

The background of the image is a microscopic view of numerous green, spherical vesicles. These vesicles have a textured, ribbed surface and are densely packed. A large, semi-transparent white circle is overlaid on the center of the image, containing the logo and text.

# VES4US

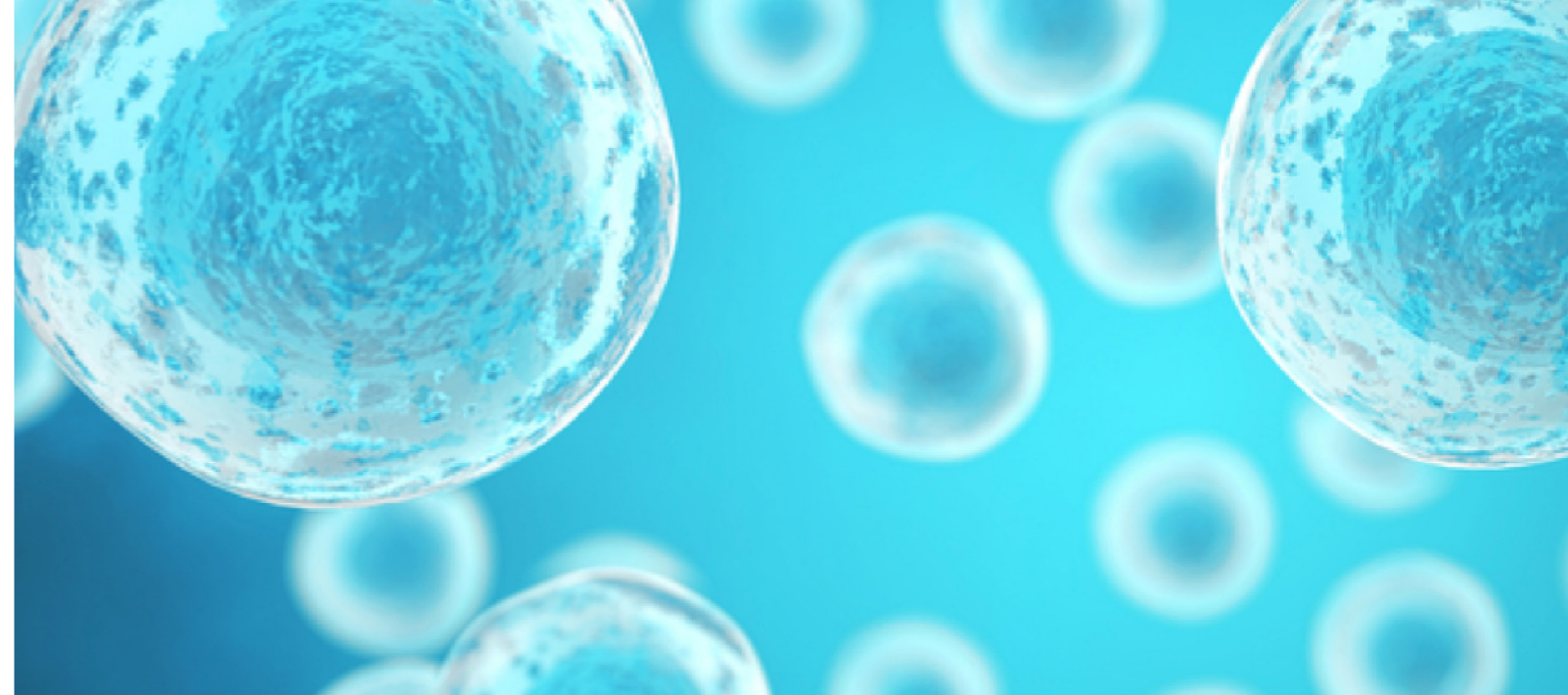
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Extracellular vesicles from a natural  
source for tailor-made nanomaterials

[www.ves4us.eu](http://www.ves4us.eu)

VES4US is a project funded by the FET-Open Call of the Horizon2020 Programme of the European Commission. VES4US goal is to develop a radically **new platform for the efficient production and functionalisation of EVs**. This will enable for their exploitation as tailor-made products in the fields of **nanomedicine, cosmetics and nutraceuticals**.

