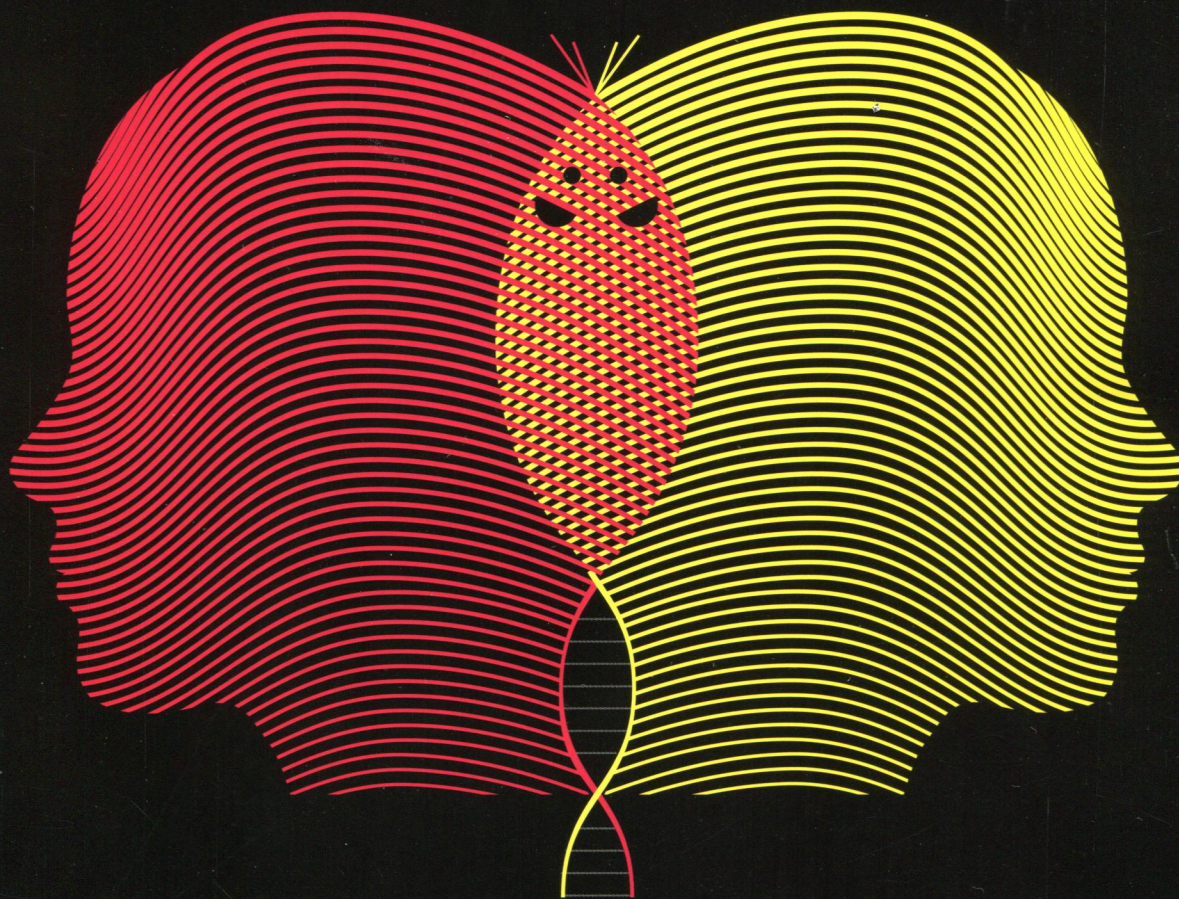


# nature

THE INTERNATIONAL WEEKLY JOURNAL OF SCIENCE



## HEAD TO TAIL

Mouse ENCODE's comprehensive data on genomic regulation — and human comparisons **PAGES 346 & 355**

RESEARCH FUNDING

**HIGH MAINTENANCE**  
*The eye-watering costs of keeping the lights on*  
**PAGE 326**

CLIMATE CHANGE

**CLEARING THE AIR**  
*Manage pollutants and emissions in tandem*  
**PAGE 335**

CARDIOVASCULAR DISEASE

**HEART BREAKER**  
*Succinate build-up causes tissue injury*  
**PAGES 350 & 431**

[NATURE.COM/NATURE](http://NATURE.COM/NATURE)

