Ingenious Brain

*Inno*July 2024

Monthly top innovations in **Life Science & Healthcare**

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Novel Light-Powered Enzyme System for Producing Natural Terpenoids

A team of researchers led by Professor Zhiguang Zhu from Tianjin University of Science and Technology and the Chinese Academy of Sciences have invented a new approach to produce α-foreseen using methanol and light. Instead of relying on plant extraction or conventional chemical synthesis, which can be inefficient and harmful, this new method leverages thylakoid membranes from plant cells. These membranes are essential in photosynthesis and energy production. By imitating the way plants convert light into chemical energy, researchers have developed a system where methanol is transformed into α- farnesene through a series of 13 enzyme-driven reactions powered by light. This process not only uses renewable resources but also achieves significant yields, making it a promising option for scalable industrial applications. The method's adaptability to different light conditions and potential for further efficiency improvements highlight its future relevance for sustainable industrial practices. This study underscores the growing importance of innovative, eco-friendly approaches in producing valuable natural compounds.

Improving Accuracy and Flexibility in Genetic Sensor Technology

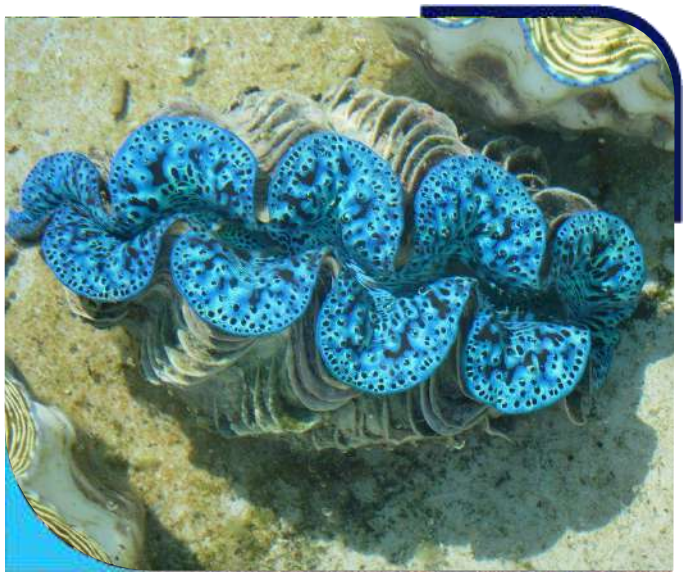
Genetic sensors are crucial for regulating gene expression in response to environmental changes, but their development has been limited by slow growth rates and challenges in precision and sensitivity. A recent review by Dr. Thomas Gorochowski, published in *BioDesign Research*, highlights significant advancements in this field. The study presents new, highly efficient biosensors that detect a broad range of substances with high specificity. Innovations include protein-based sensors, RNA aptamers, and advanced synthetic techniques like Sensing Enabled by Metabolic Pathways (SEMP) and Toehold switches. Integrating these sensors with light and electrical signals enhances their capabilities, offering promising applications in healthcare, environmental monitoring, and biotechnology. This progress underscores the potential for genetic sensors to revolutionize various fields by addressing complex global challenges.

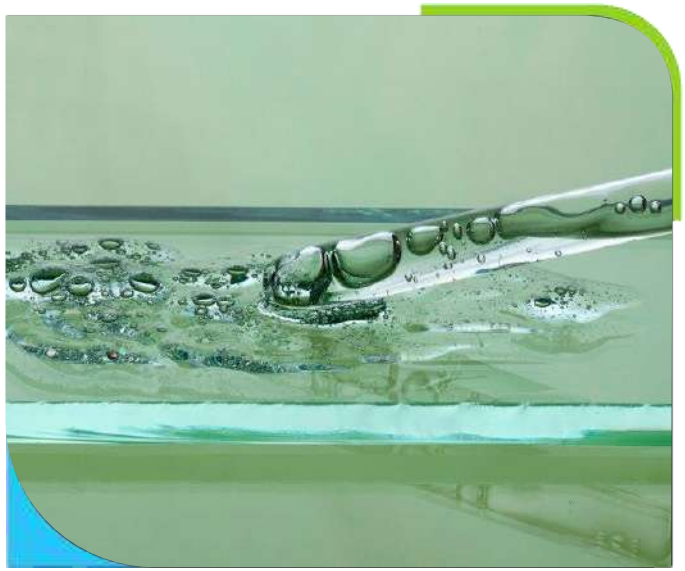
Advanced UAV Technique Improves Monitoring of Wheat Uniformity and Yield Forecasting

A new method developed by researchers of Nanjing Agricultural University uses unmanned aerial vehicle (UAV) imaging to measure wheat uniformity by estimating leaf area index (LAI), SPAD, fractional vegetation cover, and plant height. This approach calculates twenty uniformity indices throughout the growing season, with Pielou's LAI index showing the strongest link to yield and biomass. The study found that UAV-based assessments and models incorporating these indices significantly improved the accuracy of yield and biomass predictions compared to traditional methods. This innovative technique offers an efficient way to monitor wheat uniformity, providing valuable insights for crop management and future breeding programs.

