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

Phys2BioMed

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

Two positions available for Early Stage Researchers (ESRs) at Università degli Studi di Milano.


The Phys2BioMed network
The network “Biomechanics in health and disease: advanced physical tools for innovative early diagnosis” (Phys2BioMed) will involve sixteen partners (eleven beneficiaries, hiring young researchers, and five partner organisations, supporting training and research), merging diverse competences at European level, from different fields like nanoscience and nanotechnology, physics, biology, and medicine. Phys2BioMed will offer excellent interdisciplinary and cross-sectoral training to a team of motivated early stage researchers (ESRs) on the application of cutting-edge physical tools for the mechanical phenotyping of cells and tissues of clinical relevance, aiming at developing novel early-diagnostic tools. Secondments to other nodes of the network will represent the main and more effective channel of dissemination and cross-fertilization of competences, ideas, and knowledge within the network. Phys2BioMed will provide scientific and technological outcomes on biomechanics, and the mechanical determinants of diseases.

Description of the ESRs’ Projects
The two positions opened at the Interdisciplinary Centre for Nanostructured Materials and Interfaces (CIMaINa) – Dept. of Physics of Università degli Studi di Milano, are aimed at the experimental investigation of the mechanical properties of cells and tissues in health and disease, under the supervision of Prof. Alessandro Podestà ([http://www0.mi.infn.it/~podesta/](http://www0.mi.infn.it/~podesta/)).

Project of fellow ESR1
Project Title. The influence of the microenvironment of healthy and tumoural cells.
Start date: April 2019.
Objectives. To investigate the response of healthy and tumoural cells to controlled chemical-physical stimuli provided by its microenvironment; to develop reliable and standardised approaches for the

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2 This project has received funding from the European Union’s Horizon 2020 research and Innovation programme under the H2020-MSCA-ITN-2018 grant agreement N. 812772.
nano-mechanical characterisation by Atomic Force Microscopy (AFM) of cells, ExtraCellular Matrices (ECMs) and other soft samples.

**Expected Results.** The ESR will develop suitable platforms based on morphologically and chemically patterned substrates to provide controlled stimuli to healthy and cancerous cells. Suitably patterned substrates for cell culture using nanostructured/nanocomposite materials with controlled morphology and elasticity mimicking natural ECMs will be used to provide mechanical stimuli to cells, triggering mechanotransduction processes. The ESR will characterise the mechanical phenotype of cells in different stimulation conditions by means of AFM coupled to optical techniques, and commercial nano-indentation techniques. The ESR’s project will have a strong focus on methodological aspects of the research, including calibration of probes, modelling and data analysis, and contribute to the network-wide standardisation effort. ESR will be involved actively on several network tasks in training, dissemination and communication, and will support coordination activities of the PI.

**Planned secondments.** Optics11 (The Netherlands), mastering commercial nano-indenter Piuma; University of Bremen (Germany), optimising calibration of AFM probes and data analysis; Vmicro SAS (France), development of custom probes and interferometric calibration; INSERM (France), study of mechanical response of cells in confined/patterned geometries; JUMC (Poland), studying the phenotype of malignant cells and advanced sample preparation procedures.

**Project of fellow ESR2**

**Project Title.** Nano-mechanical fingerprints of extracellular matrices from healthy and tumoural tissues.

**Start date:** June 2019.

**Objectives.** To investigate the relation between the mechanical properties of the extracellular matrix (ECM), and the development and progression of diseases (with focus on bladder cancer): to develop a standardised approach for the nano-mechanical characterisation of ECM samples from clinical tissues.

**Expected Results.** During this project the ESR will investigate the mechanical fingerprints of diseases, focusing in particular on bladder cancer, in collaboration with Ospedale San Raffaele (OSR). To this purpose, the ESR will contribute developing and validating sample preparation protocols for ECM derived from clinical tissues, in close collaboration with medical partners. Samples will be studied primarily by AFM-based indentation, but also by complementary correlative techniques. The cellular component of tissues will be studied also by microfluidic cytometry. The ESR will participate to the network-wide standardisation effort at the clinical level. The ESR will be involved actively on several network tasks in training, dissemination and communication, and will support coordination activities of the PI.

