

MarineBiotech



Marine Biotechnology  
ERA-NET



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# Marine Infrastructures in Europe new opportunities for research and technology development in marine biotechnology

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# *Vision for the future*

***By 2020 European Union will develop and apply advanced tools, platforms and infrastructures to support Marine Biotechnology in order to address key societal challenges in the next decade in the areas of food and energy, development of novel drugs and the sustainable use and management of the seas and oceans.***



# ENABLING TECHNOLOGIES AND INFRASTRUCTURES



**European marine biotechnology activity has made significant progress over the past decade in building a research community and infrastructure to support research and innovation.**

**Despite this progress, there remains an acute need to continue to build research and innovation capacity — in both the research and enterprise sectors and to enhance the science and technology research infrastructure.**

**A major goal of ERA-MBT is to position marine biotechnology within a self-sustained enterprise driven network that is supported by national and European funding agencies. Reaching this goal delivers the vision for European Marine Biotechnology set by the ESF-Marine Board in its 2010 position paper.**

*How to achieve this through current projects such as EMBRC*



**EMBRC**  
EUROPEAN  
MARINE  
BIOLOGICAL  
RESOURCE  
CENTRE



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EUROPEAN  
MARINE  
BIOLOGICAL  
RESOURCE  
CENTRE



*What is EMBRC?*

•**EMBRC is distributed Marine Research Infrastructure of state-of-the-art research and training facilities (part of the ESFRI roadmap for Biological and Medical Research) that brings together 24 leading European marine stations in 9 different countries across Europe.**

•**EMBRC is a driver in the development of blue biotechnologies, supporting both fundamental and applied research activities for sustainable solutions in the food, health and environmental sectors.**



## GOALS AND OBJECTIVES

EMBRC Objectives are to:

- Offer access to a portfolio of state-of-the-art research platforms, biological resources, analytical services, expert advice and data to users from academia, the private sector as well as policy stakeholders;
- Improve the quality of access by developing common standard quality practices and unique integrated workflows of specialized services;
- Strengthen the connection of science with users from industry through the establishment of Expert Centres for blue biotechnology innovation;
- Educate the next generation of research scientists through exposure to and training on excellent infrastructures and services, as well as advanced technology; train researchers, also from the private sector, to utilize advanced technologies; to enhance the managerial competence and technical skills of the RI personnel;

# status



- EMBRC was integrated into the ESFRI roadmap in 2008;
- A MoU to establish the EMBRC-ERIC entered into force in 2013 (FR, HR, IT, PT, ES, UK, BE, IS and NO);
- France was selected to host EMBRC-ERIC, with HQ in Paris;
- EMBRC submitted its final ERIC application in May 2017;
- EMBRC-ERIC is expected to enter the Operational Phase in late 2017, with nine country Members.

# Scientific themes

- Developmental Biology & Evolution
- Biogeochemistry & Global Change
- Marine Products & Resources**
- Biodiversity & Ecosystem Functioning
- Biomedical Sciences**



# *Ecosystems and biodiversity readily accessible to shore-based marine stations*

- Fjords
- Estuaries
- Mud flats
- Sea grass beds
- Kelp forests
- Volcanic seeps
- Coral reefs
- Megatidal seas
- Deep sea environments



# Access to platforms

Coastal research vessels, remote operated vehicles, tethered buoys, scientific diving, and animal borne sensors



# Experimental facilities

Seawater supply, cold and warm water aquaria, environmental control (pH, CO<sub>2</sub>, temperature, light, salinity), plankton and invertebrate feed culture, mesocosms



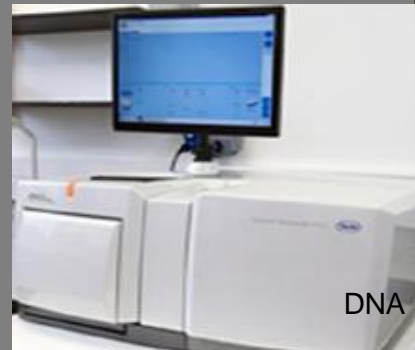
# Biological resources

Model species, genotypes, mutant strains including transgenics, genomic resources (e.g. BAC libraries), type culture collections, antibodies



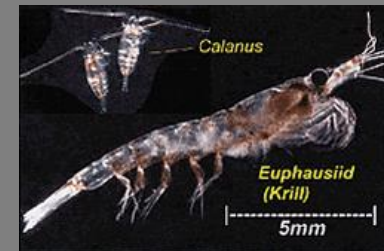
# Major equipment

Next Generation Sequencers, X-ray diffraction, nuclear magnetic resonance spectroscopy, mass spectrometry, laser confocal scanning microscopes, electron microscopes, analytical chemistry



