



# THE SIGNIFICANCE OF VIRUSES FOR POLAR MARINE ECOSYSTEM FUNCTIONING (VIRPOL)

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## INTRODUCTION

Every aquatic ecosystem on our planet relies on microbial communities for its primary production (phytoplankton) and mineralisation of organic matter (heterotrophes), thereby supporting also the aquatic polar ecosystems (Arctic and Antarctic). Microbial communities include also **viruses, which are by far the most abundant biological entities on the Earth**. Viruses are major players influencing biogeochemical and ecological processes, including host population dynamics, nutrient cycling, biodiversity, and gene transfer. Moreover, viruses convert particulate organic carbon into dissolved and colloidal organic carbon that does not sink into the deep ocean, potentially decreasing the efficiency of the biological pump in the world's oceans. The subsequent respiration within the surface layer to carbon dioxide directly affects the flow of carbon. Since the carbon stored in the DOM pool equals that in atmospheric CO<sub>2</sub>, viruses may influence global climate. Considerable evidence exists to suggest that viruses are key components in microbial communities, yet relatively little attention has been paid to their role in aquatic polar ecosystem.

**Despite the likely importance of viruses in polar ecosystems, polar viral ecology is a subject still very much in its infancy. Only limited knowledge is available about the polar viral community composition, their ecological role, the interactions between host and virus, and their response to environmental changes.**

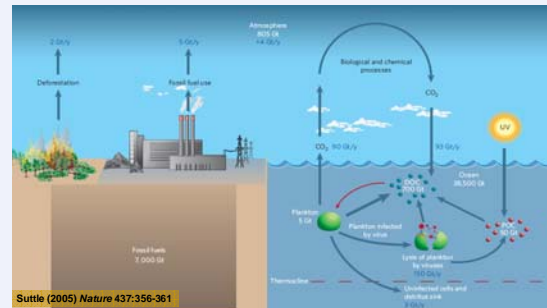
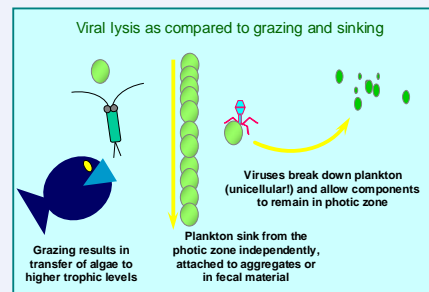
## MAIN GOALS

The present project will be the first comprehensive study to focus on viruses and viral mediated processes in polar environments. Four field campaigns (2 Arctic and 2 Antarctic) are planned. As part of the Polar Aquatic Microbial Ecology (PAME) IPY activity program, this project's objectives are:

- **To examine the abundance and composition of viruses and their host (prokaryotes and phytoplankton) in bipolar marine environments,**
- **To compare the significance of viruses and their impact on microbial mortality and geochemical cycling in the aquatic polar ecosystems, and**
- **To unravel the impact of climate and global environmental change on the ecological role of viruses and their activities.**

Both the Arctic and the Antarctic seas are key regions in the ocean's circulation and are considered sensitive to global warming. The global change-induced environmental changes will directly impact the polar microbial community and most likely enhance the significance of viruses. The results are expected to provide new insights in our understanding of the structure of polar marine pelagic food webs and geochemical cycling, as well as to what extent both polar regions are different. The obtained data will, furthermore, be essential for a more accurate evaluation of global carbon cycle models.

## ILLUSTRATIONS



Viruses can affect the efficiency of the biological pump. Viruses cause lysis of cells, converting them into particulate (POC) and dissolved (DOC) organic carbon. This reduces the rate at which carbon sinks from the surface layer into the deeper waters (biological pump). Instead the carbon is retained in the surface waters where it is remineralised. The net effect is a faster rate of CO<sub>2</sub> build-up in the atmosphere than would occur if the POC were 'exported' to the deep ocean.

## EOC

Ideas to help raising the awareness of the ecological role of viruses in polar regions to the wider public:

- A great possibility would be to attract the Rotterdam Zoo (Diergaard Blijdorp) as they have a clear focus on aquatic ecosystems with their Oceanium and plan an Arctic unit to be opened in 2007. Including the polar marine microbial ecosystem and its importance for the higher trophic levels will contribute substantially to the public outreach.
- Attracting students from the Netherlands Film and Television Academy, Photo Academy and/or Art Academy to get involved is attractive and may receive special attention from the media.
- Contribute to education of scholars by involving schools in the field expeditions.
- Participation in the national Science Week and the national polar symposium.
- Develop a summer course for academic students focusing on polar microbial ecology.
- As an interesting note, collaboration with EUR-OCEANS (EU network of excellence) might be an option for making movies, organizing floating university courses and workshops.

