

Science

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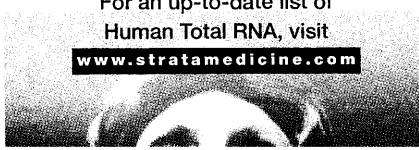
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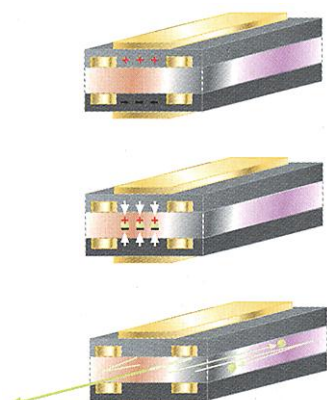
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COVER Murder rates are down in the United States, but violent crime still continues to inflict a heavy toll on society. What preys on the minds of violent individuals, compelling them to harm others? A special section beginning on page 569 probes the biological and psychological roots of violence and reviews the strategies being tested for preventing people from injuring others or themselves. [Illustration: Daniel Mackie/Digital Vision]



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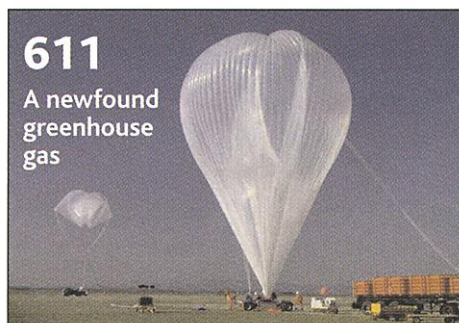
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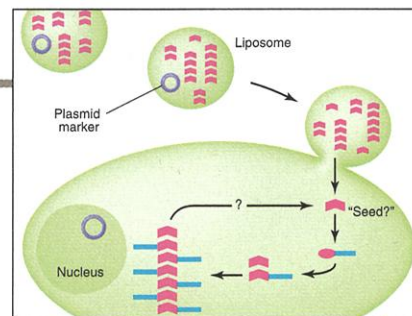
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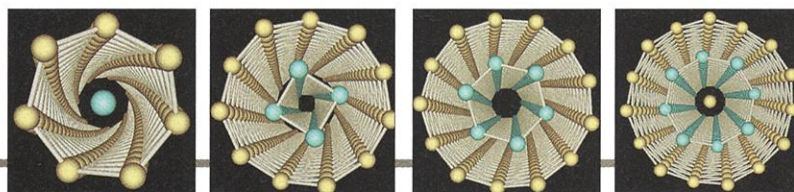
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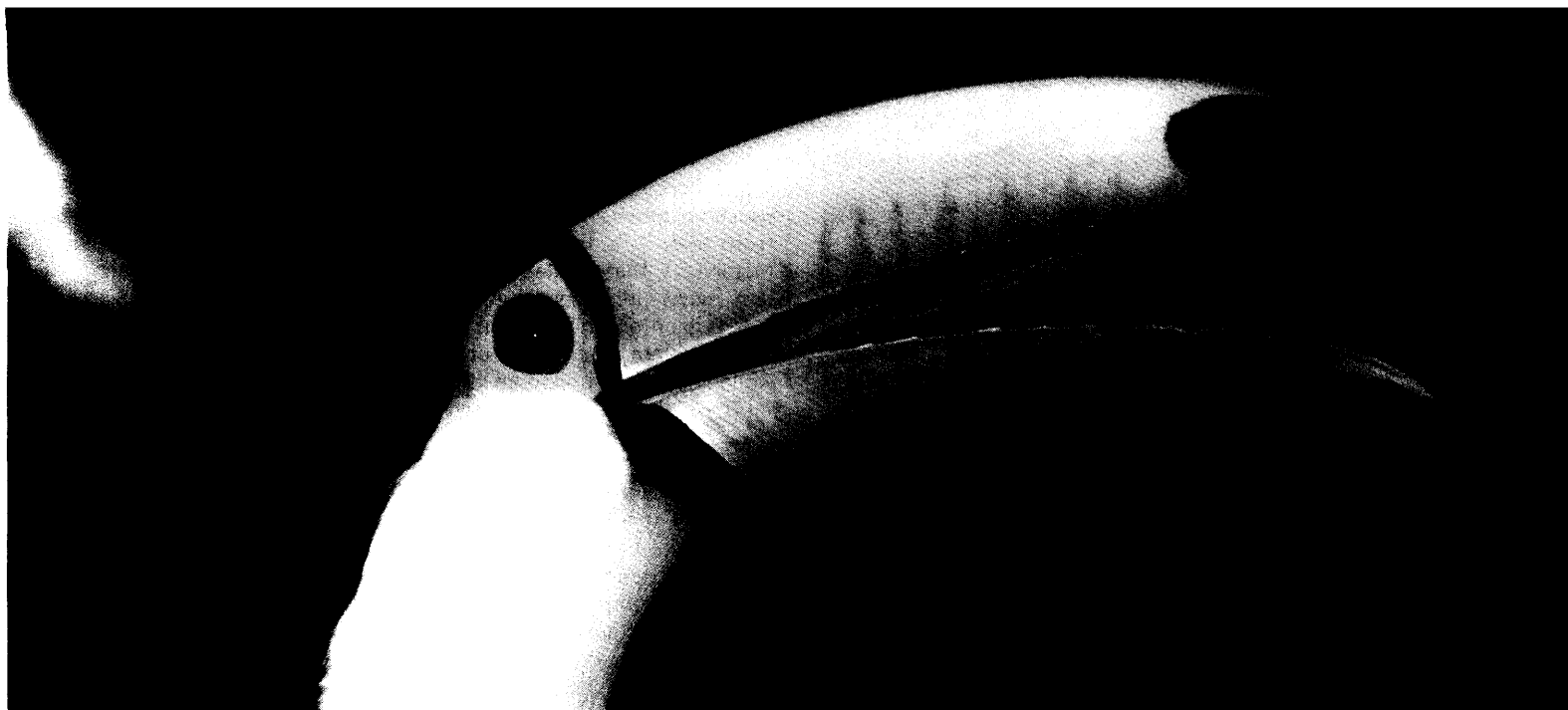
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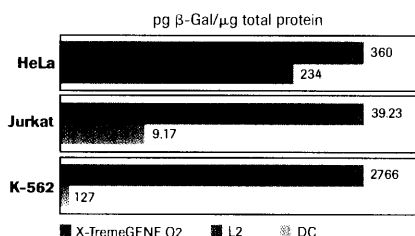
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BUILDING A 3D PHOTONIC CRYSTAL

Full three-dimensional photonic bandgap (PBG) crystals—materials whose structure prevents almost all light from propagating over a certain range of wavelengths—have been very difficult to realize but have great potential for optoelectronics. Noda *et al.* (p. 604; see the Perspective by Yablonovitch) have now improved and reduced their woodpile-like structures for producing PBG crystals to submicrometer dimensions. These PBG crystals, which function in the near-infrared (optical communications wavelengths), prevented 99.99% of the incident light at wavelengths from 1.3 to 1.55 micrometers from entering the crystal.

