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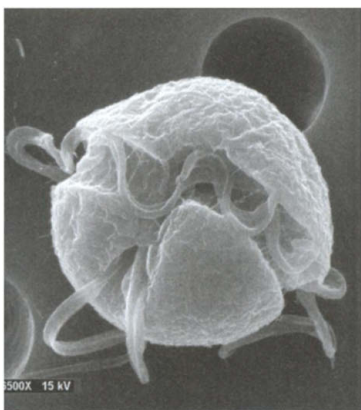
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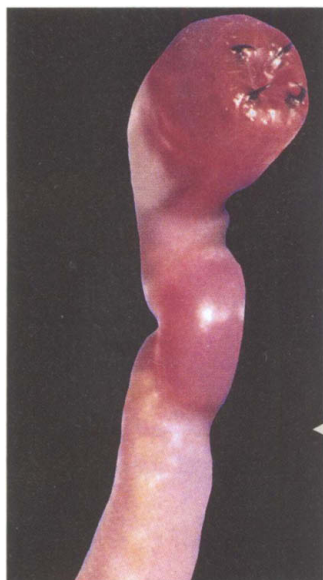
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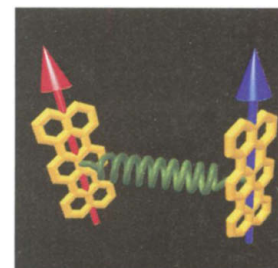
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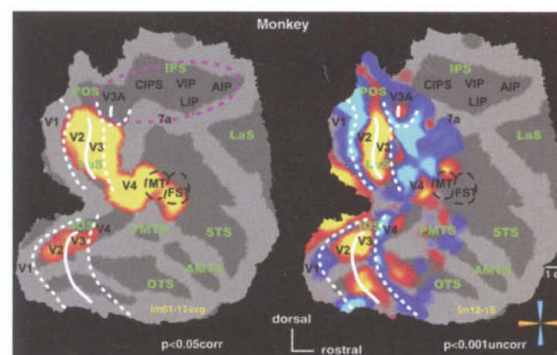


COVER 385

Artist's impression of two near-by molecules that "couple" (upper image), lose their individualities, and give rise to new spectral features (lower image). By combining high-resolution laser spectroscopy and scanning probe techniques, it is now possible to look deep into the world of fluorescent molecules even if they are only a few nanometers apart. [Image: C. Hettich]

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3D processing in
the brain



New on Science Express

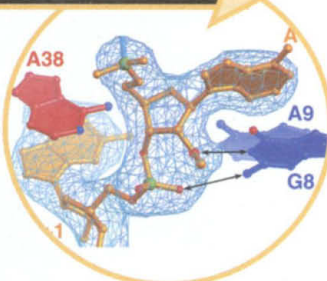
How a ribozyme does
catalysis



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Projection of an Immunological Self-Shadow Within the Thymus by the Aire Protein M. S. Anderson *et al.*

Controlled expression of tissue-specific genes in the thymus by the aire protein helps prevent autoimmunity.

Transition State Stabilization by a Catalytic RNA P. B. Rupert, A. P. Massey, S. Th. Sigurdsson, A. R. Ferré-D'Amaré

An RNA enzyme stabilizes the transition state relative to the ground state.

Spatial and Temporal Offsets Between Proxy Records in a Sediment Drift N. Ohkouchi, T. I. Eglinton, L. D. Keigwin, J. M. Hayes

Planktonic foraminifera and haptophyte-derived alkenones can have different radiocarbon ages, a potential complication for reconstructing past sea surface temperatures.

TECHNICAL COMMENTS

Effect of Producing Sons on Maternal Longevity in Premodern Populations

Helle *et al.* (Brevia, 10 May 2002, p. 1085) analyzed preindustrial demographic records of Sami people in northern Scandinavia and reported that bearing sons reduced human maternal life-span after menopause, whereas bearing daughters had a life-extending effect. Beise and Volland comment that "specific sociocultural or population genetic conditions may make it difficult to generalize effects observed in such a population," and they present a similar analysis on two other European premodern populations. Whereas one population showed the same negative relation between the number of sons born and maternal longevity, the other showed a positive correlation. In response, Helle *et al.* argue that Beise and Volland fail to challenge the conclusion that "both cultural and biological processes interactively determined longevity of females in Sami."

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/298/5592/317a

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Quarterly Author Index

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career resources for scientists

CANADA: Quantum Control—Merging Disciplines, Opening Doors V. Zeman

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Deciphering the NIH's career development awards.

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The risks and benefits of a second postdoc.

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NOTEWORTHY THIS WEEK: Rules of Attraction M. Leslie

Wound-closing cells might initiate formation of artery-plugging plaques.

NOTEWORTHY THIS WEEK: Tumor-Free, But Not in the Clear

R. J. Davenport

Off-kilter tumor suppressor promotes aging and stunts growth.

