Division of Biotechnology
Half Yearly Newsletter

BIOLUMIERE

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Plasmacytoid dendritic cells control homeostasis of megakaryopoiesis

Platelets play a crucial role in blood clotting, and our bodies need to maintain a careful balance in how many of them are produced every day. These platelets are formed from large bone-marrow cells called megakaryocytes, which are continuously made and broken down. Despite their importance, the exact mechanisms that help the body sense when platelet production needs adjustment have not been fully understood.

This study highlights an unexpected player in this process: plasmacytoid dendritic cells (pDCs), immune cells traditionally known for their role in antiviral defense. Researchers found that pDCs closely monitor dying megakaryocytes in the bone marrow. When increased cell death is detected, pDCs release interferon-alpha (IFN-α), which helps regulate the production of new megakaryocyte progenitors.

What makes this discovery particularly interesting is the identification of a direct communication loop between the immune system and blood cell formation. This insight deepens our understanding of platelet homeostasis and could be significant for studying bleeding disorders, bone-marrow dysfunction, and immune-based therapies.

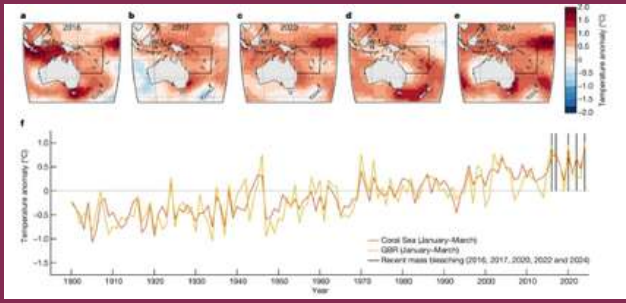
- Devashish Wakde URK22BT4017

Plant Bling: Cellulose That Sparkles

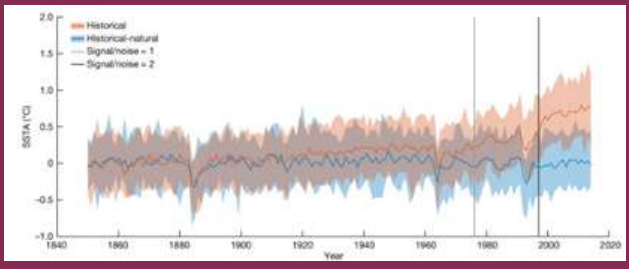
In a compelling example of sustainable materials innovation, Nature Biotechnology reports on Sparxell's development of cellulose nanocrystals (CNCs) that produce vibrant, iridescent colors without relying on synthetic dyes, microplastics, or mined glitter materials such as titania and mica. Derived from wood pulp and other plant waste, these CNCs reflect light through structural coloration—the same physical principle responsible for the shimmering hues of butterfly wings and peacock feathers—rather than chemical pigments. As a result, the colors are durable, fade-resistant, and biodegradable, offering a high-performance alternative to plastic glitter widely used in packaging, cosmetics, and personal care products.

Sparxell's patent-protected process involves creating a cellulose nanocrystal suspension that is dried into large, iridescent films capable of delivering consistent optical effects. While the science is well established, the primary challenge lies in scaling production for industrial use. To address this, the company is developing prototypes and proof-of-concept samples across target sectors including cosmetics and fashion, alongside expanding its manufacturing capabilities. Recently, Sparxell secured over $3.2 million in seed funding, underscoring investor confidence in the technology's commercial and environmental potential. The innovation positions plant-based structural color as a viable, circular alternative for industries seeking to eliminate microplastics and reduce environmental impact.

-Nidhi Daniel URK22BT1028



Widespread high SSTAs during GBR mass bleaching events.



Climate change is driving the rise in Coral Sea January–March SSTAs.

Highest ocean heat in four centuries places Great Barrier Reef in danger

Coral reefs are highly sensitive ecosystems, and even small increases in ocean temperature can cause widespread damage. In recent years, mass coral bleaching events have become more frequent, but it has been difficult to place today's warming in a long-term historical context. This study set out to answer a key question: just how unusual are current ocean temperatures, and what do they mean for reef health?

