

CONTENTS

12 March 2015 / Vol 519 / Issue No 7542

THIS WEEK

EDITORIALS

- 129 ASTRONOMY**
An array of problems
The decision on the headquarters for the SKA should be black and white
- 129 GEOLOGY**
All in good time
It is premature to hail the dawn of the Anthropocene
- 130 SCIENTIFIC PUBLISHING**
In the beginning
The 350th birthday of *Philosophical Transactions* marks time for reflection

WORLD VIEW

- 131 Help to fight the battle for Earth in US schools**
Nicole D LaDue
Education standards that promote Earth sciences merit full-scale support

RESEARCH HIGHLIGHTS

- 132 SELECTIONS FROM THE SCIENTIFIC LITERATURE**
Global warming to accelerate? / Earliest *Homo* fossil / Deadly female whales / A tiny bacterium / Science goes Twitter-arty / A virus gets X-rayed / 'Mechanochromic' materials



SEVEN DAYS

- 134 THE NEWS IN BRIEF**
Biosimilar drug secures approval / Dawn probe reaches Ceres / Late El Niño weaker than predicted / Solar plane makes round-the-world bid

CAREERS

- 251 SOCIAL BEHAVIOUR**
Indecent advances
Surveys are revealing the true extent of sexual harassment and assault in science

253 CAREER BRIEFS

NEWS IN FOCUS



- 137 VIROLOGY**
Influenza evolution tracked in China
- 138 POLICY**
Efforts to appease Congress put National Science Foundation under pressure
- 139 BIOLOGY**
Rate of genetic mutation in humans called into question
- 140 MARINE ECOLOGY**



- True extent of whale slaughter last century is revealed
- 142 PARTICLE PHYSICS**
The Large Hadron Collider gears up for a smashing time



FEATURES

- 144 ANTHROPOCENE**
The human age
Debate rages over whether to create a geological time period to mark humanity's impact on the planet

- 148 CONFLICT RESOLUTION**
Wars without end
Complexity science is the latest weapon in a bid to end protracted fighting

COMMENT

GLOBAL CHANGE

Risky business

Manage the exposure of people and assets to networked threats **PAGE 151**



BOOKS & ARTS

- 154 LINGUISTICS**
The ascent of English
Andrew Robinson
- 155 BOOKS IN BRIEF**
- 156 SUSTAINABILITY SCIENCE**
Exploiting the synergies
Dave Griggs

CORRESPONDENCE

- 158** Raising standards of research conduct / Tax high-speed trades / Undergraduates in research / 'Sexist' grants were a success / Predicting antibiotic resistance

OBITUARY

- 159 Yves Chauvin (1930–2015)**
Jean-Marie Basset



FUTURES

- 256 The Egg**
S B Diya

CONTENTS

12 March 2015 / Vol 519 / Issue No 7542

RESEARCH

NEW ONLINE

161 Papers published this week at nature.com

NEWS & VIEWS

162 PLANETARY SCIENCE

Enceladus' hot springs

Evidence of ongoing hydrothermal activity beyond Earth

Gabriel Tobie **SEE LETTER P.207**

163 CELL SIGNALLING

Disarming Wnt

The mechanism underlying inhibition of Wnt signalling by the Notum enzyme

Roel Nusse **SEE ARTICLE P.187**

164 EVOLUTION

Fitness tracking for adapting populations

Tracing beneficial mutations in an evolving population of yeast cells

David Gresham **SEE ARTICLE P.181**

166 MICROBIOLOGY

How bacteria get spacers from invaders

Mechanistic details of a bacterial CRISPR-Cas system

Ido Yosef & Udi Qimron

SEE ARTICLES P.193 & P.199

167 CLIMATE CHANGE

Black carbon and atmospheric feedbacks

Measuring the climatic effects of black carbon

Ben Booth & Nicolas Bellouin

168 EVOLUTIONARY BIOLOGY

The origin of terrestrial hearing

Implications of the discovery of rudimentary hearing in lungfish

Jennifer A Clack

PERSPECTIVE

171 BIOGEOGRAPHY Defining the Anthropocene

S L Lewis & M A Maslin

ARTICLES

181 EXPERIMENTAL EVOLUTION Quantitative evolutionary dynamics using

high-resolution lineage tracking

S F Levy et al. **SEE N&V P.164**

187 CELL BIOLOGY Notum deacylates Wnt proteins to suppress signalling activity

S Kakugawa et al. **SEE N&V P.163**



ON THE COVER

The human epoch

The idea that the Holocene is over and the human-dominated Anthropocene has begun is being extensively discussed. Simon Lewis and Mark Maslin assess anthropogenic signatures in the geological record against formal requirements for the recognition of a new epoch. See also the News Feature on page 144.

PAGES 171 & 144

193 IMMUNOLOGY Integrase-mediated spacer acquisition during CRISPR-Cas adaptive immunity

J K Nuñez, A S Y Lee, A Engelman & J A Doudna **SEE N&V P.166**

199 IMMUNOLOGY Cas9 specifies functional viral targets during CRISPR-Cas adaptation

R Heler et al. **SEE N&V P.166**

LETTERS

203 ASTROPHYSICS Regulation of star formation in giant galaxies by precipitation, feedback and conduction

G M Voit, M Donahue, G L Bryan & M McDonald

207 PLANETARY SCIENCE Ongoing hydrothermal activities within Enceladus

H-W Hsu et al. **SEE N&V P.162**

211 QUANTUM PHYSICS Observation of antiferromagnetic correlations in the Hubbard model with ultracold atoms

R A Hart et al.

215 CLIMATE SCIENCES Decrease in CO₂ efflux from northern hardwater lakes with increasing atmospheric warming

K Finlay et al.

219 EVOLUTION Spatiotemporal transcriptomics reveals the evolutionary history of the endoderm germ layer

T Hashimshony, M Feder, M Levin, B K Hall & I Yanai

223 MEDICAL GENETICS Large-scale discovery of novel genetic causes of developmental disorders

The Deciphering Developmental Disorders Study

229 NEUROSCIENCE Orientation columns in the mouse superior colliculus

E H Feinberg & M Meister

233 NEUROSCIENCE Mechanosensory interactions drive collective behaviour in *Drosophila*

P Ramdya et al.

237 IMMUNOLOGY Identification of a mast-cell-specific receptor crucial for pseudo-allergic drug reactions

B D McNeil et al.

242 OBESITY Group 2 innate lymphoid cells promote beiging of white adipose tissue and limit obesity

J R Brestoff et al.

247 BIOCHEMISTRY Crystal structure of the human OX₂ orexin receptor bound to the insomnia drug suvorexant

J Yin, J C Mobarec, P Kolb & D M Rosenbaum



QUANTUM PHYSICS

Cold comfort

Condensed-matter modelled at really low temperatures. **PAGE 211**

ALBERTO SEVESO