Giant Clams Could Enhance Solar Energy Efficiency

According to a recent Yale study by Alison Sweeney, designers of solar panels and biorefineries might gain valuable insights from the iridescent giant clams found in tropical coral reefs. These clams have unique structures—vertical columns of photosynthetic algae covered by a light-scattering layer—that could make them incredibly efficient at harnessing solar energy. Despite their dark interiors, giant clams are more effective at converting sunlight into energy than current solar panel technologies. The study, published in *PRX Energy*, presents a model analyzing the clams' efficiency based on their geometry and light-scattering properties. The researchers found that the clams' ability to absorb sunlight is enhanced by their vertical algae arrangement and the iridocytes that scatter light. When the clams adjust their structure in response to sunlight changes, their efficiency improves dramatically, reaching 67%, compared to 14% for tropical green leaves. This research underscores the potential of nature-inspired designs for developing more efficient solar technologies, emphasizing the importance of preserving biodiversity to uncover such innovations.



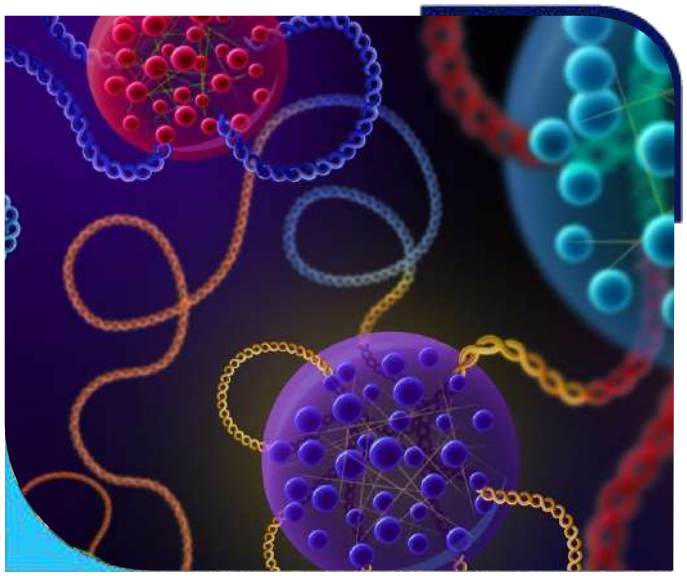


Study Uncovers How Bio-Inspired Methods Control Liquid Flow

The latest research from Hong Kong Polytechnic University (PolyU) has revealed a fascinating new way that nature controls liquid flow, potentially revolutionizing various technologies. Traditionally, it was thought that liquids could only move in one fixed direction in organisms with specific liquid transport features. However, PolyU researchers have discovered that the African plant Crassula muscosa, known for its succulent nature, can direct water flow in different directions. Published in *Science*, the study showed that this plant can move liquid either toward its tip or its root, depending on the orientation of its specialized leaves, which are shaped like fins. These fins control the flow by manipulating the liquid's surface meniscus. By mimicking this natural system with 3D-printed fins called CMIAs (*C. muscosa*-inspired arrays), researchers created a new tool for dynamically controlling liquid flow in industrial and lab settings. The CMIAs can even reverse flow direction using a magnetic field, making them useful for microfluidics, chemical synthesis, and biomedical diagnostics applications. This breakthrough offers exciting possibilities for improving fluid management and mixing in various technological fields.

Researchers Unveil Unprecedented View of Gene Transcription"

Every living cell transcribes DNA into RNA, a process that kicks off when the enzyme RNA polymerase (RNAP) binds to DNA. This binding causes the DNA to unwind and form a transcription bubble, allowing one DNA strand to be copied into RNA. Despite its importance, capturing RNAP during this rapid process has been challenging. A recent study published in Nature Structural & Molecular Biology has made a breakthrough by visualizing E. coli RNAP opening the transcription bubble. This study, led by Ruth Saecker and Seth Darst from Rockefeller University, achieved this by capturing RNAP in the act within 500 milliseconds of it encountering DNA. The research reveals four distinct intermediate complexes that form during this brief window, providing new insights into how RNAP binds to and processes DNA. The team's use of advanced cryo-electron microscopy and a high-speed robotic sample preparation system allowed them to observe these complex molecular interactions in unprecedented detail. Their findings suggest that the crucial step in transcription may be positioning the DNA template strand within RNAP's active site, which involves overcoming significant energy barriers. This new method offers a valuable tool for studying other rapid biological processes and could significantly advance our understanding of gene expression.

