MaCuMBA project news

www.macumbaproject.eu

Issue 7 | May 2014

MaCumBA is a 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.

Welcome to the seventh newsletter of the MaCuMBA project.

Daniel Vaulot

In this issue, Daniel Vaulot explains the work of **MaCuMBA** work package 4, *Secure novel bio-resources and provide access to genetic and phenotypic information*. Daniel Vaulot is a senior scientist at the Centre National de la Recherche Scientifique (CNRS) - Station Biologique de Roscoff. He is part of the Diversity and Interactions among Plankton team, focusing on the taxonomy, ecology and genomics of small photosynthetic eukaryotes, and is also the Director of the Roscoff Culture Collection (RCC).

Can you briefly explain the aims of your work package and how it will contribute to achieving the overall objective of the MaCuMBA project?

Work package 4 is dedicated to the dissemination and long term preservation of strains that are produced during the **MaCuMBA** project. Our initial aim is to compile a list of available strains and to disseminate this information to all partners so that they are aware of this resource and can start screening for interesting products or activity. The most important strains are deposited to "core" collections for long term preservation. The genetic and phenotypic information are compiled and made available through web search interfaces. Lastly, we are also working on methods to achieve the long term preservation of this resource, especially through cryo-preservation.

Can you tell us about the culture collections that will be used by MaCuMBA?

We are distinguishing two types of collections. "Research" collections are basically laboratory collections where individual partners gather all cultures that they are going to isolate during the **MaCuMBA** project. "Core" collections on the other hand are large international collections with the capacity to hold strains over long periods of time and to distribute them. At present, we have two core collections: the DSMZ (Deutsche Sammlung von Mikroorganismen und Zellkulturen) in Braunschweig and the RCC (Roscoff Culture Collection). The most interesting strains isolated during **MaCuMBA** will be deposited to one of these core collections.

How do you preserve microorganisms in collections?

This really depends on the type of micro-organism. Many bacteria can be easily preserved by simple freezing with a cryo-protectant such as glycerol and then kept in liquid nitrogen. In contrast, some microalgae are still impossible to cryo-preserve and must be transferred into new medium every month, which is very labour-intensive when you are dealing with thousands of strains. Therefore we are developing novel protocols to cryo-preserve microalgae based on optimum choice of cryo-protectant and on slow freezing at a constant rate (e.g. lowering the temperature by one degree a minute). This effort has proved quite successful and at the RCC several hundreds of microalgae can be preserved this way, which drastically cuts down on transfer work load.

Could the work carried out by this WP have benefits beyond the scope of the MaCuMBA project?

First, the "Core" collections will hopefully contain a large number of novel strains that will be very useful for future research. Second, we are developing long term preservation protocols that will be very useful beyond the project.

What are the next milestones your WP aims to achieve?

Our next milestone is to amplify the deposition of **MaCuMBA** strains to core collections and to increase the circulation of information concerning all the interesting micro-organisms that are produced by **MaCuMBA** partners.

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 7

MaCuMBA Strains Available Online from the New Roscoff Culture Collection Website

One of the aims of **MaCuMBA** is to isolate and distribute novel strains of microorganisms. To achieve this goal, organisms collected during the project will be deposited in international culture collections from which interested research laboratories and private companies can order them. The **MaCuMBA** Steering Committee decided at a recent meeting that all strains of microorganisms collected during **MaCuMBA** should also be made available online through selected culture collections.

Algae and cyanobacteria collected during the project will be deposited in the Roscoff Culture Collection (RCC), which is located at the Station Biologique in Roscoff, France and is a member of the **MaCuMBA** consortium. The RCC has recently launched a new website (www.roscoff-culture-collection.org) and a first list of strains from **MaCuMBA** is already available online at www.roscoff-culture-collection.org/strains/shortlists/projects/macumba.

The Station Biologique is one of the oldest marine laboratories in the world and is jointly managed by the Centre National de la Recherche Scientifique (CNRS) and the Université Pierre et Marie Curie (UPMC, Paris 6). The RCC maintains at present around 3,500 strains of marine phytoplankton, bacteria and viruses, with emphasis on cyanobacteria (in particular *Prochlorococcus* and *Synechococcus*), picoeukaryotes (*Pelagomonas, Micromonas, Ostreococcus*) and coccolithophorids (*Emiliania*). A large fraction of the RCC strains have been isolated by the Station's team from various oceanic regions, while the rest have been obtained from other culture collections. Some are available for distribution, while others are still in the process of being described or under study.

