

The sea surface microlayer: vital and unique



Specific competence and interest in joining the consortium:
Marine B3 - Marine Biodiversity, Bioinformatics and Biotechnology

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Sea surface microlayer (SML) research – highlights and advances

1. The SML is a gelatinous aggregate-enriched biofilm: e.g. Cunliffe M & J C Murrell (2009) *The ISME Journal* 3: 1001–1003.

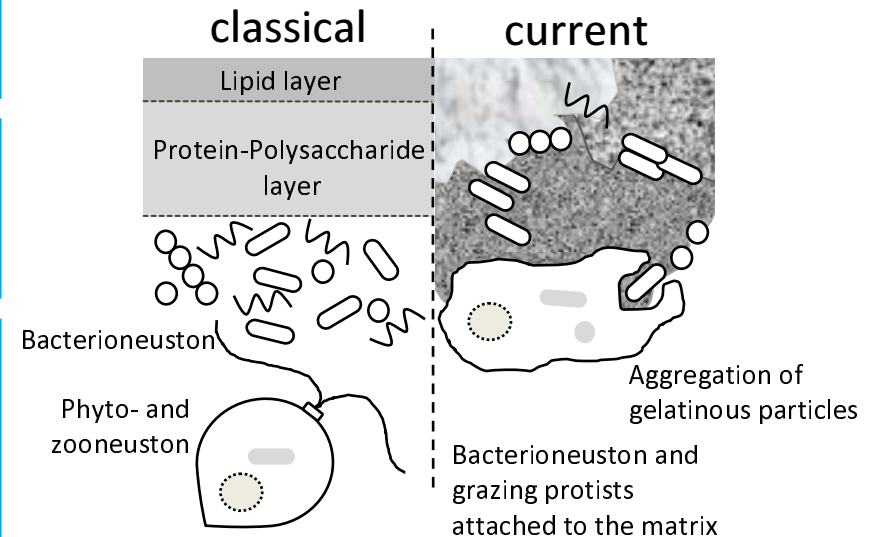
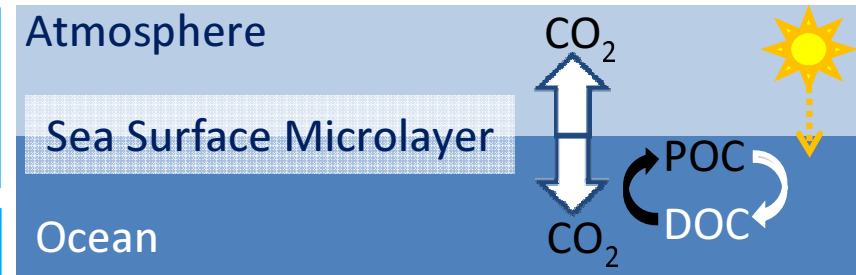
2. Bacterial populations in the SML are different to those in the water column: e.g. Cunliffe M et al (2009) *Applied and Environmental Microbiology* 75: 7173-81.

3. Protist populations in the SML are different to those in the water column: e.g. Cunliffe M et al (2010) *The ISME Journal* 4: 455-458.

4. Important microbially driven processes in the SML:

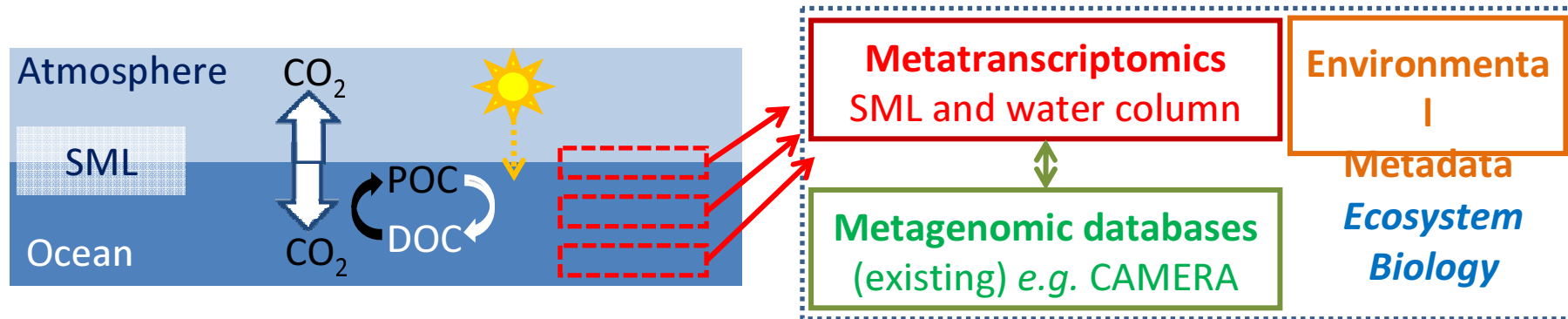
- Ocean-atmosphere gas exchange
- Carbon cycling – particulate ↔ dissolved
- Light-driven energy metabolism

5. Suitable SML sampling methods have been developed for molecular microbial research: Cunliffe M et al (2009) *Aquatic Microbial Ecology* 57: 69-77.



