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# A novel targeted drug delivery system

## Problems addressed

- Vascular thrombosis is a major clinical problem. Timely lysis and/ or removal of blood clots to rapidly re-establish blood flow is critical to treat thrombotic diseases, such as ischemic stroke, myocardial infarction and pulmonary embolism.
- Intravenous infusion of thrombolytic agents, such as tissue plasminogen activator (tPA), is one of the clinical strategies. tPA converts plasminogen to plasmin and thus triggers fibrin lysis. Unfortunately, tPA has an extremely short half-life (2-6 min); it is rapidly inactivated by circulating inhibitors such as plasminogen activator inhibitor-I (PAI-I). Therefore, large doses of tPA are required for effective thrombolysis. However, excessive administration and systemic distribution of tPA are detrimental since it impairs normal haemostatic capabilities and leads to bleeding complications.

## Technology overview

This invention relates to red blood cell-derived vesicles (RBCVs) comprising attached targeting ligands and encapsulated active agents (e.g., thrombolytic and antiplatelet drugs) and their use as a targeted thrombolytic drug delivery system.

The RBCVs protect thrombolytic agents in the blood circulation, leading to improved stability and prolonged half-life and temporarily suppress thrombolytic activity, leading to reduced haemorrhagic side effects. Upon selective binding to activated platelets through the combined effects of self-navigated thrombus-homing and active thrombus-targeting, the RBCVs display efficient clot penetration and fuse with the activated platelet membrane, leading to rapid and efficient release of thrombolytics. This is favourable for treatment of various thrombotic diseases including ischemic stroke which requires immediate drug action.

## Proposed Use

Targeted delivery of thrombolytic drugs to blood clots.

This drug delivery platform technology can be used to develop various therapeutics for thrombotic diseases, including stroke, myocardial infraction and pulmonary embolism, using different drug groups, such as (i) thrombolytic drugs, including tPA, for clot lysis and (ii) anti-platelet drugs for prevention of clot formation.

## Benefits

- A novel nanomedicine platform technology which utilises biocompatible and biodegradable nanovesicles as carriers for a variety of thrombolytic and antiplatelet drugs
- Superior drug stability and efficacy and targeted delivery to the clot site, minimising the chance of bleeding side effects.
- Efficient and rapid controlled drug release
- Enhance penetration of drugs into clots
- The technology is compatible with multiple thrombolytic drugs, existing or in development

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## Intellectual property information

Red Blood Cell-Derived Vesicle, Imperial reference number 10462

- European Application Number: 20838205.1
- US Application Number: 17/786403

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