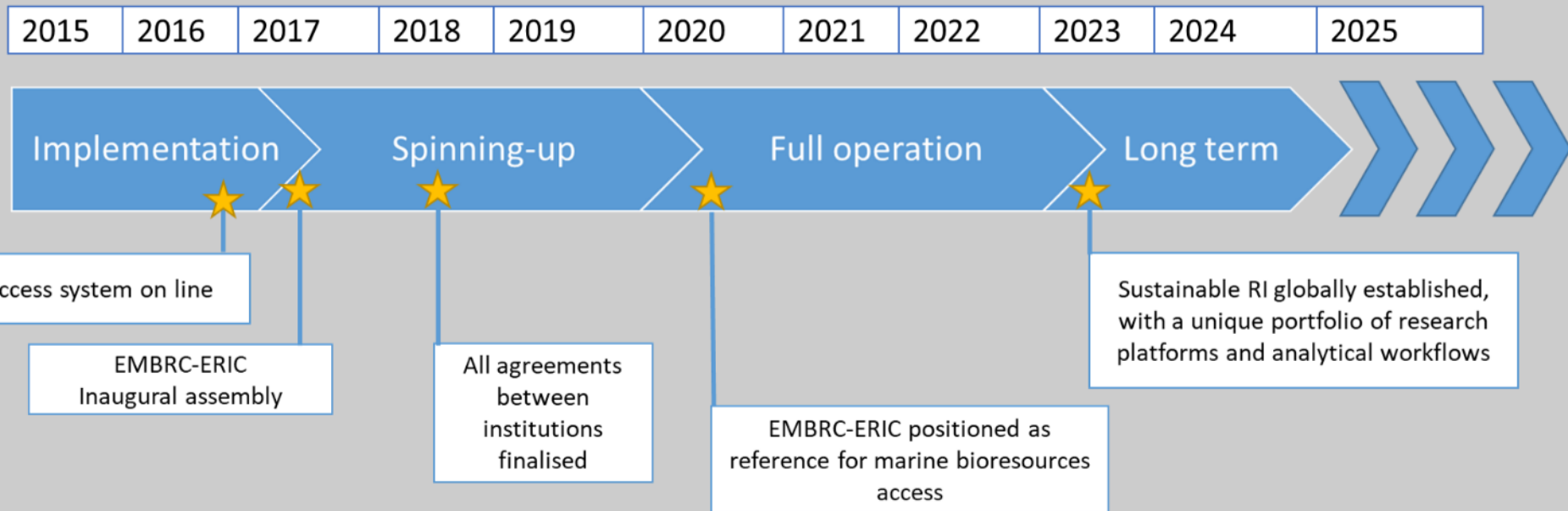
DNA sequencer

## Data sets and time series



Hosting and teaching facilities

# EMBRC Timeline



Many services are already active, and accessible through the EMBRC Access Portal

<http://www.embrc.eu/>



### EMBRC-ERIC

The European Marine Biological Research Centre (EMBRC-ERIC) is a research Infrastructure of pan-European relevance. Part of the ESFRI roadmap since 2008, it is designed to further fundamental and applied marine biology and ecology research. At the moment, there are 9 countries partner to the infrastructure cluster

### The Belgian Node of EMBRC

The Belgian node, EMBRC-BE, is currently represented by Ghent University, University of Hasselt, the Flanders Marine Institute and the Royal Belgian Institute for Natural Sciences. Together, these institutes can deliver a wide array of services to suit the needs of our stakeholders.



### Strategy

By providing access to state-of-the-art national facilities, EMBRC-ERIC will provide the necessary and relevant services, facilities and technology platforms to study marine organisms and ecosystems. EMBRC-ERIC will help promote the development of blue biotechnologies by supporting fundamental and applied research activities in medicine, nutrition, aquaculture, biotechnology, and fisheries, among others.

## EMBRC Nodes:

- Belgium (BE)
- Greece (GR)
- Spain (ES)
- France (FR)
- Israel (IL)
- Italy (IT)
- Norway (NO)
- Portugal (PT)
- United Kingdom (UK)

### Services, Resources and Facilities

Access to Habitats



Experimental Facilities



Training



Technology Platforms



Biological Resources



Data and e-Infrastructures



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



## HARMONIZATION of PROCEDURES for INTEROPERABILITY & MULTI-DISCIPLINARITY

EMBRC-ERIC is involved in a number of EU projects, which consolidate and integrate the RI community, linking RIs and standardised procedures for data-gathering, -handling, -calibration and -storage, continuous workflows across RI platforms, and common open platforms for data sharing.



[embric.eu](http://embric.eu)



[corbel-project.eu](http://corbel-project.eu)



[envriplus.eu](http://envriplus.eu)

# The **EMBRIC cluster** 9 countries and 27 institutional partners



Six pan-European **Research Infrastructures** contributing to the development of a knowledge-based **blue**

**bioeconomy**



# EMBRIC objectives

1



## ENABLE ACCESS TO RESOURCES

Enable access to biological, analytical and data resources by developing coherent chains of high quality services.

