SCIENCE ADVANCES

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ONLINE COVER: A tobacco plant with electrodes attached with an adaptable coupling layer for long-term monitoring. Current non-invasive methods of measuring plant electrophysiology are not suitable for long-term measurements, preventing continuous monitoring over long periods of time. Wong *et al.* designed an electrode that allows for a month-long, non-invasive method of…

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SOCIAL AND INTERDISCIPLINARY SCIENCES AND PUBLIC HEALTH

Lifecourse genome-wide association study meta-analysis refines the critical life stages for adiposity's influence on breast cancer risk

BY GRACE M. POWER, LAXMI BHATTA, AMANDA M. HUGHES, CAROLINA MEDINA-GOMEZ, ANNE RICHMOND, GENEVIEVE LEYDEN, BETHAN LLOYD-LEWIS, ELEANOR SANDERSON, REBECCA RICHMOND, ELIZABETH C. CORFIELD, [...] GEORGE DAVEY SMITH +9 authors • 21 JAN 2026

Improving knowledge of adiposity's genetic architecture across the lifecourse refines insights into its role in breast cancer.

ABSTRACT

The earliest elephant-bone tool from Europe: An unexpected raw material for precision knapping of Acheulean handaxes

BY SIMON A. PARFITT, SILVIA M. BELLO • 21 JAN 2026

Europe's earliest elephant-bone tool sheds light on 500,000-year-old human innovation and cognitive abilities.

ABSTRACT

Ambient air quality and health impacts of $PM_{2.5}$ from US residential wood combustion

BY KYAN K. SHLIPAK, SARA F. CAMILLERI, VICTORIA A. LANG, ANASTASIA MONTGOMERY, JORDAN L. SCHNELL, DANIEL E. HORTON • 23 JAN 2026

Air pollution from residential wood burning contributes to thousands of premature deaths annually, with unexpected urban impacts.

ABSTRACT

Far-reaching hunter-gatherer networks during the Last Glacial Maximum in Western Europe

BY MARTA SÁNCHEZ DE LA TORRE, XAVIER MANGADO, SAMUEL CASTILLO-JIMÉNEZ, FELIPE CUARTERO, RICHARD J. HEWITT, LUIS LUQUE, BERNARD GRATUZE, MIGUEL ALMEIDA, MARÍA DE ANDRÉS-HERRERO, GUILHEM CONSTANS, [...] MANUEL ALCARAZ-CASTAÑO +3 authors • 21 JAN 2026

Geochemistry of stone tools reveals unprecedently large social ties among European hunter-gatherers during the Last Ice Age.

ABSTRACT

COBRA-k: A powerful framework bridging constraint-based and kinetic metabolic modeling

BY PAVLOS STEPHANOS BEKIARIS, STEFFEN KLAMT • 21 JAN 2026

COBRA-k unlocks next-generation metabolic modeling—accurate, flexible, and predictive, delivering broad biological insights.

ABSTRACT

NEUROSCIENCE

Dynamic context–based updating of object representations in the visual cortex

BY GIACOMO ALDEGHERI, SURYA GAYET, MARIUS V. PEELEN • 21 JAN 2026

Objects are mentally rotated together with the changing viewpoint on a scene, affecting their representation in the visual cortex.

ABSTRACT

EARTH, ENVIRONMENTAL, ECOLOGICAL, AND SPACE SCIENCES

Slowing planetary rotation influences ocean nutrient cycling and oxygenation

BY ASHIKA CAPIRALA, STEPHANIE L. OLSON • 21 JAN 2026

Slowing rotation (longer days) may improve marine biospheric productivity and oxygenation on Earth and Earth-like exoplanets.

ABSTRACT

Bilateral Loa-Kea trends of the Hawaiian Islands caused by the bottom-up splitting of plume conduit

BY JIE ZHANG, JIASHUN HU, KAI WANG • 23 JAN 2026

Global mantle convection models reveal how LLVP-sourced plumes evolve, explaining the transient geochemical zoning of Hawaii.

