

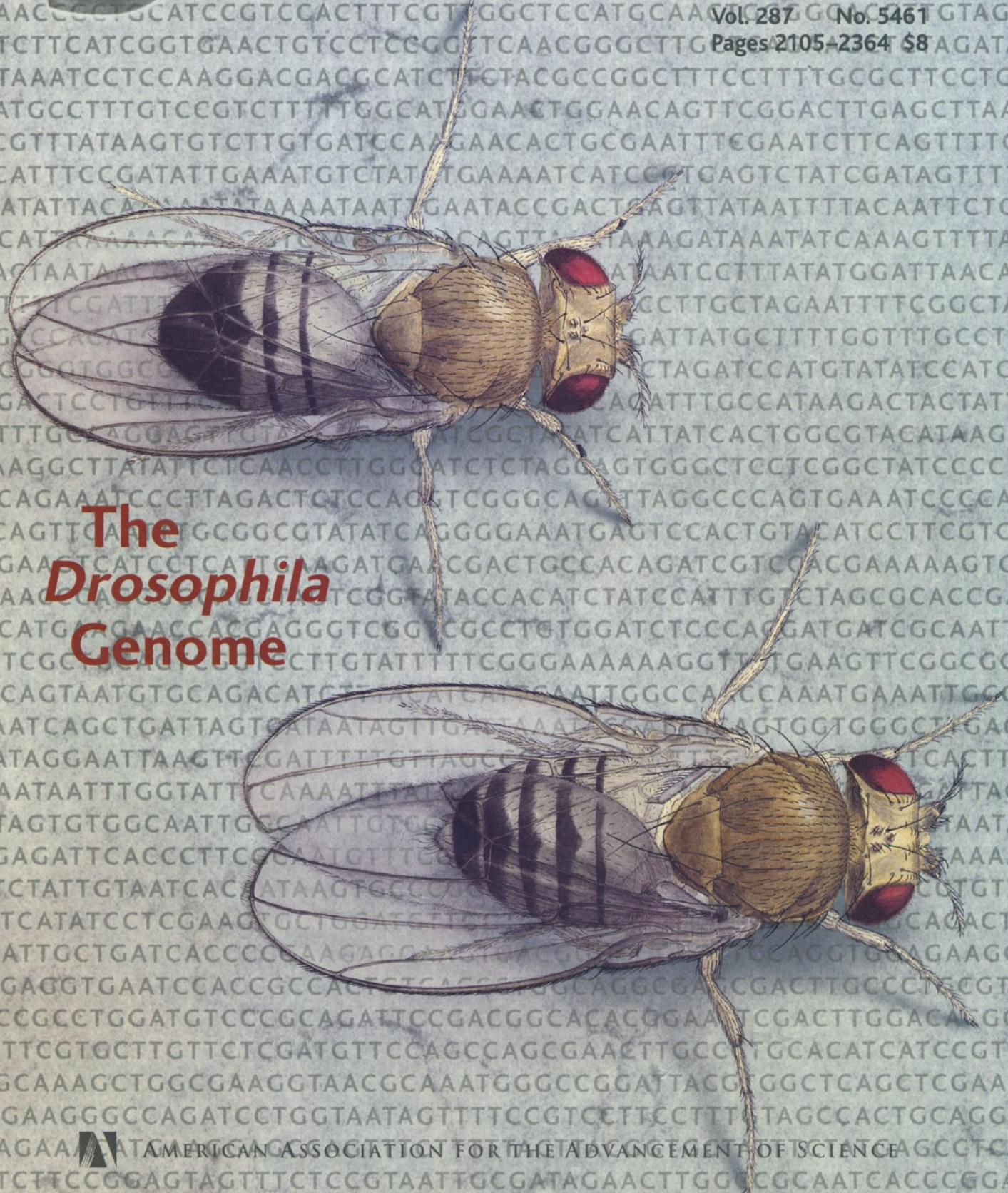
Science

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Pages 2105-2364 \$8

The *Drosophila* Genome



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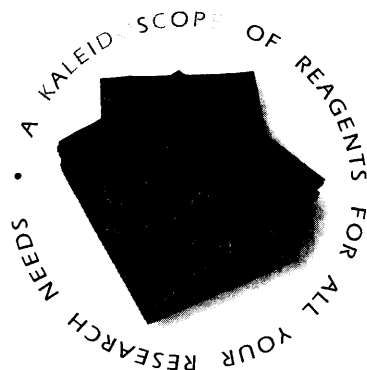
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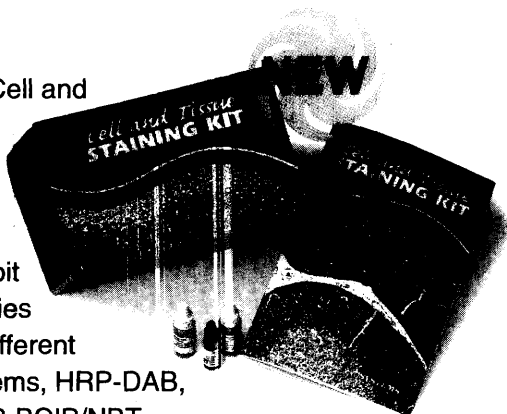


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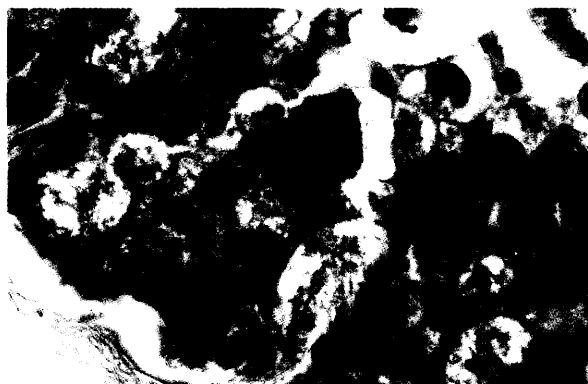


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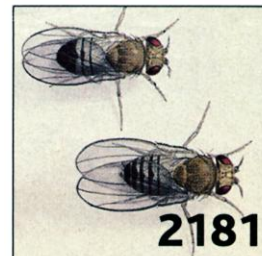
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COVER This cover is a melding of old and new. The fruit flies are 1934 drawings by E. M. Wallace, which have been superimposed on nucleotide sequence information. They are a reminder of the rich history surrounding *Drosophila melanogaster* genetics and the new avenues to research that are being opened by the announcement and initial analyses of the *Drosophila* genome sequence in the special section, beginning on page 2181, and related features.

