Science Newsletter

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November, 2025

Contents

Introduction:

There are 3 main elements in the Science Newsletter which is composed. In the first part, we list the most up to date papers about central issues for each discipline in our university, and they are provided with 5 subjects for a time. In the second part, there are papers from the top journals last month, and most of them are from Nature and Science. In the third part, we post information about calling papers for international conferences. Hopefully, some of the information in this manuscript may be useful for those who are dedicating to scientific career. Besides, the journals are also posted on the website of our library, and they are available to be accessed any time at https://lib.jsut.edu.cn/2025/0228/c5474a193334/page.htm.If there are any questions or suggestions, please send e-mails to ccy@jsut.edu.cn in no hesitate.

Ⅰ Topics

The keywords of this month is **Chemistry**:
We post several papers which are related to the top concerned topics of researches on Chemistry. The papers are classified in 5 categories, and they are: **Analytical Chemistry, Biological Chemistry, Organic Chemistry, Physical Chemistry** and **Catalysis**. Also, the listed papers are all arranged in a descending sort of JCR impact factor. If you want full pages of these papers, please contact us for help.

ANALYTICAL CHEMISTRY

Adv Mater (impact factor: 26.8) 1 区 TOP

Nanopore-Based Label-Free and Single-Molecule Sequencing toward Precision Diagnosis.

Yufan Cui, Yueming Zhai, et. al

Abstract:

Nanopore-based single-molecule sequencing (SMS) is a powerful tool for acquiring detailed heterogeneous information on critical building blocks of life, such as nucleic acids, proteins, and a wide array of biomolecules, at the single-molecule level. Realtime current-intensity fluctuations corresponding to the passage of target molecules through nanopores enable long-read length, high-throughput, and high-accuracy detection, thus meeting the stringent demands of precision diagnosis. Herein, a concise overview of various principles and fabrication methods is provided for nanopores, with particular emphasis on recent advancements in nanopore-based DNA and protein sequencing, revealing innovative approaches for effectively capturing and translocating target molecules, and rapid and accurate identification. Further typical cases of nanopore-based SMS applications in precision diagnosis are analyzed, focusing on genetic disorders, infectious diseases, cancers, and abnormal post-translational modifications to highlight the clinical potential of nanopores. Additionally, the inherent limitations and challenges of nanopores in terms of sensitivity, detection range, and selectivity are discussed and present the latest strategies for enhancing nanopore performance. Finally, perspectives are provided on the future of nanopore-based SMS, particularly at the intersection of microfluidic devices, surface functionalization, and machine learning, to facilitate more diverse and advanced developments in this field.

Anal Chem (impact factor: 6.7) 1 区 TOP

Affinity-Driven Two-Step Immobilization of Endogenous Natural GABAA Receptor to Quantify Drug-Protein Analysis with Enhanced Sensitivity and Accuracy.

Xue Zhao, Mingxuan Kang, et. al

Abstract:

Immobilized proteins have been conceived as promising for developing assays, including biosensors and chromatographic methods. Conventional efforts are geared toward the attachment of purified or recombinant protein, while lacking strategies for capturing endogenous protein in live cells. Herein, we developed a rapid, two-step method for the target- and site-selective immobilization of endogenous natural γ-amino butyric acid receptors (GABAAR) directly from live hippocampal neuronal cells (HT22 cells). The method employed a ligand-tethered reagent as a recognition motif and a derivative of acyl-imidazole as an alkyne donor, which selectively introduces an alkyne click handle into specific sites of GABAAR. Subsequent click reaction between the alkyne-protein and azide-modified dye or support surface enables visualization of the receptor in live cells, as well as fabrication of GABAAR-immobilized surface plasmon resonance (SPR) sensor chips or affinity chromatography stationary phases. Compared to a typical affinity-driven one-step capture method, this approach significantly shortens the immobilization time from 6 h to 15 min while preserving receptor functionality. The immobilized endogenous GABAAR was successfully applied in two analytical platforms: as an SPR sensor chip for enhancing sensitivity in revealing drug-receptor interactions, and as a stationary phase in affinity chromatography, where it markedly improved resolution, selectivity, and accuracy in analyzing drug-receptor

interactions. Such unique features indicate that the two-step strategy may be a versatile tool for modifying endogenous natural proteins in live cells while minimizing the influence on their functions. It has great potential to facilitate the construction of affinity analytical assays using immobilized endogenous proteins.

Anal Chem (impact factor: 6.7) 1 区 TOP

Laser Desorption-Rapid Evaporative Ionization Mass Spectrometry (LD-REIMS): A New Tool for the High-Throughput Metabolomic and Lipidomic Profiling of Live Cells.

Stefania Maneta-Stavrakaki, Aurelien Tripp, et. al

Abstract:

Understanding the dynamic cellular metabolism is essential for gaining deeper insights into inter- and intracellular functions. In recent years, mass spectrometry (MS) has become the technology of choice for the biochemical characterization and profiling of cell lines, particularly when coupled with separation techniques such as liquid chromatography (LC-MS). However, these methods typically involve extensive sample preparation with potent organic solvents, which is labor-intensive, time-consuming, and incompatible with direct analysis of intact, live cells. Here, we propose the use of the ambient ionization technique Laser Desorption-Rapid Evaporative Ionization Mass Spectrometry (LD-REIMS) incorporated in an automated platform, for the high-throughput profiling of live or frozen cell monolayers, with minimal pretreatment. Validation experiments using 10 breast and colorectal cancer cell lines confirmed high accuracy, repeatability, and molecular coverage of the method, with over 400 metabolites and lipids detected and identified, including saccharides, amino acids, fatty acids, and glycerophospholipids. Of these, 144 were further confirmed and quantified with LC-MS/MS and standard compounds. We also applied the method to establish lipidomic differences across the isogenic MCF10A cells harboring either WT or MUT PIK3CA. Finally, we conducted time-series experiments on hypoxic cells, which revealed significant dynamic changes in metabolism, including lactate accumulation due to anaerobic glycolysis.