A core aspect of the project is to focus vesicles from a natural source to constitute a more economically viable and sustainable source of EVs. This process will allow the development of natural nanocarriers with unprecedented abilities for drug delivery in specific tissues such as brain, lung, skin, dendritic or tumour cells.



## OBJECTIVES:



The identification of suitable upstream and downstream conditions such as the source of EVs, the purification of EVs and the manipulation approaches



The development of a robust analytical platform to evaluate the key EVs attributes: physicochemical properties and biological activities.



Elaboration of post-production strategies for chemical functionalization



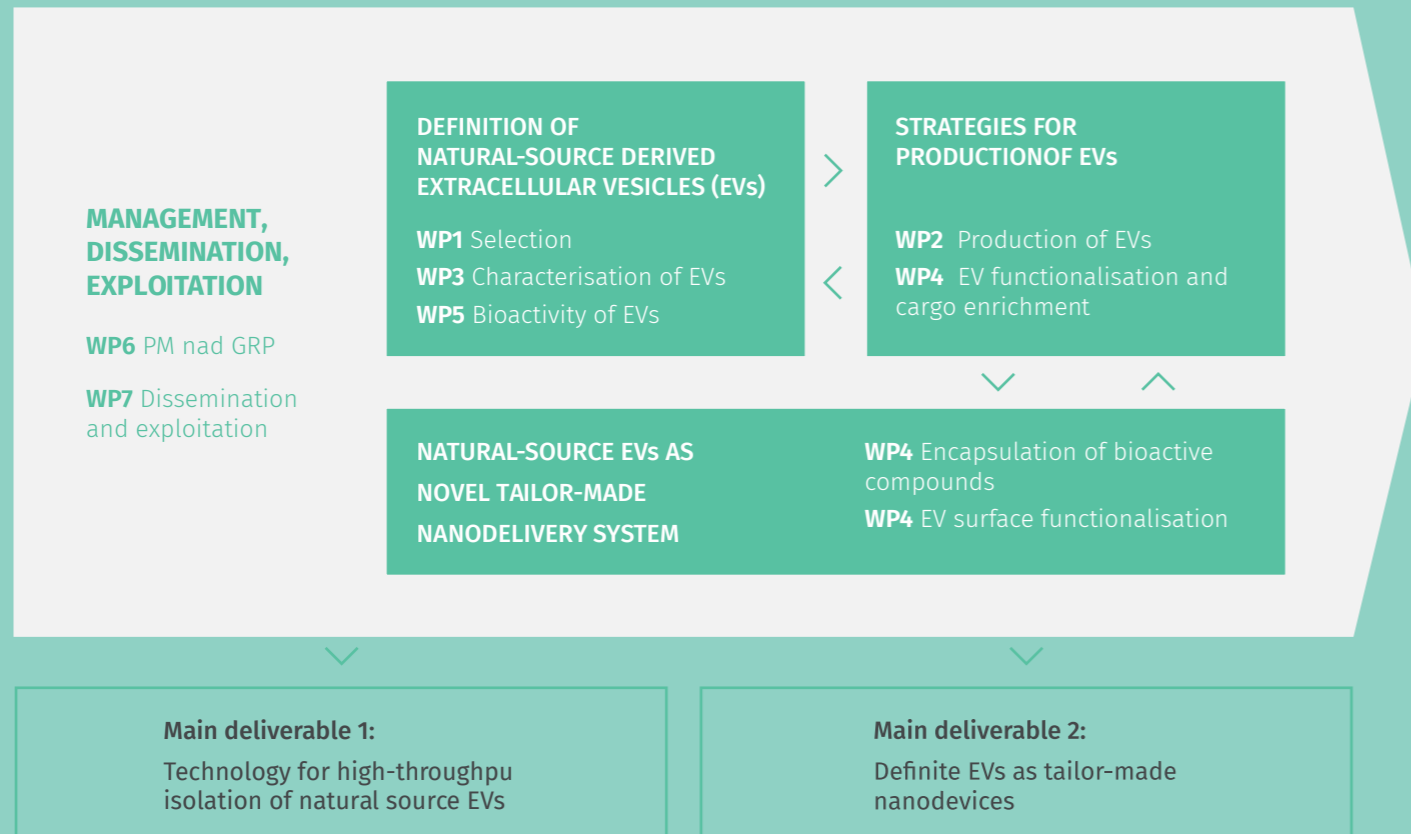
Bioengineer natural source EVs as tailor-made nanodevices and nano-carriers.