[DRAWINGS ARE COURTESY OF THE ARCHIVES, CALIFORNIA INSTITUTE OF TECHNOLOGY]



NEWS

NEWS OF THE WEEK

- ▼2126 CLIMATE CHANGE: Globe's 'Missing Warming' Found in the Ocean
2225
- 2127 BIOTECHNOLOGY: How a Bland Statement Sent Stocks Sprawling
- 2127 TAIWAN: Academy Head Touted for Top Political Post
- 2129 INFECTIOUS DISEASES: New York's Deadly Virus May Stage a Comeback
- ▼2130 SYNCHROTRON SCIENCE: X-ray Pulses Chopped to Femtoseconds
2237
- 2131 HUMAN EVOLUTION: Hominid Ancestors May Have Knuckle Walked
- 2132 LOOKING AHEAD: Medalists Gaze Out on a Familiar Future
- ▼2132 NEUROSCIENCE: New Ion Channel May Yield Clues to Hearing
2229

- 2133 NEUROSCIENCE: Family of Bitter Taste Receptors Found

- 2135 COMMUNICATIONS SATELLITES: Iridium's Loss Is Astronomers' Gain

NEWS FOCUS

- 2136 PROTEOMICS: Can Celera Do It Again?
- 2138 TECHNOLOGY CONTROLS: Space Scientists Decry Stricter Export Rules
- 2139 BIOMEDICAL POLITICS: Controversial Cancer Therapy Finds Political Support
- 2142 ASTRONOMY: Odd-Shaped Pieces Confuse Puzzle of Galaxy Evolution

THE DROSOPHILA GENOME

- 2181 The Universe of *Drosophila* Genes

NEWS

- 2182 Ideas Fly at Gene-Finding Jamboree Are Sequencers Ready to 'Annotate' the Human Genome?

RESEARCH

RESEARCH ARTICLES

- ▼2225 Warming of the World Ocean S. Levitus,
2126 J. I. Antonov, T. P. Boyer, C. Stephens
- ▼2229 A *Drosophila* Mechanosensory Transduction Channel R. G. Walker, A. T. Willingham, C. S. Zuker
2132

REPORTS

- 2235 Spontaneous Ordering of Oxide Nanostructures S. Aggarwal, A. P. Monga, S. R. Perusse, R. Ramesh, V. Ballarotto, E. D. Williams, B. R. Chalamala, Y. Wei, R. H. Reuss
- ▼2237 Generation of Femtosecond Pulses of Synchrotron Radiation R. W. Schoenlein, S. Chattopadhyay, H. H. W. Chong, T. E. Glover, P. A. Heimann, C. V. Shank, A. A. Zholents, M. S. Zolotov
2130
- 2240 A Class of Microstructured Particles Through Colloidal Crystallization O. D. Velev, A. M. Lenhoff, E. W. Kaler
- 2244 Resonant Oscillations Between the Solid Earth and the Atmosphere K. Nishida, N. Kobayashi, Y. Fukao

- 2185 The Genome Sequence of *Drosophila melanogaster* M. D. Adams *et al.*

- 2196 A Whole-Genome Assembly of *Drosophila* E. W. Myers *et al.*

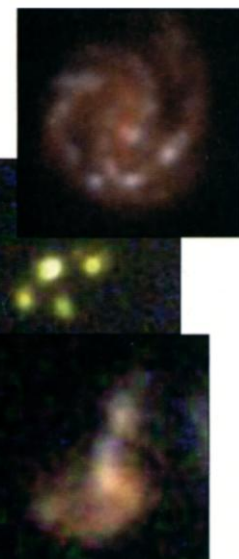
- 2204 Comparative Genomics of the Eukaryotes G. M. Rubin *et al.*

VIEWPOINTS

- 2216 A Brief History of *Drosophila*'s Contributions to Genome Research G. M. Rubin and E. B. Lewis
- 2218 The *Drosophila* Genome Sequence: Implications for Biology and Medicine T. B. Kornberg and M. A. Krasnow
- 2220 From Sequence to Chromosome: The Tip of the X Chromosome of *D. melanogaster* P. V. Benos *et al.*
- 2222 A *Drosophila* Complementary DNA Resource G. M. Rubin, L. Hong, P. Brokstein, M. Evans-Holm, E. Frise, M. Stapleton, D. A. Harvey

See also Editorial on p. 2157, Perspective on p. 2173, and Report on p. 2271.

