Call for PhD Candidate Vacancies – 1st recruitment period

Disc4All

Training network to advance integrated computational simulations in translational medicine, applied to intervertebral disc degeneration

Funding: European Commission H2020-MSCA-ITN-ETN-2020 GA: 955735

Contact: disc4all@upf.edu

Web: https://www.upf.edu/web/disc4all

General Information:

The European community requires early stage researchers (ESRs) who can work across the boundaries of traditional disciplines, integrating experimental and in silico approaches to understand and manage highly prevalent multifactorial disorders, such as musculoskeletal disorders. The Disc4All training network utilises intervertebral disc degeneration (LDD) leading to low back pain (LBP) as a relevant application for the integration of data and computational simulations in translational medicine, to enable rational interpretations of the complexity of the interactions that eventually lead to symptoms.

LBP is the largest cause of morbidity worldwide, yet there remains controversy as to the specific cause leading to poor treatment options and prognosis. LDD is reported to account for 50% of LBP in young adults, but the interplay of factors from genetics, environmental, cellular responses and social and psychological factors is poorly understood. Unfortunately, the integration of such data into a holistic and rational map of degenerative processes and risk factors has not been achieved, requiring creation of professional cross-competencies, which current training programmes in biomedicine, biomedical engineering and translational medicine fail to address, individually.

Disc4All aims to tackle this issue through collaborative expertise of clinicians; computational physicists and biologists; geneticists; computer scientists; cell and molecular biologists; microbiologists; bioinformaticians; and industrial partners. It provides interdisciplinary training in data curation and integration; experimental and theoretical/computational modelling; computer algorithm development; tool generation; and model and simulation platforms to transparently integrate primary data for enhanced clinical interpretations through models and simulations. Complementary training is offered in dissemination; project management; research integrity; ethics; regulation; policy; business strategy; and public and patient engagement. The Disc4All ESRs will provide a new generation of internationally mobile professionals with unique skill sets for the development of thriving careers in translational research applied to multifactorial disorders.

Disc4All will have three recruitment periods. **This call focusses on the 1st recruitment period**. For further detail about the forthcoming periods, please check our expression of interest form: (https://docs.google.com/forms/u/2/d/e/1FAIpQLSdL_BGNlew4wE5_w4gjowvHeBFn8nXwmPmNHVvHJN5jmH8mUA/viewform)

Hiring Institution

Hiring Disc4All Members:

- InSilicoTrials (www.insilicotrials.com, See job offer ESR 1)
- Barcelona Supercomputing Center – Centro Nacional de Supercomputación (www.bsc.es – See job offer ESR 2)
- University of Oulu (www.oulu.fi – See job offer ESR 4)
- Galgo Medical (https://www.galgomedical.com – See job offer ESR 5)
- King's College London (http://www.kcl.ac.uk/aboutkings/index.aspx - See job offer ESR 6)
- Sheffield Hallam University (https://www.shu.ac.uk/research - See job offer ESR 7)
- University of Bern (www.dbmr.unibe.ch – See job offer ESR 9)
- University of Liège (https://www.uliege.be – See job offer ESR 12)

Type of contracts: temporary (36 months)

Job status: full-time

Hours per week: See individual job offers

Offer starting dates: Between November 1st, 2020 and January 31st, 2021

EU Research Framework: H2020 MSCA-ITN-ETN

Marie Curie Grant Agreement Number: 955735

Open Positions for Early Stage Researchers (ESR)

- **ESR 1:** ***Management of clinical, biological & simulated data for uniform simulation workflows***
  ESR 1 will exploit large research data infrastructure and will be responsible for the systematic treatment and machine interpretability of heterogeneous datasets (organ phenotype, patient condition, molecular signatures, sex & gender, psychological status, known comorbidities, …), to enable integration of data into holistic disease models and decision support systems.
  HOST: InSilicoTrials, Italy - Secondments: OULU; AQUAS; BSC-CNS - PhD delivered by: UPF - Deadline for recruitment: January 2021
  SEE JOB OFFER & APPLY - Deadline: 31/10/2020
  https://www.upf.edu/documents/236182816/236664378/ESR1-Vacancies-Disc4All_InSilicoTrials.pdf/

- **ESR 2:** ***Integrated solvers for bidirectional coupling of physical & biological events over multiple scales***
  The ESR will work on creating models and algorithms for simulation of Intervertebral disc degeneration pathologies. The main task will be to develop a multiscale mechanistic modelling software by coupling an Agent Based (AB) simulation solver with a Finite Element (FE) solver for High Performance Computing. The Finite Element solver will be adapted to couple mechanical deformations and solute transport to perform osmoporoviscoelastic

simulations, by using the processed MRI data of patient-specific disc geometries. The candidate will be expected to cover the following tasks: 1) Adapt the FE solver Alya to tackle solute transport simulations coupled with porous media finite deformations & with Donnan osmotic swelling; 2) Adapt AB solver Pandora to integrate regulation network and work with 3D meshes; 3) Couple Alya & Pandora over 3D meshes and generate a new multiscale AB-FE solver; 4) Verify and validate the multiscale solver & simulations; 5) Optimize for massive multiscale simulations on HPC; 6) Generate software package & provide initial support for integration into final platform - Host: BSC-CNS, Spain - Secondments: ULG; UBern - PhD delivered by: UPF - Deadline for recruitment: January 2021
SEE JOB OFFER & APPLY **- Deadline: 30/09/2020**
https://www.upf.edu/documents/236182816/236664378/ESR2-Vacancies-Disc4All_BSC.pdf/

