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21 NOVEMBER 1997 $7.00
VOL. 278 • PAGES 1369–1532

NEW ENGLAND BIOLABS

Molecular Biology and PCR

Summer Workshops

WHEN:

Session 1: May 31-June 13, 1998
Session 2: June 21-July 4, 1998
Session 3: July 12-July 25, 1998

WHERE:

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Smith College
Northampton, MA

FACULTY:

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Dept. of Biological Sciences, Smith College,
and Molecular and Cellular Biology,
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INTENDED FOR BEGINNERS IN MOLECULAR BIOLOGY: No previous experience in molecular biology is required or expected. Forty-eight participants per session will be selected from a variety of disciplines and academic backgrounds. Last year's participants included principal investigators, directors of programs, postdoctoral fellows, graduate students, and research assistants. Their fields of research included medicine, biochemistry, ecology, immunology, microbiology, pharmacology, plant biology, genetics, physiology and others. They came from large universities, small colleges, medical schools, hospitals, industry, and private foundations; 75% came from the USA, and 25% from overseas. With eight instructors, the student to teacher ratio is 6 to 1.

FEE: $3200 per participant includes lab manual, use of all equipment and supplies, and room and board (all rooms are singles). Fee includes the use of the libraries, computers, and all campus athletic facilities.

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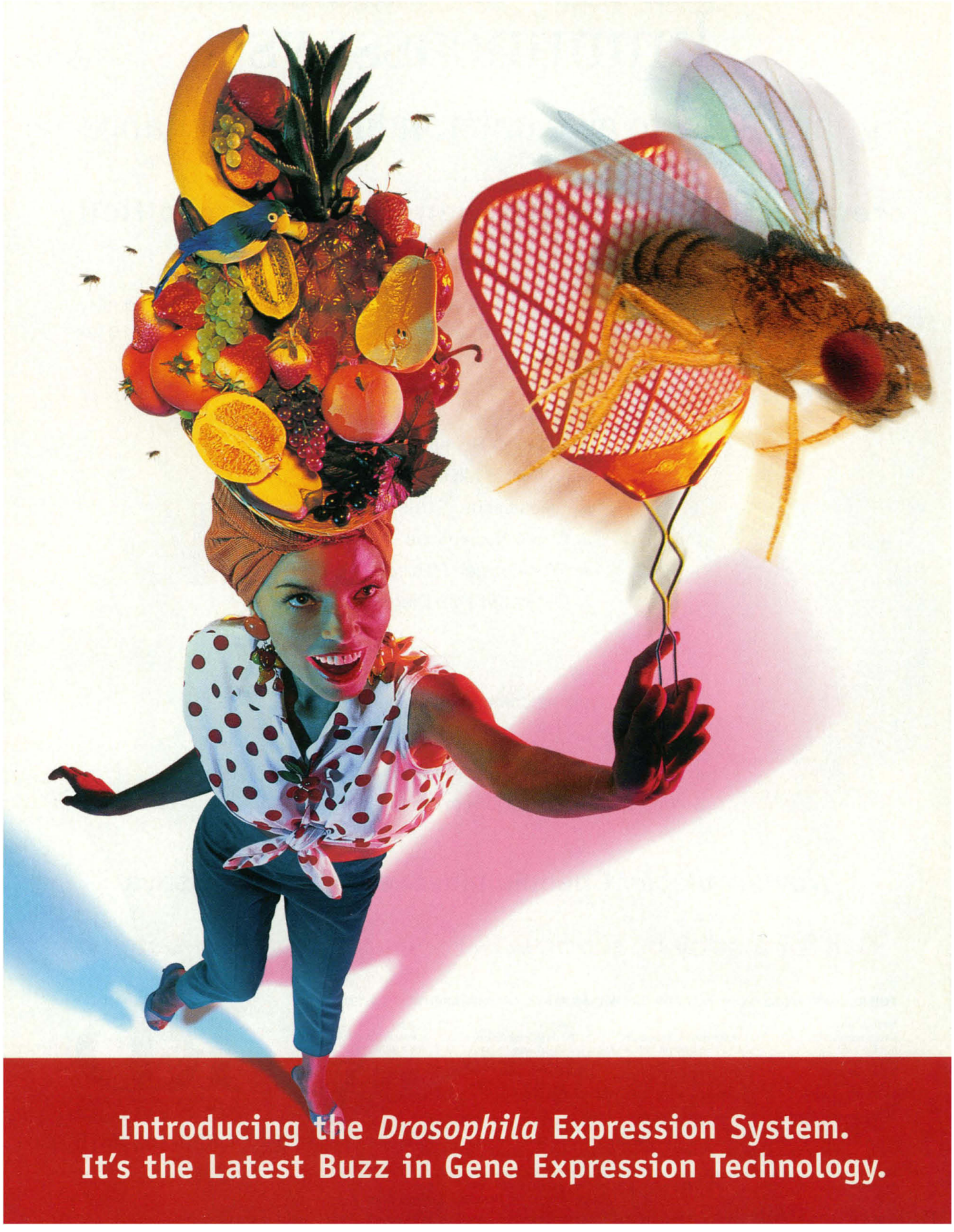
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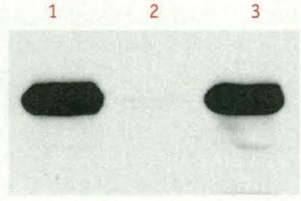

