

SPECIAL SECTION

BIOMATERIALS

INTRODUCTION

899 Biomaterials

NEWS

900 China's Push in Tissue Engineering

REVIEWS

903 Multifunctional Nanoparticles: Cost Versus Benefit of Adding Targeting and Imaging Capabilities
Z. Cheng et al.

- 910 Soft Matter Models of Developing Tissues and Tumors
D. Gonzalez-Rodriguez et al.
- 917 Unlike Bone, Cartilage Regeneration Remains Elusive
D. J. Huey et al.
>> *Science Podcast*
- 921 Printing and Prototyping of Tissues and Scaffolds
B. Derby

>> *Science Careers* articles; *Science Translational Medicine* Editorial, Commentary, Perspectives, and Reviews at www.sciencemag.org/special/biomaterials



page 876

EDITORIAL

863 Responsible Research Conduct
Indira Nath and Ernst-Ludwig Winnacker

NEWS OF THE WEEK

868 A roundup of the week's top stories

NEWS & ANALYSIS

- 871 Disappointing Results Blunt Hopes for Malaria Vaccine
- 872 Researchers Lobby to Spare Science From E.U. Budget Cuts
- 873 Billionaire Restores Funding for Novel Biomedical Network
- 874 Old Challenges, New Faces Await Science Community in 2013
Change Versus Experience?

NEWS FOCUS

- 876 Nearly Buried, Mussels Get a Helping Hand
The Evolutionary Allure of Mussels
>> *Science Podcast*
- 879 Winds of Change
Slip Sliding Away

LETTERS

- 882 Small Science: Radical Innovation
E. Berlekamp
- Small Science: View from Developing Nations
B. Slippers
- Small Science: Big Science Will Prevail
L. Siminovitch
- Small Science: High Stakes
E. R. Gamazon
- Disease Prevention: Experiments in Nature
L. A. Cohen
- Disease Prevention: Vitamin D Trials
S. Pilz et al.

BOOKS ET AL.

- 884 Women Scientists in America
M. W. Rossiter, reviewed by G. M. Montgomery
- 885 The Structure of Scientific Revolutions
T. S. Kuhn, reviewed by D. Lehoux and J. Foster

POLICY FORUM

- 887 The Green Economy Post Rio+20
E. B. Barbier

PERSPECTIVES

- 889 Promoting Tumorigenesis by Suppressing Autophagy
I. Koren and A. Kimchi
>> *Report p. 956*
- 890 Functional DNA Origami Devices
M. S. Strano
>> *Report p. 932*
- 891 Cooperative Transcription Factor Complexes in Control
G. J. Martinez and A. Rao
>> *Report p. 975*
- 893 Speeding Up Artificial Muscles
M. Schulz
>> *Research Article p. 928*
- 894 Convergent Evolution of Hearing
R. R. Hoy
>> *Report p. 968*
- 895 Mediterranean Island Voyages
A. Simmons
- 897 A Vitrage of Asteroid Magnetism
B. P. Weiss
>> *Report p. 939*

CONTENTS continued >>



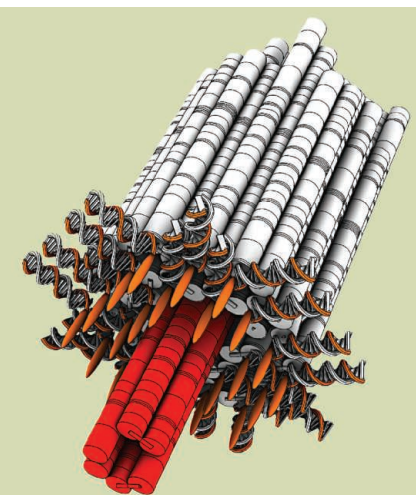
COVER

A 36× enlarged triply periodic porous cube of photocured polymer, 60 millimeters in total length, shown reflected off a pool of uncured resin. Computer-aided design makes it possible to tailor materials with control over porosity, pore size, and mechanical properties. These materials may subsequently find use as scaffolds for tissue engineering and cell-laden hydrogel constructs. See the special section starting on page 899 for a series of articles on biomaterials.

Fabrication: Ferry P. W. Melchels, Jan Feijen, Dirk W. Grijpma; Photograph: Nikki Hamers

DEPARTMENTS

- 861 This Week in *Science*
- 864 Editors' Choice
- 866 *Science* Staff
- 981 New Products
- 982 *Science* Careers



pages 890 & 932



pages 893 & 928



pages 894 & 968

RESEARCH ARTICLE

- 928** Electrically, Chemically, and Photonically Powered Torsional and Tensile Actuation of Hybrid Carbon Nanotube Yarn Muscles
M. D. Lima et al.
Thermally driven actuators use a guest material within carbon nanotube yarns to generate fast torsional and tensile motions.
>> *Perspective p. 893*