- 2246 Simulation of Early 20th Century Global Warming T. L. Delworth and T. R. Knutson



2142

A zoo of galaxies

DEPARTMENTS

NETWATCH
2111

THIS WEEK IN
SCIENCE
2113

EDITORS' CHOICE
2117

CONTACT SCIENCE
2122

SCIENCE SCOPE
2129

RANDOM SAMPLES
2145

NEW PRODUCTS
2279



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EDITORIAL

- 2157 Flying to New Heights

LETTERS

- 2159 Restoration Ecology T. A. Alcoze, W. W. Covington, P. Z. Fulé, Ecological Restoration Principles Class. Evolution of an Advocate P. R. Ehrlich. Trojan Horses G. B. Gori. "Model" Behavior E. H. Sarkis. Response R. R. Gainetdinov, W. C. Wetsel, M. G. Caron. Corrections and Clarifications

POLICY FORUM

- 2163 MEDICAL ETHICS: Principles for Human Gene Therapy Studies T. Friedmann

BOOKS ET AL.

- 2166 PHYSICS: *Quantum Dialog The Making of a Revolution* M. Beller, reviewed by D. Greenberger
2167 ART AND ASTRONOMY: *Cosmos From Romanticism to the Avant-Garde* J. Clair, Ed., reviewed by J. M. Pasachoff

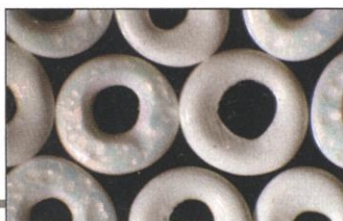
2170

Mowing down moas



PERSPECTIVES

- ▼2170 2250 ARCHAEOLOGY: Blitzkrieg Against the Moas J. Diamond
2171 ASTRONOMY: How Flat Is the Universe? E. Pierpaoli, D. Scott, M. White
2172 SOLAR PHYSICS: The Day the Solar Wind Almost Disappeared A. J. Lazarus
2173 GENOMICS: The End of the Beginning S. Brenner
▼2174 2254 ANTHROPOLOGY: Age, Sex, and Old Goats C. W. Marean



2240

Colloidal crystals take shape

- ▼2250 2170 Rapid Extinction of the Moas (Aves: Dinornithiformes): Model, Test, and Implications R. N. Holdaway and C. Jacomb
▼2254 2174 The Initial Domestication of Goats (*Capra hircus*) in the Zagros Mountains 10,000 Years Ago M. A. Zeder and B. Hesse
2257 Molecular Linkage Underlying Microtubule Orientation Toward Cortical Sites in Yeast W. S. Korinek, M. J. Copeland, A. Chaudhuri, J. Chant
2260 Positioning of the Mitotic Spindle by a Cortical-Microtubule Capture Mechanism L. Lee, J. S. Tirnauer, J. Li, S. C. Schuyler, J. Y. Liu, D. Pellman
2262 Driving AMPA Receptors into Synapses by LTP and CaMKII: Requirement for GluR1 and PDZ Domain Interaction Y. Hayashi, S.-H. Shi, J. A. Esteban, A. Piccini, J.-C. Poncer, R. Malinow
2267 Response of Schwann Cells to Action Potentials in Development B. Stevens and R. D. Fields

- 2271 A BAC-Based Physical Map of the Major Autosomes of *Drosophila melanogaster* R. A. Hoskins, C. R. Nelson, B. P. Berman, T. R. Lavery, R. A. George, L. Ciesiolka, M. Naeemuddin, A. D. Arenson, J. Durbin, R. G. David, P. E. Tabor, M. R. Bailey, D. R. DeShazo, J. Catanese, A. Mammoser, K. Osoegawa, P. J. de Jong, S. E. Celniker, R. A. Gibbs, G. M. Rubin, S. E. Scherer
2274 Rapid Progression to AIDS in HIV+ Individuals with a Structural Variant of the Chemokine Receptor CX₃CR1 S. Faure, L. Meyer, D. Costagliola, C. Vaneensberghe, E. Genin, B. Autran, French ALT and IMMUNOCO Study Groups, J.-F. Delfraissy, SEROCO Study Group, D. H. McDermott, P. M. Murphy, P. Debré, I. Théodorou, C. Combadière

TECHNICAL COMMENTS

- Power-Law Distribution of the World Wide Web L. A. Adamic and B. A. Huberman. Response A.-L. Barabasi, R. Albert, H. Jeong, G. Bianconi

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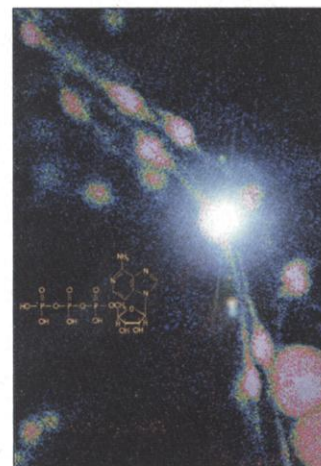
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GLOBAL OCEAN WARMING

Much attention has been paid to the possibility of atmospheric warming during the last century, but the oceans, which have a mass approximately 2500 times greater than that of the atmosphere, can also store much more heat and thus affect atmospheric temperatures by energy transfer. Levitus *et al.* (p. 2225; see the news story by Kerr) have estimated the variability of heat storage in the upper 3000 meters of the major ocean basins during the past 50 years. They found a heat storage maxima in the mid-1970s and 1990s and an increase in the amount of heat stored by the world ocean during the past 40 years. Understanding what mechanisms have produced these changes is crucial for understanding climate.

AN EARTH-ATMOSPHERE DUET

Seismometers continuously record excited free oscillations of the solid Earth, but the source of these oscillations has been unknown. Nishida *et al.* (p. 2244) analyzed free oscillation data collected between 1989 and 1997 and found two fundamental spheroidal modes of degree 27 and 39 that showed peaks in their amplitude above the noise level. These two solid-Earth-enhanced oscillations are coupled to atmospheric oscillations: This interpretation is supported by the peaking of the amplitude of these modes in the summer of the Northern Hemisphere. Thus, the solid Earth resonates with the atmosphere, and seismic data can be used to understand global weather.