ABSTRACT

Dynamic redox–promoted iron and nutrient cycling drove graptolite evolution across the Ordovician-Silurian transition

BY ZHEN QIU, CAINENG ZOU, JIAQIANG ZHANG, AIGUO DONG, WEILIANG KONG, YIJUN XIONG, PAUL B. WIGNALL, MING LI, ZAICONG WANG, XIANGKUN ZHU, SIMON W. POULTON
21 JAN 2026

Fe-driven nutrient cycling was responsible for graptolite evolution across the Ordovician-Silurian transition.

ABSTRACT

Prototaxites fossils are structurally and chemically distinct from extinct and extant Fungi

BY CORENTIN C. LORON, LAURA M. COOPER, SEAN MCMAHON, SEÁN F. JORDAN, ANDREI V. GROMOV, MATTHEW HUMPAGE, NIALL RODGERS, LAETITIA PICHEVIN, HENDRIK VONDRACEK, RUARIDH ALEXANDER, [...] ALEXANDER J. HETHERINGTON +3 authors • 21 JAN 2026

Prototaxites fossils are distinct from Fungi, suggesting that they represent an extinct lineage of eukaryotic life.

ABSTRACT

PHYSICAL AND MATERIALS SCIENCES

Piezoelectric surface acoustic wave memristor neural network

BY YI ZHANG, YI DENG, DINGCHEN WANG, ZILONG XIONG, YANG JIANG, CHENKAI DENG, CHUYING TANG, SHAOCONG WANG, MUJUN LI, XIAOHUI WANG, [...] ZHONGRUI WANG +6 authors • 21 JAN 2026

A compact piezoelectric SAW memristor neural network enables nonvolatile programmable wireless RF signal processing.

ABSTRACT

Adaptable thermoresponsive polymer for long-term electrical coupling in plant electrophysiology monitoring

BY YI JING WONG, YIFEI LUO, WENLONG LI, EDEN VINA LAMOSTE GRATE, FEILONG ZHANG, ZHISHENG LV, QIANYU LIN, MENGYUAN ZHANG, YANSONG MIAO, XIAN JUN LOH, XIAODONG CHEN
21 JAN 2026

An electrode enables month-long, noninvasive electrophysiology on diverse plants, unlocking insights into plant health.

ABSTRACT

Pairing particles into holonomies

BY VERA NEEF, MATTHIAS HEINRICH, TOM A. W. WOLTERINK, ALEXANDER SZAMEIT • 21 JAN 2026

Previously unknown holonomies in two- and many-particle quantum systems revealed by a state-based approach.

ABSTRACT

Two-dimensional lamellar nanosheet membranes with intrinsic size-sieving nanopores for ultrafast hydrogen separation

BY YUFENG LIU, RUI WANG, XINYI MA, YIDUO WANG, SHAOHUA SHEN, BOFENG BAI, CHENGZHEN SUN • 21 JAN 2026

A carbon nitride nanosheet membrane with intrinsic nanopores enables effective hydrogen separation with ultrahigh permeance.

ABSTRACT

Bioinspired growable humanoid robot with bone-mimetic linkages for versatile mobility

BY HAO LIU, YANDA YANG, TING WANG, JINTAO YIN, HONGQIANG WANG • 23 JAN 2026

A soft humanoid robot with bone-inspired linkages can grow, walk, crawl, swim, fly, and safely interact with humans.

ABSTRACT

Photovoltaic nanoassembly of nanowire arrays sensitized with colloidal nanocrystals for near-infrared retina photostimulation

BY TARIK S. KAYA, HUMEYRA N. KALELI, ANTOINE CHAFFIOL, ANDREA CORNA, CORENTIN JOFFROIS, RIDVAN BALAMUR, UGUR B. CALISKAN, ASIM ONAL, CIGDEM PEHLIVAN, EREN TEKINAY, [...] SEDAT NIZAMOGLU +5 authors • 21 JAN 2026

Nanocrystal-sensitized nanowires evoke vision-restoring neural activity in blind retinas under safe near-infrared illumination.

