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Science Advances

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ONLINE COVER: Microparticle eye drops used to treat dry eye disease. Dry eye disease involves not only a lack of tears but also an inflammatory response that affects the innate and adaptive immune systems, Chen *et al.* developed eye drops for autoimmune dry eye disease treatment that use porous arginine–glycine–aspartic acid-modified alginate microcarriers to deliver...

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SOCIAL AND INTERDISCIPLINARY SCIENCES AND PUBLIC HEALTH

Technological complexity and combinatorial invention in small-scale societies

BY MARCUS J. HAMILTON, JOSÉ LOBO, MARK COLLARS, ROBERT S. WALKER, BRIGGS BUCHANAN • 24 SEP 2025

More complex technologies might solve more problems, but only with more costs, even in traditional societies.

ABSTRACT

Exploring nationwide patterns of sleep problems from late adolescence to adulthood using machine learning

BY ADRIAN O. ZUCCO, HENNING JOHANNES DREWS, JERODEN F. ULEMAN, SAMIR BHATT, NAJIA HULVEJ ROD • 24 SEP 2025

Sleep problems from late adolescence to adulthood have increased in the past 10 years and can be linked to complex factors.

ABSTRACT

NEUROSCIENCE

Impaired macroautophagy in oligodendrocyte precursor cells suppresses neuronal plasticity via a senescence-associated signaling

BY HONG CHEN, YAN-YUN SUN, QI-FU LI, YU-TONG DU, NA-NA HU, AOHAN SU, XIAO-QING LUO, XIN HUANG, CHAO ZHU, GANG YANG, [...] QUAN HONG MA

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Senescent OPCs, caused by a declined autophagy, suppress neuronal firing and excitatory transmission via CCL3/5–CCR5 signaling.

ABSTRACT

Synchronization of women's menstruation with the Moon has decreased but remains detectable when gravitational pull is strong

BY CHARLOTTE HELFRICH-FORSTER, ESTHER D. DOMENIE, OLIVER MITTESSER, THOMAS HOVESTADT, ALBERTO PERLIN, THOMAS A. WEHR, RODOLFO COSTA, SARA MONTAGNÈSE • 24 SEP 2025

In modern times, menstrual cycles run in synchrony with the Moon only during Perihelion and Minor Lunar Standstills.

ABSTRACT

BDNF-driven synaptic plasticity requires autocrine matrix metalloproteinase–9 activity

BY DIANA LESUTSKA, LUKASZ BUŁOCH, BRZDĘK OLSZAK, BOŻENA KUŹNIEWSKA, KATARZYNA KALITA, RYDHEI YABUDA, LESZEK KACZMAREK, PIOTR MICHAŁUK

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Extracellular protease, MMP-9, controls structural synaptic plasticity by regulating TrkB activation at a single synapse.

ABSTRACT

Salient experiences enhance mundane memories through graded prioritization

BY CHENYANG (LEO) LIN, WEN WEN, PHILLIP (XIN) CHENG, SETH SCHALLIES, SHIREY GROVER, ROBERT M. G. REINHART • 24 SEP 2025

Emotional events strengthen otherwise forgettable memories by prioritizing those that share key features.

ABSTRACT

An interoceptive model of energy allostasis linking metabolic and mental health

BY SARA Z. MEHRHOFF, HUGO FLEMING, CAMILLA L. NORD • 24 SEP 2025

Interactions between metabolic interoception and regulation may drive comorbidity between mental and metabolic ill-health.

ABSTRACT

EARTH, ENVIRONMENTAL, ECOLOGICAL, AND SPACE SCIENCES

Slab tearing and segmented subduction termination driven by transform tectonics

BY BRANDON SHACK, BRIAN BOSTON, SUZANNE M. CARBOTTE, SHUGUO HAN, ANNE BÉCEL, NATHANIEL C. MILLER, J. PABLO CANALES, JESSE HUTCHINSON, REID MERRILL, JEFFREY BEESON, [...] HAROLD TOBIN

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Transform faults act as tectonic segmentation boundaries, enabling diachronous slab detachment and subduction termination.

ABSTRACT

Endo-exo framework for a unifying classification of episodic landslide movements: Implications for forecasting catastrophic failures

BY QINGHUA LEI, DIDIER SORNETTE • 24 SEP 2025

Landslides may not remain at criticality: Episodic dynamics shaped by endo–exo interplay reveal key paths to catastrophic failure.

ABSTRACT

PHYSICAL AND MATERIALS SCIENCES

Liquid crystal–guided DNA information storage: Nondestructive recovery and long-term preservation

BY YI ZHANG, YANDYU LIU, LI MIAO, HUIXIA ZHU, YUBIN REN, KELU ZHAO, DIKANG WAN, YAWEI LIU, YANG YANG, CHUNHUA LU, [...] KAI LIU

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Liquid crystal–guided DNA information preservation platform is developed for large-scale and long-term digital storage.