BIOLOGICAL CHEMISTRY

Science (impact factor: 45.8) 1 区 TOP

Rapid compensatory evolution within a multiprotein complex preserves telomere integrity.

Sung-Ya Lin, Hannah Futeran, et. al

Abstract:

Intragenomic conflict with selfish genetic elements spurs adaptive changes in subunits of essential multiprotein complexes. Whether and how these adaptive changes disrupt interactions within such complexes and threaten their essential functions remains unexplored. To investigate this, we exploited a Drosophila melanogaster multiprotein complex that protects telomeres from lethal fusions despite one subunit, HOAP (HP1/ORC-associated protein), evolving adaptively to restrict selfish telomeric retrotransposons. Swapping HOAP's adaptively evolving interaction partner, HipHop (HP1-HOAP-interacting protein), between closely related Drosophila species disrupted HOAP recruitment to the telomere, leading to lethal telomere fusions. Reverting six adaptively evolving sites on HipHop's interaction surface with HOAP, or introducing its conspecific HOAP, restored protein recruitment, telomere protection, and viability. Our in vivo, evolution-guided manipulations illuminate how intermolecular compensatory evolution preserves essential functions in the face of antagonism by selfish elements.

Science (impact factor: 45.8) 1 区 TOP

Targeted protein degradation in the transmembrane and extracellular space.

Rongfeng Zhu, Heng Zhang, et al

Abstract:

Transmembrane and extracellular proteins play crucial roles in diverse cellular functions and communication, affecting the progression and treatment of various diseases by mediating vital cellular processes. Whereas targeted protein degradation (TPD) represents an advancing therapeutic modality that leverages cellular degradation machinery to eliminate proteins of interest, present strategies have been largely confined to intracellular targets. Now, emerging strategies toward transmembrane and extracellular proteins are rapidly expanding the horizon of this powerful technology. Here, we review TPD in the transmembrane and extracellular space (meTPD) and discuss platform technologies, features, applications, and limitations. We focus on the conceptual innovations used in developing the present meTPD technology as well as its potential value for biological research and therapeutic interventions.

Adv Colloid Interface Sci (impact factor: 19.3) 1 区

Native biolubricants mucin and lubricin: Comparative study of lubrication origins, synergy lubrication and molecularly mimicked biolubricants.

Linwen Zhang, Yihan Sun, et. al

Abstract:

Mucin and lubricin, are both bottlebrush-like glycoproteins in biofluids, play pivotal roles in friction reduction at biological tissue-tissue and tissue-implant contact

interfaces. Such two glycoproteins give rise to the intrinsic friction reducing ability that vast research interests have been attracted. A deeper insight into the origin of their lubrication properties should promote the novel scientific findings in lubrication science, medicals and biophysical chemistry. For this purpose, in contrast with previous works, we provide a relative comprehensive summary to analyze their similarities and differences in molecular structures, molecular adsorption and conformation, and lubrication synergy with other biomacromolecules. On the basis of understanding their structure characteristics, we examine how lubricin and mucin provide a special combination of bulk and surface features for the lubrication and minimal wear. The concept of lubrication synergy with other biomacromolecules in native surroundings are generally discussed as well. Significant advances in these aspects have stimulated the developing of bioinspired lubrication systems involved with bottlebrush-like polymers, especially for the molecular mimicked biolubricants synthesized using recombinant protein approaches. By providing a comparative study in discussing the key elements in mediating the tribological properties of mucin and lubricin, this review aims to provide a better understanding of the lubrication origin of biomacromolecules and to encourage the construction of bioinspired lubricating systems with low coefficient of friction and high wear resistance.

ORGANIC CHEMISTRY

Science (impact factor: 45.8) 1 区 TOP

Structural basis for the recruitment and selective phosphorylation of Akt by mTORC2.

Martin Taylor, Maggie Chen, Matthew Hancock, et. al

Abstract:

The mTOR protein kinase forms two multiprotein complexes, mTORC1 and mTORC2, that function in distinct signaling pathways. mTORC1 is regulated by nutrients, and mTORC2 is a central node in phosphoinositide-3 kinase (PI3K) and small guanosine triphosphate Ras signaling networks commonly deregulated in cancer and diabetes. Although mTOR phosphorylates many substrates in vitro, in cells, mTORC1 and mTORC2 have high specificity: mTORC2 phosphorylates the protein kinases Akt and PKC, but not closely related kinases that are mTORC1 substrates. To understand how mTORC2 recognizes substrates, we created semisynthetic probes to trap the mTORC2-Akt complex and determine its structure. Whereas most protein kinases recognize amino acids adjacent to the phosphorylation site, local sequence contributes little to substrate recognition by mTORC2. Instead, the specificity determinants were secondary and tertiary structural elements of Akt that bound the mTORC2 component

mSin1 distal to the mTOR active site and were conserved amongst at least 18 related substrates. These results reveal how mTORC2 recognizes its canonical substrates and may enable the design of mTORC2-specific inhibitors.

