Division of Biotechnology
Half Yearly Newsletter

BIOLUMIERE

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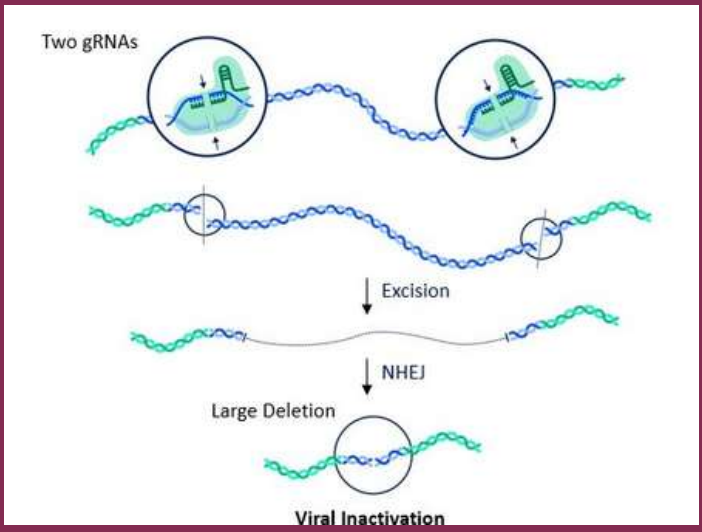
Excision BioTherapeutics Advances CRISPR-Based HIV Gene Therapy

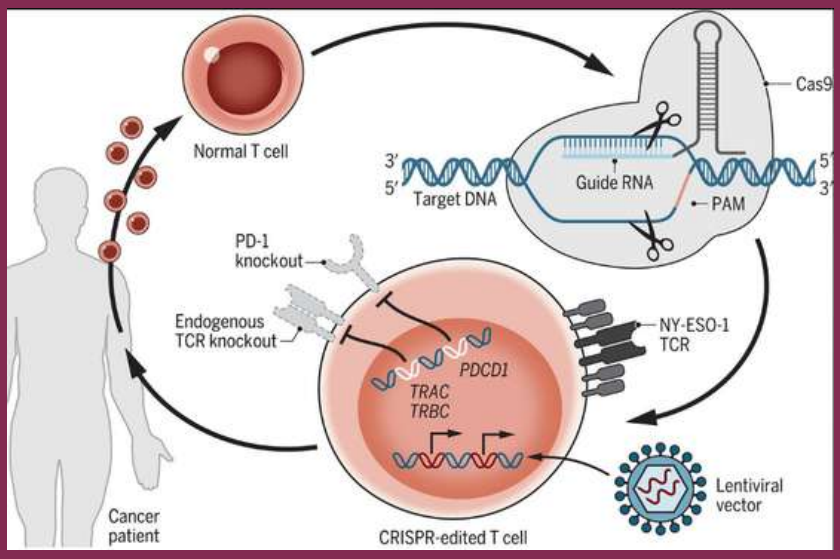
Excision BioTherapeutics reported key progress in its investigational CRISPR-based gene therapy EBT-101 targeting HIV infection. Designed to excise HIV DNA from a patient's infected cells using CRISPR-Cas9, EBT-101 represents one of the first attempts to apply genome editing to directly eradicate a persistent viral reservoir. Early clinical results indicated that while the treatment did not sustain viral suppression when used alone at the initial dose, there was evidence of delayed viral rebound in one participant, suggesting partial on-target activity. Importantly, the therapy was well-tolerated in early recipients, providing vital safety data for further optimisation. These findings underscore the challenges of achieving functional cures for chronic infections but also highlight gene editing's expanding therapeutic reach beyond rare genetic diseases and oncology. As Excision continues to refine delivery methods and dosing strategies, EBT-101's ongoing development offers a valuable proof of concept for CRISPR-based approaches to combat lifelong viral infections, potentially transforming the landscape of HIV treatm



The diagram illustrates dual-gRNA–mediated CRISPR targeting, where two guide RNAs induce excision of a DNA segment followed by non-homologous end joining (NHEJ).

