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ERA-MBT Final Conference: 'Oceans of opportunities'

ERA-MBT projects

Work Package 5

Joint activities: implementation to joint calls and training & education activities

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December 2013 - November 2017

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MARBioFEED

Enhanced biorefining methods for the production of marine biotoxins and microalgae fish feed

MarineBiotech

PROJECT FACTSHEET

CALL 1 | NOVEMBER 2015

ABSTRACT

Shellfish production sites in the EU are prone to closures due to the accumulation of biotoxins, with over 26 EU regulated toxins requiring statutory monitoring. Further impacts are exerted on fish farming industries through the production of feed from contaminated shellfish. The focus of this proposal is to isolate large quantities of biotoxins using enhanced biorefining methods for the preparation of reference materials and to allow for research to be conducted on the effects of biotoxins on other important aquaculture industries. Further work will focus on enhanced production of microalgae as fish feed. Biotoxins will be sourced from contaminated shellfish, bulk algal culturing, harvesting of algal blooms in situ and enzymatic conversions. Biorefining processes will be enhanced through optimisation of algal culturing, the development and use of novel immunoaffinity and polymeric columns, reducing cost and increasing economic viability.

Dr Jane Kilcoyne, Project Coordinator
Marine Institute
Ireland

Topic:

- Feed
- Materials
- Environment and monitoring (e.g. biosensors, anti-fouling technology, bioremediation…)

Marine biomass:

- Molluscs
- Microalgae
- Fish

Keywords:

Marine biotoxins, biorefining, fish feed, reference materials, LC-MS, NMR, structure elucidation, HP20 resin, Harmful algal blooms, shellfish, monitoring, aquaculture

Total costs*: € 749.949

Funding granted*: € 749.949

Duration: 3 years (2016-2018)

** Exact amount may change after completion of national contracts*

CONSORTIUM

Name	Organisation	Country
Jane Kilcoyne	Marine Institute	Ireland
Christopher Owen Miles	Norwegian Veterinary Institute	Norway
Beatriz Reguera	Instituto Espanol de Oceanografia (IEO)	Spain
Pearse McCarron	National Research Council Canada	Canada
Fidel Delgado	Neoalgae Microseaweeds products	Spain
Stephen Burrell	Marine Institute	Ireland
Joe Silke	Marine Institute	Ireland
Ingunn Anita Samdal	Norwegian Veterinary Institute	Norway

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Mar3Bio

Biorefinery and biotechnological exploitation of marine biomasses

MarineBiotech

PROJECT FACTSHEET

CALL 1 | NOVEMBER 2015

ABSTRACT

The marine biomasses to be used in Mar3Bio are brown algae and crustacean byproducts. These abundant but underexploited renewable biomasses have great potential for production of high value biomolecules. The current bottlenecks for a bio-refinery focusing on these raw materials are low yields, high energy consumption and incomplete spectrum of recovered biomolecules. Mar3Bio will tackle this by a multidisciplinary and intersectorial R&D approach, and contribute to the development of efficient and sustainable bio-refinery processes for exploitation of the selected biomasses. The main objective is to advance technology beyond state-of-the-art to I) increase the yield and quality of the products arising from early process streams by optimizing the isolation and fractionation steps performed on the raw materials, and II) modify selected fractionated biomolecules to high value products. The expected achievements will have great impact on the fulfilment of the ambitions of ERA-MarineBiotech.

Håvard Sletta, Project Coordinator
SINTEF Materials and Chemistry
Norway

Topic:

- Materials
- Cosmeceuticals (e.g. skincare)
- Health (e.g. food supplements)
- Pharmaceuticals

Marine biomass:

- Macroalgae
- Crustacea

Keywords:

Extraction, high value products, enzymes in processing steps, reduced energy consumption

Total costs*: € 3.378.920

Funding granted*: € 2.181.032

Duration: 3 years (2016-2018)

** Exact amount may change after completion of national contracts*

CONSORTIUM

Name	Organisation	Country
Håvard Sletta	SINTEF Materials and Chemistry	Norway
Vincent Bulone	Royal Institute of Technology (KTH)	Sweden
Finn Lillelund Aachmann	Norwegian University of Science and Technology	Norway
Sergio Paoletti	University of Trieste	Italy
Olav Gåserød	FMC Biopolymer AS	Norway
Gudmundur Hreggvidsson	MATIS	Iceland
Blaž Likozar	National Institute of Chemistry	Slovenia

