2 February 2001

Science

Vol. 291 No. 5505
Pages 777–932 $9

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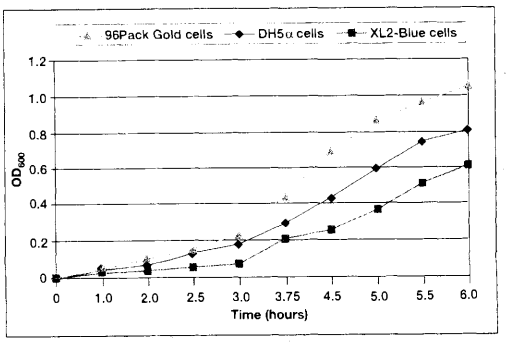

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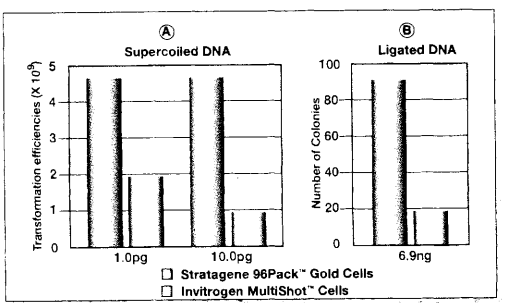

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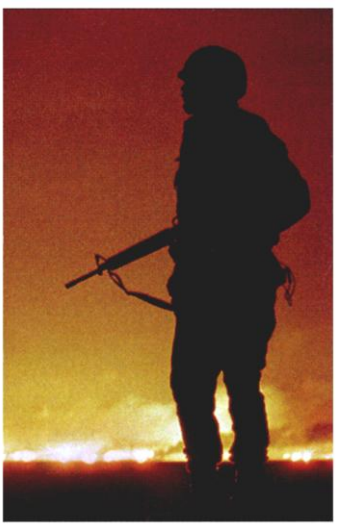

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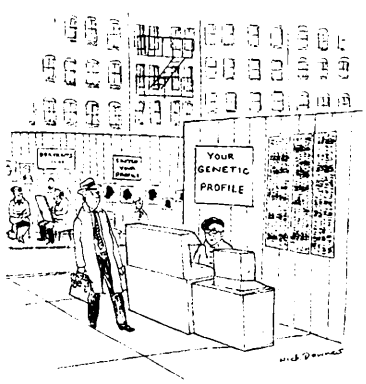

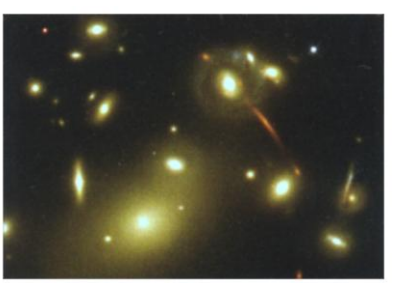

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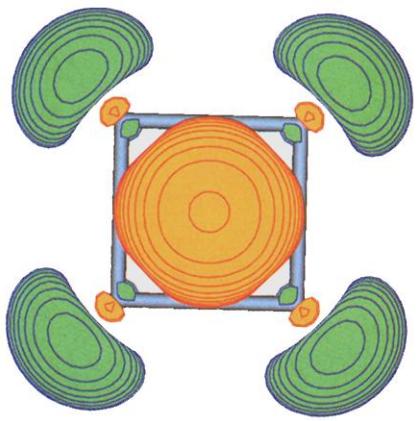
REPORTS



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Aromatic without carbon

COVER 878

Bakers' yeast forms a large floral structure called a mat (~7.5 centimeters in diameter), which is made up of millions of yeast cells. The cells form these multicellular structures with a reproducible pattern when grown on the surface of semi-solid media. A cell surface glycoprotein, Flo11p, is required for mat formation and adherence to plastic. [Photograph: F. Frankel]

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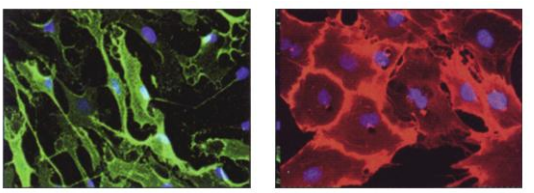
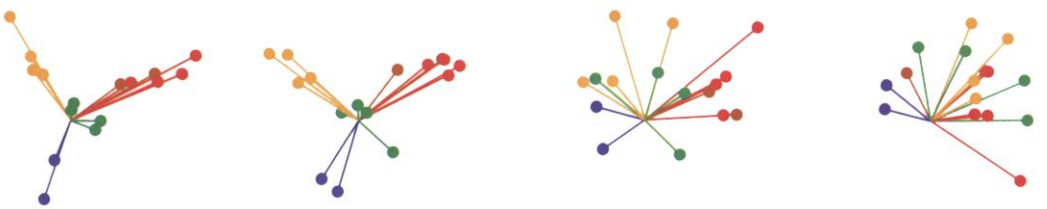
Immortal brain cells





