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BIOLUMIERE

Newsletter by the Department of Biotechnology

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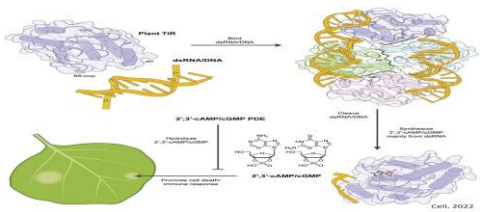
Neuromorphic memory device simulates neurons and synapses

Researchers have reported a nano-sized neuromorphic memory device that emulates neurons and synapses simultaneously in a unit cell, another step toward completing the goal of neuromorphic computing designed to rigorously mimic the human brain with semiconductor devices. Neuromorphic computing aims to realize artificial intelligence (AI) by mimicking the mechanisms of neurons and synapses that make up the human brain. However, current Complementary Metal-Oxide Semiconductor (CMOS)-based neuromorphic circuits simply connect artificial neurons and synapses without synergistic interactions, and the concomitant implementation of neurons and synapses still remains a challenge. To address these issues, a research team implemented the biological working mechanisms of humans by introducing the neuron-synapse interactions in a single memory cell, rather than the conventional approach of electrically connecting artificial neuronal and synaptic devices

How plants get immunity from microbes

Scientists have discovered a novel biochemical mechanism explaining how immune proteins defend plants against invading microorganisms. Their findings are published in the journal Cell. Key players in these plant immune responses are so-called immune receptors, which detect the presence of molecules delivered by foreign microorganisms and set in motion protective responses to repel the invaders.



'OFF THE SHELF' ENGINEERED STEM CELLS TO TREAT AGGRESSIVE BRAIN CANCER

Glioblastomas (GBMs) are highly aggressive cancerous tumors of the brain and spinal cord. Brain cancers like GBM are challenging to treat because many cancer therapeutics cannot pass through the blood-brain barrier, and more than 90 percent of GBM tumors return after being surgically removed, despite surgery and subsequent chemo- and radiation therapy being the most successful way to treat the disease.

In a new study, scientists devised a novel therapeutic strategy for treating GBMs post-surgery by using stem cells taken from healthy donors engineered to attack GBM-specific tumor cells. This strategy demonstrated profound efficacy in preclinical models of GBM, with 100 percent of mice living over 90 days after treatment

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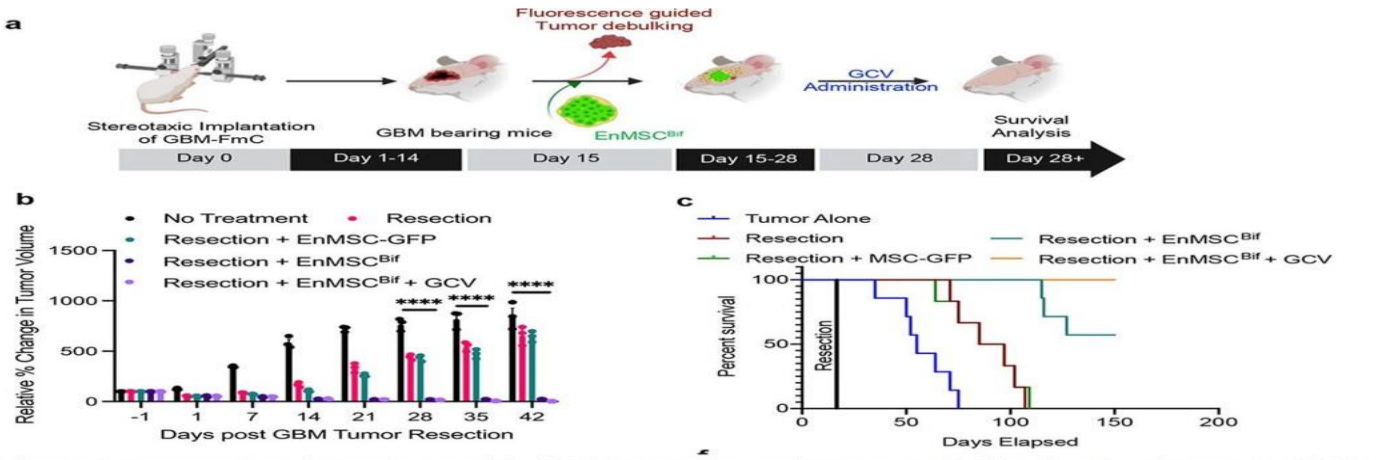
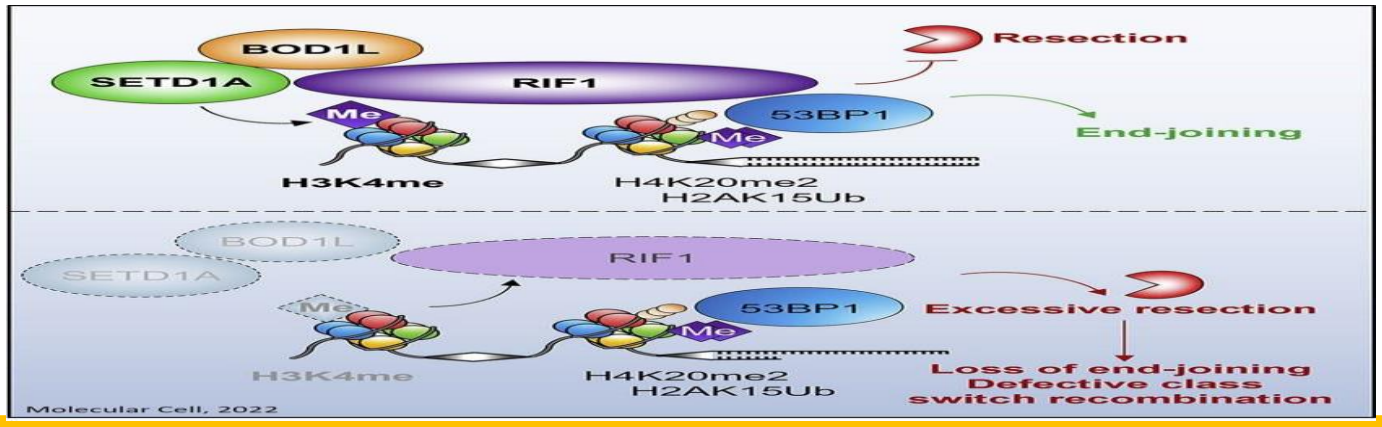


