



Cupido

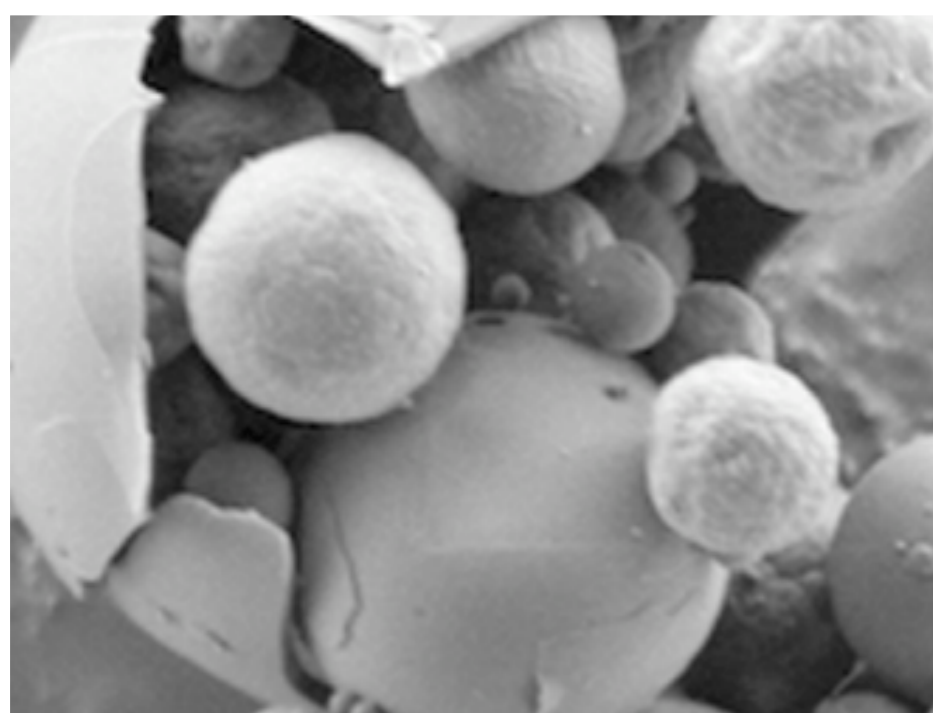
Cardio ultraefficient nanoparticles for inhalation of drugs products

BACKGROUND

Cardiovascular diseases, such as myocardial infarct and heart failure, represent a societal burden, accounting for more than 30% of deaths globally and spending yearly ~190 billion € in European healthcare. The chronic treatment of patients leads only to short-term benefits due to several weak points of conventional therapies (side-effects, reduced efficacy, invasive administration). The field needs fresh approaches to discover novel patient-friendly therapies that are more efficient, safe and heart-specific.

OBJECTIVES

The EU-funded project Cupido, started in February 2017, propose to apply **nanotechnologies** to the cardiovascular field. Cupido aims to hit the core of the cardiovascular disease, developing inhalable nanoparticles that can deliver as simple as breathing a therapeutic directly to the diseased heart.



HOW

To achieve the goal, the Cupido consortium is working to develop **biocompatible** and **biodegradable** nanoparticles that can **self-assemble** and encapsulate drugs, novel or available, in a suitable format for the treatment of cardiovascular disease.

APPLICATIONS

Cupido will address cardiovascular diseases associated with structural and functional impairment of the myocardium presenting a reduced systolic function (i.e. Heart Failure with reduced Ejection Fraction-HFrEF). Treatments will first be evaluated in a **mouse model of HFrEF** and the most effective formulation for therapeutic delivery will be then applied to an HFrEF model in **mini-pigs**. The project will prepare the way for future clinical trials by proofing the preclinical feasibility of the nanotherapy.

THE CONSORTIUM

The EU-based consortium, composed of 6 academic research groups, 5 SMEs, 2 industries, and 1 pharmaceutical company, gathers a vast array of expertise and joins cutting-edge research with pre-clinical experience and industrial manufacturing.



