

CONVOCATORIA DE PRÁCTICAS INTERNACIONALES / CALL FOR INTERNATIONAL INTERNSHIP

CONVENIO CEBE 2021 / CEBE 2021 AGREEMENT

I. HOST APPLICANT INFORMATION

This person is responsible for signing the Learning Agreement, amending it if needed, supervising the trainee during the traineeship and signing the Traineeship Certificate.

Name	Jorge Barrasa Fano				
Position	PhD student				
Contact (e-mail, phone)	● —————				
Department/Faculty. Institution	Biomechanics section / Department of Mechanical Engineering / Faculty of Engineering Science / KU Leuven				
Organization Type (see annex I)	EPLUS-EDU-HEI				
Public body	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Non-Profit	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Size	<input type="checkbox"/> < 250 employees <input checked="" type="checkbox"/> >250 employees
Address; website	Celestijnenlaan 300 - bus 2419, 3001 Leuven; https://www.mech.kuleuven.be/en/bme/research/mechbio				

II. PROJECT DESCRIPTION

Description of the project that will be done by the student-trainee at the host institution.

Wished period for mobility ⁽¹⁾ : from (day/month/year) 01/06/2021. to (day/month/year) 30/12/2021
1. Project title: Development of software for accessing cell mechanical information in 3D in vitro models
2. Number of working hours per week: 13 35 hours per week

3. Detailed programme of the traineeship ⁽²⁾ (max. 300 words):

Cellular behavior is not only regulated by bio-chemical processes. Cells are affected also by their mechanical microenvironment. For example, stem cells can differentiate into tissue-specific cells depending on the stiffness of the extracellular matrix (ECM)¹. Moreover, cells also actively exert forces to shape their environment and perform their (mal)function under physiological as well as pathological conditions. For example, cancer cells can migrate away from the primary tumor causing metastasis by applying pulling forces on the surrounding collagen fibers². Seeking physiological relevance, biologists often select three-dimensional in vitro models to study cell behavior. Typically, cellular forces are computed by means of Traction Force Microscopy (TFM). TFM is a multidisciplinary technique that requires cell culturing, microscopy imaging, image processing and mechanical modelling. Initially, TFM was developed for 2D cultures and currently being extended to be compatible with 3D in vitro cultures. Until now, there were no 3D TFM software tools that can simultaneously guarantee accurate force calculation and easy usability by non-technical users.

In the last years, our lab has developed 2D TFM routines³. More recently, we have recently developed an open source, user-friendly Matlab toolbox called TFMLAB that integrates all the necessary computational steps for 3D TFM⁴. However, while the current trend is to move towards 3D in vitro cultures, 2D cultures are still used in many labs due to their simplicity and lower cost. The goal of this project is to integrate our existing 2D TFM routines within TFMLAB to further extend the potential of this toolbox. At the same time, the trainee must focus on guaranteeing ease of use by non-technical users and optimize the computational efficiency of the workflows.

References

1. Engler et al *Cell* (2006)
2. Kopanska et al *PLoS One* (2016)
3. Izquierdo-Alvarez et al *Ann. Biomed. Eng.* (2019)
4. Barrasa-Fano et al *bioRxiv* (2020)

4. Knowledge, skills and competences to be acquired by the end of the traineeship (expected Learning Outcomes)(max 100 words):

While the focus of this project will lie on the software development skills of the trainee, he/she will work in a multidisciplinary research group, with expertise on cell culture labs, microscopy imaging, image processing and computational mechanics. The exposure of the trainee to this working environment will provide substantial knowledge on these fields and at the same time, will enrich the trainee's team-work competences and presentation skills (see Monitoring plan).

5. Monitoring plan (max 100 words):

The work of the trainee will be monitored by establishing weekly meetings (subject to the progress of the trainee's work) either physically or via Microsoft Teams. Rapid daily communication will be done via a Slack channel within our group's workspace. Moreover, the trainee will present his/her progress periodically in the group's meetings (typically, every 5-6 weeks).

During the 7 months of traineeship, the student will follow a work plan:

- June-July: familiarization with the TFM methodology, codes and existing algorithms.
- August-October: integration of the 2D TFM routines into TFMLAB
- November-December: code testing, debugging and ensuring user friendliness of the software.

6. Evaluation plan (max 100 words):

The trainee will be evaluated based on:

- *Continuous* monitoring of his/her work (30%). The trainee's progress will be monitored weekly both to provide help and to evaluate the quality of his/her work. The trainee's daily work and creative input will be valued positively. His/her oral presentation skills and contribution to scientific discussions will also be evaluated during the weekly group meetings.
- *Final* evaluation of his/her work (70%). The trainee must deliver a fully integrated and optimized version of the TFM codes. Moreover, he/she will write a short report summarizing the work throughout the traineeship.

7.a. Impacts and benefits of the traineeship to the host applicant (max 100 words):

While most of the software routines have already been developed, the integration of different toolboxes into one unique and standardized TFM software tool while maintaining its user friendliness is a crucial step to make TFMLAB widely usable. Currently, there are no such software tools in the state of the art. Thus, the host will benefit from an exclusive tool to be used in the lab but also to be offered to other research groups, opening doors for future scientific collaborations.

7.b. Impacts and benefits of the traineeship to the trainee (max 100 words):

The trainee will be exposed to a working in a multidisciplinary environment with expertise on cellular biology, microscopy imaging, image processing and mechanical modelling. At the same time, he/she will be involved in the activities of a research group, getting insight from scientific discussions and the way research works in a lab.

Moreover, our group will use this software tool to analyze our microscopy data and will eventually be part of scientific publications. Therefore, this traineeship could also be an

opportunity for the trainee be a co-author in a scientific publication, which would strongly enrich his/her CV.