The RCC launched its new website at the beginning of April 2014. The website was designed by a small start-up company called Scrol (www.scrol.fr), which specialises in the design of scientific websites. Renovating the website had two major aims. The first was to enable visitors to search for strains with special features. For example, strains can be searched based on location. The second aim was to make it easier for customers to purchase strains through an online store. The modern design also makes it easier to integrate novel functions and links to social networks.

Petri Dish Profiles: ULIXES

In our series of Petri Dish Profiles, MaCuMBA Project News features other European-funded projects related to the study of marine microorganisms. In this issue, we talk to Prof Daniele Daffonchio, of the University of Milan (UMIL), Italy, who was the coordinator of the ULIXES (Unravelling and exploiting Mediterranean sea microbial diversity and ecology for xenobiotics' and pollutants' clean up) project. UMIL is also a partner in MaCuMBA and contributes to WPs 2, 3, 4, 6 and 7.

Prof Daniele Daffonchio, the ULIXES Scientific Coordinator

What aspects of the MaCuMBA project are you involved in?

Within **MaCuMBA,** UMIL is involved in five RTD work packages, investigating some peculiar extreme ecosystems: the Deep Hypersaline Anoxic Basins (DHABs) in the Mediterranean Sea, and mangrove ecosystems. Apart from sampling, UMIL is working to set up new strategies and media to select novel bacteria and improve the cultivation and preservation of isolated strains over long-term periods. In addition, UMIL is performing screening to assess the ability of the available strains to perform biotransformations of industrial relevance.

What was the ULIXES project about?

The ULIXES project aimed to explore and exploit microbial natural resources for bioremediation purposes. Bioremediation is a waste management technique that involves the use of organisms to remove or neutralise pollutants from a contaminated site. The project focused on microbes from a series of selected polluted sites from the north and the south sides of the Mediterranean basin and the Gulf of Aqaba in the Red Sea.

EU and Southern Mediterranean laboratories cooperated in the project, using complementary scientific approaches. Special focus was placed on pollutant categories included in the priority list of high impact pollutants in the EU and around the world.

Following efforts to identify suitable microbial resources, ULIXES aimed to develop and implement novel processes at reactor scale as well as in pilot ex situ and in situ field treatments at selected sites. The combined cultivation dependent and independent approaches applied in ULIXES provided insights on the taxonomic and metabolic diversity of

biodegrading microbial communities inhabiting the selected polluted sites, including seashore sands, coastal lagoons and oil refinery sediments.

Can you explain a little more about bioremediation?

Bioremediation is an environmentally-friendly approach for the clean-up of polluted environments such as marine sediments and water. Bioremediation technologies have been proposed in a large range of cases including marine water and beaches polluted due to accidental oil spills from ships or pipelines, or for the removal of halogenated compounds from polluted sediments.

Effective sustainable bioremediation strategies to clean up marine polluted ecosystems require the definition of the complex relationships between biodegradation rates, the different categories of contaminant molecules, and the microbial community composition and dynamics.

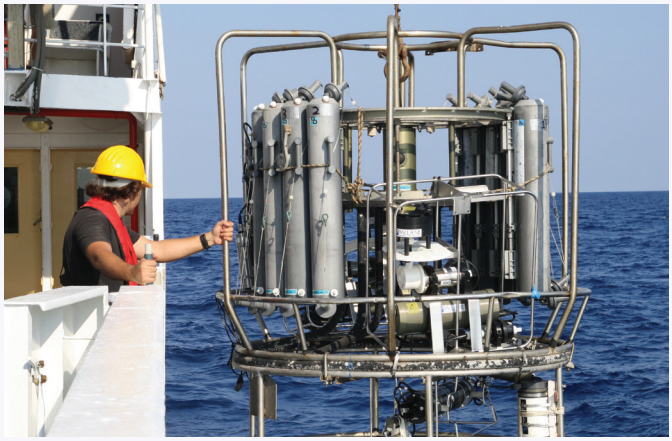
A picture of some of the participants at the MedRem-2014 Conference organised in the frame of the ULIXES project

How can the work of ULIXES be related to the work of MaCuMBA?