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signal transduction knowledge environment

PROTOCOL: Analysis of Tyrosine Phosphorylation Sites in Signaling Molecules by a Phosphotyrosine-Specific Immunoprecipitation (PSI) Scanning Method H. Steen, A. Pandey, J. S. Andersen, M. Mann

A method to identify phosphorylated tyrosine residues by mass spectrometry.

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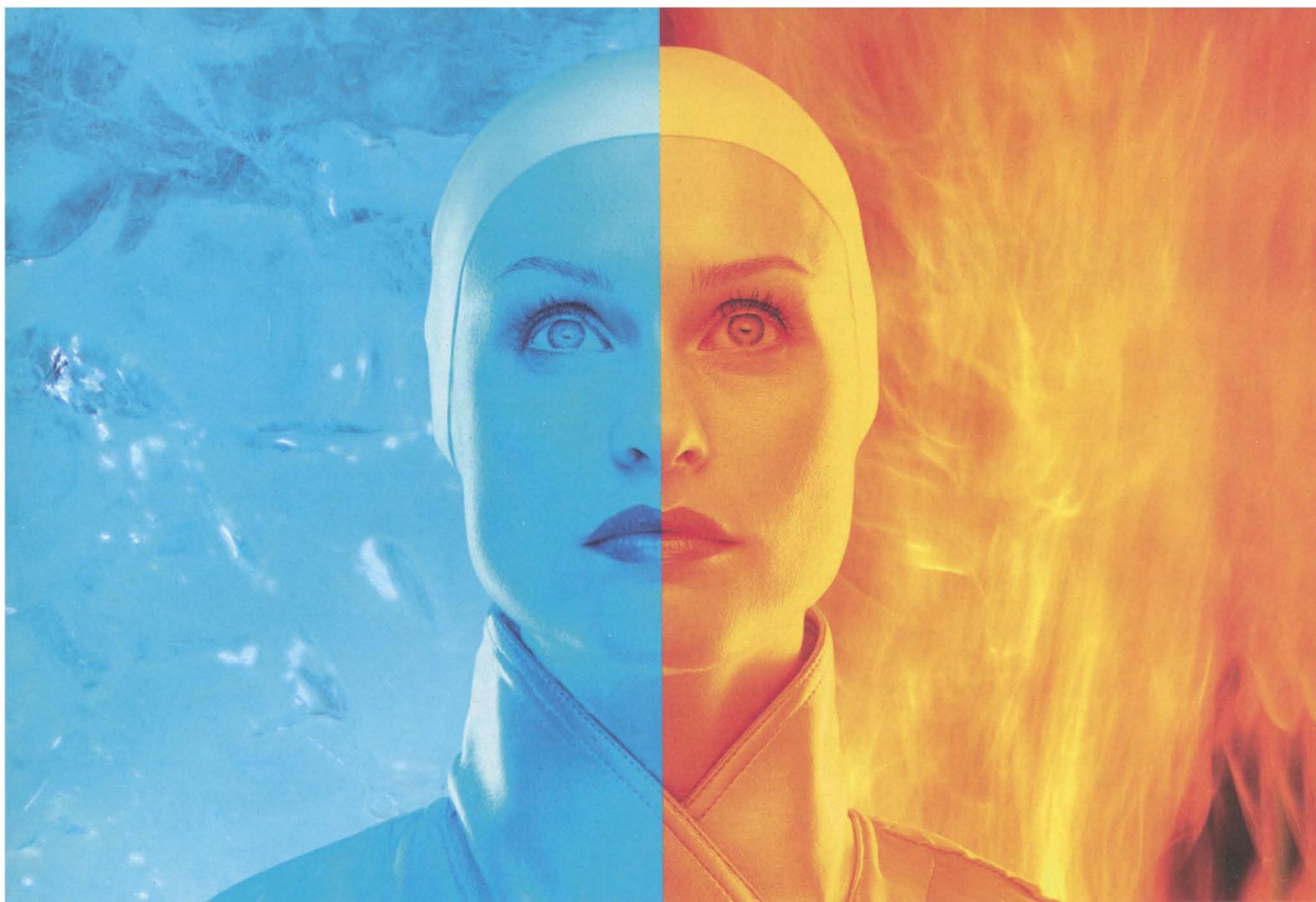
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THIS WEEK IN Science

edited by Phil Szuromi

Watching Molecular Cross-Talk

Single-molecule studies often require that molecules be well-spaced so that their individual spectral features can be discriminated. Hettich *et al.* (p. 385; see the cover and the Perspective by Orrit) show that by using a nearby scanning probe tip to supply a local electric field and induce Stark shifts, molecules of terrylene, embedded in a *p*-terphenyl crystal, that are only 12 nanometers apart can be resolved for samples at cryogenic temperatures. The authors then looked at the effects of dipole-dipole coupling between these molecules in the absence of the field. A new line appears nearly midway between the optical lines of the coupled system that arises through the two-photon excitation of pair's doubly excited state. When the pair is excited through a new central line, the emitted photons exhibit "bunching"—they are emitted in pairs. These results suggest that this entanglement of molecular emission could be further manipulated with larger applied electric fields. **X**

Copper-Hardened Jaws

Copper is rarely thought of as a component of biominerals, but the mineral atacamite [$\text{Cu}_2(\text{OH})_3\text{Cl}$] occurs in the jaws of bloodworms (*Glycera dibranchiata*). However, its functional significance, or even if its presence is natural or is the result of pollution, has been unclear. Lichtenegger *et al.* (p. 389; see the Perspective by Weiner and Addadi) now show that atacamite forms elongated crystals that orient with the outer contour of the jaw. This biomineral enhances the hardness and stiffness of the jaw and provides abrasion resistance comparable to tooth enamels.