Environ Sci Technol (impact factor: 11.3) 1 区 TOP

Identification of Key Components with Cardiovascular Effect in Airborne Particulate Matter Using an Expanded Component-separation Strategy.

Weican Zhang, Zhuyi Zhang, Haozhong Tian, et. al

Abstract:

Environmental exposures contribute significantly to the global disease burden. However, identifying key toxicants within these complex exposures remains a challenge. Here, we propose an effect-based identification framework with expanded component-separation strategy that encompasses both organic and previously overlooked inorganic components to identify key components with cardiovascular effect in fine particulate matter (PM2.5). This framework integrates a high-efficiency extraction and separation method, high-content imaging for vascular morphometric outcomes in a zebrafish model, and multidimensional single-particle analysis for ultrafine particles (UFPs). We identified the effect components in PM2.5, with combustion-derived Fe3O4 nanoparticles (NPs) as the strongest effect component. This unanticipated focus on NPs significantly expands the current scope of potential toxicant candidates. Validation using human cell exposure models confirmed that Fe3O4 NPs exhibit higher cardiovascular toxicity than other PM2.5 components. Our results reveal the crucial toxic contributions of previously overlooked components and provide a revolutionary strategy for identifying effect components within complex environmental matrices.

Inorg Chem (impact factor: 4.7) 2 区 TOP

Consolidating the Immobilization of Tellurotungstate via Integrating with a Metal-Organic Framework for Electrocatalytic Hydrogen Evolution Performance in Alkaline/Seawater Medium.

Zhihan Chang, Zhifei Zu, et. al

Abstract:

Polyoxotungstates, as a kind of polyoxometalate, show an advantage with high electrocatalytic activity for hydrogen evolution. Integrating polyoxotungstates with a metal-organic framework not only brings high stability in an aqueous environment but also tailors the distribution of active sites. In this work, four tellurotungstate-based coordination architectures are constructed based on the extension strategies toward nitrogen-rich organic ligands, including covalent modification and in situ

transformation. The extended ligands are beneficial for constructing a metal-organic framework and immobilizing the tellurotungstate: The V-type interactions between the metal ion and N sites both reinforce the structure and extend the structure. In situ transformation for organic ligands from linear conformation to triangle expands the coordination direction and enhances the dimension. The specific immobilization of tellurotungstate brings more active sites and enhances the electrocatalytic activity. The carbon cloth-based electrode modified with TeW-4 can achieve a low overpotential of 17.0/34.7 mV at the catalytic current density of 10 mA cm-2 for hydrogen evolution in 1 M KOH/simulated seawater and exhibit stable electrocatalytic stability.

PHYSICAL CHEMISTRY

Green Chem (impact factor: 9.2) 1 区 TOP

Polyetherureas as aqueous binders for Li ion batteries.

Garima Saini, Mei Tan, et. al

Abstract

We report here the application of polyetherureas as a new class of aqueous binder for the LiFePO4 positive electrode material in lithium-ion batteries. Polyetherureas have been synthesized by ruthenium-catalyzed dehydrogenative coupling of polyethylene glycol diamine and methanol avoiding conventionally used toxic diisocyanate feedstock. The best binder performance was obtained when polyetherurea was used in combination with SBR (Styrene-Butadiene Rubber), exhibiting a coulombic efficiency of ~99.9% and a cell polarization of 30 mV. Remarkably, the combination of polyetherurea/SBR as a binder demonstrates comparable performance as that of CMC (carboxymethyl cellulose), which is a commonly used aqueous binder for lithium-ion batteries. Evidence of the involvement of polyetherureas in binder performance has been provided using IR spectroscopy and scanning electron microscopy. Physical, electrochemical, and mechanical properties of the polyetherurea have been studied using TGA, DSC, powder XRD, cyclic voltammetry, nanoindentation, tensile testing, and 180° peel test that shed light on why this polymer acts as a good binder.This journal is © The Royal Society of Chemistry.

ACS Appl Nano Mater (impact factor: 5.5) 3 区

How Ti Doping Improves the Catalytic Methane Dry Reforming of Nanoporous Reduced LaNiO3 Perovskites.

Thomas Winterstein, Andreas Oss, et. al

Abstract

We studied the effect of Ti substitution on nickel B-sites in LaNiO3 to unravel the influence of Ti doping on structural stability, Ni exsolution, and methane dry reforming (DRM) properties. Ni can be substituted by Ti down to compositions of xNi = 0.25 without compromising both phase and structure purity. At even higher Ti doping levels, formation of the pyrochlore-type La2Ti2O7 phase occurs. Ti substitution has a significant influence on the stability under reducing conditions and the appearance of specific intermediate structures relevant for DRM operation. Full decomposition is only observed for LaNiO3 and the xNi = 0.75 sample, which yield the La2O3 phase relevant for DRM activity at low Ti doping levels. A common impurity phase between xNi = 0.75 and 0.25 is La2TiO5, which acts as a Ti and La sink and hinders the formation of La2O3. For higher Ti doping levels, hydrogen reduction increases the amount of La2Ti2O7. A common denominator of all samples after hydrogen reduction is the full leaching of all nominally available Ni from the perovskite. The self-activation properties during DRM operation strongly depend on the Ti substitution level. Self-activation with either full or partial decomposition is only possible for LaNiO3 and xNi = 0.75, where intermediate lanthanum oxycarbonate formation occurs. For xNi = 0.50, the remaining perovskite structure is stable, but Ni exsolution nevertheless occurs, triggering DRM activity. Successive Ti doping invokes a change in the DRM mechanism from oxycarbonate-based at low Ti amounts (LaNiO3 and xNi = 0.75) to a more reactive-oxygen dominated one for samples xNi ⩽ 0.50, as indicated by X-ray photoelectron spectra. Ti doping also allows to economize the amount of Ni for DRM applications it can be lowered to a quarter of the initial amount referenced to pure LaNiO3 without compromising DRM activity.