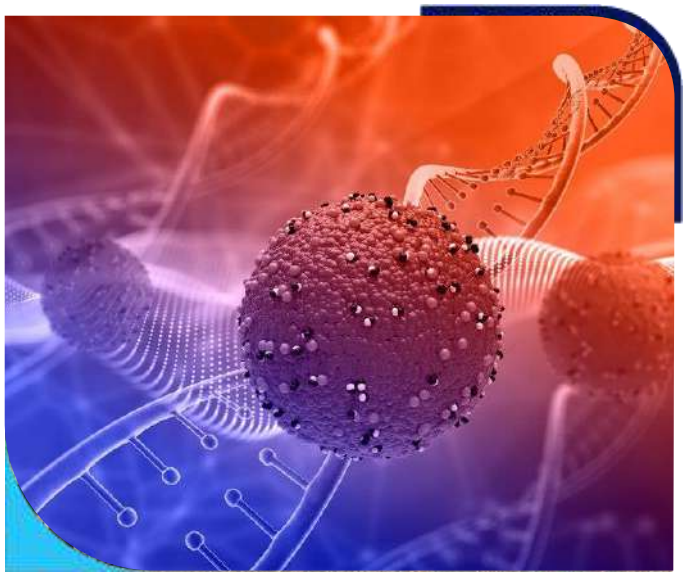


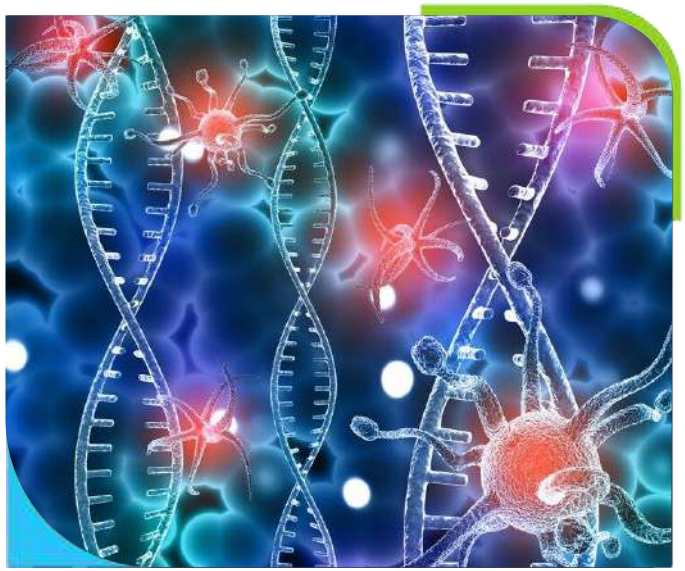
Strawberries under the high-tech magnifying glass

Strawberries are loved for their sweet flavor and health benefits, which come from specific biochemical compounds called biomarkers. Researchers from TU Bergakademie Freiberg and the University of Belgrade used ultra-high-resolution mass spectrometry to analyze these biomarkers in different strawberry varieties. Their study, published in *Wiley Analytical Science and Plants*, found that most important biomarkers are concentrated in the strawberry's red skin. One notable compound identified was pelargonidin-3-O-malonyglucoside, known for its antioxidant properties. The precise analysis technique allowed the researchers to map these compounds accurately, providing valuable insights for breeding strawberries that are both nutrient-rich and flavorful.

Researchers Innovate in Ultrafast Science for More Detailed Molecular Imaging

Researchers at SLAC National Accelerator Laboratory have advanced ultrafast science using the Megaelectronvolt Ultrafast Electron Diffraction (MeV-UED) instrument. Recent studies have improved the device's accuracy and efficiency. One study, published in *Structural Dynamics*, developed a new technique for better time resolution. Another, in *Nature Communications*, used artificial intelligence to optimize the electron beam for diverse experimental needs. These innovations enable more precise observation of rapid chemical reactions and material changes, pushing the boundaries of ultrafast science and enhancing the MeV-UED's capabilities for future research.





New Method for Forecasting Gene Expression Changes in Individual Cells

Advances in single-cell RNA sequencing have enabled detailed study of gene expression changes at the individual cell level. Still, challenges like sample acquisition and high sequencing costs necessitate improved computational prediction methods. To enhance prediction accuracy, Shengquan Chen's team developed SCREEN, a generative model combining masked variational autoencoders with optimal transport mapping. Published in *Frontiers of Computer Science*, SCREEN has been shown to significantly outperform existing methods in predicting gene expression responses to perturbations. It also demonstrates robustness to data noise and cell type imbalances, highlighting its potential for diverse biological analyses.

