"Enhancing Bioeconomy (Earth & Space) and under-demand manufacturing in Space through in-situ natural materials and Additive Manufacturing"

Prof. Nieves Cubo Mateo

Principal Investigator of ARIES, Nebrija University Responsible of Space Exploration Club



Previous studies: PLT – Space 2018-2019 (ESA funding)







3D Printing of Living Tissues for Space Exploration

Programme: Discovery *Start/End Date:* 2018/2019 Programme Reference: 15/069 Contractor: OHB System AG

Country: Germany

SPACE SYSTEMS

Summary: PLT – Space 11.12.2019, ESTEC, Noordwijk

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We. Create. Space.

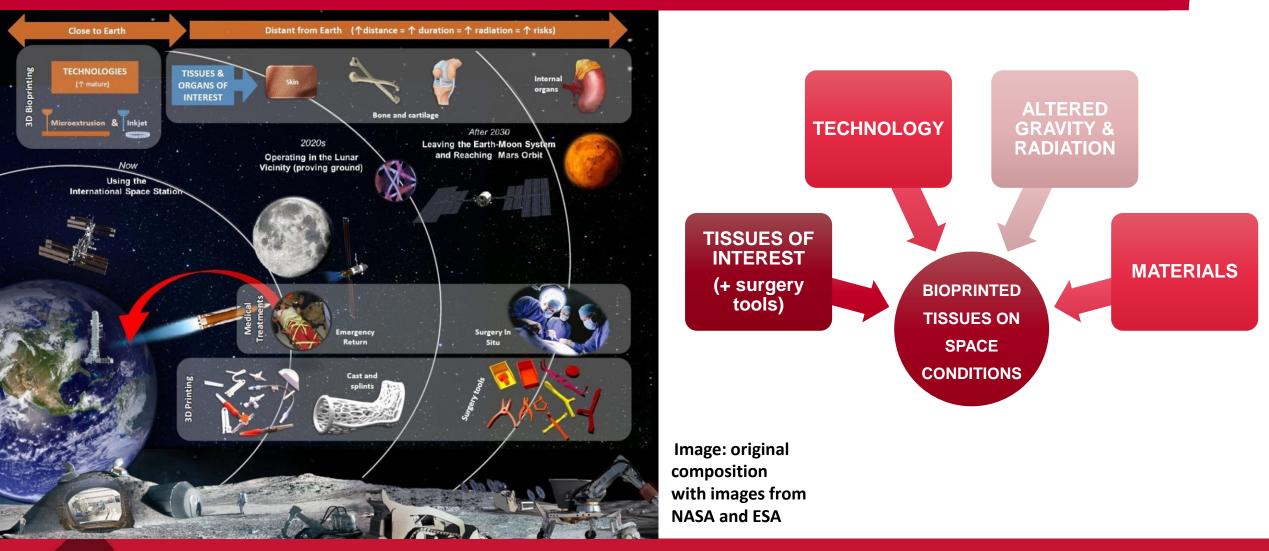


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Long-term missions: enhance autonomy



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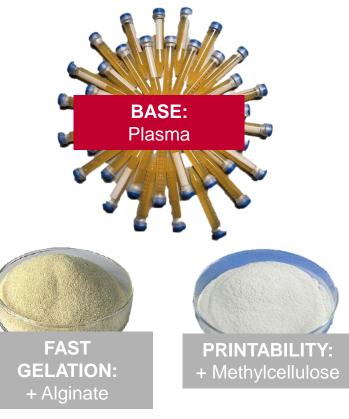
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Raw materials: growable, reusable, edible









A novel plasma-based bioink stimulates cell proliferation and differentiation in bioprinted, mineralized constructs. *Tilman Ahlfeld, Nieves Cubo-Mateo, Silvia Cometta, Vera Guduric, Corina Vater, Anne Bernhardt, A Rahul Akkineni, Anja Lode, Michael Gelinsky*

