

CONTENTS

18 July 2013 / Vol 499 / Issue No 7458



THIS WEEK

EDITORIALS

253 NEUROSCIENCE

The benefits of brain mapping

Efforts to understand the brain should reap rewards, as long as the money is properly deployed

253 HEALTH

Active protection

The success of the HPV vaccine is being undermined by sluggish uptake in the United States

254 COMMUNICATION

Light show

The path to effective data transfer in space will be lit by lasers



WORLD VIEW

255 Don't market stem-cell products ahead of proof

Paolo Bianco

Translational medicine should run from bench to bedside, not the other way round

RESEARCH HIGHLIGHTS

256 SELECTIONS FROM THE SCIENTIFIC LITERATURE

HIV alters gut flora / Dogs of America / Hot metal printing / Laser tests red blood cells / Watching crickets / Human gene knockdown / Building muscle



SEVEN DAYS

258 THE NEWS IN BRIEF



Giant iceberg forms in Antarctic / Exoplanet's colour is revealed / NASA plans next Mars rover / Myriad files two lawsuits over patent infringement / India gears up for more nuclear power

CAREERS

371 TURNING POINT

Geneticist and company-founder Thijn Brummelkamp designs tools for the job

NEWS IN FOCUS



261 SPACE

Plan to capture asteroid needs a target

262 BIOTECHNOLOGY

Race is on to identify source of trespassing GM wheat

263 MEDICINE

NIH aims to breathe new life into abandoned drug candidates

264 ANIMAL DISEASE

Research into rinderpest resumes

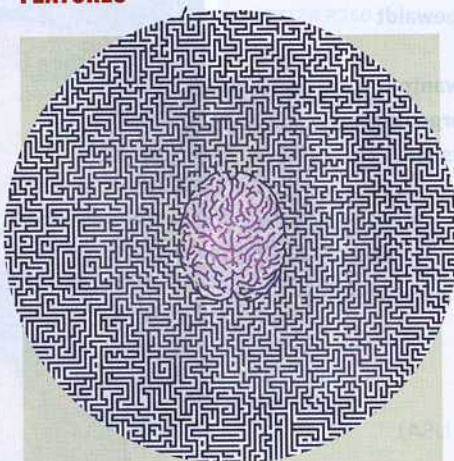
265 RADIATION BIOLOGY

Researchers probe effects of radiation on ecosystems in Fukushima

266 SPACE SCIENCE

Laser communication comes of age for data transfer in space

FEATURES



NEUROSCIENCE

Solving the brain

Big science turns its attention to deciphering how brains work **PAGE 272**

DIGITAL LEARNING

FEATURES

268 The virtual lab

Online education is tackling the tricky prospect of how to teach practical skills remotely

COMMENT

275 Look then leap

Michael M Crow

Deployed appropriately, massive open online courses can enrich higher education

277 Online on-ramps

Hazel Sive & Sanjay Sarma

Web courses are a boon to interdisciplinary research

CAREERS

369 How to make a MOOC

Course design for the online world needs the spark of imagination



A Nature and Scientific American special

nature.com/digitallearning

COMMENT

BOOKS & ARTS

280 IN RETROSPECT

The Prince

John Whitfield

282 NEUROPHILOSOPHY

My brain and I

Chris Frith

283 GENOMICS

Art of the hypothetical

Elie Dolgin

CORRESPONDENCE

284 Lessons of Lysenko / Rating preclinical research / No to hyperbole / How to use big data



FUTURES

374 Think big

Gregory Benford

RESEARCH

NEW ONLINE

285 Papers published this week at nature.com

NEWS & VIEWS

286 QUANTUM PHYSICS

Andreev states taken to the next level

Direct observation of the Andreev bound-state doublet
 Simon Gustavsson & William D Oliver
 SEE LETTER P.312

287 BIOGEOCHEMISTRY

Carbon dioxide and water use in forests

Rising CO₂ levels have increased the water-use efficiency of forests
 Belinda Medlyn & Martin De Kauwe
 SEE LETTER P.324

