

McGRAW-HILL YEARBOOK OF  
**Science &  
Technology**

**2003**

**Comprehensive coverage of recent events and research as compiled by  
the staff of the McGraw-Hill Encyclopedia of Science & Technology**

**McGraw-Hill**

New York Chicago San Francisco Lisbon London Madrid Mexico City Milan  
New Delhi San Juan Seoul Singapore Sydney Toronto

**Library of Congress Cataloging in Publication data**

McGraw-Hill yearbook of science and technology.  
1962- . New York, McGraw-Hill.

v. illus. 26 cm.

Vols. for 1962- compiled by the staff of the  
McGraw-Hill encyclopedia of science and technology.

1. Science—Yearbooks. 2. Technology—  
Yearbooks. I. McGraw-Hill encyclopedia of  
science and technology.

Q1.M13 505.8 62-12028

ISBN 0-07-141062-7

ISSN 0076-2016

**McGraw-Hill Yearbook of Science & Technology**

Copyright © 2003 by The McGraw-Hill Companies, Inc.

All rights reserved. Printed in the United States of America.

Except as permitted under the United States Copyright Act of 1976,  
no part of this publication may be reproduced or distributed in any  
form or by any means, or stored in a data-base or retrieval system,  
without prior written permission of the publisher.

The following articles are excluded from McGraw-Hill Copyright:

ABC lipid transporters; Coalbed methane; Enzyme catalysis (thermodynamics);  
Exotic mesons; Extrasolar planets; Far-ultraviolet astronomy; Global warming  
and atmospheric ozone; Hubble Space Telescope; International GPS Service;  
Invasive species impacts; Nuclear decay; Phosphorus; Satellites of outer planets;  
Space flight; Universe; Wood preservation.

1 2 3 4 5 6 7 8 9 0 DOW/DOW 0 9 8 7 6 5 4 3

*This book was printed on acid-free paper.*

*It was set in Garamond Book and Neue Helvetica Black Condensed by  
TechBooks, Fairfax, Virginia. The art was prepared by TechBooks.  
The book was printed and bound by RR Donnelley, The Lakeside Press.*

## Article Titles and Authors

---

- ABC lipid transporters**  
Silvia Santamarina-Fojo, Justina Wu,  
Charles Joyce, Federica Basso
- Acoustic phonetics**  
Gary G. Weismer
- Advanced glycation end products**  
Nicole Verzijl, Jeroen DeGroot, Ruud A. Bank,  
Johan M. TeKoppele
- Aerosol-climate interactions**  
Jonathan Abbatt
- Aluminum-accumulating plants**  
Steven Jansen, Erik Smets,  
Mundayatan Haridasan
- Antarctic ice stream dynamics**  
Slawek Tulaczyk, Ian Joughin
- Antibiotic resistance**  
M. Teuber
- Ape cognition**  
Richard W. Byrne
- Aspect-oriented software development**  
Tzilla Elrad
- Atom interferometer, magnetic waveguide**  
Jeffrey McGuirk
- Avian evolution**  
Gareth John Dyke, Luis M. Chiappe
- Bacterial transformation of fungi**  
C. Peter Romaine
- Biocatalysis**  
Ruizhen Chen
- Bioluminescence in insects**  
Marc Branham, R. Adam Broadley,  
John W. Wenzel
- Bio-micro-electro-mechanical systems  
for drug delivery**  
Jeffrey D. Zahn
- Body dysmorphic disorder**  
Jon E. Grant, Katharine Phillips
- Burkholderia cepacia complex**  
Eshwar Mahenthiralingham, Philip Sayre
- C-H activation**  
Robert H. Crabtree
- Capability maturity modeling**  
Mike Phillips
- Capacitance tomography**  
Wu Qiang Yang
- Carbon isotope discrimination measurement**  
Bjorn Martin
- Ceramic whiskers**  
Mats Nygren, Mats Johnsson
- Circadian clock (plants)**  
Andrew J. Millar, Roger I. Cook
- Climate change and plant adaptation**  
Colleen K. Kelly
- Coalbed methane**  
Charles Barker
- Connected landscapes**  
David M. Theobald
- Contact lenses**  
Russell Spaulding
- CP symmetry and its violation**  
Helen Quinn
- Crustacean olfactory organ**  
Barry Ache
- Data mining**  
Ramon A. Mata-Toledo
- Declining amphibians**  
John W. Wilkinson
- Deep-sea squid**  
Richard Young
- Deuterostome evolution**  
Simon Conway Morris, Degan Shu
- Diamond electrodes (electrochemistry)**  
Greg M. Swain
- Digital Object Identifier**  
John S. Erickson
- Digital photography**  
Anthony Stanton
- Digital watermarking**  
Julie Shaffer
- Disease-modifying anti-rheumatic drugs**  
Richard Meehan
- DNA delivery systems**  
Dan Luo
- DNA helicases**  
Stephen C. Kowalczykowski, Maria Spies,  
Mark S. Dillingham
- Dynamic brain atlas**  
Thomas Hartkens, Derek Hill, J. V. Hajnal,  
D. Rueckert, S. M. Smith, K. McKleish
- Dyslexia**  
Bennett Shaywitz, Sally E. Shaywitz
- Electron tomography**  
Bruce F. McEwen
- Electronic paper**  
Nicholas K. Sheridan
- Emergence of vertebrates**  
Philip C. J. Donoghue
- End-Triassic mass extinction**  
József Pálfy
- Enzyme catalysis (thermodynamics)**  
Robert N. Goldberg
- Enzymes of thermophilic fungi**  
Ramesh Maheshwari
- Epicuticular waxes (botany)**  
Wilhelm Barthlott, Kerstin Koch,  
Christopher Neinhuis
- Evidence of Archean life**  
Minik T. Rosing
- Evolution of Bantu languages**  
Clare Janaki Holden
- Exercise and the brain**  
Fernando Gómez-Pinilla
- Exotic mesons**  
Suh-Urk Chung
- Extrasolar planets**  
David Latham, Timothy M. Brown
- Far-ultraviolet astronomy**  
George Sonneborn