The Breathing Heart

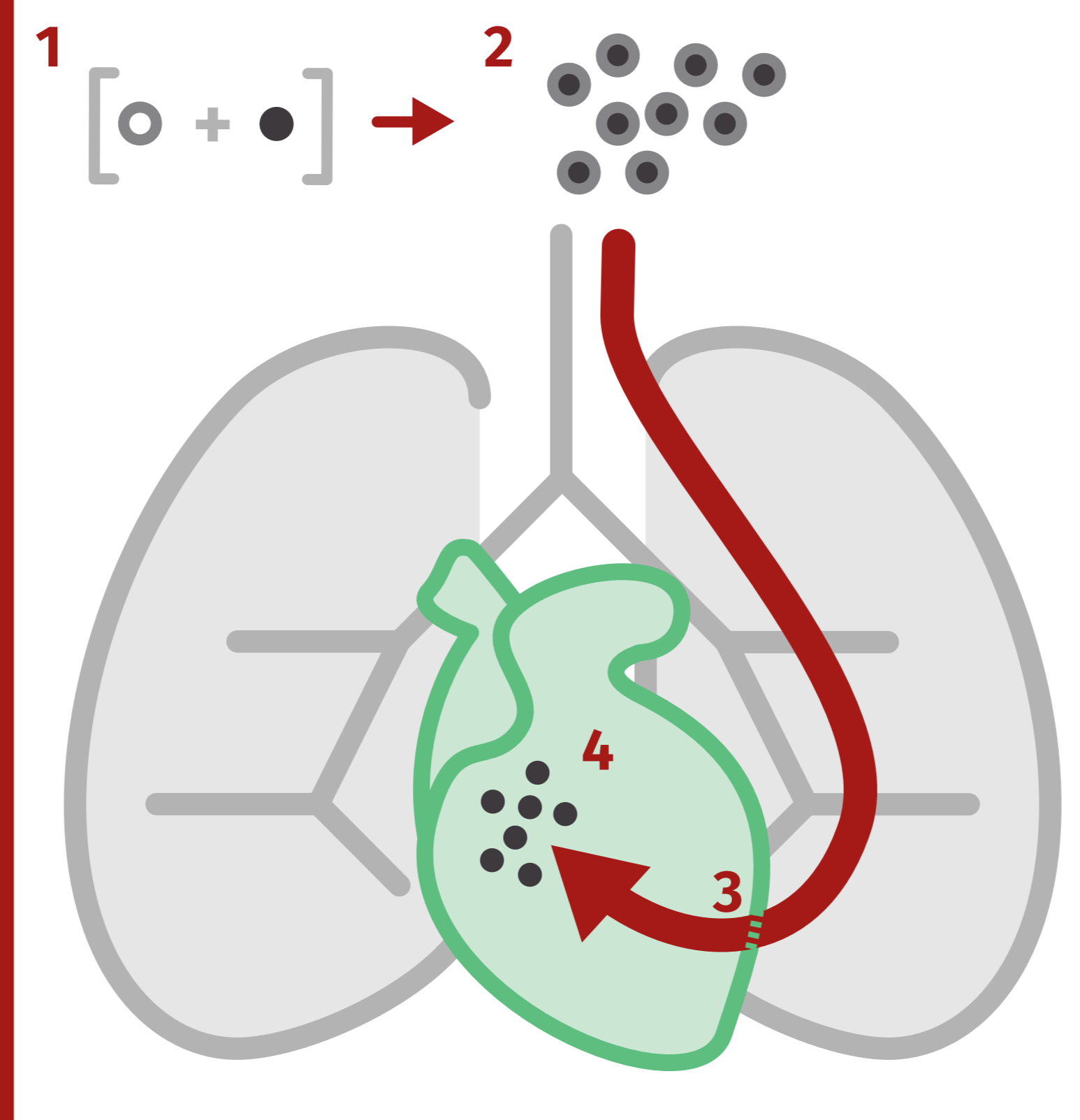


1 Nanoparticle preparation

Negatively charged calcium phosphate nanoparticles can encapsulate bioactive molecules and function as an effective drug-delivery system through the formation of life-compatible nano-pores that allow cellular internalization.

2 Nano-embedded microparticle production and inhalation

Unlike nano-sized materials (1 nm - 1µm), particles in the range between 1-3 µm can be efficiently deposited at the alveolar level. CaPs will, therefore, be transformed into a microparticle dry powder that can be easily inhaled and reach the deep lung. Once inhaled the microparticles can dissolve in the lung fluid.



3 Nanoparticle release and translocation to the heart

During respiration, the oxygenated blood moves from the pulmonary circulation first to the heart via the pulmonary vein. In line with this, the inhaled CaPs able to cross the alveolar-capillary barrier will rapidly reach the myocardium.

4 Monitoring and guidance to the heart

The fate of the nanoparticles and the effective biodistribution will be monitored *in vivo* through radiolabeling to select the most promising delivery systems. To achieve selective drug delivery to myocardial cells and reduce the adverse side effects, *Cupido* will implement aptamers as cardiac-specific carriers or magnetic guidance.

www.cupidoproject.eu



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