SPECIAL SECTION

Plant Genomes

INTRODUCTION

Green Genes

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GM Crops: A World View

Tough Lessons From Golden Rice

GM Papaya Takes on Ringspot Virus and Wins

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Uncorking the Grape Genome

A Life With Grapes

Sowing the Seeds for High-Energy Plants

PERSPECTIVES

Genome-Enabled Approaches Shed New Light on Plant Metabolism

D. DellaPenna and R. L. Last

Genomic Plasticity and the Diversity of Polyploid Plants

A. R. Leitch and I. J. Leitch

Selection on Major Components of Angiosperm Genomes

B. S. Gaut and J. Ross-Ibarra

Synteny and Collinearity in Plant Genomes

H. Tang et al.

The Epigenetic Landscape of Plants

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Extending Genomics to Natural Communities and Ecosystems

T. G. Whitham et al.

From Genotype to Phenotype: Systems Biology Meets Natural Variation

P. N. Benfey and T. Mitchell-Olds

New Superconductors Propel Chinese Physicists to Forefront

When Hobbits (Slowly) Walked the Earth

Two Geologic Clocks Finally Keeping the Same Time

Europe Takes Guesswork Out of Site Selection

Rebuilding the Injured Warrior

Bypassing Medicine to Treat Diabetes

Japanese Experts Steal a Glance at Once-Taboo Royal Tomb

Pardis Sabeti: Picking Up Evolution’s Beat

A Renowned Field Station Rises From the Ashes

Cover

Representatives of diverse species from the plant kingdom. The genomes of thale cress (Arabidopsis thaliana), grape (Vitis vinifera), rice (Oryza sativa), and the moss Physcomitrella patens have been sequenced, and there is ongoing genetic research on apple (Malus domestica), rose (Rosa spp.), tomato (Solanum lycopersicum), Gerbera daisy (Gerbera hybrid), monkey flower (Mimulus lewisii), columbine (Aquilegia formosa), maize (Zea mays), wheat (Triticum aestivum), tulip poplar (Liriodendron tulipifera), and the fern Ceratopteris richardii. The special section beginning on page 465 includes News stories and Perspectives exploring plant biology, ecology, economic applications, and the future of plant genomics research.

Photo illustration: Kelly Krause/Science (images: Jupiter Images, Getty Images, USDA, Oregon State University)
CLIMATE CHANGE
The Sensitivity of Polar Ozone Depletion to Proposed Geoengineering Schemes
S. Tilmes, R. Müller, R. Salawitch
Calculations imply that injection of sulfur into the atmosphere to counteract global warming would threaten the ozone layer, as occurred after the Mount Pinatubo eruption.
10.1126/science.1153966

IMMUNOLOGY
Coordination of Early Protective Immunity to Viral Infection by Regulatory T Cells
J. M. Lund, L. Hsing, T. T. Pham, A. Y. Rudensky
In mice infected with herpes virus, an usually immunosuppressive T cell is necessary for rapid arrival of immune cells and elevated cytokine levels at the site of infection.
10.1126/science.1155209

LETTERS
Parsing the Evolution of Language
B. D. Joseph and S. S. Mufwene
Response Q. D. Atkinson et al.
Inspecting Urban Health
E. Thomas
Response C. Dye
The Quest for Stronger, Tougher Materials
R. O. Ritchie
Response Y. Dzenis

TECHNICAL COMMENT ABSTRACTS
OCEAN SCIENCE
Comment on “Eddy/Wind Interactions Stimulate Extraordinary Mid-Ocean Plankton Blooms”
A. Mahadevan, L. N. Thomas, A. Tandon
Response to Comment on “Eddy/Wind Interactions Stimulate Extraordinary Mid-Ocean Plankton Blooms”
D. J. McGillicuddy Jr., J. R. Ledwell, L. A. Anderson

BOOKS ET AL.
Fruits and Plains The Horticultural Transformation of America P. J. Pauly, reviewed by S. Kingsland
Most Dangerous Catch
D. Elisco, Director;
FLOW: For Love of Water
I. Salina, Director;
Building the Future—Energy
N. Brown, Director;
Gimme Green
I. Brown and E. Flagg, Directors;
Scarred Lands and Wounded Lives: The Environmental Footprint of War
A. Day and L. Day, Directors

POLICY FORUM
Harvesting Data from Genetically Engineered Crops
M. Marvier et al.

EDUCATION FORUM
The Advantage of Abstract Examples in Learning Math
J. A. Kaminski, V. M. Sloutsky, A. F. Heckler

PLANT SCIENCE
Cell Identity Mediates the Response of Arabidopsis Roots to Abiotic Stress
J. R. Dinneny et al.
In Arabidopsis root tips exposed to high salinity or iron deficiency, clusters of genes are induced that are unique to one or both of these stress responses.
>> Plant Genomes section p. 465
10.1126/science.1153795

PLANT SCIENCE
Genome-Scale Proteomics Reveals Arabidopsis thaliana Gene Models and Proteome Dynamics
K. Baerenfaller et al.
The Arabidopsis proteome shifts as the plant develops, and proteins not predicted from genome analysis, some derived from introns and pseudogenes, are expressed.
>> Plant Genomes section p. 465
10.1126/science.1157956

PERSPECTIVES
Enigmas of Blood Clot Elasticity
J. W. Weisel
Identifying Ancient Asteroids
T. H. Burbine
A One-Sided Signal
G. D. Fain and S. Grinstein
Carbon Crucible
M. Marquis and P. Tans
RNA Metabolism and Oncogenesis
D. L. Johnson and S. A. S. Johnson

BREVIA
PALEONTOLOGY
Molecular Phylogenetics of Mastodon and Tyrannosaurus rex
C. L. Organ et al.
Phylogenetic analyses of collagen protein fragments from fossils and 21 extant organisms group mastodons with elephants and Tyrannosaurus rex with birds.