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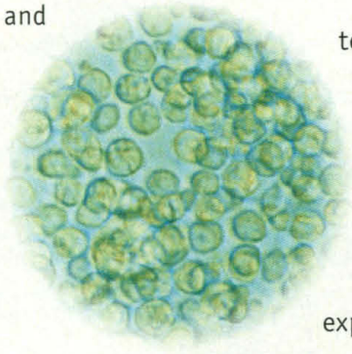

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Circle No. 30 on Readers' Service Card

ISSN 0036-8075
21 NOVEMBER 1997
VOLUME 278
NUMBER 5342

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COVER

Unlike those found in normal chloroplasts, thylakoid membranes (colored red) from mutant *hcf106* (*high-chlorophyll fluorescence*) maize leaves are not subdivided into stacks. Instead, they frequently adopt a uniform whorled arrangement (here ~2 to 3 micrometers in diameter). The *Hcf106* gene is conserved in bacterial genomes and encodes a membrane protein that mediates protein translocation independent of the SecA translocation pathway. See page 1467. [Image: A. M. Settles, J. Barr, and R. Martienssen]

RESEARCH ARTICLE

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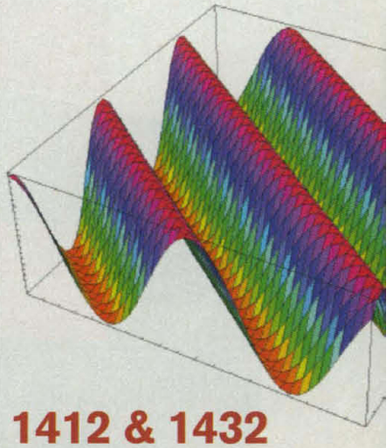

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Magnetism in superconductors

1413 & 1457
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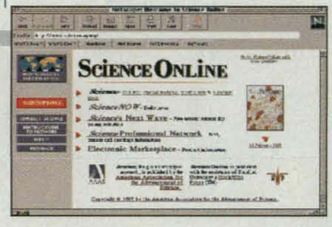

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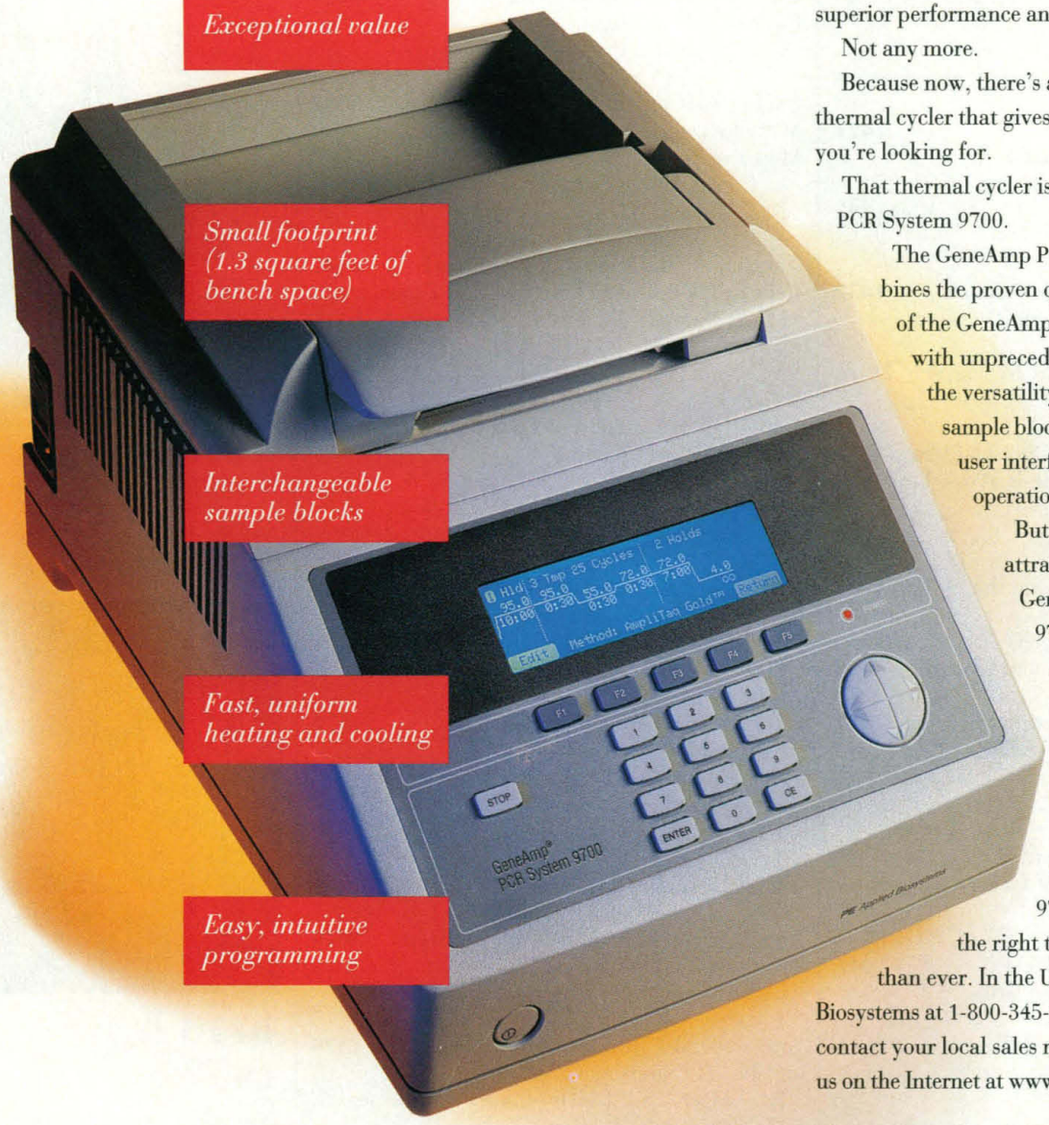

