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## Development of a hormonal dosage device by coupling electrochemistry and microfluidics

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More than 9 million couples in France are struggling with infertility and consult for Medically Assisted Procreation. Standard protocol includes a ten-day hormonal treatment followed by regular blood tests (2 to 3 in ten days). Estradiol, Progesterone and Luteinising hormone are tested along with uterine and ovary ultrasound to help gynaecologist with follow-up. Either continue treatment or proceed with ovulation and insemination or IVF and egg puncture. Estradiol helps characterise egg cells, progesterone indicate the receptivity of the uterine lining and LH indicate ovulation. These repeated blood tests are stretching and stressful for patients. Painful, they also impact patients' professional activity. 2 to 4h are being dedicated to tests and waiting in addition to secondary effects of hormonal treatments (headaches, fatigue, mood disorders). Ideally measurements would be made at patient bedside by the gynaecologist or at home. With microfluidics' rise, a solution could be a hormonal Point-of-Care similar to glucose or pregnancy tests.

In this context, funding has been received by the Service Médecine de la Reproduction of the CHU d'Angers to establish a proof of concept in collaboration with the Biosys Team from the Centre of Nanosciences and Nanotechnologies (Paris-Saclay) strong of the know-how of electrochemical lab-on-chips. Biosys team from C2N provides an expertise in coupling electrochemistry and microfluidics for capture and measurements of nucleic acids. In fact, coupling microfluidics and electrochemistry allows multiplexing of measurements and improved sensitivity by controlling the flow of molecules and the geometry of the device<sup>1, 2, 3, 4</sup>. Current detection of Estradiol, Progesterone and Luteinising hormone at CHU d'Angers is done on serum with the automate ADVIA Centaur from Siemens. In order to challenge the reference method and to provide gynaecologist with meaningful measurements, blood has been chosen as biological matrix. The aim of this work is to provide a state of the art of immunosensing with electrochemistry and a proof of concept of a miniaturised hormonal device using blood, coupling electrochemistry and microfluidics.

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