

29 July 2011 | \$10

Science

POPULATION

SPECIAL SECTION

Population

INTRODUCTION

- 538 Doom or Vroom?

NEWS

- 540 9 Billion?
544 Are More People Necessarily a Problem?
547 The Upside of Downsizing
548 Does Family Planning Bring Down Fertility?
549 A Pitched Battle Over Life Span
551 How to Engineer a Baby Boom
552 Young and Restless Can Be a Volatile Mix
Gray Ladies in the Spotlight
555 Regional Snapshots
558 A World of Chronic Disease

REVIEWS AND ANALYSIS

- 560 PERSPECTIVE: When the World's Population Took Off: The Springboard of the Neolithic Demographic Transition
J.-P. Bocquet-Appel

- 562 REVIEW: 7 Billion and Counting
D. E. Bloom
569 REVIEW: The Outlook for Population Growth
R. Lee
574 POLICY FORUM: Population Policy in Transition in the Developing World
J. Bongaarts and S. Sinding
576 REVIEW: India's Demographic Change: Opportunities and Challenges
K. S. James
581 REVIEW: China's Demographic History and Future Challenges
X. Peng
587 REVIEW: Global Human Capital: Integrating Education and Population
W. Lutz and S. KC
592 PERSPECTIVE: Cities, Productivity, and Quality of Life
E. L. Glaeser

>> Editorial p. 499; Reports pp. 616 and 623; Science Translational Medicine and Science Careers content p. 496, plus Podcast and multimedia features at www.scim.ag/pop2011

EDITORIAL

- 499 Population and Development
Babatunde Osotimehin
>> Population section p. 538

NEWS OF THE WEEK

- 504 A roundup of the week's top stories

NEWS & ANALYSIS

- 507 One Year On, LHC Sees Hints of Higgs—And Nothing Else
508 How an Alluring Geologic Enigma Won the Mars Rover Sweepstakes

- 510 Report Alters Definition of What Students Should Learn
511 Bad Birthday News for First Bird?
512 Russia Launches a Telescope, Decades in the Making
513 When Is It Ramadan? An Arab Astronomer Has Answers

NEWS FOCUS

- 514 THE INVISIBLE WOUNDS OF WAR
Healing the Brain, Healing the Mind
>> ScienceNOW story p. 496
517 A Battle No Soldier Wants to Fight
520 Predicting the Psychological Risks of War

LETTERS

- 523 An Online Alternative to Freshman Year
N. J. Nusbaum
Hidden Declines in Post-Soviet Education
A. Gorobets
Lab Course Goals: Science or Writing?
M. E. Goggin

Response

C. Moskovitz and D. Kellogg

524 CORRECTIONS AND CLARIFICATIONS

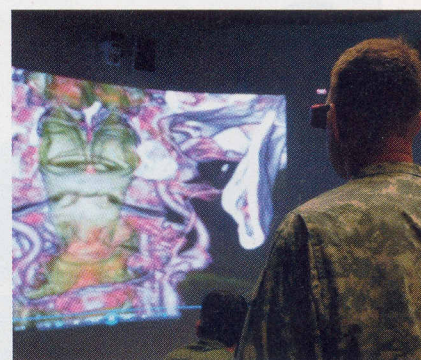
BOOKS ET AL.

- 525 The Origins of Political Order
F. Fukuyama, reviewed by J. A. Robinson
526 Adapt
T. Harford, reviewed by D. J. Rankin

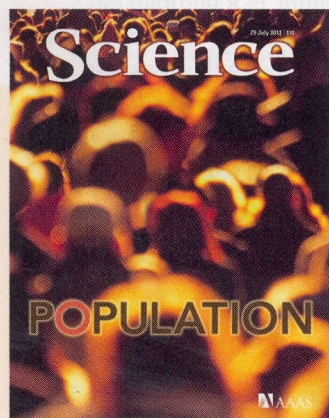
POLICY FORUM

- 527 Promoting Convergence in Biomedical Science
P. A. Sharp and R. Langer

CONTENTS continued >>



page 514



COVER

New York City. The United States is the only currently developed country projected to rank among the 10 most populous countries in 2050. Unlike many developed countries, the U.S. has a fertility rate slightly greater than replacement level, which provides balanced growth of youngsters, working-age adults, and elderly dependents. For our global coverage of population, see the special section beginning on p. 538 and at www.scim.ag/pop2011.