20 November 2014 £10

Vol. 515, No. 7527



# CONTENTS

20 November 2014 / Vol 515 / Issue No 7527

## THIS WEEK

### EDITORIALS

#### 311 ADVOCACY

##### A global vision

The International Council for Science needs a clear direction to thrive

#### 311 SCIENCE & SOCIETY

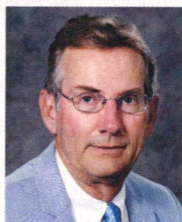
##### Save the museums

Italy's curators can band together to save threatened collections

#### 312 ANNOUNCEMENT

##### Data-access practices strengthened

Improved links with *Scientific Data* will make information more accessible



### WORLD VIEW

#### 313 Openness in science is key to keeping public trust

Mark Yarborough

Researchers must actively seek out problems and fix them

### RESEARCH HIGHLIGHTS

#### 314 SELECTIONS FROM THE SCIENTIFIC LITERATURE

Mind over genes / Neochromosome an anti-cancer target / Mozartian laser beams / Spot the leopard

### SEVEN DAYS

#### 316 THE NEWS IN BRIEF

US and China announce climate plans / Europe axes science-adviser post / PubPeer contests legal action

## CAREERS

#### 453 MENTORING AWARDS

##### Focus on people

Commitment is the watchword for the winners of *Nature's* annual mentoring award, who this year are from Ireland and Northern Ireland

#### 455 TURNING POINT

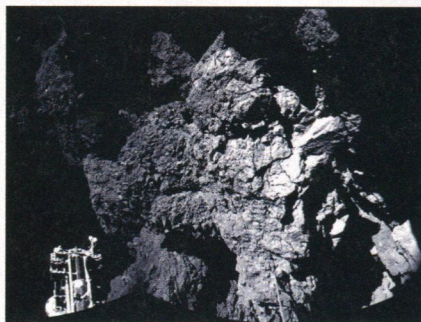
Clinical neuroscientist Kate McAllister is keeping in touch in a big way

#### 455 CAREER BRIEFS

### NATURE JOBS ADVERTISING FEATURE

Spotlight on the Netherlands

## NEWS IN FOCUS



#### 319 ROSETTA MISSION

Philae comet lander's extraordinary 64 hours of science

#### 321 DISASTER RESPONSE

Citizen scientists tapped to make crisis maps more reliable

#### 322 ECOLOGY

Green List highlights conservation success stories

#### 323 GENOMICS

Researchers home in on platinum-standard human genome

#### 324 TECHNOLOGY

US labs pool resources to get supercomputer boost

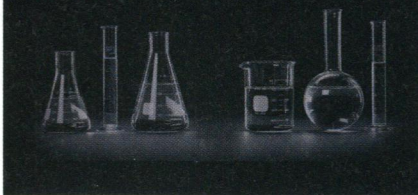
## FEATURES

### RESEARCH FUNDING

# Keeping the lights on

*Nature* investigates what actually happens to US infrastructure funds

PAGE 326



#### 330 DEVELOPING WORLD

##### Far-flung physics

The International Centre for Theoretical Physics has helped to train more than 100,000 researchers around the world

## COMMENT

#### 335 CLIMATE CHANGE

##### Clean up our skies

Julia Schmale, Drew Shindell, Erika von Schneidemesser, Ilan Chabay & Mark Lawrence

Tackle air quality and mitigate climate change simultaneously



### CLIMATE CHANGE

# High-res models

International supercomputing centres dedicated to climate prediction are needed to reduce uncertainties PAGE 338

## BOOKS & ARTS

#### 340 HISTORY OF SCIENCE

##### Pursuing the primordial

Ted Nield

#### 341 BOOKS IN BRIEF

## CORRESPONDENCE

343 The evolution debate / Primates in the lab / Funding ALS research

## OBITUARY

#### 344 Allison Doupe (1954–2014)

Thomas R Insel & Story Landis

## FUTURES

458 When the music ends  
Philip Ball



# CONTENTS

20 November 2014 / Vol 515 / Issue No 7527

## RESEARCH

### NEW ONLINE

345 Papers published this week at nature.com

### NEWS & VIEWS

#### 346 GENOMICS

##### Mice in the ENCODE spotlight

Comparative analyses of mouse and human genomic regulation

Piero Carninci [SEE ARTICLES P.355, P.365, P.371 & LETTER P.402](#)

#### 347 ORIGINS OF LIFE

##### RNA made in its own mirror image

A ribozyme that overcomes enantiomeric cross-inhibition

Sandip A Shelke & Joseph A Piccirilli [SEE LETTER P.440](#)

#### 348 MATERIALS PHYSICS

##### Reactive walls

Domain walls can promote exotic crystallographic phase formation

Philippe Ghosez & Jean-Marc Triscone [SEE LETTER P.379](#)

#### 350 BIOCHEMISTRY

##### Succinate strikes

Succinate accumulation contributes to ischaemic reperfusion injury

Luke A J O'Neill [SEE LETTER P.431](#)