2



## FEDERATE A COMMUNITY

Federate a community of technology transfer services that will strengthen the connection of science with industry.

3

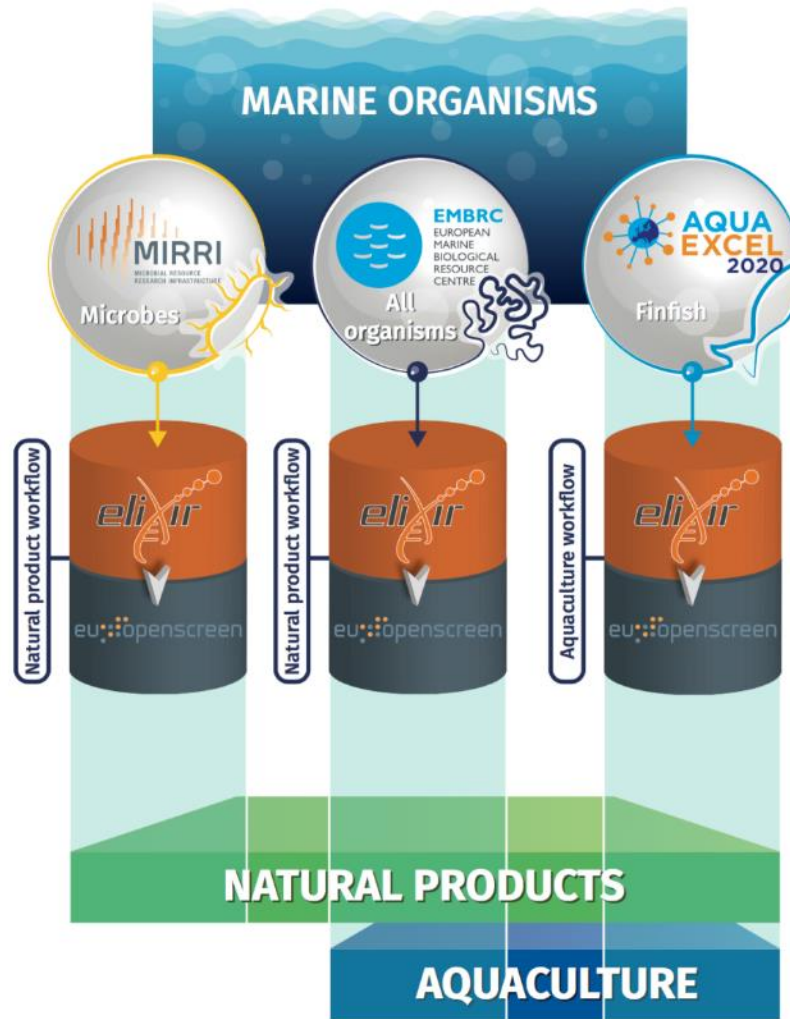


## INTEGRATE PUBLIC AND PRIVATE-SECTOR COMMUNITIES

Integrate public and private-sector communities in the domain of marine biotechnology by involving regional RDI policy-makers.



# EMBRIC pipelines



# EMBRIC pipeline examples



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## Discovery Pipelines

### Protein Pipeline

*Proteins, the building blocks of life*

Horizon 2020's Blue Growth Strategy states that "marine biodiversity and biotechnology research have a huge potential to contribute new knowledge for high value products and processes and increase marine resources and biodiversity understanding". The bio-potential and value of marine proteins is immense and the development of tools and technologies for the production of recombinant proteins are targeted at overcoming the problems associated with heterologous protein production.

**Centre for Marine Science – CCMAR (Universidade do Algarve)**

- Strong competence in cloning and expression systems for the production of piscine proteins
- Protein expression and purification
- In vitro and in vivo activity screening platform
- Biosensor capabilities

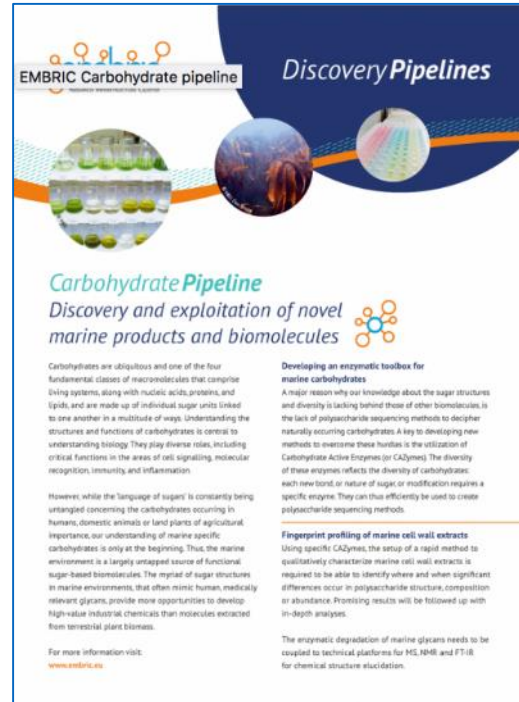
**Biomedical Sciences Research Complex – BSRC (University of St Andrews)**

