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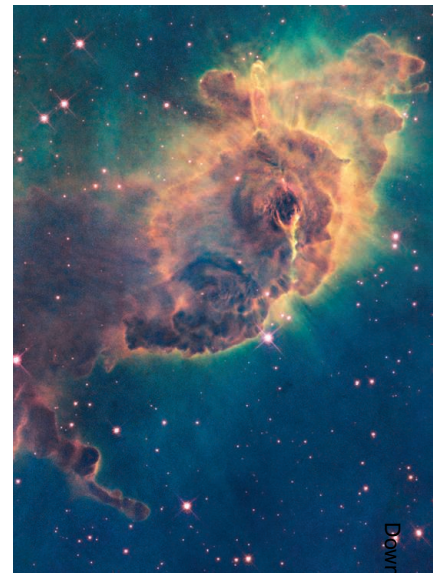
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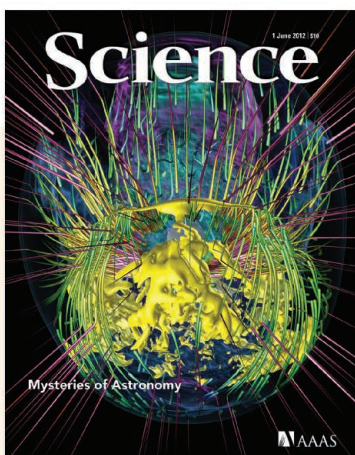


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## COVER

Three-dimensional computer models such as this one help researchers explore the mechanisms behind core-collapse supernovae, the violent death of short-lived massive stars. In the image, tubes represent paths of gas falling into a supernova, deflected by an accretion shockwave (horizontal width of 600 km); colors represent different velocities. The question of how stars explode is one of the "Mysteries of Astronomy" described in a special News package beginning on page 1090.

*Visualization: Hongfeng Yu and Kwan-Liu Ma, University of California-Davis and the SciDAC Institute for Ultra-Scale Visualization; Simulation: John Blondin, North Carolina State University*

## DEPARTMENTS

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## BREVIA

- 1129** Structure of a 16-nm Cage Designed by Using Protein Oligomers  
*Y.-T. Lai et al.*  
A general computational method allows the design of proteins that self-assemble into a desired symmetric architecture.

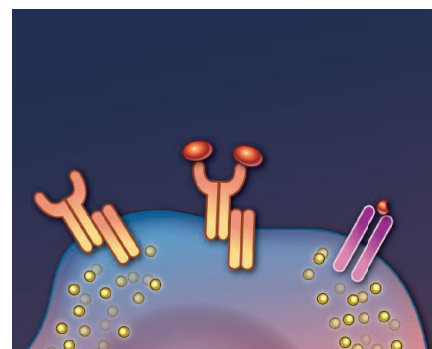
## RESEARCH ARTICLE

- 1130** Quantum Algorithms for Quantum Field Theories  
*S. P. Jordan et al.*  
A quantum computer may be able to efficiently simulate theories used to describe particle scattering in accelerators.  
>> *Perspective p. 1122*; *Science Podcast*

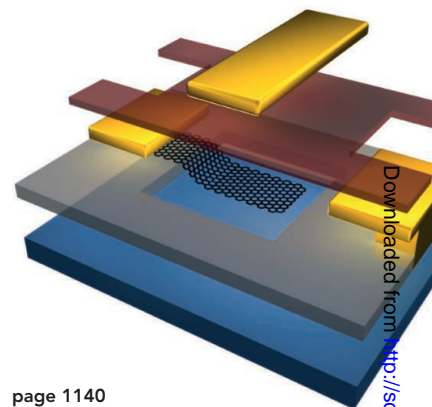
## REPORTS

- 1133** The Detection and Characterization of a Nontransiting Planet by Transit Timing Variations  
*D. Nesvorný et al.*  
Analysis of the deviations in the orbit of a transiting exoplanet revealed an outer planet in the same planetary system.  
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- 1137** Tracking Cooper Pairs in a Cuprate Superconductor by Ultrafast Angle-Resolved Photoemission  
*C. L. Smallwood et al.*  
Time-resolved spectroscopy is used to probe the dynamics of electron pairing recovery in a high-temperature superconductor.
- 1140** Graphene Barristor, a Triode Device with a Gate-Controlled Schottky Barrier  
*H. Yang et al.*  
The absence of defects and surface oxides at a graphene-silicon interface enables voltage control of graphene devices.
- 1143** Tailoring Electrical Transport Across Grain Boundaries in Polycrystalline Graphene  
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- 1147** Theory Untangles the High-Resolution Infrared Spectrum of the *ortho*-H<sub>2</sub>-CO van der Waals Complex  
*P. Jankowski et al.*  
High-level calculations assign the unusually complex spectrum of a molecular pair implicated in interstellar chemistry.
- 1150** Secreted Kinase Phosphorylates Extracellular Proteins That Regulate Biom mineralization  
*V. S. Tagliabracci et al.*  
The elusive enzyme that modifies proteins involved in building bone and teeth has now been identified.