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THIS WEEK IN SCIENCE

edited by PHIL SZUROMI

At tree line

It has generally been thought that changes in temperature were primarily responsible for shifts in tree lines in the past, although some recent models have suggested that the large changes in atmospheric CO_2 levels at the end of the last glaciation also had an effect. Street-Perrott *et al.* (p. 1422; see the Perspective by Farquhar, p. 1411) analyzed carbon isotopes in fossil leaf waxes and algal biomarkers to show that the changes in atmospheric CO_2 had a significant effect on high-altitude tropical ecosystems.

■

Mind the pseudogap

The parent compounds of the high-temperature superconductors are antiferromagnetic insulators. Blumberg *et al.* (p. 1427) performed electronic Raman scattering studies of the superconducting bismuth cuprate compound to see how such ordering may evolve into the superconducting state. At temperatures well above the superconducting transition temperature, possible precursors to superconductivity develop, such as long-lived hole states with $d_{x^2-y^2}$ symmetry and a binding energy of 75 millielectron volts. As the temperature is decreased, greater coherence is seen in the electronic system and a pseudogap opens up in the spectrum.

■

Current events

The flow of currents between macroscopic quantum systems, such as superfluids or superconductors, that are weakly connected will depend on the relative quantum phase describing each condensate. Such effects, which govern superconducting tunnel junctions, are much more difficult to observe directly in superfluids such as liquid helium-3. Backhaus *et al.* (p. 1435) determined the current-phase relation directly for superfluid helium by using a membrane array of 4225 apertures to connect two reservoirs, and they observed the transition with increasing temperature from linear to sinusoidal behavior.

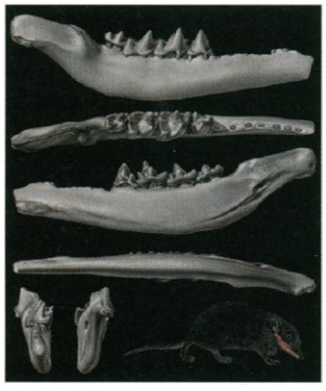
Protective immune responses to HIV

In order to rationally design a vaccine against AIDS, it will be necessary to understand the correlates of protective immunity. Rosenberg *et al.* (p. 1447; see the related news story by Balter, p. 1399) have studied individuals infected with the human immunodeficiency virus (HIV) who managed to control HIV proliferation in the absence of antiviral drug therapy. These individuals had specific proliferative responses of $CD4^+$ T helper cells that resulted in the production of interferon-γ and antiviral β chemokines. Virus load was inversely related to the strength of the proliferative response to the viral protein p24.

■

Repeated deliveries

Placental mammals have been thought to have dispersed from South America through Antarctica to Australia in the Cenozoic, sometime after about 60 million years ago. Rich *et al.* (p. 1438; see the news story by Wuethrich, p. 1401) have now found a jaw of an early placental mammal (or early ancestor of



one) from the Early Cretaceous in Australia, about 115 million years ago. This fossil thus implies that Australia and the southern continents were not faunally isolated from northern continents in the Cretaceous. These early placentals may have become extinct in Australia, only to be reintroduced later.

Two by two

The atomistic growth pathway from single adsorbed atoms (adatoms) of silicon or germanium adatoms to larger rows and islands is complex. Qin and Lagally (p. 1444) now provide a possible missing link between monomer absorption and the formation of two-dimensional islands. Scanning tunneling microscope images show that prenucleation structures, consisting of paired adatoms that are distinctly different electronically from previously characterized dimers, play a crucial role in the formation of larger rows and islands on this surface.

■

Coral connections

The eggs and larvae of marine organisms can be transported over great distances. Based on a detailed analysis of the surface currents and assuming a larval lifespan of 1 or 2 months, Roberts (p. 1454; see the Perspective by Ogden, p. 1414) mapped out potential "transport envelopes" that link different reef areas around the Caribbean. Such studies could help in assigning priority for preservation by identifying "upstream" supplier sites.

■

Dissolved partnership

Many features of the stepwise mechanism by which HIV binds to CD4 and its coreceptors are currently unclear. Binding of the HIV viral envelope protein gp120 to T cells likely exposes a previously concealed coreceptor binding site. Although binding of HIV gp120 to the coreceptor CCR5 depends on CD4, Martin *et al.* (p. 1470) show that this is not so for the simian counterpart SIVmac239. The difference can be attributed to a one amino acid change in the CCR5 amino terminus, which may be in the region that makes direct contact with gp120. The finding of the critical role of a single amino acid rather than an entire domain may make it possible to design targeted assay systems for vaccines and therapeutics.

