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Titre du projet

Lactate, pH and O2 sensors for wearables, implantables or early diagnosis.

- Laboratoire, institution

  ESYCOM UMR9007

- Équipe ou projet dans le laboratoire

  Micro-capteurs / Capteurs pour la santé

- Partenaire international

  University of Edinburgh, School of Engineering

  Contacts : Jon Terry, Senior Lecturer since 1999 in Biosensor design, microfabrication, electrochemistry, and Jamie Marland, Lecturer since 2011 in Biosensor design, gas sensing, manufacturing, in vivo testing.

- Nom et adresse e-mail du tuteur

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- Filières adaptées : Systèmes électroniques intelligents, e-santé et Biotechnologie, Systèmes embarqués.

- Présentation générale du sujet (environ 5 à 10 lignes)

  The aim is to develop specific electro-chemical micro-sensors based on fabrication process available in ESIEE clean room, in collaboration with phD students and post-docs in Esycom Lab. Characterisation and optimisation of existing sensors will be initiated before proposing new routes for different applications in bio-engineering.
  Context of the collaboration with the international partner: The University of Edinburgh (UoE, UK) and the University Gustave Eiffel (UGE, France) both have strategic interests in advanced sensing for biomedical applications, drawing on mutual strengths in engineering and electrochemistry. A first grant has been awarded in 2024 to settle this collaboration.

- Objectif du projet (environ 10 à 20 lignes)

  Biological pH in body fluids (blood, saliva,, urine, tear, sweat) or tissues (skin, muscle) is an important indicator in many medical procedures to monitor physical conditions and diagnose abnormal situations. A lot of biological process are pH dependent, since the activity of most chemical reactions mediated by enzyme proteins depends on the pH of the body fluid [1-2]. In parallel to the development of miniaturised sensors, the proper definition of a validation protocol and safe packaging, especially for implanted sensors, remains a critical challenge. We will work on ultra-thin Titanium Nitride (TiN) based micro-sensor fabricated on polyimide flexible substrate as pH sensors [3]. Modifications of these sensors will be proposed to obtain lactate or oxygen sensors [4]. A novel package solution will also be explored to better-fit implantation constraints.

- Bibliographie

[1] W. Aoi and Y. Marunaka, 'Importance of pH Homeostasis in Metabolic Health and Diseases: Crucial Role of Membrane Proton Transport', BioMed Res. Int., vol. 2014, pp. 1–8, 2014, doi: 10.1155/2014/598986.

[2] L. Gaohua, X. Miao, and L. Dou, 'Crosstalk of physiological pH and chemical pKa under the umbrella of physiologically based pharmacokinetic modeling of drug absorption, distribution, metabolism, excretion, and toxicity', Expert Opin. Drug Metab. Toxicol., vol. 17, no. 9, pp. 1103–1124, Sep. 2021, doi: 10.1080/17425255.2021.1951223.

[3] Thi Thanh Thuy Nguyen. PH and SPO2 miniaturized sensors for fetal health monitoring. Micro and nanotechnologies/Microelectronics. Université Gustave Eiffel, 2023. English. HAL Id: tel-04448326 https://theses.hal.science/tel-04448326

[4] Marland JRK, Gray ME, Argyle DJ, Underwood I, Murray AF, Potter MA (2021). Post-Operative Monitoring of Intestinal Tissue Oxygenation Using an Implantable Microfabricated Oxygen Sensor. Micromachines, 12(7):810. DOI: 10.3390/mi12070810.