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Preservation of microalgae in BCCM collections

DURATION
01/12/2013 - 29/02/2016

BUDGET
377.000 €

PROJECT DESCRIPTION

Context

Biological Ressources Centers (BRCs) are essential infrastructures supporting the Life Sciences and Biotechnology sectors (Janssen et al. 2010). Their establishment and maintenance require distributing well characterized, stable and performant biological materials (i.e. living organisms, cells, genes or related information) to the users in Life and Health sciences, Biotechnologies, Food industries, etc. Therefore, the implementation of reliable preservation technologies of the biological resources is crucial in the management of the BRCs.

General objectives and underlying research questions

The project aims to develop and optimize new and cost-effective preservation techniques of photosynthetic microalgae (diatoms and cyanobacteria) in the two BCCM collections, BCCM/DCG and BCCM/ULC. This is a critical factor for the future growth and valorization of these collections. Therefore, the project aims to explore and improve technologies to preserve the strains and their genomic information (high quality DNA).

The major objectives of the project are:

1. to improve cryopreservation methods for diatoms and cyanobacteria (higher viability and larger number of taxa),
2. to evaluate the impact of the preservation protocols on the genomic stability of selected microalgal strains,
3. to create and validate a genomic DNA bank of microalgae,
4. to determine and improve the cultivation success of strains and species from different habitats,
5. to develop single-cell techniques as an alternative/addition to culturing for diatom taxa that resist cultivation.

Methodology

To achieve these objectives, the following methods and techniques will be tested and evaluated:

1. The traditional two-step cryopreservation technique will be adapted to photosynthetic microalgae strains. In particular, the effect of the culture conditions, the type and concentration of cryoprotectants, and the preservation temperature on the survival of microalgae will be examined.. In addition, different vital dyes will be tested to assess viability following cryopreservation. The encapsulation/dehydration technique as alternative to the two-step cryopreservation method will be evaluated. An independent validation of the developed protocols will be performed by Culture Collection of Algae and Protozoa (UK) (subcontractor) to ensure that they are robust, transferable and reproducible for the conservation of diatom and cyanobacterial strains.
2. Selected strains for which a genome sequence is available will be resequenced to investigate the genetic changes induced by different cryopreservation techniques developed in the first step and compared to serial subculturing.
3. To establish a high-quality genomic DNA bank, different DNA extraction and storage methods will be compared and the DNA collections of the host laboratories integrated in the BCCM culture collections.
4. The cultivation success of diatoms will be determined from samples isolated from contrasting habitats (eutrophic versus oligotrophic, benthic versus planktonic, marine versus freshwater) using a range of different culture media.
5. Single cell techniques, including testing multiple displacement amplification, will be optimized using cells isolated from cultures, after which they will be applied on various diatoms resisting cultivation.

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Potential impact of the research on science, society and/or on decision-making

The improvement of the preservation techniques and the creation of a DNA bank in the two BCCM collections of microalgae will improve their capacity to fulfill the needs of their users. Indeed, photosynthetic microalgae, including diatoms and cyanobacteria, are increasingly used in different areas of applied research, as in biotechnology (e.g. biodiesel, bioplastics), pharmaceutical research (e.g. bioactive molecules), or cosmetic applications. They are also used as food complement (polyunsaturated fatty acids), bio-fertilizers, bio-pesticides, animal food, etc. Their use in these fields requires having access to high-quality and authentic biological resources.

Moreover, the long-term preservation of strains in public culture collections is important for taxonomic, evolutionary and biodiversity studies. Their role includes the distribution of nomenclatural types for taxonomists, the provision of biological resources for DNA barcoding and the development of reference databases on which the identification of environmental DNA sequence data can be based.

At the European level, the project will foster the development of new collaborations and exchanges with other culture collections (as subcontractor or in the follow-up committee). This project will also give more visibility to the Belgian collections of photosynthetic microalgae and to the BCCM consortium as a whole.

Description of finished products of research at short and medium term

A website with information on the project, the implemented protocols and the published papers will be created. The follow-up committee will be kept regularly informed of the results through communication and annual meetings. The research results will be communicated to the scientific community through publications, conferences and posters. A scientific workshop with invited speakers is also planned at the end of the project.

CONTACT INFORMATION

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