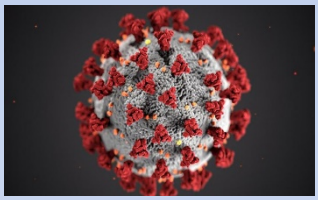
3
April-June 2020

CURABONE

Predictive models and simulations in bone regeneration: a multiscale patient-specific approach

Managing a MSCA-ITN project during the COVID-19 pandemic



The **Research Executive Agency** (REA), responsible for the management of the **Marie Sklodowska-Curie Actions** (MSCA), has provided all **Innovative Training Networks** (ITN) Coordinators with general information on how to handle the **COVID19** pandemic within MSCA projects, and their main message is clear:

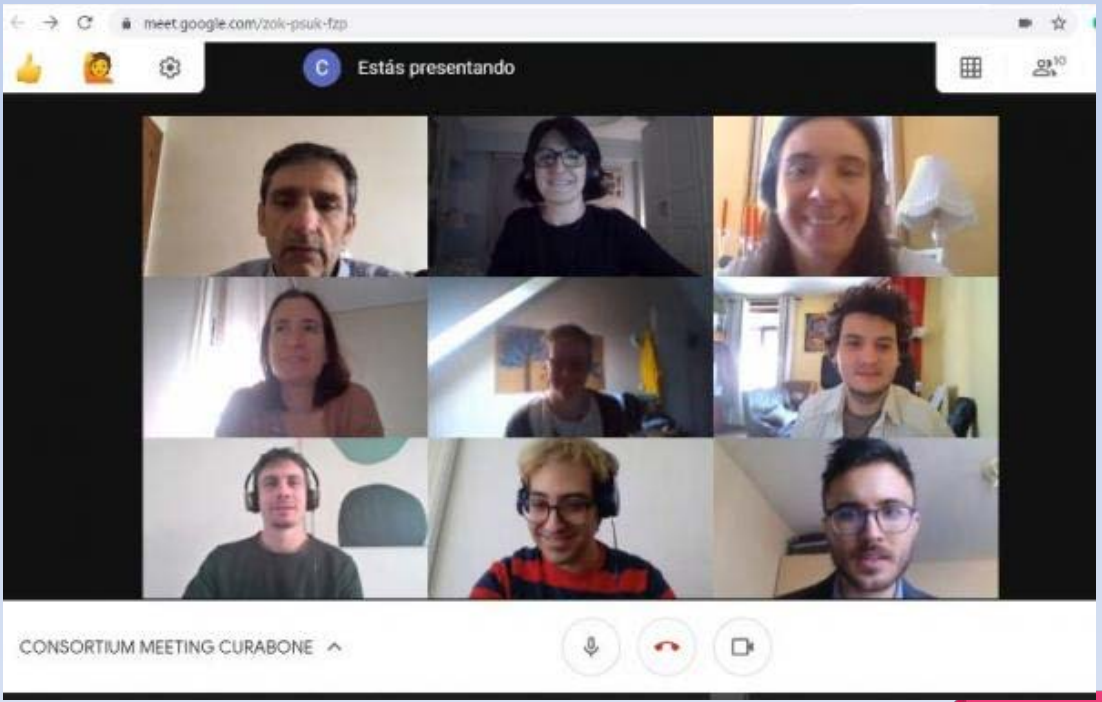
The REA is aware of the possible implications that the COVID-19 outbreak could have on the implementation of MSCA projects, so Coordinators and beneficiaries alike should decide on the course of action themselves. The REA recommends that institutional and national schemes should be followed, and should the current situation prevent the fulfilment of obligations laid down in the grant agreement, the REA may adopt a flexible approach and apply the rules on force majeure foreseen.

Of all Horizon 2020 funded projects, ITNs are especially affected by the COVID-19 pandemic as **international mobility** is a vital part of the training programme. Many meetings and trainings have had to be cancelled or postponed and secondments cannot take place as planned.

Many uncertainties arise but in **Curabone** we keep on working, facing all these new challenges and constraints with good spirit.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 722535.