Chem Commun (Camb) (impact factor: 4.2) 2 区 TOP

Chiral amplification of prebiotic peptide synthesis induced by chemical-physical interactions on calcite surfaces.

Shichao Yu, Xiangxiao Zheng, et. al

Abstract

Understanding how life substances adopted a single configuration under prebiotic conditions is central to exploring the origins of homochirality. This study shows a chiral amplification effect during prebiotic peptide synthesis on calcite surfaces, driven by the synergy between chemical synthesis and physical adsorption. This chemical-physical coupling mechanism offers a unique and promising strategy for promoting the emergence of homochirality.

Angew Chem Int Ed Engl (impact factor: 16.9) 1 区 TOP

Ultrabroadband 1D and 2D NMR Spectroscopy.

Yannik Woordes, Kyryl Kobzar, et. al

Abstract

The chemical shift range of many NMR-active isotopes cannot be excited in a single experiment by classical hard pulse high-resolution spectroscopy or even conventional broadband excitation. Such nuclei can be addressed by specifically optimized saturation pulses or xy-excitation, which are derived from linear frequency sweeps that are further optimized using methods derived from optimal control theory. A multi-isotope 1D experiment covering 6 MHz as well as homonuclear COSY and heteronuclear HMBC experiments covering more than 100 kHz are demonstrated, which can be adapted to fit any needs for specific isotopes at any spectrometer field. In general, the approach is very useful for 1D and 2D absolute value overview spectra at high magnetic fields and/or wideband and low-gamma nuclei.© 2025 The Author(s). Angewandte Chemie International Edition published by Wiley‐VCH GmbH.

J Am Chem Soc (impact factor: 15.6) 1 区

Catenanes of Twin-Cavity Cages.

Ze-Ming Xu, Weihao Wang, et. al

Abstract:

Catenanes, interlocked molecular architectures, hold promise for molecular machines and catalysis, yet constructing complex topologies from multicavity cages remains challenging. Herein, we report the selective synthesis of an interwoven dimeric catenane comprising twin-cavity organic cages, achieved through a one-pot reaction between a trialdehyde planar panel and a triamine linker. This efficient synthesis is rationally guided by our probabilistic model. The model begins with a topological analysis that captures the essential spatial arrangement of the planar panels, which provides the main driving force for catenane formation and defines the interwoven and chain-like topological isomers. A probability density function that accounts for the π-π stacking interactions between the planar panels is then incorporated into the probabilistic model, enabling the semiquantitative prediction that the interwoven isomer is predominantly favored over the chain-like counterpart. Single-crystal X-ray diffraction unambiguously confirms the interwoven structure, revealing the stabilizing π-π stacking between the panels. This integrated theoretical-experimental approach offers a rational strategy for the selective one-pot synthesis of sophisticated interlocked architectures among various isomers.

ACS Catal (impact factor: 13.1) 1 区 TOP

Cation-Dependent Interfacial Properties Determine the Activity of Pt(111)

Electrodes in Alkaline Media.

Haiting Yu, Song Xue, et. al

Abstract:

Energy conversion and storage technologies require optimal electrode-electrolyte interfaces to drive electrocatalytic reactions. However, the impact of interfacial phenomena on the catalytic activity remains debated. This study investigates the role of alkali metal cations in interfacial properties and correlates them with electrocatalytic activities toward several energy-related reactions in alkaline media using model Pt(111) single crystal electrodes. Through electrochemical impedance spectroscopy and laser-induced current transient techniques, interfacial parameters, such as the double layer capacitance, the potential of the capacitance minimum, and the potential of maximum entropy (pme), are determined. The latter exhibit a linear dependence on cation hydration energies. Notably, two distinct pmes are observed at the Pt(111)-alkaline electrolyte interfaces, attributed to water dipole reorientation. Correlating pme with reaction activities reveals that interfacial entropy is a robust and general descriptor of electrocatalytic reaction kinetics. Particularly, electrocatalytic activity improves as the pme aligns more closely with the thermodynamic equilibrium potential of the respective reaction, providing a solid framework for optimizing interfacial microenvironments to enhance electrocatalytic performance.

Ⅱ Concentration

PHYSICS

Wavefront shaping enables high-power multimode fiber amplifier with output focus

Stefan Rothe, Chun-Wei Chen, et al.

