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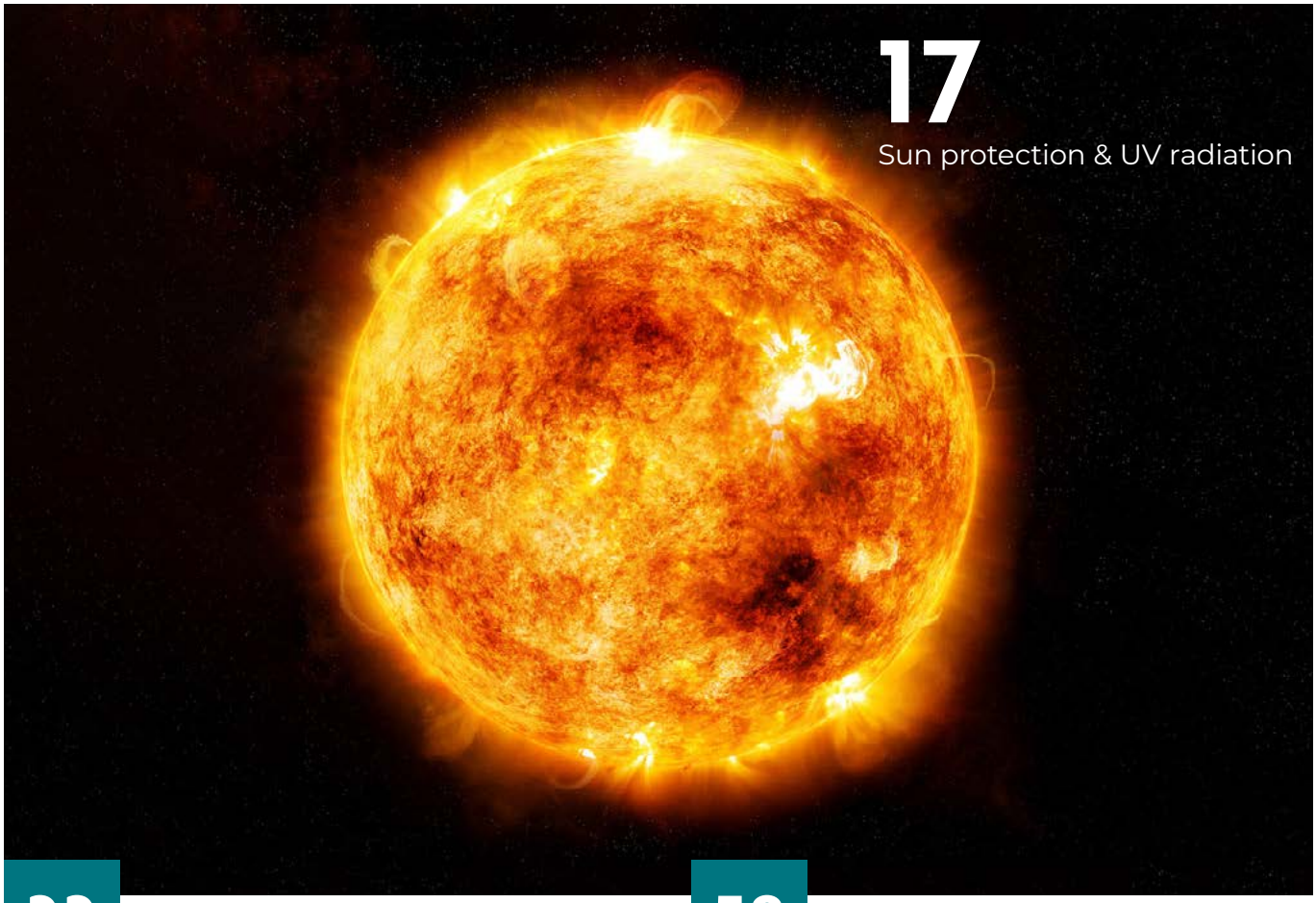

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WHAT'S NEW

Advancing extracellular vesicle analysis from skin wounds with a portable device

This section is a contribution from the SKINTEGRITY.CH interdisciplinary research consortium. The present work was performed by researchers in the team of principal investigator Jean Christophe Leroux, in collaboration with the Dengjel and Werner labs. The first author received the SKINTEGRITY.CH Young Investigator Award for his work.

Maarten Schledorn
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Vadim Krivitsky, Valeria Mantella, Adva Krivitsky, Jean-Christophe Leroux.

Acytronix.ch, an ETH spinoff, unveils a portable device for ultrafast extracellular vesicle isolation, and applies it for wound healing insights.

Extracellular vesicles (EVs) have emerged as pivotal mediators of intercellular communication with profound implications for therapeutics and diagnostics [1]. Despite their potential, conventional methods for EV isolation pose significant challenges, often yielding impure samples and requiring extensive processing time. Addressing this limitation, Krivitsky et al. developed a portable microstructured electrochemical device (PMED) for the ultrafast and controlled capturing, loading, and release of extracellular vesicles. Published in Advanced Materials, their study highlights the device's efficiency in rapidly isolating EVs directly from diverse biofluids, including serum, plasma, urine, cell culture, and skin wounds [2].

