DOCTORAL THESIS IN ROBOTICS

Development of microrobotic catheter equipped with grasping at the tip

PhD open position within the doctoral network "Soft Active Matter Microrobots for Medicine (SAM3)", funded by EU HORIZON-MSCA-2025-DN-01-01 # 101312674

Collaboration Prof Kanty RABENOROSOA (UMLP, Besançon, France), Dr Daniele MARTELLA (LENS, Firenze, Italy), Prof Pierre LAMBERT (ULB, Bruxelles, Belgium), Dr Loïc BLANC (LYS, Charleroi, Belgium)

Research project on Development of microrobotic catheter equipped with grasping at the tip (SAM3/ESR9 - catheter)

This project takes place within the Marie Curie Doctoral Network on Soft Active Matter Microrobots for Medicine (SAM3). This doctoral network of 12 PhD candidates aims at exploring the ear-nose-throat area from a microrobotics perspective. Thanks to active matter and small scale microrobotics engineering, three specific goals are targeted: (1) access the middle ear through the Eustachian tube; (2) access the olfactory clefts for mucosal biopsy; (3) access the skull cavity through the nose and the cribble plate for cerebrospinal fluid biopsy.

This specific PhD proposal on Development of microrobotic catheter equipped with grasping at the tip is part of the second endoscopic area namely the olfactory clefts. The goal of the PhD is to develop grasping functions at the tip of soft robots with the inner tube as optical fiber. The gripper has to be integrated on the tip of the optical fiber for biopsy or particle releasing.

The expected results are further set as follows: **1) Fabrication process** of the microgripper at the fiber's diameter footprint. **2) Pioneering the grasping** and the microrobots releasing on the tip of soft robot. **3) Experimental validation** and demonstration of the entire proposed system.

The candidate will be enrolled as PhD student at UMLP (Besançon, France), in the Doctoral Degree in Robotics, Doctoral school SPIM, UMLP. A co-supervision is planned with Prof Wissem HAOUAS (UMLP, Besançon, France).

An academic stay of 4 months is planned at LENS (Dr Daniele MARTELLA, Firenze, Italy) for the fabrication process of LCNs, a second academic stay of 3 months is planned at ULB (Prof Pierre LAMBERT, Bruxelles, Belgium) for bistable gripper integration and an industrial stay of 3 months is planned at LysMedical (Dr Loïc BLANC, Charleroi, Belgium)) for the development of robotic catheter with positioning capabilities and a handle to test navigation in phantom.

Research environment

The main research lab will be the FEMTO-ST lab of the UMLP - Université Marie et Louis Pasteur (UMLP, Campus La Bouloie, Besançon, France).

The PhD student will be supervised by Prof Kanty RABENOROSOA (UMLP,Besançon, France) and co-supervised by Prof. Wissem HAOUAS (UMLP, Besançon, France).

Both supervisors of this project have complementary expertise towards the goals of this PhD: design and modeling microrobots, microfabrication and experimental characterization.

More information on the supervisors:

- Prof Kanty RABENOROSOA https://sites.google.com/view/rkanty/, full Professor (section 61) at University of Franche-Comté with the Automatic Control and Micro-Mechatronic Systems (AS2M) department of FEMTO-ST Institute. His research interests include mechatronics, smart actuator, soft and continuum microrobotics for medical applications.
- Prof Wissem HAOUAS https://sites.google.com/view/haouaswissem, Associate Professor at the Robotics and Automation Department (AS2M), FEMTO-ST Institute, Marie & Louis Pasteur University. His academic and research career has focused on the development of innovative robotic systems, particularly in the fields of soft robotics, miniature robotics, and bio-inspired robotic devices.

The department FEMTO-ST Institute/AS2M Department belongs to the Université Marie et Louis Pasteur (Besançon, France) and operates the microfabrication platform https://platforms.femto-st.fr/centrale-technologie-mimento/en, equipped with all necessary facilities for manufacturing and characterization at the small scale.

For the implementation of the project, the candidate will move for 4 month to LENS (Firenze, Italy), 3 months to ULB (Bruxelles, Belgium) and 3 months to LysMedical (Charleroi, Belgium).

Job description and profile for SAM3/ESR9

We will appoint 1 PhD student on this project, related to 11 other positions open in the SAM3 EU network.

He/she will be registered within the Doctoral School of Robotics, Doctoral school SPIM, UMLP.

The candidate should have a master degree or diploma in mechanical, mechatronics or robotics engineering, less than 5 years of career at the recruitment date and not having a doctoral degree.

We are seeking talented and enthusiastic students to perform a PhD, with solid background in modelling of multi-physical systems, system design, robotics, soft materials, and manufacturing (micromachining); familiar with Matlab, Python or C++, CAD software and Finite Element Methods

Regarding skills, we look at ability for research management, dissemination, communication with colleagues and supervisors, strong teamwork spirit, creativity, problem solving and attention to safety.

The candidate should have good command of spoken and written English, and French skills are of course an asset.

For more information regarding the PhD studies at the UMLP please check the website https://spim.ubfc.fr/en/

How to apply

Applications should be sent to the mailbox SAM3@umons.ac.be dedicated only to recruitment. They should include: a) a digital copy with all academic certificates and the respective official transcription in English; b) a detailed CV and a motivation letter in English; c) 2 letters of recommendation.

Duration: 3 years full time.
Starting date: Autumn 2026
Deadline for the submission of applications: 31/8/26 though the position will remain open until it is filled