a Schematic representing the murine model of GBM resection and treatment. **b** Plot showing changes in GBM8-FmC tumor volume over time following EnMSC^{Bif} administration post tumor resection as compared to controls. **c** Kaplan–Meier survival analysis of EnMSC^{Bif} treatment in GBM8-FmC mouse model of resection. Nature Communications, 2022

New proteins in DNA repair!

These new findings shed new light on how cancer cells react to chemotherapy and radiotherapy, and also uncover a new way in which cancer can become resistant to targeted treatments. These insights may help clinicians decide on different cancer treatments that can be more targeted to specific patients. Repairing damage to DNA is vital for cells to remain healthy, and to prevent diseases like cancer from developing. Understanding how DNA repair works is crucial to better understand how cancer develops, and also how anti-cancer treatment such as radiotherapy and chemotherapy can be used effectively to induce DNA damage that kill cancer cells. In the study, published in *Molecular Cell*, a team of researchers pinpointed two proteins that had not previously been identified in the DNA repair process. Called SETD1A and BOD1L, these proteins modify other proteins called histones which are bound to DNA. Removing these two proteins changes how DNA is repaired, and makes cancer cells more sensitive to radiotherapy. Loss of SETD1A and BOD1L also makes cancer cells resistant to certain anti-cancer drugs called PARP inhibitors.

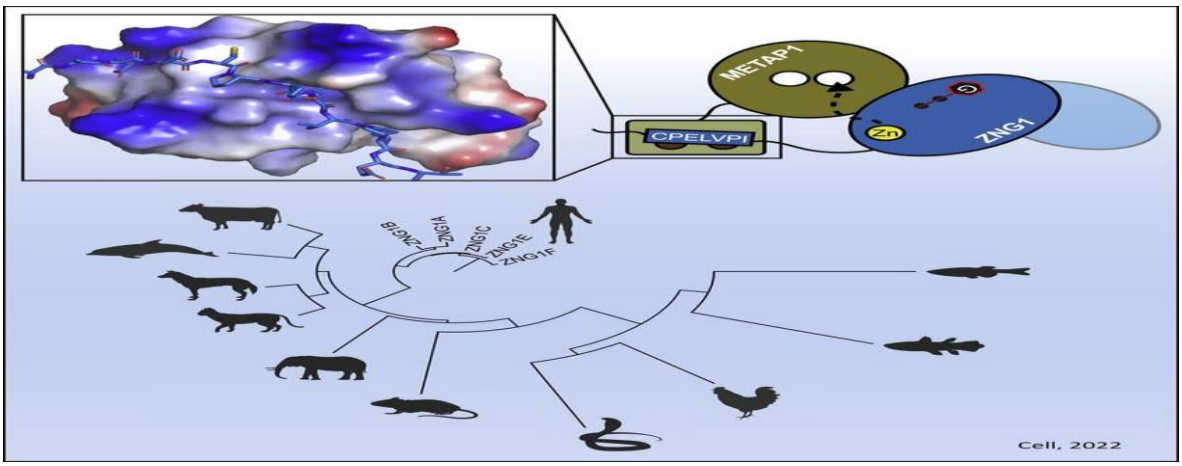


THE FIRST CELLULAR "CHAPERONE" FOR ZINC IDENTIFIED!

