



project news

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Gerard Marx

Prof Gerard Marx, of Heriot-Watt University (HWU), UK, is leader of MaCuMBA Work Package 8, Development of hardware and equipment for high throughput isolation, cultivation and screening.

What is the aim of this work package?

The aim of this work package is to develop new equipment to help with the isolation, screening and culture of marine microorganisms.

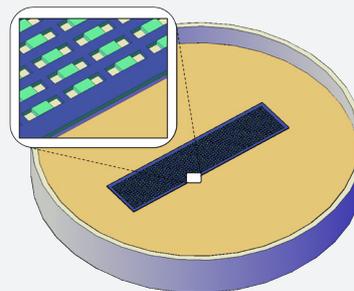
How is this work package working to improve technologies currently used to isolate single microorganisms?

In some areas of microbiology, for example the identification of microbes, developments have been rapid and researchers readily make use of sophisticated pieces of equipment to find out what microorganisms they have

to deal with. At the same time, however, microbiologists are happy to use 19th century technologies such as the Petri dish to carry out cell isolation and initial culture. Don't get me wrong, the Petri dish and its liquid equivalent, the test tube, have passed the test of time. They are proven technologies and in many cases work perfectly well, but for marine microbes they don't, and I think overreliance on their use has held the field back for many years. For marine organisms other approaches may be needed.

In the natural environment, many microorganisms live in contact with other microorganisms of the same or different species. How do you mimic these conditions in culture systems?

Some of the approaches that are being developed in WP8 make use of the reliance of marine microbes on products from other cells for their continued growth.



Design of chip for defined coculture of different microbial species. Cells are grown separately in microchambers on the chip but are able to communicate in pairs through a shared porous membrane.

For example, our partners at Universite de Bretagne Occidentale (UBO) in France are developing gel microdroplet techniques for isolating microbes, in which the cells are encapsulated in very small gel beads, smaller than 100 micron, and therefore so small they are invisible to the naked eye. The gel

isolates the cells from the environment but at the same time chemicals can diffuse through the gel. In this way the cells can be kept separate from their environment but they can still get nutrients, get rid of waste and, possibly most importantly, they can also get the chemicals from other cells that they may need for growth.

A related approach is being developed by our team in HWU in collaboration with Microdish in the Netherlands, in which we

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MaCuMBA students at work in the phototonics lab at HWU

put the cells in miniature bioreactors made with techniques borrowed from the electronics industry. These reactors use membranes or miniature channels for the exchange of chemicals. This means we don't have to put cells in gel, which some of the microbes don't like.

How have the new technologies developed by this WP been transferred to partner organisations?

As the technologies are being developed, prototypes become available which are then being tested in collaboration with partner organisations. Examples include the Cocagne platform developed by UBO, the cyanobacteria survival box developed by CyanoBiotech, the micro Petri dishes for in-situ isolation of microbes developed by Microdish, and the laser-tweezers setup developed by HWU. Testing is either done by the originating partner or, preferably, by the collaborating partner.

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

We foresee that the technology developed by this work package may also find uses outside marine microbiology. The technology could be used for any microbes, not just marine. The problems encountered when dealing with marine microbes are also common in the culture of other

cell types, and in particular mammalian cell culture, for example: having to deal with single cells and small numbers of cells, culturability and productivity being highly dependent on microenvironmental factors including cell-cell communication, and many of these factors being unknown.

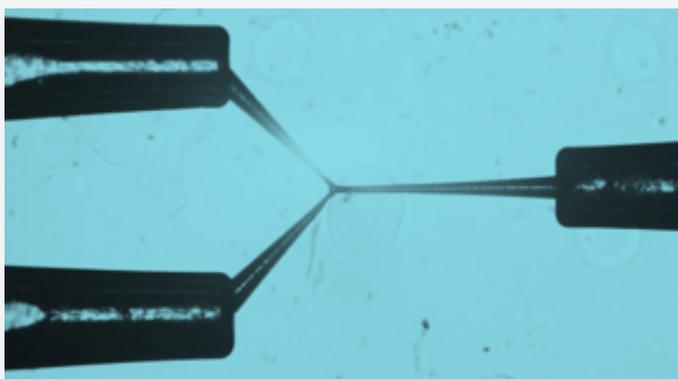
Can you tell us about some of the results WP8 has achieved so far?

