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HAIR FOLLICLES FOR NON-INVASIVE HEALTH MONITORING ON-SITE ON THE ISS SPACE STATION AND HAIR FOLLICLES DERIVED RETINAL ORGANOIDS FOR OFF-SITE BIOMEDICAL RESEARCH

Abstract

Microgravity environments have significant advantages for biotechnology engineering and great risks for human space exploration. Here we like to present a novel technology to monitor astronaut health and provide new opportunities in space biotechnology engineering. In this novel non-invasive technology, we use hair roots of plucked hair to isolate cells as source material for health monitoring and production of organoids for biotechnology assignments like drug screening.

Hair roots provide several cell sources (keratinocytes of the outer root sheath, fibroblasts, and hair root cells) and are extremely easy and non-invasively harvested from every individual by plucking hair from various body parts with a focus on scalp and beard. Furthermore, hair roots can easily be subjected to cryopreservation or direct RNA extraction in a very space-saving manner preserving the excellent opportunity for long-term health studies.

Furthermore, harvesting those cells in microgravity conditions like the absence of sedimentation, hydrostatic pressure, tangential stress by the weight of fluids and shear forces will enhance the formation of natural 3D cell agglomeration. Those unique in vivo conditions lead to a new strategy for tissue engineering of multicellular cancer spheroids, organoids, artificial vessel constructs, and a variety of tissues for new opportunities for drug screening and biomarker discovery.

In summary, we suggest that hair keratinocytes are one of the most suitable cell reservoirs for long-termed and close-meshed investigations in space and could contribute to the understanding of the effect of microgravity on the human body and additional would be a great start for biotechnology engineering on the ISS space station, Moon or Mars.