RETRACING CLIMATE STEPS

Global observations of surface temperatures during the 20th century indicate that warming has occurred in two distinct 20-year steps. How much, if any, of this warming is the result of human influence, such as the production of greenhouse gases like carbon dioxide, rather than natural climate variations? Delworth and Knutson (p. 2246) attempt to answer this question with a series of simulations using a coupled ocean-atmosphere climate model. Their results suggest that the best explanation of the warming is a combination of anthropogenic factors and natural climate variability, which can explain the timing of the temperature increases as well as their magnitudes.

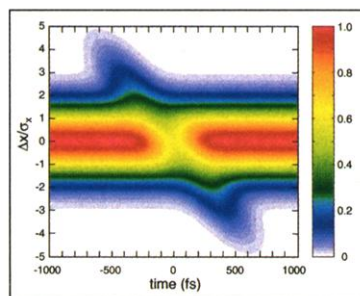
SELF-ASSEMBLED OXIDE TIPS

Heating of thin films can cause thermal stresses and lead to the undesired formation of bumps or hillocks. Aggarwal *et al.*

(p. 2235) have used this effect to advantage—oxidation of thin films of palladium (40 to 200 nanometers thick) led to the formation of oxide tips 500 to 1200 nanometers in height, spaced about 2 micrometers apart on average. Arrays of conducting oxide tips such as these could find use in field emission displays.

SPEEDING UP X-RAY PULSES

Synchrotrons produce high-brightness x-ray radiation by directing bunches of electrons through a region of modulated magnetic field called a wiggler. Modulation of the kinetic energy of the electrons results in the emission of pulses of x-rays that are typically several picoseconds in duration, which is still too slow for most investigations of



the dynamics of phase transitions and biochemical interactions. Schoenlein *et al.* (p. 2237; see the news story by Service) now show that pulses only several femtoseconds in duration are possible from a synchrotron. While the electron bunch is passing through the wiggler, they hit it with a femtosecond laser pulse, which increases the energy of a small packet of the electrons and spatially separates them from the main bunch to produce a shorter pulse.

COLLOIDAL CRYSTALS MADE DROPWISE

Crystals of colloidal particles, such as nanometer-scale latex spheres, could find use through their porosity and their optical properties, but templating methods, which control the final crystal shape, tend to give disordered crystals and a wide distribution of pore sizes. Velev *et al.* (p. 2240) have now grown colloidal crystals in aqueous drops that were suspended on heavy fluorinated oil in a sealed chamber. A desiccant was used to slowly decrease droplet size. Spherical crystals formed that are well ordered and diffract visible

light. Surfactants can be used to create other particle shapes, such as toroids. The colloidal particles will separate by weight during crystal formation, so “two-sided” crystals, such as a magnetic-nonmagnetic composite, can be made.

TRANSDUCING TOUCH

In contrast to vision, olfaction, and taste perception, which utilize G protein-coupled receptors, mechanical stimuli, such as touch and sound, are thought to regulate ion channels directly by converting mechanical forces into electrical signals. Walker *et al.* (p. 2229; see the news story by Barinaga) have identified such a channel in the sensory bristle neurons of *Drosophila*. A genetic screen coupled with direct electrophysiological recordings of neurons identified a new, distant member of the TRP family of cation channels. The molecular identity of such a mechanosensory channel should allow further characterization of signaling mechanisms involved in sensing mechanical stimulation.

MOA VULNERABLE

At least 500 large bird species are believed to have gone extinct across the islands of the Pacific since humans arrived. Most spectacular were the 11 species of moa, large flightless birds of the islands of New Zealand, which disappeared in the centuries after the arrival of the Maoris. Holdaway and Jacomb (p. 2250; see the Perspective by Diamond) model the population dynamics of the moa using parameters from the life histories of other long-lived birds. Their simulations show that the moa would have been very vulnerable to any increase in adult mortality rates and that the human population required to extinguish the moa altogether was small—on the order of a few hundred. The time to extinction in all of their simulations was less than 160 years from initial human colonization, in accord with new archaeological information indicating that humans colonized New Zealand in the late 13th century and that moa had already become very scarce just 100 years later.

GETTING THEIR GOATS

An enduring question in archaeology centers on the transition from hunting to herding in the Near East. The domestication of the wild goat was a key component of this process and took place about 9000 years ago. Zeder and Hesse (p. 2254; see the Perspective by Marean) compared modern skeletal collections of wild and domestic

CONTINUED ON PAGE 2115



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THIS WEEK IN SCIENCE

CONTINUED FROM PAGE 2113

goats with bone assemblages and developed a method for computing the sex-specific age profiles of the harvested animals in the archaeological assemblages. This approach allowed them to quantify the transition from hunting to herding, in particular by tracking the changes in the age profiles of male and females killed for food.

COMING INTO ALIGNMENT

When budding yeast divide, the mitotic spindle, built mainly of microtubules, must be aligned with the budding daughter cell for proper segregation of genetic material. A cellular cortex of actin filaments is thought to somehow interact with the microtubules to establish this polarity and spindle orientation. Korinek *et al.* (p. 2257) and Lee *et al.* (p. 2260) have identified a protein interaction that is critical for the integration of these two structural networks during yeast mitosis: Kar9, which is associated with the bud cortex, appears to bind to Bim1, which is associated with microtubules. The dependence of spindle positioning on this interaction may extend to higher eukaryotic cells as well.

STUDYING SYNAPSES WITH TAGGED RECEPTORS

What are the molecular mechanisms underlying synaptic plasticity at functional synapses in the central nervous system? Hayashi *et al.* (p. 2262) used electrophysiologically tagged AMPA receptor subunits to show that new AMPA receptors are inserted into the postsynaptic membrane of glutamatergic synapses after the induction of long-term potentiation or after activity enhancement of calcium/calmodulin-dependent protein kinase II (CaMKII), an enzyme previously shown to be involved in synaptic plasticity. Mutation experiments show that the control substrate

of CaMKII is not the AMPA receptor itself. The receptor incorporation into the membrane involves binding between the AMPA receptor and a still unknown protein with a PDZ domain.