- Gene cloning based on His/TEV/GFP and Gateway enables expression in E. coli, yeast or insect cells
- Protein expression and purification
- Crystallization and structure determination facility (including membrane proteins, and complexes)

**Station Biologique Roscoff – SBR (Université Pierre-et-Marie-Curie)**

- Bioinformatics platform
- Medium throughput cloning and expression systems
- Structural characterization tools
- Carbohydrates and fucoids

For more information visit:  
[www.embric.eu](http://www.embric.eu)



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## Discovery Pipelines

### EMBRIC Carbohydrate pipeline

### Carbohydrate Pipeline

*Discovery and exploitation of novel marine products and biomolecules*

Carbohydrates are ubiquitous and one of the four fundamental classes of macromolecules that comprise living systems, along with nucleic acids, proteins, and lipids, and are made up of individual sugar units linked to one another in a multitude of ways. Understanding the structures and functions of carbohydrates is central to understanding biology. They play diverse roles, including critical functions in the areas of cell signaling, molecular recognition, immunity, and inflammation.

However, while the 'language of sugars' is constantly being untangled concerning the carbohydrates occurring in humans, domestic animals or land plants of agricultural importance, our understanding of marine specific carbohydrates is only at the beginning. Thus, the marine environment is a largely untapped source of functional sugar-based biomolecules. The myriad of sugar structures in marine environments, that often mimic human, medically relevant glycans, provide more opportunities to develop high-value industrial chemicals than molecules extracted from terrestrial plant biomass.

For more information visit:  
[www.embric.eu](http://www.embric.eu)

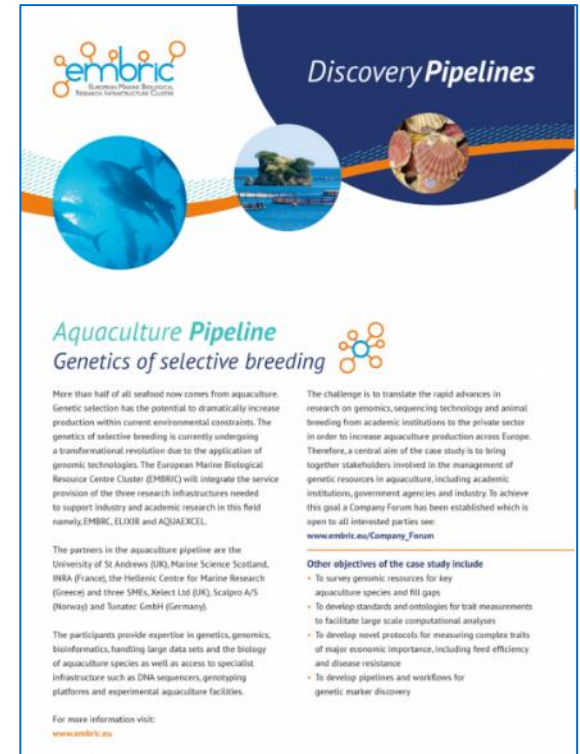
**Developing an enzymatic toolbox for marine carbohydrates**

A major reason why our knowledge about the sugar structures and diversity is lacking behind those of other biomolecules is the lack of polysaccharide sequencing methods to decipher naturally occurring carbohydrates. A key to developing new methods to overcome these hurdles is the utilization of Carbohydrate Active Enzymes (or CAZymes). The diversity of these enzymes reflects the diversity of carbohydrates: each new bond or nature of sugar or modification requires a specific enzyme. They can thus efficiently be used to create polysaccharide sequencing methods.

**Fingerprint profiling of marine cell wall extracts**

Using specific CAZymes, the setup of a rapid method to qualitatively characterize marine cell wall extracts is required to be able to identify where and when significant differences occur in polysaccharide structure, composition or abundance. Promising results will be followed up with in-depth analyses.

The enzymatic degradation of marine glycans needs to be coupled to technical platforms for MS/MS and FT-IR for chemical structure elucidation.



