

21 December 2012 | \$10

Science

BREAKTHROUGH
of the YEAR
The **HIGGS**
BOSON

SPECIAL SECTION

Breakthrough of the Year

WINNER

- 1524 The Discovery of the Higgs Boson

RUNNERS-UP

- 1525 A Home Run for Ancient DNA
1526 Genomic Cruise Missiles
1527 Crash Project Opens a Door in Neutrino Physics
1528 Genomics Beyond Genes
1529 Scary Engineering Tames Martian Terror
1530 First Protein Structure From an X-ray Laser
1530 Brain-Machine Interfaces Start to Get a Grip
1531 Majorana Fermions, Quasi-Here at Last
1532 Making Eggs From Stem Cells

OTHER FEATURES

- 1526 Italian Quake Verdicts Rattle Researchers
1528 Areas to Watch
1532 Scorecard
1533 A Year On, the H5N1 Debate Remains Infectious, With No End in Sight
1534 The Year in News

>> Editorial p. 1511; Articles pp. 1558 to 1582; Science Careers story by E. Pain; Science Podcast; and videos online at www.sciencemag.org/special/btoy2012



page 1540

EDITORIAL

- 1511 The Breakthroughs of 2012
Bruce Alberts
>> Breakthrough of the Year section p. 1524

NEWS OF THE WEEK

- 1516 A roundup of the week's top stories

NEWS & ANALYSIS

- 1519 NIF Report Asks for More Time to Achieve Ignition
1520 An *Annus Horribilis* for Anthropology?
1521 Sutter's Mill Meteorite Produces Mother Lode of Research
>> Research Article p. 1583
1522 Fall Meeting of the American Geophysical Union
No Lake Mud for Curiosity Rover to Investigate?
Tying Megaeruptions to a Mass Extinction Long After the Fact
Buildup to Quakes Spied in Both Model and Real World
Snapshots From the Meeting

LETTERS

- 1537 Dam Threatens Mekong Ecology
G. R. Lanza
Mobilizing Religion and Conservation in Asia
S. M. Awoyemi et al.
Shark Sanctuaries: Substance or Spin?
L. N. K. Davidson
1539 CORRECTIONS AND CLARIFICATIONS
1539 TECHNICAL COMMENT ABSTRACTS

BOOKS ET AL.

- 1540 The Secrets of Alchemy
L. M. Principe, reviewed by A. Grafton
1541 Death
assembled by R. Harris

EDUCATION FORUM

- 1542 Interdisciplinary Graduate Training in Teaching Labs
R. D. Vale et al.

PERSPECTIVES

- 1545 Visualizing the Influenza Genome
Y. J. Tao and W. Zheng
>> Reports pp. 1631 and 1634
1546 Tackling Meningitis in Africa
H. Thorsteinsdóttir and T. W. Sáenz
1547 Splicing in 4D
P. Papasaikas and J. Valcárcel
>> Research Articles pp. 1587 and 1593
1549 Cardiac Regeneration
A. Rosenzweig
>> Research Article p. 1599
1550 Symmetry Meets Topology
X.-L. Qi
>> Report p. 1604
1551 Modeling the Formation of Porphyry-Copper Ores
S. E. Ingebritsen
>> Report p. 1613
1553 Retrospective: Keith Campbell (1954–2012)
I. Wilmut

CONTENTS continued >>



COVER

Mosaic of the CMS and ATLAS detectors (as in 2007), part of the Large Hadron Collider at CERN. In 2012, research teams used these detectors to fingerprint decay products from the long-sought Higgs boson and determine its mass, successfully testing a key prediction of the standard model of particle physics. See the Breakthrough of the Year special section beginning on page 1524, three Articles beginning on page 1558, and www.sciencemag.org/special/btoy2012.

Photos: Maximilien Brice and Claudia Marcelloni/CERN

DEPARTMENTS

- 1508 This Week in *Science*
1512 Editors' Choice
1514 Science Staff
1556 AAAS News & Notes
1638 New Products
1639 Science Careers

SCIENCE PRIZE ESSAY

- 1554 **How We Got Here: An Inquiry-Based Activity About Human Evolution**
R. M. Price

ARTICLES

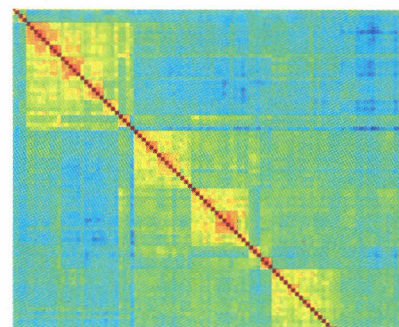
- 1558 **The Higgs Boson**
Glossary
- 1560 **Journey in the Search for the Higgs Boson: The ATLAS and CMS Experiments at the Large Hadron Collider**
M. Della Negra et al.
- 1569 **A New Boson with a Mass of 125 GeV Observed with the CMS Experiment at the Large Hadron Collider**
The CMS Collaboration
- 1576 **A Particle Consistent with the Higgs Boson Observed with the ATLAS Detector at the Large Hadron Collider**
The ATLAS Collaboration
>> *Breakthrough of the Year* section p. 1524