SCHWANN SONG

Activity in the nervous system helps to regulate the developmental process by which neurons build and refine their connections. Stevens and Fields (p. 2267) now show that neuronal activity also regulates the development of Schwann cells, which will eventually envelop axonal projections and aid in conduction of the electrical impulses. In this developmental phase, electrical signals put Schwann cell differentiation on hold, perhaps in wait for subsequent specific myelination signals.

BAC TO THE FUTURE

As part of the landmark effort to sequence the *Drosophila melanogaster* genome, Hoskins *et al.* (p. 2271) present a physical map, based on bacterial artificial chromosome (BAC) clones, of chromosomes 2 and 3, which represent 80% of the genome. The map and clones were used to assemble and validate the sequence and will provide a resource for future in-depth analyses.

CX₃CR1 AND AIDS

The receptor for the chemokine fractalkine, CX₃CR1, is also a coreceptor for human immunodeficiency virus (HIV) entry into human cells. Faure *et al.* (p. 2274) found nucleotide polymorphisms in CX₃CR1 are associated with rapid progression to AIDS in Caucasians. In patients who were homozygous for this polymorphism, the receptor showed lowered binding affinity for fractalkine, which may help facilitate HIV entry into cells.

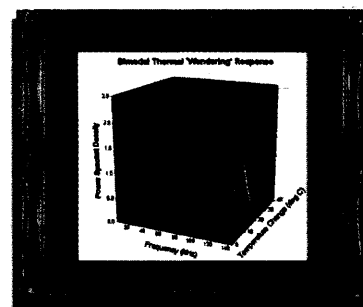
TECHNICAL COMMENT SUMMARIES

Power-Law Distribution of the World Wide Web

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/287/5461/2115a

Barabási and Albert (Reports, 15 Oct., p. 509) analyzed several large networks, including the World Wide Web (WWW), and explained the power-law scaling of vertex connectivities in such systems through a simple model that combined the continuous addition of new vertices and preferential attachment of them "to sites that are already well connected." Adamic and Huberman comment that such a model may not explain the power-law distribution of links in the WWW. Whereas, the model "predicts that older sites have more time to acquire links and gather links at a faster rate than newer sites," an analysis of 260,000 sites suggests to Adamic and Huberman that site age and site connectivity are uncorrelated. Barabási and Albert respond that this result stems from the choice of Adamic and Huberman not to average their data, and illustrate the effects of averaging on scaling relationships through an examination of an analogous network, a database of 392,340 motion-picture actors.

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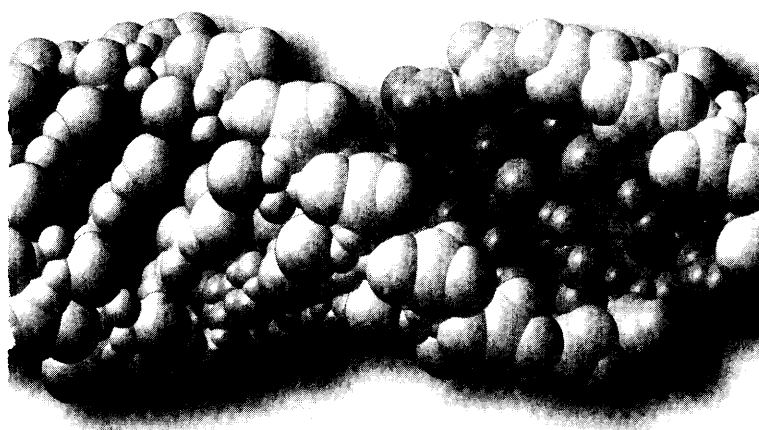
See Sampson G, Morris C.

New oncogene linked to colon cancer.

Inv Hum Genet 1999;9:152-60.

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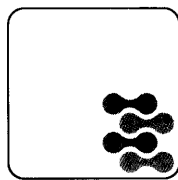
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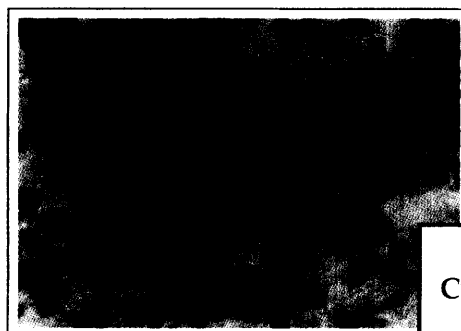
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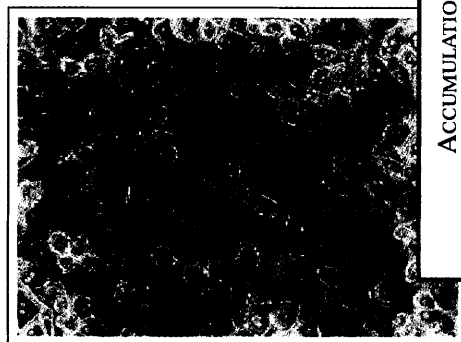
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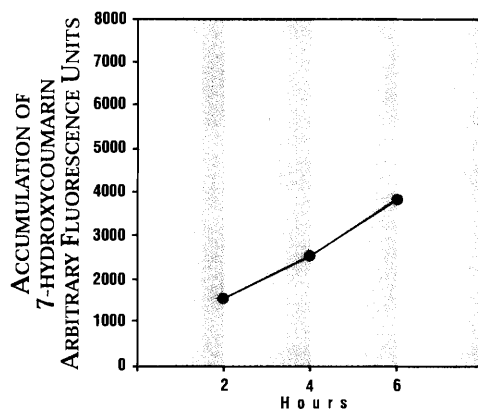


