21 August 1998

Science

Vol. 281 No. 5380
Pages 1101–1240 $7

American Association for the Advancement of Science

VOLUME 281 21 AUGUST 1998 NUMBER 5380

Science

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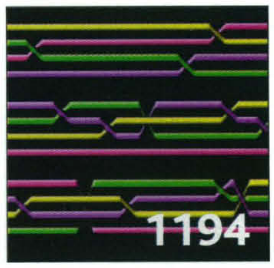
COVER DNA sequence information from the genome projects in combination with microhybridization technology allows heritable variation to be assessed with new ease. Oligonucleotide arrays were used to genotype ~3800 markers in the four meiotic products from a cross between two yeast strains. Recombination events between DNA strands (crossed lines) for the 16 chromosomes are depicted. [Image: E. A. Winzeler]



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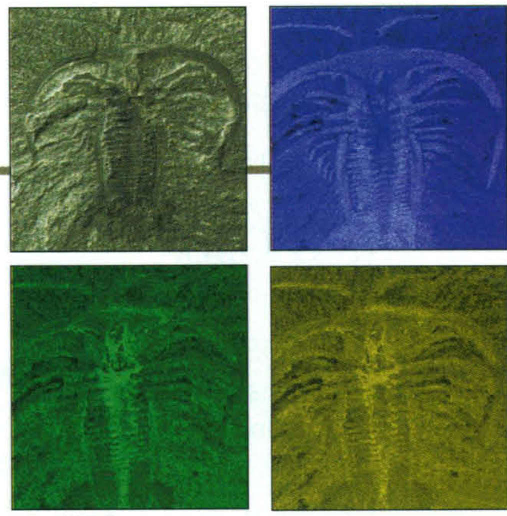

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SCIENCE (ISSN 0036-8075) is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1200 New York Avenue, NW, Washington, DC 20005. Periodicals Mail postage (publication No. 484460) paid at Washington, DC, and additional mailing offices. Domestic individual membership and subscription (51 issues): $108 ($60 allocated to subscription). Domestic institutional subscription (51 issues): $295. Foreign postage extra: Mexico, Caribbean (surface mail) $55; other countries (air assist delivery) $90. First class, airmail, student, and emeritus rates on request. Canadian rates with GST available upon request, GST #1254 88122. IPM #1069624. **Printed in the U.S.A.**

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Where are memories encoded?