Image: Mitchell Funk/Getty Images

DEPARTMENTS

- 497 This Week in Science
500 Editors' Choice
502 Science Staff
536 AAAS News & Notes
649 New Products
650 Science Careers

PERSPECTIVES

- 528 The World Through a Bat's Ear
M. B. Fenton
>> Reports pp. 627 and 631
- 529 Who's Talking?
P. K. Kuhl
>> Brevia p. 595
- 530 Building a Lewis Base with Boron
Y. Wang and G. H. Robinson
>> Report p. 610
- 531 H₂O in a Desert of Carbon Atoms
A. L. Balch
>> Report p. 613
- 532 A Cellular Roadmap for the Plant Kingdom
C. R. Landry
>> Research Articles pp. 596 and 601

SCIENCE PRIZE ESSAY

- 534 Facilitating Scientific Investigations and Training Data Scientists
M. A. Korb and U. Thakkar

BREVIA

- 595 Human Voice Recognition Depends on Language Ability
T. K. Perrachione et al.
People with dyslexia have more difficulty than expected in recognizing familiar voices.
>> Perspective p. 529

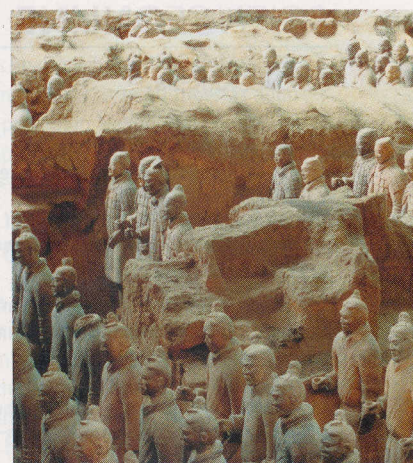
RESEARCH ARTICLES

- 596 Independently Evolved Virulence Effectors Converge onto Hubs in a Plant Immune System Network
M. S. Mukhtar et al.
- 601 Evidence for Network Evolution in an *Arabidopsis* Interactome Map
Arabidopsis Interactome Mapping Consortium
An analysis of protein-protein interactions in *Arabidopsis* identifies the plant interactome.
>> Perspective p. 532

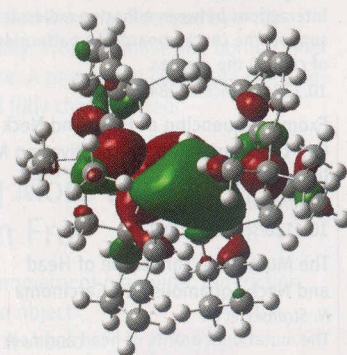
REPORTS

- 607 Friction Anisotropy-Driven Domain Imaging on Exfoliated Monolayer Graphene
J. S. Choi et al.
Otherwise identical regions of supported graphene can be distinguished by changes in friction with sliding direction.
- 610 Synthesis and Characterization of a Neutral Tricordinate Organoboron Isoelectronic with Amines
R. Kinjo et al.
Carefully chosen carbon substituents stabilize a boron oxidation state that bears an extra electron pair.
>> Perspective p. 530