We acquire zinc by eating it — in foods or multivitamin supplements — but up to 30% of people in some parts of the world are at risk for zinc deficiency, which can cause slowed growth, impaired immune function, neurological disorders and cancers. The World Health Organization considers zinc deficiency a leading contributor to disease and death.

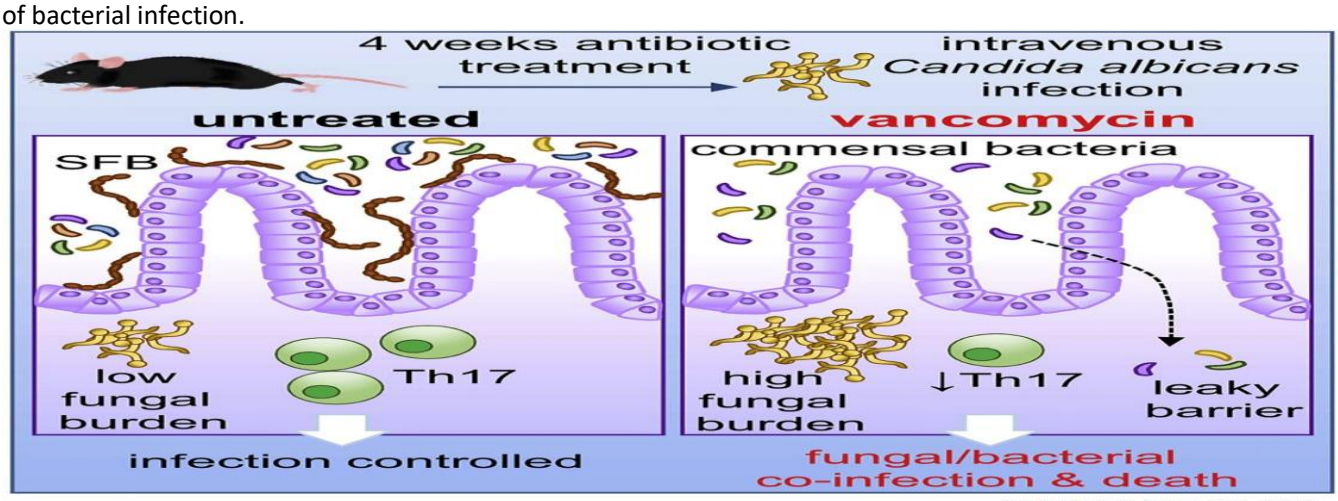
A team of researchers has described and characterized the first zinc metallochaperone: a protein that puts zinc into other "client" proteins. The findings, reported in the journal Cell, shed light on the public health issue of zinc deficiency and open an entirely new area of biology for exploration. The researchers named ZNG1 (for zinc regulated GTPase metalloprotein activator 1).

The researchers found that ZNG1 is conserved from yeast to humans. Using human, mouse and zebrafish versions of ZNG1 as "bait" to discover ZNG-interacting proteins, they identified the enzyme METAP1 as a client for zinc insertion and fully characterized its interaction with ZNG1. METAP1 removes the initial amino acid on about half of newly synthesized proteins, contributing to protein stability, maturation and cellular location.



HOW ANTIBIOTICS USE CAN LEAD TO FUNGAL INFECTION

Patients prescribed antibiotics in hospital are more likely to get fungal infections because of disruption to the immune system in the gut, according to a new study. Using immune-boosting drugs alongside the antibiotics could reduce the health risks from these complex infections say the researchers. A research team discovered that antibiotics disrupt the immune system in the intestines, meaning that fungal infections were poorly controlled in that area. Unexpectedly, the team also found that where fungal infections developed, gut bacteria were also able to escape, leading to the additional risk of bacterial infection.



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PUBLICATIONS

Students' corner:

- **Asma Musfira Shabbirahmed** published an article on Bimetallic p-ZnO/n-CuO nanocomposite synthesized using Aegle marmelos leaf extract exhibits excellent visible-light-driven photocatalytic removal of 4-nitroaniline and methyl in ***Photochemical & Photobiological Sciences*** of **Springer** with an impact factor of **4.328**.

Faculties' corner:

- **Dr. Dibyajyoti Haldar** published an article on Understanding the management of household food waste and its engineering for sustainable valorization- A review in ***Bioresource Technology*** of ***Elsevier*** with an impact factor of **11.889**.