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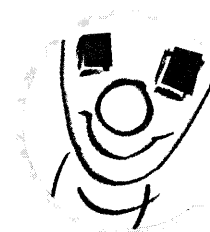
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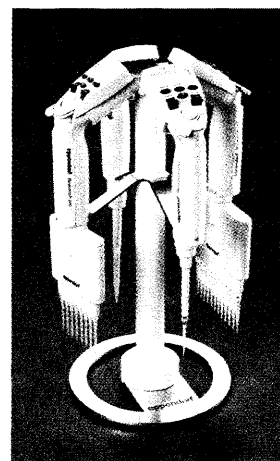
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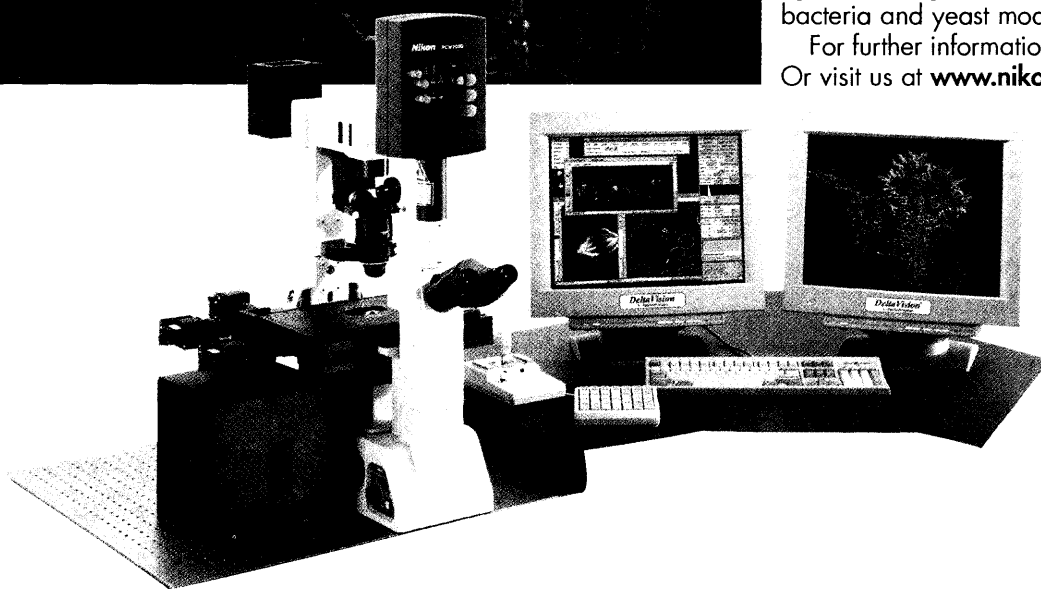
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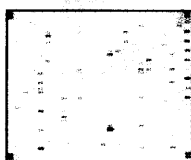
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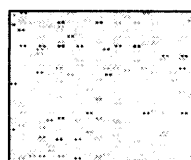
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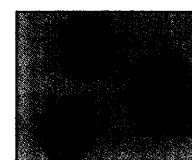