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MicroMBT

Discovery and training of microbial biocatalysts for biomass conversion using moving bed technology (MBT)

MarineBiotech

PROJECT FACTSHEET

CALL 1 | NOVEMBER 2015

ABSTRACT

A culture collection of >100 genome sequenced marine bacteria from the Arctic region, and the Moving Bed Technology (MBT) will be used as tools to increase the value of marine rest raw materials. The bacterial isolates have been screened for biocatalyst activities (e.g., PUFA production, lipases, proteases), and hence represent an excellent starting point for this project. Inspired by the RAS (Recirculating Aquaculture system) technology, the idea is to establish and optimize microbial communities on MBT biobeads. The bacterial communities will be specifically trained into microfactories for conversion of low value rest-raw material from the fish industry. The process will be analogous to RAS, where biofilters are used to convert waste into non-toxic products. Water and lipid phases from spent medium will be collected and screened for potential products. In summary, the robust MBT method will be used in a completely new area, to convert cheap marine biomasses into new products.

Dr Peik Haugen, Project Coordinator
UiT-The Arctic University of Norway
Norway

Topic:

- Food
- Feed
- Materials
- Cosmeticeuticals (e.g. skincare)
- Health (e.g. food supplements)
- Pharmaceuticals

Marine biomass:

- Fish
- Crustacea
- Molluscs
- Macroalgae

Keywords:

Moving bed technology, Recirculating Aquaculture System, RAS, metagenomics, metabolomics, microbial factories, microbial communities.

Total costs*: € 1.832.446

Funding granted*: € 1.503.285

Duration: 3 years (2016-2018)

** Exact amount may change after completion of national contracts*

CONSORTIUM

Name	Organisation	Country
Peik Haugen	UiT-The Arctic University of Norway	Norway
Ragnhild D Whitaker	Norwegian Institute of Food, Fisheries and Aquaculture Research	Norway
Elin Moe	Instituto de Tecnologia Quimica e Biologica	Portugal
Fredrik Almqvist	Umeå University	Sweden

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NEPTUNA

Novel Extraction Processes for mulTiple high-value compoUNds from selected Algal source materials

MarineBiotech

PROJECT FACTSHEET

CALL 1 | NOVEMBER 2015

ABSTRACT

Novel enzyme-based extraction technologies will be applied to algal biomass derived from selected algal taxonomic groups including macroalgae (seaweeds), microalgae and cyanobacteria. Algal species will be chosen according to their potential to produce high bioactive levels which will be further enhanced by applying abiotic stresses. Algal extracts produced by enzymatic and traditional approaches will be tested for multiple applications, concentrating on antioxidant and antimicrobial activities with applications in food, cosmetics, animal health (aquaculture) and personal/home care. Extracts that exhibit high activities will be chemically characterised to identify active components.

Dr Dagmar Stengel, Project Coordinator
National University of Ireland Galway
Ireland

Topic:

- Food
- Feed
- Materials
- Cosmeticeuticals (e.g. skincare)
- Health (e.g. food supplements)
- Pharmaceuticals
- Environment and monitoring (e.g. biosensors, anti-fouling technology, bioremediation…)

Marine biomass:

- Microalgae
- Macroalgae
- Bacteria

Keywords:

Algae, antioxidant, antimicrobial, aquaculture, bioactive, cosmetics, cyanobacteria, enzymatic extraction, food, home care

Total costs*: € 894.918

Funding granted*: € 759.976

Duration: 2 years (2016-2018)

** Exact amount may change after completion of national contracts*

CONSORTIUM

Name	Organisation	Country
Dagmar Stengel	National University of Ireland Galway	Ireland
Alan Dobson	University College Cork	Ireland
Peter Bossier	Ghent University	Belgium
Sarah Hosking	Unilever	UK
Jeanette Andersen	UiT- The Arctic University of Norway	Norway

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SeaRefinery

The Seaweed Biorefinery – for high value added products

MarineBiotech

PROJECT FACTSHEET

CALL 1 | NOVEMBER 2015

ABSTRACT

SeaRefinery will develop eco-friendly chemical and enzymatic processing technologies to extract and purify high value-added components such as antioxidants, antimicrobial components and hydrocolloids from cultivated seaweed species (e.g. Saccharina latissima) in an integrated biorefinery. Bioactive compounds, e.g. phlorotannins, fucoidan, and laminarin, will be selectively tested for bioactivity. In addition, laminarin and marine proteins will be tested in nutraceutical and selected food model systems. Alginate will be tested as additive for textile applications via coating and extrusion technologies. In order to maximise the value of the biorefinery feedstock (input) and derived products (output), we will grow monocultures on innovative textile cultivation substrates with high yield biomass production. Seasonal variation, replicated over two years, of the selected biomolecules will be a measuring tool for harvesting the seaweeds with maximum contents of bioactive compounds.