Team Unveils Easy Method for Creating Mouse and Bovine Cholangiocyte Organoids

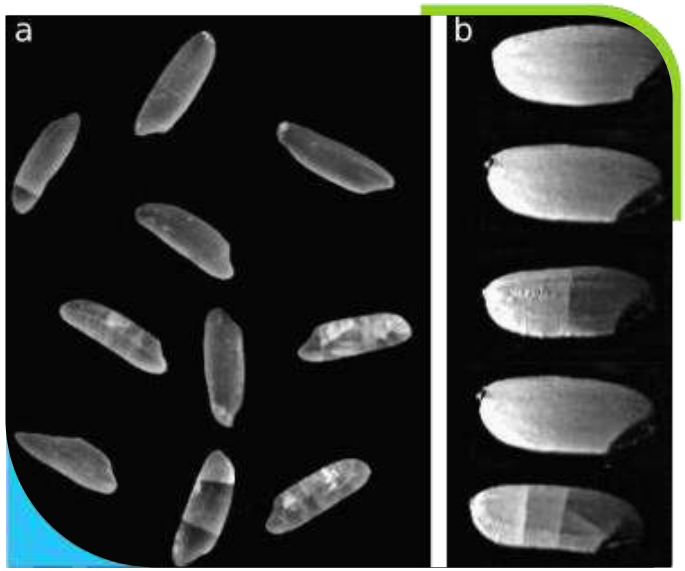
In a paper published in *eLife*, Chinese scientists led by Prof. Feng and Prof. Xiao from South China Agricultural University describe straightforward methods for creating mouse and bovine cholangiocyte organoids (Chol-orgs). These organoids support the growth of *Cryptosporidium parvum*, a parasite causing gastrointestinal disease, and facilitate in vitro studies of biliary cryptosporidiosis. The Chol-orgs, which can be maintained for over three months and cryopreserved for more than a year, enable the complete development of *C. parvum*, producing infectious oocysts. RNA-seq analysis reveals how *C. parvum* affects host immune responses and cell metabolism. This new model will aid research into Cryptosporidium-host interactions and potential treatments for liver infections, including those in AIDS patients.

Using Origami Techniques to Enhance 3D Bioprinting

Researchers at Tel Aviv University have used origami principles to solve a key challenge in 3D bioprinting: integrating sensors into tissue models. Instead of printing tissue over sensors, they designed an origami-inspired structure that folds around the bioprinted tissue, positioning sensors precisely. This method, known as the Multi-Sensor Origami Platform (MSOP), allows for accurate placement of sensors to monitor cell activity. The team demonstrated its effectiveness by recording neuronal activity in 3D-printed brain tissues and can also simulate the blood-brain barrier to study drug permeability. This innovative approach combines art with science to enhance tissue modeling and biological research.

Dual-Branch Network Improves Plant Disease Detection for Better Crop Protection

A team of researchers from the Chinese Academy of Sciences has introduced LGNet, a dual-branch network integrating convolutional neural networks (CNNs) and visual transformers (VTs) to enhance plant disease detection. LGNet excels in capturing both local and global features, achieving impressive accuracies of 88.74% on the AI Challenger 2018 dataset and 99.08% on a custom corn disease dataset. This advanced model outperforms traditional methods and single models like ConvNeXt-Tiny and Swin Transformer-Tiny by 1-2%. Published in Plant Phenomics, LGNet's dual-branch approach improves feature extraction and model performance, with future research aiming to develop lightweight models for mobile use and gather more real-world data to boost accuracy in precision agriculture.



New Non-Invasive Technique for Identifying Internal Cracks in Rice Seeds

Prof. Wang Rujing and Wang Liusan from the Hefei Institutes of Physical Science have developed a non-destructive method for detecting internal cracks in rice seeds using near-infrared spectroscopy. Published in *Spectrochimica Acta Part A*, their technique employs machine learning algorithms and spectral preprocessing to identify seed quality issues that are not visible to the naked eye. The study found that partial least squares discrimination combined with original spectral data provided the best results, improving both the efficiency and accuracy of rice seed quality assessment. This method offers a new tool for better seed quality control in agriculture.

New One-Step Technique for Making Multiple Genome Edits in Cells

Researchers at Gladstone Institutes have developed a one-step method to make multiple genome edits in cells using engineered retrons called multitrons. Unlike traditional approaches that edit genomes sequentially, multitrons enable simultaneous modifications at multiple sites. This advancement overcomes previous limitations, allowing large DNA sections to be deleted and enabling more efficient genetic engineering. Published in *Nature Chemical Biology*, the technique has potential applications in molecular recording and metabolic engineering, such as enhancing the production of compounds like lycopene and improving the sensitivity of cellular recordings.