Abstract

High-power fiber lasers are powerful tools used in science, industry, and defense. A major roadblock for further power scaling of single-frequency fiber laser amplifiers is stimulated Brillouin scattering. Efforts have been made to mitigate this nonlinear process, but these were mostly limited to single-mode or few-mode fiber amplifiers, which have good beam quality. Here, we explored a highly multimode fiber amplifier in which stimulated Brillouin scattering was greatly suppressed due to a reduction of light intensity in a large fiber core and a broadening of the Brillouin scattering spectrum by multimode excitation. By applying a spatial wavefront shaping technique to the input light of a nonlinear amplifier, the output beam was focused to a diffraction-limited spot. Our multimode fiber amplifier can operate at high power with high efficiency and narrow linewidth, which ensures high coherence. Optical wavefront shaping enables coherent control of multimode laser amplification, with potential applications in coherent beam combining, large-scale interferometry and directed energy delivery.

Quantum-amplified global-phase spectroscopy on an optical clock transition

Zaporski, Leon, Liu, Qi, et al.

Abstract

Optical lattice clocks are at the forefront of precision metrology[1,2,3,4,5,6], operating near a standard quantum limit set by quantum noise[4,7]. Harnessing quantum entanglement offers a promising route to surpass this limit[8,9,10,11,12,13,14,15]; however, there are practical difficulties in terms of scalability and measurement resolution requirements[16,17]. Here we adapt the holonomic quantum gate concept[18] to develop a new Rabi-type ‘global-phase spectroscopy’ that uses the detuning-sensitive global Aharonov–Anandan phase[19]. With this approach, we can demonstrate quantum-amplified time-reversal spectroscopy on an optical clock transition that achieves directly measured 2.4(7) dB metrological gain and 4.0(8) dB improvement in laser noise sensitivity beyond the standard quantum limit. To this end, we introduce rotary echo to protect the dynamics from inhomogeneities in light–atom coupling and implement a laser-noise-cancelling differential measurement through symmetric phase encoding in two nuclear spin states. Our technique is not limited by measurement resolution, scales easily because of the global nature of entangling interaction and exhibits high resilience to typical experimental imperfections. We expect it to be broadly applicable to next-generation atomic clocks and other quantum sensors approaching the fundamental quantum precision limits[20,21,22].

Low-overhead transversal fault tolerance for universal quantum computation

Zhou, Hengyun, Zhao, et al.

Abstract

Fast, reliable logical operations are essential for realizing useful quantum computers[1,2,3]. By redundantly encoding logical qubits into many physical qubits and using syndrome measurements to detect and correct errors, we can achieve low logical error rates. However, for many practical quantum error correction codes such as the surface code, owing to syndrome measurement errors, standard constructions require multiple extraction rounds—of the order of the code distance d—for fault-tolerant computation, particularly considering fault-tolerant state preparation[4,5,6,7,8,9,10,11,12]. Here we show that logical operations can be performed fault-tolerantly with only a constant number of extraction rounds for a broad class of quantum error correction codes, including the surface code with magic state inputs and feedforward, to achieve 'transversal algorithmic fault tolerance'. Through the combination of transversal operations[7] and new strategies for correlated decoding[13], despite only having access to partial syndrome information, we prove that the deviation from the ideal logical measurement distribution can be made exponentially small in the distance, even if the instantaneous quantum state cannot be made close to a logical codeword because of measurement errors. We supplement this proof with circuit-level simulations in a range of relevant settings, demonstrating the fault tolerance and competitive performance of our approach. Our work sheds new light on the theory of quantum fault tolerance and has the potential to reduce the space–time cost of practical fault-tolerant quantum computation by over an order of magnitude.

MATERIALS

Layer-by-layer epitaxial growth of perovskite heterostructures with tunable band offsets

Yang Lu, Young-Kwang Jung, et al.

Abstract

Halide perovskites exhibit superior optoelectronic properties but lack precise thickness and band offset control in heterojunctions, which is critical for modular multilayer architectures such as multiple quantum wells. We demonstrate vapor-phase, layer-by-layer heteroepitaxial growth exemplified by CsPbBr3 deposition on single crystals of PEA2PbBr4 (PEA: 2-phenylethylammonium). Angstrom-level thickness control and subangstrom smooth layers enable quantum-confined photoluminescence of CsPbBr3 from monolayer, bilayer, and through to bulk. The interfacial structure controls the electronic structure from a Cs–PEA-terminated interface (type II heterojunction) to a PEA–PEA-terminated interface (type I heterojunction), with a layer-tunable band offset shift exceeding 0.5 electron volts. Electron transfer from CsPbBr3 to PEA2PbBr4 for a type II Cs–PEA heterojunction results in delayed electron-hole recombination beyond 10 microseconds. Precise quantum confinement control and large band offset tunability unlock perovskite heterojunctions as platforms for scalable, superlattice-based optoelectronic applications.

Electrolytes that reduce electro-osmotic drag improve fast charging of lithium-ion batteries

Chang-Xin Zhao, Zeyi Wang, et al.

Abstract

Fast charging (at rates greater than 4 C) is essential for high-energy lithium-ion batteries in electric vehicles yet remains challenging owing to a lack of understanding of fast-charging barriers. Conventional optimization strategies concentrate on shortening lithium-ion transport pathways through electrode structure modification, which often compromises energy densities. In this work, we demonstrate that thick-electrode fast charging is constrained by solvent withdrawal within porous electrodes and the resulting electro-osmotic drag polarization, which is driven by cation-induced electro-osmotic drag. To reduce electro-osmotic drag polarization, we designed electrolytes with weak cation solvation and strong anion solvation, where a difluorinated solvent weakens lithium-cation solvation and its difluoromethyl hydrogen atoms enhance anion solvation through hydrogen bonding. This electrolyte enables thick-electrode, energy-dense batteries to achieve 80% charge within 13 minutes.