A DIFFERENT TWIST ON GOLD

Nanometer-scale objects often have structures that differ from the bulk material; for example, small gold particles form icosahedral particles on the nanometer scale. Simulations have suggested that nanoscale metal wires may be helical, but experimental verification has been lacking. Kondo and Takayanagi (p. 606; see the Perspective by Tosatti and Prestipino) have prepared gold nanowires that consist of helical, concentric shells similar to those in carbon nanotubes, as shown in high-resolution electron microscopy studies. The number of atomic rows in each shell appears to follow a "magic number" sequence.

STILL MORE GREENHOUSE FORCING

After all of the attention given to the known greenhouse gases, Sturges *et al.* (p. 611) have found a new potential warming threat: SF_5CF_3 . This gas, the most potent greenhouse molecule found in the atmosphere to date, has only existed for the last 40 years or so. Its concentration is still low (about one tenth of a part per trillion in 1999) but is increasing, and its source is unknown. Because SF_5CF_3 has a long lifetime, it has the potential to be a major component in the radiative balance of Earth.

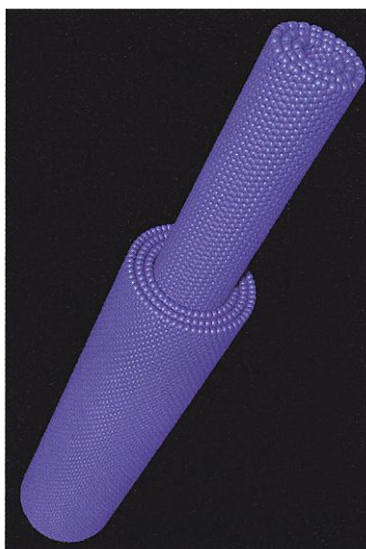
INJECTION LASERS WITH ORGANIC CRYSTALS

Organic-based electronics has developed tremendously, particularly in applications for light-emitting diodes and thin-film transistors. However, the electronic properties and large defect densities characteristic of many organic materials have made electrically pumped lasing an elusive goal. Schön *et al.* (p. 599; see the news story by Service) now demonstrate such a laser made from a tetracene single crystal, whose bipolar nature allows electrical contact made to either

side of the crystal. Electrons or holes can be induced at each interface, and an electric field applied across the crystal then brings the charges together for recombination. Lasing is demonstrated for injection currents so far unobtainable in other organic materials.

EASY SLIDER

Graphite sheets slide past each other with relatively little friction, and it has been predicted that multiwall carbon nanotubes could also readily slide past each other. Cumings and Zettl (p. 602; see the Perspective by Forró) have taken advantage of a recently developed "arcing" method to free inner carbon nanotubes from the outer-



most tubes at the end caps and now explore the motion of undamaged nested nanotubes. They attached a nanomanipulator to the inner bundle and show that it slides out freely. When a pulled-out inner tube is detached from the manipulator, van der Waals forces rapidly retract it back into the bundle. Such low-friction sliding motion could possibly be used as "bearings" in mechanical nanodevices.

DIAMONDS' RAPID ASCENT

Kimberlites are diamond-bearing volcanic rocks that are thought to form by the rapid and explosive eruption of gas- and fluid-rich magma from depths of hundreds of kilometers. Kimberlites contain fragments ripped from the surrounding upper mantle rock, and these xenoliths can provide information

about the structure of the mantle if they are transported to the surface rapidly enough to avoid subsequent alteration. Kelley and Wartho (p. 609) used $^{40}\text{Ar}/^{39}\text{Ar}$ dating of phlogopite grains in kimberlite xenoliths to show that these xenoliths were transported to the surface rapidly—within a few hours to a few days. Argon and other noble gases may be retained in the cores of the grains and could provide estimates of the noble gas content of the upper mantle.

DIRECT PRION PROPAGATION IN YEAST

The prion hypothesis suggests that infectious protein conformations can be transmitted from cell to cell and that this mode of transmission underlies certain fatal neurodegenerative disorders like Creutzfeldt-Jacob disease. In yeast, the $[\text{PSI}^+]$ phenotype is thought to model prion diseases, but direct demonstration that a protein, rather than the gene encoding a particular protein, can cause the prion phenotype in vivo has been lacking. Sparrer *et al.* (p. 595; see the Perspective by Tuite) introduced the "pathological" form of the yeast prion protein, Sup35p, through liposomes into normal yeast cells and induced the $[\text{PSI}^+]$ phenotype, thus demonstrating directly that a protein alone can propagate a phenotype.

MAKING UP THE MERISTEM

The role of the *CLAVATA* (*CLV*) genes in the differentiation of the plant meristem of *Arabidopsis* is the focus of two reports. Trotochaud *et al.* (p. 613) investigated the interactions between CLV3, a small peptide, and CLV1, a receptor kinase. Most of the CLV3 found in vivo is complexed with CLV1. That fraction of CLV3 not bound up with CLV1 is found in a smaller multimeric complex. CLV1 similarly is found in two different complexes, only one of which includes CLV3. As with other ligand-receptor signaling systems, other components may sequester unbound ligand. Brand *et al.* (p. 617) have uncovered some of the signaling pathways that balance the supply and demand of stem cells, which provide a renewable source of replacement cells but only when needed. Stem cell accumulation is regulated by CLV3 activity, which in turn is subjected to regulatory feedback.

MAPPING THE TRANSCRIPTION ELONGATION COMPLEX

Recently, the structure of RNA polymerase, the enzyme responsible for transcription, has been determined at atomic resolution. Now Korzheva *et al.* (p. 619) have used

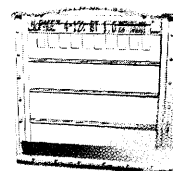
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THIS WEEK IN SCIENCE

CONTINUED FROM PAGE 505

RNA- and DNA-protein cross-linking data to map the path of nucleic acids through a transcription elongation complex (TEC). The downstream duplex DNA (that part yet to be transcribed) is cradled in a trough formed by the β' subunit with a top formed by the β subunit. The RNA/DNA hybrid is in a channel that extends from the enzyme active site to a rudder-shaped structure in the β' subunit. The rudder likely causes the RNA transcript to separate from the DNA template strand before it exits through another channel in the β subunit.