889

Representation of smell in the brain

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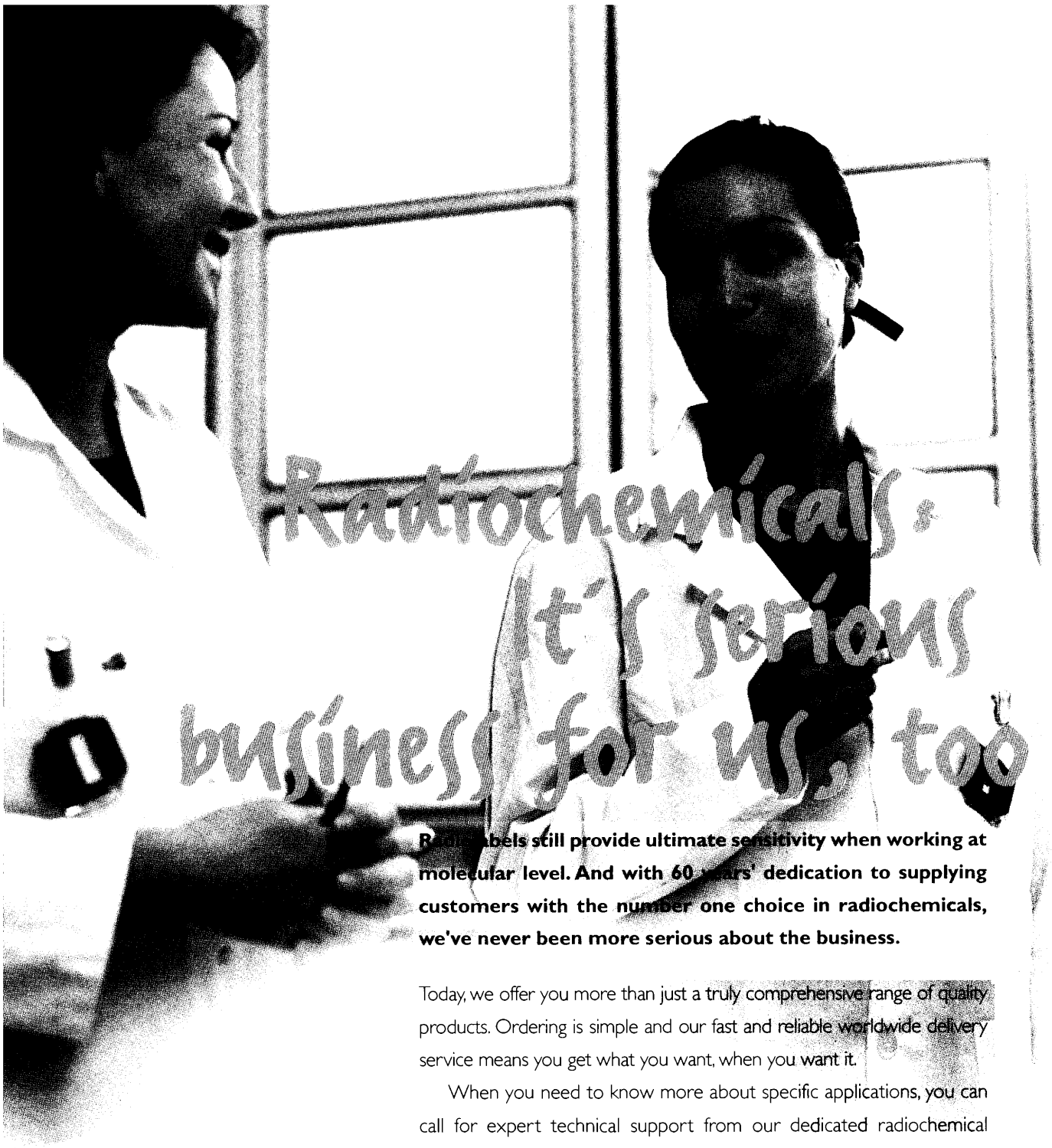
SCIENCE (ISSN 0036-8075) is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1200 New York Avenue, NW, Washington, DC 20005. Periodicals Mail postage (publication No. 484460) paid at Washington, DC, and additional mailing offices.

Domestic individual membership and subscription (51 issues): $115 ($64 allocated to subscription). Domestic institutional subscription (51 issues): $370; Foreign postage extra: Mexico, Caribbean (surface mail) $55; other countries (air assist delivery) $87. First class, air-mail, student, and emeritus rates on request. Canadian rates with GST available upon request, GST #1254 88122. Publications Mail Agreement Number 1069624. **Printed in the U.S.A.**

Change of address: allow 4 weeks, giving old and new addresses and 8-digit account number. **Postmaster:** Send change of address to *Science*, P.O. Box 1811, Danbury, CT 06813–1811. **Single copy sales:** $9.00 per issue prepaid includes surface postage; bulk rates on request.

Science is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.



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Automated Solid-Phase Synthesis of Oligosaccharides O. J. Plante, E. R. Palmacci, P. H. Seeberger

▼ 805 Carbohydrate synthesis, normally a manual process, has now been automated in a manner analogous to that for nucleic acids and peptides.

An Iron-Regulated Ferric Reductase Associated with the Absorption of Dietary Iron A. T. McKie *et al.*

A cytochrome b–like protein is implicated in the control of whole-body iron homeostasis.

Recovery of Infectious Ebola Virus from cDNA: Transcriptional RNA Editing of the GP Gene and Viral Cytotoxicity V. E. Volchkov, V. A. Volchkova, E. Mühlberger, L. V. Kolesnikova, M. Weik, O. Dolnik, H.-D. Klenk

A new, safe lab technique for studying the deadly pathogen is yielding intriguing, potentially invaluable insights into its molecular biology.

TECHNICAL COMMENTS

Dinosaur with a Heart of Stone

▼ 811 Using computerized tomography (CT), Fisher *et al.* (Reports, 21 April 2000, p. 503) interpreted an object found within the rib cage of a fossil ornithischian dinosaur as a fossil heart. Rowe *et al.* comment that the object "fails both geological and anatomical tests" of such an identification, arguing that it is more likely an ironstone concretion, that preservation of soft tissues is extremely unlikely in the sedimentary environment in which the putative heart fossil was found, and that the object lacks most "of the...anatomical structures of an actual heart." Russell *et al.* respond that fossils of soft tissues have indeed been reported from the Hell Creek Formation, where the object was found, that the position of the object within the fossil skeleton supports the heart interpretation, that CT imaging allows identification of large-scale structures consistent with that hypothesis, and that identifying the object as a fossil heart "need not assume structural identity with a crocodile heart or the preservation of relatively thin-walled structures."

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/291/5505/783a

science's stke www.stke.org

Perspective: Ras GTPases: Singing in Tune M. Symons and Y. Takai

Report from a meeting on the Ras superfamily.

science's next wave www.nextwave.org

Global: Nanotechnology Meets the Life Sciences—Careers in Nanobiotechnology

In Next Wave's February special feature issue, our global editorial team fills you in on the job prospects and encouraging research funding situation in Europe and North America for the emerging science of nanobiotechnology. Top nanobiotechnologists from around the world share their impressions of the field—and the potential that it holds for up-and-coming scientists.

US: Establishing a Postdoctoral Association at Brown University D. Bucci

How postdocs at Brown got together to form an association that could represent their interests and needs to the university's administration.

Germany: How to Write a Successful Grant Proposal W. Adamczak

Practical grant-writing tips designed to maximize the chances that your proposals in Germany are funded.

