DOCTORAL THESIS IN ENGINEERING SCIENCES

Bistability and structural design actuated by soft active matter

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. Pierre LAMBERT (ULB, Brussels, Belgium), Prof. Daniele MARTELA (LENS, Firenze, Italy) and Dr Jean-Marc BREGUET (Alemnis, Thun, Switzerland)

Research project on Bistability and structural design actuated by soft active matter (SAM3/ESR7-Bistability)

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 bistability and structural design actuated by soft active matter is part of the second endoscopic area namely the olfactory clefts. The goal of the PhD is to design a biopsy gripper with a bistable mechanism. By triggering the mechanism with active matter (e.g. hydrogel), the elastic energy stored in a bistable structure can be released and trigger the closure of the biopsy gripper.

The expected results are further set as follows: 1) Mechanical design using both analytical methods and finite element modeling (FEM). 2) Fabrication of components in resin via 2PP for flexure thicknesses down to 1 µm, or in glass using femtosecond laser processing for flexure thicknesses down to 5 µm. 3) Force–displacement characterization of the active matter through a dedicated experimental setup to be developed. 4) Integration of active matter into a bistable gripping mechanism. 5) Incorporation of the gripping mechanism into one of the continuous structures (tube or catheter) developed by other project partners.

The candidate will be enrolled as PhD student at ULB (Brussels, Belgium), in the doctoral degree in the Engineering Sciences and Technologies. A co-supervision is planned with Prof. Daniele MARTELLA at LENS (Firenze, Italy).

An academic stay of 5 months is planned at LENS (Prof. Daniele MARTELLA, Firenze, Italy) for the development and characterization of novel active matter, and an industrial secondment of 5 months is planned at Alemnis AG (Dr Jean-Marc BREGUET, Thun, Switzerland) for materials characterization.

Research environment

The main research lab will be the TIPs department (https://tips-ulb.be/) of the engineering school at Université libre de Bruxelles (ULB, Solbosch Campus, Brussels, Belgium).

The PhD student will be supervised by Prof. Pierre LAMBERT (ULB, Brussels, Belgium) and co-supervised by Prof. Daniele MARTELLA (LENS, Firenze, Italy).

Both supervisors of this project have complementary expertise towards the goals of this PhD: polymer design and synthesis, microfabrication and mechanical design.

More information on the supervisors:

- Prof. Pierre LAMBERT, http://plambert.ulb.be/, professor of micro-robotics/engineering at the engineering school EPB of ULB, leading research in the fields of soft/wet microrobotics (wetting, capillarity, microrobotics, microfabrication). Recently he has developed activities towards medical application: lung endoscopy and nose-to-brain drug delivery
- Prof. Daniele MARTELLA, PhD, researcher at the Department of Chemistry of UNIFI and associate at LENS. Responsible for the synthesis, preparation, characterization and structuration of smart materials.

The TIPs department belongs to the Polytechnic School of Université libre de Bruxelles and operates the experimental platform micromilli.ulb.be, equipped with all necessary facilities for manufacturing and characterization at the small scale.

For the implementation of the project, the candidate will move for 5 months to LENS (Italy) and 5 months Alemnis (Switzerland).

Job description and profile

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

The candidate will have a background in engineering and design, with a strong interest in polymers. He/she will be registered within Doctoral School in Engineering Sciences and Technology at ULB with Prof. P. Lambert as supervisor.

We are seeking talented and enthusiastic students to perform a PhD, with a solid background in mechanical design and micromechatronics or microrobotics, skilled with Matlab, Pyhton and CAD-CAM tools. Skills on data analysis will be welcome. The candidate will have a strong interest in polymers.

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

For more information regarding the PhD studies at the ULB please check the website (https://www.ulb.be/en/phd/phd-programmes).

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: From September 2026
Deadline for the submission of applications: 15/7/2026 though the position will remain open until it is filled.

DOCTORAL THESIS IN ENGINEERING SCIENCES

Anatomical phantoms and test environment

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. Pierre LAMBERT (ULB, Brussels, Belgium), Prof. Marc VANDER GHINST (Academic hospital Erasme, Brussels, Belgium), Prof. Stefano PALAGI (Sant'Anna, Pisa, Italy) and Dr Robert KIRCHNER (Heteromerge, Dresden, Germany)

Research project on the development of anatomical phantoms and test environments (SAM3/ESR11-Phantoms)

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 the development of anatomical phantoms and test environments is central in the doctoral network project. Different phantoms will be produced from patient specific anatomical data and instrumented to enable test and validation of the various proof-of-concepts developed by the other doctoral candidates of the network, including test of navigation, drug delivery, biopsies, imaging, force measurement.

The challenges include the multiscale manufacturing of these anatomical cavities including rigidity contrasts between different locations as artefacts of bones or soft tissues. Biological cells or artificial mucosa will be considered to coat the phantoms.

The expected results include phantoms for three pathways: 1) nasal cavities, 2) Eustachian trump (towards the ear), and 3) frontal sinus (towards the cerebrospinal cavity).

The candidate will be enrolled as PhD student at ULB (Brussels, Belgium), in the doctoral degree in the Engineering Sciences and Technologies under the supervision of Prof. Pierre LAMBERT (main supervisor, engineering school of ULB) and Prof. Marc VANDER GHINST (co-supervisor, medicine faculty and ear-nose-throat department of the academic hospital Erasme). An academic stay of 6 months is planned at Sant'Anna (Prof. Stefano PALAGI, Pisa, Italy) towards advanced phantom of the cribble plate coated by printed cells and an industrial placement of 4 months is foreseen at Heteromerge (Dr Robert KIRCHNER, Dresden, Germany) for mastering multi-material printing towards enhanced cribble plate phantom.

Research environment

The main research lab will be the TIPs department (https://tips-ulb.be/) of the engineering school at Université libre de Bruxelles (ULB, Solbosch Campus, Brussels, Belgium). The TIPs department operates the experimental platform micromilli.ulb.be, equipped with all necessary facilities for manufacturing and characterization at the small scale.

The PhD student will be supervised by Prof. Pierre LAMBERT (ULB, Brussels, Belgium) and co-supervised by Prof. Parc VANDER GHINST (LENS, Firenze, Italy).

Both supervisors of this project have complementary expertise towards the goals of this PhD: microfabrication and mechanical design as well as medical and anatomical expertise for the ear-nose-throat district.

More information on the supervisors:

- Prof. Pierre LAMBERT, http://plambert.ulb.be/, professor of micro-robotics/engineering at the engineering school EPB of ULB, leading research in the fields of soft/wet microrobotics (wetting, capillarity, microrobotics, microfabrication). Recently he has developed activities towards medical application: lung endoscopy and nose-to-brain drug delivery
- Prof. Marc VANDER GHINST, medical doctor and head of the ear-nose-throat department of the ULB/Erasme academic hospital, is involved to set up experimental plans and to interpret the results, enable access to CT-scans of patients

For the implementation of the project, the candidate will move for 6 months to Sant'Anna (Pisa, Italy) and 4 months to Heteromerge (Dresden, Germany).

Job description and profile

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

The candidate will have a background in engineering and design, with a strong interest in polymers, manufacturing and cad-cam tools, medical applications, image processing, instrumentation. He/she will be registered within Doctoral School in Engineering Sciences and Technology at ULB with Prof. P. Lambert as supervisor.

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

For more information regarding the PhD studies at the ULB please check the website (https://www.ulb.be/en/phd/phd-programmes).

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