BICARBONATE SENSING BY SPERM

When exposed to prostatic and vaginal fluids, ejaculated mammalian sperm undergo increased motility, capacitation, and the acrosome reaction. These processes can be triggered by bicarbonate ions and depend on increased production of cAMP (cyclic adenosine 3',5'-monophosphate). Chen *et al.* (p. 625; see the Perspective by Kaupp and Weyland) now report that the bicarbonate sensor appears to be the recently cloned soluble adenylyl cyclase (sAC), which is activated in the presence of bicarbonate to produce more cAMP. The mammalian sAC protein is closely related to adenylyl cyclases from cyanobacteria that are also stimulated by bicarbonate ions. Thus, regulation of cAMP signaling through bicarbonate-sensitive sACs appears to be an evolutionarily conserved mechanism that could also function in other animal tissues where sAC is present and bicarbonate concentrations are regulated.

ONCE BITTEN, TWICE SENSITIVE

Advances in operation techniques and other medical treatments have improved the survival chances of immature or otherwise medically compromised neonates. Do such tissue damage and painful interventions early in life have adverse long-term effects?

Ruda *et al.* (p. 628; see the news story by Helmuth) show that hindlimb inflammation in rat pups triggers exuberant growth of small-diameter, pain-transmitting axons in the dorsal horn of the spinal cord. These changes are coupled with an increase in the sensitivity of the paw after inflammation in the adult. These results show that painful stimuli in early development can cause long-term alterations in the neuronal circuitry.

EVOLUTION CAUGHT IN THE ACT

Many of the morphological changes that typify evolution are known only from analysis of lineages that have already grown far enough apart to become separate species. Studying the blind cavefish and its sighted close relative, Yamamoto and Jeffery (p. 631; see the news story by Pennisi) now have insights into the developmental processes that underlie this intriguing specialization for life in dark places. The later morphology depends on apoptosis of the optic lens early in its development. Reciprocal transplants of lenses show that the lens organizer drives the morphological adaptation.

REDRESSING THE IMBALANCE

Damage to a structure in the brain called the basal ganglia is the underlying cause of several neurodegenerative disorders, such as Parkinson's disease. Activity of striatal nerve cells is usually modulated by dopaminergic and cholinergic inputs. Kaneko *et al.* (p. 633) introduced a selective and highly specific ablation of striatal cholinergic interneurons in one hemisphere of the brains of mice. All of the symptoms observed in the acute postablational phase could be explained by the sudden dominance of the dopaminergic system. The compensatory mechanisms in the chronic phase, however, were best explained by a downregulation of postsynaptic dopamine receptors rather than by a reduction of the dopaminergic input.

TECHNICAL COMMENT SUMMARIES

Tektites and the Age Paradox in Mid-Pleistocene China

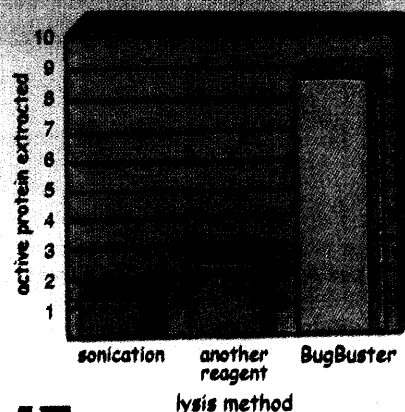
Hou Yamei *et al.* (Research Articles, 3 March, p. 1622) used $^{40}\text{Ar}/^{39}\text{Ar}$ dating of tektites associated with Acheulean-like stone tools in the Bose basin, South China, to infer an age of 800,000 years ago for the artifacts—a date that implies use of this relatively sophisticated tool technology in East Asia far earlier than previously thought. Koeberl and Glass point out that tektites “are not commonly found in situ, but instead generally are found in deposits younger than their isotopic ages,” owing, in some cases, to transport by humans. Keates, in a separate comment, adds that the tektites might also have been transported and redeposited in younger sediments by river systems. In their response, Potts *et al.* present arguments based on sedimentology and stratigraphy, tektite form, and geomorphological distribution that “indicate a firm in situ and original association and a sound basis for assigning the tektite age to the tools.”

