



# Marine Microbial Biodiversity, Bioinformatics & Biotechnology



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# First Set of Fact Sheets

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Restricted to other programme participants (including the Commission Services) (PP)	
Restricted to a group specified by the consortium (including the Commission Services) (RE)	
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## Introduction & Summary

Originally a first set of fact sheets was planned to be ready at the end of 2012. Micro B3 took advantage of a great opportunity that was presented to it: an in-depth article and Q&A session with Professor Frank Oliver Glöckner, coordinator of this Ocean of Tomorrow project, to be published in the magazine International Innovation - Environment Issue, October 2012 with a guaranteed distribution to 40,000 readers. A large amount of publication effort (printed magazines and electronic subscriptions) as well as design and 200 printed copies of the high-quality magazine as well as a stand-alone brochure (excl. printing costs but including copyright for further use) was included in the offer from the magazine's editors for a total cost of €2,250. Thus the initially planned fact sheets were not deemed necessary anymore. The content and details of this and other publications and distribution done to date are described in the following text.

The seven-page brochure, entitled "Understanding the World from a Marine Microbial Perspective", provides an overview on the specific aims and objectives of Micro B3. A digital version is available on the Micro B3 website and print outs of the brochure are handed out at events. The article was sent to all partners for distribution to further interested parties by email.

Furthermore, a first roll-up banner for Micro B3 focusing on bioinformatics has been developed and printed ahead of the planning schedule. The roll-up has already been deployed at two events. Further publications on Micro B3 done on initiative of German and European institutions are shortly covered.

## *1. Magazine Article and Brochure on Micro B3*

### *1.1 Creation of the Article*

The magazine International Innovation is the leading global dissemination resource for the wider scientific, technology and research communities. With discrete publications covering Climate, Energy, Environment, Food & Agriculture, Healthcare, Nanotechnology and US Research it was a fantastic opportunity for Micro B3 to be offered an article in its October 2012 environment issue. Their professional development of the article and interview by expert editorial and design team included artwork, proposing interview questions and editing. It also included the complementary development of a seven-page dissemination brochure, which made the originally planned first set of fact sheets obsolete (See Annex 1).

Professor Frank Oliver Glöckner, coordinator of the Micro B3 project, was interviewed in great detail about the emergence of new marine knowledge based on the genomic revolution. He explained the secrets of marine genomics in a question and answer session. Furthermore the subjects of the Ocean Sampling Day and intellectual property are addressed and there is a schematic overview of the main recommendations he developed together with the Marine Board for the recent position paper 17\*, and expected impacts on key societal and scientific challenges. In the sidebar the objectives, partners, contact and funding information is listed. In total, the article took three pages of the magazine and the copyright lies with Micro B3/Jacobs Uni which owns a pdf file of it as well as an InDesign file for further use. For a link to the brochure and the article please go to

<http://www.microb3.eu/media-material/printed-material>

A copy of the seven-page article with title page and full partner information is also attached in Annex 1.

### *1.2 Distribution of the Article and Future Translations*

The environment edition of the International Innovation magazine is produced bi-annually. It focussed purely on environmental research, and covers a different theme within environment. This year's October issue had the title "Delving Deeper – a new Era for Marine Collaboration" and focussed on marine and ocean research. The audience profile is inserted below – see Annex 2. The magazine is sent to 30,000 readers in a hard copy format and has a digital distribution/readership of 10,000. Their website is [www.research-europe.com](http://www.research-europe.com).

Micro B3 was entitled to 182 hard copies of the magazine in October 2012,

- One for every of our 32 partners
- 100 for the coordinator, 24 of which were immediately distributed at the BioMarine Convention in London October 24-25 by Dr. Johanna Wesnigk of EMPA and Prof. Glöckner, mainly to attendees of Think Tank 5 on "Marine Biotech for the Environment" which was attended by 32 international scientists and industry leaders.