-Sanya Mary Thomas URK23BT5018

CRISPR-Engineered CAR-T Cells Show Promising Clinical Trial Results

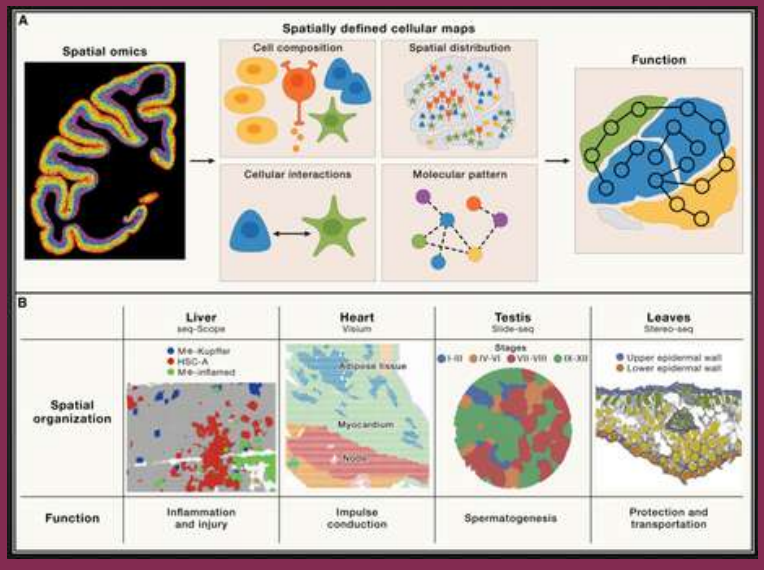


The schematic depicts CRISPR–Cas9–mediated genome editing of patient-derived T cells, including PD-1 and endogenous TCR knockout and insertion of a tumor-specific NY-ESO-1 TCR via lentiviral delivery.

In early 2024, multiple clinical trials reported encouraging outcomes for CRISPR-engineered CAR-T cell therapies targeting blood cancers, marking significant progress in immuno-oncology. A US-based Phase 1 study of universal CRISPR-edited CAR19 T cells for refractory B-cell leukemia demonstrated high response rates, with nearly all participants responding and several maintaining complete remission for six months or longer. Parallel trials using CRISPR base editing targeted acute myeloid leukemia and multiple myeloma, reflecting diversified therapeutic strategies. These early phase results not only highlight the feasibility and safety of CRISPR-modified allogeneic T cells but also illustrate potential advantages over traditional CAR-T approaches, including off-the-shelf availability and reduced manufacturing complexity. Regulatory agencies have granted fast-track and RMAT designations to several candidates, accelerating their path to pivotal Phase 3 studies. Collectively, these advancements reinforce the potential of genome-edited cellular therapies to deliver transformative treatments for cancers with limited existing options, while also informing future design of precision immunotherapies with improved safety and efficacy profiles.

- Shanthosh F URK23BT3011

Spatiotemporal omics for biology and medicine



The figure summarizes spatial omics approaches that integrate cell composition, spatial distribution, cellular interactions, and molecular patterns to generate functionally defined cellular maps.

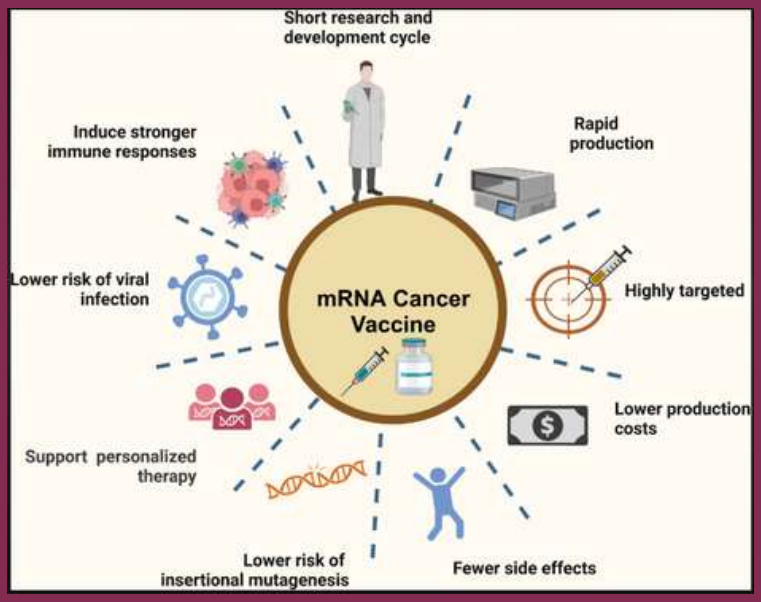
Understanding how cells behave is not just about knowing *what* molecules are present, but also *where* they are and *when* they act. Traditional biological techniques often average signals across large numbers of cells, making it difficult to capture the spatial organization of tissues or the dynamic changes that occur over time. This review addresses a growing challenge in biology: how to study life with both spatial and temporal precision.

The article brings together recent advances in spatiotemporal omics—technologies that combine genomics, transcriptomics, proteomics, and metabolomics with spatial location and time-based data. These methods allow researchers to map molecular activity within tissues at near single-cell resolution and track how it changes during development, disease progression, or treatment.

What makes this field especially noteworthy is its ability to bridge molecular data with real biological context. Spatiotemporal omics is already transforming our understanding of cancer, brain function, and developmental biology, and holds strong potential for precision medicine by enabling more accurate diagnosis and targeted therapies.