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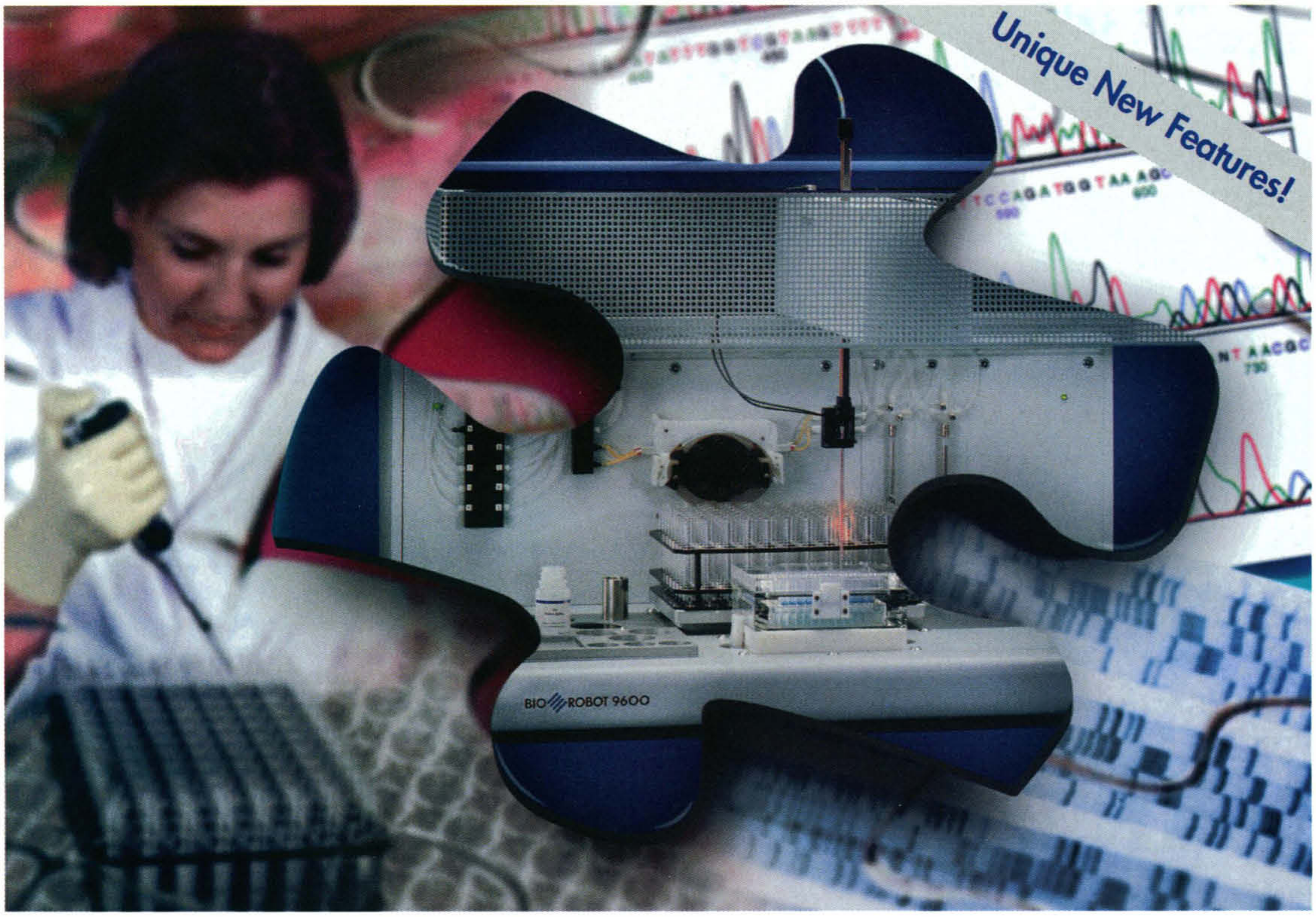

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THIS WEEK IN *SCIENCE*

edited by PHIL SZUROMI

MARINE DIVERSITY: LOCAL TO GLOBAL

Long and extensive records of global marine faunal diversity since the Cambrian (about 550 million years ago) have led to two different interpretations of the factors that affect diversity. One is that mass extinctions reset diversity trends and allow less dominant families to radiate where once dominant families lived, and the other is that long-term diversification, linked to biotic interactions, is unaffected over the long run by mass extinctions. Miller (p. 1157) reviews the development of these interpretations based on the marine record and concludes that there is actually a third interpretation that is gaining proponents through recent detailed regional studies of marine biota: Diversification is fueled by relatively rapid local or regional changes in the environment with mass extinctions being the extreme case. Diversity would come quickly in one region and then be transferred to a global scale during a longer time period, thus leading to the gradual increase in diversity seen in the global marine fauna.

STARRY GASES IN DIAMOND DUST

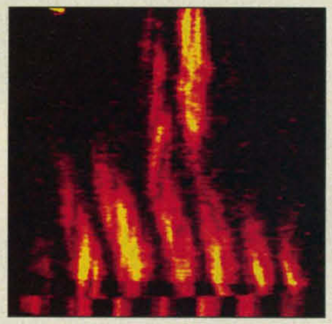
Diamonds found in meteorites are thought to represent solid grains created before the formation of the solar system and thus are tracers of presolar conditions. Verchovsky *et al.* (p. 1165) used ultracentrifugation to separate diamond grains collected from the Efremovka meteorite into four grain size fractions. The measured abundances of noble gases increased with increasing grain size, while those of nitrogen and carbon did not vary. The noble gases present were implanted as ions into the grains when they were in the interstellar medium, a process that was more efficient for larger grains.