Dr Anne-Belinda Bjerre, Project Coordinator
Danish Technological Institute
Denmark

Topic:

- Feed
- Materials
- Cosmeticeuticals (e.g. skincare)
- Health (e.g. food supplements)
- Pharmaceuticals

Marine biomass:

- Macroalgae

Keywords:

Seaweed, Saccharina latissima, cultivation, harvesting, storage, preconversion, biorefinery, bioactive, hydrocolloids, protein, nutraceuticals, functional foods, pharmaceuticals, biobased materials, extraction, enzymes, green solvents

Total costs*: € 2.607.074

Funding granted*: € 1.406.156

Duration: 3 years (2016-2018)

** Exact amount may change after completion of national contracts*

CONSORTIUM

Name	Organisation	Country
Anne-Belinda Bjerre	Danish Technological Institute	Denmark
Rósa Jónsdóttir	MARINOX EHF	Iceland
Sarah Hotchkiss	CyberColloids Ltd	Ireland
Bert Groenendaal	SIOEN Industries NV	Belgium
Guy Buyle	Centexbel	Belgium
Job Schipper	Hortimare AS	Norway
Jan Alexander Villadsen	ViVoX ApS	Denmark
Helen Oshea	Cork Institute of Technology	Ireland

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ThermoFactories

Thermophilic cell factories for efficient conversion of brown algae biomass to high-value chemicals

MarineBiotech

PROJECT FACTSHEET

CALL 1 | NOVEMBER 2015

ABSTRACT

Brown algae biomass is a promising and challenging resource for industrial bioconversions, but there is a need to develop efficient cell factories to convert the constituent carbohydrates into high-value added products. In this proposal, four metabolically different environmental bacteria, inherently suitable to harsh process conditions, will be engineered for production of a number of industrially important platform and specialty chemicals, including 1,2-propanediol, cadaverine, propanol and lycopene. The project will implement and integrate systems biology and metabolic engineering, including rounds of model-driven metabolic optimization. Feedstock development and process engineering are important parts, to optimize fermentability of the algal hydrolysates, and ensure integration with downstream processing and product recovery. At the end of the project, use of all major carbohydrate fractions from brown algae through integrated processing will be demonstrated at small pilot scale.

Dr Trygve Brautaset, Project Coordinator
Norwegian University of Science and Technology
Norway

Topic:

- Materials
- Energy as by-product
- Production of other commodities or services

Marine biomass:

- Macroalgae
- Bacteria

Keywords:

Microbial metabolic engineering, systems biology, value-added chemicals, integrated bioprocess, fermentations

Total costs*: € 2.485.677

Funding granted*: € 1.981.507

Duration: 3 years (2016-2018)

** Exact amount may change after completion of national contracts*

CONSORTIUM

Name	Organisation	Country
Trygve Brautaset	Norwegian University of Science and Technology	Norway
Alexander Wentzel	SINTEF Materials and Chemistry	Norway
Steinn Gudmundsson	University of Iceland	Iceland
Eva Nordberg Karlsson	Lund University	Sweden
Jochen Förster	Technical University of Denmark	Denmark
Gudmundur Oli Hreggvidsson	Matis Ohf	Iceland
Bruno Ferreira	Biotrend SA	Portugal
Simão Soares	SilicoLife Lda	Portugal

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BLUETEETH

Marine Origin Biopolymers as Innovative Building Blocks from the Sea for the Development of Bioresorbable Multilayered Membranes for Guided Bone Regeneration