By combining modern ocean temperature records with historical coral data stretching back nearly 400 years, researchers found that the Coral Sea is now experiencing its highest ocean heat levels in centuries. These extreme temperatures are directly linked to large-scale bleaching events across the Great Barrier Reef.

What makes this finding especially striking is the clear evidence that recent heat levels are well outside natural variability. This work strongly reinforces the link between climate-driven ocean warming and reef decline, highlighting the urgent need for climate action to protect one of the world's most important marine ecosystems.

-Harini S URK22BT1061

This milestone marks a significant advancement in plant synthetic biology, demonstrating the safe application of genetic engineering for ornamental horticulture.

Bioluminescent Petunias Approved for Commercial Release in the United States

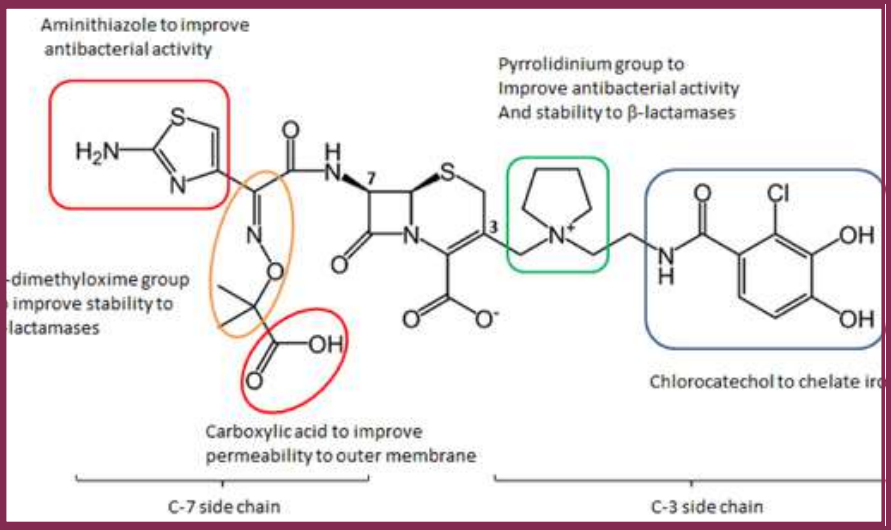
In a landmark development for plant biotechnology, genetically engineered bioluminescent petunias have received approval for commercial sale in the United States. Following a detailed assessment, the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (USDA-APHIS) determined that these plants pose no greater plant pest risk than conventionally bred petunias. The approval marks the first time a glowing ornamental plant has been cleared for widespread consumer use in the country.

The bioluminescent trait is achieved through the introduction of genes involved in natural light-producing biochemical pathways, enabling the plant to emit a soft, visible glow without external chemical inputs. While the immediate appeal lies in their novelty and aesthetic value, researchers emphasize that the broader significance extends beyond ornamentation. Similar genetic systems could eventually be adapted for agricultural applications, such as real-time visualization of plant stress, nutrient status, or disease progression.

This regulatory decision reflects growing confidence in precisely engineered plant traits and highlights how transparent risk assessment can facilitate public acceptance of innovative biotechnology products.

- Henry Y URK22BT1017

New Class of Antibiotics Effective Against Multidrug-Resistant Bacteria



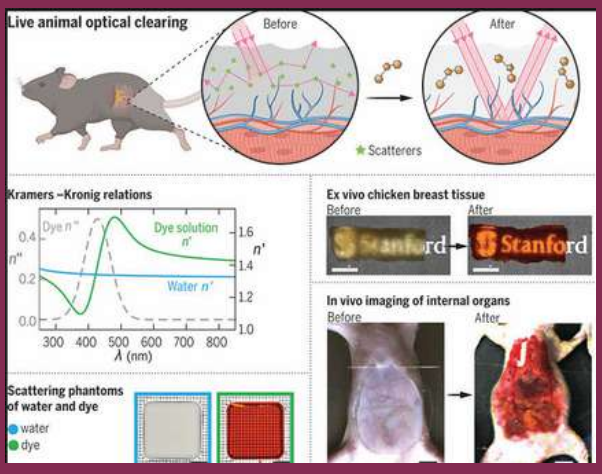
The figure depicts a rationally designed antibiotic structure with specific side-chain modifications to enhance antibacterial activity and β-lactamase stability

