

COLLOQUIUM | MELiSSA: Regenerative Life Support for Humans in Space

FRANCESC GODIA

September 08, 2025
12:00 to 13:00
ICFO Auditorium

ABSTRACT:
MELiSSA (Micro Ecological Life Support System Alternative) is developing regenerative Life Support technologies for long-term human Space exploration missions. In the scenario of missions targeting longer distances and presence in Space (Moon, Mars) there is the need to decrease the dependency from Earth resupply. The MELiSSA loop is conceived as a circular system with several compartments, each one performing a specific function, providing all together the basic functions in life support: food production, atmosphere regeneration, water recovery. The sustainability of the system should be attained using wastes (CO2, urine, organic waste) generated by the crew as resources. The MELiSSA Pilot Plant is a facility designed for the terrestrial demonstration of this concept, hosting laboratory rats as a crew

mimicking the respiration of humans. The MELiSSA Pilot Plant includes the continuous operation of several bioreactors, working in axenic conditions, connected one to each other, for long term operation campaigns, under the supervision of an overall control system. Th work program at the Pilot Plant is currently focused on the integration of its compartments i long-term continuous and controlled operation, in consecutive steps, involving liquid, soli and gas phases, targeting to the completion of the proposed loop. The integration of fou compartments: a packed-bed bioreactor performing urine hydrolysis and nitrification using defined consortium of six bacterial strains, an air-lift photobioreactor for the culture of th edible cyanobacteriaLimnospira indica with concomitant capture of CO2 and oxygen production, a higher plants chamber and an animal isolator with rats as mock-up crew, has been performed, exploring the effect of several variables in the operation of the four compartments, including the complex gas management dynamics between them and its control in continuous operation. The system showed high robustness and reliability over long operation periods and the coordinated performance of oxygen producing and oxygen consuming compartments has been achieved under transitory and steady-state conditions.

BIO:

Full Professor of Chemical Engineering at Universitat Autonoma de Barcelona (UAB) since 1993. Teaching activities in Biotechnology and Chemical Engineering. Coordinator of the Biotechnology Doctoral Program at UAB. His research activity is focussed on Regenerativ Life Support Systems in Space for human long-term missions and Animal Cell Technology t produce biopharmaceuticals, recombinant vaccines and vectors for gene therapy. Overal Manager of the MELiSSA Pilot Plant a joint facility of UAB and ESA (European Space Agency) for the demonstration and integration of Life Support technologies. Author of 135 papers i JCR journals, 4 patents, 9 book chapters and advisor of 43 completed PhD thesis. Member o the Scientific and Organizing Committee of several International Congresses. Coordinator o the ESACT International Courses on Animal Cell Technology and Cell-based Viral Vaccines He served as Vice Rector of UAB, President of the Spanish Society of Biotechnology President of the Blood and Tissue Bank of Barcelona and President of Fundacio Parc Tauli Currently, he is the President of the European Federation of Biotechnology and member o the Executive Board of the European Society for the Advancement of Cel Technology.

Hosted by: Prof. Dr. Nicoletta Liguori