MarineBiotech

PROJECT FACTSHEET

CALL 2 | DECEMBER 2016

ABSTRACT

Natural origin polymers from algae and arthropods can be obtained in large scale, and a great effort has been paid to find applications for such high-added value materials. Periodontal disease is frequent in humans and constitutes, together with dental caries, the principal cause of tooth loss in adults. Currently, one of the available treatment strategies for periodontal disease comprises the use of non-resorbable or resorbable membranes as barrier membranes for guided tissue/bone regeneration (GTR/GBR). Such membranes will act as a physical barrier to protect the defect site and to prevent soft tissue to reach the injured area, as well as "guide" the bone regeneration process. Several synthetic and natural membranes are currently being used for GTR/GBR to improve periodontal regeneration but, so far, complete regeneration has not yet been reported. In this concern, BLUETEETH intends to create a pioneering and innovative biocompatible and bioresorbable free-standing (FS) multilayered membrane that would address the limitations of the current ones, in terms of regeneration potential, by promoting an effective GTR/GBR to treat periodontal disease. Such multilayered membrane will have a special design and composition, thus allowing the spatiotemporal control of several parameters, including biocompatibility, biodegradability, mechanical performance, bioactivity and bioadhesion. This project attempts to develop the entire pipeline, bridging the isolation of the marine raw materials up to the final device, with expected improved medical performance and technical characteristics suitable to accelerate market entry.

João Mano, Project Coordinator
University of Aveiro (UAVR), Portugal

Topic:

- Marine origin biopolymers

Marine biomass:

- Crustacea

Source of marine biomass:

- Marine biomass processing by-products and waste fractions

Keywords:

Blue biotechnology, marine environment, value-added marine origin by-products, chitosan/chitosan chemical modification, bioactive agents, layer-by-layer assembly, bioresorbable membranes, biomedical applications, guided bone regeneration, periodontal disease

Total costs*: € 1.005.000

Funding granted*: € 797.000

Duration: 3 years (2017-2019)

** Exact amount may change after completion of national contracts*

CONSORTIUM

Name	Organisation	Country
João Mano	University of Aveiro (UAVR)	Portugal
Már Másson	University of Iceland (UI)	Iceland
Hélène Lauzon	Primex ehf (PRIMEX)	Iceland
Janne Reseland	University of Oslo (UiO)	Norway

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BlueShell

Exploring Shellfish By-products as sources of Blue Bioactivities

MarineBiotech

PROJECT FACTSHEET

CALL 2 | DECEMBER 2016

ABSTRACT

About 70% of annual shellfish production ends up as by-products. Apart from use in chitin/chitosan, this marine biomass is either used to make fertilizer/low value products or is sent to landfill, incinerated or dumped at sea. BlueShell will address this problem by exploring 3 typical shellfish by-products; shrimp shells, crab shells and defect mussels, for potential (bio)active compounds targeted at the sustainable supply of safe, healthy foods. Research indicates that the abundance of hepatopancreas tissue, the open circulatory system, the filtering nature and the shell structures render crustaceans and bivalves as sources of unique proteins/peptides, unusual fatty acids, pigments and chitin. Applying enzymatic hydrolysis or fermentation will enhance bioactivity through controlled proteolysis, lipolysis and production of low molecular weight compounds. It will facilitate fractionation through lipid-protein disconnections and demineralization/de-proteinisation. Different starter cultures will be tested against a standardized enzymatic hydrolysis as reference. Peptide-, lipid- and chitin-enriched fractions will be explored for (bio)activities relevant to: (i) functional foods development, (ii) food safety applications and (iii) plant health applications. Molecular characterisation of the most active fractions will help identify the specific compounds involved. BlueShell will investigate upscaling feasibility and market potential for the most interesting cases.

Katleen Raes, Project Coordinator
Ghent University, Belgium

Topic:

- Shellfish by-products

Marine biomass:

- Crustacea

Source of marine biomass:

- marine biomass processing by-products and waste fractions

Keywords:

fermentation, enzymatic hydrolysis, mussel, crab, shrimp, nutrition, food safety, plant health, antifouling, antimicrobial

Total costs*: € 1.319.000

Funding granted*: € 1.152.000

Duration: 3 years (2017-2019)

** Exact amount may change after completion of national contracts*

CONSORTIUM

Name	Organisation	Country
Katleen Raes	Ghent University	Belgium/ Flanders
Johan Robbens	Institute of Agricultural and Fisheries Research	Belgium/ Flanders
Ingrid Undeland	ChalmersUniversity of Technology	Sweden
Donatella de Pascale	National Research Council	Italy
Ragnhild Whitaker	Whitaker Nofima	Norway
Michelle Giltrap	Dublin Institute of Technology	Ireland
Karl Bonner	Irish Fish Canners Ltd	Ireland

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CYANOBESITY

Cyanobacteria as a source of bioactive compounds with effects on obesity and obesity-related co-morbidities

