Water Frontier Research Center (WaTUS), RIST, Special Lecture

Title

Wearable electrochemical microneedles-based (bio)sensors for minimally-invasive and continuous monitoring of biomarkers for personalized medicine

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Date：April 7th, 2025, 10:00-11:00

Location: Tokyo University of Science Noda campus,

Bldg. 7, 6th Floor Auditorium

Abstract: Wearable electrochemical (bio)sensors are a fast-evolving topic at the intersection of healthcare, technology, and personalized medicine. Over the past recent years, through materials, devices, and system innovations, significant progress has been made in the field of wearable (bio)sensors for analyzing biomarkers in body fluids, such as sweat, interstitial fluid (ISF) and saliva [1]. In particular, microneedle arrays-based biosensors allow the minimally invasive and continuous monitoring of several biomarkers of clinical interest in the ISF, which is, compared to other biological fluids, the most similar to blood in terms of composition, biomarker concentration and temporal patterns [2]. Microneedles allow measurements in the upper part of the dermal interstitial compartment, where no blood vessels and no nerve endings are present and, therefore, they are associated with less skin irritation, reduced pain and tissue trauma, compared to invasive devices.

The seminar will focus on our recent applications of the microneedle-arrays technology to the development of electrochemical sensors for the detection of total catecholamine and b-estradiol, and of electrochemical enzymatic biosensors for glucose, lactate and b-hydroxybutyrate [3-5]. In particular, the possibility of a continuous detection of b-hydroxybutyrate, the most important blood ketone body, with a non-invasive wearable biosensor upon the intake of food and supplements is of extreme importance for a future personalized precision nutrition approach [6]. Key opportunities and challenges toward the successful realization of an effective real time monitoring of biomarkers will be addressed as well as critical issues which have restricted the widespread use of microneedles-based systems.

[1] Hu, Y.; Chatzilakou, E.; Pan, Z.; Traverso, G.; Yetisen, A.K., *Adv. Sci*. **2024**, 11, 2306560 DOI: 10.1002/advs.202306560
[2] Heikenfeld, J.; Jajack, A.; Feldman, B.; Granger, S.W.; Gaitonde, S.; Begtrup, G.; Katchman, B.A., *Nat. Biotechnol*. **2019,** 37, 407 DOI:
[3] Bollella, P.; Sharma, S.; Cass, A..G.; Antiochia, R., *Biosens. Bioelectr*., **2019**, 123, 152-159 DOI: 10.1016/j.bios.2018.08.010
[4] Bollella, P.; Sharma, S.; Cass, A.E.G.; Antiochia, R., *Electroanal.,* **2019**, 31, 374-382 DOI: 10.002/elan.201800630
[5] Tortolini, C.; Cass, A.E.G.; Pofi, R.; Lenzi, A.; Antiochia, R., *Microchim. Acta*, **2022**, 189, 180. DOI: 10.1007/s00604-022-05260-2 DOI: 10.1038/s41587-019-0040-3.
[6] Del Cano, R.; Saha, T.; Moonla, C.; De la Paz, E., Wang, J., *TrAC,* **2023**, 159, 116938, DOI: 10.1016/j.trac.2023.116938

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