Researchers at Uppsala University announced the discovery of a novel class of antibiotics that demonstrate potent activity against multidrug-resistant Gram-negative bacteria, a group of pathogens that pose a severe global health threat due to rising antibiotic resistance. The new compounds target a critical bacterial enzyme called LpxH, which plays a key role in synthesizing the protective outer membrane (lipopolysaccharide) of these bacteria. Targeting LpxH is significant because it represents a mechanism that is distinct from those of existing antibiotics, meaning pathogens are less likely to harbor pre-existing resistance.

In controlled laboratory studies, the new antibiotic class not only showed broad activity against critical resistant species such as Escherichia coli and Klebsiella pneumoniae but also cured bloodstream infections in mouse models, providing strong evidence of in vivo efficacy. Because the LpxH protein has not been previously exploited as a drug target and resistance mechanisms are absent in existing clinical strains, this discovery addresses a key gap in the antibiotic pipeline and offers a promising direction for future therapeutic development pending further optimization and clinical trials.

- Rachel C G URK22BT1011

Achieving optical transparency in live animals with absorbing molecules



The figure demonstrates live animal optical clearing techniques that reduce light scattering to enhance deep-tissue and organ imaging.

Seeing inside living animals without surgery has long been a challenge in biology. While advanced imaging tools exist, tissues like skin and muscle naturally scatter light, limiting how deeply researchers can observe biological processes in real time. This study addresses a long-standing problem: can living tissues be made temporarily transparent without harming the animal?

Researchers demonstrated that certain light-absorbing molecules can be applied to live mice to briefly reduce light scattering in tissues, effectively making parts of the body optically transparent. These molecules work by balancing how light is absorbed and scattered, allowing light to pass through tissues more cleanly without altering their structure or function.

What makes this work especially remarkable is that the transparency is reversible and non-invasive. Once the molecules are removed, normal tissue properties return. This breakthrough opens new possibilities for real-time imaging of organs, blood vessels, and disease processes in living animals, with potential applications in biomedical research, diagnostics, and drug development.

- Santhosh URK22BT1019

Philippines Grants Clearance to Gene-Edited Bananas to Reduce Food Waste

Reduced-browning banana lines TRB011001 and TRB011002 are genetically modified to suppress polyphenol oxidase activity, minimizing enzymatic browning after cutting or bruising.

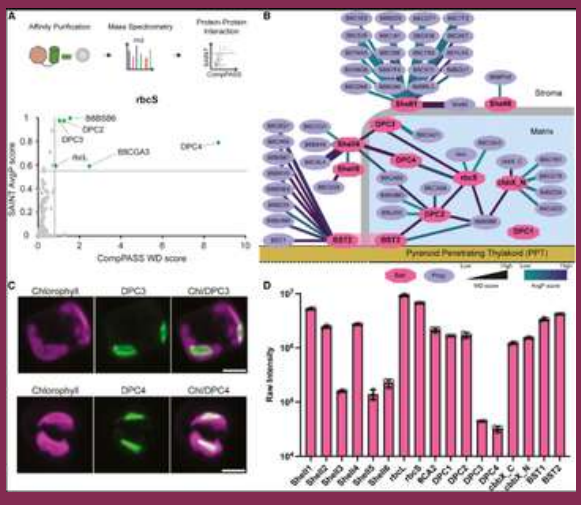
The Philippine Bureau of Plant Industry (BPI) has granted Certificates of Non-Coverage to two gene-edited banana varieties designed to reduce post-harvest browning, formally classifying them as non-GMO under national biosafety regulations. This decision followed a rigorous scientific review confirming that the bananas were developed without introducing foreign DNA, aligning them with modern gene-editing standards.