A STEP IN TIBET

The Tibetan Plateau, created by the collision of India into Eurasia, is the largest and highest platform of thickened, folded, and faulted crust. Although the towering Himalayas provide some indication of the extreme crustal deformation produced by this collision, it is unclear how the Moho, the boundary between the crust and the uppermost mantle, may have been affected by this tectonism. Zhu and Helmberger (p. 1170) noticed a peculiar pair of pulses in some compressional teleseismic waveforms recorded at one seismic station on the northern boundary of the Tibetan Plateau. Their model implies that the jump in the Moho is caused by a thickened, weaker crust beneath the plateau that is juxtaposed against a vertical wall of thinner stronger crust and mantle north of the plateau. This modeled jump in the Moho may provide a barrier for lateral deformation of the crust and may cause the thickening of the plateau by vertical deformation.

LASER-SHOCKED METALLIC DEUTERIUM

Understanding the behavior of hydrogen under high pressure is fundamental for determining the structure and evolution of the jovian planets, extrasolar giant planets, brown dwarfs, and low-mass stars that are composed pre-



dominantly of hydrogen under high pressure. Collins *et al.* (p. 1178; see the news story by Kerr) used a recently developed technique to shock liquid deuterium to pressures between 22 and 340 gigapascals with an intense laser beam. Deuterium, an isotope of hydrogen, serves as a proxy for the hydrogen equation of state because its properties can be scaled to those of hydrogen by a correction for their density differences. The transition of deuterium from an insulating molecular fluid to a reflective metallic fluid occurred at about 100 gigapascals. Their work indicates that hydrogen is about 50 percent more compressible than had been previously predicted by theory.

IDENTIFYING FOSSILS ORGANICALLY

Dinoflagellates, an important group of plankton, are widely recognized back to the Triassic (about 240 million years ago), although some data have indicated a much earlier origin. In a search for earlier evidence of dinoflagellates, Moldowan and Talyzina (p. 1168) isolated specific biochemical markers of dinoflagellates and examined enigmatic fossils and organic remains of Cambrian sedimentary rocks. The data imply that dinoflagellates were abundant by the Early Cambrian (540 million years ago).

FROM LIFE TO CLAY

The Burgess Shale, formed during the great metazoan diversity in the Cambrian, contains some of the most exquisitely preserved fossils and possibly some organic matter from these early animals. The manner in which these fossils were preserved has been debated. Orr *et al.* (p. 1173) used elemental mapping of some of these fossils and their adjacent matrix to demonstrate that clay minerals copied and replaced some of the soft tissue components. This previously unrecognized mechanism of preservation should improve our understanding of the history of the fossils and also the life of the metazoans because this preservation method can potentially distinguish between different soft tissue components.

SQUEEZE AT THE PLATE

Subduction zones are collisional margins of plate boundaries where one plate slides below the other. A sloped line of earthquakes, the Benioff zone, traces the boundary between these plates, and Bilek and Lay (p. 1175) have used the earthquakes along the subducting oceanic crust beneath the island of Japan to characterize the properties of the downgoing crust as it is squeezed and heated with depth. A trend of longer rupture duration or greater stress drop for deeper earthquakes suggests that the plate boundary is becoming more rigid with increasing depth as the shallow looser sediments give way to deeper, more rigid basalt.

ELECTRONS ON THE LOOSE

When electrons are confined to systems of reduced dimensions, such as planes or chains, the conditions required for forming a metallic state are not clear. Vescoli *et al.* (p. 1181; see the Perspective by Bourbonnais and Jérome) have studied the optical properties of a variety of organic linear chain conductors (Bechgaard salts) that can exhibit either insulating or metallic properties and compared these results with their magnetic behavior. The crossover from insulating to metallic behavior correlates with an increased probability for electrons to hop between chains and be deconfined. The metallic state appears to be anomalous; its properties are inconsistent with those of a standard Fermi liquid theory

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and are better described as a Luttinger liquid with strong correlations. They also find that while there is an energy gap for charge excitations in these metals, there is no gap for spin excitations.

