

Investigating phage-related threats to the MELiSSA loop

T. Sassen^{1,2}, J.r Mahony², R. van Houdt¹, N. Leys¹, F. Mastroleo¹, D. van Sinderen^{2,3}

¹Belgian Nuclear Research Centre, SCK•CEN, Mol, Belgium

²Department of Microbiology and ³Alimentary Pharmabiotic Centre, University College Cork, Cork, Ireland

The MELiSSA (Micro-Ecological Life Support Alternative) loop is an artificial ecosystem intended as a regenerative life support system for long-term space missions. It is important to know whether the bacteria that are used in such a system are susceptible to external threats such as infection by bacteriophages or internal ones like induction of prophages present in their genome. DNA stress, such as caused by cosmic radiation, is known to induce prophages in various bacterial species, and factors like the high biodiversity in waste streams and the mixed culture fermentation in the first compartment increase the odds of a bacteriophage being present with a host range that includes *Rhodospirillum rubrum* S1H (the bacterium used in the consecutive compartment).

To investigate those phage related threats, a three pronged approach was taken: 1) the genome of *R. rubrum* was analysed to find regions similar to known prophages, 2) *R. rubrum* was exposed to DNA damage caused by mitomycin C and the cell lysate was analysed for the presence or absence of induced prophages, 3) samples of dissimilar sources of waste (A sample from a pilot of MELiSSA compartment I, two sewage samples, two grease trap samples and a compost sample) were used to investigate the presence of bacteriophages with lytic activity against *R. rubrum*.

The initial investigation *in silico* indicated that the presence of prophages was unlikely, which was confirmed by the absence of induced prophages in the cell lysates. No bacteriophages with lytic activity against *R. rubrum* were found, only against the *E. coli* BL21 strain used to demonstrate the validity of the lytic bacteriophage detection method.

Short Summary

Investigating internal and external phage-related threats to compartment II of the MELiSSA loop, an artificial ecosystem intended as a regenerative life support system for long-term space missions.

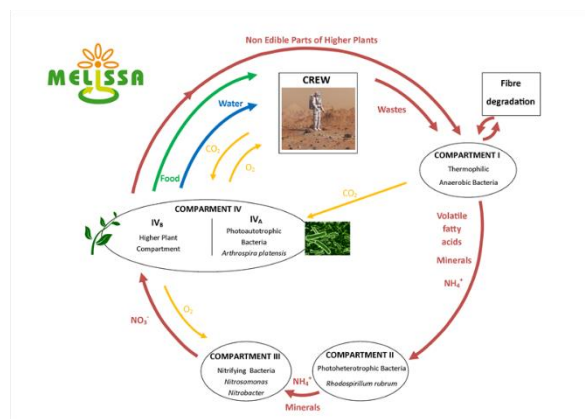
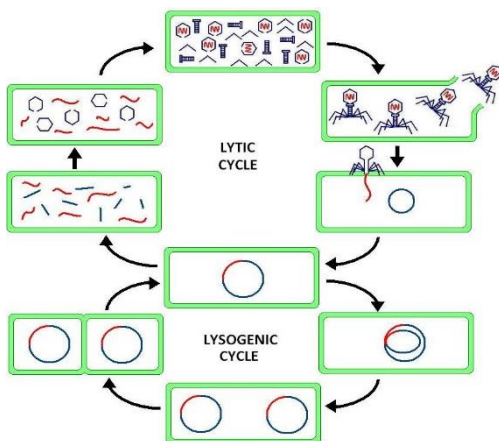


Figure 5: The MELiSSA loop

Figure 6: Phage life cycles.

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