A hot spring in Bali, Indonesia. The discovery of thriving microbial communities in such unexpected places has motivated investigation into the diversity and distribution of microbial life. The special issue beginning on page 1027 explores the microbial world.

Image: Sylvain Grandadam/Getty Images

EDITORIAL
985 Microbes in the Energy Grid by James Tiedje and Timothy Donohue

>> Microbial Ecology section p. 1027

SPECIAL SECTION
Microbial Ecology

INTRODUCTION
Lost in Microbial Space 1027

NEWS
The Inner Lives of Sponges 1028
Confusing Kinships 1031

REVIEWS
The Microbial Engines That Drive Earth’s Biogeochemical Cycles 1034
P. G. Falkowski, T. Fenchel, E. F. Delong

Microbial Biogeography: From Taxonomy to Traits 1039
J. L. Green, B. J. M. Bohannan, R. J. Whitaker

Microbial Ecology of Ocean Biogeochemistry:
A Community Perspective 1043
S. L. Strom

>> Editorial p. 985; News stories pp. 1001 and 1006; Science Express Report by R. E. Ley et al.; Brevia p. 1046; Research Article p. 1047; Report p. 1081; for online content see p. 979 or go to www.sciencemag.org/microbialecology/

NEWS OF THE WEEK
Landslides, Flooding Pose Threats As Experts Survey Quake’s Impact 996

Farm Bill Gives Agriculture Research a Higher Profile in the Department 998

Australia’s New Science Budget Gets a Mixed Review 998

Hurricanes Won’t Go Wild, According to Climate Models 999

SCIENCESCOPE
999
Polar Bear Listing Opens Door to New Lawsuits 1000
The Threat to the World’s Plants

Bacteria Are Picky About Their Homes on Human Skin 1001

NEWS FOCUS
A New Great Lake—or Dead Sea? 1002
The End of an Intellectual Dark Age?

All That Makes Fungus Gardens Grow 1006

GLAST Mission Prepares to Explore the Extremes of Cosmic Violence 1008
CELL SIGNALING
The Rag GTPases Bind Raptor and Mediate Amino Acid Signaling to mTORC1
Y. Sancak et al.
Nutrients, specifically amino acids, are sensed by small guanosine triphosphatases, which bind to a signaling complex, moving it close to the nucleus where it initiates cell growth.
10.1126/science.1157535

MICROBIOLOGY
Evolution of Mammals and Their Gut Microbes
R. E. Ley et al.
Genomic sampling of the microbes in the feces of 60 mammals shows that herbivores harbor the most diversity and that individuals of the same species have the same flora.
>> Microbial Ecology section p. 1027
10.1126/science.1155725

CELL BIOLOGY
β-Arrestin–Mediated Localization of Smoothened to the Primary Cilium
J. J. Kovacs et al.
β-arrestin, which has several known roles in signaling systems, also links a key receptor to a motor protein so that the receptor can be transported to cilia for sensing environmental cues.
10.1126/science.1157983

CLIMATE CHANGE
Evidence for Upwelling of Corrosive “Acidified” Water onto the Continental Shelf
R. A. Feely et al.
As a result of anthropogenic CO₂ uptake, corrosive seawater undersaturated with calcium carbonate shoaled on the continental shelf of western North America in 2007.
10.1126/science.1155676

BOOKS ET AL.
Systems Biology Philosophical Foundations
F. C. Boogerd et al., Eds.; An Introduction to Systems Biology Design Principles of Biological Circuits
U. Alon, reviewed by C. J. Cain et al.
1013

BROWSEINGS
Phylogeny and Evolution of the Mollusca
W. F. Ponder and D. R. Lindberg, Eds., reviewed by M. Glaubrecht
1014

POLICY FORUM
Public-Private Partnerships and Scientific Imperialism
T. J. Tucker and M. W. Makgoba
1016

PERIODICALS
Sci. Signal. Vol 1, Issue 12
1017

BREVIA
MICROBIOLOGY
Extending the Sub–Sea-Floor Biosphere
E. G. Roussel et al.
Prokaryotic cells and DNA from Archaea are present at depths greater than 1 kilometer in sediments below the ocean floor, where temperatures range up to 100° Celsius.
RESEARCH ARTICLES

MICROBIOLOGY

Virus Population Dynamics and Acquired Virus Resistance in Natural Microbial Communities
A. F. Andersson and J. F. Banfield
Fragments of viral genes found within Archaea and Bacteria genomes are part of an antiviral defense system and can be used to identify and track the viruses themselves.

BIOCHEMISTRY

Regulated Protein Denitrosylation by Cytosolic and Mitochondrial Thioredoxins
M. Benhar, M. T. Forrester, D. T. Hess, J. S. Stampler
Thioredoxins—known to be antioxidants—also remove nitrosyl groups from a protease to activate it and may also function in this way in other cellular regulatory systems. >> Perspective p. 1019

REPORTS

MATERIALS SCIENCE

Structural Diversity of Sodium
E. Gregoryanz et al.
Single-crystal diffraction data reveal that many crystalline phases of sodium, some quite complex, occur near its unusual minimum melting temperature at very high pressure.