III. STUDENT PROFILE AND REQUIREMENTS

This section refers to specific knowledge or expertise that the student/trainee must have in order to proceed successfully with the proposed project.

8. Research Area (see annex II): Biomedical engineering / Computer engineering / Computer engineering and Mathematics / Electrical Engineering		
9. Is the host applicant / scientific supervisor willing to evaluate the project performance so that the student could validate the traineeship as ECTS credits (3):	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
10. Student required expertise and technical knowledge: strong expertise in computer programming with Matlab and some notions of image/signal processing		
11. Level of studies: Master studies		
12. Language: English		
(4) The level of language competence in <u>English</u> _____ (indicate here the main language of work that the trainee already has or agrees to acquire by the start of the mobility period is: A1 <input type="checkbox"/> A2 <input type="checkbox"/> B1 <input type="checkbox"/> B2 <input type="checkbox"/> C1 <input checked="" type="checkbox"/> C2 <input type="checkbox"/> Native speaker <input type="checkbox"/>		
13. Does the host institution require any other language besides the language of work?	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	Which one?:
14. Does the host institution require any further paperwork done or any other relevant information to host a student/trainee (under the condition of this programme)	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	14. A If YES, please detail:

IV. Consent to publish Traineeship Data.

I agree that my name, title of the project, its duration and the name of the Receiving Institution / Enterprise can be published on the CEBE website as awarded supervisor of the Traineeship Programme 2020.

- (1) a) Related to UAM: A minimum of 2 months and up to 4 months (only the first 3 are funded). The planned period in this call should be between 1st of June 2020 and 30th of December of 2021. After the matching of host candidates with students and by mutual agreement between the two parties, the exact dates can be changed and the total stay could be prolonged up to 6 months; b) Related to UCLM: A minimum of 2 months and up to 4 months (all 4 months are funded). The estimated start date of the internship is 1st July and can be extended up to a total of 12 months.
- (2) Consider that this must be read by the selection committee but also by the students, who will apply to the project.
- (3) If NO, only students who will not validate the project as ECTS credits will be assigned for matching with this applicant. The application to validate the project as ECTS credits will come exclusively from the student.
- (4) Level of language competence: a description of the European Language Levels (CEFR) is available at: <https://europass.cedefop.europa.eu/en/resources/european-language-levels-cefr>

Annex I: List of Organisation Types

CODE	Organisation type
EPLUS-EDU-HEI	Higher education institution (tertiary level)
EPLUS-EDU-GEN-PRE	School/Institute/Educational centre – General education (pre-primary level)
EPLUS-EDU-GEN-PRI	School/Institute/Educational centre – General education (primary level)
EPLUS-EDU-GEN-SEC	School/Institute/Educational centre – General education (secondary level)
EPLUS-EDU-VOC-SEC	School/Institute/Educational centre – Vocational Training (secondary level)
EPLUS-EDU-VOC-TER	School/Institute/Educational centre – Vocational Training (tertiary level)
EPLUS-EDU-ADULT	School/Institute/Educational centre – Adult education
EPLUS-BODY-PUB-NAT	National Public body
EPLUS-BODY-PUB-REG	Regional Public body
EPLUS-BODY-PUB-LOC	Local Public body
EPLUS-ENT-SME	Small and medium sized enterprise
EPLUS-ENT-LARGE	Large enterprise
EPLUS-NGO	Non-governmental organisation
EPLUS-FOUND	Foundation
EPLUS-SOCIAL	Social partner or other representative of working life
EPLUS-RES	Research Institute/Centre
EPLUS-YOUTH-COUNCIL	National Youth Council
EPLUS-ENGO	European NGO
EPLUS-NET-EU	EU-wide network
EPLUS-YOUTH-GROUP	Group of young people active in youth work
EPLUS-EURO-GROUP-COOP	European grouping of territorial cooperation

EPLUS-BODY-ACCRED	Accreditation, certification or qualification body
EPLUS-BODY-CONS	Counselling body
EPLUS-INTER	International organisation under public law
EPLUS-SPORT-PARTIAL	Organisation representing the sport sector
EPLUS-SPORT-FED	Sport federation
EPLUS-SPORT-LEAGUE	Sport league
EPLUS-SPORT-CLUB	Sport club

Annex II: Research Areas

Area of knowledge	University
Agricultural and agri-food engineering	Universidad Castilla La Mancha
Aerospace engineering	Universidad Castilla La mancha
Biochemistry	Universidad Autónoma de Madrid, Universidad Castilla La mancha
Biology	Universidad Autónoma de Madrid
Biomedical engineering	Universidad Castilla La Mancha
Chemical Engineering	Universidad Autónoma de Madrid, Universidad Castilla La mancha
Chemistry	Universidad Autónoma de Madrid, Universidad Castilla La mancha
Computer Engineering	Universidad Autónoma de Madrid, Universidad Castilla La mancha
Computer Engineering and Mathematics	Universidad Autónoma de Madrid
Electrical Engineering	Universidad Castilla La mancha
Environmental Sciences	Universidad Autónoma de Madrid, Universidad Castilla La mancha
Food Science and Technology	Universidad Autónoma de Madrid, Universidad Castilla La mancha
Forestry and environmental engineering	Universidad Castilla La mancha
Human nutrition and dietetics	Universidad Autónoma de Madrid
Industrial and automatic electronics engineering	Universidad Castilla La mancha
Mathematics	Universidad Autónoma de Madrid
Mechanical engineering	Universidad Castilla La mancha
Medicine	Universidad Castilla La mancha
Nursing	Universidad Castilla La mancha
Pharmacy	Universidad Castilla La mancha
Physics	Universidad Autónoma de Madrid
Physiotherapy	Universidad Castilla La mancha