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##### Entanglement on demand

Deterministic delivery of entanglement in quantum networks

Julien Laurat [SEE LETTERS P.264 & P.268](#)

#### 193 IMMUNOLOGY

##### Tumour tamed by transfer of one T cell

One patient's response reveals a gene that affects immunotherapy success

Marcela V Maus [SEE LETTER P.307](#)

#### 195 BIOPHYSICS

##### Remote wiggling helps cold enzymes work

An entropic mechanism of allosteric enzyme regulation

Ashok A Deniz [SEE LETTER P.324](#)

#### 196 CLIMATE CHANGE

##### How humans and rising seas affect each other

Estimates of future areas of coastal flood plains

Aimée Slangen

#### 197 GENE REGULATION

##### A new phase in transcription

Phase separation helps the P-TEFb complex promote transcription

James A Goodrich & Dylan J Taatjes

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### ARTICLES

#### 243 MICROBIAL ECOLOGY Environment and host as large-scale controls of ectomycorrhizal fungi

S van der Linde et al.

#### 249 BIOCHEMISTRY Visualizing late states of human 40S ribosomal subunit maturation

M Ameismeier, J Cheng,

O Berninghausen & R Beckmann

#### 254 STRUCTURAL BIOLOGY Structure of a volume-regulated anion channel of the LRRC8 family

D Deneka, M Sawicka, A K M Lam,

C Paulino & R Dutzler

### LETTERS

#### 260 ASTRONOMY Stellar populations dominated by massive stars in dusty



#### starburst galaxies across cosmic time

Z-Y Zhang, D Romano, R J Ivison,

P P Papadopoulos & F Matteucci

#### 264 QUANTUM PHYSICS Deterministic quantum state transfer and remote entanglement using microwave photons

P Kurpiers et al. [SEE N&V P.192](#)

#### 268 QUANTUM PHYSICS Deterministic delivery of remote entanglement on a quantum network

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#### 274 MATERIALS SCIENCE Printing ferromagnetic domains for untethered fast-transforming soft materials

Y Kim, H Yuk, R Zhao, S A Chester & X Zhao

#### 280 CHEMISTRY Velocity-resolved kinetics of site-specific carbon monoxide oxidation on platinum surfaces

J Neugeboren et al.

#### 284 CLIMATE SCIENCE Minimal East Antarctic Ice Sheet retreat onto land during the past eight million years

J D Shakun et al.

#### 288 PALAEOONTOLOGY Rapid recovery of life at ground zero of the end-Cretaceous mass extinction

C M Lowery et al.

#### 292 NEUROSCIENCE Parallel emergence of stable and dynamic memory engrams in the hippocampus

T Hainmueller & M Bartos

#### 297 PLANT SCIENCES A molecular rheostat adjusts auxin flux to promote root protophloem differentiation

P Marhava et al.

#### 301 CARDIOVASCULAR DISEASE Oxidized phospholipids are proinflammatory and proatherogenic in hypercholesterolaemic mice

X Que et al.

#### 307 TUMOUR IMMUNOLOGY Disruption of TET2 promotes the therapeutic efficacy of CD19-targeted T cells

J A Fraietta et al. [SEE N&V P.193](#)

#### 313 CELL BIOLOGY EMI1 switches from being a substrate to an inhibitor of APC/C<sup>CDH1</sup> to start the cell cycle

S D Cappell et al.

#### 318 GENE REGULATION Phase-separation mechanism for C-terminal hyperphosphorylation of RNA polymerase II

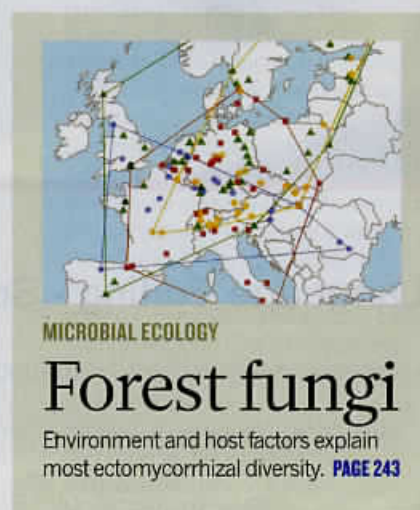
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#### 324 BIOPHYSICS Dynamic allostery can drive cold adaptation in enzymes

