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

---

# 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
P. G. Falkowski, T. Fenchel, E. F. Delong 1034

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

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

---

# 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

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

Bacteria Are Picky About Their Homes on Human Skin 1001

# NEWS FOCUS

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

All That Makes Fungus Gardens Grow 1006

GLAST Mission Prepares to Explore the Extremes of Cosmic Violence 1008
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

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

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

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

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.
10.1126/science.1155657

Free Access to Landsat Imagery
The Landsat Science Team
Why Rowe-Clark Doesn’t Teach By the Book
R. Kramer and V. Galacza
Science Education: Should Facts Come First? S. Guo
Response S. Freeman, J. Lawhorn, A. Zheng
A Victory for PETA C. R. Spiess

Comment on “Brain IRS2 Signaling Coordinates Life Span and Nutrient Homeostasis”
C. Selman, S. Lingard, D. Gems, L. Partridge, D. J. Withers
full text at www.sciencemag.org/cgi/content/full/320/5879/1012b

Response to Comment on “Brain IRS2 Signaling Coordinates Life Span and Nutrient Homeostasis”
A. Taguchi and M. F. White
full text at www.sciencemag.org/cgi/content/full/320/5879/1012c

Comment on “Brain IRS2 Signaling Coordinates Life Span and Nutrient Homeostasis”
C. Selman, S. Lingard, D. Gems, L. Partridge, D. J. Withers
full text at www.sciencemag.org/cgi/content/full/320/5879/1012b

Response to Comment on “Brain IRS2 Signaling Coordinates Life Span and Nutrient Homeostasis”
A. Taguchi and M. F. White
full text at www.sciencemag.org/cgi/content/full/320/5879/1012c

Wi-Fi-Fo-Fum
R. Morrow

SNO Removal
A. Holmgren >> Research Article p. 1050

Marine Calcifiers in a High-CO₂ Ocean
V. J. Fabry

Stronger, Tougher Steels

Slicing and Dicing for Small RNAs
J. A. Birchler and H. H. Kavi >> Report p. 1077

Retrospective: Edward N. Lorenz (1917–2008)
K. Emanuel

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.
10.1126/science.1155657

Microbial Ecology section p. 1027
10.1126/science.1155725

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

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

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.
10.1126/science.1155657
RESEARCH ARTICLES

MICROBIOLOGY

Virus Population Dynamics and Acquired Virus Resistance in Natural Microbial Communities
A. F. Andersson and J. F. Banfield

Fragmentsof 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. Stamler

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.

GEOPHYSICS

Anticorrelated Seismic Velocity Anomalies from Post-Perovskite in the Lowermost Mantle
A. R. Hutko, T. Lay, J. Revenaugh, E. J. Garnero

Analysis of 10,000 seismic waves passing through the deep mantle shows that a velocity jump 300 kilometers below 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.
Microbial Ecology

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.

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