- Another 50 hard copies were sent directly to selected stakeholders selected by the Micro B3 management team mainly in Europe, with some focus on Germany, and Great Britain, and some to the USA (based on the 2012 EU-US meeting on biotechnology held in Bremen).

A high quality brochure of the article is the final output of this initiative, which includes a nicely title page layout as well as full contact information for all partners. The brochure is in English and a German translation is in the making and will become available soon. The option of transferring the brochure design and content into other languages, depending on the interest and capacity, including covering costs involved, was circulated to all Micro B3 partners in December 2012.

## *2. First Roll-Up for Micro B3*

### *2.1 Creation of the First Roll-Up on Bioinformatics*

The first of four planned roll-up banners for Micro B3 was produced in October 2012 by EMPA ahead of schedule. It measures 200x80 cm and is printed on stable material in full color (see picture Annex 3). It was developed from ideas during the WP leaders meeting in Oxford on 20 September 2012 which was attended by a few additional members and one Advisory Board member of Micro B3. The banner shows pictures of bacteria and other plankton organisms in an ocean environment with a computer symbolizing the Micro B3 Information System above. The key words “Biodiscovery”, “Genes & Functions” and “Omic & Environment” are rising up in the water (integrated into a symbol for WLAN). The aim is to give a pictorial idea of how the integrative bioinformatics information system that Micro B3 is building will collect vital genomic information from the sea, analyze it and make it accessible to society. Our key stakeholders are addressed through the terms “Ecosystem Biology” and “Biotechnology” emerging out of the water.

### *2.2 Use of the Banner*

The first time the banner was deployed was at the BioMarine Convention in London October 24.-25., when Dr. Johanna Wesnigk of EMPA and Prof. Glöckner led the Think Tank 5 on Marine Biotech for the Environment which was attended by 32 scientists and industry leaders from all over the world (<http://www.microb3.eu/news/biomarine-think-tanks-embrace-omics-input>).

The second time the banner was shown was with partners of Micro B3 at the Marine Microbiology and Biotechnology 2012; Biodiscovery, Biodiversity and Bioremediation meeting at University College Cork, Ireland, October 14 - 16 2012 (<http://www.microb3.eu/news/micro-b3-wp7-meeting-cork>). There it was seen by about 140 people, the majority of whom were representatives from the international scientific community. The roll-up will travel to further meetings and conventions with representatives of Micro B3 and will eventually be complemented by a further three roll-ups focussing on biodiversity and biotechnology as well as on the Ocean Sampling Day 2014.

### *3. Further Published Articles with Relation to Micro B3*

Three further publications for interested stakeholders feature Micro B3 content elements:

1) The Max Planck Magazine MaxPlanckForschung “Fokus Biodiversität” published in February 2012 contained an article by Prof. Glöckner in German with the title “Das Meer als Genpool”. It was later also published in the English version “The Sea as a Gene Pool”. These magazines is published four times per year and is distributed free of charge. The German version is printed in 78.000 copies and the English version MaxPlanckResearch 10.000 times. Both articles are available on the Micro B3 website under

<http://www.microb3.eu/media-material/printed-material>

2) One of the Submariner Project magazines called “Blue Biotechnology in the Baltic Sea region: New Strategies and Future Perspectives”, which was produced for the Blue Biotechnology Cooperation Event in Kiel, Germany, 9 -10 May 2012 contains an article by Dr. Wesnigk called “Knowledge transfer from environmental genomic science to marine biotechnology – big data, big challenges”. It introduces the Micro B3 and the MG4U projects, their aims, partners and structure and relation to biotechnology. The magazine can be downloaded in its entirety at [www.submariner.project.eu](http://www.submariner.project.eu) under Publications, Perspectives from Cooperation Events, [blue\\_bio\\_magazine\\_web.pdf](#) or by following this link: [http://www.submariner-project.eu/index.php?option=com\\_jdownloads&Itemid=0&view=finish&catid=59&cid=223](http://www.submariner-project.eu/index.php?option=com_jdownloads&Itemid=0&view=finish&catid=59&cid=223) and at <http://www.microb3.eu/media-material/printed-material>

The Submariner Project concerns itself with sustainable uses of the Baltic marine resources and printed version of its magazines are sent to all partners in the eight European states that share the shores of the Baltic Sea (Poland, Germany, Denmark, Sweden, Estonia, Lithuania, Latvia and Finland). Also the speakers got copies, some of which were distributed at the 2012 EFIB event during one session on marine biotechnology.

