COVER
The many layers of gene regulation in a eukaryotic cell, envisioned as a video game. Transcription in the nucleus (green circle) proceeds to translation in the cytoplasm via genome topology, polymerase pausing, microRNA repression, RNA splicing, and riboswitch regulation. See the special section beginning on page 1781.
Illustration: Carin L. Cain

SPECIAL SECTION
Gene Regulation

INTRODUCTION
Freedom of Expression

NEWS
MicroRNAs Make Big Impression in Disease After Disease

PERSPECTIVES
Gene Regulation by Transcription Factors and MicroRNAs
O. Hobert
The Eukaryotic Genome as an RNA Machine
Multilevel Regulation of Gene Expression by MicroRNAs
E. V. Makeyev and T. Maniatis
Transcription Regulation Through Promoter-Proximal Pausing of RNA Polymerase II
L. J. Core and J. T. Lis
Gene Regulation in the Third Dimension
J. Dekker
Complex Riboswitches
R. R. Breaker
Evolution of Eukaryotic Transcription Circuits
B. B. Tuch, H. Li, A. D. Johnson

>> Editorial p. 1733; for online content, see p. 1727 or go to www.sciencemag.org/generegulation/

DEPARTMENTS
1727 Science Online
1729 This Week in Science
1735 Editors’ Choice
1738 Contact Science
1741 Random Samples
1743 Newsmakers
1775 AAAS News & Notes
1856 New Products
1857 Science Careers

EDITORIAL
1733 Shortcuts to Medical Progress?
by Bruce Alberts
>> Gene Regulation special section p. 1781

NEWS OF THE WEEK
Roads, Ports, Rails Aren’t Ready for Changing Climate, Says Report
Study Fingers Soot as a Major Player in Global Warming
Smart Birds Lend a Beak for Food
NIH Reports Breach of Patient Records
Elusive Pathogen Cornered at Last

SCIENCESCOPE
China’s Modern Medical Minister
Saudi Start-Up Hopes Grants Will Buy Time

NEWS FOCUS
Science by the Masses
Weighing the Climate Risks of an Untapped Fossil Fuel
With New Disease Genes, a Bounty of Questions
Lunar and Planetary Science Conference
Cooking Up the Solar System From the Right Ingredients
New Piece of the Solar System Puzzle Fits In
What Was a ‘Wet and Warm’ Early Mars Really Like?
Snapshots From the Meeting

CONTENTS 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.
10.1126/science.1154367

APPLIED PHYSICS
Silica-on-Silicon Waveguide Quantum Circuits
A. Politi et al.
Quantum circuits—in which individual photons interfere, entangle, and form logic gates—have been realized on silicon chips.
10.1126/science.1155441

LETTERS
The Last Inventor of the Telephone
J. Schmidhuber
1759
Thinking Outside the Reef
E. L. Peterson, M. Beger, Z. T. Richards
Putting Ant-Acacia Mutualisms to the Fire
R. Cochard and D. Agosti
Response
T. M. Palmer et al.

BOOKS ET AL.
Proust Was a Neuroscientist
J. Lehrer; 1763
Artscience
Creativity in the Post-Google Generation
D. Edwards, reviewed by J. Labinger
Victorian Popularizers of Science
Designing Nature for New Audiences
B. Lightman, reviewed by P. J. Pauly

POLICY FORUM
The Planet Debate Continues
M. V. Sykes
1765

BIOCHEMISTRY
Reconstitution of Pilus Assembly Reveals a Bacterial Outer Membrane Catalyst
M. Nishiyama, T. Ishikawa, H. Rechsteiner, R. Glockshuber
The cell-free formation of the protruberant pilus of a pathogenic bacteria is accelerated by a protein that catalyzes supramolecular assembly without input of cellular energy.
10.1126/science.1154994

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.
10.1126/science.1155174

PERSPECTIVES
Multitasking in Tissues and Materials
P. B. Messersmith
1767
A Milestone in Time Keeping
D. Kleppner
1768
When a Commodity Is Not Exactly a Commodity
N. Folbre
1769
Recording Earth’s Vital Signs
R. F. Keeling
1771
A Postgenomic Visual Icon
J. N. Weinstein
1772

REVIEW
MATERIALS SCIENCE
Doped Nanocrystals
D. J. Norris, A. L. Efros, S. C. Erwin
1776