Vector-stimuli-responsive magnetorheological fibrous materials

Pu, Junhong, Li, et al.

Abstract

Fibrous materials that provide reversible actuation[1,2] or adapt mechanical properties[3,4] in response to external stimuli hold great promise for smart textiles[5], soft robotics[6] and wearable technologies[7]. Although considerable progress has been made in creating fibrous materials responsive to scalar stimuli such as voltage[8], temperature[6], humidity[2] and ion concentration[9], these technologies often lack directional controllability and functional diversity[10,11,12,13,14]. Here we report a class of vector-stimuli-responsive magnetorheological fibrous materials, guided by our engineering model integrating the structural mechanics of textiles with the magnetics of soft magnetic materials. We mass-produced soft magnetic polymer composite fibres with optimized mechanical and magnetic properties, which we then assembled into concentric helical yarns. These yarns exhibited pronounced bending and stiffening properties controlled by the direction and magnitude of magnetic fields, allowing for customized fabrics with various actuation and stiffening functionalities. We demonstrated innovative smart textiles derived from those fabrics, including an active ventilation fabric for personal moisture management, an integrated conformable gripper for handling objects of varying shapes and stiffness, and a compact remote-controllable haptic finger glove that replicates the sensation of fabric hardness and smoothness. Our work provides insights into stimuli-responsive fibrous materials, elevating them from scalar to sophisticated vector control, heralding an era of smart textile innovation.

CHEMISTRY

A multimodal robotic platform for multi-element electrocatalyst discovery

Zhang, Zhen, Ren, Zhichu, et. al

Abstract

One of the goals of ‘AI for Science’ is to discover customized materials through real-world experiments. Pioneering advances have been achieved in computational predictions and the automation of materials synthesis[1–7]. Yet, most materials experimentation remains constrained to using unimodal active learning (AL) approaches, relying on a single data stream. The potential of AI to interpret experimental complexity remains largely untapped[8,9]. Here we present Copilot for Real-world Experimental Scientists (CRESt), a platform that integrates large multimodal models (LMMs, incorporating chemical compositions, text embeddings, and microstructural images) with Knowledge-Assisted Bayesian Optimization (KABO) and robotic automation. CRESt employs knowledge-embedding-based search space reduction and adaptive exploration–exploitation strategy to accelerate materials design, high-throughput synthesis and characterization, and electrochemical performance optimization. CRESt allows monitoring with cameras and vision-language-model-

driven hypothesis generation to diagnose and correct experimental anomalies. Applied to electrochemical formate oxidation, CRESt explored over 900 catalyst chemistries and 3500 electrochemical tests within 3 months, identifying a state-of-the-art catalyst in the octonary chemical space (Pd–Pt–Cu–Au–Ir–Ce–Nb–Cr) which exhibits a 9.3-fold improvement in cost-specific performance.

A molecularly impermeable polymer from two-dimensional polyaramids

Ritt, Cody L., Quien, Michelle, et. al

Abstract

All polymers exhibit gas permeability through the free volume of entangled polymer chains[1,2,3]. By contrast, two-dimensional (2D) materials including graphene stack densely and can exhibit molecular impermeability[4,5,6]. Solution-synthesized 2D polymers that exhibit the latter by poly-condensation have been a longstanding goal. Herein, we demonstrate self-supporting, spin-coated 2D polyaramid nanofilms that exhibit nitrogen permeability below 3.1×10^{-9} Barrer, nearly four orders of magnitude lower than every class of existing polymer, and similar for other gases tested (helium, argon, oxygen, methane and sulfur hexafluoride). Optical interference during the pressurization of nanofilm-coated microwells allows measurement of mechanosensitive rim opening and sealing, creating gas-filled bulges that are stable exceeding three years. This discovery enables 2D polymer resonators with high resonance frequencies (about 8 MHz) and quality factors up to 537, similar to graphene. A 60-nm coating of air-sensitive perovskites reduces the lattice degradation rate 14-fold with an oxygen permeability of 3.3×10^{-8} Barrer. Molecularly impermeable polymers promise the next generation of barriers that are synthetically processable, chemically amenable and maximize molecular rejection with minimal material, ultimately advancing sustainability goals.

Homogenized chlorine distribution for >27% power conversion efficiency in perovskite solar cells

Zhuang Xiong, Qian Zhang, et. al

Abstract

The spatial heterogeneity of halogen distribution in perovskite thin films represents a critical factor currently limiting both the power conversion efficiency and stability of solar cells. We identified pronounced through-film inhomogeneity in chlorine distribution in formamidinium lead iodide films, with the generally used additive methylammonium chloride. We demonstrated that incorporating alkali metal oxalates could effectively homogenize the chlorine distribution. These compounds underwent thermal dissociation, releasing alkali metal cations that selectively bound chloride ions,

which considerably suppressed surface defects and eliminated interfacial barriers. A certified steady-state power conversion efficiency (PCE) of 27.2% (device area and measured mask area: 0.108 square cm and 0.074 square cm, respectively) in perovskite solar cells was achieved, and devices retained 86.3% of their initial PCE after 1529 hours of continuous maximum power point tracking (MPPT) under 1 Sun condition. Moreover, the unpassivated device maintained 82.8% of its original PCE under MPPT at 85°C aging under 1 Sun illumination after 1000 hours.