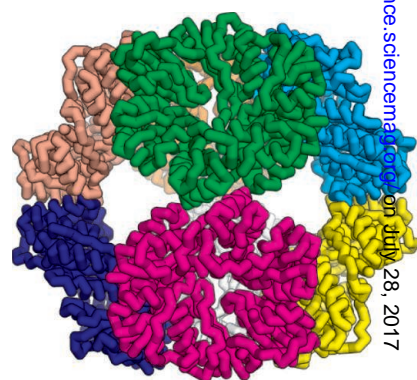
- 1154** Evolution of a Vertebrate Social Decision-Making Network  
*L. A. O'Connell and H. A. Hofmann*  
Across vertebrates, behaviorally relevant brain regions are remarkably conserved over 450 million years of evolution.
- 1157** Evolutionary Trade-Offs, Pareto Optimality, and the Geometry of Phenotype Space  
*O. Shoval et al.*  
The fitness of an organism can be modeled graphically to determine how phenotypic trade-offs are maximized.  
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- 1160** Chitin-Induced Dimerization Activates a Plant Immune Receptor  
*T. Liu et al.*  
Structural analysis shows how fungus-derived chitin dimerizes its receptor on target plants and triggers defense responses.
- 1164** Rocket Launcher Mechanism of Collaborative Actin Assembly Defined by Single-Molecule Imaging  
*D. Breitsprecher et al.*  
Triple-color microscopy suggests two factors interact to initiate actin formation and then separate as the filament grows.
- 1168** The Amyloid Precursor Protein Has a Flexible Transmembrane Domain and Binds Cholesterol  
*P. J. Barrett et al.*  
The structure of the APP transmembrane domain allows processive cleavage and cholesterol binding that may enhance cleavage.
- 1171** Computational Design of Self-Assembling Protein Nanomaterials with Atomic Level Accuracy  
*N. P. King et al.*  
A general computational method is used to design protein building blocks that self-assemble into target architectures.
- 1175** Generic Indicators for Loss of Resilience Before a Tipping Point Leading to Population Collapse  
*L. Dai et al.*  
Experiments in yeast confirm that statistical indicators can signal the approach of population crashes.
- 1178** B Cell Receptor Signal Transduction in the GC Is Short-Circuited by High Phosphatase Activity  
*A. M. Khalil et al.*  
Restricted B cell signaling in the areas responsible for immune memory cell production promotes affinity maturation.  
>> *Perspective p. 1120*
- 1182** Restoring Voluntary Control of Locomotion after Paralyzing Spinal Cord Injury  
*R. van den Brand et al.*  
A rehabilitation program involving robotic neuroprosthetics restores previously paralyzed hindlimb function.  
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## SCIENCEONLINE

## SCIENCEEXPRESS

[www.sciencexpress.org](http://www.sciencexpress.org)

**Structural Basis of Wnt Recognition by Frizzled**  
*C. Y. Janda et al.*

The structure of the morphogen Wnt bound to its receptor provides a basis for understanding Wnt's functional pleiotropy.

10.1126/science.1222879

**A Lipid Linchpin for Wnt-Fz Docking**

*M. Bienz and X. He*

10.1126/science.1224468

**Crystal Structure of the Heterodimeric CLOCK:BMAL1 Transcriptional Activator Complex**  
*N. Huang et al.*

Structure-function analyses reveal details of the interaction between two proteins that regulate daily rhythms in mammals.

10.1126/science.1222804

**High-Resolution Protein Structure Determination by Serial Femtosecond Crystallography**

*S. Boutet et al.*

A powerful x-ray laser source can probe proteins in detail using much smaller crystals than previously required.

10.1126/science.1217737

**Membrane Fusion Intermediates via Directional and Full Assembly of the SNARE Complex**

*J. M. Hernandez et al.*

During vesicle membrane fusion, straining of lipids at the edges of an extended contact zone may initiate fusion.

10.1126/science.1221976

**A *Papaver somniferum* 10-Gene Cluster for Synthesis of the Anticancer Alkaloid Noscapine**

*T. Winzer et al.*

A biosynthetic pathway inherited as a gene cluster generates a pharmaceutically useful alkaloid in poppies.

10.1126/science.1220757

## SCIENCE NOW

[www.sciencenow.org](http://www.sciencenow.org)

Highlights From Our Daily News Coverage

**Occupy the Neolithic**

Skeletons of early farmers reveal the roots of social inequality.