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/289/5479/507a

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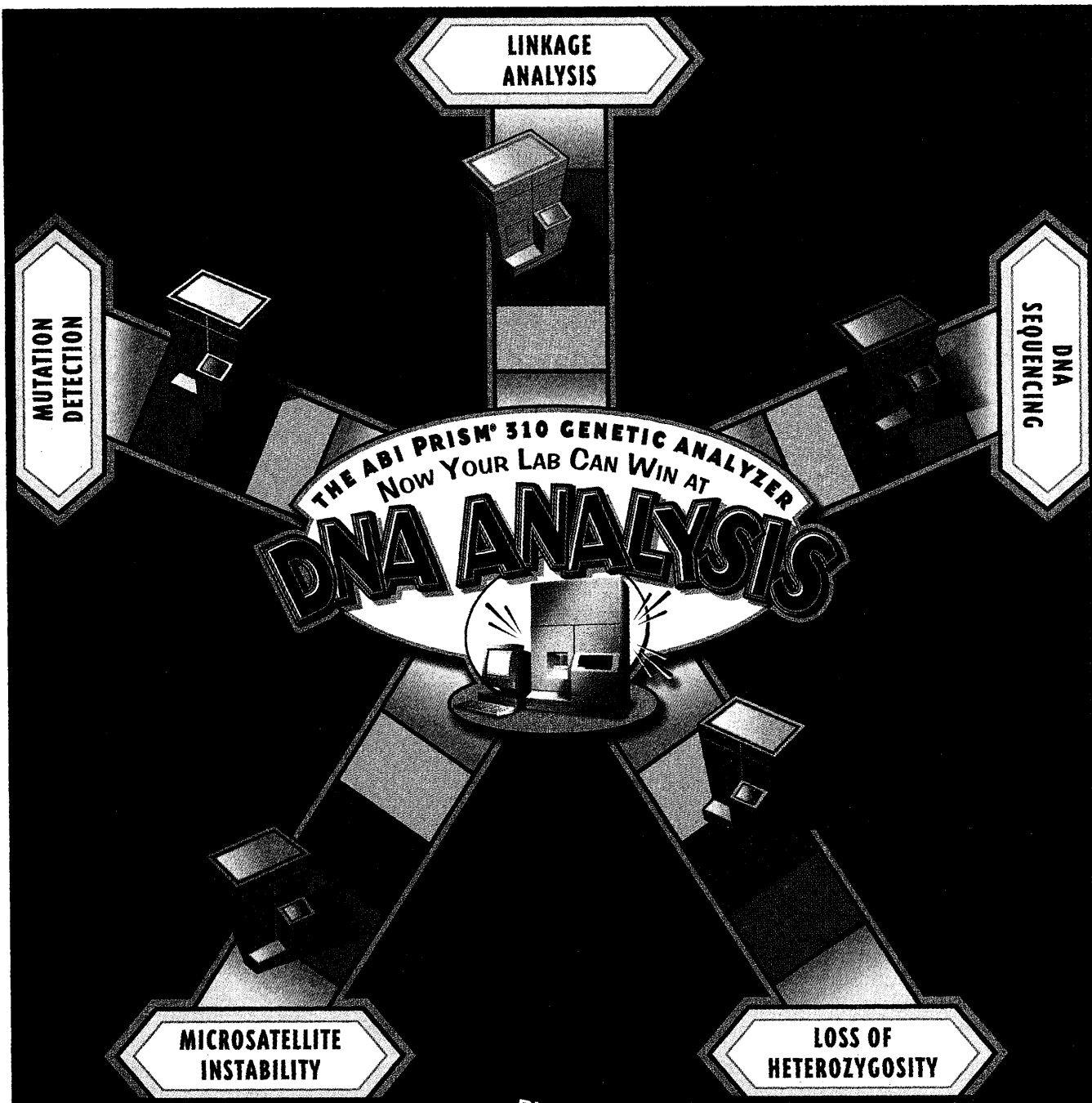
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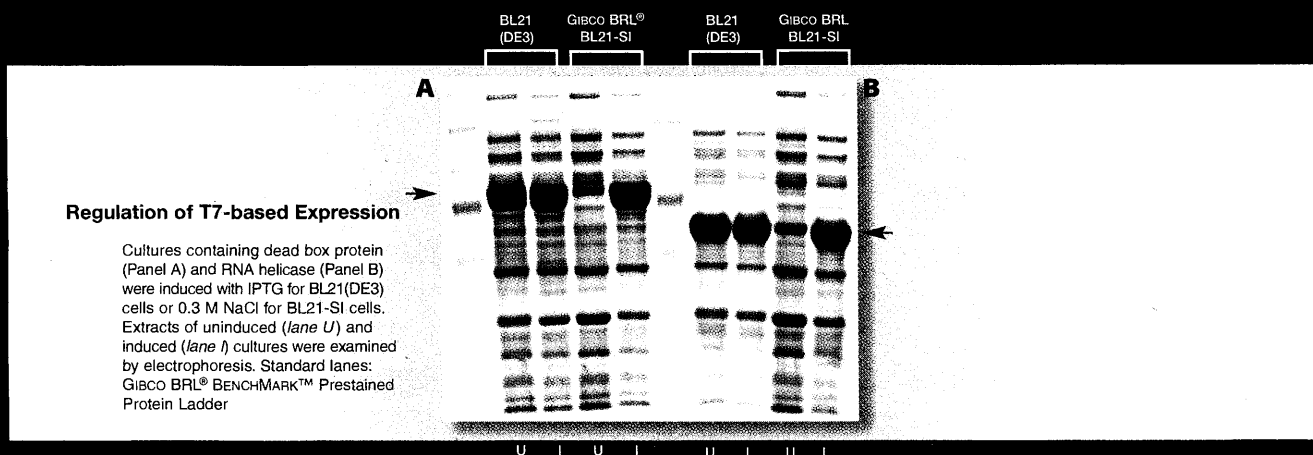
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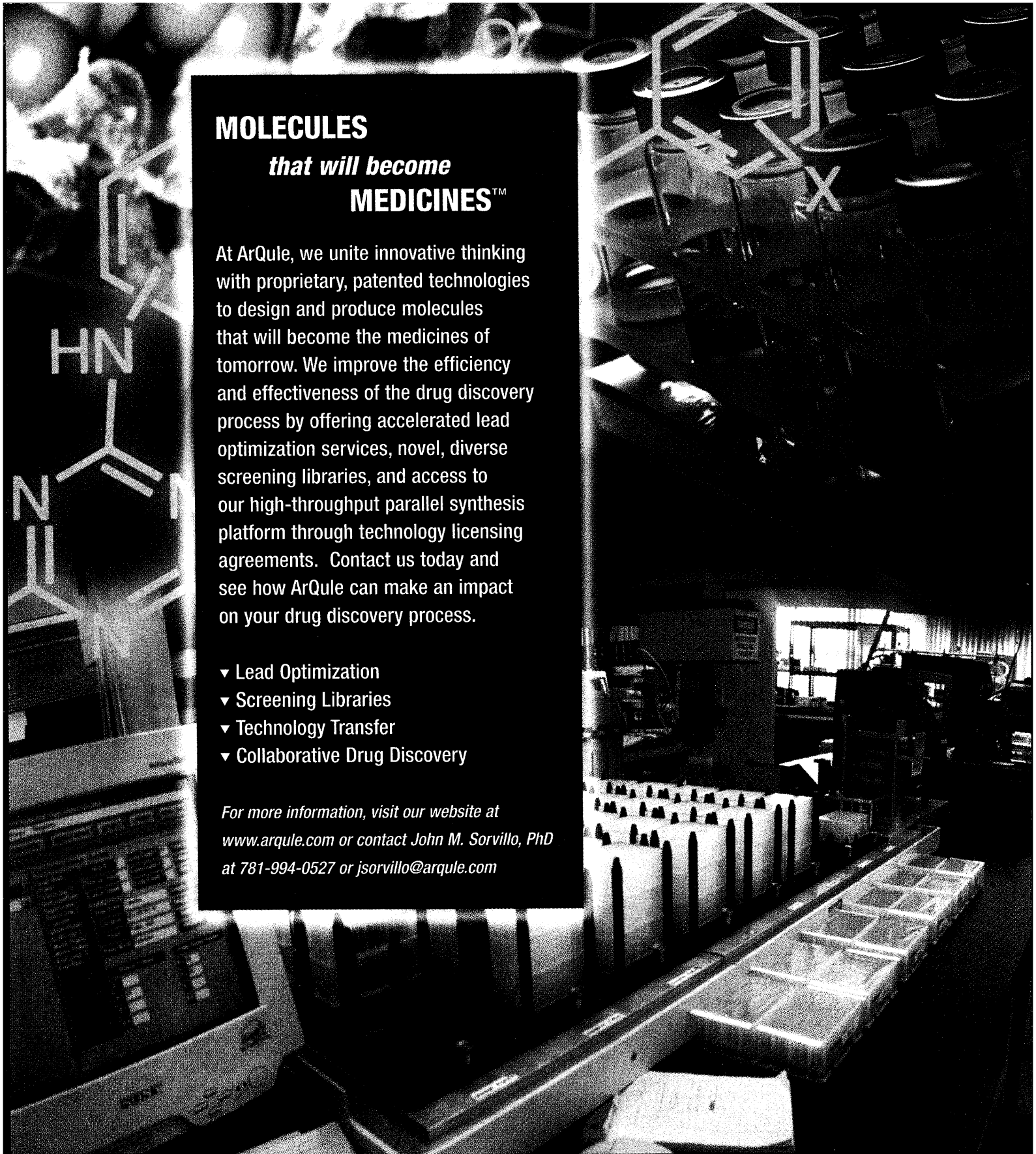
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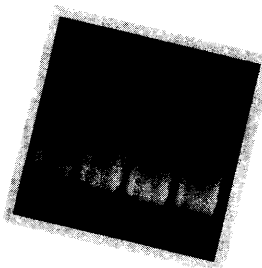
