TERMS OF REFERENCE

Marine Research Programme

Research Area:	**Policy Support**
Research Programme:	**Marine Biodiscovery**
Project Type:	**Project-Based Award**
Project Title:	A national marine biodiscovery laboratory

BACKGROUND

The biodiversity of the marine environment is recognised as a rich source of natural compounds, macromolecules and novel structures. Ireland's marine bioresource comprises many sources, including for example, whole fish, aquaculture products, macro-algae (seaweed) – both wild and cultured, micro algae, marine invertebrates and marine-derived micro-organisms. These provide opportunities to support a myriad of enterprise activity based on the sustainable use of marine bioresources in connected industry sectors such as food, health and emerging bio-based industries.

Bioprospecting relies on collaborative research and technologies developed outside the marine biological area. The search for new approaches to locate, collect and assess the potential of marine organisms as sources of novel materials represents a major and ongoing challenge. These sources are diverse including at one extreme deep-water marine environments while at the other end of the spectrum more accessible locations with associated activities that already process marine organisms.

New tools and methodologies are required to enhance the biodiscovery process. Data mining techniques target areas of high marine biodiversity; remote sensing can be used to assess abundance of some resources; and metagenomics allows DNA to be recovered from microorganisms that are not easily cultured. Developing greater capacity for bioprospecting and discovery is a way of attracting new expertise and capabilities to engage in marine bioresources research. Increasing the rate of the discovery, identification, extraction, and targeted delivery and incorporation of novel bioactive compounds, macromolecules and materials is fundamental in supporting the development of a wide range of value-added products.

Given the collaborative and multi-disciplinary nature of marine biodiscovery, the Marine Institute established the National Biodiscovery Laboratory in 2007 to support the needs of the nascent research community in Ireland which came together with funding from the seven-year Marine Biodiscovery Beaufort research award. A summary of the facilities associated with the laboratory are provided in Annex 1 of this document. This multi-institutional award was aimed at developing capacity and building networks in the Irish science community to begin exploring Ireland's marine bio-resources and develop the expertise required to detect isolate and identify bioactivity. The award led to the collection and work up of over 1400 samples of material for the Biorepository to date, 43% of which have been extracted and plated for bioactivity screening. Anti-bacterial, anti-fungal, anti-cancer, neurodegenerative

inhibition and anti-inflammatory assays have been performed on the extracts. Thus far, a positive hit rate of 25% has been found.

This body of work represents a start to explore the biotechnology value of Ireland's marine resources. In order to support future research it is anticipated that the project funded under this call will build on the outputs of the Beaufort Marine Award.

PROJECT RATIONALE:

The EU's dedicated marine strategy – Blue Growth is to the fore in identifying actions and opportunity areas related to marine bioresources, including the use of biotechnology to unlock high-value compounds from marine bioresources for use by health, cosmetic, industrial bio-materials, food, feed and chemical industries.

Research areas included in the EU Horizon 2020 challenges provide insights to growth opportunities for this sector, which are common with national goals, these include:

- Improved health and wellbeing;
- Sustainable processing systems for food, and other bio-based products; and
- Transforming industrial processes and products into environmentally friendly bio-based ones, developing integrated bio-refineries and new markets for bio-based products.

Activities that offer growth and employment linked to marine bioresources, whilst at the same time addressing a range of societal, economic and environmental challenges by supporting excellence in research include:

- the processing of marine bioresources;
- creating value-added products from marine bioresources; and
- the optimised management of marine resources and the marine environment.

The recently completed National Task Force on Marine Biotechnology (available on request)[1] recognises these opportunities and activities. It makes specific recommendations in relation to the need for:

- the maintenance and enhancement of key infrastructure, particularly the national biodiscovery laboratory and the development of an enhanced national marine bioresource repository and data-base.
- Provide a focal point for marine biotechnology research as a means of integrating leading and relevant related capabilities to perform internationally competitive research with commercial outcomes.

PROJECT AIMS:

This project aims to maintain and strengthen Ireland's capacity as a marine biotechnology research leader. The provision of a national marine biodiscovery laboratory is intended to support researchers seeking to explore potential bioactivity from marine sources. In addition, the laboratory, and those researchers working there, will act as a network hub for the many disciplines involved in this novel field of research.

The successful application will include sufficient research and scientific staffing to meet the research objectives listed below. In particular, proposals should include suitably qualified scientific staff who can:

- Ensure the smooth running and operation of the laboratory facilities, including liaising with relevant Marine Institute staff with regard to management of the operational

[1] A copy of the **Report of the Marine Biotechnology Task Force** can be obtained by sending an email request to funding@marine.ie

budget, health & safety requirements (including administrative requirements such as insurance certifications etc.).

- Authoring/Co-authoring scientific papers based on the activities taking place in the laboratory, or collaborative activities of which the laboratory forms a part.

- Preparation and execution of further research funding proposals (both at national, EU and international level) which leverage further funding for the laboratory and the staff working there (with due regard for practical considerations in relation to capacity etc.)

It is envisaged that the successful proposal will feature staff profiles featuring a range of skills, experience and backgrounds. While the lead applicant may not be based at the Marine Institute, it is anticipated that the successful application will include a senior researcher or researchers, based fulltime in the Marine Institute, who can achieve these aims.

During the lifetime of this award, it is anticipated that the Marine Institute will conduct scoping studies in relation to the expansion of the sample repository associated with the laboratory with a view to the establishment of a National Marine Biodiscovery Repository and Database. The recipient of this award will be a key stakeholder in these studies.

A key objective of this project is to foster and support the development of a marine biodiscovery community amongst Irish research Institutions. Collaborative proposals between Institutions are welcomed and encouraged.