BIOLOGY

Targeting formyl peptide receptor 1 reduces brain inflammation and neurodegeneration

Yulin Li, Zhiguo Li, et al.

Abstract

Multiple sclerosis (MS) progresses through brain region–specific inflammation and degeneration, with poorly defined mechanisms. In individuals with MS, we identified increased expression of formyl peptide receptor 1 (FPR1) in central nervous system (CNS)–resident microglia and CNS-infiltrating macrophages. Blood amounts of N-formylated peptides, which are endogenous agonists of FPR1, correlated with disease progression in patients with MS. In MS mouse models, signaling through FPR1 promoted microglial mitochondrial dysfunction, causing axonal loss and apoptosis. FPR1-expressing microglia sustained the clonal expansion of myelin-reactive CD4+ T cells in the CNS. A CNS-penetrating small molecule FPR1 antagonist, T0080, mitigated autoimmune responses and axonal degeneration. Our study identifies FPR1 signaling as a potential mechanism for MS progression and suggests antagonizing FPR1 as a therapeutic approach.

Flexible nanoelectronics reveal arrhythmogenesis in transplanted human cardiomyocytes

Junya Aoyama, Ren Liu, et. al

Abstract

The transplantation of human induced pluripotent stem cell–derived cardiomyocytes (hiPSC-CMs) offers a potential treatment for heart failure, but arrhythmogenic automaticity can arise from these transplanted cells. In this study, we investigated the effects of RADA16, a clinically approved self-assembling peptide that forms nanofibers

after injection, on the vascularization, myofibril structure, and electrophysiological adaptation of hiPSC-CMs transplanted into rat hearts. RADA16 accelerated the transition of hiPSC-CMs toward adultlike gene expression profiles, enhanced sarcomere organization, and improved vascularization in the transplanted site. Flexible mesh nanoelectronics revealed fibrillation of transplanted hiPSC-CMs within the beating recipient heart, and RADA16 drastically reduced the automaticity of hiPSC-CMs. Our findings demonstrate the potential of self-assembling nanofibers to advance cardiac cell therapy and how flexible mesh nanoelectronics technology could improve safety.

Metagenomic editing of commensal bacteria in vivo using CRISPR-associated transposases

Diego Rivera Gelsinger, Carlotta Ronda, et. al

Abstract

Although metagenomic sequencing has revealed a rich microbial biodiversity in the mammalian gut, methods to genetically alter specific species in the microbiome are highly limited. Here, we introduce Metagenomic Editing (MetaEdit) as a platform technology for microbiome engineering that uses optimized CRISPR-associated transposases delivered by a broadly conjugative vector to directly modify diverse native commensal bacteria from mice and humans with new pathways at single-nucleotide genomic resolution. Using MetaEdit, we achieved in vivo genetic capture of native murine Bacteroides by integrating a metabolic payload that enables tunable growth control in the mammalian gut with dietary inulin. We further show in vivo editing of segmented filamentous bacteria, an immunomodulatory small-intestinal microbial species recalcitrant to cultivation. Collectively, this work provides a paradigm to precisely manipulate individual bacteria in native communities across gigabases of their metagenomic repertoire.

Ⅲ　Calling for papers

ICBEA 2026（IEEE）

Submission deadline:	**Nov 30, 2025**
Conference date:	**Mar 26, 2026 - Mar 29, 2026**
Full name:	**International Conference on Biomedical Engineering and Applications**
Location:	**Kitakyushu, Japan**

2026 10th International Conference on Biomedical Engineering and Applications (ICBEA 2026) will be held in Kitakyushu, Japan during Mar. 26-29, 2026. The objective of the 2026 10th International Conference on Biomedical Engineering and Applications (ICBEA 2026) is to provide a platform for researchers, engineers, academicians as well as industrial professionals from all over the world to present their research results and development activities on Biomedical Engineering and Applications.

Call for papers:
Biomedical Signal & Image Processing：
Bio-Medical Signal
Medical Imaging
Image Acquisition, Analysis and Processing
Wearable Sensors and Systems
……

Bioinformatics,Computational Biology & IoT in Healthcare：
Protein structure, function and sequence analysis
Computational proteomics
DNA and RNA structure, function and sequence analysis
Gene regulation, expression, identification and network
Structural, functional and comparative genomics
……

Devices and Smartphone Apps for Psychological Monitoring：

Bioinstrumentation and Biomedical Devices
Computer-aided Detection and Diagnosis
Brain-Computer Interfaces
Health Monitoring Devices
Biomedical Instrumentation
Biomedical Sensors
Biomedical Metrology
……

ICCCP 2026

Submission deadline: Dec 20, 2025
Conference date: Mar 3, 2026 - Mar 6, 2026
Full name: International Conference on Chemistry and Chemical Process
Location: Tokyo, Japan

2026 15th International Conference on Chemistry and Chemical Process (ICCCP 2026) will be held at Tokyo, Japan from March 3 to 6, 2026. The conference aims to promote and carry out interdisciplinary collaborative research on cutting-edge methods and technologies in the fields of chemistry, chemical engineering and chemical processes. The conference aims to attract participants from different backgrounds, provide participants with opportunities to exchange experiences and new ideas face to face and establish cooperative relationships, and promote cross-integration between different research fields.