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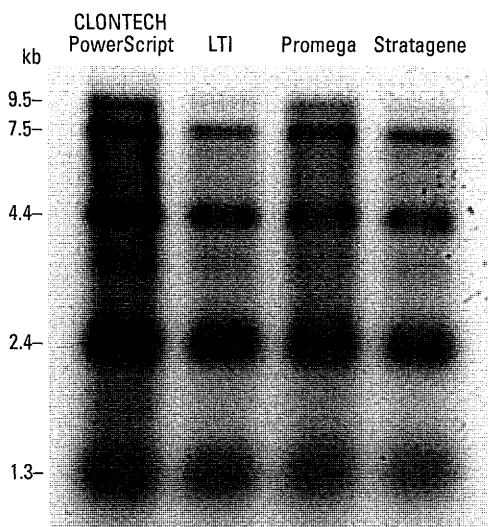
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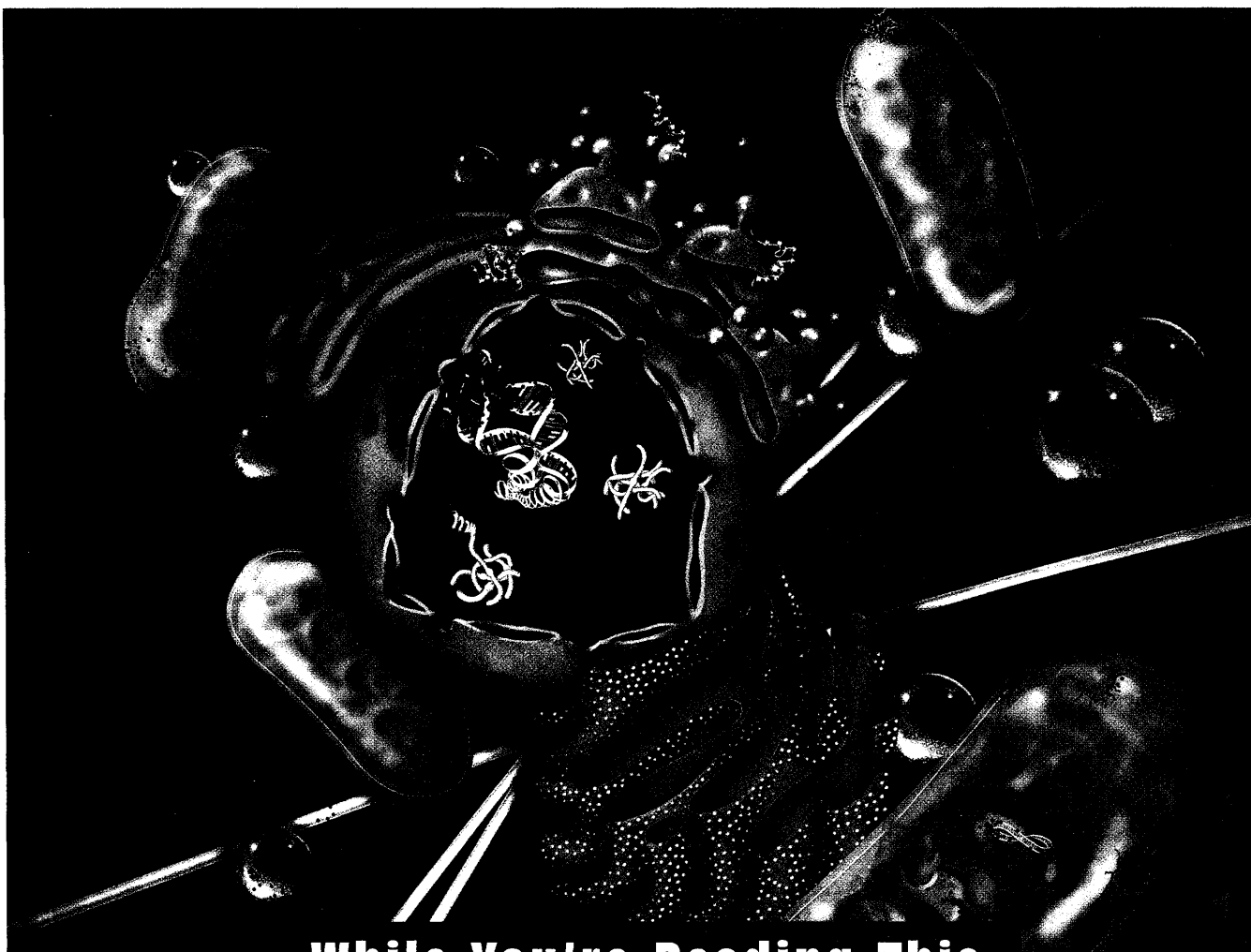
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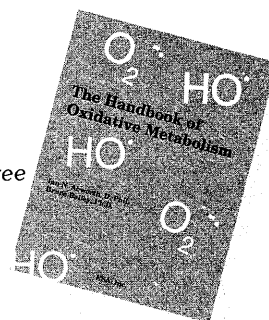
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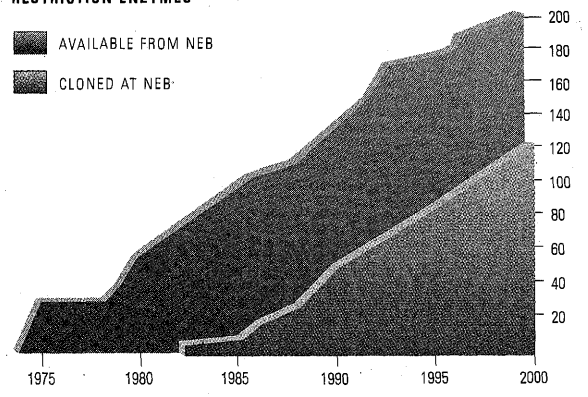
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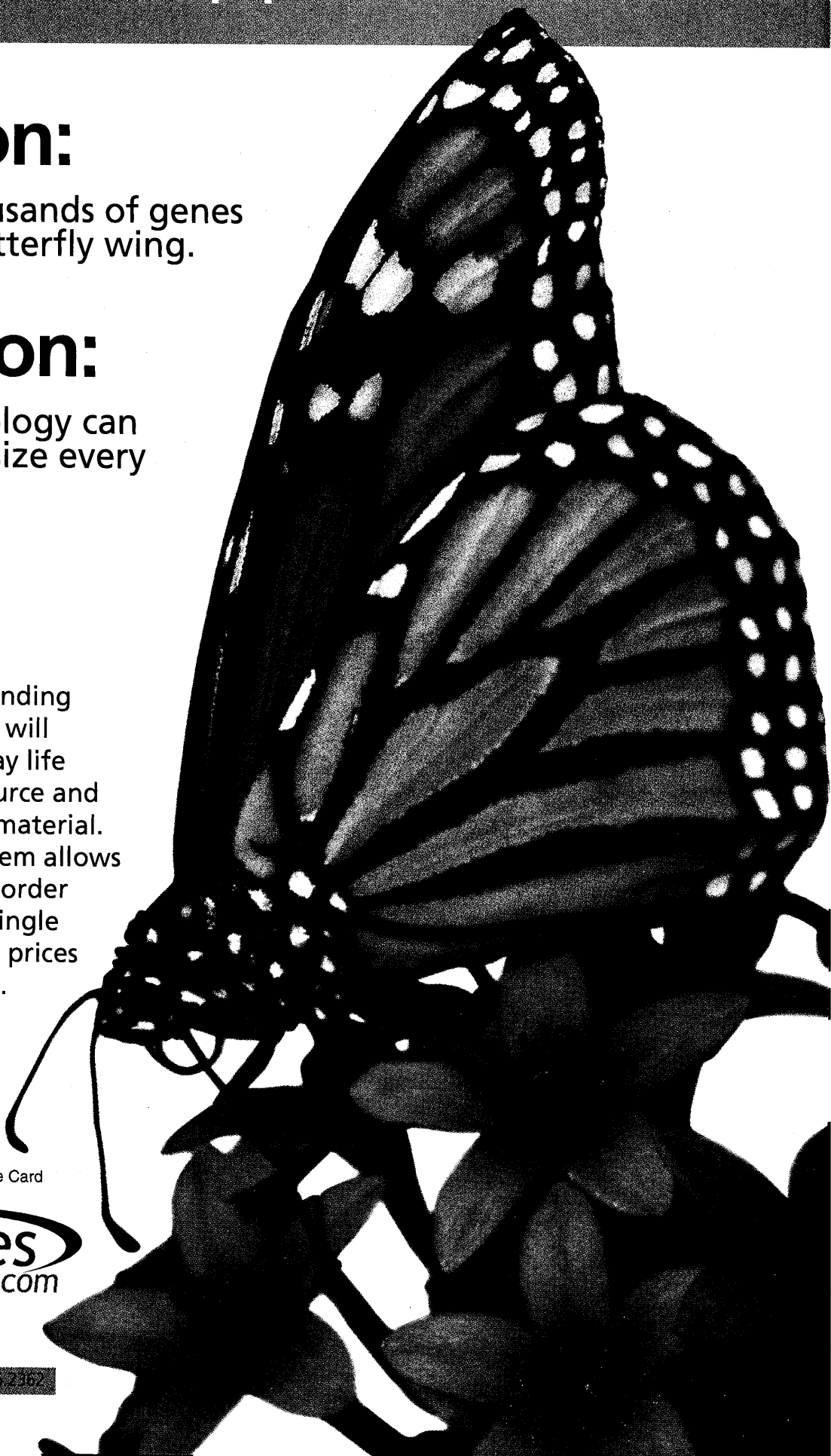
