

MaCuMBA



project news

www.macumbaproject.eu

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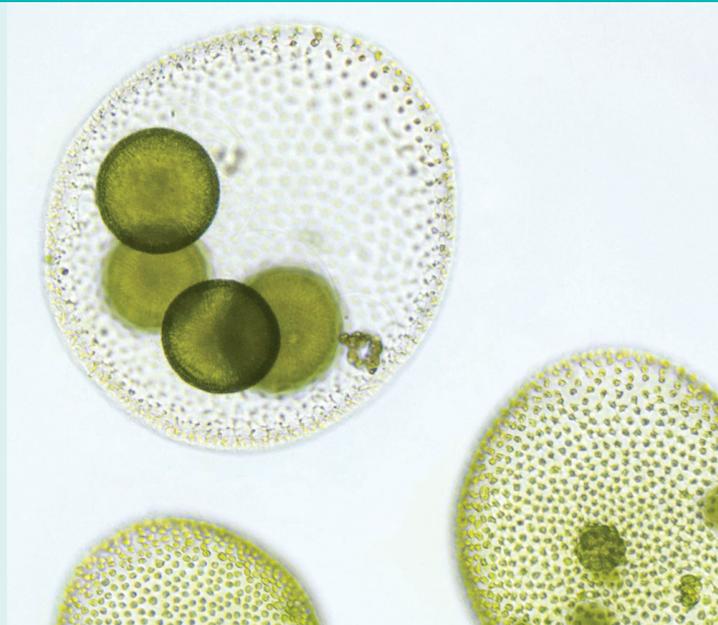
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MaCuMBA is a new four-year research project that aims to uncover the untold diversity of marine microbes using cultivation-dependent strategies. This joint venture of 23 partner institutions from 11 EU countries is led by the Royal Netherlands Institute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

The project officially started August 2012 and held its kick-off meeting in Amsterdam in October. The project has been established on the premise that unknown microorganisms may hold the key to unlocking knowledge that could contribute to the development of new medicines and energy solutions. The study of these unidentified microorganisms could also potentially help mitigate climate change and control disease. The project

team aims to develop revolutionary new methods for isolating and screening microorganisms, which may subsequently be grown in a laboratory.

The genetic diversity of marine bacteria is estimated to be one million per milliliter of seawater. Currently, only about ten thousand different bacteria have been identified. This low rate of identification is due largely to scientists being unable to successfully isolate novel microorganisms and grow them in laboratory conditions. Microorganisms are mutually dependent and communicate with each other to grow and survive. Consequently, the vast majority of marine microorganisms have not been cultivated and are often considered as 'unculturable'. Today, one of the main challenges for microbiologists is to develop strategies to cultivate the uncultured majority of marine microorganisms.

 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**



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Interview with Prof. Lucas J. Stal (NIOZ and UvA), MaCuMBA coordinator

Can you explain to a wider audience, whose knowledge of marine microorganism may be limited, why a project like MaCuMBA is important?

Most people when they hear about microorganisms think of dirt, of illness, or at best they know that microorganisms make our beer, wine, yoghurt, cheese, antibiotics, etc. Few people realise that the total biomass of microorganisms on earth is many times higher than that of all other organisms together, including man. Few people know that the genetic diversity of microorganisms is overwhelmingly larger than that of all plants and animals together and that the number of species is unknown but must be in the many tens of millions.

Most people don't care that only 10,000 species have been described. But they should! Mankind has used microorganisms for various applications (how many millions of lives have been saved due to the discovery of penicillin?); how many new applications (medicine, food, energy, clean-up of contaminants and xenobiotic compounds) are hidden among the perhaps 99.99% unknown microorganisms?

Perhaps more abstract to most people is the fact that the world was microbial for 3,200 million years and that macroorganisms have been around only for the last 600 million years (and man for only 3 million years). How many people realise that the oxygen in our atmosphere originates from microorganisms and that half of the oxygen we breathe today is produced by microorganisms? Microorganisms rule this planet; they did 3.8 billion years ago and still do today. They are responsible for the functioning of all ecosystems on earth and form the basis of the food web. But our knowledge of these processes is very limited.

In what ways could research from MaCuMBA eventually benefit society?

We are facing unprecedented global changes, increase in temperature, acidification of the ocean, energy and food crises. In order to understand these processes, predict the consequences and search for solutions we need to substantially increase our knowledge of the unknown majority of microorganisms and their properties. Yet, we have no idea how to isolate, cultivate and describe this unknown majority, at least not at the rate and cost that is necessary to bring any application in reach within the next decades, when we will need them most.

MaCuMBA focuses on marine microorganisms. Why focus on the marine?

