



Innovative Training Networks (ITN)
Call: H2020-MSCA-ITN-2018

Phys2BioMed

Biomechanics in health and disease: advanced physical tools for innovative early diagnosis

Start date of the Innovative training network (ITN): 01/01/2019
Duration: 4 years

A PhD position is available for Early-Stage Researchers (ESRs) at Inserm, CNRS, Aix-Marseille University and Erlangen-Nuremberg University.

The position is part of a Marie Skłodowska-Curie ITN European Training Network involving 15 ESRs as PhD students (Phys2BioMed).

Description of the ESR Project

The position is open at **LAI UMR1067 Inserm, CNRS, Aix-Marseille University** in France and at the **Erlangen Biophysics Group** in Germany, with the aim to experimentally investigate the mechanical properties of cells and tissues in health and disease under the supervision of Prof. Felix Rico (Marseille) and Prof. Wolfgang Goldmann (Erlangen).

Project

Project Title. Fast phenotyping of cell mechanics

Start date: April 2019.

Objectives: Development and application of fast mechanical phenotyping of cells and tissues combining AFM and microfluidics.

Expected Results: We will develop instrumentation, sample preparation, data acquisition, and analysis tools for robust and fast AFM mechanical mapping of cells and tissues. To minimize variability and to control the spreading conditions, cells will be cultured on micro-patterned substrates mimicking the physiological environment. A high-speed AFM device will be adapted to increase the throughput of mechanical mapping for clinical use. Similar strategies will be applied to map the mechanics of tissues combined with histology. The mechanics of cells grown on micro-patterns at various sizes will be measured by AFM and compared with the mechanics of suspended cells using microfluidics, a high throughput method. Both methods will be used to establish the basis for quantitative, high-throughput mechanical phenotyping for disease diagnosis. Bio-specimens will include malignant and benign tumor cell lines and normal and pathological tissue and extracellular matrix. Secondments at St. Raffaele hospital in Milan will provide experience in tissue handling and preparation within a clinical context. The secondments at an instrumentation company will allow the use of a similar technique, i.e. nano-indenter on the same samples. The secondments at Biomeca, a company dedicated to providing cell mechanical tests to external clients, will reveal the constraints and needs outside the academic world. The ESRs will be also involved in scientific communication, training, and dissemination.

Planned secondment(s): 1. FAU, W. Goldmann. Correlation between mechanics of cells by AFM grown on micro-patterns of varying size and mechanics of suspended cells using microfluidics (4 months at month 12; 2 months at month 36). 2. OSR, M. Alfano. Preparation and immobilization of tissue and ECM (1.5 months at month 20). 3. O11, D. Iannuzzi. Mechanical mapping of cells and tissues using commercial nano-indenter (1.5 months at month 30). Biomeca, P. Milani. Mechanical mapping of cells and tissues using AFM as an external service (1.5 months at month 33).

Research groups

The [Force Microscopy Group](#) is a research laboratory specialized in AFM and is part of the Laboratory of adhesion and inflammation ([LAI](#), UMR 1067) at the INSERM, CNRS, and Aix-Marseille University (AMU). The group is one of the international leaders in the application of AFM, in particular of high-speed AFM, to biological samples, from single molecules to cells and tissues. The lab is attached to the Life Sciences and Physics doctoral schools of AMU. INSERM is a public institution devoted exclusively to human health and biomedical research. Aix-Marseille University is the largest French university and is dedicated to education and research. The lab is part of the [Centuri Institute](#), an interdisciplinary consortium of 16 research groups, supporting collaborative research and mentoring projects within the labs through a common interest to quantitative biology. The campus provides access to multiple facilities and techniques such as electron microscopy, focused ion beam, and advanced optical microscopy among many others within an optimal academic environment.

