Ecological Impact Research and Ecotoxicology

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The TRIPLELUX-B Experiment - ready to fly

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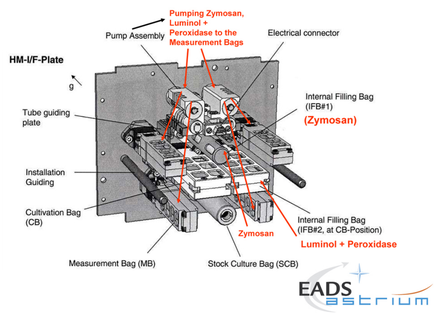
Risk assessment for humans in space - especially for long time missions – require to disentagle the complex interplay of the parameters in space and to understand the mechanisms causing the reported responses. The aim of the experiment is a better understanding of the cellular mechanisms underlying the biological phenomena observed in space: impairment of the immune functions under space flight conditions. The cellular responses will be translated into chemo-luminescence and bio-luminescence signals as a rapid optical reporter system.

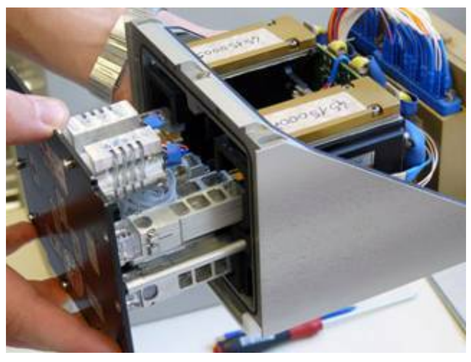
The TRIPLELUX-B experiment will contribute to answer the question: does the change in gravity influences the phagocytotic activity?

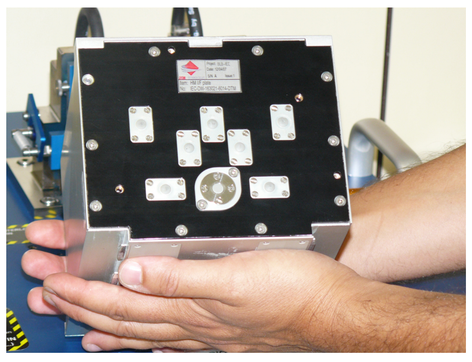
Mussel haemocytes are the primary phagocytotic defence against invading microorganisms and foreign particles. The haemocytes of invertebrate mussels are comparable in their function to macrophages of vertebrates.



Main Features of the Experiment in Orbit:

- Stock culture of mussel haemocytes launched and stored at -20/-80°C
- Cultivation bags
- Measurement bags
- Gas supply via gas permeable bag material
- Culture dilution process via handling mechanisms
- Miniature stirrer (to avoid sedimentation at 1 g rotor)
- Easy reuse of integrated experiments hardware
- Automatic addition of liquids without stopping rotor





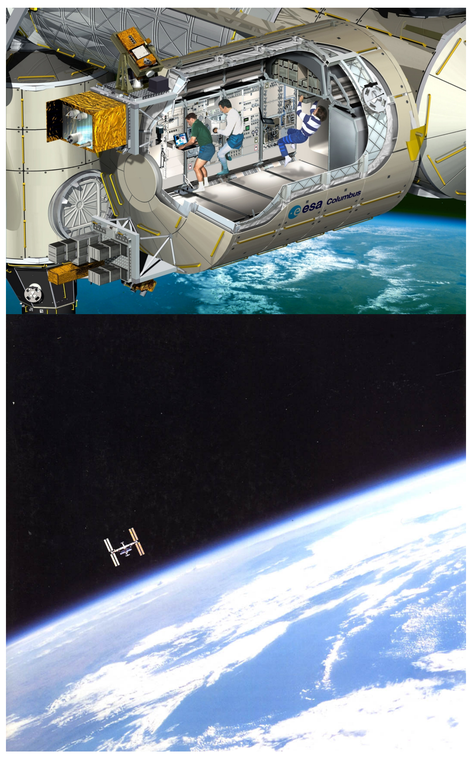
The TRIPLELUX-B Experiment is ready to fly: What next?
A Life Support System for long time missions:
Red and green Liver Technologies for the Support of Life Cycles in Space.

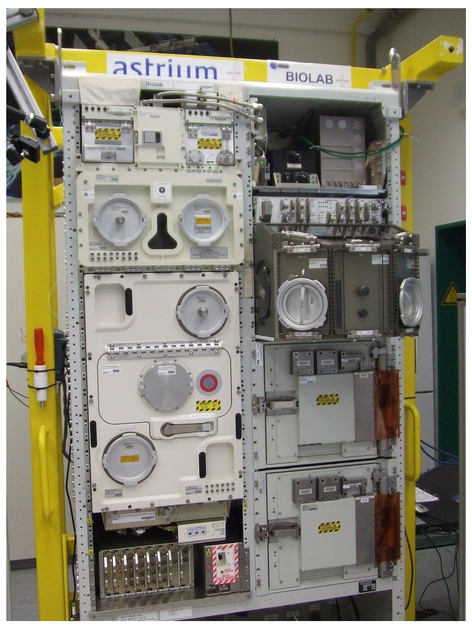
A robust mussels reactor ("red liver system" for long time missions to clean up water in the grey water and sewage system (yellow water) concerning microorganism, organic particles as a source for drinking water production in space. The "Red Liver System" will be linked for further purification with a "Green Liver System" to combine the Green Liver Systems with the use of specific bioreactors using aquatic fungi to enhance effectivness of the complete system. The "Green Liver" concept basically compares biotransformation and metabolism processes which happens e.g. in human liver with those in plants and algae.

Why is it essential for Europe and what is the expected impact?

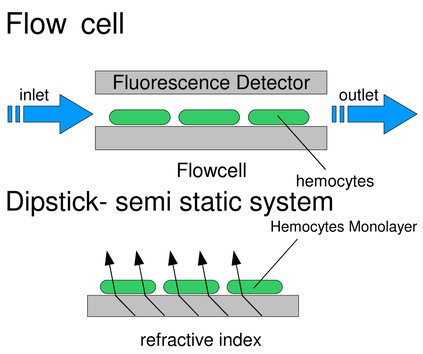
During long term missions in habitats whether they are stationary on ground or orbiting (i.e. lunar or mars missions) a robust Life Support Systems is needed. Europe takes the lead in high sophisticated concepts in the field of clean water microtechnologies in space environments using biological matrices.

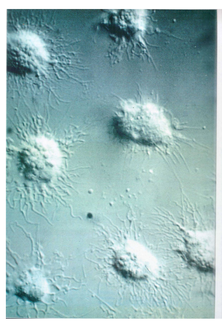
Final assembly by crew in orbit (AEC=Advanced Experiment Containment)





Bioanalytical System for phagocytosis (basic immune functions) activity "*on site*" measurements





Flow cell with cryoconservated immobilized monolayers of hemocytes and detection of the phagocytosis activity by chemoluminescence / fluorescence.

Dip stick with cryoconservated, membrane-immobilized monolayers of hemocytes for semi static measurement.

References:
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Investigations of phagocytosis concerning the immunological defence mechanism of Mytilus edulis using a sublethal luminescent bacterial assay (Photobacterium phosphoreum). Comp. Biochem. Physiol. Vol. 100C, No 1/2, 129-132
Hansen, P.-D. 2008. Biosensors and Ecotoxicology, Eng. Life Sci., *8,* 1, 1-7

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