## BIOPROCESSING APPROACH

VES4US aims at creating a fundamentally new bioprocessing approach to generate and functionalise EVs from a renewable biological source. VES4US will apply **state-of-the-art technologies** that have emerged in recent years as potent signal transducers, and cell-cell communicators. EVs will be loaded with specific cargoes directly in isolated EVs or by the modulation of producer cells. **Membrane engineering** for targeting purposes is expected to allow generating vesicle carriers with unprecedented abilities.



## WORK PACKAGES



## FROM A NATURAL SOURCE TO A COMMERCIAL PRODUCT

This innovative research will focus on developing natural derived cells biotechnology to translate fundamental work outputs into market-led opportunities relevant to the **nanomedicine, cosmetic and nutraceuticals sectors**. It is anticipated that VES4US results could replace less societal accepted animal-derived pharmaceuticals or chemical liposomes, as future vehicles for targeted drug/active compound delivery, influencing health and human wellbeing. The biotech industry generates millions of euros of revenue and sustains a sizeable work force, VES4US will undertake high risk and high gain foundation work for future internationally excellent research by promoting natural derived EVs with deep knowledge of specific sectorial needs. Industrial stakeholders could be a direct beneficiary of VES4US and potentially invest in the technology developed especially for follow-on work with **bioengineered of this nanovesicles**.

Not only the cosmetics or bio industry will be affected, an aspect of the implementation of the principle of Smart Economy is the commitment towards the training of a highly qualified workforce to meet the future **needs of the European society and develop a knowledge-based economy**. This approach of developing human capital for the future will be embraced with the recruitment of high calibre postgraduate students and staff and the translation of research aspects into undergraduate education. A career development plan will be realised for each recruited Postdocs and PGs. This will be realised for example via research-based learning and the embedding of VES4US outputs in some teaching components of science programmes delivered at the partner institutions.

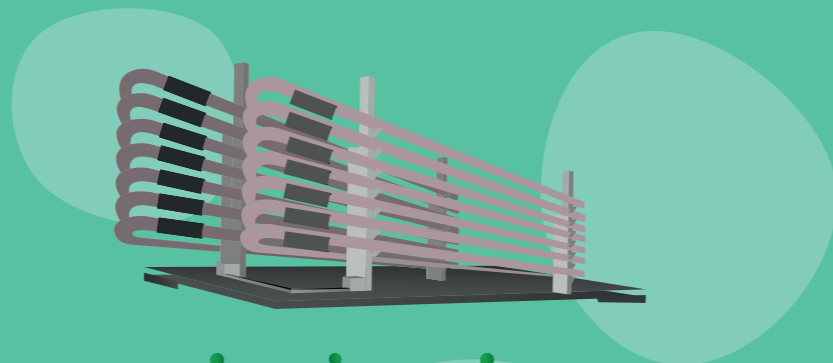


## FROM A NATURAL SOURCE...

Phase 1:

### **EVs PRODUCTION**

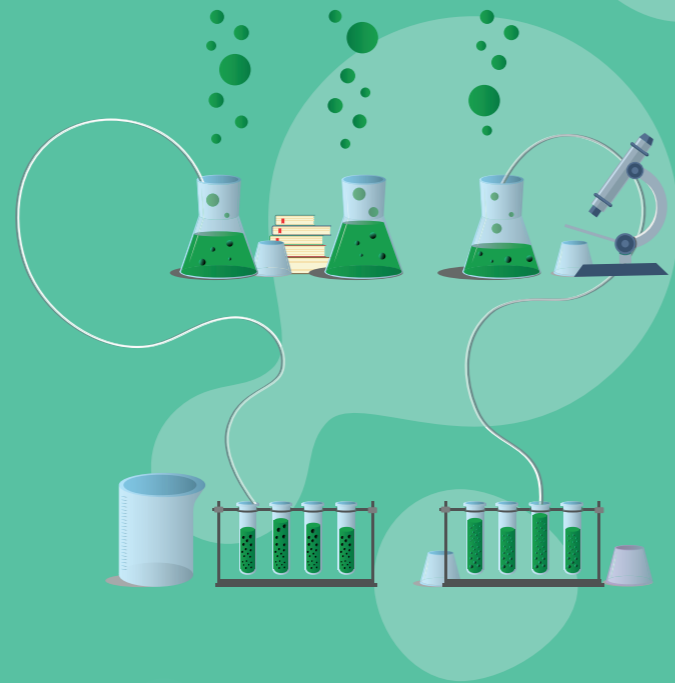
Selection of the natural source and optimization of culture condition at pre-industrial scale.