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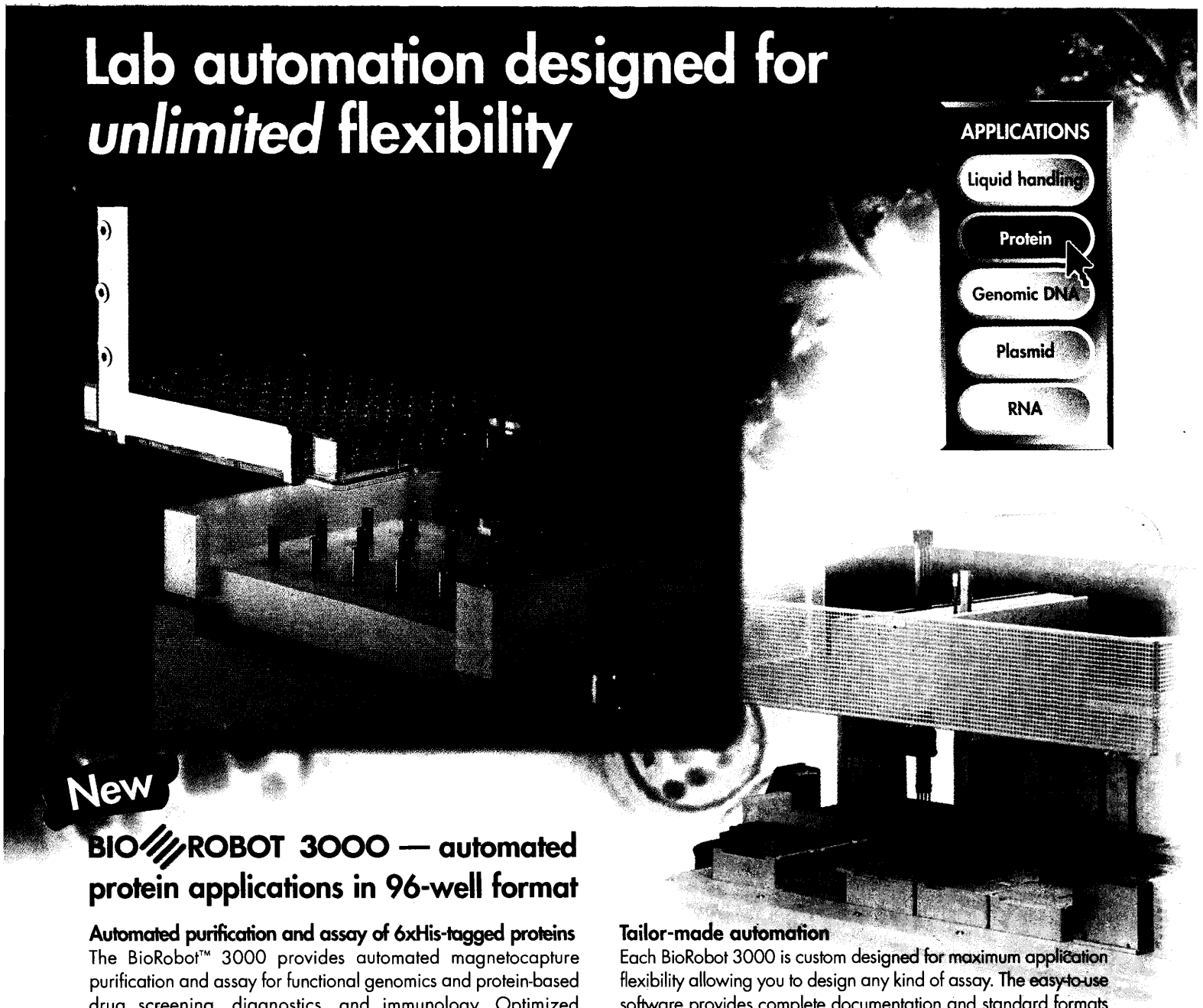

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THIS WEEK IN Science

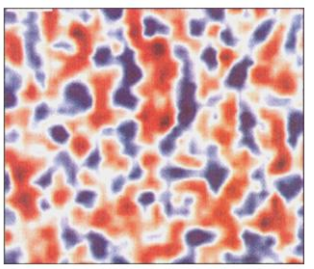
edited by Phil Szuromi

Magnetic in the Radio Range

Microstructured materials can show unusual optical properties, as exemplified by photonic band gap materials and materials that exhibit negative refractive index. Wiltshire *et al.* (p. 849) now show how an array of spiral-wound capacitors (rolled-up aluminized Mylar) can be used to direct magnetic flux. This material is nonmagnetic in a dc field but is designed to be magnetic in an applied radio-frequency (RF) field. It can be used to guide magnetic flux to the receiver coils used in nuclear magnetic resonance and magnetic resonance imaging.

Transparent Magnets

For the field of spintronics, in which electronic spin and magnetic interactions between host and carrier determine device operation, great effort is being expended in developing materials with enhanced functionality. Matsumoto *et al.* (p. 854; see the Perspective by Ohno) report the finding of a transparent ferromagnet based on cobalt-doped titanium dioxide. The material, a thin film of $Ti_{1-x}Co_xO_2$ in the anatase phase with ($0 < x < 0.08$), remains ferromagnetic above room temperature.



CREDIT: Y. MATSUMOTO *ET AL.*

Nanowire Toolbox

Their ability to readily dope silicon nanowires during the growth process into electron or hole carriers make them attractive candidates as building blocks for nanoscale electronic architecture. Cui *et al.* (p. 851) explore the potential of these materials by fabricating and demonstrating a range of functional devices that consist of simple junctions of crossed nanowires with active areas of 10^{-12} to 10^{-10} cm^2. The ability to fabricate diodes, bipolar transistors, and elementary logic devices such as inverters highlights the role these materials will play in a "bottom-up" approach to nanoscale electronics.

Copper Surprise

Determining the solvation shell of ions in water can be tricky even for relatively simple systems. For example, it has long been assumed that the Cu^{2+} ion attracts six water ligands in a distorted octahedral structure, but while the nearest-neighbor copper-oxygen bond lengths are well characterized, the more distant bond lengths have eluded characterization. Pasquarello *et al.* (p. 856) have performed a combined neutron diffraction and ab initio calculation study and show that the Cu^{2+} aqua ion only has five water ligands with similar bond lengths. There are no distal Cu–O bonds, which would explain the previous difficulty in trying to pin them down.

How Metals Square with Aromaticity

Aromatic molecules are usually carbon ring systems, although they may contain heteroatoms such as boron or nitrogen. Molecules are considered aromatic if they are cyclic, planar, and conjugated and have $(4n + 2)$ delocalized π-electrons. Li *et al.* (p. 859; see the Perspective by Seo and Corbett) report a series of unusual aromatic molecules that contain only metal atoms. The molecules contain a square Al_4-unit that fulfills both the structural and the electronic criteria for aromaticity. Other group-13 elements may form similar species.

Thinning Ice

The West Antarctic Ice Sheet contains enough water to raise sea level by 5 meters if it were to melt completely. Most permanent Antarctic ice discharge is provided by ice streams, so glaciologists (and the rest of us) would like to know sooner rather than later if ice loss by streaming is accelerating. The Pine Island Glacier, which has the largest rate of discharge of all of the West Antarctic ice streams, could be a preliminary indicator. Shepherd *et al.* (p. 862) provide evidence from satellite altimetry and interferometry that ongoing inland thinning due to ice dynamics is occurring. The acceleration of ice flow from the interior due to ice stream dynamics is a distinct possibility. If the present rate of thinning continues, the currently grounded Pine Island Glacier will be afloat in 600 years.

