

# CONTENTS

18 August 2016 / Vol 536 / Issue No 7616

## THIS WEEK

### EDITORIALS

#### 249 GENOMICS

##### Rare rewards

Large, open databases on rare genetic variants offer research trove

#### 249 DEVELOPMENT

##### Evo-devo CRISPR

Gene editing may provide a revolution in evolution

### WORLD VIEW

#### 251 Define the Anthropocene in terms of the whole Earth

Clive Hamilton

Discussions about a new epoch must transcend individual disciplines

### RESEARCH HIGHLIGHTS



#### 252 SELECTIONS FROM THE SCIENTIFIC LITERATURE

Fish declines / Diminishing lizards / Switched cell types / Titan's canyons / Ancient sea floor / Long-lived sharks / The shrinking proton

### SEVEN DAYS



#### 254 THE NEWS IN BRIEF

Polio returns to Nigeria / UK underwrites EU grants / Chimps head for retirement / Quantum satellite launches

## CAREERS

#### 365 WORK ABROAD

##### Visa to visit

Understanding and appreciating the local culture should top the agenda for researchers working outside their home country

## POLYMERS & PLASTICS

### FEATURES

#### 263 The plastic ocean

The seas contain a lot of plastic—but where is it all and what does it do?

#### 266 Fantastic plastics

Chemists are pushing polymers to new limits as they seek the next generation of plastics

### BOOKS & ARTS

#### 272 Q&A

##### The polymer conservator

Museum materials scientist Brenda Keneghan fights polymer warping, crumbling and gases

### NEWS & VIEWS IN RETROSPECT

#### 276 Sixty years of living polymers

A reaction that revolutionized polymer science  
Gary Patterson



## NEWS IN FOCUS

#### 257 EPIDEMIOLOGY

How mosquito guns and heavy fines helped keep Zika out of Cuba

#### 258 PHYSICS

Artificial black hole seems to emit Hawking radiation

#### 260 RESEARCH INSTITUTES

Nobel laureate's death puts future of Egypt's science city in doubt

#### 260 ECOLOGY

Trump's plan to wall off the US from Mexico would put wildlife at risk

#### 261 PHYSICS

Neutrino experiment offers clue to antimatter mystery



### TECHNOLOGY

#### 361 CRYSTALLOGRAPHY

##### Let the structural symphony begin

The modern biologist's toolkit is bringing the prospect of understanding function from structure ever closer

## COMMENT

#### 269 SAFETY

##### Rethink how chemical hazards are tested

John C Warner & Jennifer K Ludwig  
Three ways to help inventors create safer chemicals and products

### BOOKS & ARTS

#### 271 ETHICS

##### Taming our technologies

Steven Aftergood

#### 273 BOOKS IN BRIEF

### CORRESPONDENCE

274 Royal Society on Brexit / PhD thesis or compilation of papers? / Last IVF ban falls / Vultures in air-traffic corridors / The well-tempered keyboard



### FUTURES

368 Legacy admissions  
S R Algernon



# CONTENTS

18 August 2016 / Vol 536 / Issue No 7616

## RESEARCH

### NEW ONLINE

- 275 Papers published AOP this week at nature.com

### NEWS & VIEWS

#### 276 IN RETROSPECT

##### Sixty years of living polymers

A reaction that revolutionized polymer science  
Gary Patterson

#### 277 HUMAN GENOMICS

##### A deep dive into genetic variation

60,706 human exome sequences, aggregated from 14 diverse studies  
Jay Shendure

SEE ARTICLE P. 285

#### 278 NEUROSCIENCE

##### Flipping the sleep switch

Deciphering how dopamine signalling inactivates sleep-promoting neurons  
Stephane Dissel & Paul J Shaw

SEE LETTER P. 333

#### 280 CATALYSIS

##### Elusive active site in focus

The structure of the methane-oxidizing  $\alpha$ -Fe(II) species  
Jay A Labinger

