Image credit: BASE Facility

NCRIS TURBO-CHARGES NEW MRNA DRUGS

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RNA PRODUCTS

mRNA therapies work by delivering genetic instructions into the body to produce therapeutic proteins, offering promising treatments for cancer, genetic, and infectious diseases. However, lipid nanoparticles (LNPs)—the most common delivery vehicle—naturally accumulate in the liver, limiting the technology's reach beyond liver-targeted applications. Modifying LNPs to reach other tissues can compromise scalability, alter particle size, and trigger immune responses.

Ms Bettina Dietmair and other team members from A/Prof Seth Cheetham's group at the Australian Institute for Bioengineering and Nanotechnology (AIBN) at the University of Queensland recently developed a novel approach using bispecific antibodies (BsAbs) to guide mRNA-LNPs to specific tissues. This strategy demonstrated strong and sustained delivery to tumour cells, with significantly reduced off-target accumulation in the liver, both in vitro and in vivo.

This breakthrough was made possible through access to research infrastructure and expertise supported by four NCRIS providers. Therapeutic Innovation Australia enabled the formulation of mRNA-LNPs at the BASE Facility, which were used in both in vitro and in vivo experiments. The Australian National Fabrication Facility, through its Queensland node, provided access to confocal microscopy systems and training, which allowed researchers to assess the efficiency and specificity of mRNA delivery to different cell types.

Microscopy Australia supported the study through cryo-transmission electron microscopy services delivered at the Centre for Microscopy and Microanalysis, helping the team characterise the structure and morphology of the LNPs and BsAb complexes. The National Imaging Facility provided non-invasive imaging capabilities to track luciferase mRNA expression in animal models and confirm successful targeting of tumour tissue.

Together, these facilities helped advance the project from concept to experimental validation. The ability to adapt BsAbs to different target antigens opens the door to a scalable and flexible delivery platform with broad therapeutic potential. With national research infrastructure already in place, this approach could accelerate the development of mRNA-based treatments for a wide range of diseases.

> ""NCRIS infrastructure enabled us to rapidly progress our study from concept to experimental validation, successfully developing novel approaches for targeted delivery of mRNA"
> **Bettina Dietmair,** PhD student at AIBN

Impact:

TRL 1 | TRL 2 | **TRL 3** | TRL 4 | TRL 5 | TRL 6 | TRL 7 | TRL 8 | TRL 9