WP8 is making good progress and has begun producing prototypes for new equipment and technologies. We have developed a laser-tweezers system that can be used for picking single cells out of a mixture and transferring them to micropipettes, which can then be used to transfer the selected cells to establish cultures from them. The technology has been proven to work and cultures have been established from isolated cells; the system is currently being used by NIOZ in Yerseke, the Netherlands.

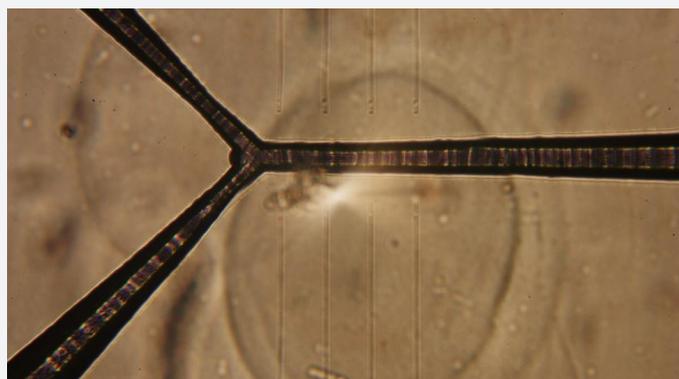
Additionally we have been working on systems in which cells are carried along by a water flow through microfluidic channels past laser waveguides. The intense laser light exerts an optical pressure on the cells which diverts them from their normal path and guides them to side channels from which they can be isolated. We have done proof-of-principle experiments so we know the system works, but development of an automated device that can be used routinely in a lab will take a bit longer.

The setting up of the planned colony-picking robotic systems and the robotic system for cell inoculation has been delayed, but the partner involved (CyanoBiotech) is very close to getting the systems up and running.

The Microdish chip for in situ cultivation has been developed and is currently in use. A number were put in the sea near Roscoff during the previous general assembly. Microdish is also doing tests with Lone Gram's group in the Technical University of Denmark on using the system for cocultures.



Microfluidic chamber for cell separation and isolation using optical pressure.



Welcome to MaCuMBA: **SeaLife** PHARMA®



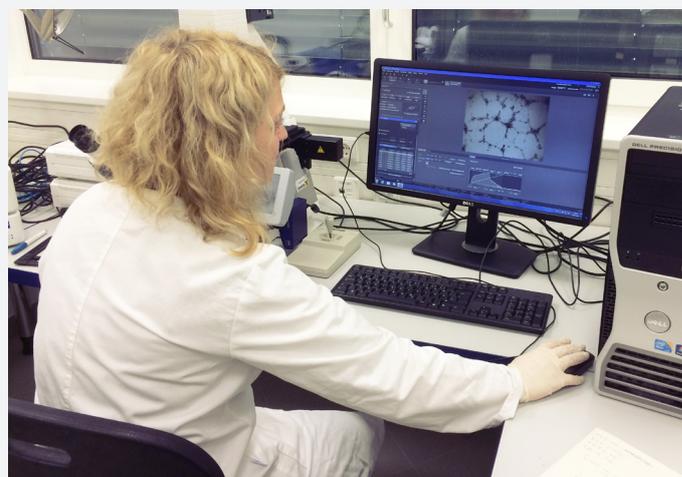
Alexander Pretsch
CEO SeaLife Pharma



Christoph Wiesner
CSO SeaLife Pharma



Dr Miroslav Genov conducts chemical replication synthesis.



Elisabeth Drucker carries out microscopy.



Alexander and Christoph at the 2nd General Assembly, September 2014, Cadiz.