VIRTUAL CONSORTIUM MEETING



Due to Covid-19 situation, we held our Consortium Meeting online on May the 13th. It was a very productive meeting. The difficult circumstances couldn't prevent us from working, reviewing and planning together.

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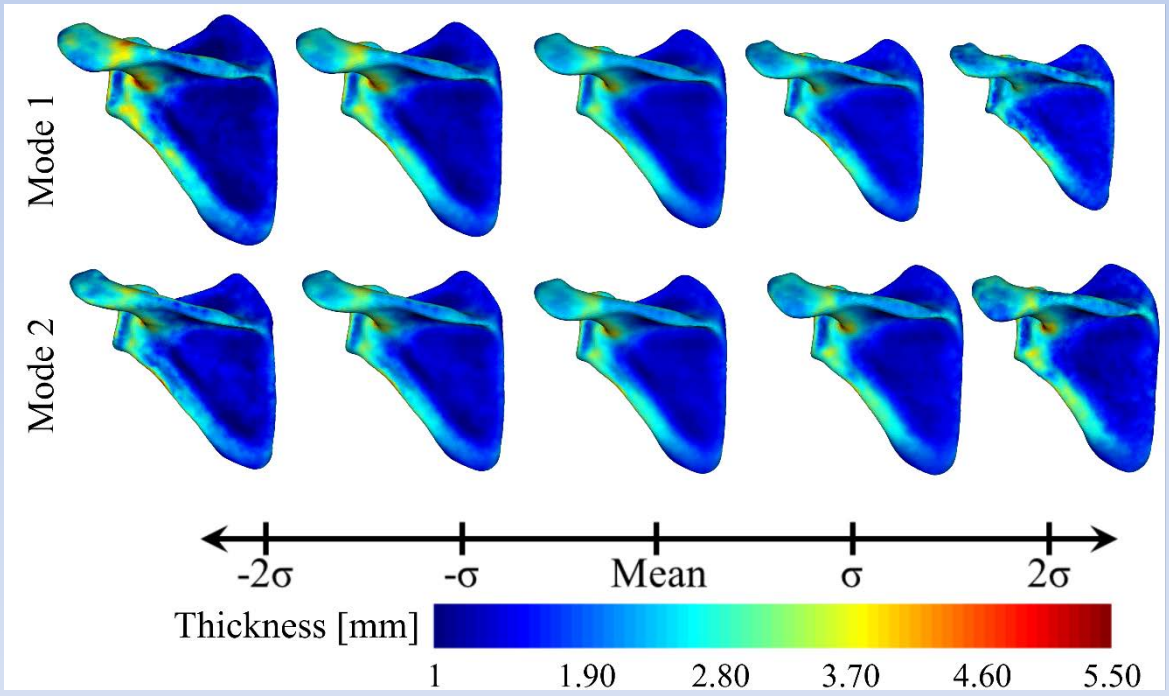
DISSEMINATION

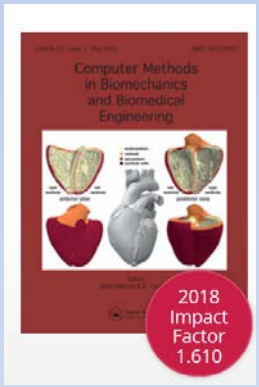
Here are some activities carried out in the second quarter of 2020. Unfortunately, the current situation resulting from the expansion of the coronavirus has severely affected the development of the foreseen dissemination activities.

Publication of ESR 2, Jonathan Pitocchi

We are happy to share the publication at **Computer Methods in Biomechanics and Bioengineering** of the manuscript **Integration of cortical thickness data in a statistical shape model of the scapula.** Jonathan Pitocchi, Roel Wirix-Speetjens, G. Harry van Lenthe & María Ángeles Pérez. Link to the publication

"Knowledge about bone morphology and bone quality of the scapula throughout the population is fundamental in the design of shoulder implants. In particular, regions with the best bone stock (cortical bone) are taken into account when planning the supporting screws, aiming for an optimal fixation. As an alternative to manual measurements, Statistical Shape Models (SSMs) have been commonly used to describe shape variability within a population. The main contribution of the paper is a novel methodology for automatically generating a large population of scapulae and deducing statistics on the cortex, thus allowing for automating implant design and screw placement in shoulder arthroplasty."





