

PhD or Postdoc position call

Uterine Hypercontractility in Endometriosis

The team of Dr. Nicolas Chevalier at Laboratoire Matière Systèmes Complexes, located in the heart of Paris, is looking for excellent, hard-working, motivated PhD or postdoc candidates to join us in this research venture. Applications from various backgrounds will be considered : physicist, biophysicist, biomedical engineer, biologist, physiologist, clinician. Five possible funding schemes: PEPR Endométriose fellowship (deadline 4th of April 2025), Ecole Doctorale EDPIF (deadline 18th of April 2025), DIMM BioConvS fellowship (deadline 30th of April 2025), ANR (results July 2025), Recherche Partenariale & Innovation Université Paris Cité; beginning of contract in all cases Sept.-Dec. 2025. If you are interested in participating in a multidisciplinary, innovative project in collaboration with clinicians and to change the life of the 10% of women affected by endometriosis, please contact me !

Endometriosis is a pathology affecting ~10% of women of reproductive age, characterized by the implantation of uterine endometrial nodules either in the body of the uterus (adenomyosis) or ectopically, on various organs in contact with the peritoneal cavity such as the bladder, intestines, Fallopian tubes etc. This pathology results in severe pain during menstruation and can lead to infertility. Endometriosis and adenomyosis are associated with hyper-contractility of the myometrium, the uterine smooth muscle: intrauterine pressures, contraction frequencies and amplitudes are 2-3 times higher in patients than in the controls^{1,2}. Contractile waves present aberrant propagation directions at the different phases of the menstrual cycle. These observations support the etiological theory of retrograde menstruation^{3,4} as the cause for the appearance of endometrial lesions in the peritoneal cavity (Fig. 1). The morphological signature of hyper-contractility is the appearance of a thickened, irregular junctional zone (Fig.1) of the myometrium, which appears distinctly upon MRI or intravaginal ultrasonography examination.

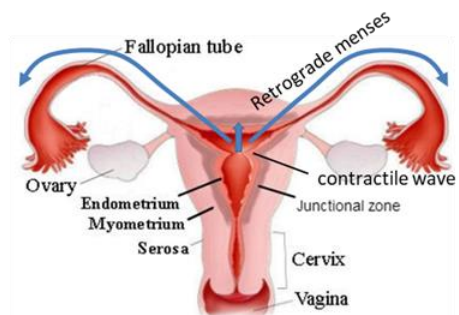


Figure 1. Anatomy of the uterus and contractile waves giving rise to retrograde menstruation that spread the endometrium throughout the body.

Our goals are:

- **Understand the origin of hyper-contractility:** does it result from a structural alteration of the architecture of the uterine wall, for example of the smooth muscle, of its innervation, or its hormone receptor distribution?
- **Therapy / prevention** by screening compounds that excite or relax contractility.
- **Diagnostic:** develop non-invasive uterine pressure measurement in patients, with the aim of generalizing this approach to adolescents at risk and for patient follow-up.

We work directly on human tissue obtained post hysterectomy (ablation of the uterus) on patients suffering from endometriosis, adenomyosis, or other diseases (control group). We collaborate with the team of gynecological surgeons and anatomopathologist of Hôpital Paris Saint Joseph

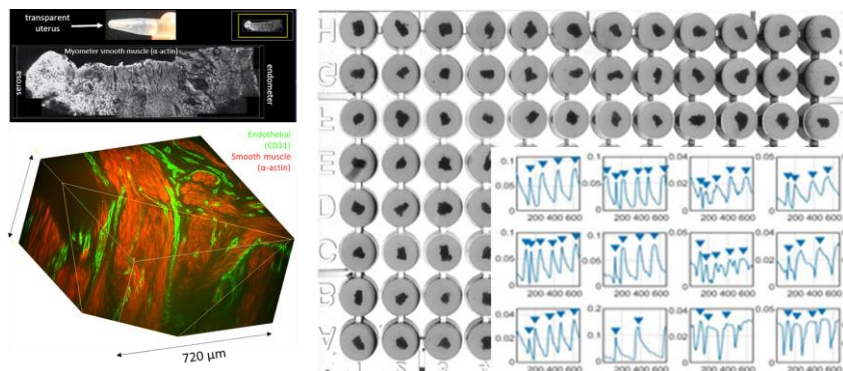


Figure 2. Some of the technics developed in the lab. Left: Tissue clearing for 3D reconstruction of the human myometrium, Right: 96-well human myometrium contractility assay for high-throughput drug screening.

(E. Bautrant, E. Petit, C. Abo, M-C. Lamau, J. Adam). The background of the PI is in biophysics and gut physiology & development, we are transposing the protocols and methods developed for gut contractility to the uterus, and more generally re-channeling our research effort towards endometriosis. The methods we employ include 2D and 3D immunohistochemistry, artificial-intelligence assisted image analysis, mass spectrometry, ex-vivo physiological bath force measurements & calcium imaging + we are developing new methodology for uterine contractility assessment. We will soon be integrating MRI & ultrasonography as further investigation tools. Equipment and material expenses are covered by the Fondation pour la Recherche sur l'Endométriose (<https://www.fondation-endometriose.org/>), project HYPERU.

Contact

Dr. Nicolas Chevalier, Chargé de recherche CNRS
 Laboratoire Matière et Systèmes Complexes, Université Paris Cité / CNRS
 10 rue Alice Domon 75013 Paris
 Phone: +33 601 825 601 nicolas.chevalier@u-paris.fr <http://nicochevalier.net>