Part of the large bacteria collection established within the ULIXES project was set up by UMIL. Such bacteria, isolated from different marine ecosystems, could potentially be used for investigation of physiological responses and activities of relevant interest in the frame of the **MaCuMBA** project. For example, a subset of this collection could be tested, in addition to the newly isolated **MaCuMBA** strains, for long term preservation and cryopreservation potential of different molecules (WP4). Most of the ULIXES strains available at UMIL require peculiar cultivation approaches and could also be used to implement and test improved cultivation strategies set up within **MaCuMBA** WP3.

What do you think are the most significant results of the ULIXES project?

The establishment of a large collection of biodegrading strains and mixed cultures was certainly an important result of the ULIXES project. The screening performed by the partners demonstrated that the ULIXES collection encompasses bacteria of high interest due to their ability to perform functions with interesting bioremediation potential.



A CTD Rosette used for sampling deep sea water

Such results have contributed to the set-up of innovative processes, and can be implemented during the management of polluted sediment and water of both marine and freshwater origin.

Another research activity which provided important results within ULIXES was the production of the widest ever metagenomic and 16SrRNA pyrosequencing dataset of the Mediterranean Sea and the Gulf of Aqaba in the Red Sea. To achieve a detailed picture of the diversity of the biodegradation potentials in each site, and in particular in the Southern Mediterranean, was one of the key objectives of ULIXES.

This result helps to fill the knowledge gap on the bioremediation potential in an as yet overlooked region. The Southern Mediterranean is one of the major oil-producing areas on Earth, but is neglected by bioremediation research.

The characterisation of the microbial diversity in this area and the set-up of novel clean-up strategies and their field tests represent the major contributions of the ULIXES project to supporting the ecological sustainability of the Mediterranean Sea.

For more information about the ULIXES project, visit: www.ulixes.unimi.it

ULIXES scientists are assessing the sampling of Mediterranean deep hypersaline brine pools sediments

MaCuMBA project news
Issue 7

Cyano Biotech Develop Survival Box for Collecting Cyanobacteria

Microorganisms collected by **MaCuMBA** partners will be screened for useful biocompounds and will be used to test new cultivation methods and technologies. **MaCuMBA** partner Cyano Biotech will be using samples provided by other partners to test new robotic equipment it is developing. To help partners collect these samples, Cyano Biotech has developed a "survival box", which contains everything that is needed for collecting cyanobacteria.

Prof Lucas Stal, **MaCuMBA** project coordinator, said: "The survival box will be a very useful tool for the **MaCuMBA** partners. Partners going on expeditions to interesting locations will take the box with them to collect new samples. I hope to use it during expeditions to the Red Sea in May and to the tropical Atlantic Ocean on the research vessel Pelagia in September."

Contents of the Cyano Biotech survival box.

Under the Microscope: Marine Microorganisms in the News

Ocean's Carbon Budget Balanced

Ocean scientists have, for the first time, successfully balanced the supply of food to midwater organisms with their demands for this food. The depth at which they consume this sinking material regulates our climate by determining how much carbon is stored by the ocean and how much remains in the atmosphere.
Shortened URL: http://goo.gl/zrg6KT

"Super Bacteria" Cleaning Up After Oil Spills

Researchers in Trondheim have achieved surprising results by exploiting nature's own ability to clean up after oil spills.
Shortened URL: http://goo.gl/TJDcty

Scientists Identify Core Skin Bacterial Community in Humpback Whales

Researchers at Woods Hole Oceanographic Institution (WHOI) and colleagues have identified a core skin bacterial community that humpback whales share across populations, which could point to a way to assess the overall health of these endangered marine mammals.
Shortened URL: http://goo.gl/nLuk90

Ancient whodunit may be solved: The microbes did it!