Proposal – an ecosystems biology approach to exploring the sea surface microlayer

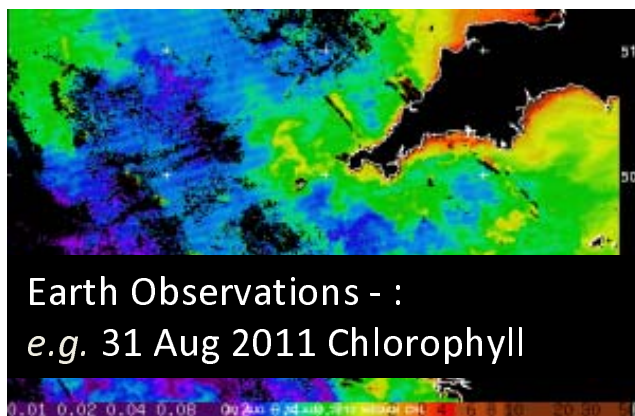
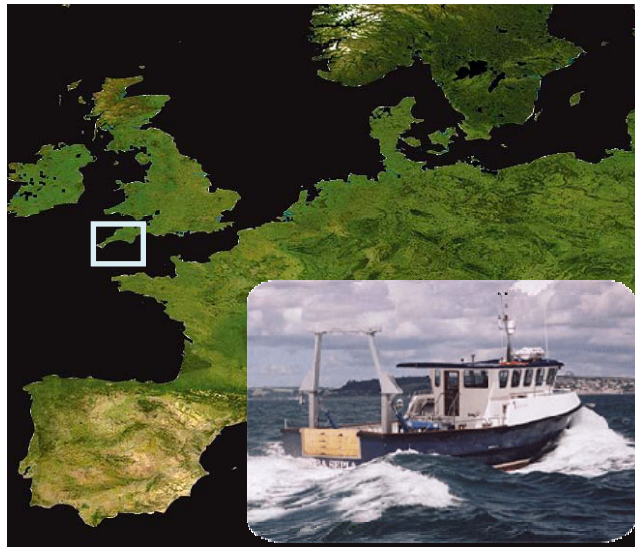
“let the microbes tell the scientists what is happening at the ocean-atmosphere interface”



Aim: Elucidate **active** microbial metabolism in the SML and determine why certain taxa dominate in the SML from a functional and adaptive perspective.

- mRNAs will allow an assessment of what genes are being expressed. This will utilise existing metagenomic datasets/resources of genes that are **present** in the water column.
- Research will have three ecosystem function foci:
 - Ocean-atmosphere gas exchange
 - Particulate and dissolved organic carbon cycling
 - Light-driven energy metabolism

The **Western Channel Observatory** is situated in the English Channel and comprises of long-term sustained observations at a number of stations.



Regularly studied and well characterised:
e.g. seasonally stratified, spring–autumn phytoplankton blooms.

Easily accessed: *e.g.* L4 station is sampled weekly from Plymouth.

Detailed environmental metadata:
e.g. temperature, nutrients, oxygen.

Building on previous microbial research:
e.g. Gilbert et al (2009) The seasonal structure of microbial communities in the Western English Channel. *Environmental Microbiology* **11**: 3132-3139.

Fully equipped for microbial research:
e.g. state-of-the art cell and molecular biology facilities at the MBA.

Building on **sea surface microlayer** expertise and research:

- A unique microbial ecosystem.
- Key role in regulating globally significant processes, including air-sea exchange.
- Developed sampling methodologies specifically for molecular microbial ecology.



Proposal – an ecosystems biology approach to exploring the sea surface microlayer:

“let the microbes tell the scientists what is happening at the ocean-atmosphere interface”

- Using metatranscriptomics, place marine microorganisms and their genes into an environmental context that is globally significant.
- Develop further the Western English Channel as a microbial observatory and laboratory.

The **sea surface microlayer** should be included in the **Marine B3 consortium** because:

Marine microbial ecosystem processes are key to Earth’s habitability.



The sea surface microlayer is the primary point for the exchange of material, *e.g.* CO₂.



To understand the marine environment we need to include the sea surface microlayer.