Separating Nonsense in Decay and Splicing

Premature termination codons (PTCs) in messenger RNA (mRNA) result in its accelerated degradation, a process known as nonsense-mediated decay (NMD), and this process prevents the synthesis of truncated and potentially dangerous proteins. PTCs can also result in nonsense-mediated alternative splicing (NAS). Prevailing models suggest that NAS is a consequence of NMD, but Mendell *et al.* (p. 419; see the Perspective by Moore) now show that NMD and NAS are distinct. NMD is initiated by the assembly of a "surveillance" complex on PTC-containing mRNAs. Analysis of hUpf1 and hUpf2, protein components of this complex, show that hUpf2 only affects NMD, and that NMD and NAS are genetically separable functions of hUpf1, whose shuttling between the

402 Filling In Fast

Conformal thin-film deposition allows even deep troughs in a substrate to be coated uniformly. Atomic-layer deposition (ALD) can be used to grow high-quality conformal films but is often slow because each cycle deposits only a single layer. Hausmann *et al.* (p. 402) have modified ALD so that they can deposit more than 30 monolayers of silica in a single cycle. Alternating vapor pulses of trimethylaluminum and tris(*tert*-butoxy)silanol reacted to form a silica and alumina laminate of uniform thickness even inside deep glass channels.

And in Brevia ...

Meegaskumbara *et al.* (p. 379; see the news story by Pennisi) describe more than 100 new species of tree frogs in the dwindling rainforests of Sri Lanka and their phylogenetic relationships.



nucleus and cytoplasm is consistent with its role in pre-mRNA processing. **X**

A Nova's Time Line

In some binary stars systems, a white dwarf accretes mass from a larger companion. If the hydrogen being accreted onto the surface of the white dwarf reaches a critical abundance, it can explode in a thermonuclear outburst that we observe as a nova. Hernanz and Sala (p. 393) used XMM-Newton to observe the nova, V2487 Oph, which exploded in 1998. The x-ray emission was characteristic of normal accretion, indicating that the binary accretion has unexpectedly returned to its typical state in the short span

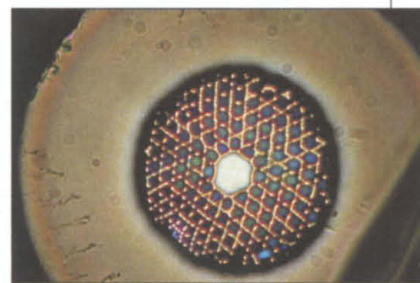
of 2.7 years after the explosion. The data also correlate with an x-ray-emitting source detected by ROSAT in 1990 and thus provide a rare glimpse of the nova before outburst.

Anchoring the Nucleus

The position of organelles within cells is highly regulated, but the factors that control positioning are not well understood. Starr and Han (p. 406) examined the process of positioning the nucleus in *Caenorhabditis elegans* embryos and discovered that a protein termed ANC-1, in association with another protein, UNC-84, was important. ANC-1 appears to act by tethering nuclei to the cell's actin cytoskeleton through its interaction with cytoplasmic actin and UNC-84 on the nuclear envelope. **X**

A Hydrogen Boost

Nonlinear optical effects, such as Raman scattering of input light, are particularly useful in spectroscopy for the conversion of laser wavelengths and materials characterization. However, efficient and practical energy exchange in the light and matter interaction typically requires high intensity, long interaction lengths, and good beam profile of the output light. Benabid *et al.* (p. 399; see the Perspective by Downer) used the light-confinement property of the photonic fiber whose hollow-core structure was filled with hydrogen to stimulate efficient Raman processes at pump powers nearly two orders of magnitude lower than those currently available.