How Plant Diversity Scales

The relation between species richness and area is an important component of ecological studies. Crawley and Harral (p. 864) provide detailed evidence that the relation varies with spatial scale, using data on plant species gathered at different spatial scales in Britain ranging from 0.01 square meter to 1000 square kilometers. Slopes of the species-area relation (logarithm of species richness versus logarithm of area) were steepest at intermediate scales, where the matrix of habitats with distinct floras tends to maximize richness in any given area. The shallowest slopes were at the smallest spatial scales, where individual plants would be expected to interact strongly with each other, and at the largest scales, where few new habitats are added.

Eternal Youth for Rodent Cells

Cells grown in culture dishes usually only divide a certain number of times before they senesce, a state in which cells cannot undergo apoptosis and have a distinctive phenotype. Now, through careful adjustment of culture conditions, indefinite normal growth of two types of rat cells appears to have been achieved. Tang *et al.* (p. 868) achieved 60 days of normal growth for oligodendrocytes, and Mathon *et al.* (p. 872) report 50 passages for Schwann cells. Fibroblasts in the same conditions senesce in three to four passages. This demonstration that rodent cells are not universally subject to replicative senescence is discussed in a Perspective by Shay and Wright. They point out that the especially long telomeres in rodent cells may allow

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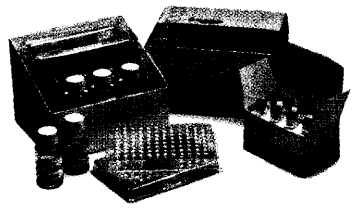

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them to continue to divide long after a comparable human cell has senesced as a result of its shortened telomeres.

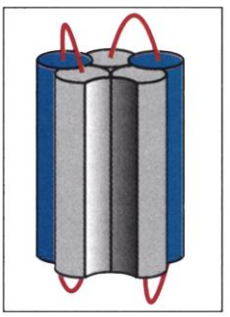
Fusion Pore Dynamics

Cellular secretion involves the fusion of membrane-bounded secretory vesicles with the cell surface. Details of the cellular fusion machinery have become clearer during the last few years. Fisher *et al.* (p. 875) looked at the role played by one protein in the fusion machinery, Munc18. Rather than playing a direct role in fusion itself, Munc18 appears to be important in the late stages of the fusion process for the expansion of the fusion pore that is required to make fusion irreversible.

Rising Film Maker

Many bacteria and fungi can grow as aggregates of cells that adhere to a solid surface. When these so-called "biofilms" form on medical devices, such as orthopedic implants, they can significantly increase the rate of infection because, in this protected microenvironment, the pathogens are more resistant to antimicrobial drug therapy. The mechanisms underlying the development of fungal biofilms are especially mysterious because most pathogenic fungi are not genetically well defined. Reynolds and Fink (p. 878; see the cover and the news story by Helmuth) have discovered that the well-studied baker's yeast *Saccharomyces cerevisiae* can undergo the initial steps of biofilm formation in the laboratory and that the cell surface glycoprotein Flo11p is required for this process. The ability to study biofilm formation by classical genetics and whole-genome approaches may help to identify new targets for therapy of fungal infections.

Adding One to a Gang of Five



Infection by HIV-1 requires fusion of the viral and cellular membranes. This is facilitated by formation of a trimer-of-hairpins structure, having as its core a six-helix bundle that serves to bring together the amino- and carboxyl-terminal regions of the gp41 ectodomain. Now Root *et al.* (p. 884; see the news story by Helmuth, 12 Jan.) have designed a small protein, called 5-Helix, that binds tightly and specifically to peptides from the carboxyl-terminal region of gp41; 5-Helix inhibits membrane fusion and, thus, infection by HIV-1 viruses with a variety of envelope proteins. These results suggest that 5-Helix may be the basis for a new class of anti–HIV-1 agents and strategies for vaccine development.

Picking Out Odors

Odor representations in the olfactory bulb are not stationary but change while the stimulus is present. Friedrich and Laurent (p. 889; see the Perspective by Yoshihara *et al.*) recorded from mitral cells in the olfactory bulb of the zebra fish. Responses of these neurons to odors became progressively transformed during the time course of stimulus presentation. This transformation was not due to sharpening of individual mitral-cell tuning profiles. Instead, odor representation appeared to become more evenly distributed at later times during stimulation. Temporal patterning reduced the similarity between ensemble activities and made each odor representation more specific over time. These data provide an important step in our understanding of how olfaction differs from other sensory modalities.

Flora Facilitating Fauna

The gut is the largest organ in a mammal and is populated by a bulky and complex flora that influences the physiology and the development of the entire host animal. Hooper *et al.* (p. 881) have started to dissect some of the complex interrelations between the gut tissue of the host and the organisms that colonize it by following the establishment of *Bacteroides thetaiotaomicron* in the intestine of germ-free mice. The presence of the bacterium influences several basic functions, from nutrient uptake and maintaining the integrity of the intestinal mucosal barrier to the metabolism of alien substances.

Published online in *Science* Express

CREDIT: M. J. ROOT *ET AL.*

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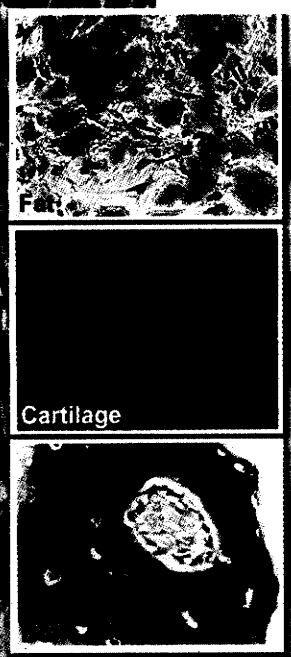

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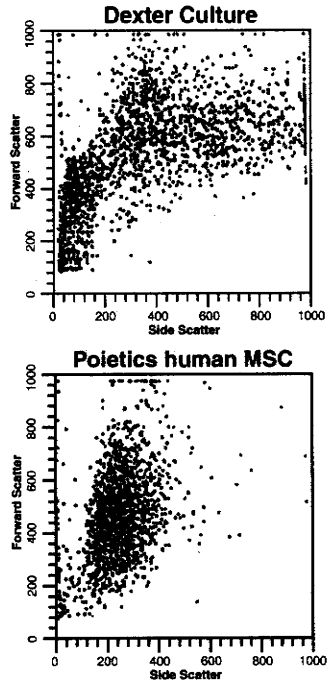