- 613 A Single Molecule of Water Encapsulated in Fullerene C₆₀
K. Kurotobi and Y. Murata
An open-cage derivative of C₆₀ was filled with one water molecule and then restored to its original closed framework.
>> Perspective p. 531
- 616 Climate Trends and Global Crop Production Since 1980
D. B. Lobell et al.
Climate change has decreased global maize and wheat production, while soybean and rice production have remained stable.
>> Population section p. 538
- 620 Sr-Nd-Pb Isotope Evidence for Ice-Sheet Presence on Southern Greenland During the Last Interglacial
E. J. Colville et al.
Melting of the Antarctic Ice Sheet contributed substantially to the excess sea-level rise of the last interglacial period.
- 623 Tenfold Population Increase in Western Europe at the Neandertal-to-Modern Human Transition
P. Mellars and J. C. French
The ability of modern humans to sustain larger populations contributed to the decline of Neandertals in Western Europe.
>> Population section p. 538
- 627 Bats Use Echo Harmonic Structure to Distinguish Their Targets from Background Clutter
M. E. Bates et al.
Bats use temporal differences in sonar echoes to suppress interference from background clutter.
- 631 Floral Acoustics: Conspicuous Echoes of a Dish-Shaped Leaf Attract Bat Pollinators
R. Simon et al.
A bat-pollinated plant has dish-shaped leaves with conspicuous echoes that serve as acoustic attractors.
>> Perspective p. 528
- 633 Initiation Complex Structure and Promoter Proofreading
X. Liu et al.
RNA polymerase II transcription complexes reveal the basis of abortive initiation and its role in promoter control.
- 637 Impaired Respiratory and Body Temperature Control Upon Acute Serotonergic Neuron Inhibition
R. S. Ray et al.
Inducible neuron inhibition reveals essential roles for serotonergic neurons in respiratory and body temperature homeostasis.



page 525



pages 530 & 610

- 642 RNA Mimics of Green Fluorescent Protein
J. S. Paige et al.
Selection for RNAs that bind and activate derivatives of the green fluorescent protein fluorophore yields a wide range of useful spectral properties.
- 646 Isolation of Succinivibrionaceae Implicated in Low Methane Emissions from Tammar Wallabies
P. B. Pope et al.
Metagenome sequence predicted the culture conditions required for successful isolation of a marsupial gut bacterium.

CONTENTS continued >>

SCIENCEONLINE

SCIENCEEXPRESS

www.sciencexpress.org

Isotopic Signature of N₂O Produced by Marine Ammonia-Oxidizing Archaea

A. E. Santoro et al.

Archaea may account for the majority of marine nitrous oxide emissions to the atmosphere.

10.1126/science.1208239

A Neutralizing Antibody Selected from Plasma Cells That Binds to Group 1 and Group 2 Influenza A Hemagglutinins

D. Corti et al.

An antibody able to broadly neutralize both group 1 and group 2 influenza A viruses—and its target epitope—are identified.

10.1126/science.1205669

Nectins Establish a Checkerboard-Like Cellular Pattern in the Auditory Epithelium

H. Togashi et al.

Interactions between adhesion molecules support the checkerboard-like patterning of cells in the cochlea.

10.1126/science.1208467

Exome Sequencing of Head and Neck Squamous Cell Carcinoma Reveals Inactivating Mutations in NOTCH1

N. Agrawal et al.

10.1126/science.1206923

The Mutational Landscape of Head and Neck Squamous Cell Carcinoma

N. Stransky et al.

The mutational profile of head and neck cancer is complex and may pose challenges to the development of targeted therapies.

10.1126/science.1208130

SCIENCENOW

www.sciencenow.org

Highlights From Our Daily News Coverage

How Blasts Injure the Brain

New findings may provide important clues to how explosions cause traumatic brain injury in soldiers.

<http://scim.ag/brainblasts>

>> News story p. 514

A Submarine That Doesn't Make Waves

A new 'wake cloak' could eliminate drag on water vessels, making them operate as though they were in a vacuum.

<http://scim.ag/wakecloak>

Heavy Armor Gave Knights a Workout

Physiologists put armor-clad historical interpreters on a treadmill and measure how quickly they run out of steam.