■

Making methane

Methyl–coenzyme M reductase catalyzes the formation of methane. Ermler *et al.* (p. 1457; see the Perspective by Ferry, p. 1413) present the high-resolution structure of this enzyme. It contains an unusual Ni-porphinoid cofactor that accepts the methyl group from methyl–coenzyme M and combines it with a hydrogen atom obtained from coenzyme B to yield methane and the mixed disulfide of coenzyme M–coenzyme B. A long hydrophobic channel helps to order and orient the two linearly shaped coenzymes.

■

Targeting cells with receptors

Traditionally, retroviral vectors have targeted cells through the cell-surface receptors. Recent studies have indicated that it is possible to reverse the process, by putting the receptor on the vector to target ligand-expressing cells. Endres *et al.* (p. 1462) show that the interaction of the envelope glycoprotein of HIV and SIV with the cellular receptor is not unidirectional; vectors containing a functional virus receptor complex can target chronically infected cells and infected macrophages.

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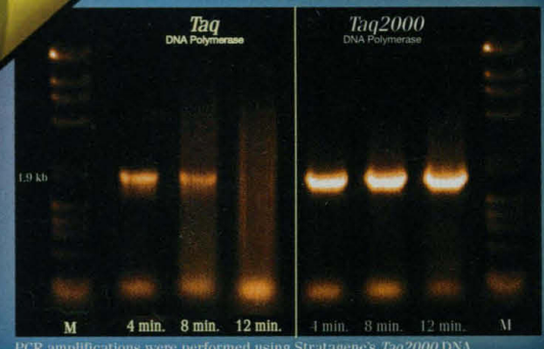

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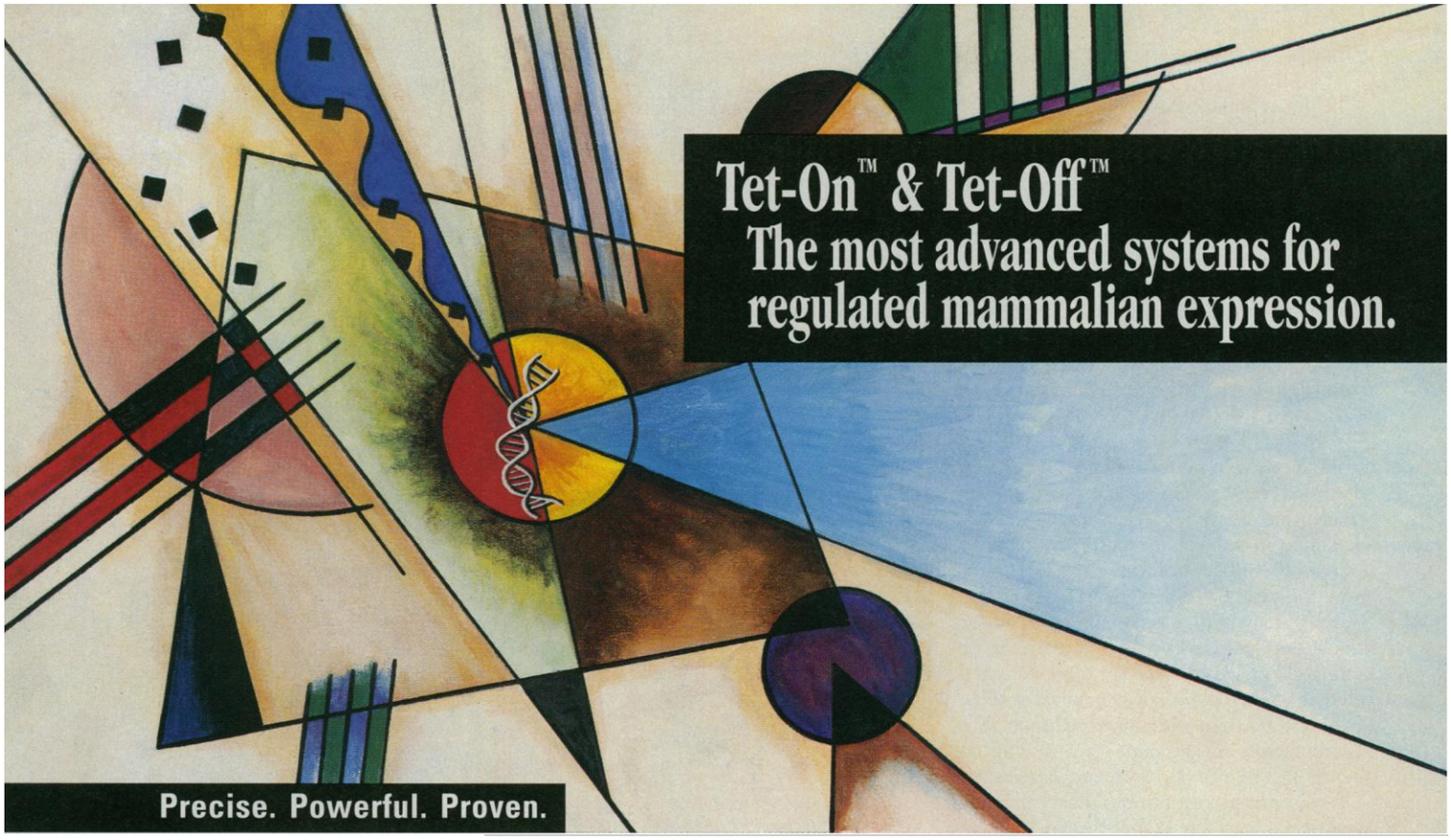
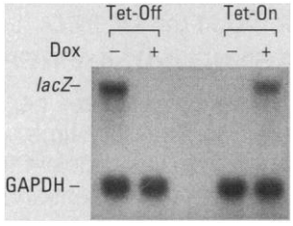
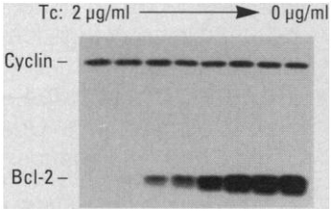