Well, 70% of the surface of this planet is covered by the ocean. If we take into account that the average depth of the ocean is 4km, we are dealing by far with the largest continuous ecosystem on Earth. All together it is estimated that 10^{29} microorganisms live in the ocean. That is a number with 29 zeros! As it is difficult to imagine such a large number we can say that in every milliliter of seawater live 1 million microorganisms and perhaps thousands of species.

Also, the sea is not homogeneous. It contains underwater salt lakes, volcanos, mounts, hot smokers and cold seeps and many more extreme environments in which many types of specialised microorganisms live. Also the abyssal deep sea with low temperatures, unimaginable high pressure and without light is an unexplored environment. The seafloor (from coastal intertidal sediments to the deep sea) is a habitat of undreamed of high numbers of microorganisms but is hardly ever explored.

The sea is full of higher organisms (mostly animals but also plants such as sea grasses), each carrying their own flora of microorganisms. We expect that we will find a wealth of new microorganisms. There is another reason why we focus on the sea. Freshwater is in ever limiting supply. If we want to use microorganisms for biotechnological purposes we will have to grow them. It is an advantage that we can grow them in seawater rather than using dwindling freshwater resources.

In terms of the project itself, can you outline how the collaborative element between the partners will work?

The consortium members were chosen because of their expertise and because their skills are complementary to

each other. Hence, we have groups that specialise in specific groups of organisms or environments. Other groups have access to ships or have developed hardware that can be used for high-throughput cultivation of microorganisms. We have groups on board that develop hardware. Some participants were invited because of their expertise in metagenomics and bioinformatics because this knowledge is thought to be crucial to design the right culture conditions to aim at promising microorganisms or environments.

We have also experts on cell-to-cell communication. We aim at using these signal compounds to improve growth and isolation rates. There are several small and medium size companies and one industry partner in the consortium that are interested in applying our expected results and products. These consortium members are working with partners that screen new isolates and existing strains for applications.

Finally, we have one professional culture collection on board. Together with numerous specialised culture collections available in the consortium, we will store the newly isolated microorganisms and make them available for the scientific community and for industry.

As you can see, this is a large consortium. The aims and the products of this project are chosen in such a way that they can only be achieved by the joint action of several members of the consortium. The work is concentrated in dedicated work packages that comprise well-defined tasks for which, in many cases, more than one consortium member is responsible. The collaboration will be further enhanced through frequent meetings between partners and the exchange of personnel.

Under the Microscope – Marine Microorganisms in the News

Projects relating to the study of marine microorganisms have been receiving high profile coverage in the European press.

CORDIS News featured an article about the discovery of a symbiosis between tiny single-celled algae and highly specialised bacteria in the ocean by a group of European and North American scientists. This discovery is expected to help scientists to better understand oceans and the role they play in our lives. The scientists discovered the important role that single-celled algae and nitrogen-fixing bacteria have in helping to fertilise the oceans by taking nitrogen from the atmosphere and transforming it into a form that other organisms can use. The article discusses Professor Jonathan Zehr's work in this area.

To read the full article, please visit:

http://cordis.europa.eu/fetch?CALLER=EN_NEWS&ACTION=D&SESSION=&RCN=35127

In the UK, the Guardian newspaper reports that "scientists have pinpointed a new treasure trove in our oceans: microorganisms that contain millions of previously unknown genes and thousands of new families of proteins." The article, written by Robin McKie and Gemma O'Neil, features interviews with Curtis Suttle, Professor of Earth, Ocean and Atmospheric Sciences at the University of British Columbia, and Professor Steve Yearley, head of the genomic forum of the UK Economic and Social Research Council (ESRC). In addition, the article discusses the role Craig Venter (one of the scientists involved in the sequencing of the human genome) is playing in the marine biotechnology sector.

To read the full article, please visit:

<http://www.guardian.co.uk/environment/2012/nov/10/marine-treasure-trove-medicine?INTCMP=SRCH>



The MaCuMBA kick-off meeting was held in Amsterdam on 29-30th October

The project's kick-off meeting was very successful. It was the first time that all members of the consortium met and all partner organisations were present. The European Commission was represented by the scientific officer responsible for MaCuMBA. In addition, two members of the Scientific

Sessions on the first day included an interesting key note presentation on Marine Biodiscovery Research: cultures, consortia and genomes, which was highly relevant for the MaCuMBA project and very stimulating for all participants, as well as an explanation of project procedures, the perspectives of the European Commission and presentations from each partner on their input into the project, and their expectations from it.

The second day was mostly dedicated to reviewing the work packages and the tasks. The kick-off meeting was a get-to-know-each-other event and review of the whole project. Now the work can really start.



Advisory Board, an independent body consisting of selected high-level experts and stakeholders who are not partners in the MaCuMBA project, but are willing to advise and support the Project Steering Committee on an annual basis, were in attendance.