3) A European Commission brochure on its “Ocean of Tomorrow projects” published in December contains an article with the title “FP7 Micro B3: Marine Microbial Biodiversity, Bioinformatics and Biotechnology”. It provides an update on the progress so far of Micro B3 including highlighting its European added value, i.e. that Micro B3 is set to revolutionise Europe’s capacity for bioinformatics and marine microbial data integration. The brochure will become available on the following website:

[http://ec.europa.eu/research/bioeconomy/fish/research/ocean/index\\_en.htm](http://ec.europa.eu/research/bioeconomy/fish/research/ocean/index_en.htm)

Links will be made to other sectorial websites of DG RTD (environment, transport...) and the Maritime Forum on DG MARE Website. Hard copies will be sent to each project quoted in the brochure and be available for distribution with the European Commission (DG RTD, DG MARE and DG ENV) and European networks (JPI Oceans and others).

The individual fiche will be sent to Micro B3 so that we can also use it for our own purposes. We will also have the brochure on our project website. The brochure might also be quoted by the European Commission in other official documents under preparation for early next year. The European Commission will also probably distribute this document at events related to the Ocean of Tomorrow projects during the first Semester 2013 (Bioeconomy event in 14-15 February in Dublin, organised by Irish Presidency on Atlantic Strategy, and possibly at the European Maritime Day).