289 RNA BIOPHYSICS

A three-state balancing act

A riboswitch that responds to both ligands and temperature
 Ronald Micura SEE LETTER P.355

290 PARTICLE PHYSICS

Let it B

Charge-parity asymmetry in the decays of B_s⁰ mesons
 Yosef Nir

291 CANCER

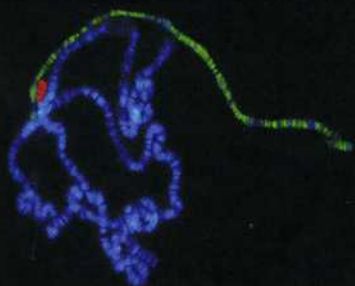
Calculated treatment

Mathematical modelling reveals the advantages of combination drug therapy
 Natalia L Komarova & C Richard Boland

EVOLUTION

Ex files

Once upon a time, *Drosophila*'s odd dot chromosome was an 'X'. PAGE 332



ON THE COVER

Health kick

Naked mole rats combine extreme longevity with virtually complete resistance to cancer. High-molecular-mass hyaluronan accumulates in their tissues and it may be this glycosaminoglycan that is the secret of their cancer resistance. PAGE 346

293 BACTERIOLOGY

Toxins in tandem

The unusual subunit assembly of typhoid toxin
 C Erec Stebbins SEE LETTER P.350

ARTICLES

295 BIOLOGICAL TECHNIQUES Ultrasensitive fluorescent proteins for imaging neuronal activity

T-W Chen et al.

301 DEVELOPMENTAL BIOLOGY Myomaker is a membrane activator of myoblast fusion and muscle formation

D P Millay et al.

306 ANGIOGENESIS LRG1 promotes angiogenesis by modulating endothelial TGF- β signalling

X Wang et al.

LETTERS

312 PHYSICS Exciting Andreev pairs in a superconducting atomic contact

L Bretheau, Ç Ö Girit, H Pothier, D Esteve & C Urbina SEE N&V P.286

316 SOLAR CELLS Sequential deposition as a route to high-performance perovskite-sensitized solar cells

J Burschka et al.

320 BIO-INORGANIC CHEMISTRY

Elucidation of the Fe(IV)=O intermediate in the catalytic cycle of the halogenase SyrB2

S D Wong et al.

324 EARTH SCIENCES Increase in forest water-use efficiency as atmospheric carbon dioxide concentrations rise

T F Keenan et al. SEE N&V P.287

328 EARTH SCIENCES Ratios of S, Se and Te in the silicate Earth require a volatile-rich late veneer

Z Wang & H Becker

332 EVOLUTION Reversal of an ancient sex chromosome to an autosome in *Drosophila*

B Vicoso & D Bachtrog

336 NEUROSCIENCE Behaviour-dependent recruitment of long-range projection neurons in somatosensory cortex

J L Chen, S Carta, J Soldado-Magraner, B L Schneider & F Helmchen

341 NEUROSCIENCE Activity-dependent phosphorylation of MeCP2 threonine 308 regulates interaction with NCoR

D H Ebert et al.

346 CANCER High-molecular-mass hyaluronan mediates the cancer resistance of the naked mole rat

X Tian et al.

350 BACTERIAL PATHOGENESIS Structure and function of the *Salmonella* Typhi chimaeric A₂B₅ typhoid toxin

J Song, X Gao & J E Galán SEE N&V P.293

355 BIOPHYSICS Three-state mechanism couples ligand and temperature sensing in riboswitches

A Reining et al. SEE N&V P.289

360 MOLECULAR BIOLOGY Promoter directionality is controlled by U1 snRNP and polyadenylation signals

A E Almada, X Wu, A J Kriz, C B Burge & P A Sharp

364 STRUCTURAL BIOLOGY Carbon catabolite repression of the maltose transporter revealed by X-ray crystallography

S Chen, M L Oldham, A L Davidson & J Chen