

Sujet de stage de fin d'études Master, TN10, extérieur

Titre/Title	<i>Multiphysics Interactions Between Fœtus, Amniotic Fluid and Uterine Wall</i>
Spécialité / Specialization	TN09 ☐ TN10 ☒ M2 BMI ☒ M2 IDS ☐ M2 autre ☒
Encadrant(s) / Supervisor(s)	Dr. Jeremy Laforet Jeremy.laforet@utc.fr and Dr. Badr Kaoui badr.kaoui@utc.fr
Laboratoire/Laboratory	BMBI
Mots clés/Key words	<i>Multiphysics, CoSimulation, Contraction, Smooth Muscle, Data Analysis</i>
Financement (minimum 4€35/heure)/ Financial information	Support pour l'indemnité de stage : Contrat CNRS ☐ Contrat UTC ☐ Aucun ☒ (demande de support SFRI/BMBI) Projet support (le cas échéant) : Sujet entrant potentiellement dans le cadre de la Chaire IA de confiance ☐
Descriptif du sujet/ Project description	Scientific context - During an average of nine months, the human embryo develops within the amniotic fluid contained within the amniotic sac. How this fluid mechanically interacts with the embryo and uterine wall is an important question for understanding the onset of contractions and their efficiency. Cases of premature birth are often associated with various maternal and fetal factors, including mechanical and physiological conditions. However, direct in vivo investigation of the mechanical interactions within this system is not possible, highlighting the need for computational and experimental approaches. Project objective - The main goal of this project is to: • conduct an extensive literature review of the biological, mechanical, and physical aspects of the problem, • develop a multi-physics and mechanistic model to characterize the hydrodynamic interaction between the embryo and the uterine walls, bridging with existing models within the lab. • implement the relevant electrodynamic effects, • develop a fluid–structure interaction (FSI) framework to investigate the coupled dynamics of the fluid, embryo, and surrounding structures. Required skills - This interdisciplinary project combines computational physics, fluid mechanics, data analysis, machine learning, and biomedical engineering. It offers an opportunity to work on a relevant biomedical problem related to pregnancy and to apply multi-physics modeling and computational methods to investigate a complex biological system.