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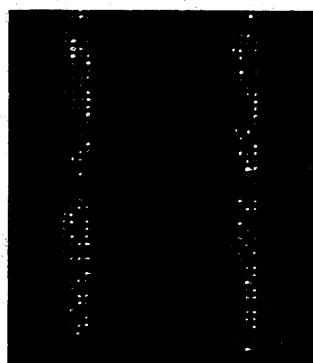
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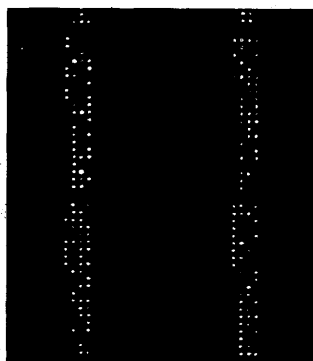
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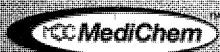
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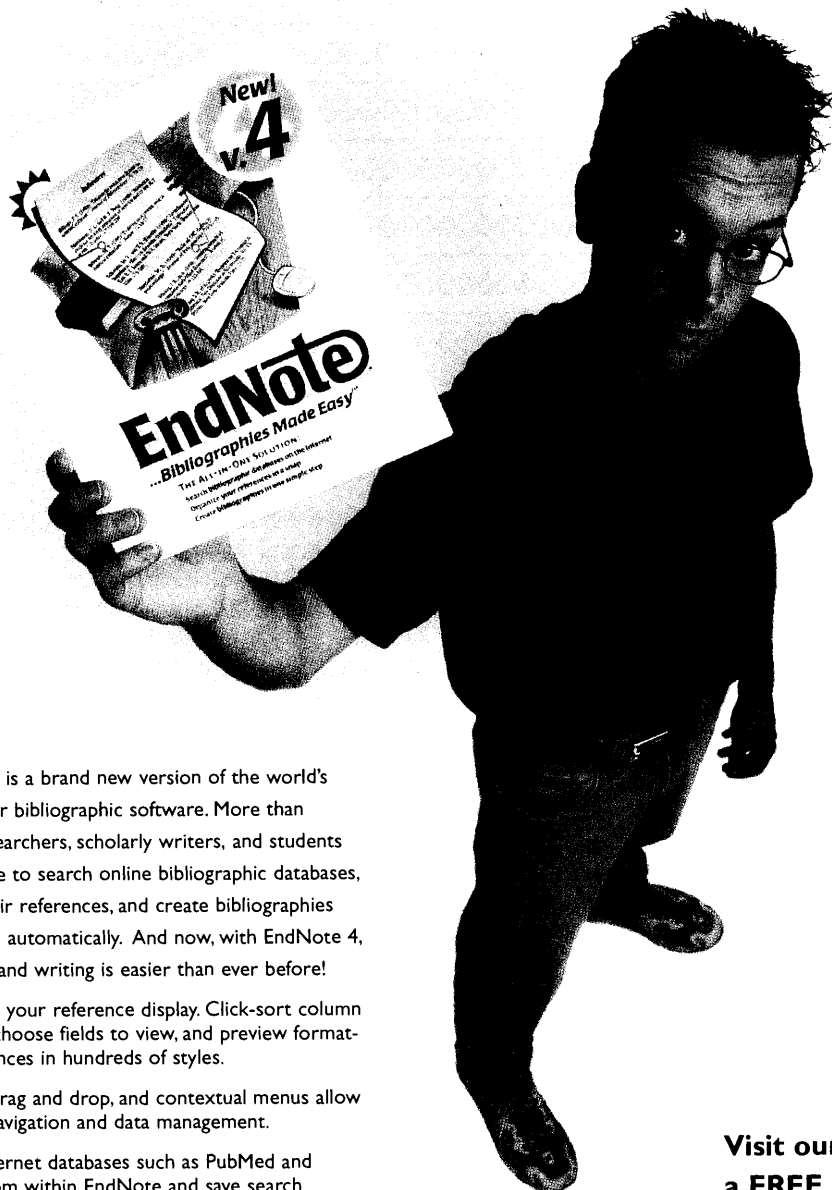
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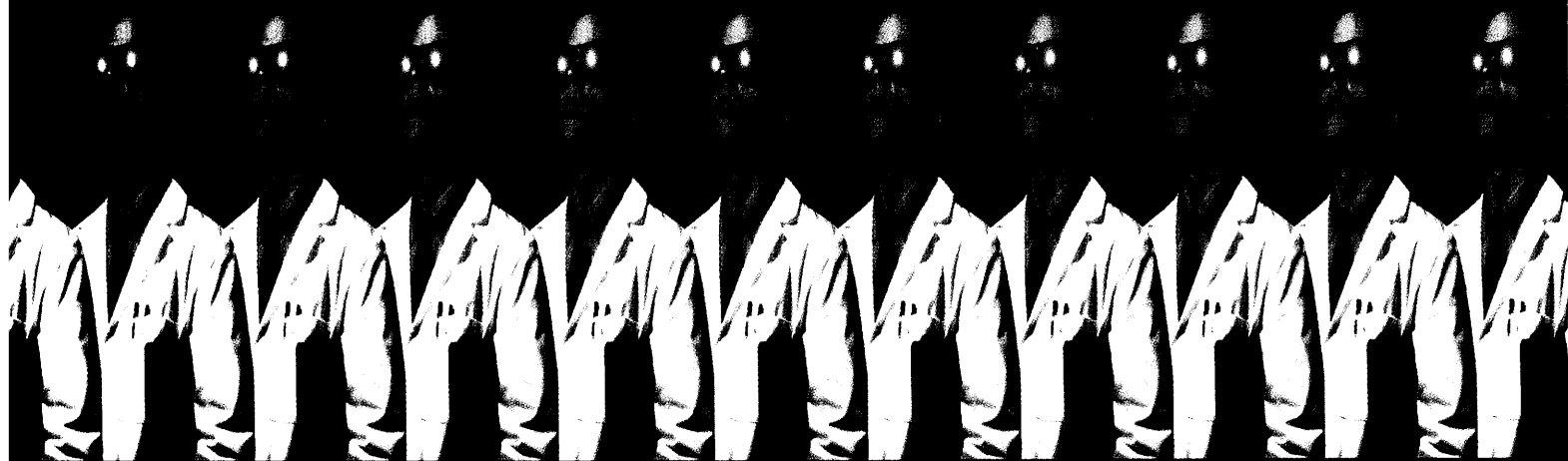