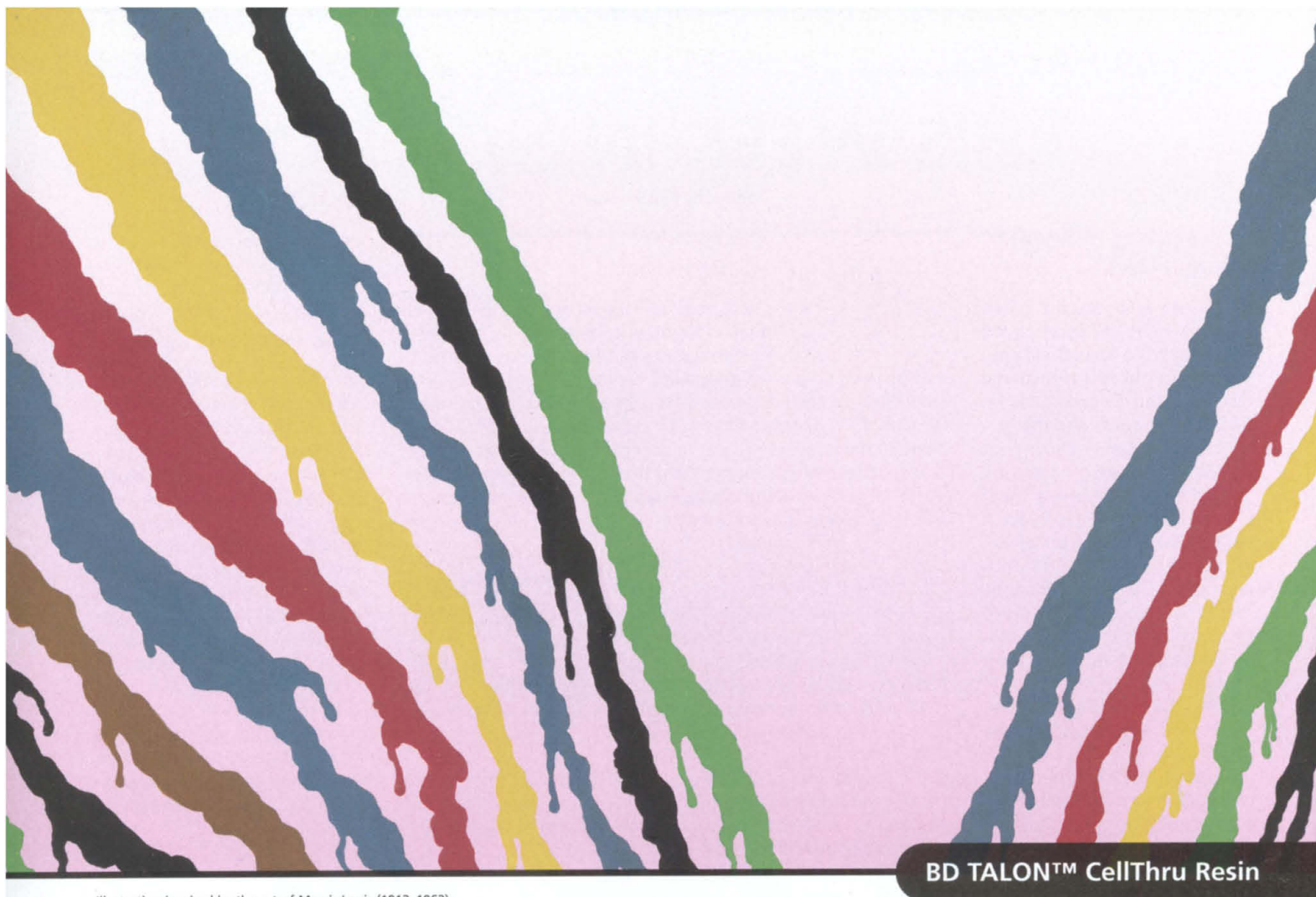


Illustration inspired by the art of Morris Louis (1912–1962).

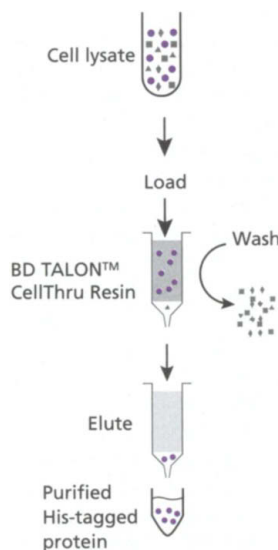
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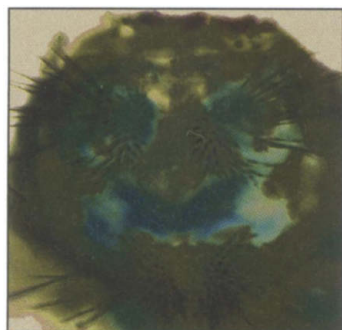
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How Images Take Shape

Our brain uses a multitude of cues to reconstruct a three-dimensional (3D) view from the necessarily two-dimensional (2D) image of the retina. Two reports focus on the brain areas in humans and monkeys that perform these functions (see the Perspective by Conner). It has long been proposed that texture gradients provide important cues for depth perception. Tsutsui *et al.* (p. 409) recorded the activity of neurons in a brain area in the intraparietal sulcus (area CIP) in response to both texture and disparity cues. Neurons were generally tuned to the same surface orientation irrespective of the cue. Moreover, monkeys could perceptually extract the 3D surface orientation from texture gradients in a cross-matching task. The 3D structure of a moving object can be derived from its complex motion vectors, and functional imaging studies suggest that an area called MT/V5 is strongly involved in this process. Are these human brain imaging results representative of primate visual processing in general, or are there interspecies differences? Vanduffel *et al.* (p. 413) used functional magnetic resonance imaging in humans and in awake monkeys performing the same tasks to compare brain areas activated by apparent 3D versus 2D motion. They found several common areas of activation, as well as differences in areas V3A and the intraparietal sulcus. The two species differed in the activation of their parietal lobe, but not in early visual processing areas.