ABSTRACT

Randomness certification in a quantum network with independent sources

BY GIORGIO MINATI, GIOVANNI RODARI, EMANUELE POLINO, FRANCESCO ANDREOLI, DAVIDE PODERINI, RAFAEL CHAVES, GONZALO CARVACHO, FABIO SCIARRINO • 23 JAN 2026

Device-independent randomness is certified within a quantum network and experimentally validated on a photonic platform.

ABSTRACT

Negative-thermal-expansion particles enable high-performance and ultradurable thermoelectric modules

BY HAO YANG, PENGFEI XU, BASSEM A. AL-MAYTHALONY, YUXIN HUANG, MENG XU, YEZHEN HUA, WENHUA ZHANG, XIYANG WANG, SENLIN CUI, HE ZHU, BIAO XU • 23 JAN 2026

Negative-thermal-expansion particles enable efficient and durable thermoelectric modules.

ABSTRACT

Digital composites with reprogrammable phase architectures

BY YUN BAI, XUEBO YUAN, YANG WENG, KAIPING YIN, HELING WANG, XIAOYUE NI • 23 JAN 2026

A digital composite uses switchable solid-liquid voxels to tune mechanical properties on demand.

ABSTRACT

BIOMEDICINE AND LIFE SCIENCES

A genome-wide genetic screen reveals the P2Y2-integrin axis as a stabilizer of EGFR mutants in non–small cell lung cancer (NSCLC)

BY YAFEI DU, WENJING WANG, HUI CHIN GOH, THAMIL SELVAN VAIYAPURI, ANANDHKUMAR RAJU, YU-CHUN HSIAO, CHENG CHUN WANG, VANISHA AGRAWAL, NOORUL FARZANA MOHIDEEN, NORHIDAYAH BINTE MOHD MAZIAN, [...] GANDHI T. K. BOOPATHY +12 authors • 21 JAN 2026

The ATP, P2Y2, and integrin signaling axis helps EGFR mutants survive in lung cancer, pointing to a target to tackle resistance.

ABSTRACT

Granuloma dual RNA-seq reveals composite transcriptional programs driven by neutrophils and necrosis within tuberculous granulomas

BY GOPINATH VISWANATHAN, ERIKA J. HUGHES, MINGYU GAN, ANA MARÍA XET-MULL, JACOB P. LOWY, CHARLIE J. PYLE, GRAHAM ALEXANDER, DEVJANEE SWAIN-LENZ, QINGYUN LIU, DAVID M. TOBIN • 21 JAN 2026

Dual host-pathogen transcriptional profiling defines granuloma-specific programs during mycobacterial infection.

ABSTRACT

Bacteriophages mobilize bacterial defense systems via lateral transduction

BY XU KUANG, JAMIE GORZYNSKI, MARIE TOUCHON, ANDREY SHKOPOROV, EDUARDO P. C. ROCHA, J. ROSS FITZGERALD, JOHN CHEN, JAKOB T. ROSTØL, JOSÉ R. PENADÉS • 23 JAN 2026

Bacteriophages and PICIs spread bacterial defenses via lateral transduction, shaping microbial immunity and pathogen evolution.

ABSTRACT

Steroid-dependent metabolic rewiring reveals novel therapeutic and imaging approaches for glioblastoma

BY MARIA FRANCESCA ALLEGA, RUHI DESHMUKH, THERESA HILLINGER, ALENA AKHMETSHINA, ANAÏS OUDIN, ROBERT BIELIK, DMITRY SOLOVIEV, VICTOR H. VILLAR, TOBIAS ACKERMANN, GUILLAUME BOURMEAU, [...] SAVERIO TARDITO +14 authors • 23 JAN 2026

Dexamethasone reprograms glioblastoma nicotinamide metabolism, sensitizing tumors to methionine restriction and enabling PET.

