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A radical change in enzyme catalysis

Excited cofactor enables a non-natural enzyme reaction

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346 CANCER

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348 HYDROLOGY

The dynamics of Earth's surface water

Global maps depicting the variability of surface water bodies

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349 STEM CELLS

Cause and consequence in aged-muscle decline

Epigenetic changes trigger Hoxa9-mediated muscle ageing

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350 BIOMEDICINE

An eye on retinal recovery

Transplanted photoreceptors exchange cytoplasmic material with host cells

Michael A Dyer

ARTICLES

395 EVOLUTION The seahorse genome and the evolution of its specialized morphology

Q Lin et al.

400 STRUCTURAL BIOLOGY Electric-field-stimulated protein mechanics

D R Hekstra et al.



ON THE COVER

Evolution at a gallop

A seahorse at the Lembah Strait, Sulawesi, Indonesia. An international collaboration reporting in this issue of *Nature* has determined the genome sequence of a seahorse — *Hippocampus comes*, the tiger tail seahorse. They find it to be the most rapidly evolving fish genome so far studied. [PAGE 395](#)

LETTERS

406 ASTRONOMY Resolved images of a protostellar outflow driven by an extended disk wind

P Bjerkeli, M H D van der Wiel, D Harsono, J P Ramsey & J K Jørgensen

410 CONDENSED-MATTER PHYSICS Extensive degeneracy, Coulomb phase and magnetic monopoles in artificial square ice

Y Perrin, B Canals & N Rougemaille

414 CHEMICAL BIOLOGY Accessing non-natural reactivity by irradiating nicotinamide-dependent enzymes with light

M A Emmanuel, N R Greenberg, D G Oblinsky & T K Hyster

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418 HYDROLOGY High-resolution mapping of global surface water and its long-term changes

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423 NEURODEVELOPMENTAL DISORDERS Genome-wide changes in lncRNA,

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N N Parikhshak et al.

428 STEM CELLS Epigenetic stress responses induce muscle stem-cell ageing by Hoxa9 developmental signals

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433 CANCER A 17-gene stemness score for rapid determination of risk in acute leukaemia

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438 VIROLOGY Zika virus infection damages the testes in mice

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443 VIROLOGY Neutralizing human antibodies prevent Zika virus replication and fetal disease in mice

G Sapparapu et al.

448 IMMUNOLOGY Receptor usage dictates HIV-1 restriction by human TRIM5α in dendritic cell subsets

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453 BIOENERGETICS Structure of photosystem II and substrate binding at room temperature

I D Young et al.

458 DRUG DISCOVERY Structure of CC chemokine receptor 2 with orthosteric and allosteric antagonists

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462 DRUG DISCOVERY Intracellular allosteric antagonism of the CCR9 receptor

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466 STRUCTURAL BIOLOGY Structure and regulation of the chromatin remodeller ISWI

L Yan, Li Wang, Y Tian, X Xia & Z Chen

470 ERRATUM Follicular CXCR5-expressing CD8⁺ T cells curtail chronic viral infection

R He et al.

470 CORRIGENDUM Synergistic, ultrafast mass storage and removal in artificial mixed conductors

C-C Chen, L Fu & J Maier

470 ADDENDUM REST and stress resistance in ageing and Alzheimer's disease

T Lu et al.

JEFF ROTMAN/GETTY IMAGES

POLYMERS

REVIEWS

354 Sustainable polymers from renewable resources

Most commodity plastics are reliant on crude oil as a feedstock, but environmental concerns and consumer pressure are driving the search for polymers that are both sustainably sourced and biodegradable or easily recyclable. This review surveys the state of the art in polymeric materials prepared from a range of crops, and using carbon dioxide as a key starting material. It also discusses issues unique to such materials, such as feedstock seasonal variability, and integration with existing manufacturing infrastructure. *Yunqing Zhu, Charles Romain & Charlotte K Williams*

363 Polymers with autonomous life-cycle control

All materials and devices have a limited lifetime and will ultimately fail and need to be disposed of. Smart materials that mimic the ability of living systems to autonomously protect, heal and even regenerate in response to damage could increase the lifetime, safety and sustainability of many manufactured items. Scott White and colleagues present the various approaches taken to endow polymer-based materials with such functions, and examine the challenges in putting them to practical use.

Jason F Patrick, Maxwell J Robb, Nancy R Sottos, Jeffrey S Moore & Scott R White

371 Printing soft matter in three dimensions

The rapidly changing digital landscape has profoundly changed how we communicate and share information. It is also profoundly changing the science and engineering of advanced materials, by enabling the digital design and fabrication of customized 3D objects with qualitatively new material properties. Ryan Truby and Jennifer Lewis survey the materials and printing methods that underpin 3D printing of polymer-based soft materials, and



NIK SPENCER/NATURE

present examples that illustrate why it is beginning to be embraced by industrial designers and engineers and set to disrupt conventional manufacturing around the world.

Ryan L Truby & Jennifer A Lewis

379 The rise of plastic bioelectronics

This review discusses how soft polymeric materials are often suited to deployment in devices that are designed to interface with biological tissues, and outlines how plastic (bio)electronics can be used to target problems such as monitoring and understanding brain function as well as disease prevention, monitoring and control. Issues associated with producing real devices for clinical applications are also summarized,

together with a look at the challenges and prospects that lie ahead for such real-world devices.

Takao Someya, Zhenan Bao & George G Malliaras

386 Mimicking biological functionality with polymers for biomedical applications

This review explores the ways in which bioengineers are combining advances in biological understanding with new engineering capabilities to design synthetic polymeric analogues of biological structures. The review considers biomimetic tissue architectures, micro- and nanoscale objects, and finally interfaces, focusing specifically on the therapeutic potential of the resulting structures.

Jordan J Green & Jennifer H Elisseeff