

BIOELECTRONIC SCAFFOLD FOR THE REAL-TIME MONITORING OF CELL BEHAVIOR

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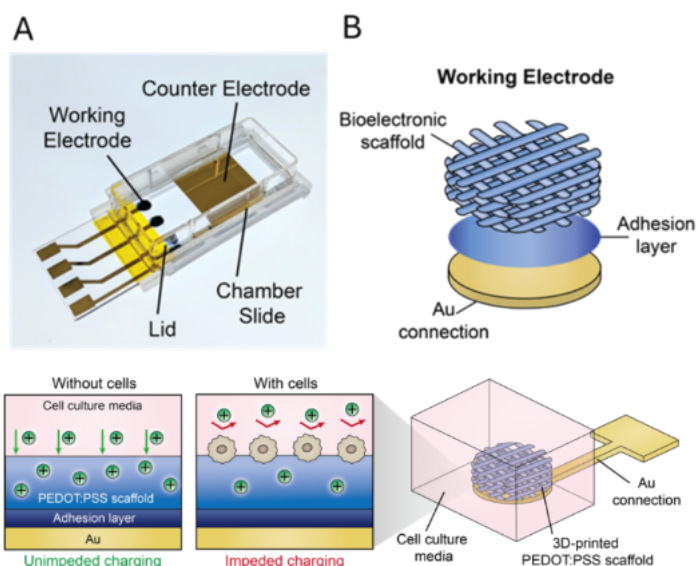
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Value Proposition: 3D printed bioelectronic scaffolds for temporal monitoring of cytotoxicity in 3D cancer models.

Technology Description

Researchers at Washington University in St. Louis have developed a 3D printed bioelectronic scaffold capable of supporting dense cultures of cancer cells and providing real-time impedance measurements for monitoring cell viability, proliferation, and cytotoxicity induced by cancer therapies. Electric Cell-Substrate Impedance Sensing is widely used to monitor cell culture characteristics by measuring impedance and capacitance changes. Current methods provide non-invasive, real-time data on cell adhesion, proliferation, and cytotoxic responses. However, traditionally, these approaches are primarily limited to 2D cultures, which fail to replicate the complex 3D architecture and behavior of in vivo tumors, underscoring the need for advanced 3D systems.

This 3D bioelectronic scaffold is made from poly(3,4-ethylenedioxythiophene)/polystyrene sulfonate (PEDOT:PSS) to support 3D cell cultures and enable real-time impedance monitoring. The scaffolds, bonded to gold electrodes, facilitate continuous impedance measurements, successfully detecting changes in cell presence, proliferation, and drug-induced cytotoxicity (effectiveness of anti-cancer drugs). This innovation offers a non-destructive method for temporal cell viability monitoring in 3D.



A) The larger device the invention fits within. B) Schematic emphasizing the invention. PEDOT:PSS scaffolds bonded to a gold dry connection makes up the working electrode.

Stage of Research

Preliminary studies have demonstrated the feasibility of the device for supporting 3D cell cultures, producing reproducible impedance/ capacitance readings that allow for differentiation between the free scaffold and cell-laden scaffold, and measuring impedance changes in response to chemotherapeutic agents like carboplatin.

Publications

- Somtochukwu S. Okafor, Sandra K. Montgomery, Jae Park, Tianran Liu, Mbama Safrega, Justin S. Yu, Cayleigh P. O'Hare, Angela Schab, Anna P. Goesten Kors, Cielo J. Vargas Espinoza, Yuqing Wu, Elena Lomonosova, Ismael Seáñez, Mary M. Mullen, Alexandra L. Rutz. 3D Printed Bioelectronic Scaffolds for Impedance-based Cytotoxicity Monitoring of In Vitro Cancer Models. bioRxiv 2026.05.07.719019; doi: <https://doi.org/10.64898/2026.05.07.719019>.

Applications

- Monitoring cell viability, proliferation, and cytotoxicity
- Cancer drug development

Key Advantages

- Provides a more physiologically relevant environment compared to 2D cultures
- High biocompatibility compared to metal or silicon scaffolds
- Reduces the need for endpoint assays and cell lysis
- Scaffold allows a higher sensitivity in detecting cell behavior changes
- Enables real-time monitoring of cell behavior, thereby reducing the need for labor-intensive endpoint assays that miss crucial temporal/ continuous behaviors

Patents

Patent pending

Related Web Links – [Alexandra Rutz Profile](#); [Rutz Lab](#)