Methane-producing microbes may be responsible for the largest mass extinction in Earth's history.
Shortened URL: http://goo.gl/PNs13i

Scientists Study How Marine Bacteria Release Cloud-Making Compound

University of Georgia marine scientists are uncovering how genes in ocean microbes transform sulfur into clouds in the Earth's atmosphere.
Shortened URL: http://goo.gl/folMqX

Bacteria Seed Ocean with Nutrient-Rich Packets

The most abundant photosynthetic organism in the world sheds countless little sacs into the oceans, which could be having a dramatic impact on marine ecosystems, according to a new study.
Shortened URL: http://goo.gl/adYhI7

Marine Bacteria to Fight Tough Infections

Researchers from the University of Copenhagen are studying a new form of treatment for staphylococci based on marine bacteria.
Shortened URL: http://goo.gl/dn98AZ

MaCuMBA project news
Issue 7

Culture Club: Meet the scientists making MaCuMBA possible

Mario López-Pérez
PhD Student
Evolutionary Genomics Group
Universidad Miguel Hernández, Spain

I joined the department at UMH in 2012. My current research interest is to understand the underlying principles that govern microbial aquatic populations. I use comparative genomic, molecular biology, transcriptomic and metagenomic methodologies to investigate the ecological and evolutionary implications of genomic diversity among closely related genotypes. As a model, I work with the marine heterotroph *Alteromonas macleodii*. My recent work has been dedicated to exploring bacterial biodiversity and ecology of several samples along the Mediterranean Sea using metagenomics.

Publications: This section includes details of some of the growing number of scientific publications acknowledging MaCuMBA

Connecting thermal physiology and latitudinal partitioning in marine *Synechococcus*

Pittera, J., Humily, F., Thorel, M., Grulois, D., Garczarek, L. and Six C. (2014). The *ISME Journal* 1-16. Available from: DOI: 10.1371/journal.pgen.1003987
Shortened URL: http://goo.gl/slxNTc

Methanococcoides vulcani sp. nov., a novel marine methylotrophic methanogen; using betaine, choline and N,N-dimethylethanolamine for methanogenesis, isolated from the Napoli Mud Volcano in the Eastern Mediterranean Sea; and emendation of the genus *Methanococcoides*

L'Haridon, S., Chalopin, M., Colombo, D., and Toffin, L. (2014). *Int J Syst Evol Microbiol*. Available from: DOI: ijs.0.058289-0v1-ijs.0.058289-0.
Shortened URL: http://goo.gl/n2eVnN

Astonishing Fungal Diversity in Deep-Sea Hydrothermal Ecosystems: An Untapped Resource of Biotechnological Potential?

Burgaud, G., Meslet-Cladière, L., Barbier, G. and Edgcomb, V. P. (2014). in Outstanding Marine Molecules: Chemistry, Biology, Analysis (eds S. La Barre and J.-M. Kornprobst), Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany. Available from: DOI: 10.1002/9783527681501.ch04
Shortened URL: http://goo.gl/AxpmfJ

Prokaryotic taxonomic and metabolic diversity of an intermediate salinity hypersaline habitat assessed by metagenomics

Ana Beatriz Fernández, A. B., Ghai, R., Martin-Cuadrado, A. B., Sánchez-Porro, C., Rodriguez-Valera F., and Ventosa, A. (2014). *FEMS Microbiol Ecol*. Available from: DOI: 10.1111/1574-6941.12329
Shortened URL: http://goo.gl/oBEXQJ

Spatiotemporal changes in the genetic diversity of harmful algal blooms caused by the toxic dinoflagellate Alexandrium minutum

Dia, A., Guillou, L., Mauger, S., Bigeard, E., Marie, D., Valero, M. and Destombe, C. (2014). *Molecular Ecology*, 23: 549–560. Available from: DOI: 10.1111/mec.12617
Shortened URL: http://goo.gl/VQ2z0e

Improved heat tolerance in air drives the recurrent evolution of air-breathing

Giomi, F., Fusi, M., Barausse, A., Mostert, B., Pörtner, H. A., and Cannicci, S. (2014). *Proc. R. Soc. B* 281(178220132927). Available from: DOI: 10.1098/rspb.2013.2927
Shortened URL: http://goo.gl/4bMQCZ

Draft Genome Sequence of the Strain Heron Island J, Exhibiting Chromatic Acclimation Filamentous Cyanobacterium *Leptolyngbya* sp.