The **MaCuMBA** consortium is delighted to welcome **SeaLife Pharma®** as a new partner. Here, **Dr Alexander Pretsch (Chief Executive Officer (CEO))** and **Prof Christoph Wiesner (Chief Scientific Officer (CSO))** tell us about the company and the role it will play in **MaCuMBA**.

What does SeaLife Pharma do?

SeaLife Pharma is an innovative drug discovery company focused on developing new products for the pharmaceutical market. Our approach is founded on the chemical diversity of the marine ecosystem.

The company is located at the Campus Tulln, Austria, and combines broad expertise at all relevant levels from basic research to clinical development. Innovative and dynamic action – based on combined in-house knowledge – is our fundamental principle and guarantees fast and cost-efficient development of core substances.

What is the role of SeaLife Pharma in the MaCuMBA project?

SeaLife Pharma is mainly responsible for screening and identification of bioactivities in the anti-infective, immunomodulatory and neurodegenerative field. Additionally promising candidates should be screened in several pre-clinical test systems addressing genotoxicity and general toxicology. The company keeps all test platforms in house, so a fast information flow is guaranteed. Besides the testing activities, SeaLife Pharma will also isolate coral microbes and ferment them by mimicking the coral mucus layer; using a new way to get neglected bacterial strains.

Culture Club: MaCuMBA Researcher Profiles

Meet the scientists making MaCuMBA possible



Birgit Kreiseder

Birgit Kreiseder

PhD Student
SeaLife Pharma GmbH

Birgit studied biotechnology and environmental engineering and has developed novel cell-based and organotypic test systems for drug screening and cancer research. At the moment she is enrolled in a PhD-programme examining molecular signal transduction at the Medical University of Vienna. Birgit is responsible for the **MaCuMBA** project screening activities at SeaLife Pharma.



Elisabeth Drucker

Elisabeth Drucker

PhD Student
SeaLife Pharma GmbH

Elisabeth studied biotechnological processes and molecular biotechnology. She recently finished her master's thesis on the topic of characterisation of novel antibacterial substances and has gained expertise in cell based drug screening assays and fermentation skills. As part of the **MaCuMBA** project, Elisabeth is responsible for the coral mucus project and support screening activities.



Cendrella Lepleux

Cendrella Lepleux

Post Doctoral Researcher
Leibniz Institute Deutsche Sammlung von Mikroorganismen und Zellkulturen (DSMZ) (the German Collection of Microorganisms and Cell Cultures GmbH)

Cendrella did her PhD in Nancy, France, at the National Institute for Agronomical Research (INRA). She studied the mineral-associated bacterial communities in nutrient poor forest soil. She was interested in examining their biogeochemical role, their metabolic capacities with a particular focus on their mineral weathering ability, and the molecular mechanisms involved in the mineral weathering process.

She is now a post-doctoral researcher in the MöD (microbial ecology and diversity) research group at DSMZ. In the **MaCuMBA** project she is mostly involved in the development of new isolation techniques, the identification of new bacteria and the improvement of cultivation conditions for particular groups of bacteria.

Cendrella recently presented her **MaCuMBA**-related research at the fourth Joint Conference of the Association for General and Applied Microbiology (VAAM) and the Society of Hygiene and Microbiology (DGHM) in Dresden, Germany, and at the 2014 International Symposium for Microbial Ecology (ISME) in Seoul, South-Korea.



MaCuMBA's Second General Assembly

MaCuMBA held its second General Assembly from 22-26 September 2014 in Cadiz, Spain, locally organised by our partner PharmaMar. The General Assembly (GA) is the most important meeting of the MaCuMBA project and is held once a year. Here, MaCuMBA's Coordinator, Prof Lucas Stal reports on this year's meeting.



The Cadiz meeting marked the end of the second year of the project and therefore also served as an internal mid-term review. All but one of the beneficiaries of **MaCuMBA** were represented at the GA, with 64 participants in attendance, including three members of the Scientific Advisory Board (SAB). The GA was held at the

Faculty of Economy and Business of the University of Cadiz and the meeting facilities were kindly made available to **MaCuMBA** by the International Center of Excellence of the Sea of the University of Cadiz (CEIMAR) who also organised the sampling expedition of the local marine environment. I would like to take this opportunity to extend a big thanks to our colleagues at CEIMAR for organising this year's meeting!