**Planned secondments.** Friedrich-Alexander-Universität Erlangen-Nürnberg FAU (Germany), elasticity study of suspended cells by fluidic cytometry; IBEC (Spain), mastering frequency-dependent AFM indentation measurements; IFJPAN (Poland), mechanical signature of disease in ECMs; BioMeca SAS (France), sample preparation procedures for ECMs and cells, and data analysis; TMT-C2RC (France), mastering sample preparation techniques with clinical tissues; CNRS (France), correlative techniques complementary to AFM.

**Research group**

The PhD students will work at the premises of CIMA, located at the Department of Physics of the University of Milan, under the supervision of Prof. Alessandro Podestà. The University of Milan ([http://www.unimi.it](http://www.unimi.it)) is a public teaching and research-intensive university, the only Italian among the 21 prestigious members of LERU (League of European Research Universities), and an
interationally high-ranked university for scientific productivity. The Department of Physics (eng.fisica.unimi.it/ecm/home) is one of the largest and most productive Physics Departments in Italy, with a PhD School in “Physics, Astrophysics and Applied Physics”, which offers a broad range of courses on core physics disciplines and complementary skills (phd.fisica.unimi.it). The School has been active at the University of Milano since 1983, and it currently involves about 60 students as well as about 70 faculty members as supervisors and/or teachers. CIMalNa (cimaina.unimi.it) was established in 2004 at the University of Milan by a grant of the Italian Ministry of Education, to be the hub for the integration and merging of research activities relevant for nanotechnology coming from disciplines such as Physics, Chemistry, Biology, Pharmacology and Medicine. CIMalNa owns dedicated laboratories and facilities in addition to already existing structures to promote a more intense cooperation between scientists with different backgrounds by sharing common infrastructures. The recruited ESRs will be enrolled in the PhD programme of the Dept. of Physics. The group of Prof. Alessandro Podestà has a long-dated expertise in experimental studies of the nanoscale properties of nanostructured systems by scanning probe microscopies, including studying biomolecular and cellular interactions at biologically-relevant interfaces.

**Candidate profiles**

We are looking for excellent and highly motivated candidates with a degree in physics and strong interest and experience in biophysics, physics of matter, nanomedicine and related disciplines. Consolidated expertise in atomic force microscopy will be appreciated. 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 (for example Python, Labview, Matlab etc) will be appreciated.

**Appointment and enrolment in a PhD programme**

The successful candidates will be employees of the Università degli Studi di Milano, and will be paid in accordance with the MSCA rules\(^2\). The contract period will be for 36 months. The candidate will be enrolled in the PhD programme of the Department of Physics under the supervision of Prof. Alessandro Podestà. Phys2BioMed aims at having the positions filled before the end of June 2019, but there is flexibility of an earlier or potentially slightly later start, if required by personal circumstances.

**Admission criteria**

- Students must have a second-level degree or an equivalent qualification (Master’s Degree) from a foreign University, before the end of the present call.
- 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 (Italy in this case) for more than 12 months in the 3 years immediately before the reference date. Compulsory national service and/or short stays such as holidays are not taken into account.
- 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 (at least level B2).

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\(^2\) See the latest MSCA-ITN Guide for Applicants, under “Financial Aspects”.
The suitability of the foreign academic qualifications in terms of content is appraised by the Evaluation Board constituted for admission to each PhD programme, in compliance with the regulations in force in Italy 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. Alessandro Podestà (alessandro.podesta@mi.infn.it) 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 one 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 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 programme.

Eligible candidates will be interviewed, possibly by means of web-conferencing tools.

For more information, contact Prof. Alessandro Podestà at alessandro.podesta@mi.infn.it.

**General Data Protection Regulation (GDPR)**

Phys2BioMed will process data collected from the applicants for recruitment purposes only, according to the GDPR policies (details can be found following this link). Phys2BioMed will not share data outside the network, unless upon authorisation from the interested applicant. The data will be kept for a period of five years after the end of the project for the purpose of an audit by the EU.