

TITLE: *Polar microbial diversity: exploration, function and exploitation***CONTACT PERSONS AND INFORMATION:**

Dr. Annick Wilmotte, CIP, Chemistry B6, University of Liège, 4000 Liège, BE. Tel; 32 (0)4 366 38 56. email: awilmotte@ulg.ac.be

DESCRIPTION OF BELGIAN CONTRIBUTION:

The **3 Belgian partners** that propose this research concept have built a unique experience, during the EC-project MICROMAT, in the study of the biodiversity (cultivated and yet-to-be cultivated) of prokaryotic (eubacteria and cyanobacteria) and eukaryotic microorganisms in microbial mats of Antarctic lakes. For the IPY07, we propose to use this expertise for the study of terrestrial, freshwater and marine polar ecosystems, including cryoconites, benthic mats in lakes, meltwaters and the marine littoral, sea-ice, crusts on rocks and soils, volcanic springs, and cryptoendolithic biota. This work will include the isolation of strains that can be used for biotechnological and pharmaceutical screenings, as well as the morphological, genotypic and phylogenetic characterisation of strains and environmental samples. We also propose to study and exploit the metagenome of these communities in order to access the diversity of functional genes from uncultivated microorganisms. In addition, we plan to use physiological experiments, and molecular-genetic and genomic approaches to study how selected key organisms have adapted to the extreme polar environment. Ultimately, our research will contribute to a better understanding of what biological and environmental processes have shaped polar microbial communities.

PARTNERS:

1. Laboratory of Protistology and Aquatic Ecology, Department of Biology, Krijgslaan 281-S8, University of Gent, 9000 Gent. Expertise: Morphological, molecular and functional diversity of eukaryotic microorganisms. Contact: Profs. Wim Vyverman and Koen Sabbe, T: 32 (0) 9 264 85 01 (wim.vyverman@Ugent.be, Koen.Sabbe@UGent.be).
2. Laboratory of Microbiology, University of Gent, 9000 Gent. Expertise: Isolation and polyphasic characterisation of eubacteria. Contact: Profs. J. Swings and P. De Vos, Microbiology, University of Gent. T: 32 (0)9 264 5110 (Jean.Swings@Ugent.be)
3. Center for Protein Engineering, University of Liège, 4000 Liège. Expertise: Morphological and molecular diversity of cyanobacteria in cultures and environmental samples. Analysis of the metagenome from environmental samples. Contact: Dr. A. Wilmotte, T: 32 (0) 366 38 56. (awilmotte@ulg.ac.be)

Apart from the scientific expertise, all three research groups have excellent laboratory facilities for the cultivation and polyphasic characterization of microbial organisms.

ADDED VALUE IF ADOPTED BY IPY07:

This research is highly relevant as polar ecosystems, and especially Antarctica, are dominated by microbial organisms and their activity. Antarctic can rightly be named a microbial continent, where almost all higher organisms are not permanent inhabitants. It is also a continent with extreme environmental conditions, that have selected for a unique genetic diversity that still awaits full exploration and exploitation. In addition, our research will contribute to our knowledge on the effects of climatic change on the gradient of ecosystems going from coastal, freshwater and terrestrial environments, which form the research topic of programmes RISSC (Regional Sensitivity to Climate Change in Antarctic Terrestrial and Limnetic Ecosystems) and N-RISSC (idem in the Arctic), that are linked to SCAR and ICSU.

Our purpose is to cooperate with Belgian and international partners in order to:

- 1) construct culture collections of polar microorganisms
- 2) perform a polyphasic characterization of these polar microorganisms
- 3) exploit and screen the microbial strains isolated during the project to find interesting compounds and enzymes
- 4) elucidate physiological adaptations and functioning of the microbial communities
- 5) exploit and screen the libraries of the metagenomic studies

CONCEPTS FOR CROSS-CUTTING ACTIVITIES

We envisage that an undertaking to describe and explore the applied potential of polar microbial diversity should be highly international in order to avoid overlap and to ensure adequate coverage of all above-mentioned habitats and organisms. In the framework of previous projects we have built up a network of scientists which have efficiently collaborated in the past and present (see list below).

A better documentation and understanding of the microbial diversity of polar ecosystems is highly relevant for understanding the functioning of polar ecosystems, and their role in a global (climatic) context. The results of our studies will therefore be crucial to many other polar research areas, ranging from biogeochemical cycling to paleoclimatology.

Finally, international cooperation will increase access to polar materials and ensure efficient use of logistics (boats, planes, laboratories).

If a multidisciplinary study is undertaken internationally on a few selected polar biotopes, including a bipolar comparison where possible, this activity will serve as a 'flagship' to focus the scientific effort, to multiply its impact thanks to cooperation between different disciplines, and to communicate more easily to the public what is the importance of the IPY07.

ALREADY ESTABLISHED PARTNERSHIPS:

- 1) Dr. G. Feller, Laboratory of biochemistry, University of Liège, Liège
Expertise: screening for psychrophilic enzymes with added biotechnological value
- 2) Dr Dom Hodgson, BAS, UK
Expertise: sampling and logistics, analyses of pigments
- 3) Pr. Johanna Laybourn-Parry, University of Nottingham, Nottingham, UK
Expertise: diversity of protozoans
- 4) Dr. R. De Wit, Bordeaux II University, Arcachon, France
Expertise: ecological characterisations of microbial communities
- 5) Dr. Flavia Marinelli, Vicuron, Gerenzano, Italy (SME)
Expertise: pharmaceutical screenings of eubacterial and cyanobacterial strains
- 6) Prof. W. Vincent, University of Québec, Québec, Canada
Expertise: study of microbial mats and picocyanobacteria
- 7) Dr. Antonio Quesada, Autonomous University Madrid, Madrid, Spain
Expertise: study of microbial mats and UV protection
- 8) Dr David Pearce, BAS, UK
Expertise: microbial diversity
- 9) Dr Niall A. Logan, Glasgow Caledonian University, Glasgow, UK
Expertise: diversity of spore-forming bacteria

KEYWORDS:

microbial biodiversity, eubacteria, cyanobacteria, protists, algae, strains, molecular ecology, metagenomics,