MarineBiotech

PROJECT FACTSHEET

CALL 2 | DECEMBER 2016

ABSTRACT

An urgent demand for new anti-obesogenic compounds is present, and marine cyanobacteria promise to be an excellent source for natural-derived molecules and novel nutraceuticals. Some strains of cyanobacteria are commercially available for consumption due to their beneficial properties to human health. Preclinical studies have been performed in various animal models and demonstrated hypolipidemic activities in rats and mice, lowering hepatic cholesterol and triglyceride levels. In the proposed project, marine cyanobacterial strains of a culture collection will be screened for beneficial properties towards obesity and obesity-related co-morbidities (obesity, fatty liver disease, diabetes, appetite and hyperlipidaemia) and the chemical structure will be elucidated. By applying an innovative biotechnological platform, the interactions from oral administration to the blood stream will be analyzed, and with different target tissues *in vitro*. A proof of concept regarding the improvement of metabolism will be performed in a relevant physiological model. The general aim of the project is to develop novel nutraceuticals that have the potential to improve the quality of life for millions of people worldwide.

Ralph Urbatzka, Project Coordinator
CIIMAR - Interdisciplinary Center of Marine and Environmental Research, Portugal

Topic:

- Nutraceuticals

Marine biomass:

- Bacteria
- Microalgae

Source of marine biomass:

- Biobanks and repositories that are held within institutions/companies

Keywords:

Obesity, metabolic disorders, white and brown adipocyte differentiation, phenotypic screening, cell-based bioassays, zebrafish-based bioassays, cyanobacteria collection, nanotechnology platform, lab-on-a-chip, chemical proteomics

Total costs*: € 1.893.000

Funding granted*: € 1.289.000

Duration: 3 years (2017-2019)

** Exact amount may change after completion of national contracts*

CONSORTIUM

Name	Organisation	Country
Ralph Urbatzka	CIIMAR - Interdisciplinary Center of Marine and Environmental Research	Portugal
Susana Cristobal	Linköping University	Sweden
Siegfried Ussar	Hemholtz Center Munich	Germany
Finnur Eiriksson	ArcticMass ehf.	Iceland
Margreth Thorteinsdóttir	University of Iceland	Iceland

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MARPLAST

Marine microorganisms for bioplastics production

MarineBiotech

PROJECT FACTSHEET

CALL 2 | DECEMBER 2016

ABSTRACT

The steady increase in microplastic concentration could result in dramatic effects on the vulnerable wildlife of the oceans and marine food supplies. It is therefore of immediate importance to develop novel types of polymeric materials that can be sustainably produced to address these environmental concerns. MARPLAST focuses on Polyhydroxyalkanoates (PHAs), a class of biodegradable bioplastics which are considered to be feasible replacements for current petroleum-based plastics. PHAs are polymers occurring in nature, produced among others by bacteria, and with properties similar to oil-derived polypropylene and polyesters, rendering them useful as an attractive biodegradable replacement. However, the naturally occurring PHA production pathways are not sufficiently understood, and currently known technologies for production are too costly to allow for a full-scale replacement. MARPLAST aims to develop and provide tools (bacteria, enzymes, and pathways) to enable efficient production of sustainable and biodegradable bioplastics from low-cost unexploited biomass. Focus will be on PHA-producing cold-adapted marine bacteria, which have a range of properties that make them especially suitable for industrial applications. MARPLAST will utilize expertise from the Univ of Tromsø (Norway), Univ of Bucharest (Romania) and Umeå University (Sweden) to make important progress and contributions to the transition to a bio-based European economy.

Arne Smalås, Project Coordinator
University of Tromsø – the Arctic University of Norway

Topic:

- Biodegradable bioplastics

Marine biomass:

- Bacteria

Source of marine biomass:

- Culture collections
- From fishery or aquaculture activity
- Marine biomass processing by-products and waste fractions
- Biological materials collected from the foreshore (coastal areas between the limits of low and high water)

Keywords:

Marine bacteria, microbiology, enzymes, genomics, polyhydroxyalkanoates, bioplastic, biodegradable, sustainable resources, biomass conversion

Total costs*: € 1.793.000

Funding granted*: € 1.261.000

Duration: 3 years (2017-2020)

** Exact amount may change after completion of national contracts*

CONSORTIUM

Name	Organisation	Country
Arne Smalås	University of Tromsø – the Arctic University of Norway	Norway
Knut Irgum	Umeå University	Sweden
Ana-Maria Tanase	University of Bucharest	Rumania