H G Saavedra, J O Wrabl, J A Anderson,

J Li & V J Hilser [SEE N&V P.195](#)



COVER IMAGE: FELICE FRANKEL (WITH ARTWORK BY WES FERNANDES/NATURE)



## ANTARCTICA

## REVIEWS

**200 Antarctic and global climate history viewed from ice cores**

Ed Brook and Christo Buizert review the many insights arising from the Antarctic ice core record of the past 800,000 years or so. They put into context the modern changes in greenhouse gases, relative to past variability: by any metric, the current levels and rates of change are beyond anything seen previously, and clearly indicate humanity's radical alteration of atmospheric composition. But Antarctica is not simply a recorder. Antarctica both drives and responds to climate shifts throughout the planet, at a vast range of time scales, from its seemingly isolated position. Ice coring efforts now seek to extend the continuous Antarctic ice core record to more than a million years.

*Edward J Brook & Christo Buizert*

**209 The global influence of localized dynamics in the Southern Ocean**

The vast Southern Ocean encircles Antarctica and acts both to dampen and to enhance the continent's interactions with the rest of the Earth system. However, although it accounts for a disproportionate share of oceanic fluxes of heat, CO<sub>2</sub> and nutrients, the Southern Ocean is understudied and poorly understood relative to northern oceans. Steve Rintoul reviews the processes that govern the state and behavior of the Southern Ocean and argues that, although a zonally averaged perspective has provided important insights, a more locally to regionally focused view must be adopted to understand the dominant role of bottom topography and eddies in Southern Ocean dynamics.

*Stephen R Rintoul*

## ANALYSIS

**219 Mass balance of the Antarctic Ice Sheet from 1992 to 2017**

The Antarctic Ice Sheet is losing mass and contributing to sea-level rise. In 2012, the Ice Sheet Mass Balance Inter-comparison Exercise (IMBIE) assessed the three main techniques used to quantify the mass loss. Now,

the IMBIE team returns to analyse the much more extensive literature over an expanded 1992–2017 record. The full ice sheet lost about 2,720 billion tonnes, contributing almost 3,000 cubic kilometres of water to the ocean. East Antarctica's mass balance remains highly uncertain and is indistinguishable from zero. The Antarctic Peninsula and the West Antarctic Ice Sheet, however, are clearly losing mass, and the rate of loss has approximately tripled from the 1990s to 2010s.

*The IMBIE team*

## REVIEW

**223 Trends and connections across the Antarctic cryosphere**

Antarctic ice is changing, but until recently it has been difficult to extract robust signals from the considerable noise in the observations. Andrew Shepherd, Helen Amanda Fricker and Sinead Louise Farrell review the state of the Antarctic cryosphere over the past few decades, observed from space and using aircraft remote sensing. A varied pattern of ice dynamics is revealed. The individual types of ice – sea, floating, and grounded – are interlinked in a system that either suppresses or accelerates ice

flow. Minimal change in continent-wide sea ice masks strong regional increases and decreases; the floating ice shelves fringing the continent are destabilizing in some areas; and grounded land ice continues to lose mass.

*Andrew Shepherd, Helen Amanda Fricker & Sinead Louise Farrell*

## PERSPECTIVE

**233 Choosing the future of Antarctica**

What does the future hold for Antarctica? In this Perspective, Steve Rintoul and colleagues step into the shoes of an observer in the year 2070, looking back on two possible trajectories for the continent. In one scenario, Antarctica continues to suffer from unchecked emissions of greenhouse gases and lax governance, with undesirable worldwide effects. The other involves aggressive mitigation of emissions and concerted efforts to govern with a goal of stewardship rather than exploitation. The latter scenario yields a much more sustainable future for Antarctica.

*S R Rintoul, S L Chown, R M DeConto, M H England, H A Fricker, V Masson-Delmotte, T R Naish, M J Siegert & J C Xavier*



CAMILLE SEAMAN