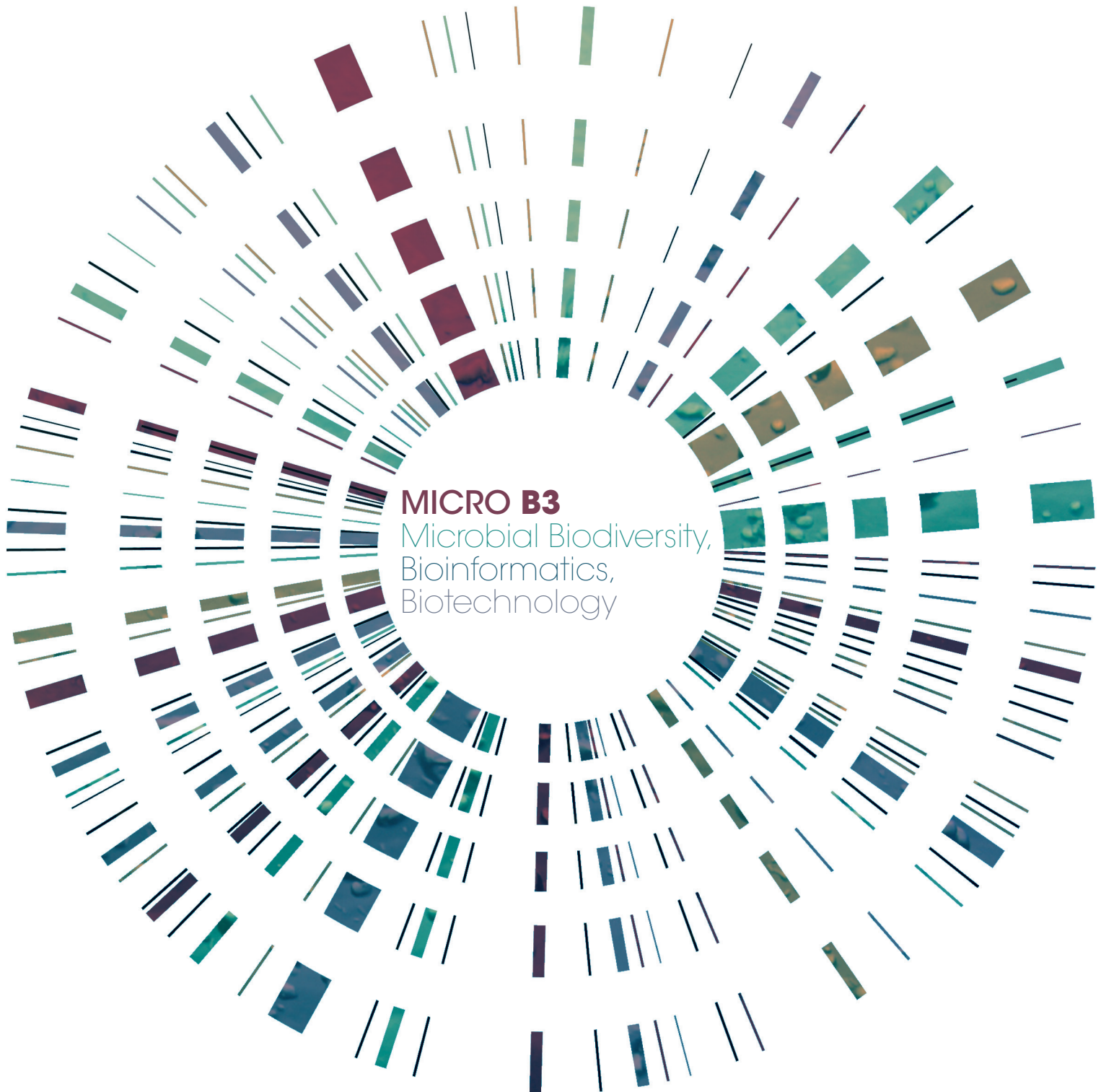
#### *4. Outlook*

As soon as the partners of Micro B3 have produced in-depth results, a set of detailed fact sheets (one for each topical area) will be produced. The Ocean Sampling Day pilots should give us presentable results, so we can produce a fact sheet, also to attract participants to the official OSD in 2014. Results from WP 6 are expected latest in 2014, including a better understanding of marine microbial ecosystems in terms of 1) their complexity, 2) the parameters driving their functioning, and 3) their effects on and sensitivity to climate change. Another fact sheet might focus on WP 7, the combined *in-silico* and lab-based approach which will not only help to develop new products from the marine system but also to get a better understanding of the functions of the marine microbial diversity and their influence on the global cycling of matter and energy.

*Annex 1: Micro B3 Brochure*

# International Innovation

Disseminating science, research and technology





# Understanding the world from a marine microbial perspective

The emergence of new marine knowledge based on the genomic revolution is leading to a better understanding of the biggest ecosystem on Earth. There is massive potential for biotechnological innovation without overharvesting the marine environment. The **Micro B3** project aims to bring about major developments in the field of environmental bioinformatics to support these novel technologies

**BIOTECHNOLOGY BASED ON** genomic, proteomic and metabolomic information (collectively called 'Omics'), from marine organisms has wide-ranging applications, most significantly in agriculture, the food industry, medicine and pharmaceuticals. In spite of this, 'blue biotechnology' is new territory for most companies. Globally, only 1 per cent of all biotechnology companies make use of marine ecosystem knowledge.