MOTOR POLARITY

The kinesin family of molecular motors moves intracellular cargo along microtubules. Most kinesin family members move specifically toward the unstable or plus end of microtubules—the end that would be directed away from the center of the cell toward the periphery. However, one kinesin, known as Ncd, moves with the opposite polarity, toward the minus end of microtubules. Endow and Waligora (p. 1200) have examined the molecular features of the motor that specify motor polarity. They defined a small region within the motor that is critical in maintaining the unusual polarity of Ncd.

NITROGEN DELIVERY

The symbiotic interaction between leguminous plants and their nodulating bacteria offers the advantage to the plant of a ready supply of fixed nitrogen. Kaiser *et al.* (p. 1202) have now cloned the transport protein that likely delivers the fixed nitrogen from the bacteroid to the plant. The protein is located in nodules and contains a single putative transmembrane domain.

MEMORY MAKERS

Why do we remember some things but not others? Brewer *et al.* (p. 1185) and Wagner *et al.* (p. 1188) show that photographs and words that elicited greater activation in prefrontal and parahippocampal regions of the brain during the initial exposure were more likely to be remembered and that forgotten experiences correlated with lower activities in these regions (see the Perspective by Rugg).

TRICKING MOTHER

Grafts and transplants from donors are rejected by the host unless the immune system is suppressed because the host's T cells react strongly to the foreign major histocompatibility antigens (MHC) on the graft. Why is a fetus, whose MHC is half from the father and, therefore, foreign to the mother, not instantly rejected? Munn *et al.* (p. 1191; see the news story by Gura) found that the tissues of the mouse fetus itself deprived the maternal T cells of a critical factor for their activation—tryptophan. A fetal enzyme (indoleamine 2,3-dioxygenase or IDO) catabolizes tryptophan. Inhibition of IDO disarmed the fetus and allowed the maternal T cells to reject the conceptus.

ASSESSING GENETIC DIFFERENCES

The ability to identify variations between genomes rapidly and efficiently will be central to understanding the molecular basis for individual differences between microbes, plants, or humans and will form the basis of identifying genes involved in multigenic or quantitative normal traits or diseases. Winzeler *et al.* (p. 1194; see the cover and the news story by Service) used high-density oligonucleotide arrays to scan for alternative alleles between two strains of yeast. The procedure did not require amplification steps and did not require knowledge beforehand of the specific nature of the variation.

HEME CHAPERONE

Many enzymes contain iron associated with heme as an essential cofactor for activity, but the mechanism of heme addition and heme targeting has been unclear. Schulz *et al.* (p. 1197) discovered a protein important for heme targeting in the periplasm of bacteria; CcmE appears to act as a chaperone, first binding heme and then releasing it to target enzymes.

TECHNICAL COMMENT SUMMARIES

"Green Rust" in the Lab and in the Soil

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/281/5380/1111a

S. C. B. Myneni *et al.* (Reports, 7 Nov., p. 1106) studied "abiotic selenium redox transformations" in the presence of iron oxides that are "called green rust." Myneni *et al.* stated that they "provide direct evidence for the formation of reduced Se species in anoxic sediments."

R. S. Oremland *et al.* comment that experiments in the report "done under highly specialized laboratory conditions" and the "agreement of rate constant data" provide "only circumstantial evidence" that green rust observed in soils is abiotic and not "directly mediated by bacteria."

In response, Myneni *et al.* agree that green rust can be produced by "many species of microorganisms," but state that current research methods "do not rule out other mechanisms" of green rust formation in sediments.