RESEARCH ARTICLE
GEOCHEMISTRY
Synchronizing Rock Clocks of Earth History
K. F. Kuiper et al.
Tying an argon-argon dating standard to a section dated with Earth’s orbital variations yields older ages for the standard and for other events, including the K-T boundary.
>> News story p. 434

REPORTS
MATERIALS SCIENCE
Sign Change of Poisson’s Ratio for Carbon Nanotube Sheets
L. J. Hall et al.
When stretched, a sheet made of carbon nanotubes contracts or expands in the opposite direction, depending on how many multiwalled tubes form zig-zag networks.
REPORTS CONTINUED...

MATERIALS SCIENCE
Stretchable and Foldable Silicon Integrated Circuits
D.-H. Kim et al.
High-performance, bendable, and stretchable electronic devices are fabricated on an elastic plastic substrate by placing the critical electronic components in the neutral bending plane.

APPLIED PHYSICS
Near-Field Plates: Subdiffraction Focusing with Patterned Surfaces
A. Gribic, L. Jiang, R. Merlin
A grating near the focal plane can focus microwave radiation to a spot size well below the diffraction limit.

PLANETARY SCIENCE
Ancient Asteroids Enriched in Refractory Inclusions
J. M. Sunshine et al.
Spectral data imply that some asteroids contain higher concentrations of early solar system grains and materials than are found in any sampled meteorite. >> Perspective p. 457

CLIMATE CHANGE
Human-Induced Arctic Moistening
S.-K. Min, X. Zhang, F. Zwiers
Comparison of 22 climate models to observations shows that human activity has increased precipitation in the Arctic over the past 50 years, altering its timing and distribution.

BIOCHEMISTRY
Efficient Inhibition of the Alzheimer’s Disease β-Secretase by Membrane Targeting L. Rajendran et al.
Tethering an inhibitor to a membrane anchor renders it effective against a membrane enzyme that creates the amyloid fragments deposited in Alzheimer’s disease, even in vivo.

MEDICINE
Plastin 3 Is a Protective Modifier of Autosomal Recessive Spinal Muscular Atrophy G. E. Oprea et al.
Expression of a protein that promotes axonal growth can compensate for the gene deletion in spinal muscular atrophy, indicating that axonal growth deficiencies cause the disease.

CELL BIOLOGY
Role of C. elegans TAT-1 Protein in Maintaining Plasma Membrane Phosphatidylserine Asymmetry M. Darland-Ransom et al.
A phospholipid translocase enzyme keeps a critical membrane lipid localized to the inner leaflet of the cell membrane so it does not trigger engulfment by immune cells. >> Perspective p. 458; Report p. 531

VIROLOGY
Vaccinia Virus Uses Macropinocytosis and Apoptotic Mimicry to Enter Host Cells J. Mercer and A. Helenius
To infect host cells, vaccinia virus exposes phosphatidylserine on its surfaces, which signals host cells to recognize the virus as cellular debris and take it up for clearance. >> Perspective p. 458; Report p. 528

CELL BIOLOGY
Encoding Gender and Individual Information in the Mouse Vomeronal Organ J. He, L. Ma, S. Kim, J. Nakai, C. R. Yu
Mice can recognize the pheromones from individual mice through unique patterns of receptor activation in the vomeronasal organ.

GENETICS
Rare Structural Variants Disrupt Multiple Genes in Neurodevelopmental Pathways in Schizophrenia T. Walsh et al.
Patients with schizophrenia carry multiple small deletions and duplications in their DNA that are associated nonrandomly with neuronal signaling and brain development pathways.

EVOLUTION
Metabolic Diversification—Independent Assembly of Operon-Like Gene Clusters in Different Plants B. Field and A. E. Osbourn
Through strong selection, similar clusters of genes for triterpene biosynthesis have arisen independently through gene duplication and neofunctionalization in several plant lines.

GENETICS
Mechanism of Self-Sterility in a Hermaphroditic Chordate Y. Harada et al.
The sea squirt prevents self-fertilization with two genetic loci, each of which encodes a tightly linked sperm-egg receptor-ligand pair, a system similar to that of flowering plants.
Notch Signaling in Osteoblasts
E. Canalis
Notch signaling plays a role in bone remodeling by inhibiting the differentiation of osteoblasts and osteoclasts.

Perspective: Back from the Dormant Stage—Second Messenger Cyclic ADP-Ribose Essential for Toxoplasma gondii Pathogenicity
A. H. Guse
The protozoan parasite T. gondii uses a plant-like signaling pathway to exit host cells.

Sleep Deprivation for Germs
Study suggests new way to target persistent bacteria.

Gene Studies Tell Placenta's Tale
Mother-fetus lifeline evolved from a combination of ancient and new genes.

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