- Forensic arson investigation**  
John J. Lentini
- Forensic microscopy**  
Edwin L. Jones, Jr.
- Forensic mitochondrial DNA analysis**  
Terry W. Melton
- Frozen light**  
Lene Vestergaard Hau
- Gamma-ray imaging**  
Matthew A. Kupinski
- Genetic diversity in nature reserves**  
Maile Neel
- Genetics of flower morphology**  
Victor A. Albert
- Geothermal energy**  
Prame Chopra
- Global warming and atmospheric ozone**  
Drew T. Shindell
- Glycoprotein synthesis**  
Chi-Huey Wong, Thomas J. Tolbert
- Graft copolymers**  
Jimmy W. Mays, Samuel P. Gido
- Gravity Probe B**  
Barry Muhlfelder
- Hepatitis C**  
Gary Levy, Nigel Girgrah, Naveen Arya
- High-brightness light-emitting diodes**  
Artūras Žukauskas, Michael S. Shur, Remis Gaska
- High-intensity focused ultrasound**  
Lawrence A. Crum, Shahram Vezy, Arthur Chan
- High-speed train aerodynamics**  
Joseph A. Schetz
- Historical ecology**  
Christine Dindia
- Homocysteine**  
Steven R. Lentz
- Hubble Space Telescope**  
Frank Cepollina
- Human origins**  
Terry Harrison
- Hyperspectral remote sensing**  
Marcus Borengasser
- Inhibin**  
N. P. Groome
- Inner-core anisotropy and hemisphericity**  
Lianxing Wen
- Inner ear development**  
Anthony Graham
- Inorganic and organometallic polymers**  
Martel Zeldin
- Intelligent completion technology**  
Victoria B. Jackson Nielsen
- International GPS Service**  
Ruth E. Neilan
- Invasive species impacts**  
Chris Harvey
- Knowledge management**  
Andrew P. Sage
- Laser-controlled chemical reactions**  
Robert J. Gordon
- Laser-driven x-ray sources**  
Donald Umstadter
- Leech evolution**  
Mark E. Siddall
- Light rail and transport policies**  
Carmen Hass-Klau
- Loran**  
G. Linn Roth
- Magnesium diboride superconductors**  
Paul C. Canfield, Sergey Bud'ko
- Manipulating cold atoms**  
Edward A. Hinds
- Materials processing**  
Yogesh Jaluria
- Medical geology**  
H. Catherine W. Skinner
- Mesoscopic mechanical systems**  
Mark A. Shannon
- Meteor storms**  
David J. Asher
- Methane clathrate**  
Carolyn Ann Koh
- Microbial enhanced oil recovery**  
Steven Bryant, Thomas P. Lockhart
- Microgravity**  
Ivan Egry
- Micro-opto-electro-mechanical systems**  
David J. Bishop
- Migration and navigation (vertebrates)**  
Donald W. Linzey, Kenneth J. Lohmann,  
R. Wiltchko, W. Wiltchko, Brent S. Stewart
- Mine seismology**  
Brad Simser
- Mobile communications**  
Robert Berezdivin
- Modeling languages**  
Ingmar Ogren
- Monoclonal antibodies**  
Larry Green
- Nanoparticles**  
M. Samy El-Shall
- Nanowire nanocircuits**  
Xiangfeng Duan, Yu Huang,  
Charles M. Lieber
- Natural aerodynamic devices**  
Steven Vogel
- Naval surface ship**  
David Andrews
- Neural model of depression**  
Helen Mayberg
- Neurogenesis**  
Paola Arlotta, Jeffrey D. Macklis, Sanjay  
S. Magavi
- Neuromusicology**  
Michael H. Thaut
- Neutrino masses and oscillations**  
Mark Chen
- Nitric oxide biosensors**  
Jae Ho Shin, Mark H. Schoenfish
- Nobel prizes**  
Yearbook Editors
- Nuclear decay**  
Jorge Gómez del Campo, Carrol Bingham
- On-press plate imaging**  
Helmut Kipphan



