Prof. Yannick Bornat

Speaker	Yannick Bornat
Talk Title	Smart control of glyceamia for diabetic patients
Institution	Univ. Bordeaux
Department	Electronic Engineering
E-mail	yannick.bornat@ims-bordeaux.fr
Webpage	https://www.ims-bordeaux.fr/en/recherche/research/85-bioelectronics/elibio/110-ELIBIO

1. Tentative Abstract

Chronic diseases are the main cause of death with a major burden on health budgets and economic losses, and diabetes increasingly contributes to them. Continuous Glucose Monitoring (CGM) linked to insulin delivery presents a major recent advance but delivers sub-optimal therapeutic insulin levels. This artificial pancreas is limited by its glucose sensor which does not capture other nutrients. In contrast islet endogenous algorithms encode electrical activity for biphasic oscillatory insulin secretion. This talk is about the design of a device that measures islets electrical activity to determine the appropriate amount of insulin to be injected to the patient, and keep them in healthy conditions. The design of such a device includes electrophysiology knowledge, signal processing, modeling, real-time computing, closed loop control… The combination of these competences leads to a new generation of artificial pancreas which does not just regulate an arbitrary glucose concentration in the body, but also determines the appropriate concentration required by the patient's condition and activity.

2. Brief Biography

Dr Bornat received his PhD from the University of Bordeaux in 2006, working on real-time hardware simulation setups applied to neuromorphic computing. He then joined the institute of Microengineering (now part of EPFL) in Neuchätel, Switzerland as a postdoctoral fellow, working on real-time computation embedded in highly parallel acquisition setup for electrophysiology. He was appointed as Associate Professor of Electronic Engineering at the Polytechnic Institute of Bordeaux in 2007. His research interest is mainly focused on the design of dedicated digital architectures for closed loop systems involving both artificial computing and excitable cells. Among the target applications, he is involved in the development of an experimental setup for neuroprosthetic experiments and a glycaemia regulation setup based on pancreatic cell activity, and the architecture design of self-adapting stimulation devices.

3. List of Representative Publications

1. S. Renaud, J. Tomas, N. Lewis, Y. Bornat, A. Daouzli, M. Rudolph, A. Destexhe, S. Saïghi, "PAX: A mixed hardware/software simulation platform for spiking neural networks", *Neural Networks*, Sep;23(7):905-16, 10.1016/j.neunet.2010.02.006.

2. A. Quotb, Y. Bornat, S. Renaud, "Wavelet transform for real-time detection of action potentials in neural signals", *Frontiers in neuroengineering*, 2011, 4, pp.1-10. 10.3389/fneng.2011.00007

3. A. Zbrzeski, Y. Bornat, B. Hillen, R. Siu, J. Abbas, R. Jung, S. Renaud, "Bio-Inspired Controller on an FPGA Applied to Closed-Loop Diaphragmatic Stimulation", Frontiers in Neuroscience., 16 June 2016, https://doi.org/10.3389/fnins.2016.00275

4. M. Ambroise, S. Buccelli, F. Grassia, A. Pirog, Y. Bornat, M. Chiappalone, T. Levi, "Biomimetic neural network for modifying biological dynamics during hybrid experiments", *Artificial Life and Robotics, Springer Verlag,* 2017, 〈10.1007/s10015-017-0366-1〉

5. Pirog, A.; Bornat, Y.; Perrier, R.; Raoux, M.; Jaffredo, M.; Quotb, A.; Lang, J.; Lewis, N.; Renaud, S. Multimed: An Integrated, Multi-Application Platform for the Real-Time Recording and Sub-Millisecond Processing of Biosignals. *Sensors* 2018, *18*, 2099