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## Discovery Pipelines

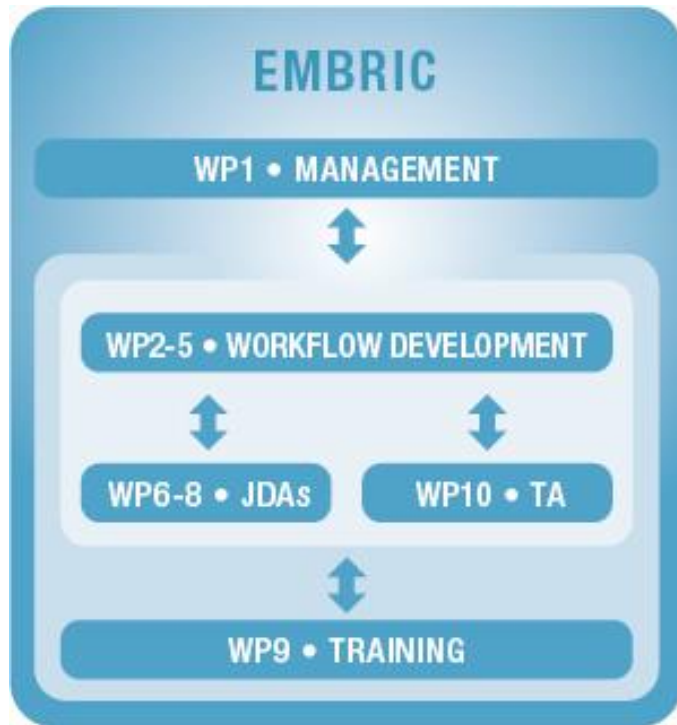
### Aquaculture Pipeline

### Genetics of selective breeding More than half of all seafood now comes from aquaculture. Genetic selection has the potential to dramatically increase production within current environmental constraints. The genetics of selective breeding is currently undergoing a transformational revolution due to the application of genomic technologies. The European Marine Biological Resource Centre Cluster (EMBRIC) will integrate the service provision of the three research infrastructures needed to support industry and academic research in this field namely EMBRIC, ELIXIR and AQUAEXCEL. The partners in the aquaculture pipeline are the University of St Andrews (UK), Marine Science Scotland, INRA (France), the Hellenic Centre for Marine Research (Greece) and three SMEs, Nectec Ltd (UK), Scalpro A/S (Norway) and Tanatar GmbH (Germany). The participants provide expertise in genetics, genomics, bioinformatics, handling large data sets and the biology of aquaculture species as well as access to specialist infrastructure such as DNA sequencers, genotyping platforms and experimental aquaculture facilities. For more information visit: [www.embric.eu](http://www.embric.eu) The challenge is to translate the rapid advances in research on genomics, sequencing technology and animal breeding from academic institutions to the private sector in order to increase aquaculture production across Europe. Therefore, a central aim of the case study is to bring together stakeholders involved in the management of genetic resources in aquaculture, including academic institutions, government agencies and industry. To achieve this goal a Company Forum has been established which is open to all interested parties see: [www.embric.eu/Company\\_Forum](http://www.embric.eu/Company_Forum) **Other objectives of the case study include** - To survey genomic resources for key aquaculture species and fill gaps - To develop standards and ontologies for trait measurements to facilitate large scale computational analyses - To develop novel protocols for measuring complex traits of major economic importance, including feed efficiency and disease resistance - To develop pipelines and workflows for genetic marker discovery

Find more information at  
[www.embric.eu](http://www.embric.eu)