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Novofeed

Novel feed ingredients from sustainable sources

MarineBiotech

PROJECT FACTSHEET

CALL 2 | DECEMBER 2016

ABSTRACT

The European aquaculture industry holds great promise as a provider of nutrient rich food to an increasing population. To ensure a sustainable and continued growth of the production, there is a need for an increased focus directed towards the development of effective approaches to prevent and control diseases in aquaculture species. One possibility is to develop functional feed ingredients that provide specific benefits to the fish. Such ingredients may be biologically active compounds, recovered from seafood processing by-products. This project aims to develop novel functional feed ingredients for the aquaculture industry through facilitating the recovery and utilization of valuable bioactive peptides from the salmon industry in Norway and the sea bass/sea bream industry in Italy. State of the art techniques within peptidomics and bioinformatics (often referred to as the in silico approach) will be used to identify peptides with predicted anti-inflammatory, immunostimulatory or anti-microbial properties in the different fractions of by-products. Based on the results, targeted hydrolysis and processing of the by-products will be performed to obtain fractions enriched in the relevant bioactive peptides. Assessments will be made of the degree of purification and up-concentration required before inclusion of these fractions in the feed formulations. The efficacy of the compounds as health promoting and disease-preventing ingredients will be assessed through in vitro studies and in vivo fish feed trials.

Fiona Provan, Project Coordinator
International Research Institute of Stavanger, Norway

Topic:

- Novel feed ingredients

Marine biomass:

- Fish

Source of marine biomass:

- from fishery or aquaculture activity
- marine biomass processing by-products and waste fractions

Keywords:

peptidomics, bioinformatics, peptides, bioactive, functional feed ingredients, aquaculture, value creation, in vitro, in vivo trials

Total costs*: € 1.421.000

Funding granted*: € 1.283.000

Duration: 3 years (2017-2019)

** Exact amount may change after completion of national contracts*

CONSORTIUM

Name	Organisation	Country
Fiona Provan	International Research Institute of Stavanger	Norway
Lennart Martens	Ghent University	Belgium/ Flanders
Alessio Bonaldo	University of Bologna	Italy
Raja Mansingh Rathore	Nutrimar AS	Norway
Helgi Thorarensen	Holar University College	Iceland
Åge Oterhals	Nofima	Norway

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DIVE-IT

Droplet In-Vitro transcription/translation Enzyme IdenTification

MarineBiotech

PROJECT FACTSHEET

CALL 3 | AUGUST 2017

ABSTRACT

„Knowledge based bioeconomy" (KBBE) interlocks traditional academic topics like food research, agri- and aquaculture with new fields such as red, white, green and blue biotechnology to enhance important topics like medicine, health, nutrition as well as the merging of traditional chemical synthesis routes with biological approaches. One important part of KBBE is the integration of novel bio-derived catalysts, into biotechnological applications. To achieve this, it is crucial to have a variety of specialized biocatalysts at hand. Therefore, science is looking for new methods to identify novel enzymes to establish completely new and artificial production routes. Promising source for the discovery of new enzymes are metagenomes. Especially marine metagenomes offer an enormous potential as the ocean and seas cover not only more than 70% of the earth´s surface, but also comprise an unlimited diversity of ecological niches. Unsurprisingly, Bacteria and Archaea in marine waters constitute a major fraction of global microbial biomass. Marine microorganisms have accordingly been used in the past as a source for novel enzymes, although many challenges exist when aiming at the exploration and exploitation of this biomass. To analyze the vast amount of genetic information within marine metagenomes, an efficient and powerful all-in-one function-linked screening system has yet to be found.
To overcome these limitations, we want to develop a new screening platform for the fast and reliable all-in-one screening of metagenomes. We will introduce habitat guiding, as a preselection tool and develop an innovative approach that combines an in-vitro compartmentalization system with cell-free protein synthesis as function-based approach. Thus, our technology will improve the exploitation of the unique opportunities of marine microbiomes.