EVs (e.g. exosomes and microvesicles) serve as carriers for various mediators such as proteins, nucleic acids, and lipids, orchestrating intricate cell-cell communication networks and modulating various physiological processes [1]. In wound healing, EVs exert pivotal roles in inflammation, angiogenesis, and tissue repair, although their composition and function can vary depending on the pathological state.
The PMED represents a significant advancement in EV isolation technology. Subpopulations of EVs are swiftly captured by immunoaffinity interactions, then purified and released through application of a negative voltage *(Fig. 1)*. This on-demand isolation capability renders the device invaluable for both research and clinical applications.
In a compelling demonstration of its utility, the researchers employed the device to isolate EVs from skin wounds of healthy and diabetic mice and subjected them to proteomic analysis *(Fig. 2)*. Their findings revealed a distinct enrichment of mitochondrial proteins in EVs from diabetic wounds *(Fig. 2B)*, which could help shedding light on the underlying molecular mechanisms of impaired wound healing in diabetes

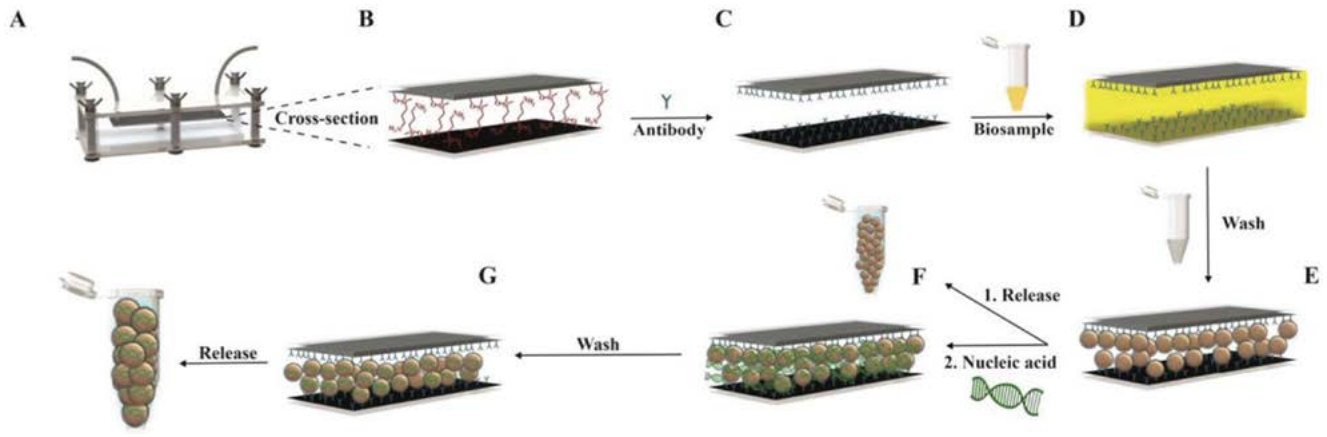

Figure 1: Schematic representation of the PMED operation. A) device setup, B) electrode previously modified with amino groups, C) antibody conjugation, D) biofluid injection, E) controlled release of the attached EVs by applying voltage, F) optional step-injection of transfection medium in order to form EV-nucleic acid:transfection complexes followed by a washing step, G) release of the loaded EVs by applying voltage.

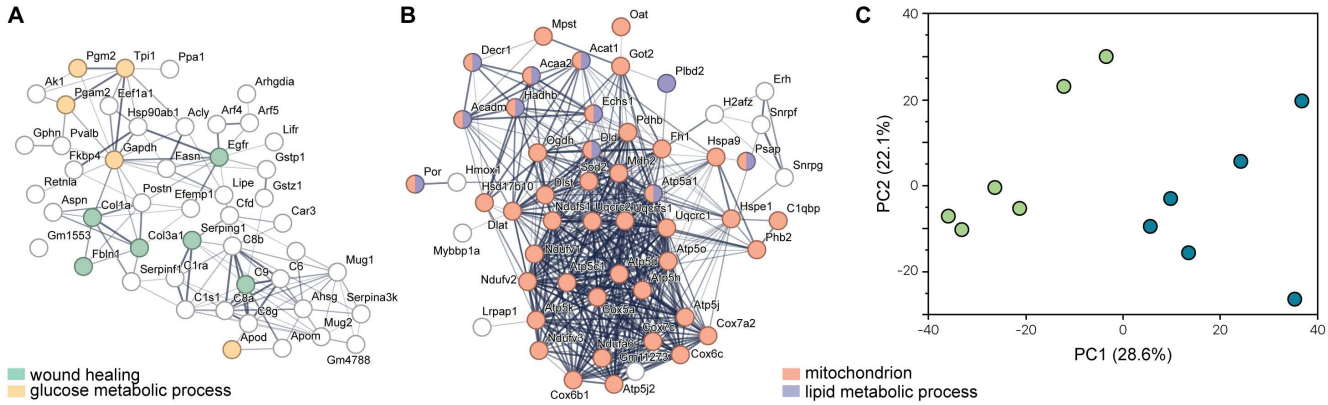

Figure 2: EVs separated from wounds of diabetic versus healthy mice. A, B) STRING protein interaction networks of proteins that were identified as significantly enriched in EVs from wild type mouse wounds (glucose metabolism, wound healing) (A), and EVs from diabetic mouse wounds (mitochondrion, lipid metabolism) (B). Nodes indicate proteins, edges indicate interactions, and the thickness of edges indicates the strength of data support. C) Principal component analysis of log_2 transformed data-independent acquisition-derived protein abundances.

and identifying potential therapeutic targets.

Moreover, the ability to load therapeutic cargo onto EVs opens up promising avenues for targeted drug delivery. Leveraging the innate cargo-loading capacity of EVs, researchers may, in addition, engineer them to transport specific nucleic acids, such as siRNA or miRNA, for precision therapy.

The Acytronix.ch team is planning to commercialize this ETH technology and make it accessible to anyone who desires an effective separation of EVs. In conclusion, by combining speed, efficiency, and portability, this technology is poised to revolutionize our understanding of EV biology and propel the advancement of EV-based therapeutics. As research in this field progresses, the transformative impact of this technology is anticipated to expand, especially in precision medicine.

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