

CONTENTS

26 February 2015 / Vol 518 / Issue No 7540

THIS WEEK

EDITORIALS

455 STEM CELLS

When right beats might

Italy looks to move on from stem-cell mess

456 AUTHORSHIP

No strings

Hidden financial ties undermine platform of climate-change sceptic

456 NEUROSCIENCE

A sore thing

Technologies to measure pain objectively must be regulated



WORLD VIEW

457 Focus on political Islamic groups to boost science

Dyna Rochmyaningsih
A societal approach is needed for the Muslim world to benefit from science

RESEARCH HIGHLIGHTS

458 SELECTIONS FROM THE SCIENTIFIC LITERATURE

DNA gels give tissues shape / Bluebirds at odds / Volcanic sulfur on the rise / Outreach needs to demolish ivory towers / Coral growth on hold / Asian climate pushed plague into Europe / Nectar chemicals benefit bee colonies

SEVEN DAYS

460 THE NEWS IN BRIEF

Cash boost for neglected diseases / IPCC chief resigns / India's PhD students protest over pay-rise delays / Rapid test for Ebola / Report warns of future New York floods

CAREERS

565 ENVIRONMENTAL TECHNOLOGY

Green light

Energy-sustainable buildings are popping up everywhere — and that means opportunities for scientists who want to build them

NEWS IN FOCUS



463 EPIDEMIOLOGY

Britain launches huge children's study

464 URBAN SCIENCE

Fears that trains will derail research at London's Francis Crick Institute

465 ARTIFICIAL INTELLIGENCE

Computer achieves human-level performance in video games

466 NEUROSCIENCE

Scientists seek to define sport-induced brain disorder

468 SPACE

An illustrated guide to two dwarf-planet missions

FEATURES



PLANETARY SCIENCE

The Pluto siblings

Dwarf-planet veterans Leslie and Eliot Young prepare for mission rendezvous [PAGE 470](#)

474 NEUROSCIENCE IN COURT

The painful truth

Brain scans that identify pain signals aim for the courtroom

INNOVATIONS IN

S1 The microbiome

A special report on the myriad microbes that call the human gut home. Turn to page 484.

COMMENT



EPIDEMIOLOGY

Open up outbreaks

Nathan L. Yozwiak, Stephen F. Schaffner & Pardis C. Sabeti

Guidelines are needed for speedy and responsible data sharing [PAGE 477](#)

BOOKS & ARTS

480 BIG DATA

The revolution is digitized

Charles Seife

481 BOOKS IN BRIEF

482 ENVIRONMENTAL SCIENCE

Dryland epiphany

Andrew Robinson

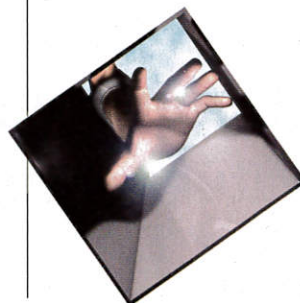
CORRESPONDENCE

483 Big data in medicine / Antibody validation / Redistribution of China's pollution / Biochar pros and cons

OBITUARY

484 Robert A. Berner (1935–2015)

Don Canfield



FUTURES

568 BFF's first adventure
Vernor Vinge

CONTENTS

26 February 2015 / Vol 518 / Issue No 7540

RESEARCH

NEW ONLINE

485 Papers published this week at nature.com

NEWS & VIEWS

486 ARTIFICIAL INTELLIGENCE

Learning to see and act

An artificial-intelligence system masters 49 classic computer games
Bernhard Schölkopf **SEE LETTER P.529**

487 BIODIVERSITY

The benefits of traditional knowledge

An ethnobotanical study of two isolated ethnic groups in the Balkans
Manuel Pardo-de-Santayana
& *Manuel J Macía*

488 STEM CELLS

Chasing blood

Tracing the stem cells involved in steady-state haematopoiesis
Sidhartha Goyal & *Peter W Zandstra*
SEE LETTER P.542

490 COSMOLOGY

A giant in the young Universe

A supermassive black hole from about 900 million years after the Big Bang
Bram Venemans **SEE LETTER P.512**

491 QUANTUM PHYSICS

Teleportation for two

Simultaneous transfer of a photon's spin and orbital angular momenta
Wolfgang Tittel **SEE LETTER P.516**

492 MOLECULAR BIOLOGY

RNA modification does a regulatory two-step

A mechanism by which the m⁶A RNA modification regulates gene expression
Dominik Theler & *Frédéric H-T Allain*
SEE LETTER P.560

ARTICLES

495 **CANCER GENOMICS** Whole genomes redefine the mutational landscape of pancreatic cancer
N Waddell et al.

502 **MOLECULAR BIOLOGY** Lagging-strand replication shapes the mutational landscape of the genome
M A M Reijns et al.

507 **IMMUNOLOGY** Crystal structure of the V(D)J recombinase RAG1–RAG2
M-S Kim, M Lapkouski, W Yang
& *M Gellert*



ON THE COVER

Learning curve

Imagined attacks from retro-styled sprites are deflected by a deep Q-network agent controlled game-paddle seen from the agent's perspective. Google's DeepMind team has developed an artificial agent — or deep Q-network — that learns to play 49 classic Atari 'arcade' games directly from sensory experience, achieving scores equal to the best human players. **PAGES 486 & 529**

LETTERS

512 **COSMOLOGY** An ultraluminous quasar with a twelve-billion solar-mass black hole at redshift 6.30
X-B Wu et al. **SEE N&V P.490**

516 **QUANTUM PHYSICS** Quantum teleportation of multiple degrees of freedom of a single photon
X-L Wang et al. **SEE N&V P.491**

520 **MATERIALS SCIENCE** Dynamically reconfigurable complex emulsions via tunable interfacial tensions
L D Zarzar et al.

525 **PLANETARY SCIENCE** An extremely high-altitude plume seen at Mars' morning terminator
A Sánchez-Lavega et al.

529 **ARTIFICIAL INTELLIGENCE** Human-level control through deep

reinforcement learning

V Mnih et al. **SEE N&V P.486**

534 **EVOLUTION** Evolution of the new vertebrate head by co-option of an ancient chordate skeletal tissue
D Jandzik et al.

538 **CULTURAL EVOLUTION** Experimentally induced innovations lead to persistent culture via conformity in wild birds
L M Aplin et al.

542 **STEM CELLS** Fundamental properties of unperturbed haematopoiesis from stem cells *in vivo*
K Busch et al. **SEE N&V P.488**

547 **DEVELOPMENTAL BIOLOGY** Tissue-resident macrophages originate from yolk-sac-derived erythro-myeloid progenitors
E G Perdiguero et al.

552 **CANCER** Role of *TP53* mutations in the origin and evolution of therapy-related acute myeloid leukaemia
T N Wong et al.

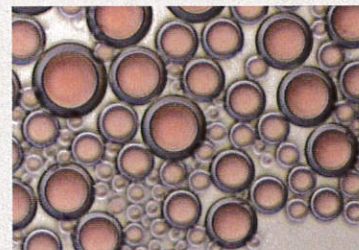
556 **GENE REGULATION** Enhancer–core-promoter specificity separates developmental and housekeeping gene regulation
M A Zabidi et al.

560 **STRUCTURAL BIOLOGY** N⁶-methyladenosine-dependent RNA structural switches regulate RNA–protein interactions
N Liu et al. **SEE N&V P.492**

MATERIALS SCIENCE

Smart solution

Multi-phase complex emulsions with droplet morphology tuned for practical applications. **PAGE 520**



MAX CANT / GOOGLE DEEPMIND