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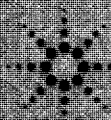
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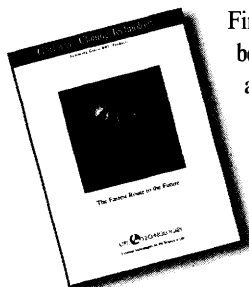
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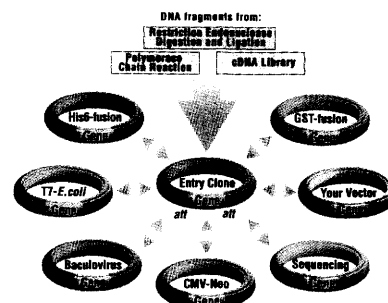
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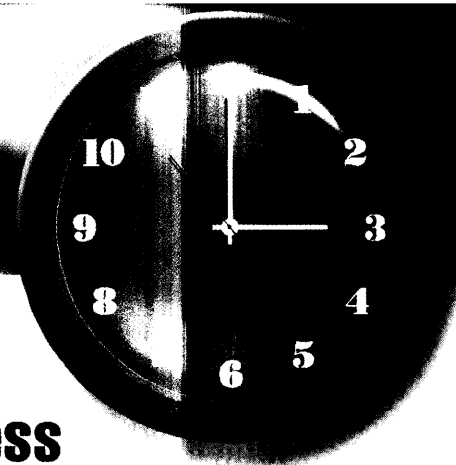
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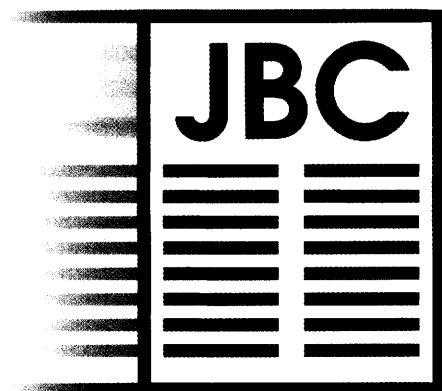
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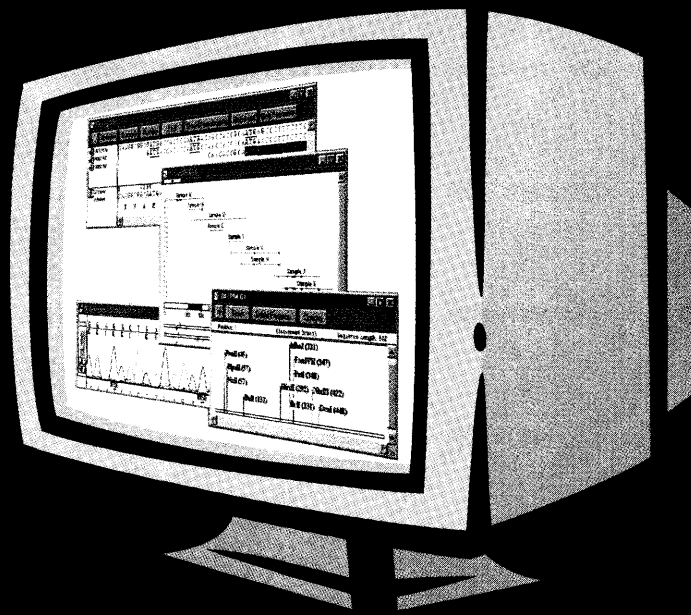