Topic:

- Metagenomes

Marine biomass:

- Microorganisms

Source of marine biomass:

- Microbiomes

Keywords:

Function-based metagenomics, habitat guiding, microfluidics, emulsion droplets, synthetic enzyme cascades

Total costs*: € 1.073.000

Funding granted*: € 1.032.000

Duration: 3 years (2018-2020)

** Exact amount may change after completion of national contracts*

Volker Sieber, Project Coordinator
Technical University of Munich, Germany

CONSORTIUM

Name	Organisation	Country
Volker Sieber	Volker Sieber	Volker Sieber
Fiona Brinkman	Fiona Brinkman	Fiona Brinkman
Simon Fraser University	Simon Fraser University	Simon Fraser University
Canada	Canada	Canada

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MarBioTech

Advanced Marine Biotechnology toolbox for accessing the uncultivated marine microbial biodiversity and its novel biomolecules

MarineBiotech

PROJECT FACTSHEET

CALL 3 | AUGUST 2017

ABSTRACT

Organisms in the marine environment represent a largely unexploited source of highly valuable biomolecules. Due to the development of sequencing technologies in the last few decades, we are now able to access a vast amount of sequence information of metagenomes of cultivable and non-cultivable marine organisms. Unfortunately, our abilities to link such sequence information with function lags completely behind. The conventional system to annotate protein functions, e.g., annotation based on BLAST homology search, is very poor and often provides false predictions, in particular for classes of proteins for which biochemical characterization data has not been accumulated. Consequently, it is virtually impossible to identify novel proteins and enzymes based on sequence based screenings, only. Therefore, the goals of MarBioTech are to develop innovative tools and technologies to advance function-based searches in combination with sequence-based searches and to deliver valuable biomolecules of marine origin. Together with the innovative technology advancement, a wide range of existing marine resources including microbiomes of marine algae, jelly fish, and marine fish farms, among others, will be exploited by combining innovative function-, sequence-based and in vitro screenings for the identification of novel active high-value marine biomolecules. The target molecules will include enzymes involved in marine plastic degradation (PET esterases), fluorescent proteins for molecular medicine, novel highly active RNA polymerases as well as DNA nucleases for metagenome mining and molecular biology and quorum quenching (QQ) proteins to prevent biofilm formation.

Wolfgang Streit, Project Coordinator
University of Hamburg, Germany

Topic:

- Biomolecules

Marine biomass:

- Microorganisms

Source of marine biomass:

- Microbiome of:
  - Algae
  - Medusozoa
  - Fish farms

Keywords:

Metagenomics, marine biodiversity, technology advancement, novel proteins and enzyme products

Total costs*: € 1.633.000

Funding granted*: € 1.515.000

Duration: 3 years (2018-2020)

** Exact amount may change after completion of national contracts*

CONSORTIUM

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Marine Biotechnology ERA-NET (ERA-MBT) is funded under the European Commission's Seventh Framework Programme. | Grant Agreement Number 604814
December 2013 - November 2017

META-MINE

Mining the microbiomes from marine wood-digesting bivalves for novel lignocellulose depolymerizing enzymes

MarineBiotech

PROJECT FACTSHEET

CALL 3 | AUGUST 2017

ABSTRACT

Lignocellulose is a greatly undervalorized biomass and methodologies to convert it to high-value products needs fortification. A critical step in biorefining is the enzymatic conversion of lignocellulose to soluble sugars and lignin. The cost and the efficiency of enzymes is far from optimal and new enzymes are needed to improve the efficiency and sustainability of lignocellulose depolymerization. Through META-MINE, we will exploit the process strategies of nature's own micro-biorefinery, the shipworm. Shipworms are voracious animals with respect to their appetite for wood. Their digestive system is especially intriguing. Wood engulfed by mechanical rasping is digested by enzymes secreted by a community of symbiotic bacteria located in the gill tissue. Current model systems for the study of cellulose degradation are highly complex (e.g. community driven anaerobe systems in ruminants and the intricate secreted enzyme systems of aerobic fungi), and challenging to analyze. The shipworm gill symbionts are specialists in lignocellulose degradation and perform this task by applying a perfected enzyme cocktail in a defined and physiochemically stable environment. Thus, by unravelling the contributions of the individual enzymes in the shipworm cocktail, we have the opportunity to take a leap forward in understanding the fundamental properties of enzymatic lignocellulose degradation. META-MINE will use the shipworms as a model system for a holistic study of marine lignocellulose degradation and mine the metagenomes for novel lignocellulose depolymerizing enzymes.

