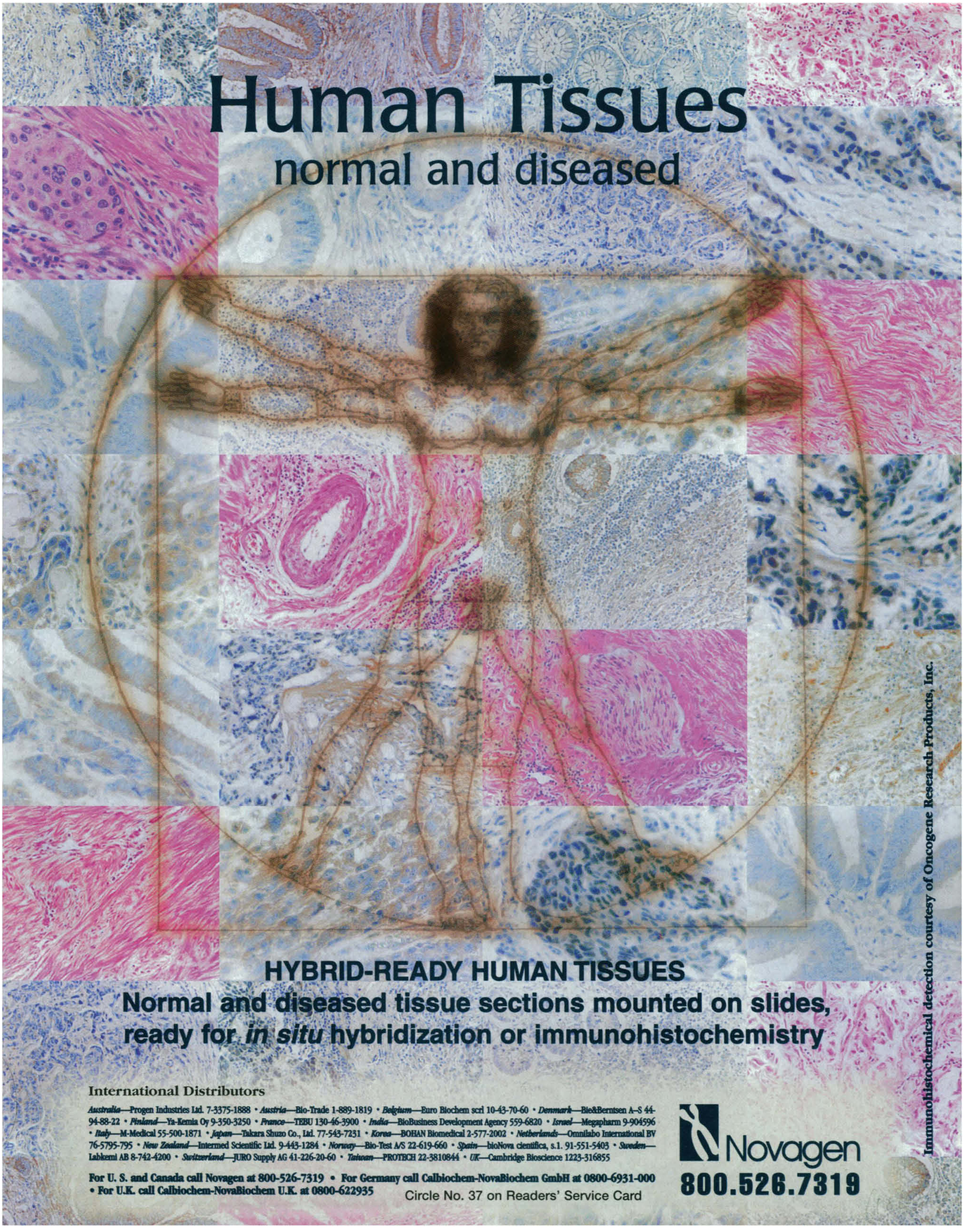


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