BREVIA
PLANETARY SCIENCE
Dynamics of Saturn’s South Polar Vortex
U. A. Dyudina et al.
Observations from Cassini show that the cloud vortex at Saturn’s south pole shares some features with hurricanes (such as an eye wall), but forms by a different mechanism.
1801

REPORTS
ASTROPHYSICS
Magnetar-Like Emission from the Young Pulsar in Kes 75
F. P. Gavriil et al.
A pulsar exhibits x-ray bursts like that seen only in magnetars, which have ultrahigh magnetic fields, implying that neutron stars exhibit a continuum of magnetic activity.
Fractional Uncertainty

Two clocks based on optical transitions in single trapped ions, set 4 kilometers apart, are able to keep time within a fractional error of $1 \times 10^{-16}$, better than the standard atomic clock.

STRUCTURAL BIOLOGY

The Flavivirus Precursor Membrane-Envelope Protein Complex: Structure and Maturation

L. Li et al.

Structure of the Immature Dengue Virus at Low pH

Primes Proteolytic Maturation

I-M. Yu et al.

Dengue and West Nile viruses mature when the envelope protein precursor is cleaved at low pH, and then the cleavage product dissociates outside the cell, allowing infection.

NEUROSCIENCE

Insect Odorant Receptors Are Molecular Targets of the Insect Repellent DEET

M. Ditzen, M. Pellegrino, L. B. Vosshall

The widely used insect repellent DEET acts by inhibiting olfactory neurons that respond to odors such as those that attract insects to their hosts.

NEUROSCIENCE

Aversive Learning Enhances Perceptual and Cortical Discrimination of Indistinguishable Odor Cues

W. Li, J. D. Howard, T. B. Parrish, J. A. Gottfried

After association of negative stimuli to one of a pair of initially indistinguishable odors, human participants learn to tell the two odors apart and show altered brain representations.

NEUROSCIENCE

Electric Fields Due to Synaptic Currents Sharpen Excitatory Transmission

S. Sylantyev et al.

The electrical field set up by currents within the synaptic cleft can influence diffusion of negatively charged neurotransmitters, such as glutamate, and prolong excitatory events.

NEUROSCIENCE

Rule Learning by Rats

R. A. Murphy, E. Mondragón, V. A. Murphy

Rats can learn the rules governing simple sequences of stimuli and then unexpectedly can generalize these rules to new situations.

MATERIALS SCIENCE

The Transition from Stiff to Compliant Materials in Squid Beaks

A. Miserez, T. Schneberk, C. Sun, F. W. Zok, J. H. Waite

Squid beaks, sharp and hard only at the tip, exhibit a chemical gradient that tailors its mechanical properties to prevent damage to the attached soft muscle tissue.

CHEMISTRY

Self-Assembly of Large and Small Molecules into Hierarchically Ordered Sacs and Membranes

R. M. Capito et al.

Mixing of a high–molecular weight polymer with a low–molecular weight peptide amphiphile instantly forms repairable membrane sacs large enough to encapsulate cells.

CHEMISTRY

Determining Transition-State Geometries in Liquids Using 2D-IR

J. F. Cohoon, K. R. Sawyer, J. P. Schlegel, C. B. Harris

Tracking vibrational modes through a transition state by spectroscopy reveals an iron compound’s thermal ligand rearrangement, which was previously too fast to monitor.

CHEMISTRY

Surface Trapping of Atoms and Molecules with Dipole Rings

H. Dil et al.

Holes in a boron nitride surface ringed by in-plane dipoles form a nanometer-scale pore network with a trapping potential that can hold weakly adsorbed molecules.

MOLECULAR BIOLOGY

Nutritional Control of Reproductive Status in Honeybees via DNA Methylation

R. Kucharski, J. Maleszka, S. Foret, R. Maleszka

Epigenetic modifications that involve methylation cause female honeybee larvae to become queens rather than workers when they are fed royal jelly.
New Form of Vision Discovered
Mantis shrimp eyes can see circular polarized light, which may be used in mating or secret signaling.

Therapeutic Cloning Shows Promise for Parkinson’s Disease
Mice treated with their own cells.

What Does a Plant Sound Like?
A computer program reveals how bats find their favorite foliage—and how we can use the same trick.

The hazards of perfectionism.