Putting Jaws in Place

Elaboration of functional jaw structures in vertebrates not only allowed the transition from the simple body plan of the jawless agnathan fishes but also opened the door to evolution of complex skull and ear structures, as well as numerous specialized jaw and dentition structures. Jaw structures develop from the branchial arches, which are simple in agnatha and more complex in jawed gnathostomes. Depew *et al.* (p. 381; see the Perspective by Koentges and Matsuoka) have examined the expression of the *Dlx* family of genes in the branchial arches of the mouse. When expression of some *Dlx* gene family members was disrupted, the mice developed an upper jaw in place of the normal lower jaw. The *Dlx* gene family is expressed such that a combinatorial code defines different regions of a particular branchial arch and normally directs developmental outcomes to form a matching pair of upper and lower jaws. **X**

When expression of some *Dlx* gene family members was disrupted, the mice developed an upper jaw in place of the normal lower jaw. The *Dlx* gene family is expressed such that a combinatorial code defines different regions of a particular branchial arch and normally directs developmental outcomes to form a matching pair of upper and lower jaws. **X**

Regulating Both Splicing and Transcription

A single gene can give rise to more than one gene product through the differential splicing of messenger RNA. There has been growing evidence that this processing event may be functionally linked to RNA transcription. Auboeuf *et al.* (p. 416) report that in the case of nuclear receptors for steroid hormones, receptor-ligand interactions coordinate these processes at specific gene promoters through the recruitment of receptor coregulators that can both control gene transcription and splicing. This double-duty may ensure that the appropriate gene product is generated in response to a steroid hormone signal.

An Inhibitory Approach to Parkinson's Disease

Individuals with Parkinson's disease have trouble walking and show pronounced hand tremor because the movement-controlling servomechanism in the brain loses the dopamine-containing cells of the substantia nigra. Luo *et al.* (p. 425) now suggest a possible compensatory approach to therapy for this disease. The authors injected viral vectors containing the genes for glutamic acid decarboxylase (the enzyme that makes the inhibitory neurotransmitter GABA) into the subthalamic nucleus of rats with artificially created Parkinson's symptoms. The overexcitatory cells in this nucleus also produced inhibition and so reduced the abnormal excitatory drive to the substantia nigra. The rats showed improvement in their Parkinson's-like disorder, and their dopamine-containing cells were protected from damage caused by further insult.

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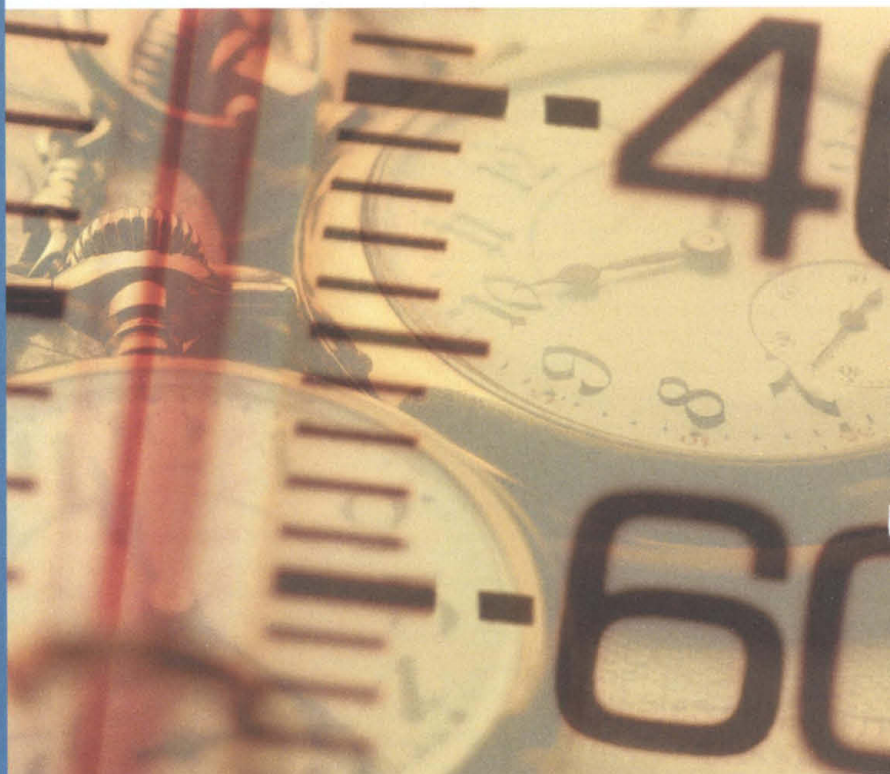