While the partners travelled to Cadiz on Sunday 21 September, the actual GA was on Monday and Tuesday 22-23 September. The format of the GA was largely the same as the first GA in Roscoff in 2013, which was considered by all participants to be very good. After the registration and get together on Monday morning, the meeting started with an introduction of CEIMAR by its director Fidel Echevarría, followed by a keynote address. In **MaCuMBA's** tradition, the address was given by one of the members of the SAB. This year, Jens Harder from the Max Planck Institute for Marine Microbiology, Germany, gave an engaging talk entitled 'Happy and Unhappy Microbes', a topic very relevant for **MaCuMBA's** research.

I then had the pleasure of opening the GA with a welcome address, announcements and approval of the agenda. I was happy to be able to announce that, as of 1 August 2014, the European Commission officially accepted our new partner SeaLife Pharma from Austria (Partner #24). Alexander Pretsch, CEO of SeaLife Pharma then enthusiastically introduced his company and explained its role in **MaCuMBA**. The **MaCuMBA** consortium is delighted to welcome this new partner and we consider them to be a wonderful addition to the project team.

Marcel van der Linden, the **MaCuMBA** financial project manager, gave a presentation explaining the administrative procedures for the 18 months reporting period earlier this year as well as the financial statements. The reports and financial statements were well received by the Commission, with very few minor corrections and an explanation of the

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reasons for the delay of some of our deliverables. We reassured the Commission that we will be on schedule before the next periodic report in August next year (month 36).

The scientific part of the GA began with three sessions, each including four lectures by **MaCuMBA's** young investigators and senior scientists. An update of Work Package 9 was then provided by Marieke Reuver from AquaTT and her new colleague Christine Shortt, who was introduced to the **MaCuMBA** community and will take over most of Marieke's work for the project. Klaas Timmermans gave an update of the organisation of the **MaCuMBA** Summer School, which will be held in April 2015 at NIOZ (the Netherlands). The first day closed with a joint dinner at the Parador Hotel in Cadiz, during which a lively discussion took place about **MaCuMBA**-related issues, with new collaborations established and old ones revived.

The next day continued with four scientific sessions with a total of 15 lectures. After lunch the SAB gave its report and provided important feed-back and suggestions. In general, the SAB was very positive about **MaCuMBA** and its achievements. They suggested that **MaCuMBA** should write a report summarising and critically reviewing the various approaches that have been tested in the project. This suggestion was enthusiastically received.

After the wrap-up of the GA, the Steering, Exploitation, and Ethics Committees had their individual meetings. While these



Committees met, a parallel meeting of 'Young **MaCuMBA**' took place. This is an initiative by Silvia Cretoiu (NIOZ) to bring together the young scientists involved in the project without their supervisors to initiate an exchange of ideas and new collaborations. This is a wonderful new initiative that we hope to see again next year!

In the evening PharmaMar organised a guided walking tour in the old city of Cadiz with a professional guide. We were all very impressed by this beautiful city and its rich history.

Wednesday 24 September was devoted to the review of the RTD work packages. The work packages were discussed in a series of short (one hour) meetings during which the work package leaders reviewed and discussed the progress and status of outstanding and forthcoming deliverables and milestones. The day was closed by Alfonso Corzo (CEIMAR) who introduced the sampling workshop that was planned for the next two days.



The sampling sites were a coastal, slightly hypersaline lagoon and a solar saltern. Several **MaCuMBA** partners took part in this sampling workshop and we are looking forward to the new microorganisms that will be isolated from these samples.

On Thursday afternoon there was a small joint scientific meeting organised between CEIMAR and **MaCuMBA** during which lectures from both groups were presented and the **MaCuMBA** project was introduced to the colleagues and students of CEIMAR.

I would like to again thank CEIMAR for their generous hospitality and for the great organisation of our GA and sampling expedition.

