
PhD opportunity - Electromechanical control of directional cell migration in the intestinal

This PhD opportunity is offered through the [BEST Doctoral Programme](#), led by the **University of Toulouse** and co-funded by the **European Union** through **Horizon Europe – Marie Skłodowska-Curie Actions (MSCA COFUND)** and the **Toulouse Initiative for Research's Impact on Society (TIRIS)**. Thanks to this programme, **19 doctoral candidates** will be recruited through an international co-supervision scheme across three major TIRIS thematic pillars : Health & Well-being, Global Changes and Sustainable Transitions. The entire recruitment process will take place between November 2026 and April 2027 and will be managed by the **University of Toulouse (UT)**.

Host Institution	Center for Integrative Biology (CBI), Centre National de la Recherche Scientifique, University of Toulouse, France
Supervisor	Denis Krndija - Gut development and homeostasis team
Co-supervising institution	Westlake University, China
Co-supervisor	Thuan Beng Saw
Contract duration: 36-month	Starting date: September/October 2027

Research topic

The intestinal epithelium is continuously renewed: newly generated cells migrate collectively from the crypts towards the villus tips, where they are eventually shed. This long-range migration is remarkably robust, despite constant mechanical and biochemical perturbations. Although active cytoskeletal forces are known to drive epithelial movement, the cues that provide persistent directional guidance along the crypt–villus axis remain unknown.

This PhD project will test the hypothesis that bioelectric signals generated by the intestinal epithelium interact with tissue mechanics to guide directional collective cell migration. The student will combine intestinal organoid monolayers and gut explants with live imaging and quantitative analysis of migration, tissue organisation and mechanics. Electrical properties will be mapped using voltage imaging and electrophysiological approaches, while mechanical activity will be monitored through cell and tissue dynamics and force-related readouts. A central objective will be to establish causal relationships by testing whether altering epithelial electrical activity changes migration directionality and tissue mechanics, and whether modifying mechanical activity in turn reshapes electrical patterns. Controlled electric field stimulation, microelectrode measurements and microfluidic approaches developed in the laboratory of Thuan Beng Saw at Westlake University will allow these relationships to be tested under well-defined conditions. By combining physiological intestinal models in Toulouse with reductionist electromechanical approaches at Westlake, the project will determine whether endogenous bioelectric cues contribute to the directional guidance and

robustness of intestinal epithelial migration. More broadly, it will reveal how physical signals coordinate cell movement during continuous epithelial renewal. The project will be carried out within an international collaboration between the Toulouse and Westlake teams recently funded by a Human Frontier Science Program (HFSP) Research Grant with additional ANR-funded gut mechanobiology research in Toulouse, providing a strong scientific framework and access to complementary expertise and technologies.

Keywords:

Intestinal epithelium, collective cell migration, directional migration, bioelectricity, mechanobiology, organoids

Context

The intestinal epithelium undergoes continuous renewal, with newly generated cells migrating collectively from crypts towards villus tips while maintaining essential barrier, absorptive and secretory functions. Although active cytoskeletal forces are known to contribute to this migration, the mechanisms that provide persistent directional guidance over long distances remain poorly understood. The intestinal epithelium also generates transepithelial electrical potentials through ion transport and junctional resistance, and growing evidence indicates that endogenous electric fields can influence epithelial organisation and cell migration. However, how these bioelectric signals interact with tissue mechanics to control directional migration in the gut remains largely unexplored. This project addresses this gap by investigating the electromechanical mechanisms that guide collective cell migration during intestinal epithelial renewal.

International Co-supervision

The project will be internationally co-supervised by **Denis Krndija from the [Gut development and homeostasis team](#) at CBI Toulouse, France (Centre National de la Recherche Scientifique, [University of Toulouse](#))** and **Thuan Beng Saw at Westlake University, China**. The doctoral researcher will undertake research periods at Westlake University, with the duration and organisation defined according to the scientific needs. This international setup will provide complementary training in intestinal epithelial biology and mechanobiology in Toulouse, and in bioelectric measurements, microfluidics and quantitative epithelial mechanics at Westlake.

Experience/Skills required :

- Hold, by 23 November 2026, a Master's degree or an equivalent qualification granting access to doctoral studies in France and not hold a doctoral degree.
- Have not resided in France or carried out your main activity in France for more than 12 months during the 36 months immediately preceding 23 November 2026. Periods of stay as a tourist, refugee, or time spent in national service, are not considered as residency.
- Have a B2 level of English
- Have a strong interest in interdisciplinary research at the interface between biology and physics.
- Experience in cell or organoid culture, fluorescence microscopy, quantitative image analysis or biophysical approaches would be advantageous, but expertise in all of these areas is not required
- The candidate should be interested in combining experimental cell biology with quantitative approaches and in working within an international research environment.

Application Process

Call for application - 23 November 2026

Applications must be submitted online through the application platform : edd-projets.utoulouse.fr

Please contact us at isabelle.saves@utoulouse.fr before applying and if you have any questions regarding CBI or the recruitment process. Please use the following email subject line: BEST call – [Supervisor name]

Eligibility check - 24 to 30 November 2026

Written evaluation - 4 December to 15 January 2027

Consolidation of pre-selected projects - 19 January to 19 March 2027

Oral evaluation - 29 March to 4 April 2027

Result - April 2027

Starting date: September/October 2027 (Contract duration: 36 months)

For additional information: <https://doctorat.univ-toulouse.fr/cofund-best>

About the CBI

Located in Toulouse, in the sunny southwestern of France, the [Center for Integrative Biology \(CBI\)](#) is a **fundamental biology research institute** affiliated with the [National Center for Scientific Research \(CNRS\)](#) - the largest public research organization in France - and the University of Toulouse. The institute brings together **47 research groups**.

The CBI aims to understand the mechanisms, dynamics and behaviors of living organisms, to advance knowledge on the current societal challenges. Research at the CBI use multidisciplinary and multi-scale approaches, from isolated molecules to whole organisms and animal societies, applied to numerous model organisms, from bacteria to man.

CBI offers an **international and interdisciplinary research environment**, with access to advanced facilities and opportunities for scientific and career development. The institute benefits from **a collaborative and international scientific culture**, and is committed to promoting equality, diversity and inclusivity.