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Question

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Bio-futures for transplanetary habitats

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Context

How can biotechnologies and biomaterials shape and sustain habitats in extreme and space environments?

Biotechnologies and biomaterials have been considered essential to the design of habitats in extreme environments such as outer space. Recent advancements in biotechnological research present novel ways in which materials, artefacts and architectural systems can be designed and developed to support life in extreme environments in space and on Earth. Different bioaspects are also researched to address the increasingly extreme environments on Earth due to climate change.

Some of these innovations include the use of microbial ecologies and mycelium-based materials to grow radiation-resistant, self-healing and adaptable space architecture. Designing for extreme environments is a complex activity and benefits from an interdisciplinary and transdisciplinary research approach.

We invite a diverse range of research contributions that explore, critically evaluate, and shape potential biotechnological futures in extreme and space environments. This includes innovative biomaterials and biodesign ranging from artefacts to habitats and systems that shape and sustain interactions between biological systems to enable advancement of space exploration.

Contributions

We invite contributions in the following areas:

Results

- Innovative material-driven methods for the design of and for habitats in extreme environments using biological systems.
- Use of biotechnology and biomaterial to ensure and support safety, sustainability, habitability, reliability and crew efficiency, productivity and comfort in extreme environments.
- Frameworks, tools and evaluation methods to develop new (or improve current) biological systems for space habitats (both qualitative and quantitative data).
- Research artefacts that advance the state of the art in bioHCI within the context of habitats in extreme environments, e.g. new technologies, types of input and biosocial interactions or new designs.
- Experiments' data on the use of biotechnologies and biomaterials to contribute to efficient, effective and responsible design and construction of habitats in extreme environments.

Analysis

- Frameworks for transdisciplinary research practice bridging the disciplines (i.e material sciences, synthetic biology, ecology, systems engineering, architecture and biodesign) to establish the foundations for future research through a system's thinking approach.
- Design frameworks using holistic systems thinking to map ecosystems or novel simulation tools to calculate flows of materials, energy, water and organisms over the lifetime of a habitat.
- Reviews of state of the art materials, technologies, architectural designs and case studies for habitats and systems using biotechnologies and biomaterials.

Impact

- Papers, curated media, ontologies, research artefacts and speculative imaginaries which critically engage and reflect on the use of biotechnology and biomaterials for space habitats.
- Curated reviews of latest research, events (incl. symposia) and discussions on the topic.

Additional material and early outputs

We welcome a broad range of contributions including speculative designs and scenarios, results of materialisation and structural studies and developments of ontologies and frameworks. As the question content develops we expect this engagement to comment on the existing archive of published material.

How to contribute to this question

If you believe you can contribute to answering this Question with your research outputs find out how to submit in the Instructions for authors (https://www.cambridge.org/core/journals/research-directions-biotechnology-design/information/author-instructions/preparing-your-materials). This journal publishes Results, Analyses, Impact papers and additional content such as preprints and "grey literature". Questions will be closed when the editors agree that enough content has been published to answer the Question so before submitting, check if this is still an active Question. If it is closed, another relevant Question may be currently open, so do review all the open Questions in your field. For any further queries, check the information pages (https://www.cambridge.org/core/journals/research-directions-biotechnology-design/information/about-this-journal) or contact this email (biotechnologydesign@cambridge.org).

Competing interests. The author declares none.

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