COVER

A metaphorical USB cable transmitting genetic information to “reprogram” cells symbolizes the Breakthrough of the Year for 2008. Advances in the burgeoning field of cellular reprogramming have brought scientists closer to the goal of using stem cells to better understand and someday treat disease. See the special section beginning on page 1766.

Image: Chris Bickel

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Breakthrough of the Year

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H. Ren et al.
Nitrogen fixation in the tropical Atlantic increased during deglaciation and, along with increased denitrification, helped to stabilize the ocean nitrogen reservoir.
10.1126/science.1165787

Glucosinolate Metabolites Required for an Arabidopsis Innate Immune Response

N. K. Clay, A. M. Adio, C. Denoux, G. Jander, F. M. Ausubel
A Glucosinolate Metabolism Pathway in Living Plant Cells Mediates Broad-Spectrum Antifungal Defense

P. Bednarek et al.
Plant cells defend against fungal attack through an innate immunity pathway in which infection triggers glucosinolate synthesis, stimulating formation of a protective callose.
10.1126/science.1164627

Rapid Membrane Disruption by a Perforin-Like Protein Facilitates Parasite Exit from Host Cells

B. F. C. Kafsack et al.
The human and animal parasite that causes toxoplasmosis escapes from host cells by using a perforin-like protein to make holes in the intracellular vacuole in which it resides.
10.1126/science.1165740

Electron Cryomicroscopy of E. coli Reveals Filament Bundles Involved in Plasmid DNA Segregation

J. Salje, B. Zuber, J. Löwe
The actin-like filaments that power movement of DNA during bacterial cell division form small bundles of three to five filaments near the nucleoid.
10.1126/science.1164346

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B. E. Riddell, R. J. Beamish, L. J. Richards, J. R. Candy
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Orbital Identification of Carbonate-Bearing Rocks on Mars
B. L. Ehlmann et al.
Despite widespread acidic weathering on Mars, detection of carbonate-bearing rocks indicates that nonacidic waters existed in the past.

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The Circadian Clock in Arabidopsis Roots Is a Simplified Slave Version of the Clock in Shoots
A. B. James et al.
A simpler plant circadian clock, which normally has three interlocking feedback loops, is used in the roots, with one feedback loop regulating only a few genes.

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Human Fetal Hemoglobin Expression Is Regulated by the Developmental Stage-Specific Repressor BCL11A
V. G. Sankaran et al.
A way to reactivate a fetal form of γ-globin in adults—by releasing it from repression by an inhibitor—may prove useful for treating certain genetic anemias. >> Perspective p. 1803

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CRISPR Interference Limits Horizontal Gene Transfer in Staphylococci by Targeting DNA
L. A. Marraffini and E. J. Sontheimer
The small CRISPR RNAs in Staphylococci bacteria that protect against phage infection are complementary to foreign phage DNA and target it for destruction.

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Highly unstable transcripts exist upstream of active human promoters.
Y. He et al.
The abundance and nonrandom genomic origin of antisense transcripts in human cells suggest that these RNAs are an important feature of gene regulation. >> Perspective p. 1804

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Label-Free Biomedical Imaging with High Sensitivity by Stimulated Raman Scattering Microscopy
C. W. Freudiger et al.
Three-dimensional imaging based on stimulated Raman scattering can detect lipids in living cells and monitor the movement of drugs through the skin.

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NEUROSCIENCE

Representation of Geometric Borders in the Entorhinal Cortex
T. Solstad et al.
A previously unknown cell type in the brain’s cortex encodes geometric boundaries of the nearby environment, perhaps providing a frame of reference.

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Leukemic Cells Create Bone Marrow Niches That Disrupt the Behavior of Normal Hematopoietic Progenitor Cells
A. Colmone et al.
Cancerous immune cells create abnormal microenvironments in bone marrow that attract normal immune precursor cells, disrupting their function and exacerbating disease.
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R. Arp and B. Smith
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B. Vastag
New Ph.D. programs in translational medicine provide basic science training and clinical experience.

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E. Pain
Curiosity, boldness, and single-mindedness won Austrian scientist Konrad Hockenedinger a place in cell reprogramming, Science’s Breakthrough of the Year for 2008.

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D. Jensen
“Activator,” “behavior,” and “consequence” are key concepts in this simple management theory.

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K. Travis
Translational researchers are pushing a fundamental change in the way science has operated for decades.

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VIDEO: 2008 Breakthrough of the Year
An introduction to some of the work that led studies in reprogramming cells to be tagged the top scientific story for 2008.

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