ABSTRACT

Interfacial chain-growth polymerization enables polypropylene-like and circular polythioglycolide

BY YANCHAO WANG, SHILONG WU, JINLONG CHEN, CHENYANG GUO, MAOSHENG LI, HAI WANG, QUAN CHEN, YONGFENG MEN, XIANHONG WANG, YONGHUA TAO, EUGÈNE Y.-K. CHEN • 24 SEP 2025

A recyclable polymer rivaling polypropylene in strength and processability was made via a green interfacial polymerization method.

ABSTRACT

Neuromorphic olfaction with ultralow-power gas sensors and onvonic threshold switch

BY MINJIE KANG, JOUN-KYU HAN, KICHUL LEE, JAESEOK JEONG, CHANYOUNG YOO, JEONG WOO JEON, BYUNGWOO PARK, WONHO CHOI, JUNGSEUNG AHN, KUK-JIN YOON, [...] INKYU PARK

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A neuromorphic olfactory system using low-power μ LED gas sensors and an onvonic threshold switch for real-time gas classification.

ABSTRACT

Quantum-enhanced multiparameter sensing in a single mode

BY CHRISTOPHER H. VALAHI, MATTHEW P. STAFFORD, ZIXIN HUANG, VASILI S. MATSOS, MAVERICK J. MILLICAN, TEERAWAT CHALERMPUSTARAK, NICOLAS C. MENICUCCI, JOSHUA COMBES, BEN Q. BARABOLA, TING REI TAN • 24 SEP 2025

Quantum states are used to measure position and momentum with uncertainties simultaneously beyond classical limits.

ABSTRACT

Optical tweezers with light aligned along the particle's trajectory enable playing tennis with light rackets

BY ALI DROBY, MOHAMMAD ATTRAISH, HANI BARHEIM, NITZAN SHANI, YAEV ROICHMAN, TAL CARMON • 24 SEP 2025

Tennis is played with light rackets, 57,600 strikes/min on a court mere hair-widths long, with a ball $1/10$ that size.

ABSTRACT

How sighing regulates pulmonary surfactant structure and its role in breathing mechanics

BY MARIA C. NOVAES-SILVA, MARIANA RODRÍGUEZ-HAKIM, BENJAMIN R. THOMPSON, NORMAN J. WAGNER, ELINE HERMANS, LIEVEN J. DUPONT, JAN VERMAANT

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Sigh-induced structural changes lower alveolar surface stress through a mechanical response.

ABSTRACT

Laser-architected MXene composite for photoenhanced microsupercapacitor

BY YONGJUN YUAN, MISHENG LIANG, TONG LI, RUI YU, WAI KIN LO, RUIGE SU, LIANGTIO QIU, XIN LI, LAN JIANG, STEVEN WANG • 24 SEP 2025

A laser-architected MXene–graphene composite with record-breaking photoenhanced energy storage performance is developed.

ABSTRACT

Acoustically powered micro-clampbot for single-particle transportation

BY ZHUNYU WANG, TAO FENG, AN REN, HONGSHU HUANG, SHANG LI, YUJING XUE, YUJING SHEN, XUEHAN LIU, ZHE CHEN, PHAGPHAD JIN, [...] WEI YANG

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An acoustically controlled microrobot enables precise clamping and transport of microobjects.

ABSTRACT

Processing soft thin films on liquid surface for seamless creation of on-liquid walkable devices

BY ZITU CHEN, MENGJIAN YIN, BAOXING XU • 24 SEP 2025

HydroSpread technology enables fabrication and laser patterning of soft films on liquid surfaces for on-liquid devices.

ABSTRACT

Quantum fluids of light in 2D artificial reconfigurable aperiodic crystals with tailored coupling

BY SERGEY ALVATKIN, KIRILL STNIK, VÁLTÍR KÁRI DÁNIELSSON, YAROSLAV V. KARTASHOV, JULIAN D. TÖPPER, HELSI SIOURSSON, PAVLOS G. LAPOUDAKIS

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Exciton–polariton condensates synchronize and reveal nontrivial phases in all-optical 2D aperiodic Penrose tiling.

ABSTRACT

BIOMEDICINE AND LIFE SCIENCES

Steric repulsion counteracts ER–to–lipid droplet protein movement

BY ALICIA GARRA, MOHAMEDINE OMARNE, OZDEN STJANOVIC, BIANCA M. ESCH, MENDI ZOUROUCH, MAXIME CARPENTIER, ROBIN KLEMM, FLORIAN FROHLICH, LYONEL FORÉ, ABOUD RACHID THIAH • 24 SEP 2025

Steric hindrance affects the relocation of ER-to-LD proteins and primarily regulates the LD proteome.