ABSTRACT

Healing of ischemic injury in the retina

BY SILKE BECKER, ZIA L'ECUYER MORISON, JORDAN ALLEN, SAMA SAEID, LEE STURGIS, AUSTIN ADDERLEY, ARI KOSKELAINEN, FRANS VINBERG • 21 JAN 2026

Light signals in postmortem human retinas challenge that ischemic injury is irreversible and aid research to restore vision.

ABSTRACT

Optimally engineered HLA/peptide-specific CAR-T cells outperform TCR-T cells to eradicate solid tumors

BY CORINNE E. DECKER, JACQUELINE IDUN, KATJA MOHRS, THOMAS CRAIG MEAGHER, IRYNA PETRIV, JONATHON GOLAS, ROBERT SALZLER, TIMOTHY HELMS, DHARANI AJITHDOSS, SUHASINI AVVARU, [...] DAVID J. DILILLO +6 authors • 21 JAN 2026

CAR-T cells targeting HLA-A2/$MAGEA4_{230–239}$ outperform TCR-T cells in vivo due to costimulatory signaling.

ABSTRACT

Autocrine TGFβ2 enforces a transcriptionally hybrid cell state in Ewing sarcoma

BY EMMA D. WRENN, JACOB C. HARRIS, APRIL A. APFELBAUM, JONAH R. VALENTI, PATRICIA A. LIPSON, STEPHANIE I. WALTER, NICOLAS M. GARCIA, AYA MIYAKI, STEVEN C. CHEN, JIM M. OLSON, [...] ELIZABETH R. LAWLOR +2 authors • 21 JAN 2026

Autocrine TGF β 2 feedback loop supports matrix-producing hybrid cell states in Ewing sarcoma.

ABSTRACT

Oxidation-activated nanotherapy boosts tumor immunity and disrupts tumor-nerve crosstalk to combat bone metastases and cancer pain

BY ZHAOWEI ZHANG, PENGFEI CHEN, YUFEI ZHENG, MOBAI LI, LAN ZHAO, ZEZHOU FU, YUJIE ZHOU, TINGYU ZHANG, XUANRONG SUN, DINGCHENG ZHU, [...] JIAJIA XIANG +3 authors
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A nanotherapy that reprograms immune and neural circuits halts bone metastasis, relieves cancer pain, and restores bone integrity.

ABSTRACT

Neuronal GPR75 deficiency protects against diet-induced obesity in a humanized mouse model

BY XUE-NAN SUN, JAN-BERND FUNCKE, CHANMIN JOUNG, CHAO LI, AYANNA COBB, TOSHIHARU ONODERA, JOSELIN VELASCO, MAY-YUN WANG, PATRICK JOSEPH ANTONELLIS, CHRISTOPHER MAZZONE, [...] DA YOUNG OH +3 authors • 23 JAN 2026

Switching off the GPR75 gene can prevent obesity or boost fat burning, depending on where it is turned off.

ABSTRACT

Resident $CD49a^+CD103^+NKG2C^+$ NK cells restrict HIV infection in human lymphoid tissue explants

BY DAVID PEREA, ALBA GONZALEZ, ANA GALLEGO-CORTÉS, NEREA SANCHEZ-GAONA, FELIX PUMAROLA, NURIA ORTIZ, INES LLANO, JUAN LORENTE, VICENÇ FALCÓ, MERITXELL GENESCÀ, MARIA J. BUZON • 23 JAN 2026

Tissue-resident NK cells adapt dynamically to early HIV, revealing memory-like subsets that link viral control and dysfunction.

ABSTRACT

RSV temporally reprograms apoptosis and pyroptosis to balance immune evasion and replication

BY CONG LIU, HAIWU ZHOU, JIAN LI, YANG MENG, JINGYU WANG, MINGBIN HE, WEIWEI WANG, ZHIFEI LI, YALI QIN, MINGZHOU CHEN • 23 JAN 2026

RSV orchestrates cell death and IL-1 β release via spatially distinct, linked death signaling axes for immune evasion and spread.

