Consortium

Nine entities stand for the success of BIOCAPAN throughout their expertise, commitment and adaptation to the project context, and interest for the patient.

- Commissariat à l'énergie atomique et aux énergies alternatives
- Charité-Universitätsmedizin Berlin
- Etablissement Français du Sang
- European Research Services GmbH
- Nanoimmunotech
- FMC BioPolymer/NovaMatrix
- Université catholique de Louvain
- Université Grenoble Alpes
- Wake Forest University Health Sciences

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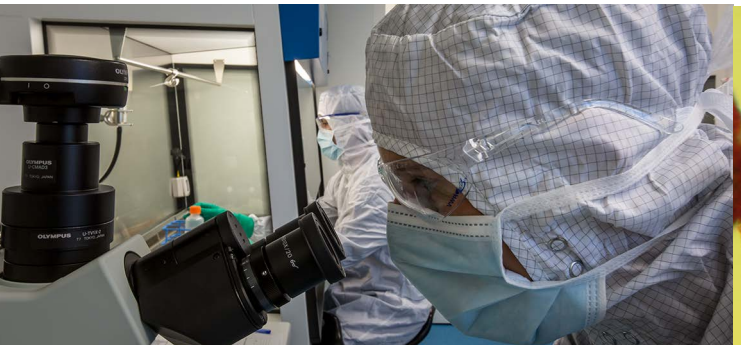
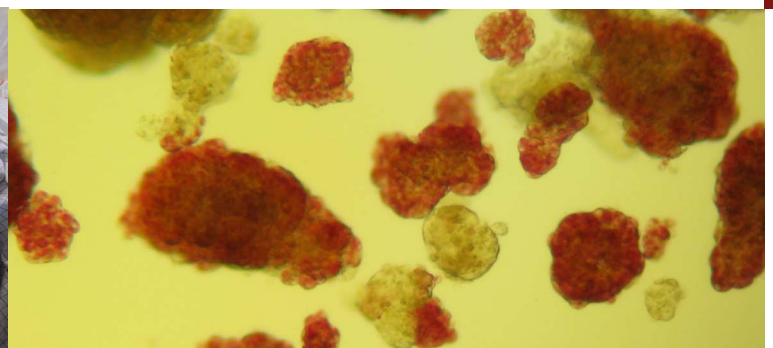
Quality control of cells on microscope © Steeves AMBILL / EFS

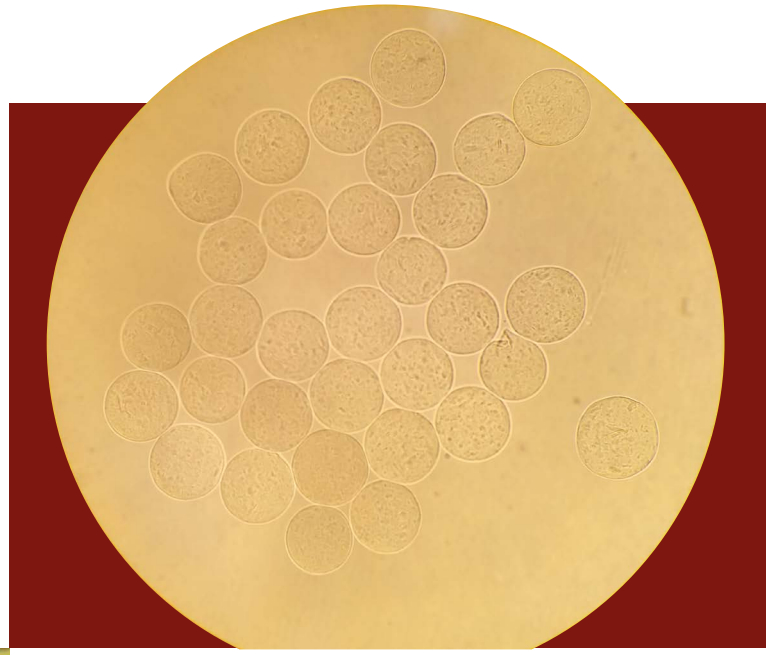


Human langerhans islets isolated from a pancreas (Dithizone labeling) © EFS



BIOCAPAN

BIOactive implantable
CApsule for **PAN**creatic
islet immunosuppression
free therapy



200 uM Microcapsules with epithelial cells HEK-293 in culture
© NIT (Nanoimmunotech S.L)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 646272.

Context

Diabetes is a chronic disease that appears when the pancreas does not produce enough insulin (Type 1 Diabetes), or when the organism does not use correctly the insulin that it produces (Type 2 Diabetes). In 2011, the World Health organization estimated the number of people suffering from diabetes to 356 million. It is expected to reach 438 million before 2030. In 2014, 9% of the adult population (18 years old and more) were diabetics. The key therapeutic issue in diabetes mellitus types 1 and 2 is glycaemic control. Indeed, maladjusted levels of insulin often lead to serious co-morbidities such as hypoglycaemia, stroke, heart diseases, or diabetic foot (amputation). The World Health Organization estimated that diabetes directly caused 1,5 million of deaths in 2012. For these patients, the disease is ever-present in day-to-day life requiring glycaemic measurements, calculations of carbohydrate intake, and insulin injections. Reducing a continuous self- monitoring and insulin injections would tremendously improve the quality of diabetics' lives.