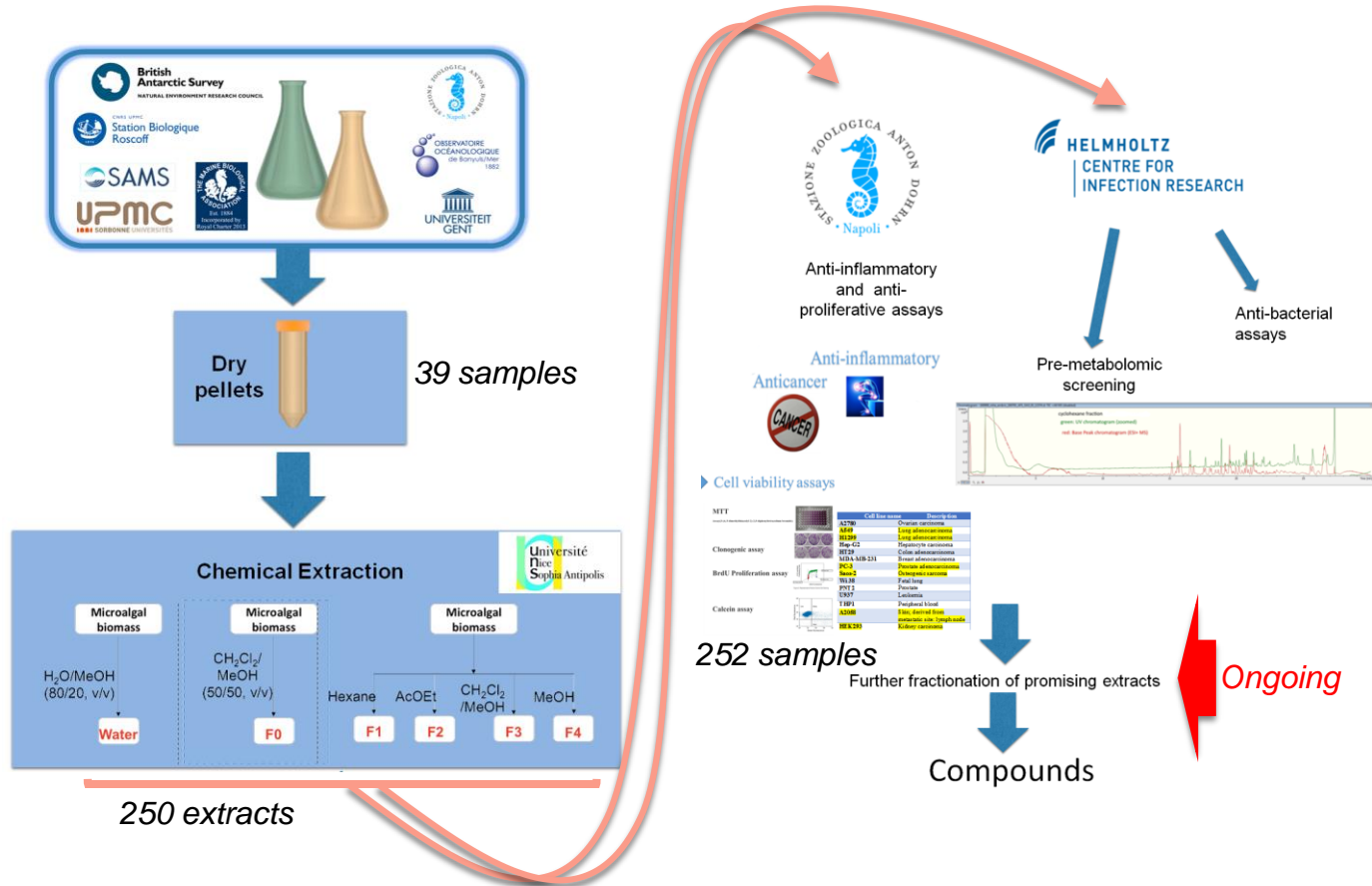
# ***EMBRIC Work Packages: task distribution and interaction***

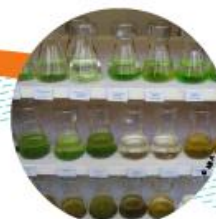


- WP1: Management and Communication*
- WP2: Improvement of access to marine organisms from Biological Resource Centers*
- WP3: Concepts for the discovery and exploitation of marine products and biomolecules*
- WP4: Data services and reporting standards*
- WP5: Mobilizing Research Infrastructures to foster blue biotechnology ecosystems in maritime regions*
- WP6: Microbial pipeline from environment to active compounds*
- WP7: Microalgae for blue biotechnological applications*
- Development of biological*
- WP8: resources for the selective breeding of shellfish and finfish*
- WP9: Training and exchange of best practice*
- WP10: Transnational Access to EMBRIC*



# WP7: Natural products from microalgal strains





## EMBRIC Integrated Training Programme



EMBRIC, the European Marine Biological Research Infrastructure Cluster launched an integrated training programme to harmonize methods and standardize procedures in the EMBRIC domain. In this framework, a trimestrial call has been set up. It provides partners an extra incentive and financial support to organise, host and participate in knowledge exchange, best practice and technology transfer.

UGent will assist and facilitate training setup

Amongst others, training activities can tackle:

- Standardised procedures for discovery, development and exploitation of resources
- Novel technical enhancements for generating marine derived products
- Methods and developments in computational resources
- Innovation dynamics, technology transfer (TT) and value creation in blue biotech
- Transnational access (TNA) and access benefit sharing (ABS)
- Human capacity building (HCB) and transferable skills
- Intellectual property (IP), governance and policy

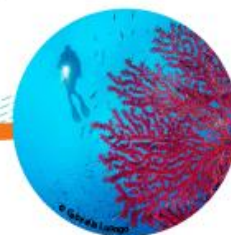
3<sup>rd</sup> call open now!

