MaCuMBA project news

www.macumbaproject.eu

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MaCumBA is a new four-year research project that aims to uncover the untold diversity of marine microbes using cultivation-dependent strategies. This joint venture of 23 partner institutions from 11 EU countries is led by the Royal Netherlands Institute for Sea Research (NIOZ), and has a budget of more than €12 million, of which €9 million is funded by the EC Seventh Framework Programme.

Interview with Prof Gerard Muyzer, leader of MaCuMBA Work Package 2

Gerard Muyzer is Professor of Microbial Systems Ecology at the University of Amsterdam (UvA), the Netherlands, and the leader of MaCuMBA Work Package 2 (WP2), *Innovative approaches for isolating and culturing the uncultured.* Here he tells us what WP2 is all about.

Can you briefly outline, for a wider audience, what your work package aims to achieve and why it is important in terms of the overall aims of the MaCuMBA project?

The aim of the work package is to develop and apply a range of different approaches for enriching and isolating bacteria that have not been isolated before. For this purpose, we will use both traditional and novel, state-of-the-art approaches. Examples of traditional isolation approaches are the 'dilution-to-extinction' approach, the application of natural substrates, such as chitin, or the development of systems mimicking the natural environment as closely as possible, such as gradient systems. Examples of state-of-the-art approaches are the 'Cocagne' platform, a high-throughput system by which single cells can be isolated, or the 'MicroDish', a million-well culture chip for simultaneously screening large numbers of microbes.

This work package is the cornerstone of the MaCuMBA project, because it provides the input, i.e. microbes, for other work packages, such as Work Package 3, which is focusing on improvement of culture efficiency; Work Package 4, which focuses on the characterisation and storage of isolated bacteria in culture collections; Work Package 6, in which the genomes of the microbes are sequenced; and Work Package 7, which aims to discover novel products with biotechnological potential from the isolated microbes.

The two main oceanic areas of focus for the MaCuMBA project are the photic zone and deep extreme ecosystems, what are the challenges faced in collecting and storing samples from these environments?

Collecting samples from oceanic regions and deep extreme ecosystems requires dedicated cruises, which need to be organised far in advance and which are very expensive. Therefore we are 'hitchhiking' on existing cruises to take samples from the Atlantic Ocean or from hydrothermal vents. We also study samples that were collected previously, such as samples from so-called 'deep hypersaline anoxic basins'. Collecting samples from coastal zones, such as microbial mats and mudflats, is much easier to organise and certainly much cheaper.

With regards to storage of samples, in general samples have to be processed as soon as possible to avoid changes in the community structure and the activity of the microbes. For molecular analysis this is straightforward; the samples are frozen on site in liquid nitrogen or dry-ice. Samples for the enrichment and isolation of microbes have to be inoculated on site in culture media or quickly transported to the laboratory for cultivation.

In what ways could research from your work package have benefits beyond the scope of the MaCuMBA project?

The bacteria isolated in the MaCuMBA project could be of interest for biotechnological applications. These might include the production of novel antibiotics, or novel enzymes that can be used in the laundry industry or for biofuel production. Many pathogenic bacteria are resistant to existing antibiotics and therefore novel antibiotics are urgently needed to combat

continued on page 2

The MaCuMBA logo includes an asterisk which represents both a microorganism and a reference to the full project title, which is Marine Microorganisms: Cultivation Methods for Improving their Biotechnological Applications

MaCuMBA project news
Issue 2

continued from page 1

these threats. In addition, novel biotechnological applications, such as the production of biofuels from agricultural waste, require enzymes that can hydrolyse organic matter at extreme conditions, such as at high or low pH or high salinity.

What milestones is your work package working towards in 2013?