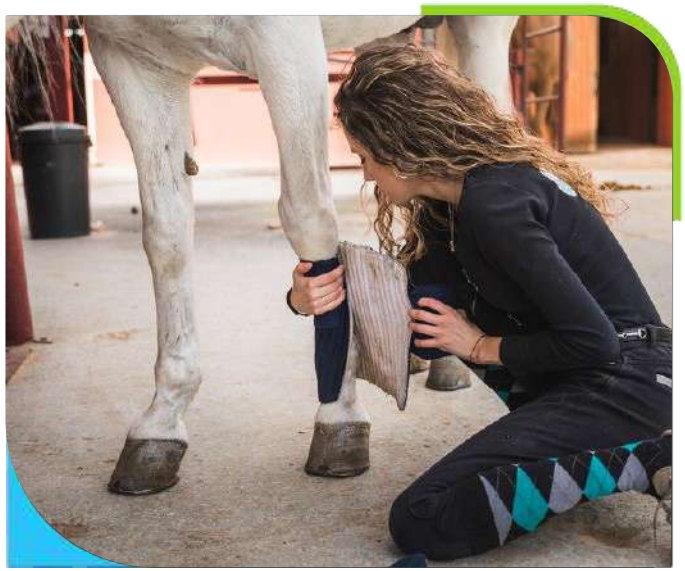
Engineered Poplar Trees Now Produce Squalene, a Valuable Chemical Traditionally Sourced from Shark Livers

Researchers at Michigan State University have engineered poplar trees to produce squalene, a valuable chemical typically sourced from shark livers. This advancement, detailed in the Plant Biotechnology Journal, highlights how poplars can be used to generate high-value chemicals and biofuels, potentially reducing the need for shark harvesting.

Squalene, used in cosmetics and vaccines, is produced by the engineered trees through two chemical pathways: one in the cytosol and another in chloroplasts. The chloroplast method yielded 0.63 milligrams of squalene per gram of leaves. Despite the production cost being higher than shark-derived squalene, strategies like increasing production or converting squalene to ambrein—a high-value compound found in ambergris—could improve economic viability. This research underscores the potential of engineered poplars to contribute to sustainable chemical production and biofuel development.

New Technologies from Robots to Drones Revolutionize Soil Health Monitoring and Improvement for Farmers

Jennifer Rowntree, the conversation, Recent advancements are addressing this issue through various methods. Satellite sensors now provide detailed imagery to track soil health and degradation, helping farmers make more informed decisions. Soil sensors, including portable and drone-mounted versions, measure organic matter and soil conditions without disturbing crops. Animal sensors monitor livestock movement, identifying areas at risk of soil compaction and optimizing grazing practices. Additionally, mobile DNA sequencers enable rapid, in-field detection of soil pathogens and microbial communities, offering timely insights into soil health. These technologies enhance soil monitoring efficiency and cost-effectiveness, supporting better agricultural practices to safeguard soil for future generations.



Movement Sensors Hold Potential for Detecting Horses at Risk of Injury

Researchers at Washington State University, led by Dr. Warwick Bayly, use a small 3-ounce sensor to track racehorses and help prevent injuries. Developed by StrideSAFE, the sensor records 2,400 data points per second, capturing detailed stride patterns that reveal risk factors for catastrophic injuries. By comparing these patterns against an ideal stride and identifying deviations, the system assigns an injury risk factor to each horse. In tests at major racetracks, the sensors have successfully flagged horses at substantial risk of injury, allowing for early intervention and preventing major accidents. This technology, which has been deployed at tracks like Churchill Downs and Saratoga, could become a standard in racing to improve horse safety and extend careers.

Technique for Targeted Gene Silencing to Advance Research and Therapy

Researchers at RIKEN have developed a precise gene-silencing method named CRISPRδ, detailed in Nature Communications. This technique temporarily silences specific genes by targeting RNA with a modified Cas13 enzyme, which blocks ribosomes from translating the RNA without damaging nearby RNA strands. Unlike existing methods, CRISPRδ offers high specificity with minimal off-target effects. This advancement holds promise for both advancing genetic research and developing targeted therapies for genetic diseases, though its efficiency compared to RNA interference is still being optimized.

New Protein Discovered That Blocks CRISPR-Cas System Activity

A study published in Nature reveals the discovery of AcrIF25, a novel anti-CRISPR protein identified by researchers from the Institute of Biophysics of the Chinese Academy of Sciences and the University of Toronto. AcrIF25 inhibits the I-F type CRISPR-Cas system by dismantling the Csy complex, specifically targeting and dissociating the Cas7 subunits without directly binding to the entire complex. The protein disrupts the interaction between Cas7 and crRNA, leading to the breakdown of the Csy complex. This finding offers new insights into CRISPR regulation and could inform the development of advanced gene-editing technologies.

Team Creates the First Cell-Free System Integrating Genetic Information and Metabolism

Researchers led by Tobias Erb at the Max Planck Institute have created the first cell-free system where genetic and metabolic networks sustain each other. This system, described in science, integrates a synthetic metabolic cycle (Cetch) and a genetic network (Pure) that continuously produce essential components and enzymes. By making the components interdependent—Cetch produces glycine for Pure, and Pure produces enzymes for Cetch—the system can operate for at least twelve hours with minimal external input. This breakthrough lays the foundation for future self-sustaining synthetic biological systems and could eventually lead to systems powered by light or sustainable electricity.