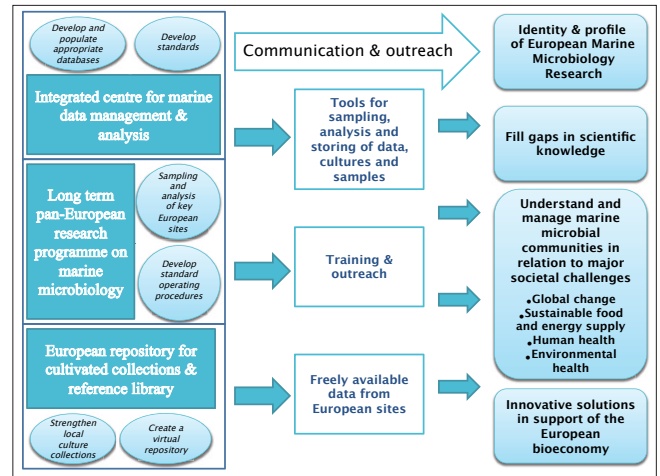
By improving the infrastructure for the huge amount of data on marine ecosystems, the ability of researchers to take a holistic approach to data can be improved, especially through combining 'Omics with environmental, biological and biochemical knowledge. A new research discipline called Environmental Bioinformatics is emerging, with Micro B3's task to ensure this is developed and implemented internationally.

The €9 million Ocean of Tomorrow Project Micro B3 is led by Dr Frank Oliver Glöckner, Professor of Bioinformatics at Jacobs University in Bremen. It forms teams of experts in bioinformatics, computer science, biology, ecology, oceanography, bioprospecting, biotechnology, ethics and law. The group includes a large number of partners who own

considerable amounts of data on marine microbial diversity and the marine environment.

Micro B3 builds on output from two earlier developments in related fields: Since 2005 the megx.net system has been providing scientists with access to integrated environmental and meta-genomic data to be used in marine microbial ecology. It is used to generate hypotheses to discover new functional genes by integrating meta-genomic and ribosomal data with curated metadata and primary environmental data. Megx.net was supplemented through the EU NEST Metafunctions project which ran from 2005-08 and achieved final proof-of-concept as well as providing further data mining tools.

Starting in 2004, main drivers for large-scale collaboration across Europe were two Networks of Excellence: 'Marine Genomics Europe' and 'Marine Biodiversity and Ecosystems Functioning'. Micro B3 builds on all these projects, its research and training is conducted in close contact with two large research infrastructure initiatives: the



**FIGURE 1.** Schematic overview of main recommendations and their expected impacts in relation to addressing the key societal and scientific challenges (ESF Position Paper 17: *Marine Microbial Diversity and its Role in Ecosystem Function and Environmental Change*, May 2012).

European Marine Biological Resource Centre (EMBR) and the European Life Sciences Infrastructure For Biological Information (ELIXIR).

Micro B3 will provide researchers with new analytical approaches to marine ecological genomics, which will be integrated, standardised and extended to other applications within the project. The consortium's main aims are to bring together the existing bodies of expertise in ecosystems biology, the processing and interpretation of data, modelling and prediction and the development of intellectual property agreements to facilitate the exploration of potential commercial applications.

"Micro B3 aims to develop an innovative, transparent and user friendly open-access system, which will allow for seamless processing, integration, visualisation and accessibility of the huge amount of data collected in ongoing sample campaigns and long-term observations," states Glöckner. "We also plan to offer analytical and feedback tools on our platform. This is unique in terms

of integrating genetic and ecological information and will generate collective knowledge. This will in turn offer new perspectives for the modelling and exploration of marine microbial communities.”

### OCEAN SAMPLING DAY

A key boost to the work will be provided by the Ocean Sampling Day (OSD), scheduled to take place on 21 June 2014. This will involve all partners in the project and will be open to any other interested labs across Europe and beyond. It will bring together a large group of marine researchers to undertake a detailed snapshot of microbes across the world's oceans on a single day.

OSD will take place at various sites, with pilots conducted 2012-13 to establish standardised sampling techniques. All analyses will adhere to the Minimum information checklists (MIxS) standard for describing molecular samples as outlined by the Genomic Standards Consortium.

The event is a key element of Micro B3 as it will generate a massive amount of useful marine microbial data to be included in the project's integrated MB3-Information System, providing other members of the team with information to generate hypotheses for more cost- and time-efficient biotechnological testing and applications.

### INTELLECTUAL PROPERTY – WHO OWNS MARINE MICROBES?

One of Micro B3's main tasks will be to develop an innovative set of model arrangements that foster facilitated access to pre-competitive research materials, software, data and published research results, as Glöckner highlights: “We promote appropriate IP management and open access strategies for downstream applications”.