Bjørn Altermark, Project Coordinator
The Arctic University of Norway, Norway

Topic:

- Lignocellulose degradation

Marine biomass:

- Symbiotic bacteria in shipworms

Source of marine biomass:

- Gill tissue of shipworms

Keywords:

Shipworm, lignocellulose-depolymerization, metagenomics

Total costs*: € 1.882..000

Funding granted*: € 1.711.000

Duration: 3 years (2018-2020)

** Exact amount may change after completion of national contracts*

CONSORTIUM

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Bjørn Altermark	The Arctic University of Norway	Norway
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ProBone

New tools for prospecting the marine bone-degrading microbiome for new enzymes

MarineBiotech

PROJECT FACTSHEET

CALL 3 | AUGUST 2017

ABSTRACT

A growing interest exists in the development of new value chains based on protein-rich deboning residues from the meat and poultry industry. Herein, enzymatic hydrolysis is an attractive refinement process to achieve new products with market potential, but its breakthrough is prevented by the lack of suitable commercial enzymes able to access the recalcitrant bone components. Driven by industrial demands, the ProBone project focuses on streamlining discovery of valuable bone hydrolytic enzymes, by selectively prospecting the unique genes and proteins of the non-cultivable marine bone-degrading microbiome. Despite its resilience, bones are degraded by free-living bacteria as well as symbiotic microorganisms associated to bone-thriving invertebrates in the marine environment. This bone-degrading microbiome is, however, largely unexplored for its biotechnological potential. ProBone aims at delivering an innovative toolbox based on omics technologies and synthetic biology methods, to expedite discovery of active bone-degrading enzymes, and to accelerate the transition from discovery to end-user applications. An international consortium with recognized scientists of complementary expertise in marine biology, microbiology, bioinformatics and biochemistry, will apply and develop a refined computational workflow for gene discovery as well as ground-breaking improvements in recombinant expression and activity assessment. These developments are key to identify tailored enzymes for the emerging bio-based economy.

Gro Elin Kjæreng Bjerga, Project Coordinator
Uni Research, Norway

Photo: Andreas R. Graven
Uni Research, Norway

Topic:

- Bone-degrading enzymes

Marine biomass:

- Microorganisms

Source of marine biomass:

- Biobanks and repositories that are held within institutions/companies

Keywords:

Marine microbiome, bone-degrading, meta-omics, toolbox, enzymes

Total costs*: € 1.004.000

Funding granted*: € 940.000

Duration: 3 years (2018-2020)

** Exact amount may change after completion of national contracts*

CONSORTIUM

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Ute Hentschel Humeida	GEOMAR Helmholtz Centre for Ocean Research Kiel	Germany
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PROMiSE

Protist Metabolome Screening

MarineBiotech

PROJECT FACTSHEET

CALL 3 | AUGUST 2017

ABSTRACT

Marine eukaryotic protists offer a huge but currently underexploited reservoir of metabolic pathways with biotechnological potential. Given their unique adaptations through symbiosis, endosymbiosis and organelle acquisition, the ecofunctionalities of protists present a hitherto untapped source to discover novel metabolic pathways and bioactivities whilst bearing a high chance of discovering different activities compared to those identified in other marine sources. The PROMiSE experimental workflow employs a comprehensive set of Omics methods. This approach spans the encoded metabolic potential to identify biosynthetic gene clusters which in turn guide the targeted metabolite profiling, merged with discovery-based metabolomics. The goal is to target identified candidate compound classes and their pathway-related metabolites and conjugations dereplicated from the Omics information. By linking these methods back to the source cell through single cell Omics methods, PROMiSE offers a unique way to recognize functional gene clusters and to understand how metabolism is partitioned across ecosystems. The vertically integrated extraction and analyses procedure within PROMiSE are supported by a comprehensive array of cutting-edge in vitro and in vivo bioassays for reliably assessing biological activities by High-Content profiling and antibacterial screening. Analytical chemistry, including high resolution mass spectroscopy and nuclear magnetic resonance spectroscopy approaches, will be used to elucidate compounds found in the bioactive fractions, which will tie back the molecular data to identify relevant enzymes, pathways, and compounds.

Tilmann Harder, Project Coordinator
Alfred Wegener Institut, Helmholtz Zentrum für Polar und Meeresforschung, Germany

Topic:

- Protist Metabolome Screening

Marine biomass:

- Protists

Source of marine biomass:

- Biobanks and repositories that are held within institutions/companies

Keywords:

Marine protists, metagenomics, bioprospecting

Total costs*: € 1.494.000

Funding granted*: € 1.074.000

Duration: 3 years (2018-2021)

** Exact amount may change after completion of national contracts*

CONSORTIUM

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