<http://scim.ag/heavyarmor>

SCIENCESIGNALING

www.sciencesignaling.org

The Signal Transduction Knowledge Environment

26 July issue: <http://scim.ag/ss072611>

RESEARCH ARTICLE: Proteome-Wide Mapping of the *Drosophila* Acetylome Demonstrates a High Degree of Conservation of Lysine Acetylation

B. T. Weinert et al.

Comparing the acetylomes with the phosphoproteomes of flies and humans suggests that phosphorylation sites may have evolved faster than acetylation sites.

RESEARCH ARTICLE: A Cell-Based High-Content Screening Assay Reveals Activators and Inhibitors of Cancer Cell Invasion

M. Quintavalle et al.

PODCAST

S. A. Courtneidge and A. M. VanHook

Cyclin-dependent kinase 5 is identified as an anticancer target because its activity promotes invasiveness of cancer cells.

PERSPECTIVE: Stem Cell Proliferation in the Skin— α -Catenin Takes Over the Hippo Pathway

E. R. Flores and G. Halder

α -Catenin inhibits the transcriptional coactivator Yap to limit epidermal stem cell proliferation.

SCIENCETRANSLATIONAL MEDICINE

www.sciencetranslationalmedicine.org

Integrating Medicine and Science

27 July issue: <http://scim.ag/stm072711>

COMMENTARY: Losing the War Against Obesity—The Need for a Developmental Perspective

P. D. Gluckman et al.

Recent scientific insights into early-life contributions to the adult obesity epidemic must now be translated into interventions.

>> Population section p. 538 and www.sciencemag.org/pop2011

REVIEW: Assessing the Safety of Adjuvanted Vaccines

S. S. Ahmed et al.

Preclinical and clinical studies assess the risk of adverse events from vaccine adjuvants.

RESEARCH ARTICLE: Photoactivated Composite Biomaterial for Soft Tissue Restoration in Rodents and in Humans

A. T. Hillel et al.

Photoactivated composite biomaterials demonstrate enhanced physicochemical properties for facial soft tissue reconstruction.

RESEARCH ARTICLE: IL-7 Promotes T_H1 Development and Serum IL-7 Predicts Clinical Response to Interferon- β in Multiple Sclerosis

L.-F. Lee et al.

High serum IL-7 predicts responsiveness of multiple sclerosis patients to IFN- β therapy and indicates a T_H1 cell-driven disease.

RESEARCH ARTICLE: Targeting TLRs Expands the Antibody Repertoire in Response to a Malaria Vaccine

S. R. Wiley et al.

PERSPECTIVE: Antibody Repertoire—Embracing Diversity

A. J. Pollard and A. V. S. Hill

Adjuvanted formulations expand the vaccine-induced antibody repertoires against a virus and a parasite.

SCIENCECAREERS

www.sciencereers.org/career_magazine

Free Career Resources for Scientists

Science in Namibia

S. Gaidos

A new series highlights what it's like to do science in different parts of the world, starting with Namibia.

http://scim.ag/namibia_careers

>> Population section p. 538 and www.sciencemag.org/pop2011

Experimental Error: The Gray Pride Parade

A. Ruben

Walk through the corridors of many scientific institutions and you'll see the results of decisions made by the hiring committee of 1962.

http://scim.ag/ee_graypride

SCIENCEPODCAST

www.sciencemag.org/multimedia/podcast

Free Weekly Show

On the 29 July Science Podcast: a special show all about population, from the major demographic shift of the Neolithic to the regional youth bulges of today.

>> Population section p. 538 and www.sciencemag.org/pop2011

SCIENCEINSIDER

news.sciencemag.org/scienceinsider

Science Policy News and Analysis

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 © 2011 by the American Association for the Advancement of Science. The title SCIENCE is a registered trademark of the AAAS. Domestic individual membership and subscription (\$1 issues): \$149 (\$74 allocated to subscription). Domestic institutional subscription (\$1 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 \$25.00 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