ABSTRACT

MSC-encapsulated porous microparticle eye drops for autoimmune dry eye disease treatment in NOD mice

BY TAOGE CHEN, RUI LIU, QIN CHEN, XUEBIN FENG, BIN KONG, YUANJIN ZHAO • 24 SEP 2025

MSC-loaded porous microcarriers improve retention and immune regulation for treating autoimmune dry eye disease.

ABSTRACT

Elucidating the structure and assembly mechanism of actinoporin pores in complex membrane environments

BY ROCO ARRANZ, CÉSAR SANTIAGO, SIMONAS MASULIS, ESPERANZA RIVERA-DE-TORRE, JUAN PALACIOS-ORTESA, DIEGO CARLERO, DIEGO HERAS-ÁRQUEZ, JOSÉ G. SÁVILAÑEL, ERNESTO ARIAS-PALOMO, ÁLVARO MARTÍNEZ-DEL-POZO, [...] JAIME MARTÍN-BENITO

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From soluble monomers to membrane disruptors, cryo–electron microscopy reveals the structural path to pore formation in PFTs.

ABSTRACT

The MC4–La1 cleavage module restricts plant virus infection by integrating R-motif-mediated defense mRNA translation

BY QINGLIN PI, RUIJIAN HU, NING YUE, ZHIHAO JIANG, JING WEI, YANLIN CHEN, MENG YANG, WEN SONG, YONGLIANG ZHANG, JINLONG WANG, DAIWEI LI

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The MC4–La1 cleavage module links R-motif-mediated cap-independent defense mRNA translation to activate plant antiviral immunity.

ABSTRACT

Glioblastoma exploits ATP from leading-edge astrocytes to fuel its infiltrative growth revealed by spatially resolved chimeric analysis

BY GAOXIA YANG, XIAODONG NIE, JIEYING GAN, TIANPING YU, MENGSHAN LI, FENG XIAO, RUI ZHANG, PING HE, YUAN YANG, YI OUI, [...] RAN ZHOU

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Creatine kinase-mediated metabolic support drives infiltrative glioblastoma growth at the astrocyte-rich tumor edge.

ABSTRACT

Gut epithelium modifies enteric behaviors during nutritional adversity via distinct peptidergic signaling axes

BY BURJOIT BURAL, ZION WALKER, OLIVER HOBERT • 24 SEP 2025

Gut epithelium modulates output from distinct enteric circuits by altering secretion of insulin and noninsulin peptides.

ABSTRACT

Cryo-EM snapshots of NMDA receptor activation illuminate sequential rearrangements

BY JAMIE A. ABBOTT, JUNHOE KIM, BEIYING LIU, GABRIELA K. POPESCU, ERIC DOUAUX, FARZAD JALALI-YAZDI • 24 SEP 2025

Opening of the NMDA receptor involves bending of the helices lining the ion channel gate.

ABSTRACT

A microneedle device for rapid dermal interstitial fluid sampling

BY ANDY H. HUNG, NETA U. KAMAT, ABEL BERAUDEZ, STEPHANIE M. BOCCER, FERNANDO J. GARCIA-MARQUEL, YER LIN TAN, JIHYUN (LINA) HIRANI, PRIMA DEVI SWAMINATH, DAN LITVY, KUNILLA L. JACOBSON, [...] JOSEPH M. DESIMONE

+3 authors • 24 SEP 2025

A device collects enough skin interstitial fluid for omics studies in just five minutes.

ABSTRACT

Structural basis of Pseudomonas biofilm-forming functional amyloid FapC flection

BY KASPER HOLST HANSEN, MERT MYRSCOK, CHANG MYRSCOK BYRON, ABULKADIR TUNIC, EMILIE BUKL FLECHINGER, MORTEN K. D. DUEHOLM, JAMES F. CONWAY, MARIA ANDREASEN, MERT GUR, UMUT ARSEY • 24 SEP 2025

The structure of FapC reveals how Pseudomonas forms biofilms via a unique β solenoid amyloid fold and dynamic assembly pathway.

ABSTRACT

Site-specific adaptive nanovesicles for oral insulin delivery

BY BOZHANG XIA, FENGFU XU, JUNGE CHEN, SHAOBO SHAN, JIJIHONG SHEN, YUXUAN ZHANG, JIUNAN WANG, ZIRAN ZHOU, WELIUN SUN, YARU JIA, [...] XING-JIE LIANG

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Milk-derived nanovesicles enable oral insulin delivery by crossing the gut barrier and targeting the liver.

ABSTRACT

From disorder to icosahedral symmetry: How conformation-switching subunits enable RNA virus assembly

BY BIVU LI, GUILLAUME TREBET, ROYA ZANDI • 24 SEP 2025

Conformation-switching subunits enable simulations where disordered RNA–protein complexes self-organize into symmetric shells.

ABSTRACT

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