MATERIALS SCIENCE

Inverse Temperature Dependence of Toughness in an Ultrafine Grain-Structure Steel
Y. Kimura, T. Inoue, F. Yin, K. Tsuzaki
A network of fine, fibrous grains formed at high temperatures substantially improves the strength and ductility of a low-alloy steel at low temperatures, where it is typically brittle. >> Perspective p. 1022

MATERIALS SCIENCE

Dislocation-Driven Nanowire Growth and Eshelby Twist
A screw dislocation drives the growth of a nanowire pine tree, in which branches regularly extend from the trunk in a spiral, confirming Eshelby’s theory of dislocations.

PLANETARY SCIENCE

Detection of Silica-Rich Deposits on Mars
S. W. Squyres et al.
The rover Spirit has found opaline silica-rich soil and rocks on Mars, providing further evidence for extensive local mineralization by hydrothermal fluids at low pH.

GEOLOGY

Formation of Box Canyon, Idaho, by Megaflood: Implications for Seepage Erosion on Earth and Mars
M. P. Lamb et al.
A classic amphitheater-shaped canyon in Idaho, similar to features seen on Mars, formed in a glacial megaflood, not through groundwater seepage at its head as was thought.

SCIENCE VO L 320 23 MAY 2008

GEOPHYSICS

Anticorrelated Seismic Velocity Anomalies from Post-Perovskite in the Lowermost Mantle
A. R. Hutka, T. Lay, J. Revenaugh, E. J. Garner
Analysis of 10,000 seismic waves passing through the deep mantle shows that a velocity jump 300 kilometers above the core is caused by a phase change in a major mantle mineral.

PHYSIOLOGY

Differential Rescue of Light- and Food-Entrainable Circadian Rhythms
P. M. Fuller, J. Lu, C. B. Saper
When hungry, rodents may optimize their chances of finding food by engaging a food-entrained circadian clock in the brain that takes over from the light-driven clock.

MOLECULAR BIOLOGY

Endogenous siRNAs Derived from Transposons and mRNAs in Drosophila Somatic Cells
M. Ghildiyal et al.
Endogenous small interfering RNAs transcribed from both transposons and messenger RNAs are found in somatic cells of flies and may act to silence “selfish” genetic elements. >> Perspective p. 1023

EVOLUTION

Resource Partitioning and Sympatric Differentiation Among Closely Related Bacterioplankton
D. E. Hunt et al.
A model of a marine plankton population reveals that ecologically distinct subgroups undergo sympatric speciation fast enough to overcome horizontal gene flow.

MEDICINE

A Polymorphism Within the G6PC2 Gene Is Associated with Fasting Plasma Glucose Levels
N. Bouatia-Naji et al.
Variation in a gene for a protein in the pancreas may help explain why people have different levels of fasting blood glucose, a factor that affects disease risk.

CELL BIOLOGY

The Serine Protease TMPRSS6 Is Required to Sense Iron Deficiency
X. Du et al.
A cell-surface enzyme that cleaves proteins is unexpectedly necessary for sensing when iron levels are low and thereby triggering compensatory absorption of iron from food.

PSYCHOLOGY

The Right and the Good: Distributive Justice and Neural Encoding of Equity and Efficiency
M. Hsu, C. Anen, S. R. Quartz
A brain region linked to emotion-processing systems is activated as humans weigh fairness to an individual against benefit for a group.
SCIENCE NOW
www.sciencenow.org
HIGHLIGHTS FROM OUR DAILY NEWS COVERAGE

Monkey Model of Huntington’s Disease
Genetically modified primates may be better than mice for studying neurological disorders.

Astronomers in a Spin About Mystery Pulsar
One of the universe’s most extreme objects just got a bit stranger.

Catching a Climate Offender
New strategy could reduce CO₂ emissions from coal plants.

An unhappy microbe-host interaction.

SPECIAL SECTION

Microbial Ecology

SCIENCE SIGNALING
www.sciencesignaling.org
THE SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

EDITORIAL GUIDE: Focus Issue—A Niche of One’s Own
E. M. Adler and J. F. Foley
The nature of microbe-host relationships often depends on signaling pathways in the host.

PERSPECTIVE: Diversification of the Function of Cell-to-Cell Signaling in Regulation of Virulence Within Plant Pathogenic Xanthomonads
M. Dow
Different plant pathogens use similar signaling molecules in distinct ways.

PERSPECTIVE: Bacterial-Modulated Signaling Pathways in Gut Homeostasis
W.-J. Lee
Stimulation of the production of reactive oxygen species in gut epithelial cells by commensal bacteria dampens the host immune response.

PERSPECTIVE: Etoxis—a Novel Cell Death Pathway
F. Wartha and B. Henriques-Normark
Pathogenic microbes are trapped and killed by mast cell— and neutrophil-derived extracellular traps.

Download the 23 May Science Podcast to hear about silica deposits on Mars, a food-driven circadian clock in mice, creating a lake in Turkmenistan, and more.

Separate individual or institutional subscriptions to these products may be required for full-text access.