#### 351 BIOGEOCHEMISTRY

##### Agriculture and the global carbon cycle

Intensive crop production affects seasonal flux of atmospheric CO<sub>2</sub>

Natasha MacBean & Philippe Peylin [SEE LETTERS P.394 & P.398](#)

#### 352 PLANT SCIENCE

##### Leaf veins share the time of day

A circadian clock in the vasculature regulates a clock in the mesophyll

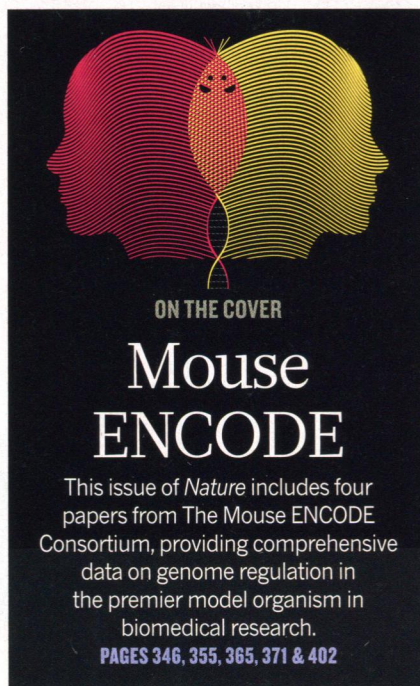
María C Martí & Alex A R Webb [SEE LETTER P.419](#)

### ARTICLES

355 **GENOMICS** A comparative encyclopedia of DNA elements in the mouse genome  
F Yue et al. [SEE N&V P.346](#)

365 **GENOMICS** Conservation of trans-acting circuitry during mammalian regulatory evolution  
A B Stergachis et al. [SEE N&V P.346](#)

371 **GENOMICS** Principles of regulatory information conservation between



mouse and human

Y Cheng et al. [SEE N&V P.346](#)

### LETTERS

376 **ASTROPHYSICS** The power of relativistic jets is larger than the luminosity of their accretion disks

G Ghisellini, F Tavecchio, L Maraschi, A Celotti & T Sbarrato

379 **NANOSCALE MATERIALS** Artificial chemical and magnetic structure at the domain walls of an epitaxial oxide

S Farokhipoor et al. [SEE N&V P.348](#)

384 **MATERIALS SCIENCE** Approaching disorder-free transport in high-mobility conjugated polymers

D Venkateshvaran et al.

389 **ORGANIC CHEMISTRY** Overcoming the limitations of directed C–H functionalizations of heterocycles

Y-J Liu et al.

394 **BIOGEOCHEMISTRY** Agricultural Green Revolution as a driver of increasing atmospheric CO<sub>2</sub> seasonal amplitude

N Zeng et al. [SEE N&V P.351](#)

398 **BIOGEOCHEMISTRY** Direct human influence on atmospheric CO<sub>2</sub> seasonality from increased

cropland productivity

J M Gray et al. [SEE N&V P. 351](#)

402 **GENOMICS** Topologically associating domains are stable units of replication-timing regulation

B D Pope et al. [SEE N&V P. 346](#)

406 **EVOLUTION** The drivers of tropical speciation

B T Smith et al.

410 **ECOLOGY** Individual improvements and selective mortality shape lifelong migratory performance

F Sergio et al.

414 **NEUROSCIENCE** Synaptic dysregulation in a human iPS cell model of mental disorders

Z Wen et al.

419 **PLANT SCIENCE** Tissue-specific clocks in *Arabidopsis* show asymmetric coupling

M Endo, H Shimizu, M A Nohales, T Araki & S A Kay [SEE N&V P.352](#)

423 **MICROBIOLOGY** Members of the human gut microbiota involved in recovery from *Vibrio cholerae* infection

A Hsiao et al.

427 **IMMUNOLOGY** Structure of malaria invasion protein RH5 with erythrocyte basigin and blocking antibodies

K E Wright et al.

431 **BIOCHEMISTRY** Ischaemic accumulation of succinate controls reperfusion injury through mitochondrial ROS

E T Chouchani et al. [SEE N&V P.350](#)

436 **DNA REPAIR** Transcript-RNA-templated DNA recombination and repair

H Keskin et al.

440 **BIOCHEMISTRY** A cross-chiral RNA polymerase ribozyme

J T Sczepanski & G F Joyce [SEE N&V P. 347](#)

443 **CANCER** Discovery and characterization of small molecules that target the GTPase Ral

C Yan et al.

448 **STRUCTURAL BIOLOGY** Structures of bacterial homologues of SWEET transporters in two distinct conformations

Y Xu et al.