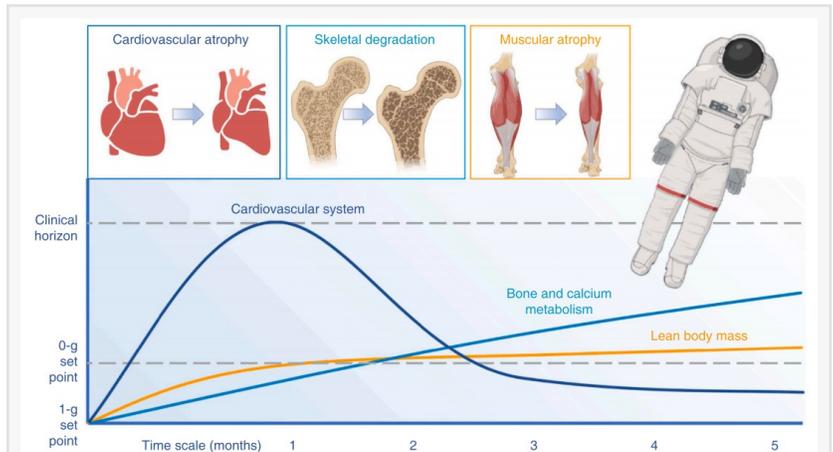


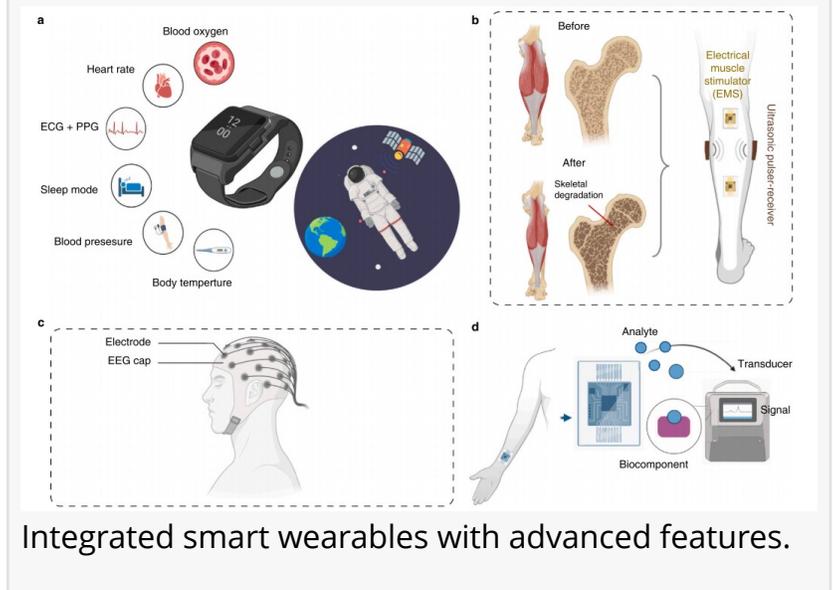
How Flexible Wearables Protect Astronauts' Health in Space

HI, UNITED STATES, April 16, 2025 /EINPresswire.com/ -- In the harsh environment of space—where microgravity, cosmic radiation, and isolation pose unprecedented health risks—flexible [wearable](#) devices have emerged as critical tools. These "smart skins" continuously monitor astronauts' vital signs, revolutionizing space medicine.

A review published recently in *Wearable Electronics* examines the current applications and persistent challenges of flexible wearable technologies in aerospace medicine. As human space exploration progresses toward extended-duration missions, the imperative for real-time monitoring of astronauts' physiological and psychological well-being has become increasingly critical. The unique space environment characterized by microgravity conditions, cumulative radiation exposure, and extreme thermal fluctuations presents multifaceted health risks to crew members.



The effects of microgravity on an astronaut's musculoskeletal system.



Integrated smart wearables with advanced features.

Flexible wearable systems, equipped with multimodal sensor arrays, enable comprehensive and continuous health surveillance. These integrated platforms include inertial measurement units, biosignal electrodes, and environmental detectors, among others. They have proven to be indispensable for early anomaly detection in cardiopulmonary functions, neuromuscular performance, and circadian rhythm regulation, thereby facilitating timely personalized

countermeasures.

Nonetheless, despite recent advancements in materials science and miniaturized electronics, three notable technical barriers persist: 1) device reliability under combined space stressors, 2) secure data management protocols addressing confined spacecraft privacy concerns, and 3) multi-parametric data fusion challenges involving temporal-spatial synchronization of heterogeneous bio-signals.

Breakthrough development trajectories emphasize future research in the field of flexible wearable devices, particularly for astronaut applications, will focus on several key areas and their interdisciplinary collaborations. These research areas will cover advanced materials science, new materials and sensor technology, intelligent algorithms, data processing and device integration. Interestingly, the development of technologies in the field will still rely on material innovation, the creation of intelligent algorithms, the improvement of user experience and interdisciplinary cooperation. In particular, continuous development and maturity of the technology, together with flexible electronic devices, will play an important role in enhancing astronauts' health monitoring capabilities and promoting the progress of human space exploration in the future.

References

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