Since Micro B3 is likely to bring about the discovery of new biotechnological applications for marine microbial data, there are complex issues of intellectual property involved, particularly given that much of the data gathered originates in exclusive economic zones or areas of ocean completely beyond any national jurisdiction. Micro B3 has a strong focus on open access and on involving all interested stakeholders in a non-exclusive way, with a view to future applications of marine diversity research.

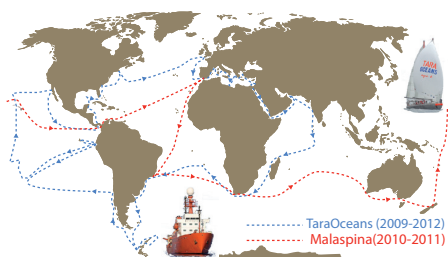


FIGURE 2. Overview of the Tara Oceans and Malaspina circumnavigation cruises © by B Garriz, E Broglio and JM Gasol.

**THE MAJOR OBJECTIVE** of the Micro B3 project is to cross borders by creating a new inter- and multidisciplinary culture in marine RTD. Detailed goals include:

- Providing access to state-of-the-art facilities and expertise to high quality sequence- and environmental data for a broad range of marine environments, combined with
  - i. Oceanographic databases, earth observation and monitoring data
  - ii. Data management, development of standards for describing all sampling, and data processing elements
- Bringing together expertise in
  - i. The development of innovative bioinformatics approaches for data processing, analysis and integration
  - ii. Ecosystems biology for better interpretation of data and to empower modelling approaches enhancing predictive capacities for the marine ecosystem
  - iii. Discovering enzymatic functions and bioactive compounds for biotransformation and biocatalysis
  - iv. Developing IP agreements for pre-competitive microbial research materials, for data and for the exploitation of high potential commercial applications
- Providing training and outreach activities to support knowledge and technology transfer as well as capacity building around Europe

The approach taken by Micro B3 is based on the Nagoya Protocol, which recognises that biological diversity is a 'common concern of humankind' and links to the broader goals of conservation and sustainable use of resources. The team aims to produce model contracts and good practice standards specifically tailored to the marine field.

Training for young scientists, including a summer school for the OSD as well as a range of workshops in biodiversity, bioinformatics and biotechnology, are planned together with highly accessible outreach activities (web portal, films, media materials) by Dr Johanna Wesnigk from the company EMPA. Related IP issues will be delivered by Dr Tom Dedeurwaerdere, Research Director of the Biodiversity Governance Unit of the Centre for the Philosophy of Law and his team.

Micro B3 is a hugely ambitious project sure to have implications on an international scale as it develops over the next four years. Glöckner and his partners are set to revolutionise Europe's capacity for bioinformatics and marine microbial data integration, to the benefit of a variety of disciplines in bioscience, technology, computing and law.

## INTELLIGENCE

# MICRO B3

**MICROBIAL BIODIVERSITY, BIOINFORMATICS, BIOTECHNOLOGY**

### OBJECTIVES

To develop new bioinformatic approaches to analyse, integrate and visualise marine molecular and environmental data jointly. From the outset, this will be done in close collaboration with field scientists providing ecosystems expertise as well as their small and large-scale datasets.

### PARTNERS

**MPIMM**, Germany • **UOXF**, UK • **HCMR**, Greece • **AWI**, Germany • **CNRS**, France • **IMS**, Portugal • **SZN**, Italy • **MBA**, UK • **VIB**, Belgium • **TUBITAK**, Turkey • **MARIS**, the Netherlands • **ICES**, Denmark • **VLIZ**, Belgium • **IFREMER**, France • **EMBL-EBI**, UK • **CEA - Genoscope**, France • **UniHB**, Germany • **UGRO**, The Netherlands • **BIOMERIT**, Ireland • **BANGOR**, UK • **IAMC**, Italy • **UCL**, Belgium • **CIESM**, Monaco • **IUCN**, Switzerland • **EMPA**, Germany • **MATIS**, Iceland • **BIO-ILIBERIS**, Spain • **INTERWORKS**, FYROM • **RIBOCON**, Germany • **Bio-Product**, The Netherlands • **PharmaMar**, Spain