Bananas are a dietary staple and major export commodity, yet they suffer significant losses due to rapid browning that affects appearance rather than safety or nutrition. By delaying enzymatic browning, these gene-edited varieties have the potential to extend shelf life, reduce food waste across supply chains, and lower greenhouse gas emissions associated with discarded produce.

The approval places the Philippines among a growing number of countries adopting trait-based regulatory approaches for gene-edited crops. It also highlights how precision breeding technologies can address sustainability challenges while remaining compatible with existing food safety frameworks. This decision may encourage further innovation in crop improvement aimed at resilience, efficiency, and environmental responsibility.

- Samantha Sevana URK22BT1009

A protein blueprint of the diatom CO2-fixing organelle



This protein blueprint provides molecular insight into carbon concentration mechanisms that enhance photosynthetic efficiency in diatoms.

Photosynthesis is one of the most important biological processes on Earth, yet many of its finer details are still being uncovered. Diatoms—microscopic algae found in oceans—play a major role in global carbon fixation, largely due to a specialized structure called the pyrenoid. While the pyrenoid is known to concentrate carbon dioxide and improve photosynthetic efficiency, its precise molecular organization has remained unclear.

In this study, researchers created a detailed protein map of the diatom pyrenoid using advanced proteomic techniques. By identifying and localizing the proteins that make up this CO_2-fixing organelle, the team revealed how its structure supports efficient carbon capture and fixation within the cell.

What makes this work particularly noteworthy is the clarity it brings to how the pyrenoid is assembled and maintained at the molecular level. This insight is significant not only for understanding marine photosynthesis and the global carbon cycle, but also for future biotechnological efforts aimed at improving carbon fixation in crops or developing climate-focused bioengineering solutions

- Ezra Mathew URK22BT1059

Highlights

From Transcription to Translation- A Biotechnology Career Perspective; 11.03.2024

Transformative Healthcare Insights through Artificial Intelligence and Machine Learning; 15.03.2024

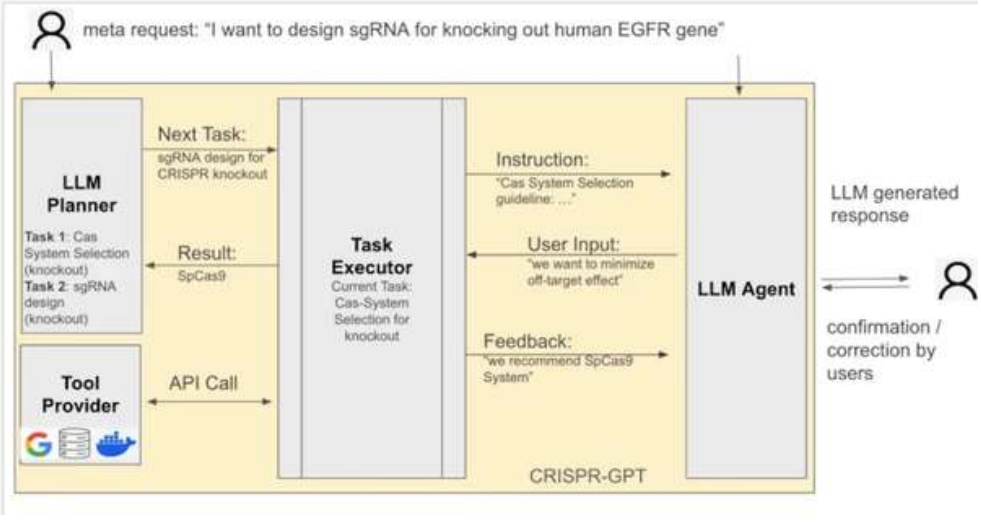
Soil-Borne supremacy: Functional Role of Beneficial Microbiome in Plant Health; 31.07.2024

Scientists Develop CRISPR-GPT: An AI-Assisted Platform to Automate Gene-Editing Design

