

# PhD proposal

## Development of a realistic phantom model for the evaluation of a novel Medical Device for the treatment of surgical hemorrhage in urology

PhD co-financed by the CAMI LABEX, <http://cami-labex.fr/> and the CEMAM LABEX, <http://cemam.grenoble-inp.fr/cemam/>

**PhD location :** TIMC-IMAG laboratory, Grenoble, France. GMCAO and BioMMat groups (<http://www-timc.imag.fr/>)

**Researchers involved:**

**PhD advisors:** Sandrine Voros, TIMC-IMAG Laboratory, GMCAO group  
Grégory Chagnon, TIMC-IMAG Laboratory, BioMMat group

**Collaboration:** François Urvoy and Vincent Delobelle, Hemosquid company

**Start date:** **September to November 2016**

### 1) PhD Context and objectives

At the university hospital of Grenoble and at the TIMC-IMAG lab, some surgeons and researchers invented a range of innovative medical devices able to stop severe hemorrhages very quickly. These devices are powered by vacuum and are therefore designed using advanced mechanical science. Unlike most solutions today to stop bleeding, these devices do not require biologic or chemical products which may be less efficient and lead to secondary effects. This work opened a new field of scientific and clinical research: vacuum hemostasis. Clinical trials are on-going or complete on 3 surgical specialties (Cardiac surgery, ENT and Obstetrics) with excellent results so far, and the start-up company Hemosquid is industrializing the devices.

Meanwhile, some surgeons have imagined a new application in urology and started to develop it within the TIMC-IMAG lab. Their objective is to stop much faster the bleeding following one of the most frequent surgical procedures in urology, which would have a very positive impact on patients since bleeding is responsible of 5-10% of all complications following this procedure. In addition, the patients could leave the hospital the day of surgery or the day after which would massively reduce the costs of the treatment, possibly saving above 100 million € per year in France alone.

In a regulatory context becoming stricter, and for the benefit of the patient, it will be mandatory to perform several pre-clinical evaluation campaigns of the prototype medical device before evaluation on patients. In the context of bleeding and urology surgery, this is particularly challenging. Indeed, the evaluations on anatomic specimens is not very helpful because they do not bleed. In addition, there is no animal model close enough for the targeted human organ pathology. Therefore, **there is a strong need for a realistic, scientific pre-clinical evaluation test bench to evaluate the performance of the new device.**

## 2) PhD location and funding source

The PhD will be performed in the TIMC-IMAG laboratory in Grenoble, France, which gathers scientists and clinicians towards the use of computer science and applied mathematics for understanding and controlling normal and pathological processes in biology and healthcare. This multi-disciplinary activity both contributes to the fundamental knowledge in those domains and to the development of systems for computer-assisted diagnosis and therapy.

This transdisciplinary PhD will be co-supervised by two researchers from the two groups of the lab CAMI and BioMMat, though the funding from “Laboratoire d’Excellence (Labex)” initiatives: the CAMI group is the leader of the Computer Assisted Medical interventions (<http://cami-labex.fr/>) and the BioMMat group is a member of the Center of Excellence of Multifunctional Architected Materials (CEMAM labex) (<http://cemam.grenoble-inp.fr/cemam/>).

## 3) Work program

Within this clinical and scientific context, the recruited PhD student will be expected to:

a) **Participate to the clinical and technical specifications of the evaluation test bench:**

- Study the anatomy of the organ (measurements, tissues structure...)
- Study the mechanical properties of the organ
- Develop a model of the environment of the organ as close as possible to the clinical reality.

The student will work closely with a urology surgeon who is also a PhD student already working on vacuum hemostasis for urology, and will benefit from the prior expertise of the CAMI / BioMMat groups of the TIMC-IMAG lab on the specification of medical phantoms.

b) **Conceive, develop and build a realistic instrumented test-bench** based on these measurements to enable realistic and quantitative pre-clinical evaluations of the device. The student will benefit from the expertise of the research groups: realistic phantoms and medical device evaluations for the CAMI group, architected materials and realistic phantoms for the BioMMat group) and from the expertise of the Hemosquid company in the field of vacuum hemostasis-based medical devices and their evaluation.

c) **Participate to the development and optimization of the Medical Device**, by means of device validations on the instrumented test bench and by development of **numerical simulations** allowing to better understand the device functioning within its environment.

The student will have to perform a thorough bibliographical study of the field and will be asked to submit work to scientific conferences and journals to promote his/her research.

## 4) Profile sought: Research Master in mechanics / biomechanics

Research Master in Mechanics, Biomechanics, biomechanical engineering or biomaterials.

A taste for instrumentation and experimentation is strongly encouraged.

Please send a CV, cover letter, recommendation letter and Master report to [Sandrine.Voros@imag.fr](mailto:Sandrine.Voros@imag.fr) and [Gregory.Chagnon@imag.fr](mailto:Gregory.Chagnon@imag.fr)