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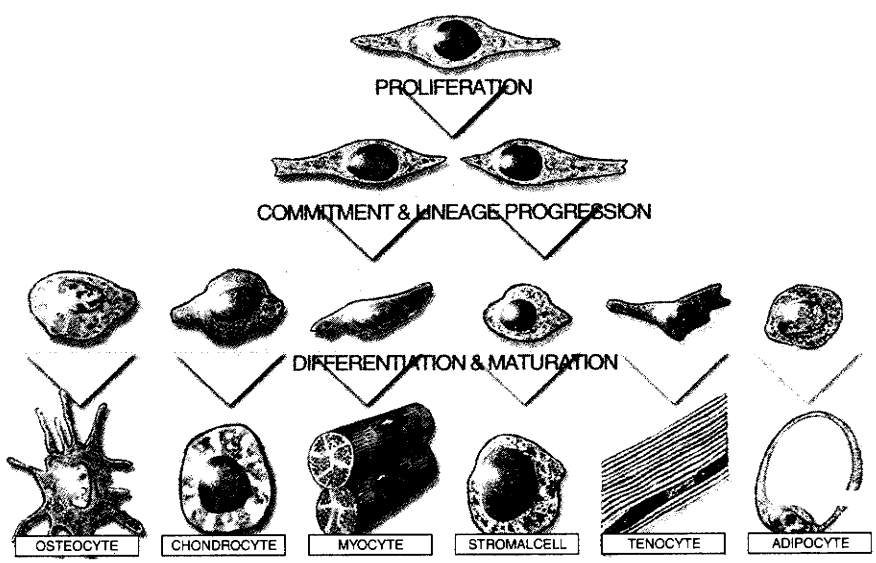

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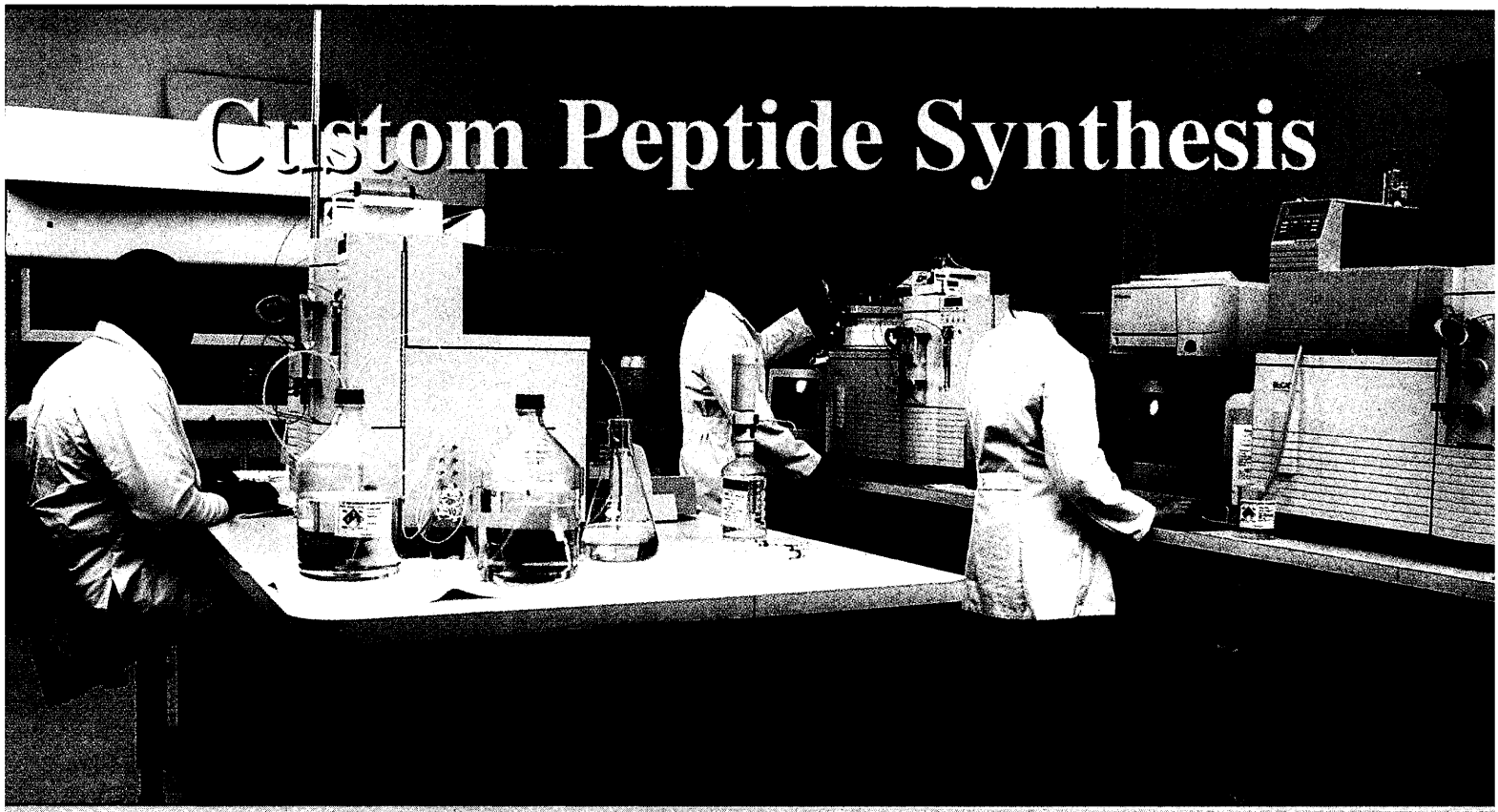

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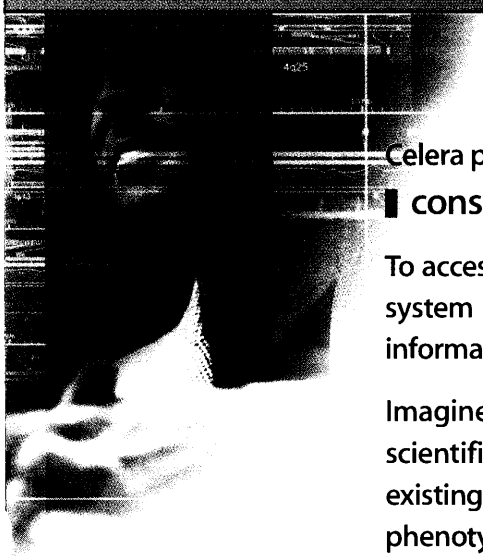

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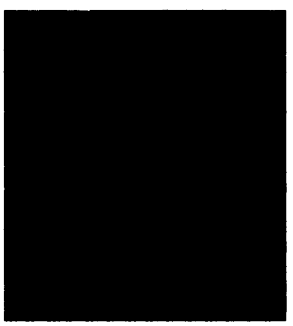