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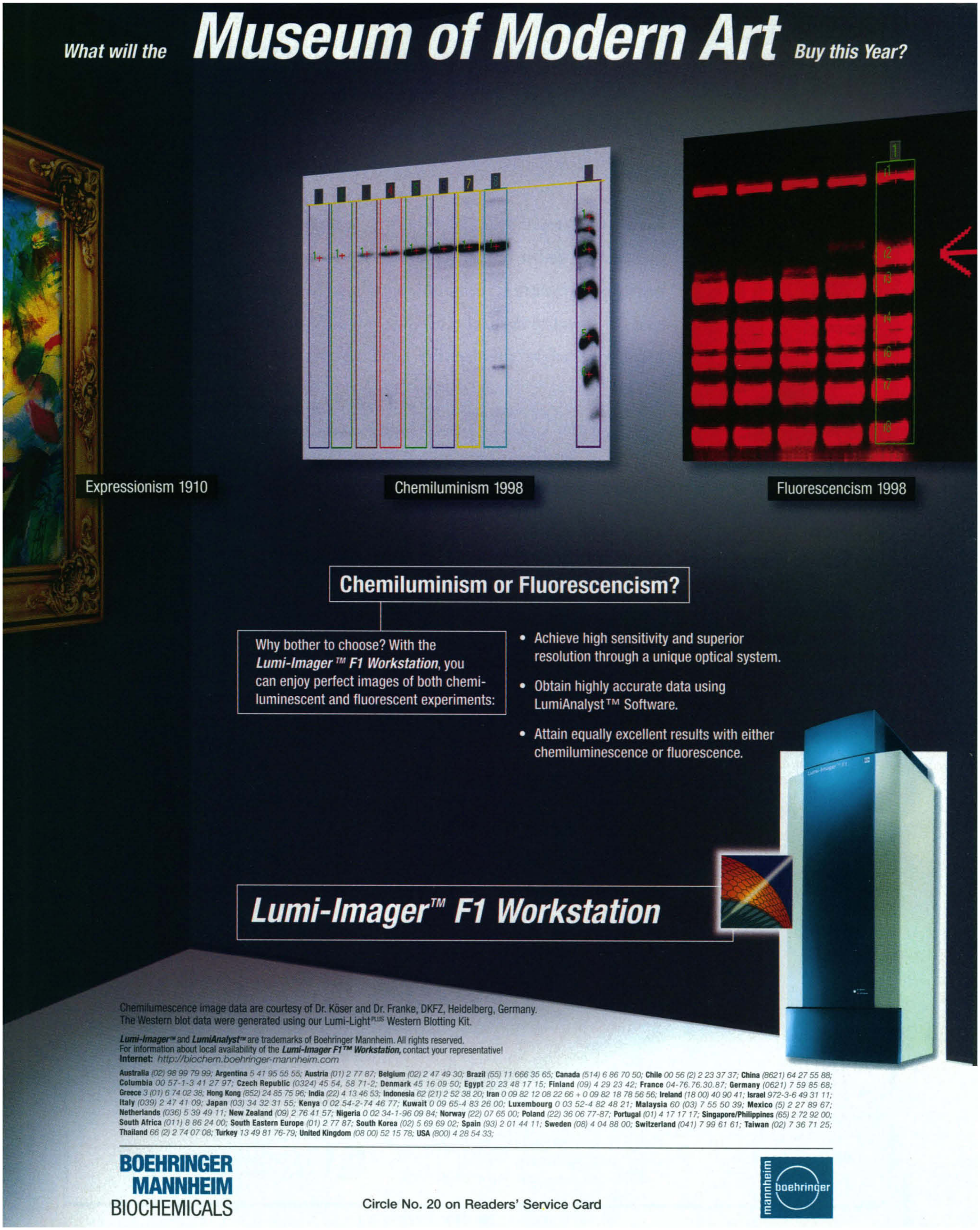

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Bill Dietrich, science writer for the Seattle Times, February 12, 1997

