CONTENTS

EDITORIAL
489  Improving Education Standards
Janet Coffey and Bruce Alberts

NEWS OF THE WEEK
494  A roundup of the week’s top stories

NEWS & ANALYSIS
497  Graphene and Brain Projects
Win European Jackpot
498  If Budget Woes Continue, Panel Says
DOE Should Shut Last U.S. Collider
499  Brain Studies Stymied by Statistics
500  The Pssst That Pierced the Sky
Is Now Churning the Sea
>> Reports pp. 563 and 568
501  Advisers Urge NIH to Scale Back
Chimpanzee Research

NEWS FOCUS
502  A Worm Vaccine, Coming
at a Snail’s Pace
504  Tight Budgets Squeeze European
Earth Observation
505  World’s Biggest Health Care System
 Goes Under the Knife
A New Dawn for Mental Health

SPECIAL FEATURE
509  2012 International Science & Engineering
Visualization Challenge
>> For related online content, go to
www.sciencemag.org/special/vis2012;
Science Podcast

LETTERS
520  Transmission Studies Resume for Avian Flu
R. A. M. Fouchier et al.
Eco-Compensation for
Giant Panda Habitat
B. Yang et al.
Environmental Health Crucial
to Food Safety
P. E. Hulme

BOOKS ET AL.
523  The Where, the Why, and the How
J. Volovovski et al., Eds., reviewed by C. Matuk
524  Notes on Three Image-Rich Books

POLICY FORUM
526  Hurdles and Opportunities for
Landscape-Scale Restoration
M. H. M. Menz et al.

PERSPECTIVES
528  Cancer Cell Phenotypes, in
Fifty Shades of Grey
A. Marcysy and K. Polyak
>> Research Article p. 543
529  Toward Molecular-Scale MRI
P. Hemmer
>> Reports pp. 557 and 561
530  Undernutrition—Looking Within
for Answers
D. A. Relman
>> Research Article p. 548
532  Measuring Mass in Seconds
J. E. Debs et al.
>> Report p. 554
533  Carbon Cycle Makeover
D. E. Canfield and L. R. Kump
>> Research Article p. 540

REVIEW
535  Carbon Nanotubes: Present and Future
Commercial Applications
M. F. L. De Volder et al.

CONTENTS continued >>

COVER
Detail of a “wiring diagram” showing long-distance neural
connections between major regions of the macaque brain.
This visualization provides guidance for connecting multiple
computer chips into a brainlike network. This diagram was awarded
first place in the illustration category in the 2012 Science/NSF
International Science & Engineering Visualization Challenge.
The winning entries are featured in a special section starting on
Illustration: Emmett McQuinn, Pallab Datta, Myron D. Flickner,
William P. Risk, Dharmendra S. Modha/IBM Research - Almaden

DEPARTMENTS
487  This Week in Science
490  Editors’ Choice
492  Science Staff
596  New Products
597  Science Careers
RESEARCH ARTICLES

540 Authigenic Carbonate and the History of the Global Carbon Cycle
D. P. Schrag et al.
The functional diversity of heterogeneous tumor cells within tumors cannot be explained by genetic differences alone.
>> Perspective p. 532

543 Variable Clonal Repopulation Dynamics Influence Chemotherapy Response in Colorectal Cancer
A. Kreso et al.
Genomic analyses of gut microbiota explain responses to dietary therapy for severe malnutrition.
>> Perspective p. 530

548 Gut Microbiomes of Malawian Twin Pairs Discordant for Kwashiorkor
M. J. Smith et al.
>> Perspective p. 528

549 Nanoscale Nuclear Magnetic Resonance with a Nitrogen-Vacancy Spin Sensor
H. J. Mamin et al.
>> Perspective p. 529

561 Nuclear Magnetic Resonance Spectroscopy on a (5-Nanometer)$^3$ Sample Volume
T. Staudecker et al.
The optical response of the spin of a near-surface atomic defect in diamond can be used to sense proton magnetic fields.
>> Perspective p. 531

563 Detecting Ozone- and Greenhouse Gas–Driven Wind Trends with Observational Data
S. Lee and S. B. Feldstein
Observations reveal how stratospheric ozone depletion and greenhouse gas accumulation affect winds in the Southern Hemisphere.

568 Recent Changes in the Ventilation of the Southern Oceans
D. W. Waugh et al.
Changing westerly winds in the Southern Hemisphere have caused coherent changes in the southern ocean ventilation.
>> News story p. 500

570 Uncovering the Protein Translocon at the Chloroplast Inner Envelope Membrane
S. Kikuchi et al.
The protein transport channel in the chloroplast inner envelope requires both nuclear- and organelle-encoded subunits.

574 Emergent Sensing of Complex Environments by Mobile Animal Groups
A. Berdahl et al.
Living in a group amplifies the reach of an individual’s capacity to sense environmental changes.
>> Science Podcast

576 The Bacteriophage T7 Virion Undergoes Extensive Structural Remodeling During Infection
B. Hu et al.
Cryo–electron tomography captures T7 bacteriophage virions at successive stages of bacterial infection.

580 Circulating Breast Tumor Cells Exhibit Dynamic Changes in Epithelial and Mesenchymal Composition
M. Yu et al.
Tumor cells circulating in the blood of cancer patients undergo a phenotypic change that may facilitate their spread.

584 Systematic Identification of Signal-Activated Stochastic Gene Regulation
G. Neuert et al.
A model quantitatively predicts stochastic activation dynamics during yeast cellular stress.

587 Molecular Mechanism of Action of Microtubule-Stabilizing Anticancer Agents
A. E. Prota et al.
Microtubule-targeted drugs use a common mechanism to stabilize the major loop in tubulin that controls microtubule dynamics.

590 A Strategy for Modulation of Enzymes in the Ubiquitin System
A. Ernst et al.
A technique for developing specific potent enzyme inhibitors is validated on enzymes of the ubiquitin-proteasome system.