Call for training opportunities in  
marine biotechnology &  
aquaculture innovation

Deadline: 7 December 2017

EMBRIC funding call eligibility criteria:

- Up to 3500€
- Proposals can involve organisations outside EMBRIC
- One EMBRIC partner should co-organise
- Only actual costs linked to the training, its venue, its training material and the finalization of its outcome
- Innovative training approaches are welcome
- Collaboration with industry & policy is encouraged



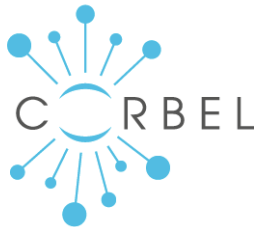
This project has received funding from  
the European Union's Horizon 2020  
research and innovation programme  
under grant agreement No 654008

For guidelines and proposal  
submission visit:

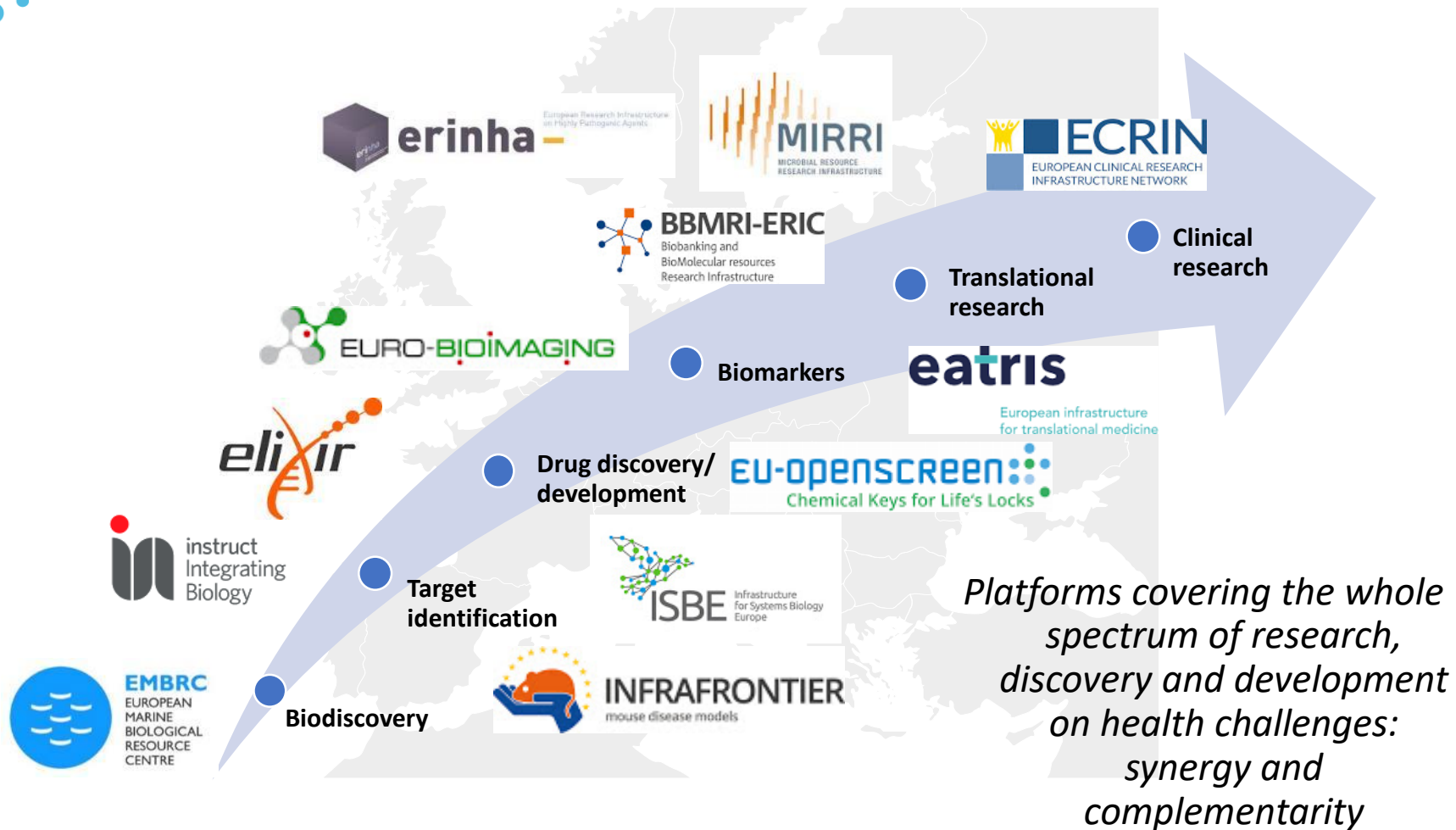
[www.embric.eu/trainingcall](http://www.embric.eu/trainingcall)

