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Author: Dr. Giorgio Cortelli
Alma Mater Studiorum - University of Bologna, Italy

Prof.Dr. Beatrice Fraboni
Alma Mater Studiorum - University of Bologna, Italy
Prof. Erika Scavetta
Alma Mater Studiorum - University of Bologna, Italy
Prof.Dr. Augusto Nascetti
Sapienza University of Rome, Italy
Dr. Monica Monici
University of Firenze, Italy
Dr. Isacco Gualandi
Alma Mater Studiorum - University of Bologna, Italy
Dr. Marta Tessarolo
Alma Mater Studiorum - University of Bologna, Italy
Prof. Erika Pittella
Sapienza University of Rome, Italy
Mr. Mohamed Salim Farissi
Sapienza University of Rome, Italy
Dr. Francesco Decataldo
Alma Mater Studiorum - University of Bologna, Italy
Dr. Marta Colletti
ASI - Italian Space Agency, Italy
Dr. Gabriele Mascetti
Italian Space Agency (ASI), Italy
Mr. Fabio Lorenzini
Kayser Italia Srl, Italy
Dr. Enrico Gabriele
Kayser Italia Srl, Italy
Mr. PierLuigi Luciano
Kayser Italia Srl, Italy
Dr. Vito Vurro
Alma Mater Studiorum - University of Bologna, Italy
Dr. Donato Calabria
Alma Mater Studiorum - University of Bologna, Italy
Ms. Elisa Lazzarini
Alma Mater Studiorum - University of Bologna, Italy
Mr. Andrea Pace
Alma Mater Studiorum - University of Bologna, Italy
Prof. Mara Mirasoli
Alma Mater Studiorum - University of Bologna, Italy

Abstract

The "Wound healing real time monitoring multisensing electronics -WEAR-ME!" project, funded by the Italian Space Agency (ASI) in the framework of the "Research Day" initiative in 2023, proposes the development of an integrated miniaturized wearable system for the non-invasive analysis of a panel of biomarkers useful for monitoring wound healing in astronauts. Among the effects of exposure to microgravity, an alteration of the wound healing process was also observed. Experiments conducted on in vitro wound healing models and animal models have highlighted changes in tissue repair/regeneration mechanisms and consequent delays in healing. While several Space Agencies are actively engaged in the development of new therapeutic solutions aimed at mitigating these problems, the development of diagnostic tools in this field is still an unsolved problem. The WEAR-ME! analytical system consists of a smart band-aid that integrates chemical sensors (electrodes), physical sensors (temperature), electrical connections, sensor interrogation electronics and power system in a single wearable device capable of monitoring multiple physical and chemical-clinical parameters without the intervention of the astronaut, who will therefore be able to carry out other activities in the meantime. The WEAR-ME! sensorized patch is equipped with multiple (bio)sensors, each one dedicated to the determination of a biomarker of interest. The (bio)sensors are based on organic electrochemical transistor (OECT) technology based on the conductive polymer PEDOT:PSS and in which selectivity towards the analyte of interest is achieved through chemical or biochemical functionalization (e.g. with antibodies for protein biomarkers) of the electrodes. WEAR-ME! will provide in real-time diagnostic information that can be easily interpreted by the astronaut, with a view to independence from remote assistance. WEAR-ME! involves the creation of a breadboard of the proposed monitoring system and the execution of scientific tests on in vitro and ex vivo wound healing models.