REPORTS

- 932** Synthetic Lipid Membrane Channels Formed by Designed DNA Nanostructures
M. Langecker et al.
DNA-based transmembrane channels exhibit gating responses and can be used for single-molecule detection.
>> *Perspective p. 890*
- 936** Coherent Phonon Heat Conduction in Superlattices
M. N. Luckyanova et al.
Coherent phonon transport is evidenced by linear increases of thermal conductivity with total superlattice thickness.
- 939** Evidence for a Dynamo in the Main Group Pallasite Parent Body
J. A. Tarduno et al.
Some pallasite meteorites might have formed when liquid FeNi from an impactor was injected into their parent body's mantle.
>> *Perspective p. 897*
- 942** Evidence for Early Hafted Hunting Technology
J. Wilkins et al.
Damage on 500,000-year-old stone points implies their use on spears, perhaps by the ancestor of Neandertals and *Homo sapiens*.
>> *Science Podcast*
- 946** Financial Costs of Meeting Global Biodiversity Conservation Targets: Current Spending and Unmet Needs
D. P. McCarthy et al.
Data for birds and protected area requirements yield estimated costs for maintaining worldwide diversity targets.
- 949** Pathological α -Synuclein Transmission Initiates Parkinson-like Neurodegeneration in Nontransgenic Mice
K. C. Luk et al.
Intracerebral inoculation of synthetic misfolded α -synuclein mimics Parkinson's disease in wild-type mice.
- 953** Orbitofrontal Cortex Supports Behavior and Learning Using Inferred But Not Cached Values
J. L. Jones et al.
Inferred value can be used to both guide behavior and modulate learning in rats.
- 956** Akt-Mediated Regulation of Autophagy and Tumorigenesis Through Beclin 1 Phosphorylation
R. C. Wang et al.
A direct link between a cancer-promoting protein kinase and the control of autophagy is presented.
>> *Perspective p. 889*
- 960** A Rab32-Dependent Pathway Contributes to *Salmonella* Typhi Host Restriction
S. Spanò and J. E. Galán
Expression of a single effector protein allows a human-specific pathogen to replicate within normally nonpermissive mice.
- 963** *Salmonella* Inhibits Retrograde Trafficking of Mannose-6-Phosphate Receptors and Lysosome Function
K. McGourty et al.
A bacterial pathogen interferes with intracellular trafficking of receptors needed for host cell lysosomal-enzyme targeting.
- 968** Convergent Evolution Between Insect and Mammalian Audition
F. Montealegre-Z. et al.
In an example of convergent evolution, rainforest katydids hear using similar mechanisms to those found in mammalian ears.
>> *Perspective p. 894*
- 971** Offspring from Oocytes Derived from in Vitro Primordial Germ Cell-like Cells in Mice
K. Hayashi et al.
Mature, fully functional female gametes can be generated from mouse pluripotent stem cells.
- 975** A Genomic Regulatory Element That Directs Assembly and Function of Immune-Specific AP-1-IRF Complexes
E. Glasmacher et al.
Cooperative binding of transcription factors to composite genomic elements regulates T helper 17 cell differentiation.
>> *Perspective p. 891*

SCIENCEEXPRESS

www.scienceexpress.org

Publication Ahead of Print

C/EBP Transcription Factors Mediate Epicardial Activation During Heart Development and Injury

G. N. Huang et al.

10.1126/science.1229765

Multiplex Targeted Sequencing Identifies Recurrently Mutated Genes in Autism Spectrum Disorders

B. J. O'Roak et al.

10.1126/science.1227764

The COMPASS Subunit Spp1 Links Histone Methylation to Initiation of Meiotic Recombination

L. Acquaviva et al.

10.1126/science.1225739

Porphyry-Copper Ore Shells Form at Stable Pressure-Temperature Fronts Within Dynamic Fluid Plumes

P. Weis et al.

10.1126/science.1225009

Optomechanical Dark Mode

C. Dong et al.

10.1126/science.1228370

Alignment of Magnetized Accretion Disks and Relativistic Jets with Spinning Black Holes

J. C. McKinney et al.

10.1126/science.1230811

SCIENCENOW

www.sciencenow.org

Highlights From Our Daily News Coverage

Wired for Harmony?

A new study shows that the ear and brain prefer harmonic sounds.

http://scim.ag/Wired_Harmony

Human Ancestors Were Grass Gourmands

Fossil teeth suggest that early hominins had a taste for the green stuff.

<http://scim.ag/Grass-Gourmands>

Bodystorming: Dance Grooves

Show How Molecules Move

Dancers help scientists assess models of molecular motion inside a cell.

<http://scim.ag/Molecular-Motion>

SCIENCE SIGNALING

www.sciencesignaling.org

The Signal Transduction Knowledge Environment

13 November issue: <http://scim.ag/ss111312>

RESEARCH ARTICLE: Single Amino Acid Substitutions Confer the Antiviral Activity of the TRAF3 Adaptor Protein onto TRAF5

P. Zhang et al.

Two single amino acid changes enable the adaptor protein TRAF5 to promote antiviral responses.

RESEARCH ARTICLE: The Tetraspanin CD37

Orchestrates the $\alpha 4\beta 1$ Integrin–Akt Signaling Axis and Supports Long-Lived Plasma Cell Survival

A. B. van Spruiel et al.

Antibody-producing B cells require CD37-dependent integrin signaling for long-term survival.