In a significant advancement at the intersection of biotechnology and artificial intelligence, researchers unveiled CRISPR-GPT, an innovative AI-driven framework designed to streamline the planning and execution of CRISPR-based gene-editing experiments. By integrating a large language model (LLM) with domain-specific biological knowledge and computational tools, CRISPR-GPT assists scientists in designing optimal guide RNAs, selecting appropriate CRISPR systems, recommending cellular delivery methods, drafting experimental protocols, and outlining validation strategies. The system aims to reduce the technical barriers involved in CRISPR experiment planning, enabling researchers—particularly those without deep expertise in genome engineering—to conceptualize and design editing workflows from scratch.

What sets CRISPR-GPT apart from traditional LLMs is its ability to incorporate mechanistic understanding of genome-editing biology and generate context-aware recommendations that align with real-world experimental constraints. In proof-of-concept applications, the platform demonstrated efficacy in guiding experimental design choices that would typically require specialized training and extensive literature review. By blending human-like reasoning with structured biological data, this approach could accelerate research productivity across academic and industrial laboratories, democratize access to gene-editing tools, and support more rapid innovation in therapeutic and agricultural biotechnology.

-Dennis Jose URK22BT1023



Schematic overview of CRISPR-GPT, an AI-assisted framework integrating LLM planning, task execution, and tool providers to automate CRISPR gene-editing design.

Highlights

INVICTUS Student Association Program;
07.10.2024

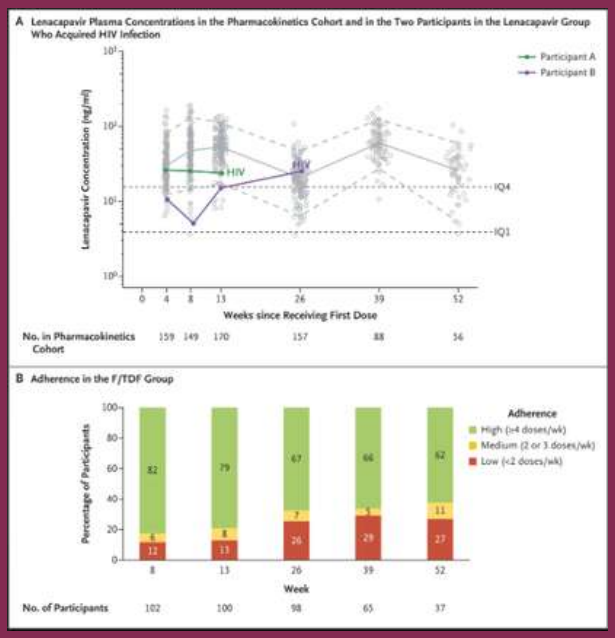
ALUMNI INTERACTION - OPPORTUNITIES IN BIOMEDICAL FIELD; 30.07.2024

Interaction lecture on "Higher Education Abroad"; 20.01.2024

Twice yearly Lenacapavir for HIV prevention in men and gender diverse persons

Preventing HIV infection has long relied on daily oral medications, which can be highly effective but are not always easy to maintain consistently. Missed doses, access barriers, and stigma have limited the real-world impact of existing pre-exposure prophylaxis (PrEP) strategies. This study set out to address a simple but important question: could long-acting protection make HIV prevention more practical and accessible?

In this large clinical trial, researchers tested lenacapavir, a long-acting injectable drug given just twice a year. Lenacapavir works by targeting the HIV capsid, a critical structure the virus needs to replicate. The results were striking—participants who received lenacapavir had near-complete protection against HIV infection, outperforming standard daily oral PrEP.
What makes this finding especially noteworthy is the dosing schedule. A twice-yearly injection could dramatically reduce adherence challenges and widen access to HIV prevention. This breakthrough has the potential to reshape global HIV prevention strategies and represents a major step forward in translating biotechnology into real-world public health impact.



he figure illustrates plasma lenacapavir concentrations over 52 weeks, showing sustained drug levels in participants, including those who acquired HIV, following twice-yearly dosing.

-Brijesh C L URK22BT1030