### FUNDING

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**FRANK OLIVER GLÖCKNER** is Head of Microbial Genomics and Bioinformatics Research Group at the Max Planck Institute for Marine Microbiology in Bremen, Germany and Professor of Bioinformatics at Jacobs University Bremen. His group develops enabling technologies to transform the wealth of sequence- and metadata from the environment into biological knowledge. Techniques are whole genome and metagenome analysis, sequence classification, phylogenetic inference as well as software and database development for integrated data analysis.



Biodiversity. Bioinformatics. Biotechnology.



# Tackling the secrets of marine genomics

**Dr Frank Oliver Glöckner**, Coordinator of the large Ocean of Tomorrow project Micro B3 on marine microbial biodiversity, bioinformatics and biotechnology, outlines the research efforts on an integrated information system including new tools for 'Omics analysis, to be used by researchers worldwide

## To begin, can you outline the context from which the Micro B3 project emerged?

With technological advances in the fields of sequencing technology, oceanography and lab automation, marine scientists are now starting projects they only dreamed of 10 years ago. However, the deluge of data produced is beyond the skill set of many marine scientists and very little data management infrastructure exists at the moment. Our project aims to facilitate the whole process from sampling and data acquisition to analysis, leading to better understanding of marine ecosystems and biotechnological applications.

## What are the specific objectives of the project?

The overarching objective is to cross borders by creating a new inter- and multidisciplinary culture in marine RTD. We aim to achieve this by providing access to, and by integrating genomic, oceanographic and Earth observation databases into, one Micro B3 Information System (MB3-IS), based on global standards for sampling and data processing.

We are building capacity across Europe including training on intellectual property rights, knowledge and technology transfer. Our Ocean Sampling Day planned for 2014, will be a major dissemination event to measure marine microbial diversity and test our bioinformatic and environmental MB3-IS in practice.

## What is the role of bioinformatics in bridging the current gaps in microbial data analysis? How do you plan to integrate and visualise this data?

Novel techniques and infrastructures for Environmental Bioinformatics are urgently needed to turn data into sensible and useful information and finally into biological knowledge. The marine bioinformaticians' work ranges from data and quality management (cleaning, standardisation) of the raw data to processing and annotating via data-mining and large-scale georeferenced data integration – and statistics and ecosystem modelling tasks.

## How is Micro B3 integrating global marine data with research on microbial biodiversity

## and function? What partner institutions are making this possible?

Our main partners are the Centre National de la Recherche Scientifique (CNRS) and Consejo Superior de Investigaciones Científicas (CSIC) for the TaraOceans and Malaspina cruises. Other partners are several European long-term ecological research sites (LTER) from the UK, France, Greece and Germany, the owners of datasets from coastal stations, and finally a five-partner SeaDataNet team (see p46) for linking us to the oceanographic community.

## By what means does Micro B3 analyse the genetic makeup of marine microbiology? Have your efforts uncovered any novel characteristics that may be of benefit to commercial applications?

With Marine Genomics we mine data, not resources. Using next-generation sequencing technologies this can be achieved quickly and efficiently. Strong arguments for using marine resources are the high bio- and chemical diversity in the sea, where many bio-active substances are in use in the fight for survival. However, sufficient quantities are difficult to obtain, expensive to extract, and any long-term harvesting of commercially useful amounts is neither sustainable nor guaranteed over time. Mining of genomic data is therefore an efficient and environmentally friendly alternative.