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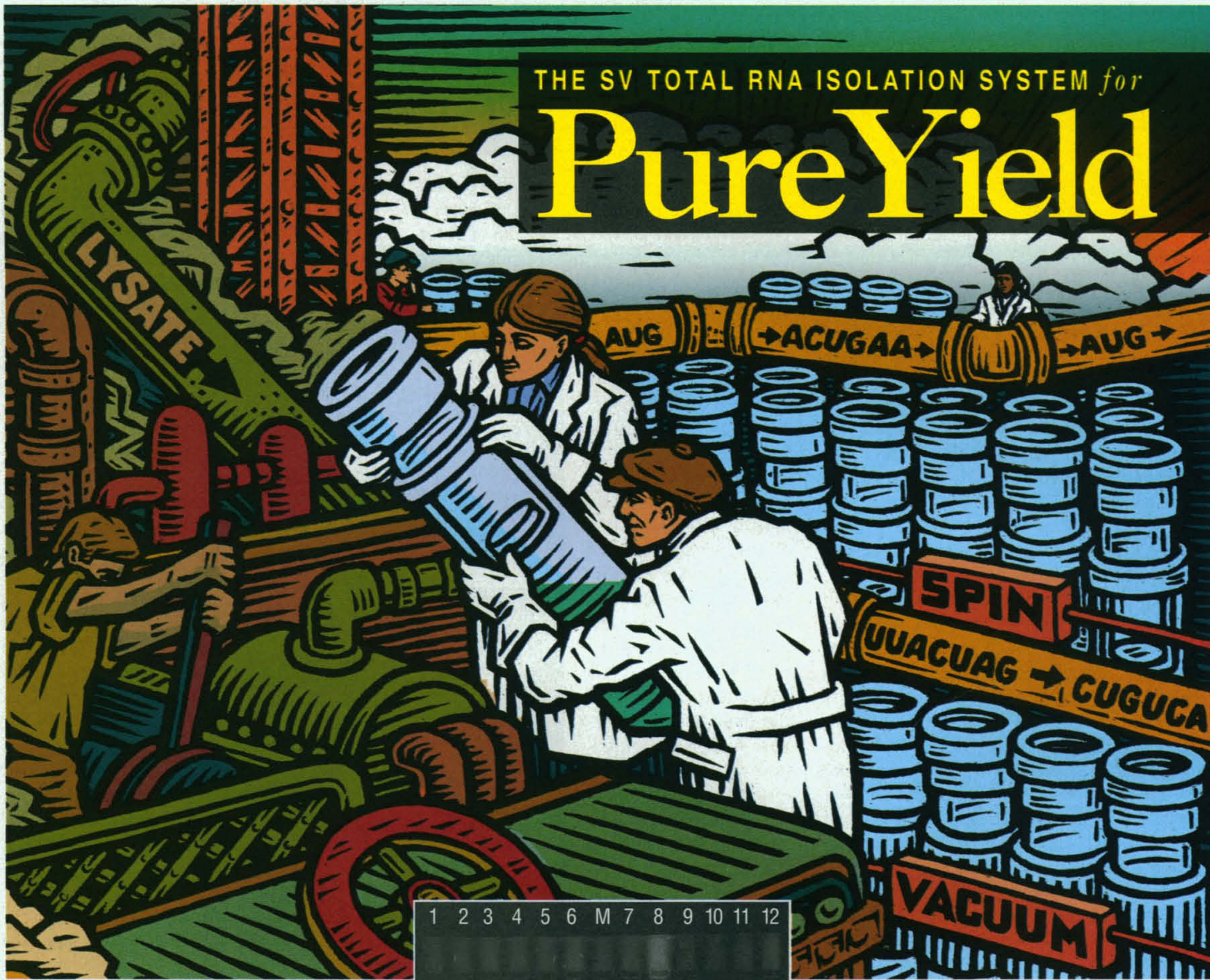

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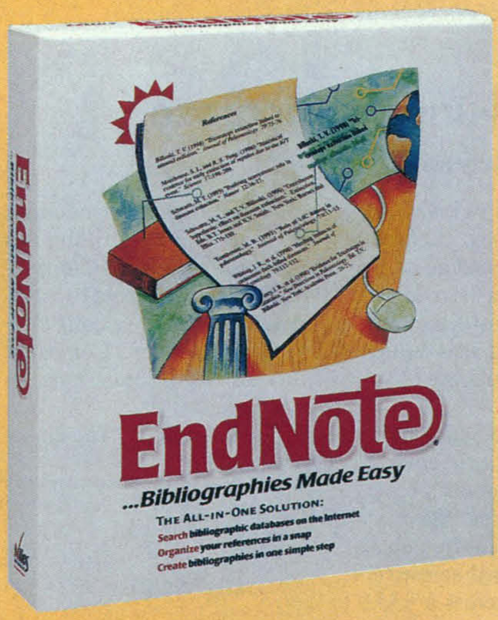

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Introducing

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The All-in-One Solution:

✓1-Step Internet Research New!