Phase 2:

### **ISOLATION AND CHARACTERIZATION**

Isolation and physiochemical characterization of the extracellular vesicles.



Phase 3:

### **FUNCTIONALIZATION AND LOAD**

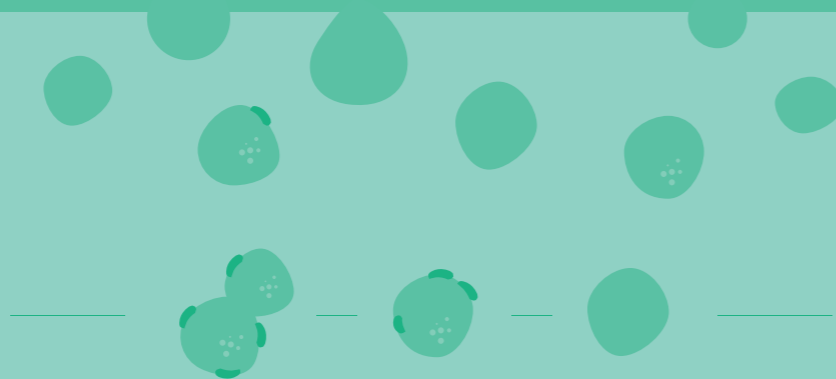
Functionalization and load of the EVs selected from the previous phase. These vesicles may differ according to the different sector needs.



Phase 4:

### **BIOLOGICAL ACTIVITY**

Biological activity of the EVs explored both in vitro and in vivo FROM A NATURAL SOURCE...



TO A COMMERCIAL PRODUCT

## **PUBLIC ENGAGEMENT**

VES4US will also aim at promoting public engagement (short-term) by involving students from schools to contribute to simple experiments at STEM focused or Open Day events which are annually organised on the premises of some of the partner institutions within VES4US (short-term).

As a next step in contributing to the EV field, VES4US in collaboration with academic and industrial partners, we will investigate the potential and suitability of developing a module on natural source-derived EVs on an educational massive open online course (MOOCs).



## EDUCATION AND TRAINING

VES4US is highly interdisciplinary and involves teams from different institutes covering different research disciplines including Biological Sciences, Nanomedicine, Green Chemistry, Physical Chemistry, Genetics, Biochemical Engineering, Biotechnology, Biophysics, Microfluidics, Nanotechnology among others.



**Training and exchanges** via staff and student travel among the consortium members will be encouraged to genuinely improve the **interdisciplinary methodology**. These measures will enhance cooperation and synergy between the consortium members. Detailed actions (**training plan**) will be undertaken to improve the interdisciplinary methodology and the scientific cross-fertilisation amongst the partners by training staff and students of each participant institution for targeted collaborative experimentation. This will be realised by visits to host institutions and the organisation of 'hands-on' workshops on specific thematic during the yearly meetings.

VES4US wants to go a step forward in the quality generation and management of research and will apply a **Quality management system** compatible to UNI EN ISO 9001:2015 and OECD GLP standards. This quality plan for the management of procedures will include **personnel training** on Standard Operating Procedures (SOP) to control major experimental activities for harvesting, manipulating, storing, characterising and treating EVs, as well as for key related activities.



## WHO IS INVOLVED?

The VES4US consortium is well-balanced group made up by 5 research centers and universities and 1 consultancy firm from 6 different European countries. The group is led by **The National Research Council of Italy**. The other partners are: **Institute of Technology Sligo** (Ireland), **The Swiss Federal Institute of Technology** (Switzerland), **University of Ljubljana** (Slovenia), **Max Planck Institute for Polymer Research** (Germany) and **ZABALA Innovation Consulting** (Spain).