ABSTRACT

CD318 expression defines a novel subset of human $CD8^+$ regulatory T cells

BY JEONG-SU DO, WEI-KAI CHEN, YU-WEN HUNG, DAVID ARRIBAS-LAYTON, CONGCONG LU, ANGEL GU, ENRIQUE MONTERO, ALEXANDRE M. CARMO, HELENA REIJONEN • 23 JAN 2026

CD318 is up-regulated in activated CD8 T cells defining a regulatory subtype with therapeutic potential.

ABSTRACT

Lrrn-mediated retinal ganglion cell targeting drives visual circuit assembly for brightness and contrast detection

BY ELENA PUTTI, GIULIA FAINI, JULIE THANH-MAI DANG, JAY H. SAVALIYA, FANNY EGGELER, KARINE DUROURE, JULIETTE VOUGNY, GONZALO ORTIZ-ÁLVAREZ, CRISTINA PUJADES, ARMIN BAHL, [...] SHAHAD ALBADRI +4 authors • 23 JAN 2026

Precise wiring by Lrrn CAMs in a deep visual circuit enables zebrafish to detect brightness and contrast for essential behaviors.

ABSTRACT

Mitochondrial heterogeneity drives the evolution of fungicide resistance in *Phytophthora sojae*, with associated fitness trade-offs

BY KANG YUAN, TAN DAI, XUHENG GAO, JIAYI SHEN, JIKUN YANG, XINGXING LU, GUIXIANG LI, YA HE, YIXIN FU, YAN WANG, [...] XILI LIU +1 authors • 23 JAN 2026

Mitochondrial heterogeneity drives the ametoctradin resistance evolution, yet it reduces the *Phytophthora sojae*'s fitness.

ABSTRACT

Aberrant methylation limits antitumoral inflammation in lung adenocarcinoma by restricting RIPK3 expression

BY DEEPTI AGRAWAL, KATARINA CISAROVA, SEBASTIAN VOSBERG, FABIAN ALLMENDINGER, ENKHTSETSEG MUNKHBAATAR, NADIA DANDACHI, FRANCISCO JOSE FERNANDEZ HERNANDEZ, MARTA TONIETTO, VANESSA JÄGER, MARTINA ANTON, [...] PHILIPP J. JOST +9 authors • 21 JAN 2026

Aberrant methylation silences RIPK3 in lung adenocarcinoma, limiting necroinflammation and immune defense against tumors.

ABSTRACT

Selective disruption of lipid peroxide homeostasis in intratumoral regulatory T cells by targeting FSP1 enhances cancer immunity

BY JESSE GARCIA CASTILLO, STEPHANIE SILVERIA, LEO SCHIROKAUER, ANTOINE SAUQUET, JESSICA HUNG, GRACE JAWORSKI, JOSEPH M. HENDRICKS, HEI SOOK SUL, JAMES A. OLZMANN, MICHEL DUPAGE • 23 JAN 2026

Deletion of Aifm2 disrupts T_{reg} cell immunosuppression within tumors without inciting autoimmune pathology in mice.

ABSTRACT

TDRD3, a Tudor domain-containing protein, regulates *Klf2*-dependent T_{reg} differentiation and function to modulate immune tolerance

BY YUN SHI, XIAOQUN TAO, LEI SHEN, YATE-CHING YUAN, GUANPENG WANG, ETHAN EURMSIRILERD, RENDELL CHANG, ZHENYU JIA, WEIRONG SHANG, YANZHONG YANG, ZUOMING SUN
23 JAN 2026

TDRD3 regulates immune tolerance via activating *Klf2* gene to promote iT_{reg} differentiation and function.