The milestones for 2013 are the development of protocols for the isolation of microorganisms with different high throughput approaches, such as the MicroDish culture chip, the Cocagne platform, and robots that can pick bacterial colonies. In addition, we hope to establish a gradient cultivation system, and a system for cultivating deep-sea sediment bacteria, as well as the development of culture media for the isolation of chemotactic bacteria. By having these protocols, culture media and cultivation systems we can start isolating novel interesting microbes.

MaCuMBA aims to improve the isolation rate and growth efficiency of marine microorganisms from conventional and extreme habitats by applying innovative methods and using automated high-throughput procedures. The project will also utilise genomic and metagenomic information in order to find clues that could help improve cultivation.

Petri Dish Profiles: Micro B3 Project

MaCuMBA isn't the only European project related to the study of marine microorganisms and MaCuMBA Project News will feature profiles of relevant projects in forthcoming issues. First up is Micro B3 (Microbial Biodiversity, Bioinformatics, Biotechnology), an FP7-funded project that aims to provide researchers with new analytical approaches to marine ecological genomics. Its coordinator, Prof Frank Oliver Glöckner, Head of the Microbial Genomics and Bioinformatics Research Group, Max Planck Institute for Marine Microbiology and Jacobs University Bremen, tells us about Micro B3's aims.

What is the Micro B3 Project and what will it contribute?

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. Recently, significant advances have been made in the technology used for DNA sequencing, oceanography and lab automation. This allows marine scientists to analyse large numbers of samples in a short time, which in turn has led to the creation of enormous collections of genetic data. However, the processing and analysis of this data is beyond the skill set of many marine scientists and very little data management infrastructure exists at the moment.

Micro B3 aims to develop an innovative, transparent and user-friendly open-access information system (MB3-IS), which will allow for seamless processing, integration, visualisation and accessibility of the huge amount of data collected in ongoing sampling campaigns and long-term observations.

Can you explain the three Bs (Biodiversity, Bioinformatics, Biotechnology) and how they will be addressed in the project?

Biodiversity refers to the variety of life present in an ecosystem. As part of the Micro B3 project, an Ocean Sampling Day (OSD) will be held to take samples of marine biodiversity.

Bioinformatics is the application of statistics and computer science to the field of molecular biology. The bioinformatics-driven teams involved in Micro B3 have established a software development environment, technical infrastructure components, and a communication workflow.

Biotechnology involves the exploitation of biological processes for industrial or other purposes. Through Micro B3, industry leaders have been targeted to promote understanding of the value of integrating environmental and Omics data.

What is Ocean Sampling Day?

The Ocean Sampling Day (OSD) is a simultaneous sampling campaign of the world's oceans and will take place on 21 June 2014. These cumulative samples, related in time, space and environmental parameters, will provide insights into fundamental rules describing microbial diversity and function. It is expected that the data collected will provide a reference data set for generations of experiments to follow in the coming decade. It could also function as a starting point for regularly coordinated future OSDs. The 2014 OSD will involve all Micro B3 partners with study sites around Europe and will also be opened up to interested labs across the world. Due to the success of the first pilot studies in 2012 it has been decided to continue to sample each summer and winter solstice until 2014.

To learn more about the Micro B3 project, please visit www.microb3.eu

MaCuMBA project news
Issue 2

Under the Microscope: Marine Microorganisms in the news

Microbiology: There's Gold in Them There Bugs!
Microbial 'alchemy' could lead to new ways of detecting and producing the precious metal.
http://www.nature.com/nature/journal/v495/n7440_supp/full/495S12a.html

A Sinusitis Solution from the Sea
A team of scientists and surgeons from Newcastle are developing a new nasal spray from a marine microbe to help clear chronic sinusitis.
http://www.ncl.ac.uk/marine/about/news/item/a-solution-to-sinusitis-from-the-sea2

Natural Marine-Based Substances are Found to Get Through the Protective Shield of Tumours
Marine organisms are interesting active substance candidates for cancer research, as they defend themselves against their rivals by attacking hostile cells and overcoming their defence systems.
http://cordis.europa.eu/wire/index.cfm?fuseaction=article.Dtail&rcn=35015&rev=0