RESEARCH OBJECTIVES:

The Marine Institute wishes to invite research proposals to address the following objectives:

1. Maintain & expand the marine biodiscovery repositories (freeze-dried marine algal, invertebrate and sediment samples as well as marine-derived microbial cultures, solvent-extracted samples in various formats such as 96 deep well plate, vials, etcetera).
2. Liaise with local management in the Marine Institute on the running of the laboratory and a small budget (see Annex 1, Point 4).
3. Maintain electronic database tracking samples processed through bioassays performed, results and isolated bioactive molecules.
4. Conduct research in the area of marine natural products (e.g. small molecule, peptides, proteins, enzymes).
5. Build relationships and liaise with the Marine Institute and other Research Performers and Funders (e.g. SFI).
6. Actively stimulate and participate in research collaborations nationally and internationally and be proactive in research proposal writing.
7. Actively promote the marine biorepository and laboratory nationally and internationally.
8. Actively engage with Industry – both small -medium sized enterprises and multinationals.

PROJECT DELIVERABLES:

- Creation and maintenance of a national network of researchers and industry working in the field.
- Build the existing facilities to a centre of excellence as a marine biorepository laboratory.
- Expansion of existing collections.
- Maintenance and development of the marine biodiscovery database

- Further develop the online portal to query marine biodiscovery database by national researchers
- A minimum of five publications in high ranking peer-reviewed journals.
- Promotion of the marine biodiscovery repository and laboratory nationally and internationally.
- Actively pursue research funds, as demonstrated through funding applications, to develop research in the marine natural products field .
- Involvement in external research projects/programmes with public and/or private organisations.

It is expected that the project will also result in a number of peer-reviewed articles and peer-reviewed conference papers.

ADDITIONAL SPECIFIC REQUIREMENTS FOR THIS PROJECT:

- The successful research group will also work closely with the Marine Institute.
- Throughout the lifetime of the award, it is also anticipated that the researcher(s) will actively seek additional sources of other funding (national and international), continuing to build links with other research groups and organisations, continuing to strengthen Ireland's capacity and capability in the area of marine biotechnology research.
- The project will include working closely with the Marine Institute and other collaborative partners including BIM and Teagasc over the lifetime of the award.
- It is expected that the researcher(s) will collaborate with national and international groups, and proposals should demonstrate how this will be achieved.

INTENDED IMPACT:

- Provide a focal point to stimulate and marine biotechnological research
- Break the barriers to broad, easy access and uptake by the wider Irish Research Community and Internationally to a biorepository of marine samples and extracts from the Irish EEZ.

PROJECT STRUCTURE AND FUNDING:

Funding up to €900,000 will be provided for a three-year project.

The project should be managed by a project coordinator, which will be responsible for ensuring that project management formalities as well as research outputs are delivered in a timely and presentable manner. Effective coordination is preferable at a senior level and this should be reflected in the proposal.

The proposal should clearly outline time commitment of existing and any additional researchers.

ADDITIONAL INFORMATION / REFERENCE MATERIAL:

Reports:

National Biotechnology Task Force Report (2016).

Government of Ireland. (2012). Harnessing Our Ocean Wealth. An Integrated Marine Plan for Ireland

Web-links

- Harnessing Our Ocean Wealth: www.ouroceanwealth.ie
- EU Integrated Maritime Policy: http://ec.europa.eu/maritimeaffairs/policy/index_en.htm

ANNEX 1 –SUMMARY OF EXISTING LABORATORY FACILITIES:

1. Laboratory Spaces
   a. Ground floor Laboratory (ca. 28m^2) equipped with oxygen depletion and carbon dioxide enrichment sensors
      i. Details of fume cupboards: 2 fumehoods reside in this laboratory

      ii. Details of specialised equipment:
      - 1 x Virtis Virtual 50XL freeze-dryer unit
      - ESCO Class II Biological Safety Cabinet
      - EL808 Absorbance Microplate reader
      - FLUOstar Omega Fluorescence microplate reader
      - 30L liquid nitrogen dewar
      - Nuaire CO_2 Incubator (water-jacketed)
      - Camag Bioluminizer
      - 2 x underbench 0-8°C Refrigerator units

   b. First floor Laboratory (ca.56m^2) – equipped with oxygen depletion and carbon dioxide enrichment sensors
      i. Details of fume cupboards- equipped with one fumehood
      ii. Details of specialised equipment:
      - 4 x Büchi Rotavapor Systems
      - 1 x Julabo Recirculating Chiller,
      - 2 x Sartorius Balances - ME414S & ED423S models
      - Hettich Rotina 420 R Centrifuge
      - Retsch Planetary Ball Miller PM 100
      - Shimadzu HPLC unit with PDA detector and small fraction collector
      - Camag TLC Visualizer
      - 1 x 0-8°C Refrigerator unit

      iii. Details of Freezers (with CO_2 back-up units & included on a temperature monitoring & alert system)
      - 1 x New Brunswick U410 -80°C Freezer
      - 2 x New Brunswick U750 -80°C Freezer
      - 1 x New Brunswick U110 -80°C Freezer

      iv. Details of Incubators:
      - 2 x Cooled 200 L Incubators
      - 1 x Shaker Incubator (> 5°C above ambient)

2. Shared ca. 14 m^2 Walk-in -20°C freezer room – on temperature monitoring and alert system.

3. Office Space
   a. Open plan space for between 3-5 people

4. Operating Budget
   a. An operating budget of €40,000 per annum is available for consumable and the maintenance of Marine Institute owned equipment.