Best Wishes,

Lucas Stal

MaCuMBA Project Coordinator



(l-r) Meredith Lloyd-Evans (PharmaSea), Lucas Stal (MaCuMBA), RuAngelie Edrada-Ebel (SeaBioTech), and Johanna Wesnigk (Micro B3) at the "Building Blue Biotech Capacity in Europe" workshop at EFIB 2014.

MaCuMBA Represented at EFIB 2014

The **MaCuMBA** project was represented at the Seventh European Forum for Industrial Biotechnology and the Biobased Economy (EFIB). This event was held from 30 September-2 October 2014 in the Reims Congress Centre, Reims, France. The event entailed three days of excellent content, networking and discussion. Professor Lucas Stal, **MaCuMBA** project coordinator, presented **MaCuMBA** at a pre-conference workshop entitled 'Building Blue Biotech Capacity in Europe', on Tuesday 30 September. This pre-conference workshop was organised by the PHARMASEA project (www.pharma-sea.eu) and focused on market potential, business opportunities and new product innovations in marine biotechnology.

Nagoya Protocol Takes Effect

The **Nagoya Protocol** on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilisation (ABS) to the Convention on Biological Diversity (CBD) came into effect on 12 October 2014.

The Nagoya Protocol aims to establish a clear and transparent legally binding framework for researchers and companies utilising genetic resources from plants, animals, bacteria or other organisms in addition to the traditional knowledge associated with these genetic resources. It further explains how benefits arising from the utilisation of genetic resources and traditional knowledge associated with genetic resources will be shared in the future.

Under the terms of the Nagoya Protocol, measures will be taken to ensure that users respect the access and benefit sharing measures of the country providing the genetic resources and associated traditional knowledge, including the respect for indigenous and local communities' rights over both.

For more information, please visit: www.cbd.int/abs/text/default.shtml

Under the Microscope: Marine Microorganisms in the News

Oil spills and marine snow: Changing microbial dynamics in the wake of the Macondo blowout

Following the oil spill caused by the blowout at the Macondo wellhead in 2010, Gulf of Mexico microbial population dynamics shifted rapidly as numbers of oil degraders quickly increased.

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New research sheds light on microbes' evolution

Scientists have created an advanced model aimed at exploring the role of neutral evolution in the biogeographic distribution of ocean microbes.

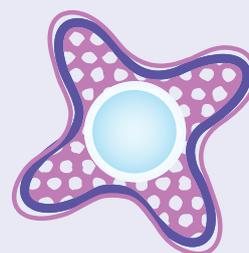
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Proteomics Reveals Ocean's Inner Workings

For decades, doctors have sought methods to diagnose how different types of cells and systems in

the body are functioning. Now scientists have adapted an emerging biomedical technique to study the vast body of the ocean.

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Not all phytoplankton in the ocean need to take their vitamins

Some species of marine phytoplankton, such as the prolific bloomer *Emiliana huxleyi*, can grow without consuming vitamin B1 (thiamine), researchers have discovered.

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Life Beneath the Ice

Louisiana State University (LSU)'s Brent Christner and colleagues document the existence of microbial life below the surface of the west Antarctic ice sheet in Nature publication.

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BioMarine
Business Convention

MaCuMBA BioMarine 2014 Round Table Session: “Marine Biotech: novel strategies for marine microbe cultivation”

MaCuMBA led a round table session at the Fifth International BioMarine Business Convention in Cascais, Portugal, on 30 Oct 2014.

BioMarine 2014 is an international conference where CEOs and executives from all areas of the marine sector have the opportunity to meet stakeholders in the marine bioresources sectors and professionals in the marine industry. This is a platform for research and industry alike to diversify their cross-sectorial knowledge, strengthen their existing partnerships and build new opportunities. This event was therefore an excellent opportunity for MaCuMBA to build new relationships and promote and transfer the innovative

outcomes of the project to key stakeholders.