Tet Systems offer inducible on/off control of gene expression. Northern analysis of RNA from HeLa Tet-Off and Tet-On cell lines stably expressing the *lacZ* gene under Tet regulation. Cells were cultured in +/– 1 µg/ml doxycycline (Dox), a tetracycline derivative.



Tet Systems provide precise control of inducible expression. HeLa S3 Tet-Off Cells stably expressing pTet-Off and pTRE-Bcl-2 were grown in decreasing amounts of tetracycline (Tc). Western analysis indicates 100-fold range of controlled induction of Bcl-2.

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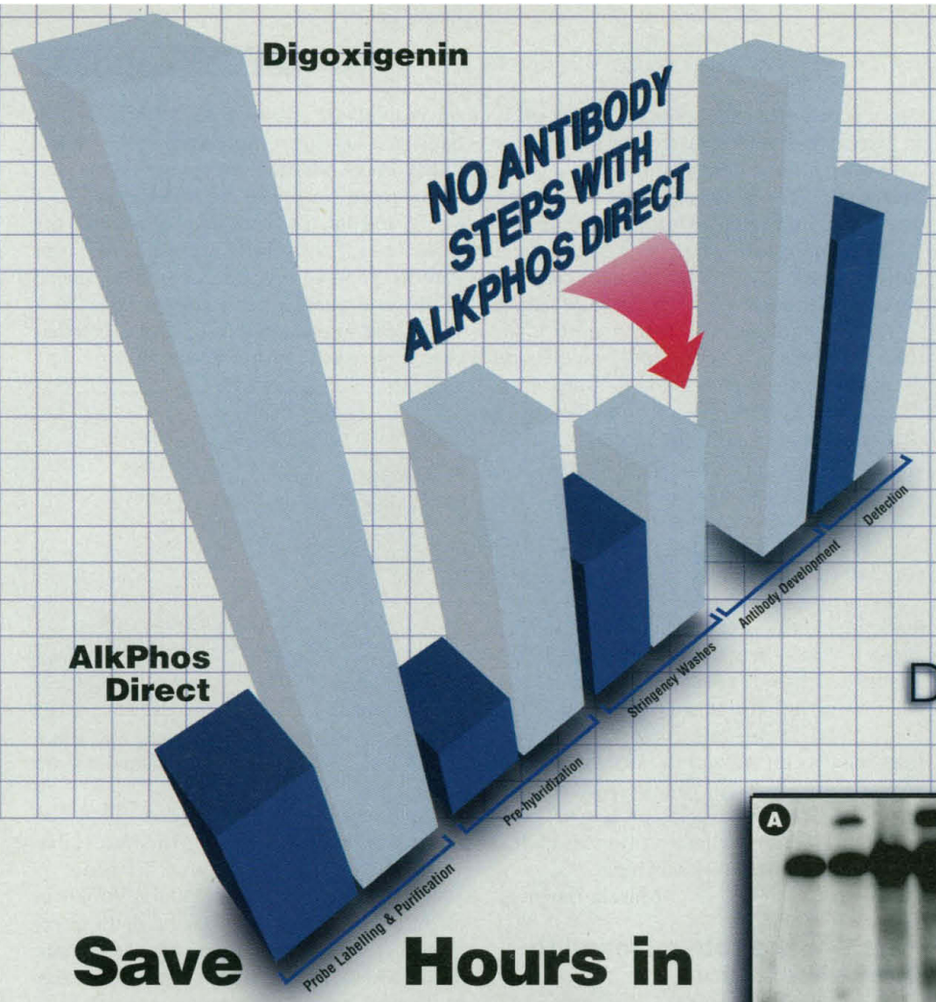

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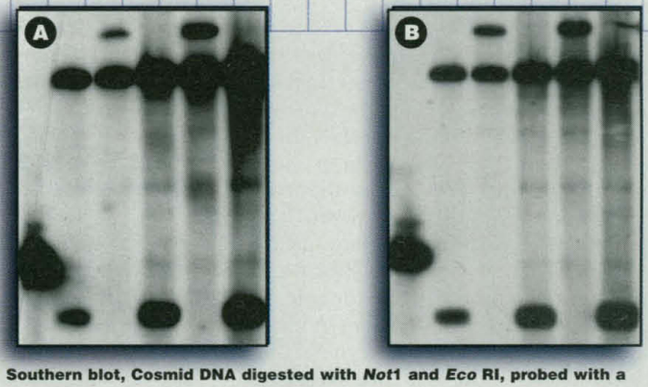