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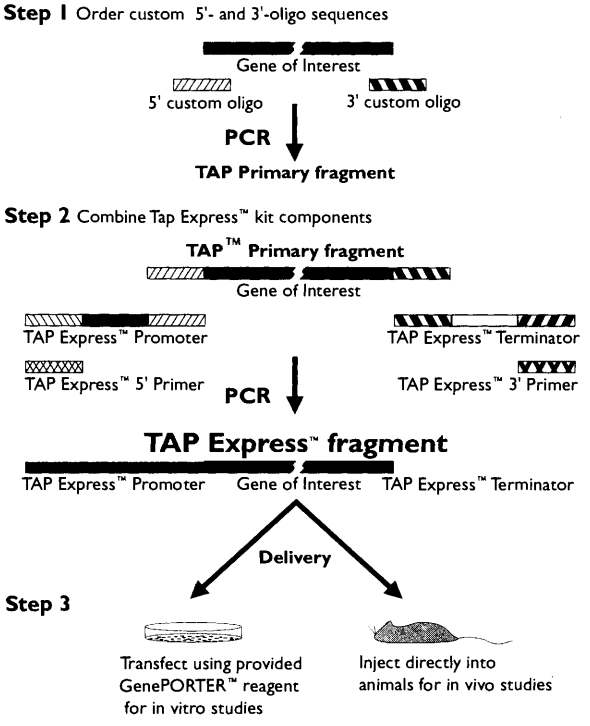

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Deadline for Receipt of Letters of Intent
30 MARCH 2001
(invitations to submit full applications will be issued at the end of June 2001)

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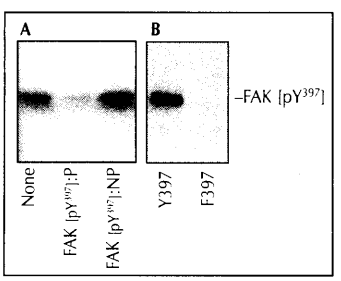

Figure A: FAK pY^{397} PSSA analysis illustrating that only the phosphopeptide blocks the Western signal.
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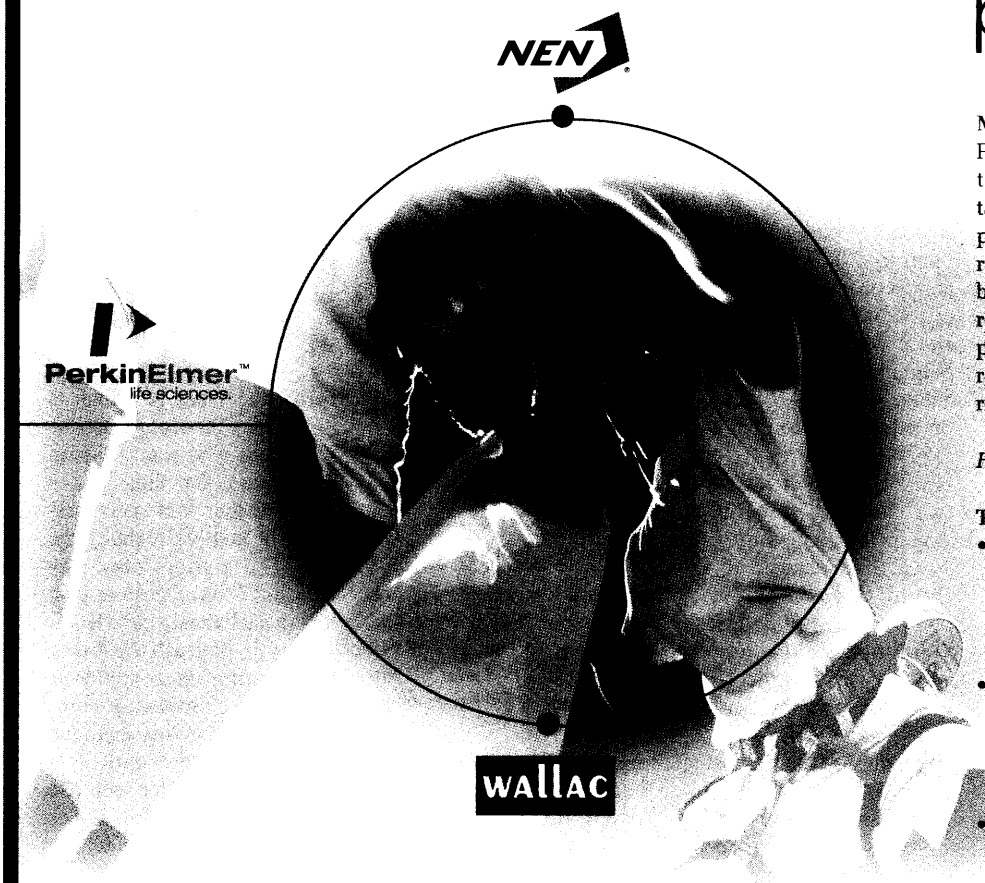

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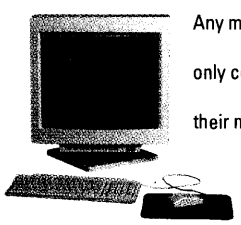

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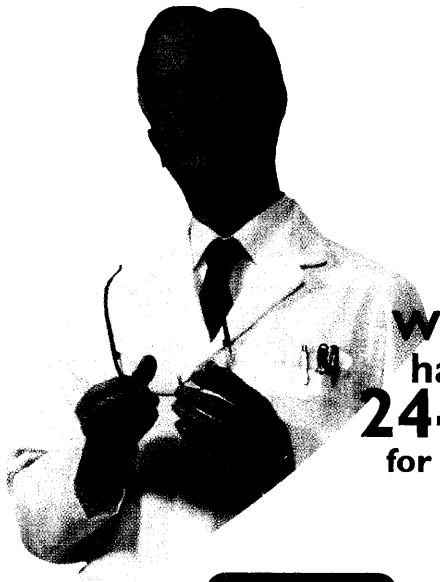

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FIG. 1 Cells are not fixed

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FIG. 2 Cells are fixed

FIG. 3 CHARIOT delivery of a 10 kDa protein, labeled with lucifer yellow at the C-terminus, to the nucleus of human fibroblast (HS68) cells. Cells are not fixed. (70% transfection efficiency after 30 min. incubation)

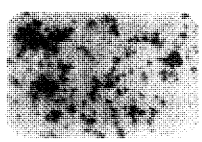

FIG. 4 CHARIOT delivery of a 119 kDa β-galactosidase protein into COS cells. Cells are fixed and stained 2 hours post-transfection. (60% transfection efficiency)