- **ESR 4:** ***Classification of IVD radiological signs and relation with SNP & multi-omics profiles***
  The ESR 4 will focus on developing machine learning based prediction and severity assessment models for intervertebral disc (IVD) degeneration. The primary aim will be to combine radiomic features from magnetic resonance (MR) and X-ray images, omics data, and other background data of the patients – in order to discover multiple phenotypes of the IVD degenerative disease. In this project, we will leverage patient material from TwinsUK and Northern Finland Birth Cohort datasets.
  HOST: OULU, Finland - Secondments: Cluster UPF, BSC-CNS, GALGO; PLEXALIS - PhD delivered by: OULU - Deadline for recruitment: January 2021
  SEE JOB OFFER & APPLY **- Deadline: 31/10/2020**
  https://www.upf.edu/documents/236182816/236664378/ESR4-Vacancies-Disc4All_UOULUv2.pdf/

- **ESR 5:** ***3D modelling of the lumbar spine & automatic extraction of 3D morphological features in LDD***
  ERS 5 will address 3D modelling of the lumbar spine from medical images. Methods using deep learning and statistical modelling will be developed to segment the lumbar vertebrae and intervertebral disks in 3D MRI sequences and CT image, and provide 3D subject-specific lumbar spine models from 2D medical images (X-rays or mid-sagital MR images) used in clinical practices. Those methods will be used in combination with finite-element-based simulation methods developed within other ESR14 and 15 to develop a diagnosis and predictive tool for intervertebral disk degeneration.
  HOST: GALGO, Spain - Secondments: OULU; InSilicoTrials - PhD delivered by: UPF - Deadline for recruitment: January 2021
  SEE JOB OFFER & APPLY **- Deadline: ~~15/09/2020~~ – EXTENDED: 15/10/2020**
  https://www.upf.edu/documents/236182816/236664378/ESR5-Vacancies-Disc4All_GALGOv2.pdf/

- **ESR 6:** ***GWAS & Microbiome associated with main IVD phenotypes.***
  The ESR will provide initial seeds for gene prioritization as well as evidences about the validity of microbiome biomarkers in LDD, by exploiting the data from the TwinsUK and NFBC population cohorts. Candidate gene and GWAS-based approaches will be used to identify

novel associations between gene variants and a variety of spine phenotypes. Bioinformatic methods will be further used for general confirmation. In particular, DisGeNET and genetic correlation with known risk factors for LDD will be interrogated. Additionally, the ESR will seek to address the question of whether the gut microbiome differs in people with Modic change. To do this, we will leverage existing MR scans available and collect stools (by post) in a process that has become routine in TwinsUK.
HOST: KCL, United Kingdom - Secondments: IMIM, UPF - PhD delivered by: KCL - Deadline for recruitment: January 2021
SEE JOB OFFER & APPLY - Deadline: 01/11/2020
https://www.upf.edu/documents/236182816/236664378/ESR6-Vacancies-Disc4All_KCL.pdf/

- **ESR 7:** ***Experimental exploration of the microbiome in degenerated IVD***
  This doctoral research program will investigate the potential role of infective agents and the microbiome in low back pain. Utilising human intervertebral disc samples from surgery the IVD microbiome will be characterised together with associated microbiome sites using high throughput microbiome sequencing. In vitro co-culture systems will then be deployed to investigate the potential roles of infective agents and the microbiome on disc cell behaviour and implications in the pathogenesis of disc degeneration. Culture systems will be utilised which mimic the cellular niche of human intervertebral disc during disc degeneration.
  HOST: SHU, United Kingdom - Secondments: UBern; ULG - PhD delivered by: SHU - Deadline for recruitment: January 2021
  SEE JOB OFFER & APPLY - Deadline: 01/11/2020
  https://www.upf.edu/documents/236182816/236664378/ESR7-Vacancies-Disc4All_SHU-v3.pdf/

- **ESR 9:** ***Standardized in vitro static modelling & mechanism- based analyses of gene /protein /SNP at the cell /tissue & organ levels***
  The contribution will consist of standardized in vitro static modelling & mechanism- based analyses of gene /protein / SNP at the cell /tissue & organ levels. The research will be to test physiological conditions using different pre-clinical 3D culture models. Laboratory methods involve qPCR, Western blotting, ELISA, immune-histology and microscopy but also biomechanical testing.
  HOST: UBern, Switzerland - Secondments: SHU; IMIM; RIT - PhD delivered by: UBern - Deadline for recruitment: January 2021
  SEE JOB OFFER & APPLY - Deadline: 20/09/2020
  https://www.upf.edu/documents/236182816/236664378/ESR9-Vacancies-Disc4All_Unibe.pdf/