ABSTRACT

MAcro Plant Projection Imaging (MAPPI): An open, scalable platform for whole-plant fluorescence real-time imaging

BY GIORGIA TORTORA, BIANCA MARIA ORLANDO MARCHESANO, STEFANO BURATTI, LAURA LUONI, MATTEO GRENZI, KEIKO YOSHIOKA, VALERIA CONTARTESE, ALESSIA CANDEO, ALEX COSTA, ANDREA BASSI • 23 JAN 2026

A scalable open-source imaging platform reveals long-distance signaling in soil-grown plants under development and stress.

ABSTRACT

Molecular and structural basis of a subfamily of PrfH rescuing both the damaged and intact ribosomes stalled in translation

BY YANNAN TIAN, QINGRONG LI, SHIRIN FATMA, JUNYI JIANG, HONG JIN, FUXING ZENG, RAVEN H. HUANG • 23 JAN 2026

A single protein rescues two notably different stalled ribosomes, and two cryo-EM structures reveal the molecular insights.

ABSTRACT

Regulatory hotspot on the influenza A virus polymerase revealed through the structure of the NEP-polymerase complex

BY ALISON REP, FANGZHENG WANG, KUANG-YU CHEN, LOÏC CARRIQUE, JANE SHARPS, JONATHAN M. GRIMES, ERVIN FODOR • 23 JAN 2026

Structural studies reveal how influenza virus switches between making new RNA genomes and exporting them from the host nucleus.

ABSTRACT

Superenhancers shape the landscape and repair dynamics of transcription-associated DNA breaks in cancer

BY OSAMA HIDMI, DIALA SHATLEH, SARA OSTER FLAYSHMAN, JONATHAN MONIN, RAMI I. AQEILAN • 21 JAN 2026

Superenhancers create hotspots of DNA fragility and mutations by intensifying transcription-associated breakage and repair.

ABSTRACT

Expanding DNA alphabet adds a previously unknown dimension to nanostructures

BY KUN ZHOU, SHUICHI HOSHIKA, JING CHENG, CHENXIANG LIN, STEVEN BENNER, YONGGANG KE • 21 JAN 2026

DNA nanostructures made with intelligently designed base pairs hold promises of improving DNA nanotechnology.

ABSTRACT

ERRATA

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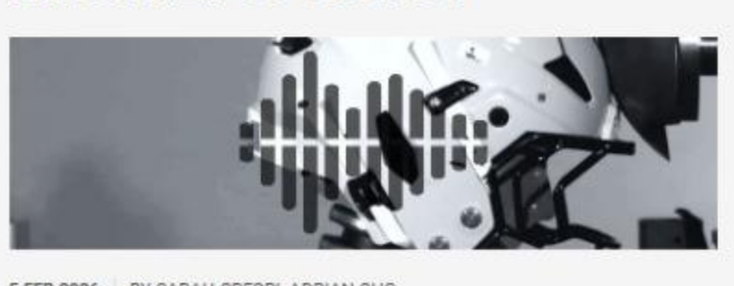

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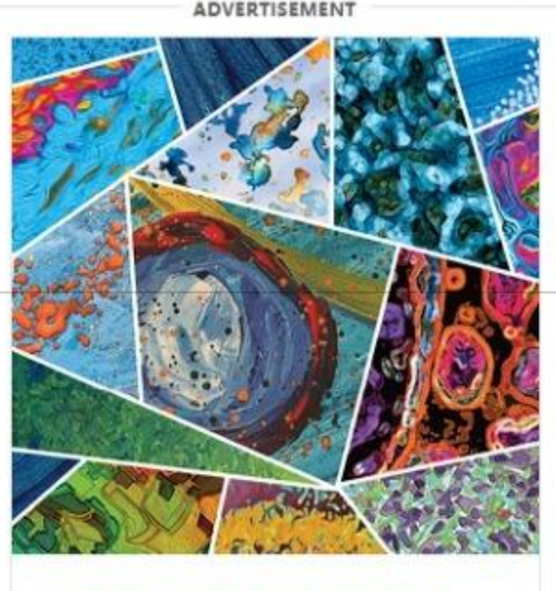

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