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The international debate on Advanced Wearable Nano Sensors for Biomedical and Environmental Application

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Wearable nano-sensors are fast-growing interdisciplinary research field that involves interfacing biomaterials with electronics, covering an array of biodevices, encompassing biofuel cells, biosensors, ingestible, and implantable. In particular, enzyme-based bioelectronics, built on diverse biocatalytic reactions, offers distinct advantages and represents a centerpiece of wearable biodevices. Such wearable bioelectronic devices predominately rely on oxido-reductase enzymes and have already demonstrated considerable promise for on-body applications ranging from highly selective noninvasive biomarker monitoring to epidermal energy harvesting. These systems can thus greatly increase the analytical capability of wearable devices from the ubiquitous monitoring of mobility and vital signs, toward the noninvasive analysis of important chemical biomarkers. Wearable enzyme electrodes offer exciting opportunities to a variety of areas, spanning from biomedical, healthcare, sport, to the environment or defense. These include real-time noninvasive detection of biomarkers in biofluids (such as sweat, saliva, interstitial fluid and tears), and the monitoring of environmental pollutants and security threats in the immediate surroundings of the wearer. In our work, we have demonstrated wearable sensors for cancer biomarker, drug, alcohol, glucose, nerve agents and for explosives using microneedles, gloves, bandage, eye glasses, tattoos and textiles in the recent past. Crucial for such successful application of enzymatic bioelectronics is deep knowledge of enzyme electron-transfer kinetics, enzyme stability, and enzyme immobilization strategies. Such understanding is critical for establishing efficient electrical contacting between the redox enzymes and the conducting electrode supports, which is of fundamental interest for the development of robust and efficient bioelectronic platforms. Figure 1 illustrates the glove based wearable sensor platform for nerve agent detection.

Biography:

Dr. Rupesh Mishra has received his bachelor's from Devi Ahilya University, Indore, India in 2004 and did his master's in Biotechnology from Pt. Ravishankar Shukla University, Raipur, India in 2006. He was awarded his Ph. D. in the field of Biosensors in 2013 from Birla Institute of Technology and Science, Goa, India. During his Ph.D., he was awarded a sandwich Ph.D. fellowship from French Embassy in India, New Delhi for 6 months to work in France. He did post doc from Aix Marseille University in France (2013-2014), University of Perpignan, France (2014-2015) and from University of California, San Diego, USA (May 2016-Aug 2019). Presently Dr. Mishra is working as an Associate Professor and Ramalingaswami fellow at Institute of Biotechnology, Amity University, Rajasthan, Jaipur, India. He received a very prestigious award from Department of Biotechnology, New Delhi, India (11 million INR). Dr. Mishra has published about 50 research articles/review articles, invited book chapters etc. His important work has been published in Advanced Functional Materials, Materials Horizon, Accounts of chemical research, ACS Sensors, Biosensors and Bioelectronics, Analytical Chemistry and Sensors and Actuators B: Chemical. His research interests are wearable sensors, small scale devices, non-invasive devices, electrochemical biosensors, optical bioassays and bioelectronics related field.

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