STARMAT – A Versatile Star Polypeptide Platform for Oligonucleotide Drug Delivery

RCSI UNIVERSITY OF MEDICINE AND HEALTH SCIENCES

Star-polymers are a new class of polymer architecture which consist of linear arms radiating from a central core. Novel Star polypeptide-based vectors discovered at RCSI have superior transfection and delivery efficacy compared to current commercially available technologies coupled with improved stability, biocompatibility and immunogenicity. Therapeutic applications include the targeted delivery of DNA plasmids, siRNA mRNA and miRNA and incorporation into bioactive scaffolds and medical devices.

BACKGROUND

Despite recent progress with advanced drug delivery technologies, there remain some significant drug development issues with clinical translation of biotherapeutics and ATMP's including: inefficient payload delivery, lack of cellular & molecular level targeting, bio-instabilty including enzymatic degradation, difficulties with tuning drug release profile, toxicity & immunogenicity, lack of scalable and flexible delivery platforms, and instability with storage conditions required e.g. cold chain.

RCSI scientists have developed the STARMAT technology specifically to address these unmet needs and to provide a value-add delivery platform for the next generation of RNA therapeutics.

VALUE PROPOSITION

Via STARMAT, RCSI have developed a synthetic platform which produces materials which are:

- Fully programmable in terms of structure and function enabling encapsulation of drugs with a variety of physicochemical properties e.g. RNA, DNA, proteins, small molecules
- Effective with difficult targets such as macrophages, stem cells, respiratory epithelial cells etc.
- 4-5 fold increased cellular delivery of gene therapeutics with superior biocompatibility compared to standard transfection agents
- Easily and inexpensively fabricated
- Stable upon storage

TECHNOLOGY

The RCSI Star polypeptide technology relates to a specific type of star-polymer whereby the core is made from a functionalisable dendrimer and the "arms" consist of polypeptides. For example: Poly-L-lysine (Star-PLL); Poly-L-glutamatic acid (Star-PGA); Poly-L-arginine (Star-PLA) and Poly-L-histidine (Star–PLH).

The polypeptide arms may be additionally functionalised by the incorporation of cell/tissue specific ligands for targeted delivery.

Therapeutic applications include: delivery of therapeutic nucleic acid cargos through a variety of methodologies including nebulisation; incorporation into biocompatible scaffolds for gene delivery and incorporation into hydrogels for protein delivery.

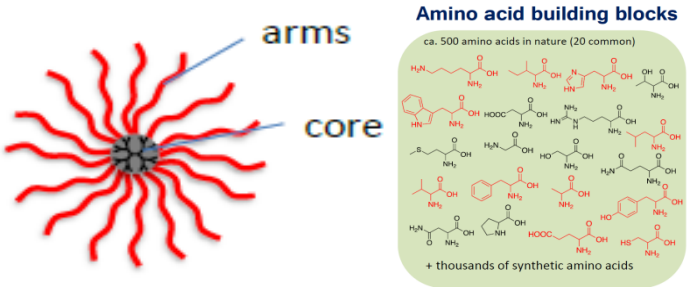

Fig 1. STARMAT – Star polypeptide functionalized core/arms can be tailored for the delivery of many different oligonucleotide cargoes

FEATURES	BENEFITS
Versatile amino acid chemistry to optimise structures for any nucleic acid cargo	Rapid identification and scale-up of the optimum delivery vector for your applications
High RNA/DNA loadings with superior transfection	Maximise efficacy for high value oligo cargoes: pDNA, mRNA, siRNA etc.
Biocompatible, stable nanoparticles with ease of handling for users	Overcomes many of the practical limitations of current nanoliposome formulations

TECHNOLOGY READINESS LEVEL

Patent filed (WO2020128089A1)
In vivo POC for gene delivery

Contact: Dr. Derek John
Office of Research and Innovation
RCSI, 121. St. Stephen's Green
Tel: 01 402 2567; Email: derekjohn@rcsi.ie

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