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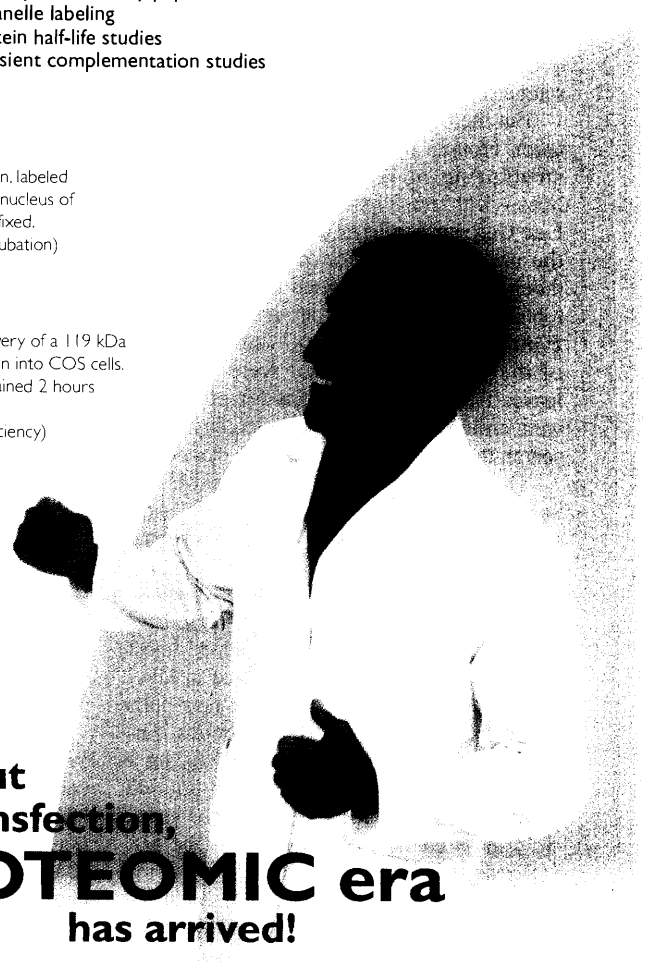

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Molecular Biology Tools for Gene Discovery

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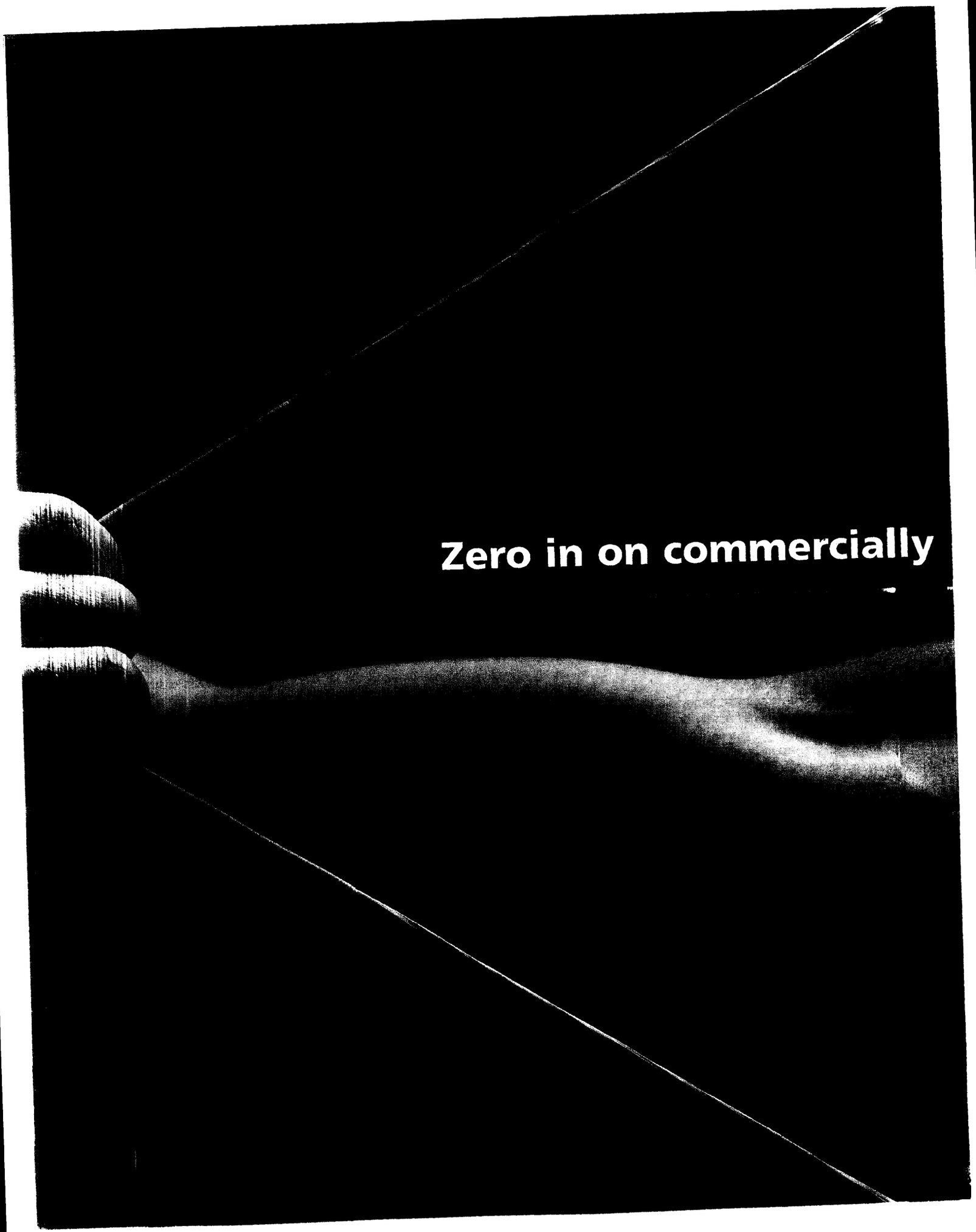
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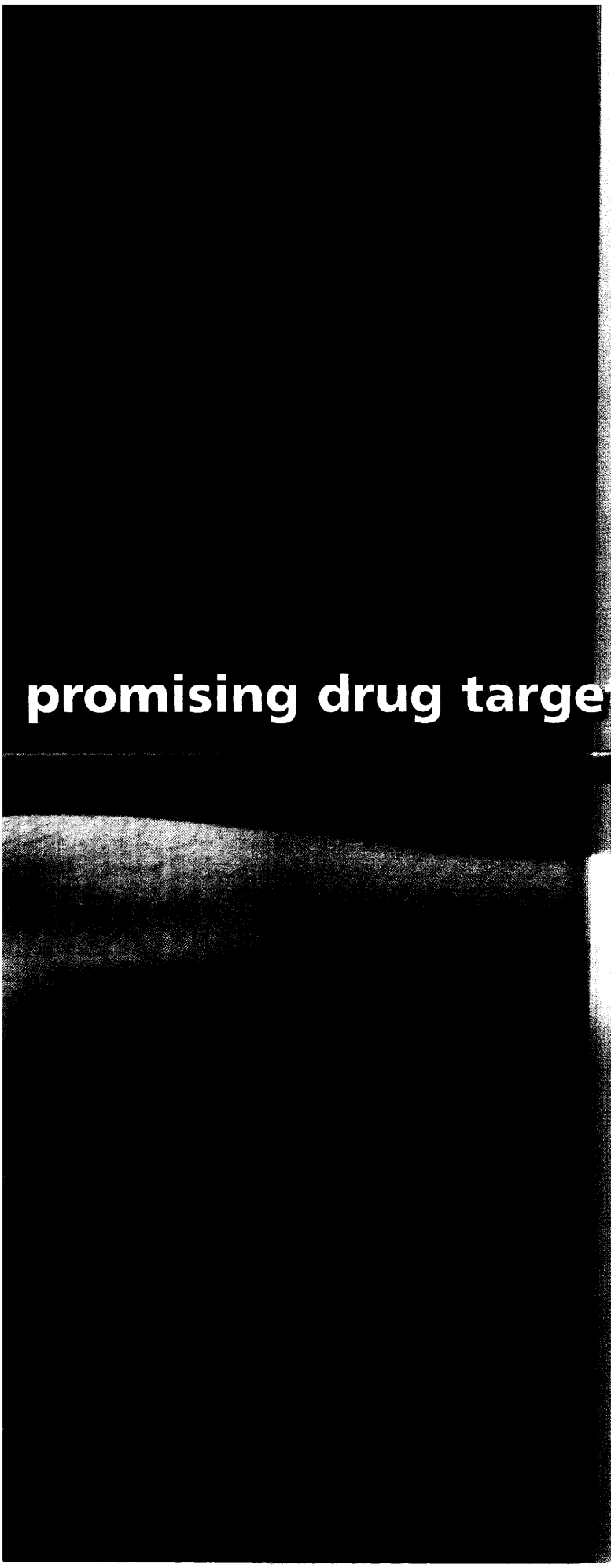