Southern blot, Cosmid DNA digested with *Not*1 and *Eco* RI, probed with a 1.1kb probe labelled with AlkPhos Direct (A) and digoxigenin (B) *(courtesy of Janet Bartels, Yale University).*

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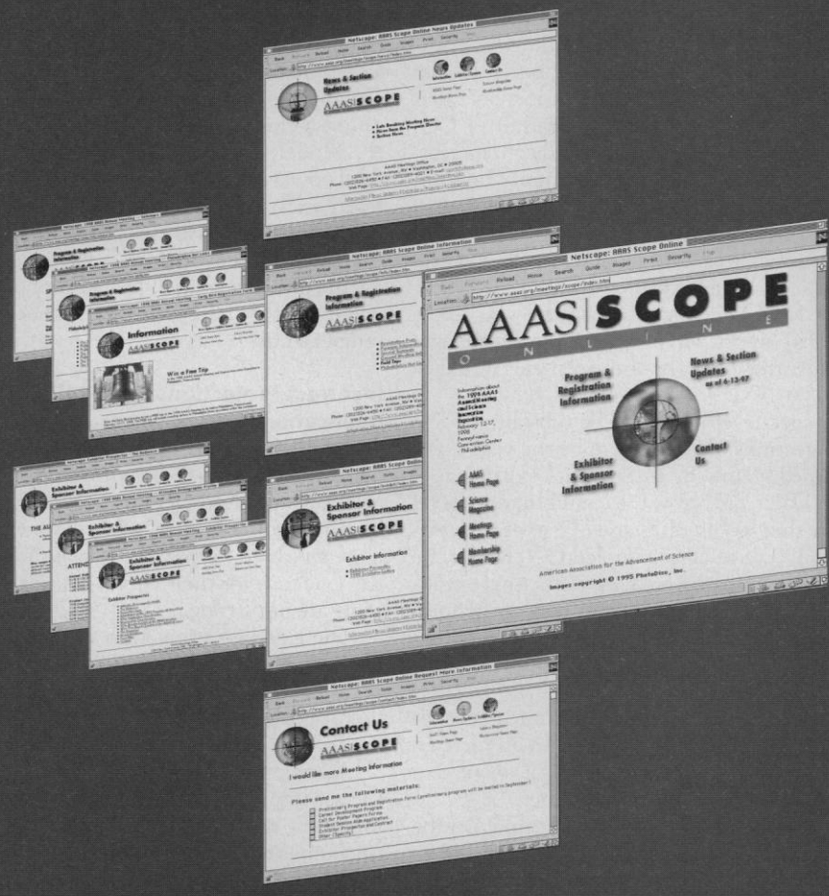

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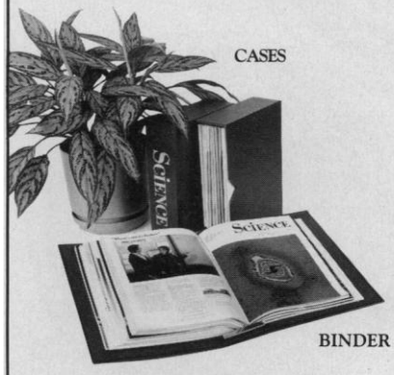

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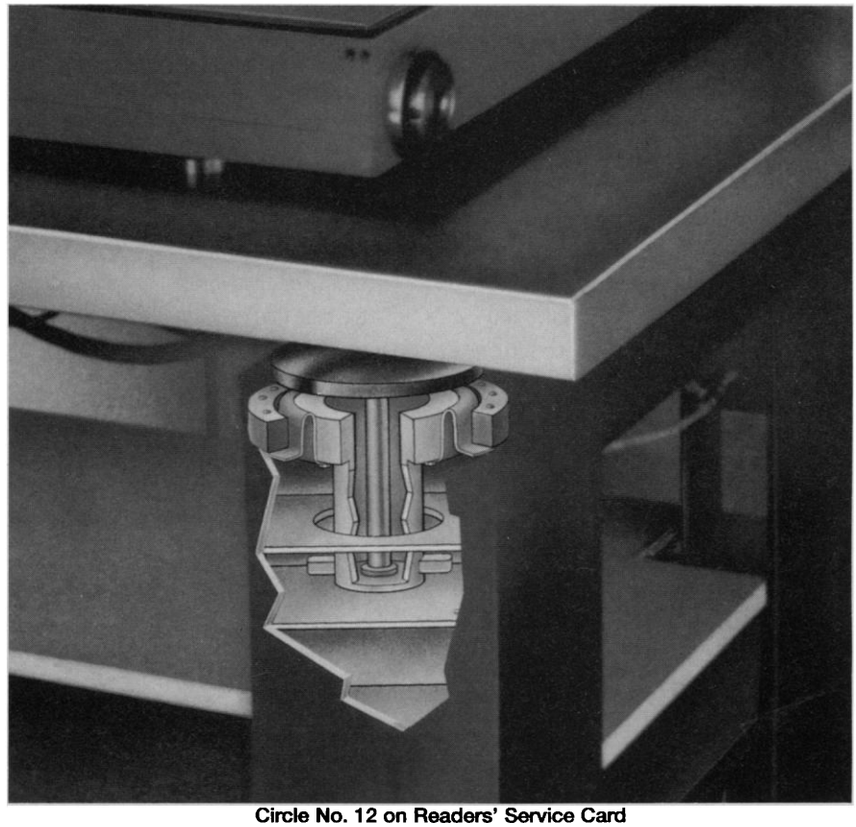