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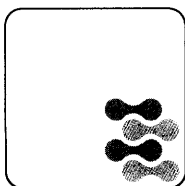
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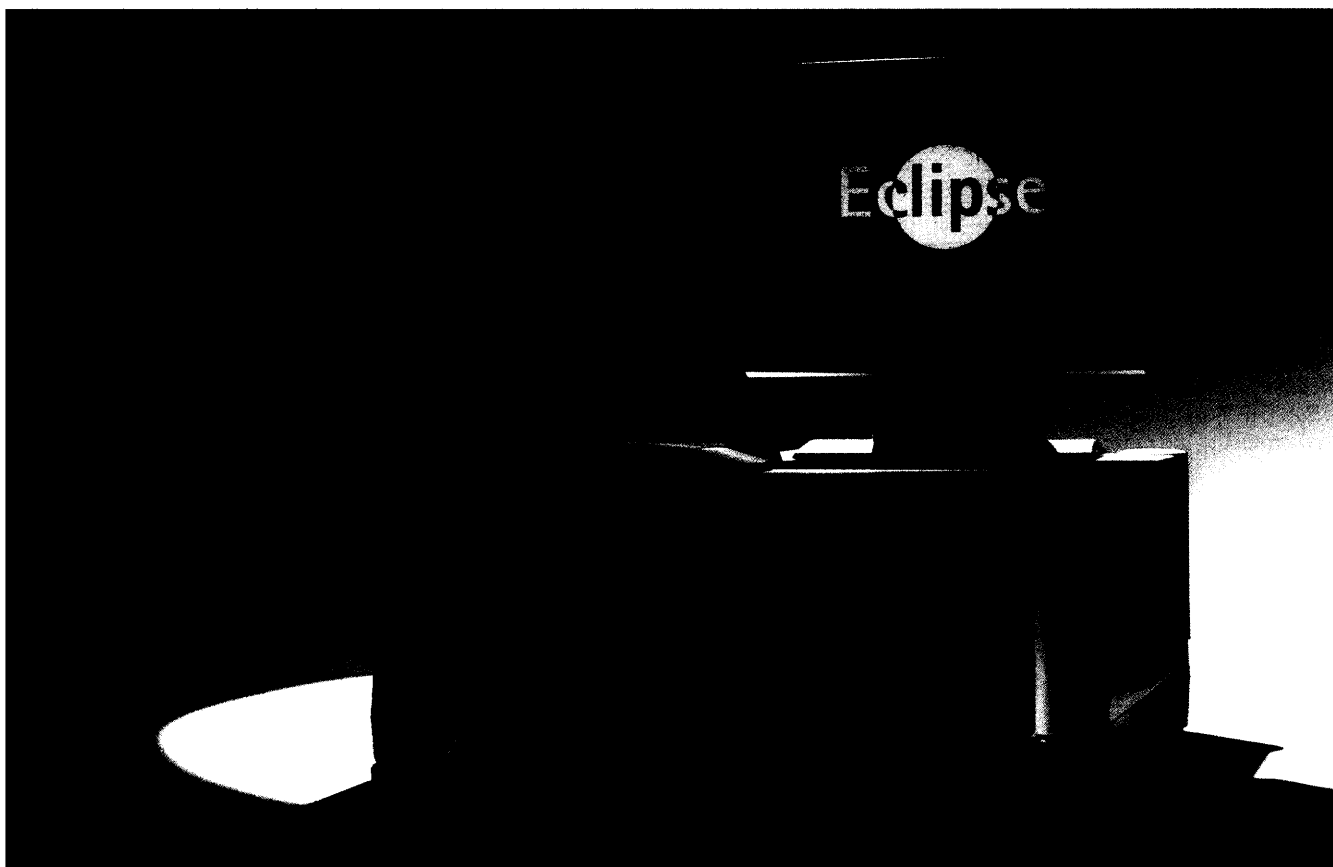
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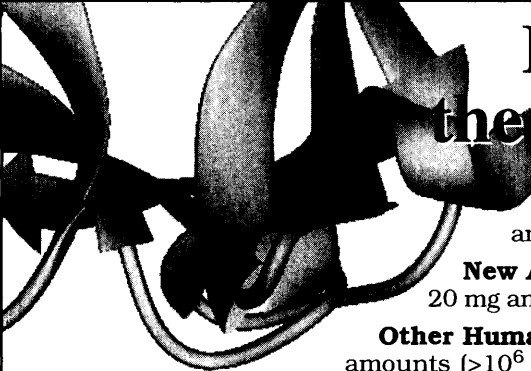
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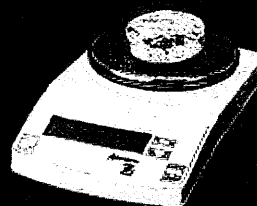
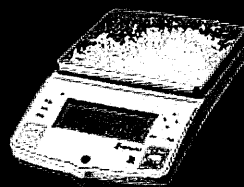
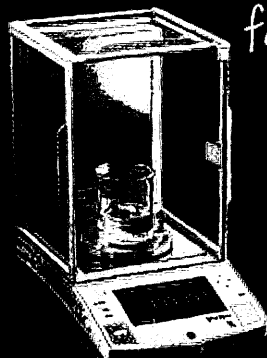
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DNA samples