- **ESR 12:** ***In vitro & In silico modelling of CEP degeneration mechanisms***
  ESR12 will be using the mesofluidics setup available at the host institute to test bovine IVD endplates under different fluid regimes defined through FE simulations with endplate micromodels by other partners in the consortium. Experiments consist of testing various biological conditions in the set-up and monitoring the tissue response through multiplex (elisa) and multi-omics (transcriptomics & metabolomics) assays. These experiments will serve to gain a system-level understanding of the interactions taking place in the IVD endplates and validate the computational models developed by other partners in the project.

HOST: ULG, Belgium - Secondments: UBern; PAO; UPF - PhD delivered by: ULG - Deadline for recruitment: January 2021
SEE JOB OFFER & APPLY - Deadline: 31/10/2020
https://www.upf.edu/documents/236182816/236664378/ESR12-Vacancies-Disc4All_ULiege.pdf/

Common benefits

The MSCA programme offers a competitive salary and attractive working conditions, in accordance with the MSCA regulations for early stage researchers (See individual job offers).

You will be enrolled in the PhD programme of your hiring institution or of its academic partner, if the hiring institution is a company, and you will have the opportunity to learn from a consortium of 19 institutions (11 Beneficiaries, 8 Partner organizations - https://www.upf.edu/web/disc4all/beneficiaries). In addition to the individual scientific projects, all ESRs will benefit from further continuing education, which includes secondment to other institutions of the Consortium (see individual job offers), a variety of training courses for specific and transferable skills and active participation in international conferences.

In addition to the 36 months full-time employment contract and monthly salary (see individual job offers), successful candidates will be offered an additional mobility and family (if applicable) allowances (see individual job offers)

Eligibility criteria

a) To apply for these MSCA Training positions, applicants must fulfil the following criteria:

- Mobility: to be eligible for a position, you should not have resided in the country of the host institution for more than 12 months over the three years before the starting date of the position, excluding holidays and (refugee status) asylum application.
- Early Stage Researcher (ESR): At the time of recruitment by the host organisation, an ESR shall be in the first four years (full-time equivalent research experience) of his/her research career and not have been awarded a doctoral degree.

Candidates must prove that they fulfil the aforementioned criteria through relevant documentation (certificates, official statements, residency card, …).

b) Applicants will also be required to successfully complete the relevant local application process at the host institution, if applicable (see individual job offers)

c) Specific requirements (see individual job offers for detail):

- Educational Level: MSc degree or equivalent by the time of enrolment
- Required languages: English mandatory
- Skills/Qualifications: See individual job offers

- Eligibility to enrol in the PhD programme at the respective university (See individual job offers)

Selection Criteria

The selection committee uses a number of indicators to evaluate the applicant's preparedness, motivation and potential.

1st phase, remote pre-selection:

The Scientific, Technological & Academic excellence will be considered at first, based on:

- Quality of the CV, in general
- Any demonstrated research experience, particularly if supported by evidences such as scientific publications, patents, participation in scientific congresses, …
- Undergraduate performance: overall, with a special focus on relevant field-specific courses
- Any demonstrated previous recognitions (grants, awards, …)
- Reference letters provided by professors and senior scientists: Three refence letters are expected. At least two letters must be issued by scholars. The third letter can be provided either by a scholar or by a relevant professional of the industrial sector. Referees are asked to address analytical capabilities, technical proficiency, ability to work independently and motivation/commitment.
- Statement of purpose: past research experience, motivation for applying to this particular PhD project, academic fit, contribution of the project to the candidate's future careers plans, ...
- Additional relevant skills (field-specific): demonstrated, e.g. through previous projects, and or through previous participation in scientific contests, trainings, ...

2nd phase, interview(s):

Should the candidate be preselected at phase 1, a second phase will consist in at least one interview through which the motivation, the proactive behaviour, the capacity to work collaboratively, the organizational skills, the communication skills and the capacity to engage in a scientific discussion and manage problems, will be assessed, among other aspects.

The final decision will be the result of a consensus of an evaluation committee that will take into account the results of both recruitment phases 1 and 2. The candidate will be informed of the section results by email.

Application Process:

All the documents that prove the eligibility of the candidate and should be provided. As for the selection process candidates are expected to provide at least the following documents:

- A brief introduction letter (no more than one A4 page) that summarizes the documents and the nature of the information provided for the selection
- A full CV
- The three requested reference letters

- The letter of purpose (no more than two A4 pages)

All documents must be sent by email to the Principal Investigator of the proposed project (see individual job offers) and to the Management of the Disc4All project (disc4all@upf.edu) before the application deadline (see individual job offers)

IMPORTANT: Though mandatory, the aforementioned application process might have to be completed, in certain cases, by a formal institutional online application process as indicated by the hiring institutions (see individual job offers)