## Could you explain what Ocean Sampling Day is and how preparations for this are progressing?

The Ocean Sampling Day (OSD) is a highly concerted effort that will be conducted in parallel on the summer solstice (21 June) in 2014 at numerous marine stations. It will use best practices developed, discussed within Micro B3 and tested during pilot OSDs in 2012 and 2013, and further refined during a summer school shortly before. It will be based on ongoing efforts of the Genomic Standards Consortium and thus ensure a high level of consistency across sites and maximum usefulness for stakeholders.

Intense regional and Europe-wide PR work will accompany this event. An open call to select the best additional sites is envisaged in 2013/14.



## How have European frameworks evolved over the years to consider the importance of marine microbes? In order to fully integrate Micro B3, what additional policy is needed?

Several small and large projects have been funded by the European Commission on national and international levels. Micro B3 is in many respects a pilot project to build appropriate capacities in bioinformatics, but also in data mining for biotechnology and modelling, as well as Intellectual Property Management (IPR). To address the latter, a group of international experts and biotech companies such as PharmaMar are integrated in Micro B3.

## To conclude, can you briefly highlight your hopes for the future success of Micro B3?

In cooperation with ESF and European research infrastructure initiatives we are achieving a better understanding of the needs and wishes across disciplines. I am convinced that success of future environmental and life sciences will strongly depend on the abilities of individual researchers to work across disciplines, ranging from classical marine knowledge to bioinformatics, oceanography, biotechnology and intellectual property management. Micro B3 will develop a mutual understanding between field and computer scientists, lawyers, industrial researchers and product developers.

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## *Annex 2: Readership Profile of International Innovation Magazine of Research Media Ltd*

### ***Policy Makers, Research Funding and Other Agencies:***

European Commission (DG Environment, DG Research, DG MARE, ESFRI, JPI Oceans, JRC etc), National Science Foundation, Regional and sub-regional councils and groups (Baltic Sea States Sub-Regional Committee etc). DG and Head of Unit European Parliament, National Research Councils, University and Academic Agencies, Ministry of Science, Technology and Innovation, Ministry of Environment, Regional Development and Management Authorities, Environmental Protection Agencies, Education Groups, Policy Formulation, Planning and Development, Policy Regulatory Affairs, Planning Authorities, Local government departments and agencies, National government departments and agencies, Regional government departments and agencies, Universities, JRC, Public research centers / institutes, Public authorities, University Libraries, Digital Libraries, European institutions (European Commission, European Parliament, Joint Research Centre), EU programmes' National Contact Points (NCPs)

### ***International NGOs and Associations:***

International NGOs and charities, Library Associations and groups (Association of European research Libraries etc), Maritime Academic Associations and agencies (United Nations, SCOR, ICES, European Environment Agency), Environmental Agencies, Ministry of Fisheries, Regional Policy and Management Agencies, Ministry of Natural Resources,

### ***Stakeholder Distribution:***

Environmental Monitoring, Coastal Management, Conservation, Earth Observation, Marine Management, Maritime Affairs, Ecosystem Management, Deep Ocean Research, Planning and Development, Rivers and Waterways Authorities, Ocean Research, Fisheries,

### ***Media Coverage:***

General and specialist press, Press agencies, Radio, TV, Web portals

### ***Technical Level Management:***

Researchers, Deans, Faculty Heads, Project and Scientific Officers, Curators, Scientists, Data Management, Policy Advisors, Conservation and Biodiversity Research Management, Ecosystem Research Managers, Policy Makers, Library Management, Conservation, Scientific Advisors, International Cooperation, Chief Executive Officers, Chief Research Officers, Research Development Officers, Head of research and exploration, Directors, Political Leaders, International Cooperation, Information Management

### ***Senior Level Policy and Management:***

Ministers, Policy Developers, Presidents, General Operations Managers, VP's & Directors

### ***Public Sector:***

Ministers, Commissioners, Department Directors/Heads, Unit Managers, International Cooperation, Deputy Directors/Unit heads, Technical Managers, Planning Officers, Resource Directors



Annex 3: Picture of the Micro B3 Roll-up Banner Bioinformatics