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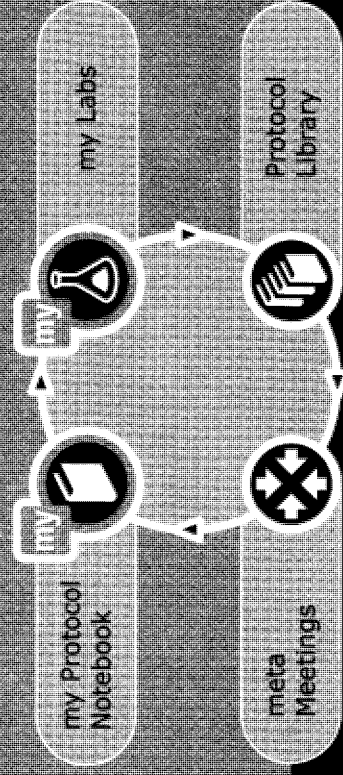
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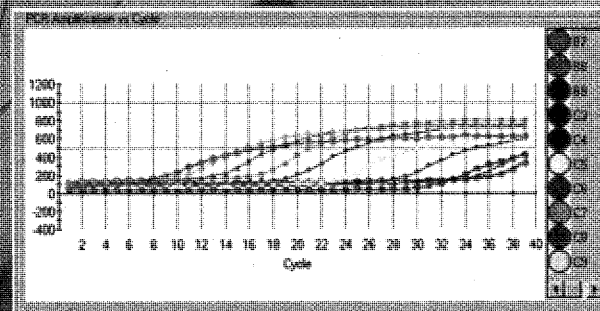
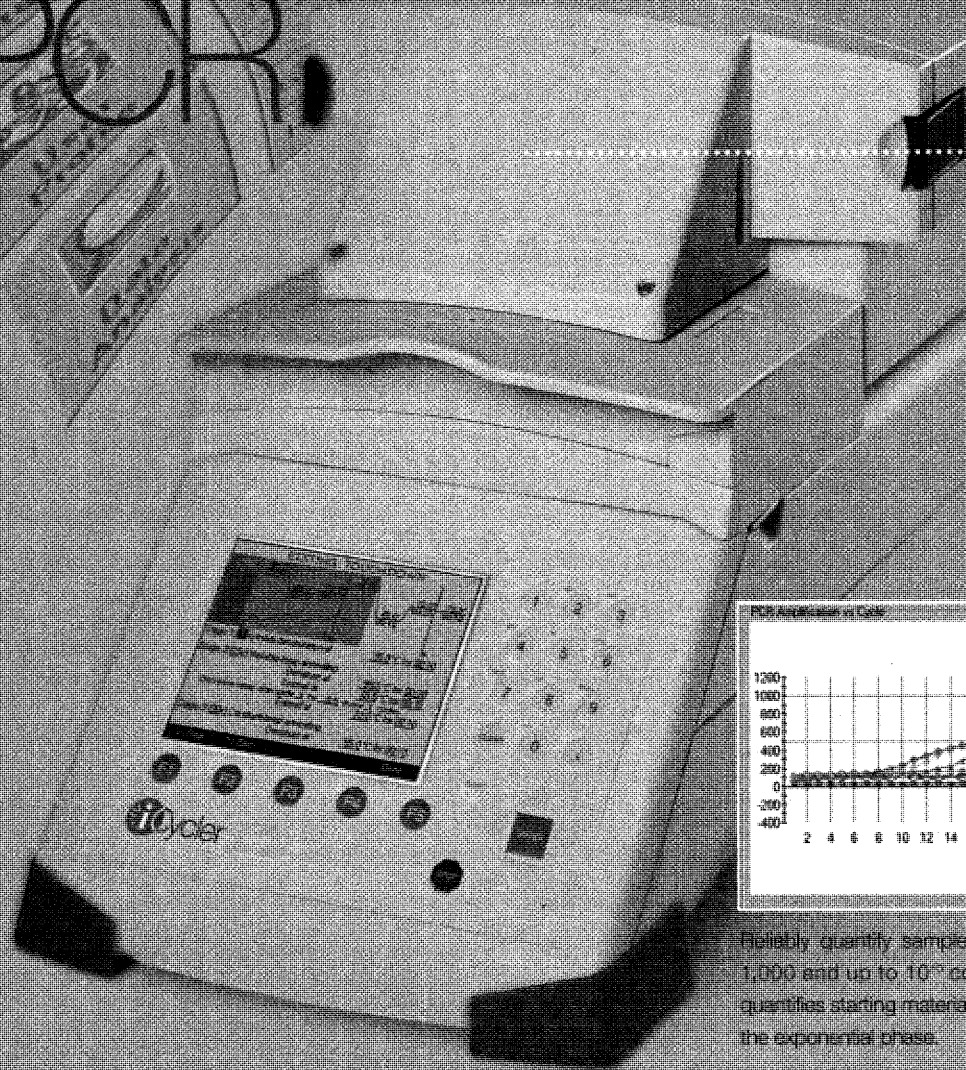
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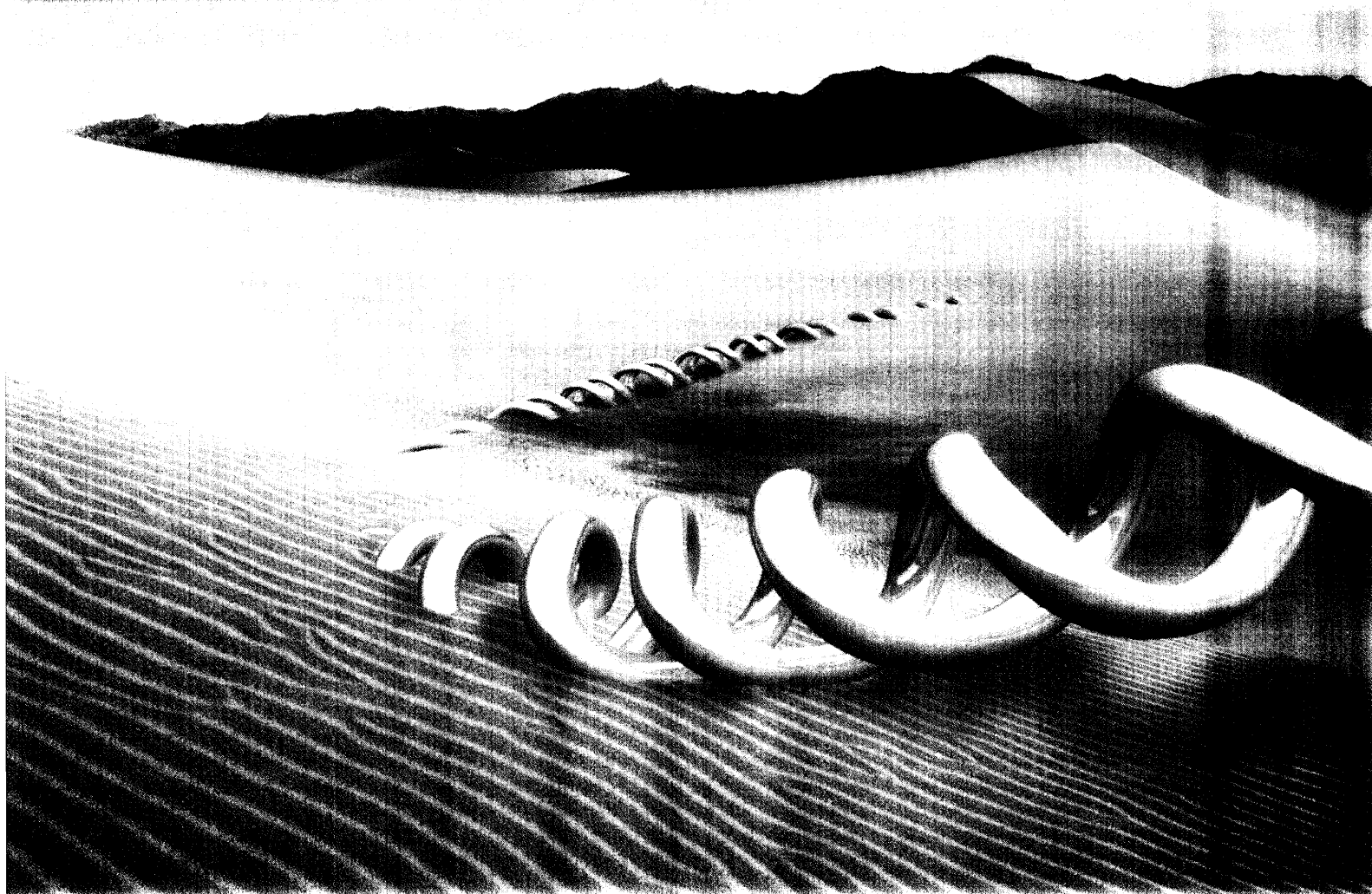
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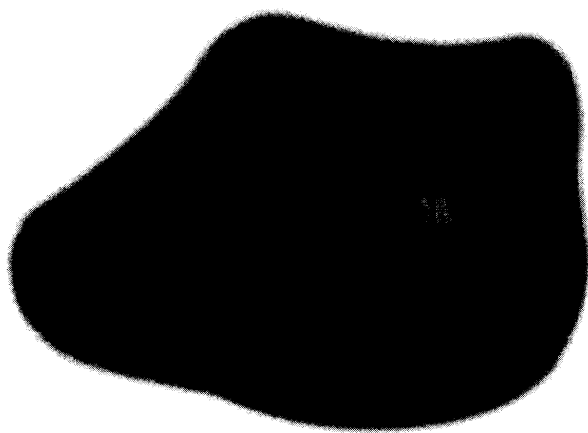
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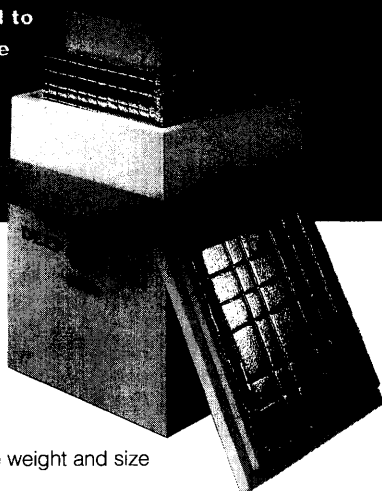
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