Scientists Create New Method for Storing Essential Medicines Without Refrigeration

Researchers led by Tobias Erb at the Max Planck Institute have created the first cell-free system where genetic and metabolic networks support each other. This system, detailed in science, integrates the synthetic Cetch cycle and the Pure genetic system to produce enzymes and essential building blocks. The system operates in vitro, with the Cetch cycle generating glycine from CO2 to fuel the Pure system. Once initiated with a small amount of glycine, it can sustain itself for at least twelve hours. Although still reliant on external inputs, this development is a significant step toward creating fully self-sustaining synthetic biological systems that could eventually run on renewable resources.

Enhanced RNA Drug Production: New Enzymatic Method Reduces Toxic Byproducts and Expands Capabilities

Researchers from Harvard's Wyss Institute and Medical School have developed a new RNA synthesis method that uses enzymes and water instead of toxic chemicals. This innovative approach produces RNA with high efficiency and purity, avoiding harmful byproducts and expanding the range of possible RNA modifications. Their method employs a yeast-derived enzyme engineered to incorporate nucleotides efficiently while avoiding damaging chemical reactions. This new technique not only aligns with industry standards but also supports the scalable production of RNA drugs. The breakthrough promises to advance RNA therapeutics, reduce environmental impact, and potentially revolutionize the field.

Developing a Chemical-Free RNA-Based Method for Controlling Flystrike in Sheep

Researchers at the University of Queensland have made progress towards a chemical-free method for controlling flystrike in sheep using RNA technology. Led by Dr. Karishma Mody and Yunjia Yang, their study focuses on using double-stranded RNA (dsRNA) to disrupt the growth of the sheep blowfly, a significant pest affecting sheep welfare and costing Australia $280 million annually. Initial tests on 12 genes showed promising results in slowing blowfly growth. Challenges remain, such as dsRNA degradation, but the team is developing delivery methods to enhance stability. This sustainable, non-toxic approach may also be applicable to other livestock pests.

A premium pectin that gels effectively with reduced sugar recipes

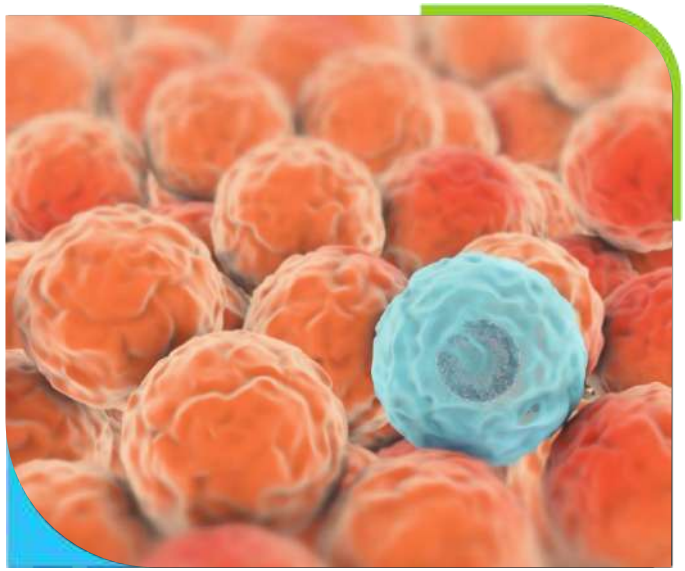
Scientists from the USDA's Agricultural Research Service (ARS) have developed a cost-effective, high-quality pectin that gels effectively in low-sugar products. Traditionally, pectins require high sugar levels to gel, but the new pectin, extracted from orange peels using a simple high-pressure processing method, maintains its gelling properties without unwanted residues. This innovation addresses the growing demand for low-sugar foods and is expected to significantly impact the pectin market, projected to exceed $2 billion by 2025. The research, involving collaboration across ARS laboratories in Florida, California, and Pennsylvania, highlights the effectiveness of combining expertise and resources to advance agricultural solutions.

Expanding the CRISPR Toolkit: Enabling Gene Scissors to Identify RNA

Researchers at the Helmholtz Institute for RNA-based Infection Research have developed a new method called PUMA that extends CRISPR technology to RNA detection. While traditional CRISPR systems, like Cas9, target DNA, PUMA utilizes Cas12 nucleases to identify RNA biomarkers, overcoming previous limitations. This approach reprograms tracrRNAs to guide Cas12 to RNA, even in the absence of specific recognition sequences. PUMA promises high sensitivity and broad application, including detecting bacterial pathogens and viral RNA, and could revolutionize molecular diagnostics. The method's potential was demonstrated by identifying five bacterial pathogens associated with acute sepsis, paving the way for enhanced diagnostic technologies.

