Protease Assisted Native-Protein Delivery Approach (PANDA)

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SUMMARY

Researchers at UCLA have developed a novel technology to safely and efficiently deliver native proteins to target cells for therapeutic, imaging, tissue engineering and regenerative medicine purposes.

BACKGROUND

Recombinant protein based drugs represent a very promising avenue of therapy for a number of medical applications and the market for protein therapeutics is currently projected to reach $141.5 billion by 2017. Despite their great commercial success, many of these drugs suffer from significant obstacles in the areas of delivery. To date, a number of protein delivery approaches have been pursued including electroporations, microinjections, protein transduction domain (PTD)-mediated platforms, and noncovalent methods. Though promising, these methods suffer from various limitations that make them clinically unfeasible. The ability to deliver protein products in an efficient and safe manner would be a significant achievement that could potentially open up an entirely new avenue of medical technologies for clinical use.

INNOVATION

Researchers at UCLA have developed a novel protein delivery approach termed the Protease-Assisted Native-protein Delivery Approach (PANDA). This technology is centered around the use of protease-degradable nanocapsules to coat native proteins for delivery into cells. Upon uptake of these complexes into target cells, the nanocapsules are degraded by cellular proteases, allowing the protein cargo to be released. The ease of preparation, high cell penetration capability, and long-term stability associated with this system, coupled with its low toxicity and protease-modulated specific degradability, make it a versatile and very promising candidate for use in the delivery of therapeutic agents.

APPLICATIONS

- Protein Therapy Delivery
  - For various purposes including antigens for vaccination, cytotoxic proteins for cell killing, as well as proteins for cellular imaging.
  - Incorporation of known cell-binding ligands, such as antibodies and peptides, to the surface of the nanocapsules will increase the efficiency of this system, as well as enable it to be used in targeting strategies.
- Tissue Engineering and Regeneration
  - For supporting the growth of tissues or cells with cell growth or differentiation factor delivery.

ADVANTAGES

- The protein nanocapsules can be successfully incorporated into tissue engineering platforms (e.g. hydrogels), without inactivation or leaching of the protein cargo.
- The relative concentration of enzyme-cleavable to non-cleavable crosslinker can varied when making the nanocapsule to control the release rate of the protein cargo.
- The protein nanocapsules can be used to successfully deliver and release growth factors.
- Use of this system enables safe and efficient delivery of native proteins to cells.
- The preparation method for protein capsules can be easily carried out and gives a high yield.
- Strong water-soluble property and robust core-shell structure gives protein nanocapsules very good stability, and enables them to be evenly distributed in serum without clustering, allowing for more efficient protein delivery.

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OTHER INFORMATION

KEYWORDS

Biomedical, Drug Delivery, Nanotechnology, Protein delivery, Protein therapeutics

CATEGORIZED AS

- **Medical**
  - Delivery Systems
- **Nanotechnology**
  - NanoBio

RELATED CASES

2009-531-0

▶ The degradation process of the shell of nanocapsules can be tailored to control where the protein payload is delivered and the rate at which it is released.

STATE OF DEVELOPMENT

Extensive *in vitro* experiments validating the technology have been performed. Studies further characterizing application of this technology to other proteins and in vivo proof-of-concept experiments are underway.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,253,483	02/22/2022	2009-531
United States Of America	Issued Patent	9,283,194	03/15/2016	2009-531

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