Rigato A, Miyagi A, Scheuring S, Rico F *Nat Phys*, 13(8): 771-775 2017

Rigato A et al., *ACS Nano*, 9, 5846-5856 2015

Rico et al. *Science*, 342, 741-743 2013

The [Erlangen Biophysics Group](#) studies the mechanical properties of cells, tissues, and complex soft matter. With regard to cells, we study how they respond to their mechanical environment, how they interact with their extracellular matrix and with neighboring cells, and what mechanisms they employ for transmigration, invasion, adhesion, contraction, and cell division. To address these questions, our lab collaborates with other research groups worldwide to develop new technologies that draw from various fields, including soft matter physics, molecular cell biology, biochemistry, engineering, and applied mathematics. Below are references to some of the ongoing projects and biophysical methods that we have implemented or developed.

Lange et al., *Biophysical J.* 2015,109, 26-34.

Lange et al., *Biophysical J.* 2017,112, 1472-80.

Bonakdar et al., *Exp. Cell Res.* 2017, 331, 331-7.

Candidate profiles

We are looking for excellent and highly motivated candidates with a degree in physics, chemistry, biology, or engineering and strong interest and experience in biophysics, physics of matter, nano-medicine and related disciplines. Expertise in atomic force microscopy and/or microfluidics is welcome. We expect dedication and enthusiasm for experimental research, combined with openness and curiosity, and the ability and willingness to team work in an interdisciplinary environment. Skills in instrument development, data analysis and in scientific numerical environments (e.g. Python, Labview, Matlab etc) are appreciated.

Appointment and enrolment in a PhD programme

The successful candidates will be employees of Inserm and paid in accordance with the MSCA rules. The contract period will be for 36 months. The candidates will be enrolled in the AMU doctoral school of Life Sciences and will be under the supervision of Profs. Felix Rico and Wolfgang Goldmann. Phys2BioMed aims to have the positions filled before the end of June 2019, but there is flexibility of an earlier or potentially slightly later start, if requested.

Admission criteria

- Students must have a second-level degree or an equivalent qualification (Master's Degree in physics, chemistry, biology, or engineering) from a foreign University.
- Candidates can be of any nationality, but need to demonstrate **transnational mobility**, i.e. must not have resided or carried out their main activity (work, studies, etc.) in the country of their host organisation (France) for more than 12 months in the last 3 years.
- The candidates must be in the first four years (full-time equivalent research experience) of their research careers and have not been awarded a doctoral degree.
- Good proficiency in written and spoken English is required (level B2).

The suitability of the foreign academic qualifications in terms of content is appraised by the Evaluation Board constituted for admission to each PhD program, in compliance with the regulations in force in France and in the country in which the academic qualification was issued, and the international treaties or agreements pertaining to the conferment of qualifications for the continuation of studies.

How to apply

The applicant must send the following documents (in pdf format, included in a single zipped file attachment) to Prof. Felix Rico (felix.rico@inserm.fr) **by March 1st, 2019**:

- 1) an updated CV;
- 2) a personal motivation letter;
- 3) at least 2 reference letters (in English); at least one of them from a former supervisor and/or lecturer;
- 4) a scanned copy of the degree (usually the Master degree), which would formally entitle him/her to embark on a doctorate, either in the country in which the degree was obtained or in the country in which the researcher will be recruited.
- 5) a document indicating his/her ranking and marks within his/her last year at his/her Master degree, with a list of the courses/modules they have attended.
- 6) a copy, or a summary, of the Master degree thesis, or a brief description of the past scientific activity.

Phys2BioMed is devoted to promote gender equality and diversity and encourages female researchers to apply.

Assessment criteria

Applications must be written in English and will be evaluated against the following criteria:

- educational record;
- scientific quality of the applicant's CV;
- expected individual impact and benefit to the fellow and to the project.
- previous experience in the subject of Phys2BioMed research program.

Eligible candidates will be interviewed, possibly by means of web-conferencing tools. For more information, contact Prof. Felix Rico (felix.rico@inserm.fr)