Professor Lucas Stal, MaCuMBA project coordinator, and Marieke Reuver (MaCuMBA Work Package 9 Leader) coordinated the round table session. During the round table, target outputs of the MaCuMBA project that have potential industrial relevance were presented and practical industrial development of these outputs were discussed with participants.

A full report from this event will be featured in the next issue of MaCuMBA Project News.

Publications

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

Molecular ecology of microbial mats

Bolhuis, H., Cretoiu, M. S., and Stal, L. J. (2014). *FEMS Microbiology Ecology*. DOI: 10.1111/1574-6941.12408
Shortened URL: <http://bit.ly/1u7VYYc>

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

L'Haridon, S., Jiang, L., Alain, K., Chalopin, M., Rouxel, O., Beauverger, M., Xu, H., Shao, Z., Jebbar, M. (2014). *Extremophiles*, 18 (1) pp 81-88. DOI: 10.1007/s00792-013-0596-7.
Shortened URL: <http://1.usa.gov/1thCP46>

Depth dependent metatranscriptomes of the marine pico-/nanoplanktonic communities in the Gulf of Aqaba/Eilat during seasonal deep mixing

Pfreundt, U., Miller, D., Adusumilli, L., Stambler, N., Berman-Frank, I., Hess, W. R. (2014) *Mar Genomics*. Jun 28. pii: S1874-7787(14)00076-2. DOI: 10.1016/j.margen.2014.06.005.
Shortened URL: <http://1.usa.gov/1vgUt4B>

Use of a targeted metagenomic approach to study in situ diversity of a genomic region involved in light harvesting in marine *Synechococcus*

Humily, F., Marie, D., Farrant, G., Partensky, F., Mazard, S.,

Perennou, M., Labadie, K., Aury, J. M., Wincker, P., Nicholas Segui, A., Scanlan, D. J. & Garczarek, L. (2014) *FEMS Microbiol Ecol*. 88(2):231-49. DOI: 10.1111/1574-6941.12285
Shortened URL: <http://bit.ly/1DwNrNC>

A Gene Island with Two Possible Configurations Is Involved in Chromatic Acclimation in Marine *Synechococcus*

Humily, F., Partensky, F., Six, C., Farrant, G. K., Ratin, M., Marie, D. & Garczarek, L. (2013) *PLoS One*. 8(12):e84459. DOI: 10.1371/journal.pone.0084459.
Shortened URL: <http://bit.ly/1wDHSes>

Dinomyces arenysensis gen. et sp. nov. (Rhizophydiales, Dinomycetaceae fam. nov.), a Chytrid Infecting Marine Dinoflagellates.

Lepelletier, F., Karpov, S. A., Alacid, E., Le Panse, S., Bigeard, E., Garcés, E., Jeanthon, C. & Guillou, L. (2014) *Protist* 165:230-244. DOI: 10.1016/j.protis.2014.02.004
Shortened URL: <http://1.usa.gov/1DwNAAB>

Parvilucifera rostrata sp. nov., a novel parasite in the phylum Perkinsozoa that infects the toxic dinoflagellate *Alexandrium minutum* (Dinophyceae)

Lepelletier, F., Karpov, S. A., Le Panse, S., Bigeard, E., Skovgaard, A., Jeanthon, C. & Guillou, L. (2014) *Protist*. 165(1):31-49. DOI: 10.1016/j.protis.2013.09.005.
Shortened URL: <http://bit.ly/1rAsaMg>

An Improved Protocol for Flow Cytometry Analysis of Phytoplankton Cultures and Natural Samples.

Marie, D., Rigaut-Jalabert, F. & Vaulot, D. (2014) *Cytometry A*. 85(11):962-8. DOI: 10.1002/cyto.a.22517.
Shortened URL: <http://1.usa.gov/10yX968>

DATE FOR YOUR DIARY **Marine Micr'Oomics for Biotech Applications Industry Expert Workshop**
Organisers: Micro B3, MaCuMBA, PharmaSea
Location: PharmaMar, Colmenar Viejo, Spain
Date: 30 -31 March 2015

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