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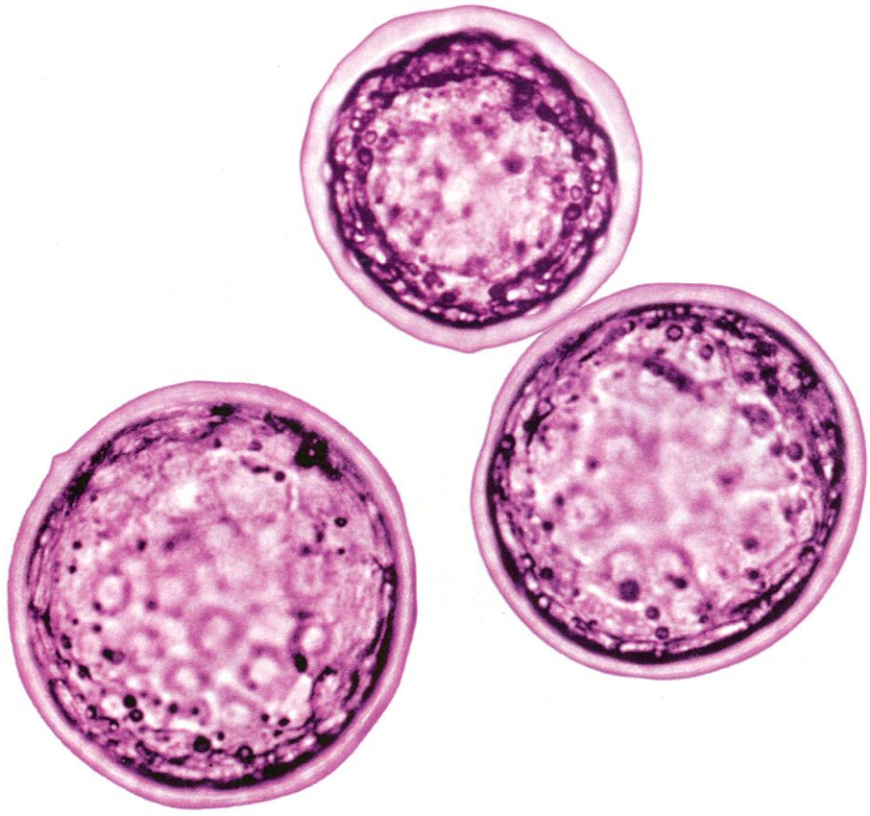

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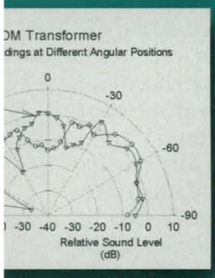