DNA samples from a
global collection network

We can meet your sample needs from inventory or by exercising our Global Collection Network on your behalf. We are adding samples, disease states, and collection sites on a regular basis.

GenomicsCollaborative

has a growing collection of DNA and serum matched to phenotypic data from patients with high prevalence diseases. These samples are available to support your research.

Some examples of samples we currently have, and are actively collecting, in the following disease states are:

- Cardiovascular disease (hyperlipidemia, hypertension, AMI stroke)
- Cancers (Breast, Ovarian, Colon, Prostate, Leukemia, Lymphoma)
- Diabetes
- Asthma
- Renal failure

All material is:

- Collected under IRB approved protocols and compliant with GCP
- Processed and stored under GCP conditions

For information regarding our current inventory of samples and disease states please contact us.

GenomicsCollaborative

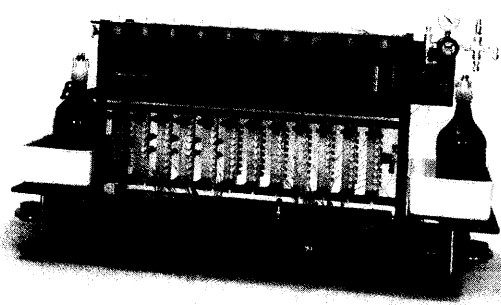
1-877-GENOMIX, extension 248 (877-436-6649)
email: getsamples@DNArepository.com
www.DNArepository.com

Circle No. 12 on Readers' Service Card

PolyPlex : The synthesizer for uniquely low-cost oligos.

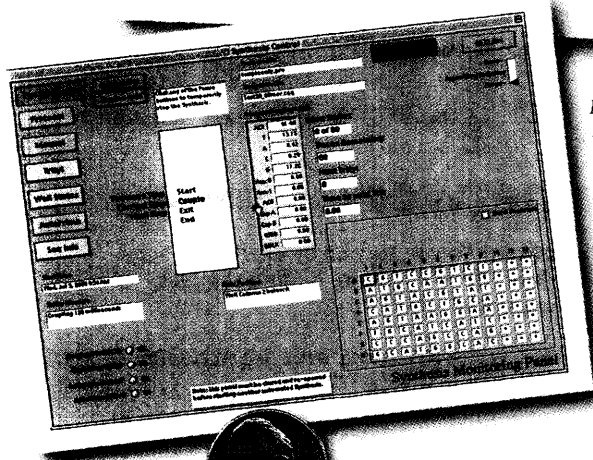
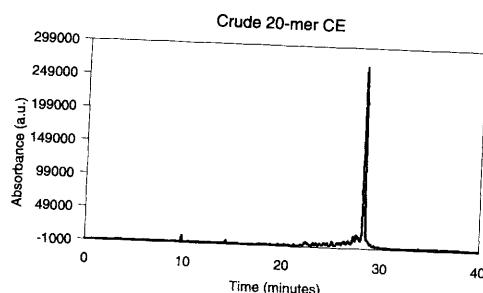
Faster. Cheaper.

Better.



Durable,
time- and
reagent-saving
design
minimizes
cost of
ownership.

CE of a
20mer oligo
(30nmol scale).
Stepwise
yield=98.6%.



PolyPlex
software
provides
thorough
synthesis
monitoring
and flexible
hardware
control.

1. Less than \$0.10/base.
2. 96-well format synthesis.
3. 3-hour unattended runs*
4. Low reagent consumption.
5. Fully-licensed phosphoramidite chemistry.
6. Robust design, maximum uptime.
7. Can synthesize modified bases.
8. >98% coupling efficiency.
9. Flexible, user-friendly software.
10. Low maintenance.
11. Fast setup time.
12. Positive pressure filtration.
13. Trityl monitoring at any point.
14. Validated protocols.
15. Field applications support.

High-speed and low cost were never synonymous with oligonucleotide synthesis. Until PolyPlex.

The reliable PolyPlex changes everything. With a unique, inert-gas chamber that delivers highest quality samples. Parallel reagent dispensing for more throughput, no line flushes and reduced consumables. A 96-well format for easier handling. And a design simple enough for a CFO to use, with an ROI he's sure to like.

So find out what the major oligo companies already know. Call 1-877-855-GENE (4363) for complete information. Or visit www.genemachines.com today.

GENEMACHINES

WORK LESS. DO MORE.™

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