RESEARCH ARTICLES

- 1583 **Radar-Enabled Recovery of the Sutter's Mill Meteorite, a Carbonaceous Chondrite Regolith Breccia**
P. Jenniskens et al.
Analysis of this rare meteorite implies that the surfaces of C-class asteroids can be more complex than previously assumed.
>> *News story* p. 1521
- 1587 **The Evolutionary Landscape of Alternative Splicing in Vertebrate Species**
N. L. Barbosa-Morais et al.
The patterns and complexity of messenger RNA splicing across vertebrates cluster by species rather than by organ.
- 1593 **Evolutionary Dynamics of Gene and Isoform Regulation in Mammalian Tissues**
J. Merkin et al.
Messenger RNA alternative splicing is highly variable among vertebrates and links to kinase signaling pathways.
>> *Perspective* p. 1547
- 1599 **C/EBP Transcription Factors Mediate Epicardial Activation During Heart Development and Injury**
G. N. Huang et al.
Transcriptional mechanisms controlling gene expression in the heart's outer layer are exploited for cardiac repair.
>> *Perspective* p. 1549

REPORTS

- 1604 **Symmetry-Protected Topological Orders in Interacting Bosonic Systems**
X. Chen et al.
Counterparts of topological insulators are predicted to exist in interacting bosonic systems.
>> *Perspective* p. 1550
- 1606 **Sign-Problem-Free Quantum Monte Carlo of the Onset of Antiferromagnetism in Metals**
E. Berg et al.
An effective lattice theory enables an efficient computational solution to an otherwise intractable problem.
- 1609 **Optomechanical Dark Mode**
C. Dong et al.
The formation of a mechanical dark mode can be used to isolate an optomechanical system from thermal noise.
- 1613 **Porphyry-Copper Ore Shells Form at Stable Pressure-Temperature Fronts Within Dynamic Fluid Plumes**
P. Weis et al.
A numerical model attributes ore metal accumulation in porphyry deposits to fluid plumes draining from large magma chambers.
>> *Perspective* p. 1551
- 1616 **Apatite $^4\text{He}/^3\text{He}$ and (U-Th)/He Evidence for an Ancient Grand Canyon**
R. M. Flowers and K. A. Farley
The Colorado River carved the Grand Canyon to nearly its modern depth 60 million years earlier than was generally believed.
- 1619 **Multiplex Targeted Sequencing Identifies Recurrently Mutated Genes in Autism Spectrum Disorders**
B. J. O'Roak et al.
Large-scale human autism candidate gene resequencing implicates de novo mutations in six genes in ~1% of sporadic cases.
- 1622 **Genome-Wide Detection of Single-Nucleotide and Copy-Number Variations of a Single Human Cell**
C. Zong et al.
A whole-genome amplification method with reduced bias compares a single cell with its descendants.
- 1627 **Probing Meiotic Recombination and Aneuploidy of Single Sperm Cells by Whole-Genome Sequencing**
S. Lu et al.
A whole-genome amplification method with reduced bias yields a personal meiotic recombination map.



pages 1547, 1587, & 1593



pages 1551 & 1613

- 1631 **Organization of the Influenza Virus Replication Machinery**
A. Moeller et al.
Electron microscopic analysis of a reconstituted RNA-protein complex outlines pathways of transcription.
- 1634 **The Structure of Native Influenza Virion Ribonucleoproteins**
R. Arranz et al.
Electron microscopic analysis of a purified RNA-protein complex links its structure to the influenza life cycle.
>> *Perspective* p. 1545

CONTENTS continued >>

ONLINE HIGHLIGHTS

SCIENCEEXPRESS

www.scienceexpress.org
Publication Ahead of Print

Reconstitution of the Vital Functions of Munc18 and Munc13 in Neurotransmitter Release

C. Ma et al.
10.1126/science.1230473

Comparative Analysis of Bat Genomes Provides Insight into the Evolution of Flight and Immunity

G. Zhang et al.
10.1126/science.1230835

An Update of Wallace's Zoogeographic Regions of the World

B. G. Holt et al.
10.1126/science.1228282

Cyclic GMP-AMP Is an Endogenous Second Messenger in Innate Immune Signaling by Cytosolic DNA

J. Wu et al.
10.1126/science.1229963

Cyclic GMP-AMP Synthase Is a Cytosolic DNA Sensor That Activates the Type I Interferon Pathway

L. Sun et al.
10.1126/science.1232458

Olefin Cyclopropanation via Carbene Transfer Catalyzed by Engineered Cytochrome P450 Enzymes