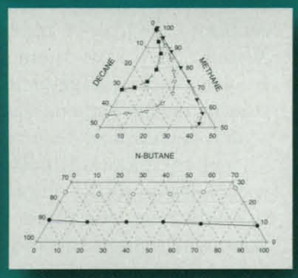

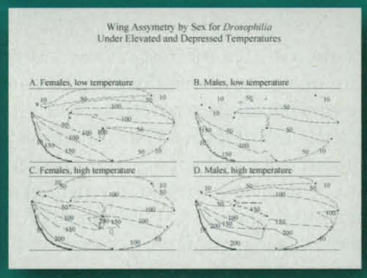

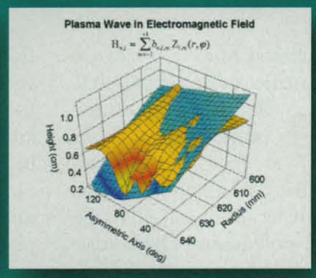

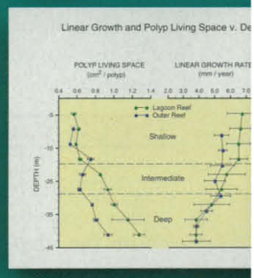

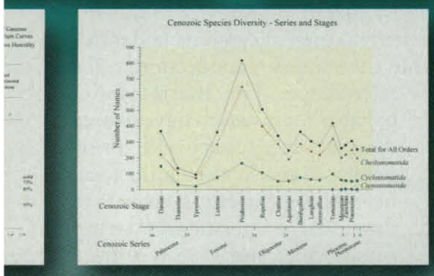

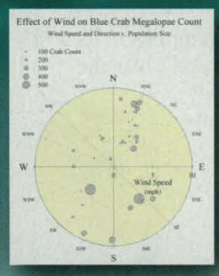

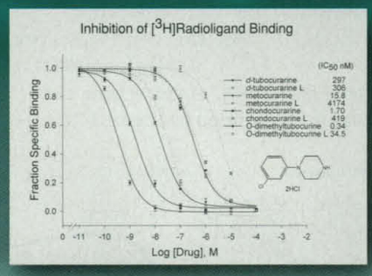

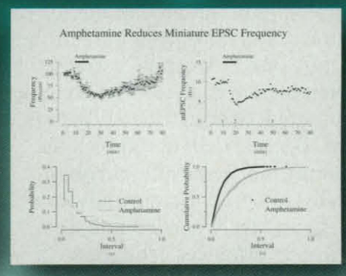

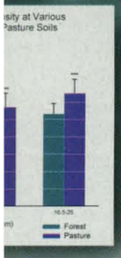

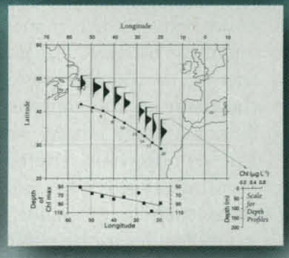

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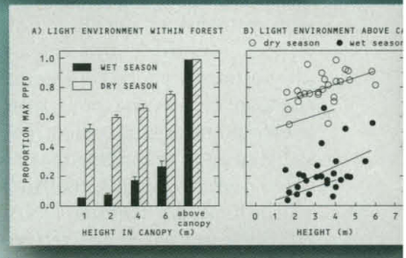

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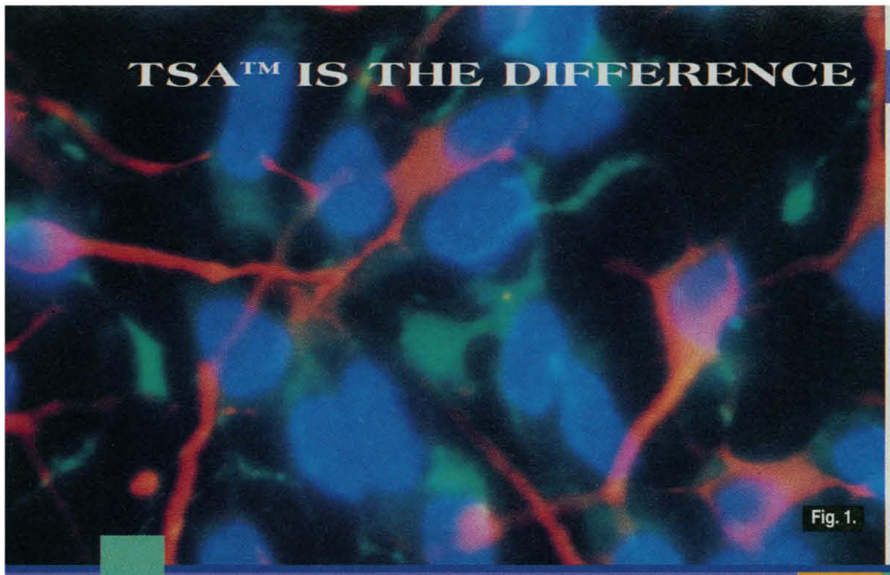

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Fig. 1. Multicolor detection using TSA-Direct.
Courtesy of Kevin Roth, M.D., Washington University School of Medicine, St. Louis, Missouri.

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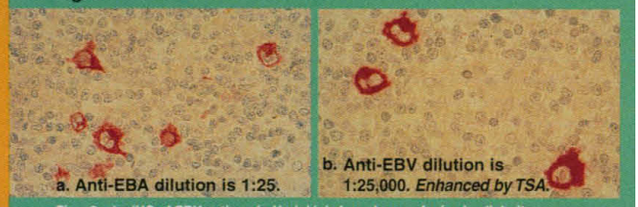
Fig. 3



a. Anti-EBA dilution is 1:25.

b. Anti-EBV dilution is 1:25,000. *Enhanced by TSA.*

Figs. 3 a-b. IHC of EBV antigen in Hodgkin's Lymphoma of mixed cellularity.
Courtesy of R. Von Wasielewski and S. Gignac, Pathologisches Institut de Medizinischen Hochscule, Hannover, Germany.

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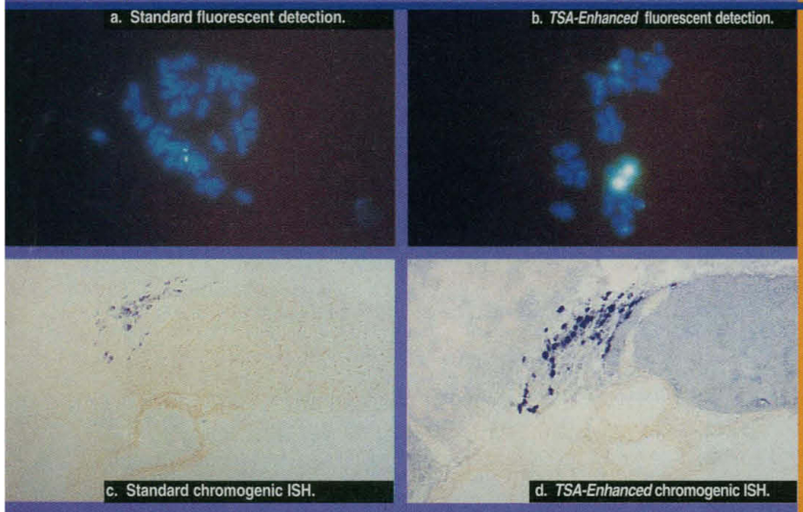
Fig. 2



a. Standard fluorescent detection.

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Figs. 2 a-b. Fluorescent detection of chromosome centromere probes in metaphase spreads.
Figs. 2 c-d. In situ chromogenic detection of oxytocin in rat brain tissue sections.

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