Improving Ratoon Rice Production and Sustainability with Advanced Breeding and Mechanization

A recent review highlights the advancements in ratoon rice cultivation in China, driven by improved breeding techniques and technology. Key areas such as cultivar selection, stubble height, and water and fertilizer management are crucial for enhancing rice regeneration and yields. Despite the historical use of ratoon rice and its rise due to hybrid technology, challenges like mechanical damage and low regeneration rates persist. The review, published in Technology in Agronomy, emphasizes the need for further research into agronomic traits and breeding practices. It underscores the importance of developing early, medium, and late-maturing varieties, and improving mechanization and infrastructure to boost sustainability and efficiency in ratoon rice farming .



The Advancing Field of Single-Cell and Spatial Technologies

The scTrends Consortium, led by Associate Professor Adam Cribbs and Dr. Jake Taylor-King, has released its first report on the state of single-cell and spatial genomics. Published in *Nature Biotechnology*, the report reviews the latest trends and commercial developments in the field, highlighting its growing impact on drug discovery and personalized medicine. The consortium, which includes experts from institutions like the Francis Crick Institute and MIT, tracks advancements in technology and market activity, aiming to provide a comprehensive resource for researchers and industry professionals.

Study Identifies Rhizobia Strains That Combat Soybean Root Rot Fungal Pathogens

Researchers have identified three effective rhizobia strains—Rhizobium sp. TZSR12C, Rhizobium sp. TZSR25B, and Bradyrhizobium sp. TZSR41A—that suppresses root rot fungal pathogens in soybeans. Tested under both in vitro and greenhouse conditions, these strains showed strong potential as biocontrol agents, with Rhizobium sp. TZSR12C performing particularly well. The study, published in Technology in Agronomy, highlights the need for further field trials to confirm these findings and to explore the specific mechanisms behind the rhizobia's biocontrol efficacy.

Cutting-edge Deep Learning and UAV Imagery Enhance Precision Agriculture for Future Food Security

A study published in Technology in Agronomy, evaluated the performance of AlexNet, a Convolutional Neural Network (CNN), for crop classification using high-resolution UAV imagery. The research found AlexNet significantly outperformed traditional CNN models, achieving a training accuracy of 99.25% and a validation accuracy of 71.81% compared to the conventional model's 62.83% and 46.98%, respectively. The study highlights the effectiveness of deep learning in precision agriculture but notes the need for early stopping to prevent overfitting. Future work will focus on optimizing AlexNet's performance and further improving crop classification methods to bolster food security.

Genome Recording: Enabling Cells to Act as Their Own Historians

Researchers have developed a method called ENGRAM, which enables living cells to record transient biological events, akin to a flight recorder in an aircraft. Led by Dr. Jay Shendure and his team, ENGRAM, short for enhancer-driven genomic recording of transcriptional activity in multiplex, encodes biological signals into the genome using symbolic barcodes. Published in *Nature*, this technique allows for detailed tracking of gene activity and cellular responses. By combining ENGRAM with the DNA Typewriter system, the team successfully recorded activities related to gene regulation, cell development, and stress responses. This breakthrough could advance our understanding of cellular processes and improve genomic recording technologies.

Self-Sustaining Soil: Innovations in Autonomous Watering and Nutrient Supply

Researchers at The University of Texas at Austin have developed a hydrogel-infused soil that captures atmospheric water and manages controlled fertilizer release. This leads to healthier plant growth with reduced water and fertilizer use. This innovative soil technology, detailed in ACS Materials Letters, promises to ease farmers' irrigation and fertilization demands while being adaptable to various climates. The smart soil demonstrated a 138% increase in plant stem length and about 40% water savings in experiments. This advancement addresses global water scarcity and nutrient inefficiency, with ongoing research aiming to integrate different fertilizers and conduct extended field tests.

Accelerating Gene Silencing: New Insights into RNAi Tool Design

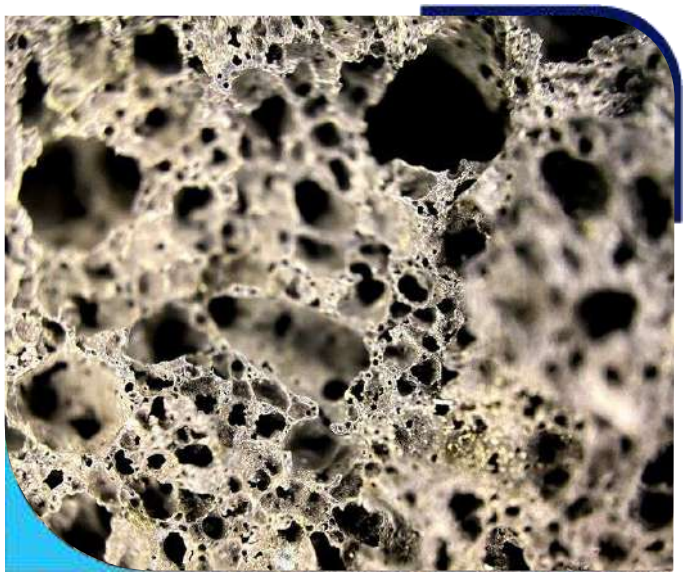
Researchers have gained new insights into RNA interference (RNAi) by studying the mechanics of the Argonaute 2 (AGO2) protein involved in gene silencing. A study led by David Bartel and Peter Wang, published in Molecular Cell, reveals that slicing rates of guide RNAs (gRNAs) can vary widely, affecting RNAi efficiency. The team discovered that slicing speed can differ by up to 250-fold among various gRNAs, with slower slicing rates potentially limiting gene silencing effectiveness. They also identified specific design features, such as base substitutions in the guide RNA, which influence slicing rate and efficacy. These findings not only validate existing RNAi design guidelines but also propose new ones to enhance RNAi tool performance and reduce off-target effects.