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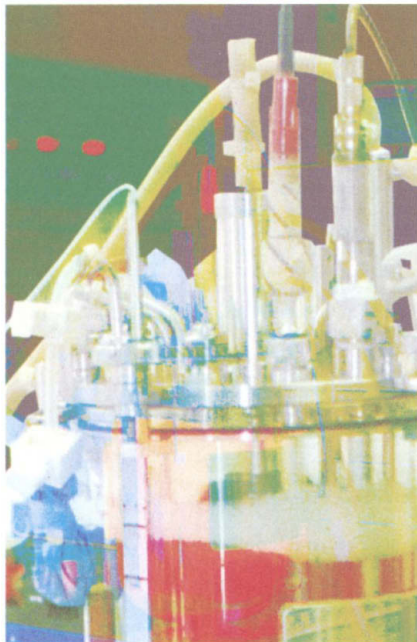
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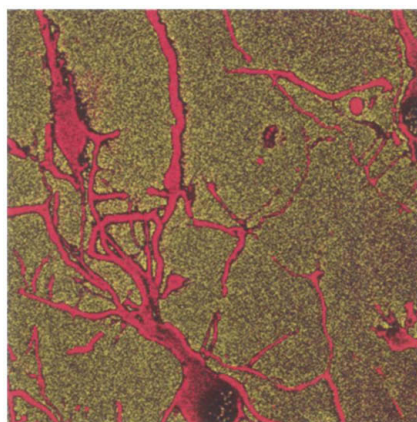


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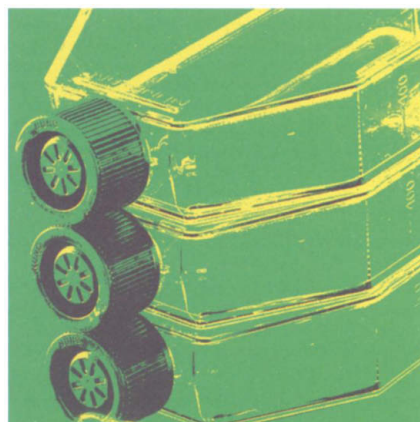