- Ontology markup languages**  
Oscar Corcho, Asunción Gómez-Pérez
- Optical manipulation of matter**  
Dag Hanstorp, Jonas Enger, Mattias Ericsson
- Orbicules (plant anatomy)**  
Stefan Vinckier
- Ordovician radiation**  
Mary Droser
- Organic catalysts**  
Peter I. Dalko
- Origins of symbolism**  
Paul G. Bahn
- Pathogen detection**  
Klaus Nüsslein
- Pathogen detection, food-borne**  
Arun K. Bhunia, Amanda Lathrop
- Phanerozoic marine diversity**  
Richard K. Bambach
- Pharmacogenomics**  
Robert Kisabeth, Julio Licinio, Ma-Li Wong
- Phosphorus**  
Benjamin L. Turner, Victor Raboy
- Photodynamic therapy**  
Michael R. Detty
- Phylogeny and speciation processes**  
Timothy G. Barraclough
- Phylogeny of early land plants**  
Yin-Long Qiu
- Polymer thermodynamics**  
J. P. Martin Trusler
- Prospecting (metalogenic trends)**  
Jeremy P. Richards
- Protein drug delivery**  
Stephen P. Schwendeman
- Radio-frequency lighting**  
Victor Roberts
- Reconstructing environmental history**  
Carlos E. Cordova
- Reconstructing temperature variations**  
Michael E. Mann
- Rhizosphere ecology**  
Mark Williams
- RNA editing**  
Nicholas O. Davidson
- Rotary motors (bacterial)**  
David F. Blair, Sieji Kojima
- Ryegrass**  
Steven C. Fransen
- Sailing craft**  
Phil Bolger
- Salt tolerance in plants**  
Roberto A. Gaxiola
- SAR interferometry**  
Howard A. Zebker
- Satellite radio**  
Robert D. Briskman
- Satellites of outer planets**  
Matthew J. Holman
- Security printing**  
Richard D. Warner
- Semiconductor factory automation**  
Devadas D. Pillai
- Semiconductor refrigerators**  
Joseph Heremans
- Ship design**  
Jack W. Abbott
- Single-molecule optical imaging**  
Edward S. Yeung
- Single-site catalysts and resulting polyolefins**  
Walter Kaminsky
- Space flight**  
Jesco von Puttkamer
- Space nuclear technology**  
Jeffrey C. Mitchell
- Stem cells**  
Chen Wang
- Stereo modeling**  
Anshuman Razdan, Mark Henderson
- Stratospheric influences (weather and climate)**  
Walter A. Robinson
- Stress-function-morphology correlations in the brain**  
Sonia J. Lupien
- Surgical consciousness monitor**  
E. Roy John, Leslie S. Pritchep
- Sustainable materials**  
Lauren Heine
- Thermohaline circulation changes**  
Stefan Rahmstorf
- Time-lapse seismic reservoir monitoring**  
Alain Labastie
- Transgenic plant vaccines**  
William H. R. Langridge, James E. Carter III
- Transmissible spongiform encephalopathies**  
J. T. Foster
- Transporting single electrons**  
Jan-Theodoor Janssen
- Tribology**  
H. S. Cheng, Y. W. Chung, L. M. Keer, Q. Wang, D. Zhu
- Tsunamiites and seismites**  
Kelvin S. Rodolfo
- Turbulent transport and mixing**  
Stavros Tavoularis
- Ultracold collisions**  
Phillip L. Gould
- Ultrahigh-density storage**  
Christopher Busch, André Immink
- Ultrawideband (UWB) systems**  
Robert J. Fontana
- Universe**  
Mark Dragovan
- Uranium mining**  
Thomas C. Pool
- Vendobionts (Precambrian evolution)**  
Adolf Seilacher
- Virtual musical instruments**  
Julius O. Smith III
- Virtual operant conditioning**  
Sanjiv K. Talwar, Shaohua Xu, John K. Chapin
- Wood composites**  
Sam Sherrill
- Wood preservation**  
Rebecca E. Ibach