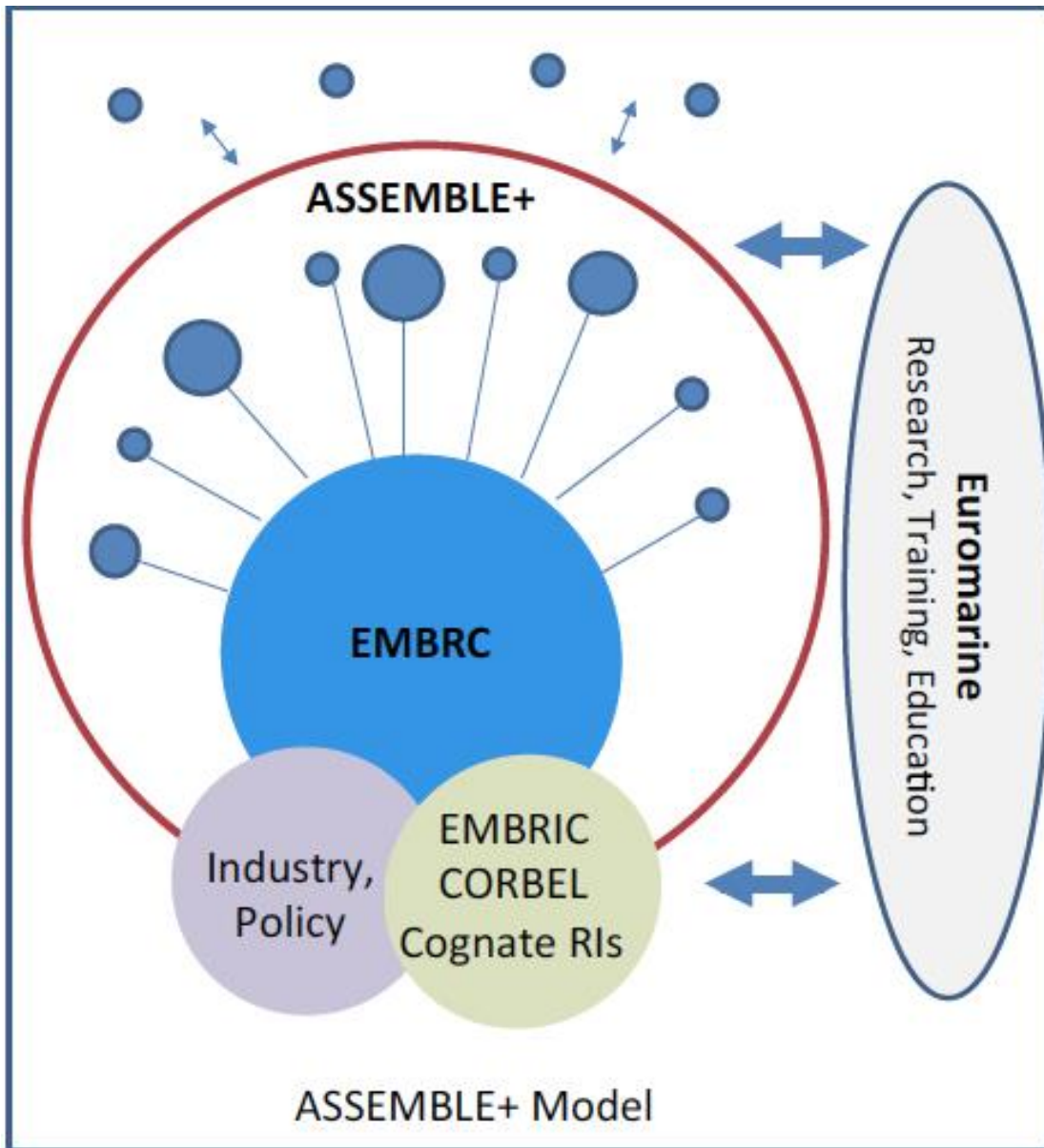


CORBEL are shared services between the ESFRI Biological and Medical Research Infrastructures that transform the European research community from discovery of basic biological mechanisms to applied medical translation – through the provision of a unified interface, aligned services and coordinated user access to a range of advanced technology platforms.



## Coordinated RIs Building Enduring Life-Science Services





ASSEMBLE Plus will provide scientists from academia, industry and policy with a quality-assured programme of Transnational Access (TA) and Virtual Access (VA) to marine biological stations offering a wide variety of marine ecosystems, unique marine biological resources, state-of-the-art experimental and analytical facilities with integrated workflows, historical observation data, and advanced training opportunities.

**The project started on the 1st of October 2017.**



### **Why are Research Infrastructures so important?**

Innovation in science and technology is vital to solving Europe's economic and societal challenges. These solutions require access to complex and costly RIs.

Efficient RIs enable the greatest **discoveries** in science and technology, **attract researchers** from around the **world** and build bridges between research communities. They allow the **training** of researchers and facilitate innovation and knowledge-sharing.

By **pooling efforts** and developing RIs, European countries can achieve **excellence** in highly demanding scientific fields and simultaneously build the European Research Area (ERA) and Innovation Union.

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Thank you for your attention