Currently, the best therapeutic option is the transplantation of allogeneic islet cells, but the current state of the art limits the applicability of this approach. Implanting unmodified islet grafts requires lifelong administration of immunosuppressants, frequently associated with adverse effects such as higher blood pressure, higher susceptibility to infections, and higher risk for cancers.

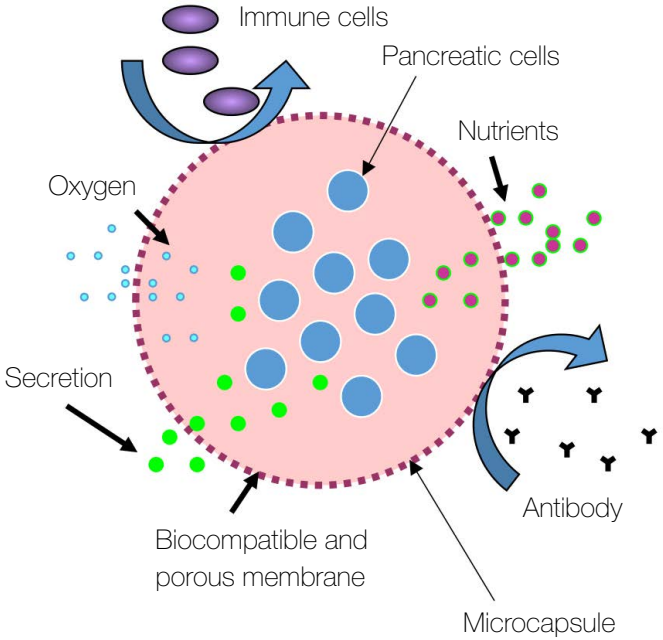
Project outcome

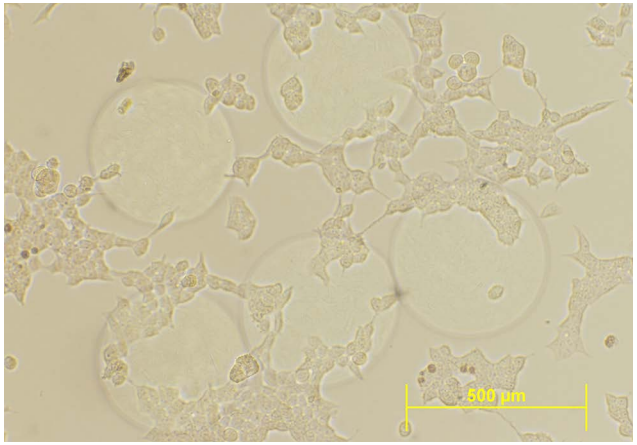
According to these facts, the **BIOCAPAN Project**; which stands for BIOactive implantable CApsule for PANcreatic islet immunosuppression free therapy, funded for 4 years by the **European Union's Horizon 2020** research and innovation programme (Grant agreement no. 646272), has started to develop an innovative GMP-grade cell-therapy product, to treat diabetes without insulin injections and immunosuppressant administration.

More precisely, this 8 million euros project is based on the implantation of smartly microencapsulated allogeneic islet cells, which will allow an effective long-lasting blood glucose level normalisation and stabilisation without the need for immunosuppressants. This treatment would be appropriate for all type 1 and about one in six type 2 diabetes mellitus patients – about 80 million people worldwide.

To reach this goal, the **BIOCAPAN Project** has three objectives:

1) Designing a complex GMP-grade bioactive microcapsule that will enhance biocompatibility, functionality and survival of transplanted allogeneic islets, in order to reach 2-years of insulin, injection-free treatment, without the need for immunosuppressants.
2) Establishing a method to encapsulate freshly harvested islets quickly, using a GMP-grade platform, to provide standardized and reproducible bioactive microcapsules.
3) Establishing a full preclinical validation, a complete Investigational Medicinal Product Dossier (IMPD) in accordance with the provisions of the Advanced Therapy Medicinal Products (ATMP) Regulation, and a whole clinical protocol for the submission of the Clinical Trial Authorization (CTA) dossier to the relevant regulatory agency in order to start clinical trials within one year of completing the project.





200 uM Microcapsules with epithelial cells HEK-293 in culture

Activities

The BIOCAPAN Project is structured into seven research & development Work Packages (WP), which are focused on:

- Delivering a specification file for the development of all the microcapsule compounds and their in vitro and in vivo assays, and submitting the Clinical Trial Authorization dossier to the regulatory agency.
- Ensuring that all the product development steps will be compliant with regulatory requirements.
- Providing the optimal composition of the bioactive BIOCAPAN microcapsule and planing for GMP production of all capsule components.
- Producing a GMP compatible microfluidic platform for standardized bioactive microcapsule production.
- Producing a GMP encapsulation process procedure with defined quality controls for intermediate and final products ensuring identification, safety and functionality of the final products.
- Validating the in vitro functionality and viability in vitro of encapsulated islets and the biocompatibility of the BIOCAPAN biomaterials and microcapsules.
- Implementing preclinical models to validate the GMP-grade bioactive microcapsule.