BACKGROUND

The limited supply of human platelets and the rapidly growing demand for medical research and clinical applications including studies of platelet-related disease mechanisms and platelet transfusions for patients, are manifest.

Our hypothesis is that platelet production ex-vivo can be precision tailored and optimized by providing megakaryocytes embedded within the correct physical and biochemical environment. This proposed system will combine valuable technologies developed within our consortium:

- Methods for the fabrication of silk-based bone marrow models
- Forward programming (FoP) approach to produce megakaryocytes from human pluripotent stem cells (hPSCs)
- hPSC derivation from patients with hereditary thrombocytopenia and CRISPR/Cas9 introduction of mutations in normal hPSCs

Clearly, in transfusion medicine there is an urgent need for new modes to generate functional platelets ex-vivo to address clinical needs as well as for insight into fundamental studies of mechanisms of physiologic and pathologic platelet production.

SILKFUSION PARTNERS

University of Pavia - UNIPV
unipv.eu
Project Coordinator

University of Cambridge - UCAM
cam.ac.uk

Institut Gustave Roussy - INSERM-IGR
gustaveroussy.fr

Integrated Systems Engineering - ISENET
isenet.it

CELLINK
cellink.com

Knowledge Innovation Market - KIM
kimglobal.com

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 767309.

The information contained reflects only the author's view and the Commission is not responsible for any use that may be made of it.

SilkFusion

A novel 3D solution for large-scale ex-vivo platelet production, transfusion and drug research

SILKFUSION PROJECT

The demand for human platelets (plts) for medical research and clinical applications is massive. The primary goal of SilkFusion is to engineer groundbreaking 3D nanotechnologies for large-scale production of blood plts for human transfusion from human pluripotent stem cells (hPSCs).

Our hypothesis is that plt production ex-vivo can be optimized by providing megakaryocytes (Mks) with the correct physical and biochemical environment. To prove this, we will develop a unique technological platform by engineering non-thrombogenic silk-fibroin biomaterial with proteins that were proven were proven to promote a gain in plt production of at least one order of magnitude, through the creation of a three-dimensional ex-vivo bone marrow model that will enhance plt release from hPSCs derived-Mks.

Our long-term vision is to foster the production of plts in-vitro for clinical transfusions in humans at a scale and cost that will address current supply challenges as immunologically matched products to alloimmunised patients.

The successful development and distribution of the SilkFusion platforms will also offer researchers and clinicians specialized precision instruments for determining the safety and efficacy of drugs, reducing costs of ineffective therapies while promoting affordable functional strategies for the development of novel molecules.

WHY USE THIS SYSTEM?

3D TECHNOLOGY: SilkFusion will use silk-fibroin as a bio-ink for 3D printing an ex-vivo bone marrow model containing viable megakaryocytes for producing platelets.

AD-HOC: SilkFusion will help to provide immunologically-matched platelets to alloimmunised patients and platelets with enhanced coagulation capacity specifically suited for patients with acute haemorrhage resulting from trauma, surgery and wounded in conflict zones.

AFFORDABLE: SilkFusion will foster the production of platelets for clinical transfusions in humans at an affordable cost.

FAST AND SELF-SUFFICIENT::SilkFusion will enable large-scale production of platelets in real time, upon demand and without depending on blood donations.

ACCURATE: SilkFusion will allow high-fidelity reproducible printing of silk-based devices for better diagnosis for diseases.

SAFE: SilkFusion will provide pathogen-free material. Silk fibroin is an EMA/FDA approved biomaterial and not thrombogenic.

PROJECT TARGETS

PLATELET PRODUCTION
Large-scale production of platelets from human Pluripotent Stem Cells (hPSCs) for transfusion medicine.

RESEARCH
Investigating specific therapeutic targets for inherited thrombocytopenia.

DRUG TESTING
Developing drug response and toxicity tests for personalized medicine.

IMPACT

1. Enlarge supplies of blood platelets not depending on donations.
2. Improve welfare of those patients with special needs through personalised medicine.
3. Provide an ex-vivo bone marrow system for researchers to investigate haematopoiesis/bone marrow disorders and for drug testing.
4. Enrolment and support of research communityand training of young actors towards future technological leadership.