Rover finds first life-friendly environment on Mars
NASA's Curiosity rover has found the first definitive evidence that the Red Planet was once suited to life – and perhaps the first direct evidence of life-friendly conditions anywhere beyond Earth.
http://www.newscientist.com/article/dn23270-rover-finds-first-lifefriendly-environment-on-mars.html

Mystery Bug Found in Antarctica's Lake Vostok
There is something alive in Lake Vostok, deep beneath the East Antarctic ice sheet, and we don't know what it is.
http://www.newscientist.com/article/dn23253-mystery-bug-found-in-antarcticas-lake-vostok.html

EU Project on Deep-sea Organisms
The collaborative project PharmaSea will bring European researchers to some of the deepest, coldest and hottest places on the planet.
http://phys.org/news/2013-02-eu-project-deep-sea.html

Microbes Likely Abundant Hundreds of Metres Below Sea Floor
Samples drilled from 3.5-million-year-old seafloor rocks have yielded the strongest evidence yet that a variety of microorganisms live deeply buried within the ocean's crust.
http://news.sciencemag.org/sciencenow/2013

Culture Club: MaCuMBA Researcher Profiles

Just like the marine microorganisms it studies, the MaCuMBA project relies on a community structure to thrive. Here we meet some of the scientists from all over Europe working together to achieve the project's aims.

Roseline Edern
Assistant Engineer
Station Biologique de Roscoff, France

Roseline works with the Roscoff Culture Collection, which contains more than 2,500 strains of microalgae, parasites, bacteria, and viruses. In order to decrease the transfer work load and to minimise culture losses, cultures in the collection have been cryo-preserved since 2011. Now the collection contains more than 800 strains cryopreserved both in liquid nitrogen and in a -150°C freezer. In the frame of the MaCuMBA project, Roseline and the Roscoff Culture Collection will develop cryopreservation protocols for more difficult strains such as dinoflagellates or diatoms. In particular they will test different types and concentrations of cryoprotectants and a variety of defrosting strategies (fast/slow, addition of antibiotic).

Klervi Crenn
PhD student
Station Biologique de Roscoff, France

In 2012, as part of her master's degree in microbiology, Klervi studied the bacterial and archaeal diversity of deep marine sediments during a six month internship at the Laboratory of Microbiology in Extreme Environments at the Institut français de recherche pour l'exploitation de la mer (Ifremer) in Brest, France. In November 2012, she started a PhD at the Station Biologique de Roscoff to study microalgae-bacteria interactions in the marine environment. As part of the MaCuMBA project, Klervi is working on the isolation of bacteria physically attached to eukaryotic microalgae, through the use of optical tweezers (in collaboration with Heriot-Watt University, UK).

Helena Vieira
Chief Executive Officer and Co-founder
BIOALVO, Portugal

Helena holds a post graduate degree in leadership and strategy in pharma and biotech, from Harvard Business School, Boston, USA, and a PhD in biomedicine from Imperial College, London, UK. BIOALVO is a biotech company which focuses on maximising the application of Portuguese natural resources to different industries such as cosmetics, pharmaceuticals, nutraceutics, detergents, textiles and industrial manufacturing processes.

Helena's role in the MaCuMBA project is mainly the management of the project internally at BIOALVO and the coordination of the interaction between BIOALVO and the other consortium partners. Helena is also a member of the Steering and Exploitation Committees of the MaCuMBA management structure, providing an industrial and market application vision to the potential results and products coming out of this ambitious project.

continued on page 4

MaCuMBA project news
Issue 2

Michael Richter
Bioinformatics Project Manager
Ribocon, Germany

Michael joined Ribocon in 2010 and works in the field of (meta)genome data analysis and development of biologist-centric software tools to enhance annotation and data mining. Nowadays, mid-scale (meta)genome projects are rapidly computed using advanced software solutions, but transferring this flood of data into biological knowledge is still challenging. For the MaCuMBA project, Michael will provide a data mining client-server infrastructure to enhance collaboration in processing, analysis, and mining of metagenomic and genomic (reference isolates) datasets.