Innovative Liquid SNP Chip to Advance Rubber Tree Breeding

Researchers have created and validated a liquid SNP chip called "HbGBTS80K," which features 80,080 SNPs across 18 chromosomes. This chip efficiently categorized 404 rubber tree accessions into four distinct groups and identified the major gene HbPSK5 related to laticifer rings, a key trait for rubber yield. Published in *Tropical Plants*, the study demonstrates the chip's effectiveness in enhancing genetic diversity analysis and functional gene identification. The HbGBTS80K chip, developed from resequencing 335 rubber tree accessions, represents a significant advance in molecular breeding, promising to improve rubber tree breeding efficiency and potentially serving as a model for other crops.

Nanoscopic Imaging Enhances Insight into Protein and Tissue Preservation in Ancient Bones

A study from North Carolina State University demonstrated that nanoscopic 3D imaging of ancient bones can offer new insights into the preservation of soft tissues like collagen and blood vessels during fossilization. By comparing modern and Ice Age bones using techniques such as scanning electron microscopy (SEM) and time-of-flight secondary ionization mass spectrometry (ToF-SIMS), researchers found that Ice Age bones often retain much of their original organic material. This imaging approach not only enhances our understanding of fossilization but also shows promise for quickly screening bones to identify those likely to preserve ancient DNA and proteins.



Researchers Create Faster, More Affordable Soil Nutrient Detection Method

Researchers at the University of Missouri, led by Matthias Young, are developing a novel, cost-effective sensor for measuring soil nitrates and phosphates. This new technique promises faster and more accurate detection by assessing ion movement through a membrane rather than binding strength. Traditional methods, including expensive ion-selective electrodes and lab-based analyses, are costly and slow. Young's approach aims to improve fertilizer efficiency and reduce nutrient runoff, contributing to waterway pollution and significant financial losses for farmers. The team's progress, outlined in ACS Omega, includes creating handheld and field-installable sensors, though challenges remain before commercialization.

Octopus and Squid Pigments Boost Sunscreen Efficacy While Remaining Eco-Friendly

Camille Martin and Leila Deravi's company, Seaspire, is advancing skincare with Xanthochrome, a synthesized compound inspired by pigments in cephalopods. Recent research in the International Journal of Cosmetic Science confirms that Xanthochrome enhances sunscreen efficacy with zinc oxide and does not harm coral. Xanthochrome, derived from cephalopod skin, offers significant antioxidant properties and UV protection while avoiding the environmental and health issues associated with traditional chemical UV filters. Seaspire aims to incorporate Xanthochrome into a range of skincare products, promoting both human safety and ecological sustainability

Researchers Design Gene-Control Circuits Using Logic Gate-Based Smart Guide RNAs

Researchers from POSTECH have developed a new type of guide RNA that acts as a smart RNA, capable of controlling gene networks based on multiple signals. This innovative guide RNA integrates CRISPR/Cas technology with biocomputing, enabling it to make decisions similar to logic gates in digital circuits. By using this approach, the team successfully regulated key genes in E. coli, demonstrating the ability to manage complex gene networks and responses. This advancement could lead to more precise gene therapies and personalized treatments for various diseases. The study, published in Nucleic Acids Research, represents a significant leap in RNA molecular engineering and gene therapy design.

New Biosensor Uncovers Gibberellin's Essential Role in Nitrogen Fixation in Legumes

Researchers from the University of Cambridge have discovered that the plant hormone gibberellin (GA) is crucial for the formation, maturation, and growth of nitrogen-fixing root nodules in legumes. Their study, published in The Plant Cell, used the advanced nlsGIBBERELLIN PERCEPTION SENSOR 2 (GPS2) to precisely track GA levels and distribution. They found that GA is essential at specific stages of nodule development, contradicting previous reports of its inhibitory role. By identifying the exact timing and locations of GA's action, the research clarifies how GA influences nodule formation and could help improve legume yields and transfer nitrogen fixation traits to other crops.

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