- Smith Vivien URK23BT4002

Personalized mRNA Cancer Vaccine Trials Expand Worldwide



The infographic highlights key advantages of mRNA cancer vaccines, including rapid development, precise targeting, lower production costs, and support for personalized therapy.

Throughout the first half of 2024, clinical development of personalized mRNA cancer vaccines gained momentum, with major research programs and national health systems launching new collaborative trials. These vaccines leverage mRNA technology — the same platform behind successful COVID-19 vaccines — to encode tumour-specific antigens tailored to individual patients. A notable initiative saw the British National Health Service establish a Cancer Vaccine Launch Pad, designed to facilitate access to personalized mRNA vaccine trials for cancers such as pancreatic, head-and-neck, and melanoma. These therapies aim to stimulate a patient's immune system to recognise and destroy tumour cells with high specificity, potentially transforming cancer care by shifting from broadly immunosuppressive treatments to precision immunotherapy. Early clinical data suggest that mRNA vaccines can elicit strong anti-tumour immune responses with manageable safety profiles, encouraging expanded enrollment and combination strategies with checkpoint inhibitors. This surge in personalized cancer vaccine research reflects biotechnology's rapid adaptation of RNA platforms to complex diseases beyond infectious pathogens, underscoring a new frontier in individualized treatment modalities.

- Abhijaye M URK23BT3002

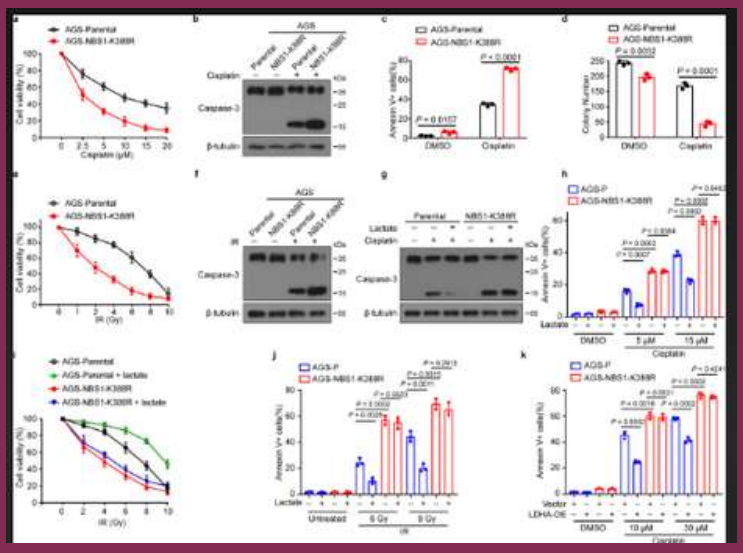
NBS1 lactylation is required for efficient DNA repair and chemotherapy resistance

Cells are constantly exposed to DNA damage, whether from normal metabolic activity or from treatments like chemotherapy. To survive, they rely on highly efficient DNA repair systems. However, cancer cells often exploit these same repair mechanisms to resist chemotherapy, making treatment less effective. This study explores how subtle chemical changes inside cells can influence DNA repair and drug resistance.

Researchers discovered that NBS1, a key protein involved in repairing DNA double-strand breaks, undergoes a modification called lactylation—a chemical change derived from cellular metabolism. This lactylation enhances the ability of NBS1 to support homologous recombination, one of the most accurate DNA repair pathways. As a result, cells with higher NBS1 lactylation are better at repairing damage caused by chemotherapy.

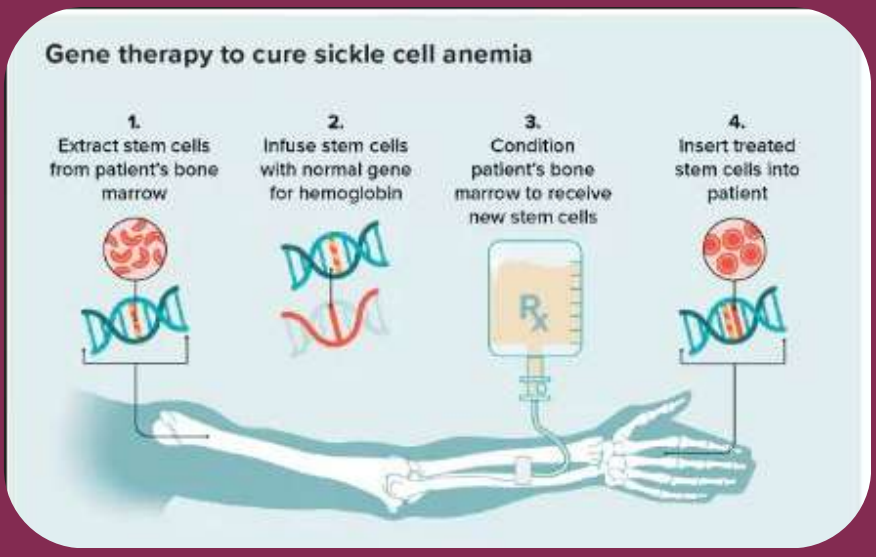
What makes this finding particularly noteworthy is the direct link it reveals between cellular metabolism and DNA repair efficiency. This insight helps explain how cancer cells develop chemotherapy resistance and opens new possibilities for targeting metabolic pathways to improve cancer treatment outcomes.