SEE LETTER P. 317

#### 281 MAMMALIAN DEVELOPMENT

##### Mechanics drives cell differentiation

Unification of models of the first lineage decision in mice  
Berenika Plusa & Anna-Katerina Hadjantonakis

SEE LETTER P. 344

#### 282 CONDENSED-MATTER PHYSICS

##### Superconducting electrons go missing

Surprising properties of overdoped high-temperature superconductors  
Jan Zaanen

SEE LETTER P. 309

### ARTICLES

#### 285 GENOMICS Analysis of protein-coding genetic variation in 60,706 humans

M Lek et al.

SEE N&V P. 277

#### 292 NEUROSCIENCE Circadian neuron feedback controls the *Drosophila* sleep-activity profile

F Guo et al.

#### 298 CANCER Defining the clonal dynamics



### ON THE COVER

As part of the Exome Aggregation Consortium (ExAC) project, Daniel MacArthur and colleagues report on the generation and analysis of high-quality exome sequencing data from 60,706 individuals of diverse ancestry. This provides the most comprehensive catalogue of human protein-coding genetic variation to date.  
PAGE 277 & 285

#### leading to mouse skin tumour initiation

A Sánchez-Danés et al.

#### 304 BIOCHEMISTRY Capturing a substrate in an activated RING E3/E2-SUMO complex

F C Streich Jr & C D Lima

### LETTERS

#### 309 CONDENSED-MATTER PHYSICS

##### Dependence of the critical temperature in overdoped copper oxides on superfluid density

I Božović, X He, J Wu & A T Bollinger

SEE N&V P. 282

#### 312 PHOTOVOLTAIC MATERIALS High-efficiency two-dimensional Ruddlesden-Popper perovskite solar cells

H Tsai et al.

#### 317 CATALYSIS The active site of low-temperature methane hydroxylation in iron-containing zeolites

B E R Snyder et al. SEE N&V P. 280

#### 322 CATALYSIS Metallaphotoredox-catalysed $sp^2$ - $sp^3$ crosscoupling of

#### carboxylic acids with alkyl halides

C P Johnston, R T Smith, S Allmendinger & D W C MacMillan

#### 326 GEODYNAMICS An early geodynamo driven by exsolution of mantle components from Earth's core

J Badro, J Siebert & F Nimmo

#### 329 BEHAVIOURAL GENETICS Natural courtship song variation caused by an intronic retroelement in an ion channel gene

Y Ding, A Berrocal, T Morita, K D Longden & D L Stern

#### 333 NEUROSCIENCE Operation of a homeostatic sleep switch

D Pimentel et al. SEE N&V P. 278

#### 338 NEUROSCIENCE A human neurodevelopmental model for Williams syndrome

T Chailangkarn et al.

#### 344 DEVELOPMENTAL BIOLOGY Asymmetric division of contractile domains couples cell positioning and fate specification

J-L Maître et al. SEE N&V P. 281

#### 349 VIROLOGY HIV-1 uses dynamic capsid pores to import nucleotides and fuel encapsidated DNA synthesis

D A Jacques et al.

#### 354 STRUCTURAL BIOLOGY Structure of mammalian respiratory complex I

J Zhu, K R Vinothkumar & J Hirst

#### 359 CORRIGENDUM CEACAM1 regulates TIM-3-mediated tolerance and exhaustion

Y-H Huang et al.

#### 360 CORRIGENDUM Mycrocercosic acid synthase exemplifies the architecture of reducing polyketide synthases

D A Herbst, R P Jakob, F Zähringer & T Maier

#### 360 CORRIGENDUM A receptor heteromer mediates the male perception of female attractants in plants

T Wang et al.

#### 360 CORRIGENDUM Mitochondrial ROS regulate thermogenic energy expenditure and sulfenylation of UCP1

E T Chouchani et al.

KELLY KRAUSE/NATURE