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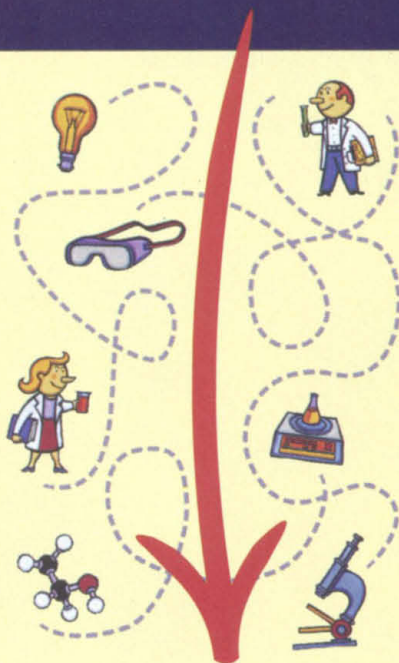
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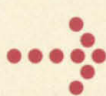
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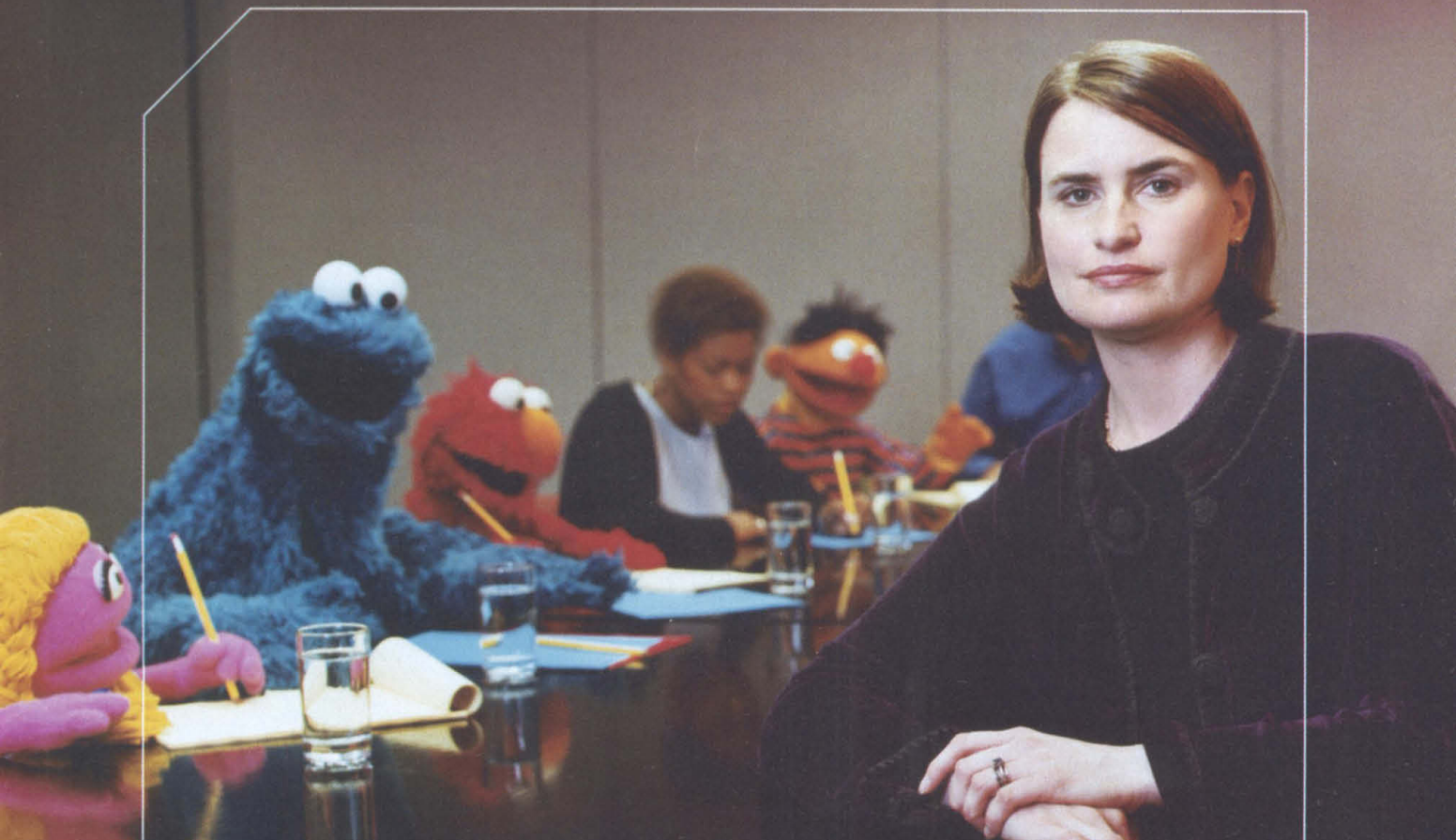
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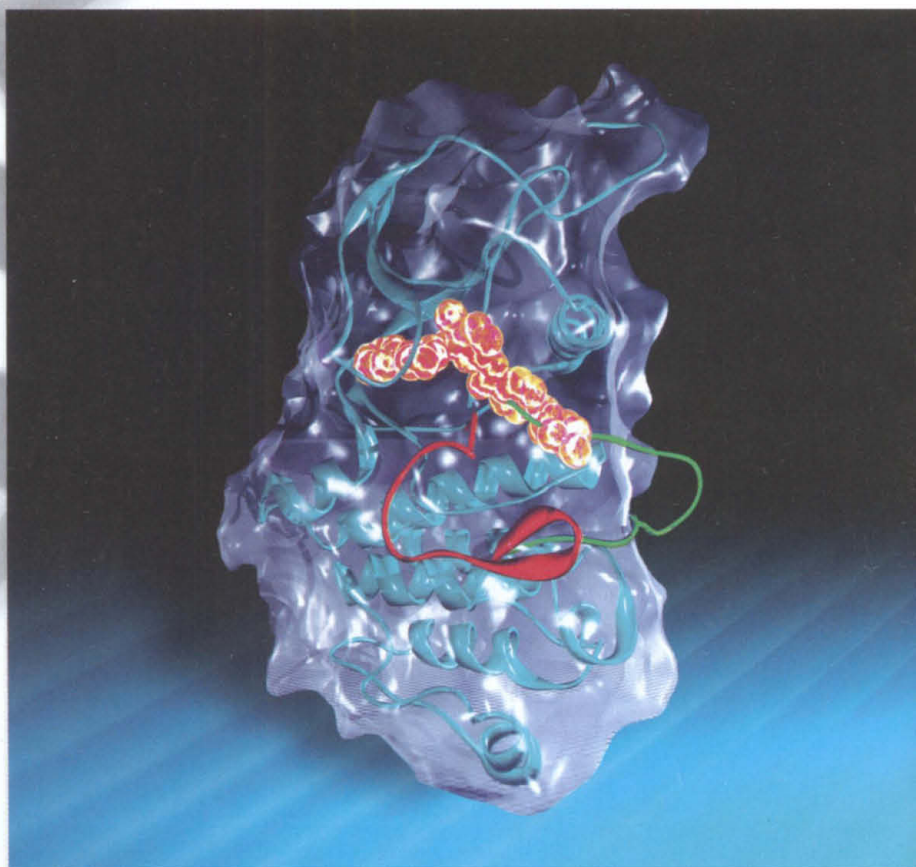
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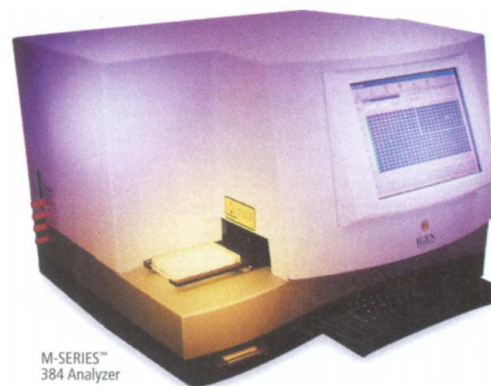
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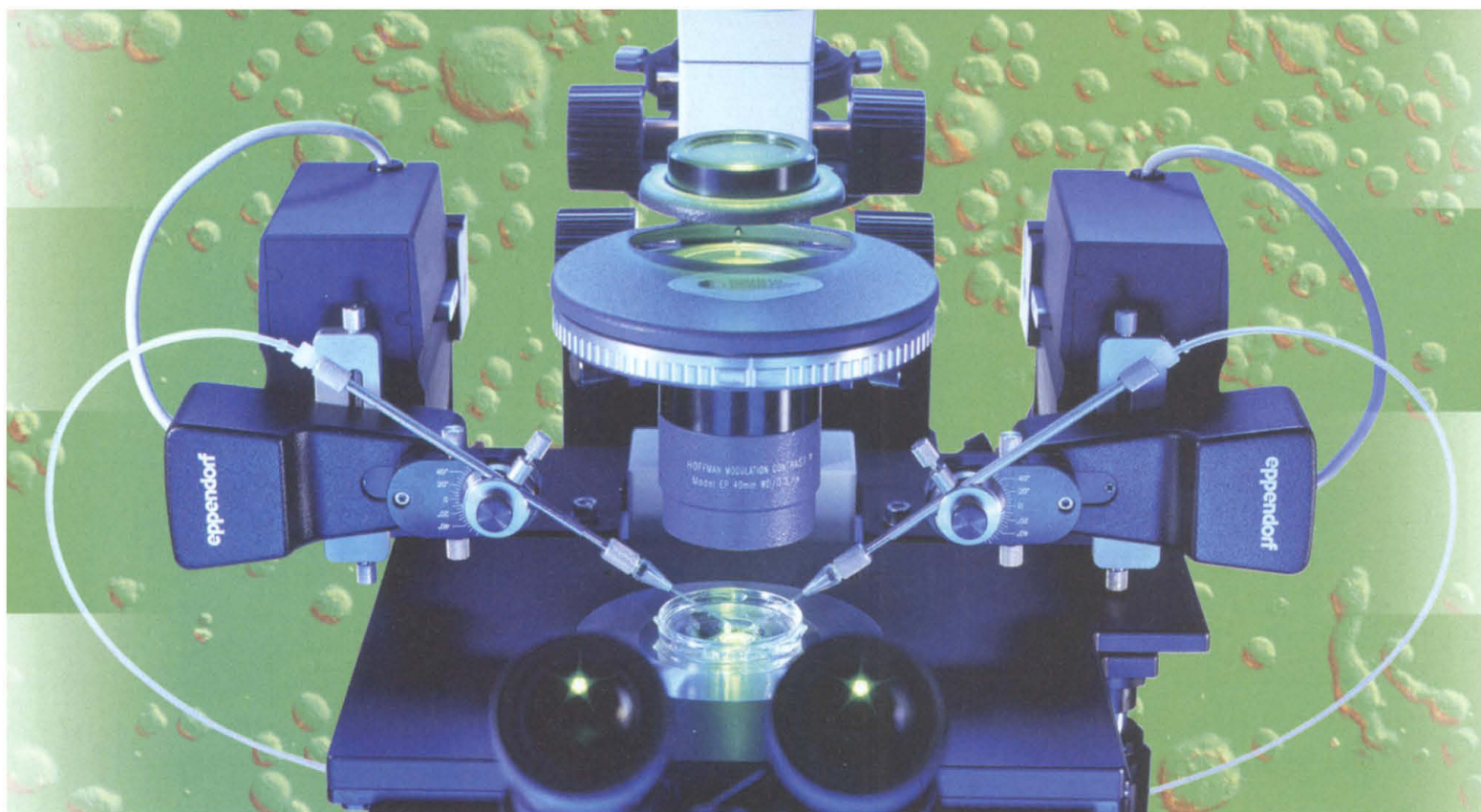