- Muhammad Suhail URK23BT3008



The figure shows that AGS gastric cancer cells expressing NBS1-K388R exhibit increased sensitivity to cisplatin and radiation, with reduced viability and elevated apoptosis.

Exagamglogene Autotemcel (Casgevy) Receives Broader Regulatory Approvals



The diagram outlines gene therapy for sickle cell anemia, showing extraction of patient stem cells, correction of the hemoglobin gene, and preparation of the bone marrow.

In early 2024, regulatory agencies extended authorizations for Casgevy (exagamglogene autotemcel) — the world's first CRISPR/Cas9-based gene-editing therapy for sickle cell disease (SCD) and transfusion-dependent β-thalassemia. Originally approved in late 2023, subsequent approvals in Europe and the United States confirmed its safety and efficacy in broader patient populations. Casgevy, developed by Vertex Pharmaceuticals in partnership with CRISPR Therapeutics, involves ex vivo editing of a patient's hematopoietic stem cells to increase fetal hemoglobin production, which ameliorates the symptoms of both conditions. Clinical data have demonstrated dramatic reductions in painful vaso-occlusive crises and transfusion dependence, with many participants remaining symptom-free long after treatment. These approvals mark a pivotal milestone in translating CRISPR genome editing into mainstream medicine, expanding treatment options for patients with debilitating genetic blood disorders. Casgevy's successful progress in regulatory review underscores gene editing's transition from experimental research to real-world therapeutic application, catalysing further investment and clinical development in CRISPR-based medicines.

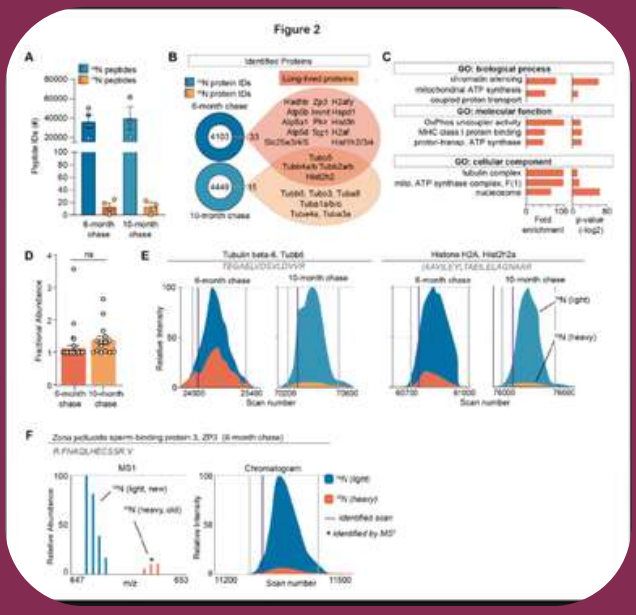
- Yuvashree C URK22BT1044

Long-lived proteomes in healthy ovaries

For a long time, biologists believed that most proteins in the body are constantly renewed, breaking down and being replaced over days or weeks. However, some tissues—especially those involved in reproduction—need to maintain stability over many years. This review highlights a surprising question: how do ovarian cells preserve their function over such long time spans?

Recent studies discussed in this article reveal that healthy ovaries contain exceptionally long-lived proteins that can persist for months or even years with minimal turnover. These proteins are particularly abundant in structures essential for egg development and ovarian integrity. Rather than relying on constant renewal, ovarian cells appear to protect and maintain these proteins through specialized quality-control mechanisms. What makes this finding especially noteworthy is how strongly it challenges traditional views of protein turnover. Understanding how long-lived proteomes are maintained could reshape our understanding of reproductive ageing and fertility. It may also provide broader insights into how cells preserve function over time, with potential relevance for ageing, degenerative diseases, and long-term tissue health.

- Jasvanth Raja V URK23BT5016



The figure presents proteomic analyses identifying long-lived proteins through isotope labeling and chase experiments, highlighting proteins persisting over 6- and 10-month periods.