Ana Belen Martin Cuadrado
Postdoctoral Researcher
Universidad Miguel Hernández, Spain

Ana's area of study is microbial communities (marine to hypersaline habitats) and comparative genomics and metagenomics. She is mainly interested in the role of genetic diversity in ecosystem dynamics and how the physiology of bacteria shapes and is shaped by environmental processes. As model organisms, *Alteromonas macleodii* and *Haloquadratum walsbyi* offer several unique advantages for approaching these questions. Ana is also interested in the maintenance of the ecological balance of microbial communities through phages and phage interactions with their bacterial hosts.

Jochen Schuster
PhD Student
Heriot-Watt University (HWU), Scotland

Jochen studied mechanical engineering at the University of Applied Sciences in Schweinfurt, Germany, before coming to HWU to continue his studies with a master's in energy. During his final dissertation he learned about his current research topic and biotechnology related work. Jochen is currently a PhD student in Prof Gerard Markx's research group in the Institute of Biochemistry, Biophysics and Bioengineering at HWU. The group's research concentrates on the development of physical cell manipulation and characterisation techniques and their application. The contribution of the HWU group to the MaCuMBA project will include the development of hardware and equipment for novel cell isolation and culture techniques for currently "unculturable" marine organisms.

Anusha Keloth
PhD Student
Heriot-Watt University, (HWU) Scotland

Anusha completed a five year integrated MSc in photonics at Cochin University of Science and Technology, India, in July 2012 and began her PhD in HWU in February 2013 under the supervision of Lynn Paterson. As part of the MaCuMBA project Anusha will develop an automated system for isolating and growing single microbes using optical micromanipulation technology. She will help to develop optical trapping techniques in order to manipulate single microbes using various emerging trapping technologies developed at HWU.

Daniela Clara Cardoso
PhD Student
Royal Netherlands Institute for Sea Research (NIOZ), the Netherlands

Daniela Clara is from Mirandela in Portugal. She studied genetics and biotechnology at the University of Trás-os-Montes and Alto Douro (UTAD) in Vila Real, Portugal. She went on to complete a master's in molecular genetics at the University of Minho in Braga, Portugal. Daniela Clara is currently working with Prof Lucas Stal in NIOZ on the MaCuMBA project. NIOZ is the managing and scientific coordinator of the project. It is the leader of WP1 (Project management) and financially oversees the project and is responsible for the distribution of the financial contributions.

Patrícia Calado
Bioactive Discovery and Development Director
BIOALVO, Portugal

Patrícia holds a PhD in biomedical sciences from the University of Lisbon. She has nine years' lecturing experience as Assistant Professor at the Faculty of Medicine of the University of Lisbon and as Assistant Professor and Coordinator of genetics and genetic engineering courses for the degree in biotechnological engineering at the University Lusófona de Humanidades e Tecnologias, Lisbon. She also has more than 15 years' research experience in molecular and cellular biology, bioassay development and bioactive discovery. Within the scope of the MaCuMBA project, Patrícia is responsible for coordinating the scientific activities developed by BIOALVO, and for supervising the accomplishment of project goals and milestones.

NOTE FOR YOUR DIARY

Please note that MaCuMBA's General Assembly and Work Package meetings will take place in Roscoff, France, from 22-28 September 2013.

MaCuMBA Project News is a newsletter service provided by AquaTT within the framework of the MaCuMBA project. The newsletter provides updates on the MaCuMBA project and relevant items related to marine microorganisms. The newsletter is published on a quarterly basis and is archived on the MaCuMBA website: **www.macumbaproject.eu**
Please submit any relevant information for inclusion in the next issue to **news@aquatt.ie**

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