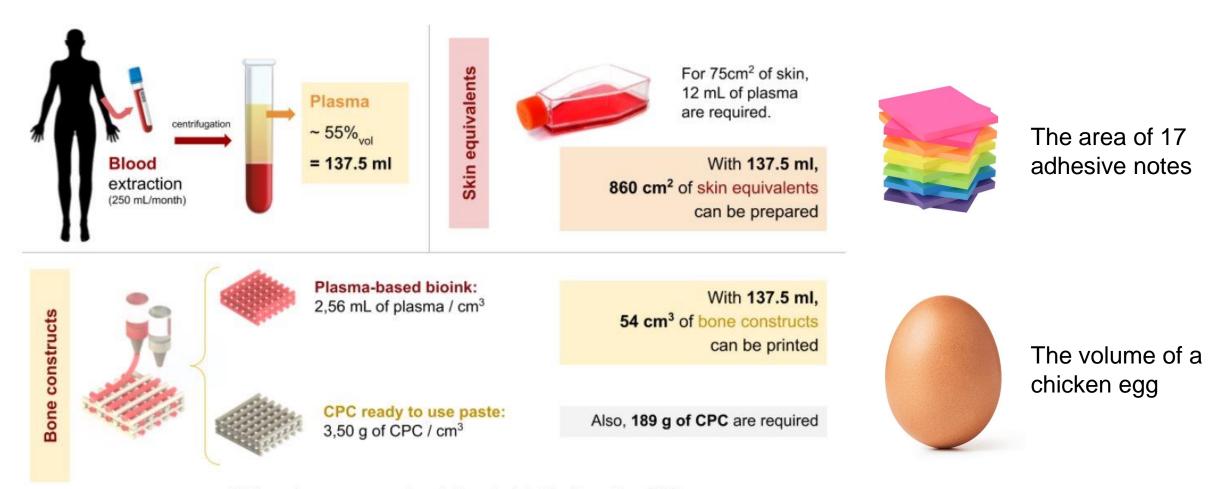


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Raw materials: growable, reusable, edible



All the values were experimentally calculated by the author (NC)



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Tech. study: altered gravity bioprinting (materials)



eesa



ENABLING & SUPPORT

Upside-down 3Dprinted skin and bone, for humans to Mars





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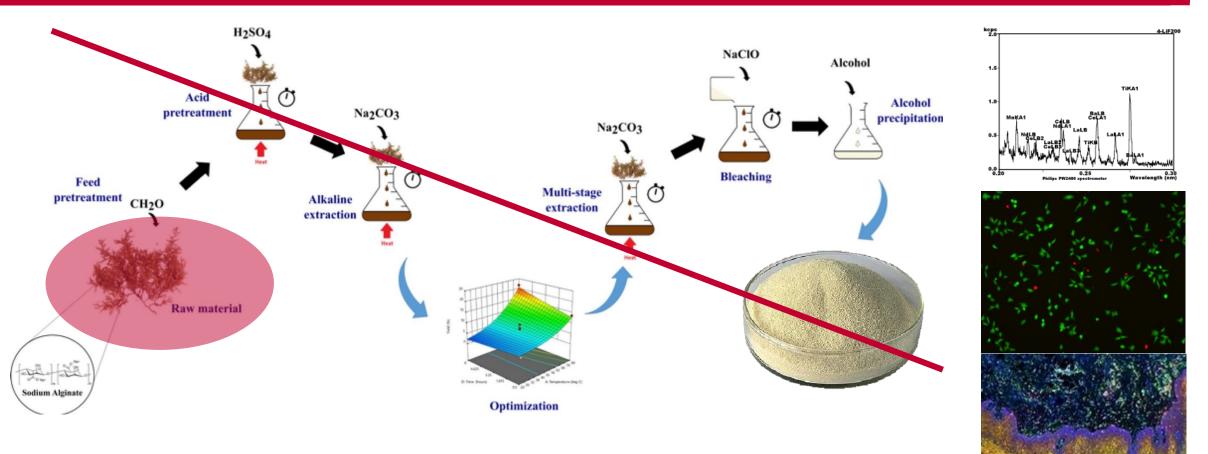
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No purified/refined materials to avoid Earth over-dependency



Mohammed, A., Rivers, A., Stuckey, D. C., & Ward, K. (2020). Alginate extraction from Sargassum seaweed in the Caribbean region: Optimization using response surface methodology. *Carbohydrate Polymers*, *245*, 116419.



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From Space to Earth: new developments and technologies



- **Technology Transfer**: Space exploration leads to innovations like advanced communications, renewable energy, and medical devices, benefiting remote areas on Earth.
- Food Security: Techniques for growing plants in space, such as hydroponics, help improve agriculture in harsh environments.
- **Healthcare**: Space medical technologies like remote health monitoring improve healthcare access in rural areas with limited healthcare infrastructure.
- **3D (bio)Printing for Remote Manufacturing:** Space exploration has advanced 3D printing technologies, allowing the production of tools and parts on-demand in isolated areas, reducing the need for complex supply chains.
 - **Sustainable Manufacturing:** Space-driven research into sustainable manufacturing processes, like 3D printing with recycled materials, supports eco-friendly production methods in regions where traditional manufacturing is challenging.
- **Growable Natural Materials:** Innovations in growing natural materials for both construction and food, inspired by space missions, can be adapted for use in resource-scarce environments, offering dual benefits of sustainable building and agriculture.

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