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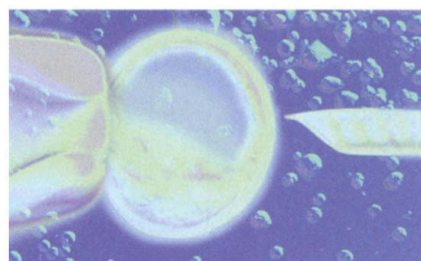


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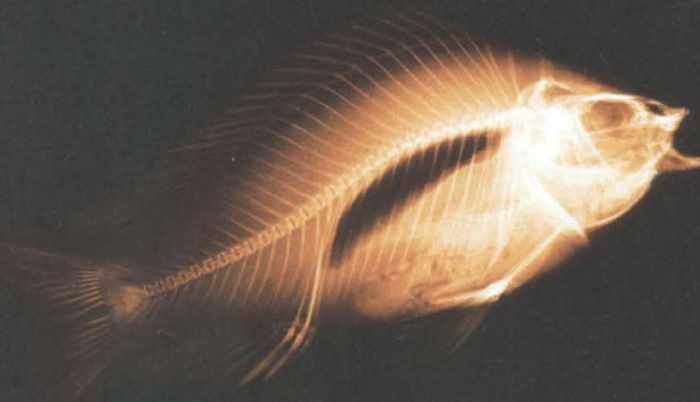


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