Working together we will face an amazing challenge for some of the most innovative fields!



Institute of  
Technology Sligo

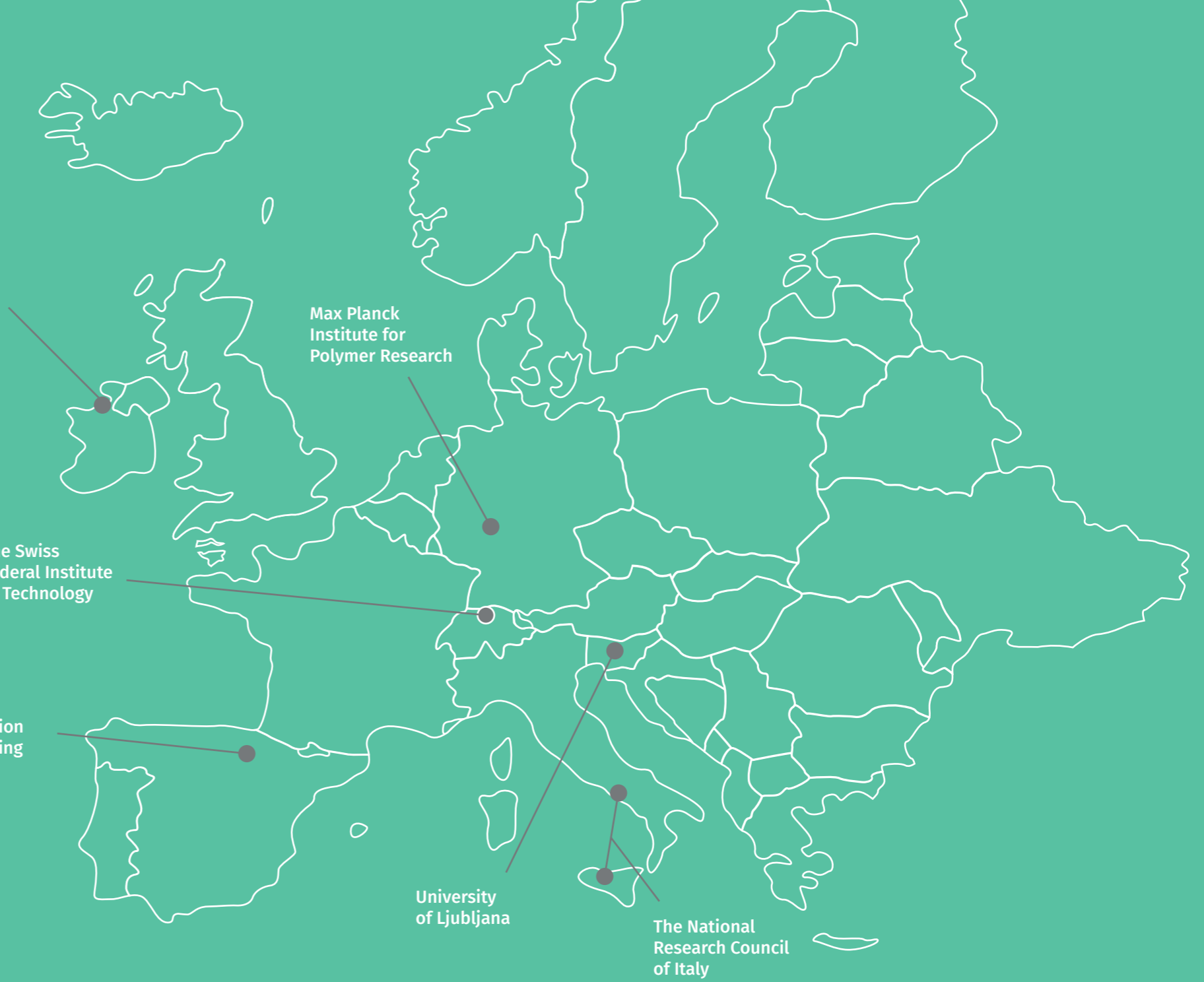
Max Planck  
Institute for  
Polymer Research

The Swiss  
Federal Institute  
of Technology

ZABALA  
Innovation  
Consulting

University  
of Ljubljana

The National  
Research Council  
of Italy





## REACH US!

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