PERSPECTIVE: PTEN—An Intercellular Peacekeeper?

N. R. Leslie

Transfer of PTEN between cells has potential as an intercellular form of tumor suppression.

ST NETWATCH: The EMBO Meeting YouTube Channel

Eminent scientists discuss their work and share their perspectives on careers in research.

ST NETWATCH: Protein Structure and Structural Bioinformatics

An online guide highlights the principles of protein structure.

SCIENCE TRANSLATIONAL MEDICINE

www.sciencetranslationalmedicine.org

Integrating Medicine and Science

14 November issue: <http://scim.ag/stm111412>

EDITORIAL: Regenerative Engineering

C. T. Laurencin and Y. Khan

The future of tissue regeneration lies in “regenerative engineering,” with biomaterials playing a key role.

COMMENTARY: What Is the Greatest Regulatory Challenge in the Translation of Biomaterials to the Clinic?

G. D. Prestwich et al.

Leaders in the field list the greatest barriers to biomaterials translation.

PERSPECTIVE: Building Vascular Networks

H. Bae et al.

Advances in generating vascular networks in biomaterials may aid translation of tissue engineering technologies.

PERSPECTIVE: Dynamic Environments—The Fourth Dimension

M. W. Tibbett and K. S. Anseth

Four-dimensional cell matrices will aid in the translation of cell-based therapies.

REVIEW: Engineering Complex Tissues

A. Atala et al.

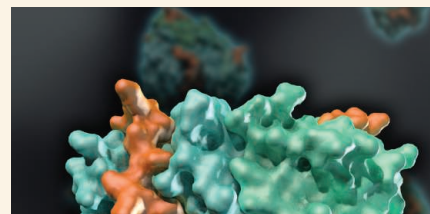
Advances in tissue engineering technologies will enable regeneration of complex tissues and organs.

REVIEW: Designing Regenerative Biomaterial Therapies for the Clinic

E. T. Pashuck and M. M. Stevens

Research, regulatory, and clinical aspects are considered for biomaterial translation.

>> *Biomaterials section p. 899*



SCIENCE SIGNALING

Understanding adaptor specificity.

SCIENCE CAREERS

www.sciencecareers.org/career_magazine

Free Career Resources for Scientists

16 November 2012 <http://scim.ag/SciCareers16November2012>

Tooling Up: Questions to Set Your Sails By (Part 1)

D. Jensen

Answering these six questions can help you choose your career path.

Careers in Biomaterials Science—An Overview

E. Pain

Scientists with an ability to work across fields can find exciting opportunities in biomaterials.

Materials Researchers in Biomedicine

M. Price

As biomedical applications emerge, materials scientists find new funding and research opportunities.

>> *Biomaterials section p. 899*

SCIENCE PODCAST

www.sciencemag.org/multimedia/podcast

Free Weekly Show for 16 November 2012

Listen to stories on biomaterials, preserving mussel diversity, early hunting technology, and more.

SCIENCE (ISSN 0036-8075) is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1200 New York Avenue, NW, Washington, DC 20005. Periodicals Mail postage (publication No. 484460) paid at Washington, DC, and additional mailing offices. Copyright © 2012 by the American Association for the Advancement of Science. The title SCIENCE is a registered trademark of the AAAS. Domestic individual membership and subscription (51 issues): \$149 (\$74 allocated to subscription). Domestic institutional subscription (51 issues): \$990; Foreign postage extra: Mexico, Caribbean (surface mail) \$55; other countries (air assist delivery) \$85. First class, airmail, student, and emeritus rates on request. Canadian rates with GST available upon request, GST #1254 88122. Publications Mail Agreement Number 1069624. Printed in the U.S.A.

Change of address: Allow 4 weeks, giving old and new addresses and 8-digit account number. Postmaster: Send change of address to AAAS, P.O. Box 96178, Washington, DC 20090-6178. Single-copy sales: \$10.00 current issue, \$15.00 back issue prepaid includes surface postage; bulk rates on request. Authorization to photocopy material for internal or personal use under circumstances not falling within the fair use provisions of the Copyright Act is granted by AAAS to libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that \$30.00 per article is paid directly to CCC, 222 Rosewood Drive, Danvers, MA 01923. The identification code for Science is 0036-8075. Science is indexed in the Reader's Guide to Periodical Literature and in several specialized indexes.



ADVANCING SCIENCE. SERVING SOCIETY

Science

338 (6109)

Science **338** (6109), 861-981.

ARTICLE TOOLS

<http://science.sciencemag.org/content/338/6109>

PERMISSIONS

<http://www.sciencemag.org/help/reprints-and-permissions>

Use of this article is subject to the [Terms of Service](#)

Science (print ISSN 0036-8075; online ISSN 1095-9203) is published by the American Association for the Advancement of Science, 1200 New York Avenue NW, Washington, DC 20005. 2017 © The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works. The title *Science* is a registered trademark of AAAS.