<http://scim.ag/Social-Inequality>

**No New Neurons for Smell?**

Lack of stimulation may have robbed the smell center of the human brain of new cells.

[http://scim.ag/Neurons\\_Smell](http://scim.ag/Neurons_Smell)

**'Asian Brown Cloud' Threatens U.S.**

Continued growth in Asian pollution could warm United States.

<http://scim.ag/Asian-Pollution>

## SCIENCE SIGNALING

[www.sciencesignaling.org](http://www.sciencesignaling.org)

The Signal Transduction Knowledge Environment  
**29 May issue:** <http://scim.ag/ss052912>

**EDITORIAL GUIDE: Focus Issue—Signaling Architecture From Domains to Complexes**

*W. Wong and N. R. Gough*

Structural analyses of domains, proteins, and complexes provide insight into signaling mechanisms and uncover therapeutic potential.

**RESEARCH ARTICLE: Sequence-Specific Recognition of a PxLPxL Motif by an Ankyrin Repeat Tumbler Lock**

*C. Xu et al.*

Phosphorylation of a motif that binds to ankyrin repeat domains switches its binding preference to 14-3-3 proteins.

**REVIEW: Signal Activation and Inactivation by the  $\alpha$  Helical Domain—A Long-Neglected Partner in G Protein Signaling**

*H. G. Dohlman and J. C. Jones*

Structural studies suggest that the helical domain of G protein  $\alpha$  subunits is an active participant in G protein signaling.

**REVIEW: Structural Insights into the Assembly of Large Oligomeric Signalosomes in the Toll-Like Receptor—Interleukin-1 Receptor Superfamily**

*R. Ferrao et al.*

Structural studies show that Toll-like receptors assemble into oligomeric intracellular signaling complexes upon ligand binding.

**ST NETWATCH: UCSF Chimera, PyMOL**

Render structures of biomolecules in various formats, generate animations, and model binding events.

## SCIENCE TRANSLATIONAL MEDICINE

[www.sciencetranslationalmedicine.org](http://www.sciencetranslationalmedicine.org)

Integrating Medicine and Science

**30 May issue:** <http://scim.ag/stm053012>

**EDITORIAL: Seeking Validation**

*D. Roblin*

Clinical validation of new drug targets may best occur in precompetitive partnerships.

**RESEARCH ARTICLE: Noninvasive Identification and Monitoring of Cancer Mutations by Targeted Deep Sequencing of Plasma DNA**

*T. Forshew et al.*

Sizable genomic regions were screened and low-frequency mutations were identified in circulating DNA of cancer patients using tagged-amplicon deep sequencing (TAM-Seq).

**RESEARCH ARTICLE: SIV Replication in the Infected Rhesus Macaque Is Limited by the Size of the Preexisting  $T_H17$  Cell Compartment**

*D. J. Hartigan-O'Connor et al.*

Macaques with abundant  $T_H17$  cells in blood and intestinal tissue before infection are resistant to SIV replication.

**RESEARCH ARTICLE: Kinase-Impaired BRAF Mutations in Lung Cancer Confer Sensitivity to Dasatinib**

*B. Sen et al.*

Induction of tumor cell senescence may explain the response of a patient with BRAF kinase-impaired lung cancer to the multikinase inhibitor dasatinib.

**RESEARCH ARTICLE: A Peptide Derived from Endostatin Ameliorates Organ Fibrosis**

*Y. Yamaguchi et al.*

**FOCUS: Relief from Within—A Peptide Therapy for Fibrosis**

*S. P. Atamas*

A naturally occurring peptide from endostatin can inhibit fibrosis in lung and skin, even when it is already established.

## SCIENCE CAREERS

[www.sciencereers.org/career\\_magazine](http://www.sciencereers.org/career_magazine)

Free Career Resources for Scientists

**Just Herself**

*V. Venkatraman*

In her life and her search for gravitational waves, MIT physicist Nergis Mavalvala is comfortable in her own skin.

<http://scim.ag/Mavalvala>

**Taken for Granted: Doing Science While Female**

*B. L. Benderly*

A new book looks at science careers across the stages of women's lives.

[http://scim.ag/TFG\\_ScienceWhileFemale](http://scim.ag/TFG_ScienceWhileFemale)

**Career Q&A: Often Wrong, Never in Doubt**

*M. Fessenden*

As head of the accelerator division at TRIUMF, Lia Merminga is a rare woman in the upper echelons of physics.

[http://scim.ag/Q\\_A\\_Merminga](http://scim.ag/Q_A_Merminga)

## SCIENCE PODCAST

[www.sciencemag.org/multimedia/podcast](http://www.sciencemag.org/multimedia/podcast)

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On the 1 June *Science* Podcast: a quantum approach to quantum field theories, motion restoration after spinal cord injury, the mysteries of astronomy, and more.

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