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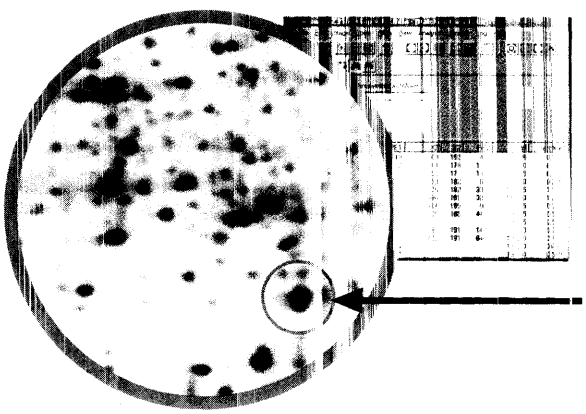

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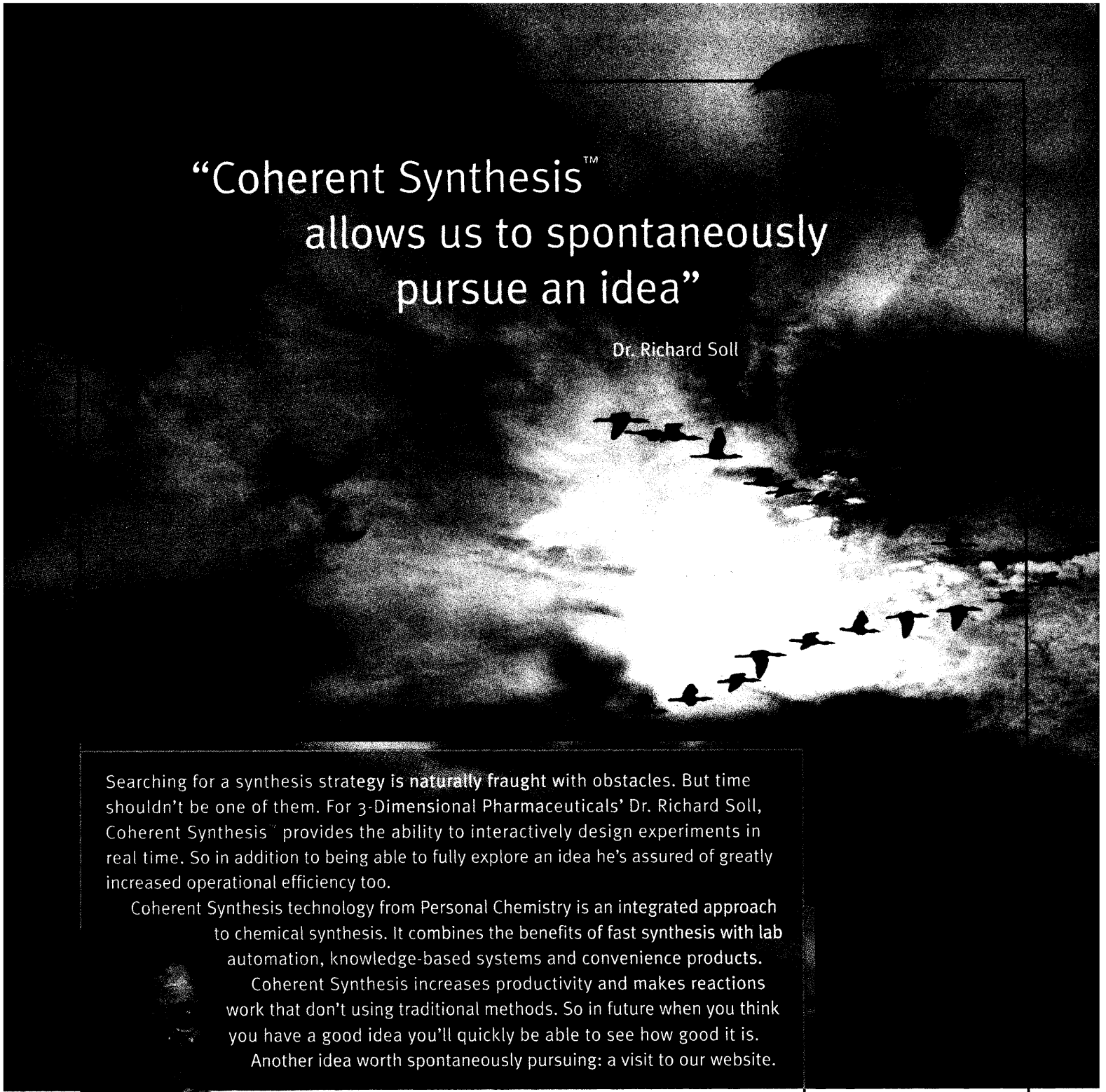

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