Paul, R., Jinkerson, R. E., Buss, K., Steel, J., Mohr, R., Hess, W. R., Chen, M., and Fromme, P. (2014). *Genome Announc 2* (1). Available from: DOI: 10.1128/genomeA.01166-13
Shortened URL: http://goo.gl/fAMNr2

Microorganisms persist at record depths in the subseafloor of the Canterbury Basin

Ciobanu, M. C., Burgaud, G., Dufresne, A., Breuker, A., Rédou, V., Maamar, S. B., Gaboyer, F., Vandenabeele-Trambouze, O., Lipp, J. S., Schippers, A., Vandenkoornhuyse, P., Barbier, G., Jebbar, M., Godfroy, A., and Alain, K. (2014). *The ISME Journal* 1-16. Available from: DOI: 10.1038/ismej.2013.250
Shortened URL: http://goo.gl/a940id

continued on page 6

Evidence for metaviromic islands in marine phages

Mizuno C. M., Rodriguez-Valera F., and Ghai R. (2014). Front Microbiol 5 (27). Available from: DOI: 10.3389/fmicb.2014.00027
Shortened URL: http://goo.gl/dEsTiv

Tales from a thousand and one phages

Mizuno C. M., Rodriguez-Valera F., and Ghai R. (2014). Bacteriophage 4(1). Available from: DOI: 10.4161/bact.28265
Shortened URL: http://goo.gl/u7hesW

Kosmotoga pacifica sp. nov., a thermophilic chemoorganoheterotrophic bacterium isolated from an East Pacific hydrothermal sediment

L'Haridon, S., Jiang, L., Alain, K., Chalopin, M., Ouafae Rouxel, O., Beauverger, M., 3, Xu, H., Shao, Z., and Jebbar, M. (2014). *Extremophiles* 18(1) pp 81-88. Available from: DOI: 10.1007/s00792-013-0596-7
Shortened URL: http://goo.gl/pgsge6

Brandtodinium gen. nov. and *B. nutricula* comb. nov. (Dinophyceae), a dinoflagellate commonly found in symbiosis with polycystine radiolarians

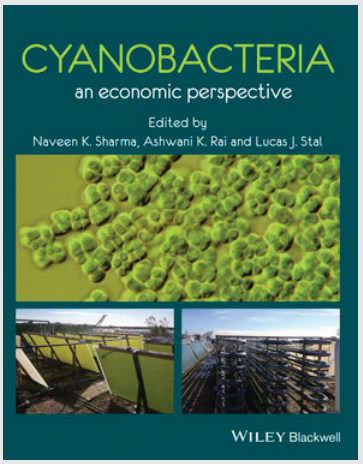
Probert, I., Siano, R., Poirier, C., Decelle, J., Biard, T., Tuji, A., Suzuki, N., Not, F. (2014). *Journal of Phycology*, 50: 388–399. Available from: DOI: 10.1111/jpy.12174
Shortened URL: http://goo.gl/FzjNIW

Expanding the Marine Virosphere Using Metagenomics

Mizuno C. M., Rodriguez-Valera F., Kimes N. E., and Ghai R. (2013). *PLoS Genetics* 9(12). Available from: DOI: 10.1371/journal.pgen.1003987
Shortened URL: http://goo.gl/pG1NXJ

Cyanobacteria: an economic perspective

Issues related to environment, food and energy present a serious challenge to the stability of nation-states. As natural resources are limited, this problem is further aggravated by increasing global population, dwindling agriculture and industrial production, and inequitable distribution of resources and technologies. Therefore, it becomes imperative to find new ways and means to increase food and fuel production while giving due consideration to the biosphere's ability to regenerate resources and provide ecological services. Cyanobacteria could play an important role in this context, as they are an environmentally-friendly resource that can be used for the commercial production of active biochemicals, drugs and future energy (biodiesel, bioethanol and hydrogen).



Written by **MaCuMBA**'s project coordinator, Prof Lucas Stal, and other leading experts, Cyanobacteria: An Economic Perspective is a comprehensive edited volume covering all areas of this important field and its application to energy, medicine and agriculture. This publication will be a highly useful resource for students, researchers and academic professionals in the life sciences, including microbiology and biotechnology.
Naveen K. Sharma, Ashawani K. Rai, Lucas J. Stal, January 2014, Wiley-Blackwell.

"Like" MaCuMBA on Facebook!

To keep up to date with news, updates and photos from the MaCuMBA project, make sure to "like" its new Facebook page at:

www.facebook.com/MaCuMBAProject

Partners can also share news and events from their organisations and related projects on the page, or email Marieke Reuver (marieke@aquatt.ie) or Alberto Vallejo (alberto@aquatt.ie) with information they would like to share.

Designed and developed by AquaTT

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement no 311975. This publication reflects the views only of the author, and the European Union cannot be held responsible for any use which may be made of the information contained therein.