We sincerely invite researchers, practitioners and industry experts to attend ICCCP 2026 to share ideas and find collaboration opportunities. Your participation will enrich our discussions and help shape the future of chemistry and chemical process. We look forward to seeing you in Tokyo, Japan!

Topics of Interest :
*Chemical, Environmental, and Process Engineering
Environmental engineering and sustainable development
Process design and optimization
Product innovation, development and economics

*Systematic Methods and Tools for Managing the Complexity
Multiscale modeling
Process synthesis & design
Process control & operations

*Chemistry and Chemical Engineering Fundamentals
Chemical engineering fundamentals
Physical, Theoretical and Computational Chemistry
Chemical engineering educational challenges and development

*Integration of Life Sciences & Engineering
Biochemical Engineering
Biotechnology
Product Engineering in the Bio Industries

ICCFE 2026

Submission deadline: **Dec 25, 2025**
Conference date: **Apr 3, 2026 - Apr 6, 2026**
Full name: **International Conference on Chemical and Food Engineering**
Location: **Osaka, Japan**

2026 11th International Conference on Chemical and Food Engineering (ICCFE 2026) will be held in Osaka, Japan during April 3-6, 2026. ICCFE 2026, is to bring together innovative academics and industrial experts in the field of Chemical and Food Engineering to a common forum.

Chemical engineering is a branch of engineering that applies physical sciences (physics and chemistry), life sciences (microbiology and biochemistry), together with applied mathematics and economics to produce, transform, transport, and properly use chemicals, materials and energy.

Food engineering is a multidisciplinary field which combines microbiology, applied physical sciences, chemistry and engineering for food and related industries. Food engineering includes, but is not limited to, the application of agricultural engineering, mechanical engineering and chemical engineering principles to food materials.

The primary goal of the conference is to promote research and developmental activities in Chemical and Food Engineering. Another goal is to promote scientific information interchange between researchers, developers, engineers, students, and practitioners working in Japan and abroad. The conference will be an ideal platform for people to share views and experiences in Chemical and Food Engineering and related areas.

Call for Papers:
Chemical, Environmental, and Process Engineering：
Environmental engineering and sustainable development
Process design and optimization
Product innovation, development and economics
Process intensification

Chemistry and Chemical Engineering Fundamentals：
Chemical engineering fundamentals
Physical, Theoretical and Computational Chemistry
Chemical engineering educational challenges and development
Chemical reaction engineering

Others：
Food Biotechnology
Food engineering education
Food microstructure development and characterization
Food properties including thermal, chemical and mechanical properties
……

POLY 2026

Submission deadline: Dec 29, 2025
Conference date: Nov 4, 2026 - Nov 6, 2026
Full name: Eighth International Symposium Frontiers in Polymer Science
Location: Chengdu, China

Frontiers in Polymer Science will be held 11-14 June 2026 in Chengdu, China in association with Progress in Polymer Science, Polymer, EPJ, Polymer Degradation and Stability, Reactive and Functional Polymers, Polymer Testing and Giant
Submit abstract by 19 December 2025
Join the mailing list to receive updates on future meetings in the series.
This conference is organized by Elsevier.

***Call for papers:**

- Novel synthetic routes for polymerization
- Molecular recognition and higher order polymer structures
- Supramolecular and supracolloidal architectures
- Sequence- and topology-specific polymers
- New polymer structures by macromolecular engineering
- Polymerization mechanisms and kinetics
- Functional modification of polymers
- Soft and hard nanoparticles
- Conjugated/conducting polymers
- Bio-inspired polymer systems
- Externally controlled polymerizations

ICBET 2026 (EI)

Submission deadline: **Jan 10, 2026**
Conference date: **Jun 12, 2026 - Jun 15, 2026**
Full name: **International Conference on Biomedical Engineering and Technology**
Location: **Bali, Indonesia**

2026 16th International Conference on Biomedical Engineering and Technology (ICBET 2026) will be held from June 12 to 15, 2026 in Bali, Indonesia. The conference is sponsored by Udayana University, supported by Kwangwoon University, Kyung Hee University, Tunku Abdul Rahman University of Management and Technology, Mapua University and Polytechnic University of Bari. The conference aims to bring together researchers, engineers, academicians, and industry professionals from around the world to present their latest research findings and advancements in the field of Biomedical Engineering and Technology. With a focus on the theme of "Advances in Biomedical Technologies: Integrating Imaging, Genomics, and Computational Approaches," the conference will explore cutting-edge developments and the integration of imaging, genomics, and computational methods in biomedical applications.

Topics of interest

1,Biomedical Imaging and Signal Processing Biomedical image processing and analysis/ Biomedical signal processing and analysis/ Medical data mining and machine learning/ AI in medical imaging and signal processing/ Medical image reconstruction techniques

2, Computational Genomics, Genetics, Bioinformatics: Computational methods in genomics and genetics/ AI in genomics and genetics/ Computational gene prediction and annotation/ Population genetics and genetic variation analysis/Functional genomics and transcriptomics

3, Biomedical Engineering and Healthcare Technology: Medical information systems and electronic health records/ Biomedical modeling and simulation/ Biomedical devices and instruments/ Human-computer interaction in biomedical engineering/ Wearable sensors and remote patient monitoring