P. S. Coelho et al.
10.1126/science.1231434

Boson Sampling on a Photonic Chip

J. B. Spring et al.
10.1126/science.1231692

Photonic Boson Sampling in a Tunable Circuit

M. A. Broome et al.
10.1126/science.1231440

TECHNICAL COMMENTS

Comment and Response on "The Local Structure of Amorphous Silicon"

Comment: S. Roorda and L. J. Lewis
<http://dx.doi.org/10.1126/science.1221738>
Response: M. M. J. Treacy and K. B. Borisenko
<http://dx.doi.org/10.1126/science.1222571>

SCIENCE NOW

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Highlights From Our Daily News Coverage

Cloud Forest Trees Drink From the Fog
Plants take up a surprising amount of moisture from the air.

http://scim.ag/Moisture_Air

Reved-Up Protein Fights Aging

Boosting a protein that keeps chromosomes in order protects mice from cancer and increases life span.

http://scim.ag/Protein_Aging

Pee Marks the Spot

A single protein in male mouse urine makes females return to old haunts.

<http://scim.ag/Single-Protein>

SCIENCE SIGNALING

www.sciencesignaling.org
The Signal Transduction Knowledge Environment
18 December issue: <http://scim.ag/ss121812>

RESEARCH ARTICLE: IGFBP7 Binds to the IGF-1 Receptor and Blocks Its Activation by Insulin-like Growth Factors

V. Evdokimova et al.
By inactivating the IGF1R, IGFBP7 suppresses growth and promotes cell death.

RESEARCH ARTICLE: c-FLIP Maintains Tissue Homeostasis by Preventing Apoptosis and Programmed Necrosis

X. Piao et al.
The anti-apoptotic protein c-FLIP blocks multiple cell death pathways in mice.

RESEARCH ARTICLE: A CC-SAM, for Coiled-Coil-Sterile α Motif, Domain Targets the Scaffold KSR1 to Specific Sites in the Plasma Membrane

D. Koveal et al.
A previously unknown module that mediates membrane binding is identified in the scaffold KSR.

REVIEW: Extracellular Phosphorylation and Phosphorylated Proteins—Not Just Curiosities But Physiologically Important

G. Yalak and V. Vogel
Extracellular proteins and extracellular protein domains can be phosphorylated.

SCIENCE TRANSLATIONAL MEDICINE

www.sciencetranslationalmedicine.org
Integrating Medicine and Science
19 December issue: <http://scim.ag/stm121912>

COMMENTARY: To Share or Not To Share—That Is Not the Question

L. Ohno-Machado
Sharing clinical and biomedical data could accelerate translational research.

REVIEW: Hidden Killers—Human Fungal Infections

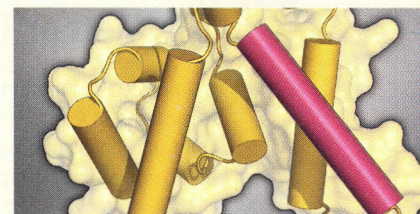
G. D. Brown et al.
Lack of rapid diagnostic tests, drugs, and vaccines impedes treatment and prevention of invasive fungal infections.

RESEARCH ARTICLE: Genetic Correction of Human Induced Pluripotent Stem Cells from Patients with Spinal Muscular Atrophy

S. Corti et al.
Induced pluripotent stem cell-derived motor neurons from spinal muscular atrophy patients show phenotype rescue after genetic correction.

RESEARCH ARTICLE: Long-Term Follow-Up After Gene Therapy for Canavan Disease

P. Leone et al.
Gene therapy for Canavan disease results in a decrease in pathologically elevated *N*-acetyl-aspartate concentrations in the brain and long-term clinical stabilization.



SCIENCE SIGNALING
Membrane-binding domain in KSR1.

RESEARCH ARTICLE: Multimodal Actions of Neural Stem Cells in a Mouse Model of ALS—A Meta-Analysis

Y. D. Teng et al.
A meta-analysis reports the beneficial effects of transplanting mouse or human neural stem cells into the spinal cord of the SOD1^{G93A} mouse, a model of ALS.

SCIENCE CAREERS

www.sciencereers.org/career_magazine
Free Career Resources for Scientists
<http://scim.ag/SciCareers21December2012>

Breakthrough of the Year:

Seekers of the Higgs Boson

E. Pain
Science Careers talks to three young investigators who contributed to this year's monumental discovery.

>> Breakthrough of the Year section p. 1524

Science Careers's Person of the Year:

Paula Stephan

B. L. Brenderly
The labor economist has worked for years behind the scenes, but this year she went public.

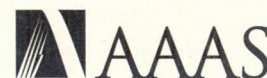
SCIENCE PODCAST

www.sciencemag.org/multimedia/podcast
Free Weekly Show for 21 December 2012

A special year-in-review show featuring the Breakthrough of the Year and Runners-Up and science news highlights from 2012.

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