✓1-Step Reference Organization

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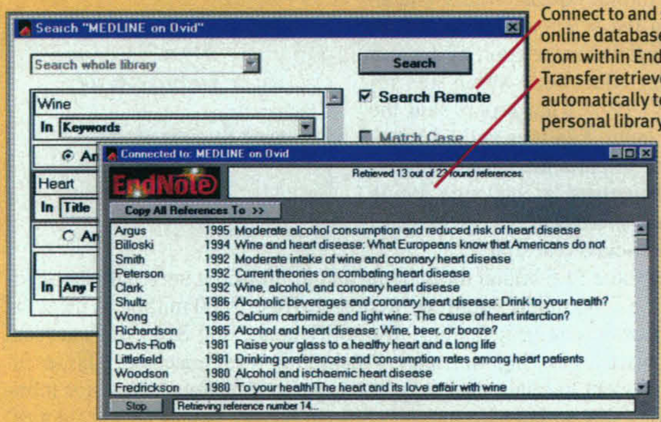
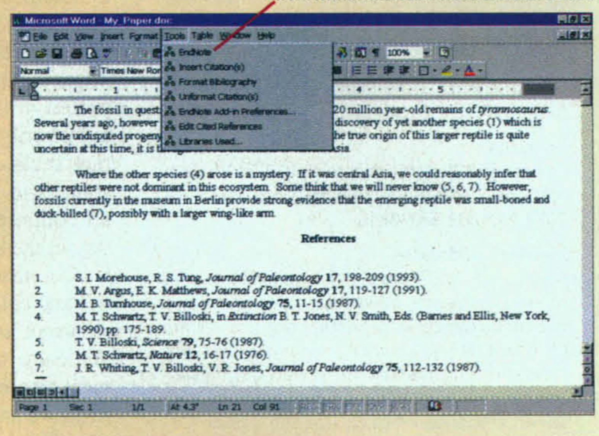


Connect to and search online databases from within EndNote. Transfer retrieved references automatically to your personal library.

Access EndNote commands and create ONE-STEP BIBLIOGRAPHIES™ from within Microsoft Word & WordPerfect.



Online Search Tool New!

EndNote includes more than 100 connection files, enabling you to seamlessly access remote bibliographic databases such as MEDLINE, PsycINFO, and many university library catalogs from within EndNote. Search these and other databases using EndNote's simple search window-then transfer your results directly into your EndNote database. No additional importing steps!

Reference Database

EndNote makes organizing references easy. Create your own EndNote databases (as many as you wish) and store up to 32,000 records in each. Store abstracts, keywords, and notes, and link records to full-text articles or other material on the World Wide Web. At the click of a button, EndNote launches your web browser (e.g. Netscape, Microsoft Internet Explorer) directly from EndNote records.

1-Step Bibliography Maker

EndNote creates 1-Step Bibliographies™ from within Microsoft Word (Macintosh and Windows) and WordPerfect (Windows), allowing you to insert citations and format bibliographies without leaving your word processing documents. For journal article submissions, grant proposals, thesis preparation and a wide variety of academic writing projects, EndNote is an invaluable time-saving tool. You can choose from over 300 pre-defined bibliographic styles (e.g., APA, Science, Nature), or create a style to suit your needs. You can revise your document as many times as needed—EndNote will update the in-text citations and bibliography quickly and easily. And EndNote will also generate bibliographies in HTML for publication on the Internet!

More than 150,000 users prefer EndNote.

Compatible with Windows 95, Windows NT, Windows 3.1 and Mac OS. To use EndNote as an online search tool: Remote databases must be z39.50 compliant; System must have Internet access and ability to run standard Internet applications.

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