Shape and cortical thickness variation in the first two modes of variations. For mode 1 (top), when passing from a large scapula (-2σ) to a small scapula (+2σ), a decrease in cortical thickness is visible. Mode 2 (bottom) shows a variation in the glenoid inclination and acromion orientation, with no visible relation to the cortical values."

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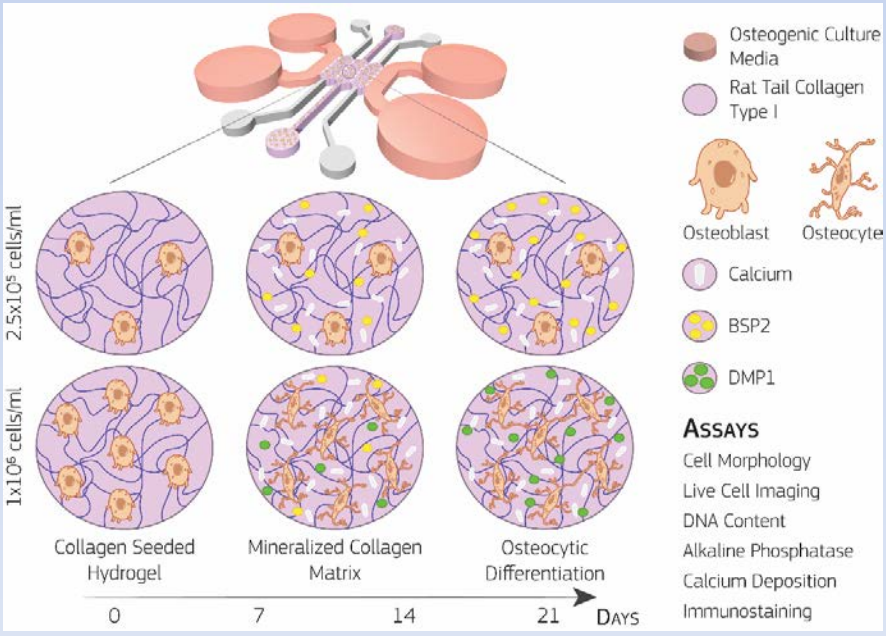
Publication of ESR 4, Gabriele Nasello

We are also happy to share the publication at **Frontiers in Bioengineering and Biotechnology** of the manuscript **Primary Human Osteoblasts Cultured in a 3D Microenvironment Create a Unique Representative model of Their Differentiation Into Osteocytes**. Gabriele Nasello, Pilar Alamán-Díez, Jessica Schiavi, María Ángeles Pérez, Laoise McNamara and José Manuel García-Aznar. Link to the publication

"Microengineered systems provide an in vitro strategy to explore the variability of patient individual response to tissue engineering products, since they favour the use of primary cell sources representing the phenotype variability. Traditional in vitro systems already showed that primary human osteoblasts embedded in a 3D fibrous collagen matrix differentiates into osteocytes under specific conditions. Here, we hypothesized that translating this environment to the microfluidic scale creates a minimal functional unit to recapitulate osteoblast maturation towards osteocytes and matrix mineralisation. Primary human osteoblasts were seeded in a type I collagen hydrogel, to establish the role of lower (2.5x10^5 cells/ml) and higher (1x10^6 cells/ml) cell density on their differentiation into osteocytes. A custom semi-automatic image analysis software was used to extract quantitative data on cellular morphology from brightfield images. The results are showing that cells cultured at a high density increase dendrite length protrusions over time, stop proliferating, exhibit dendritic morphology, upregulate alkaline phosphatase (ALP) activity and express the osteocyte marker dental matrix protein 1 (DMP1). On the contrary, cells cultured at lower density proliferate over time, do not upregulate ALP and express the osteoblast marker bone sialoprotein 2 (BSP2) at all timepoints. Our work reveals that microengineered systems create unique conditions to capture the major aspects of osteoblast differentiation into osteocyte with a limited number of cells. We propose that the microengineered approach is a functional strategy to create a patient-specific bone tissue model and investigate the individual osteogenic potential of the patient bone cells."



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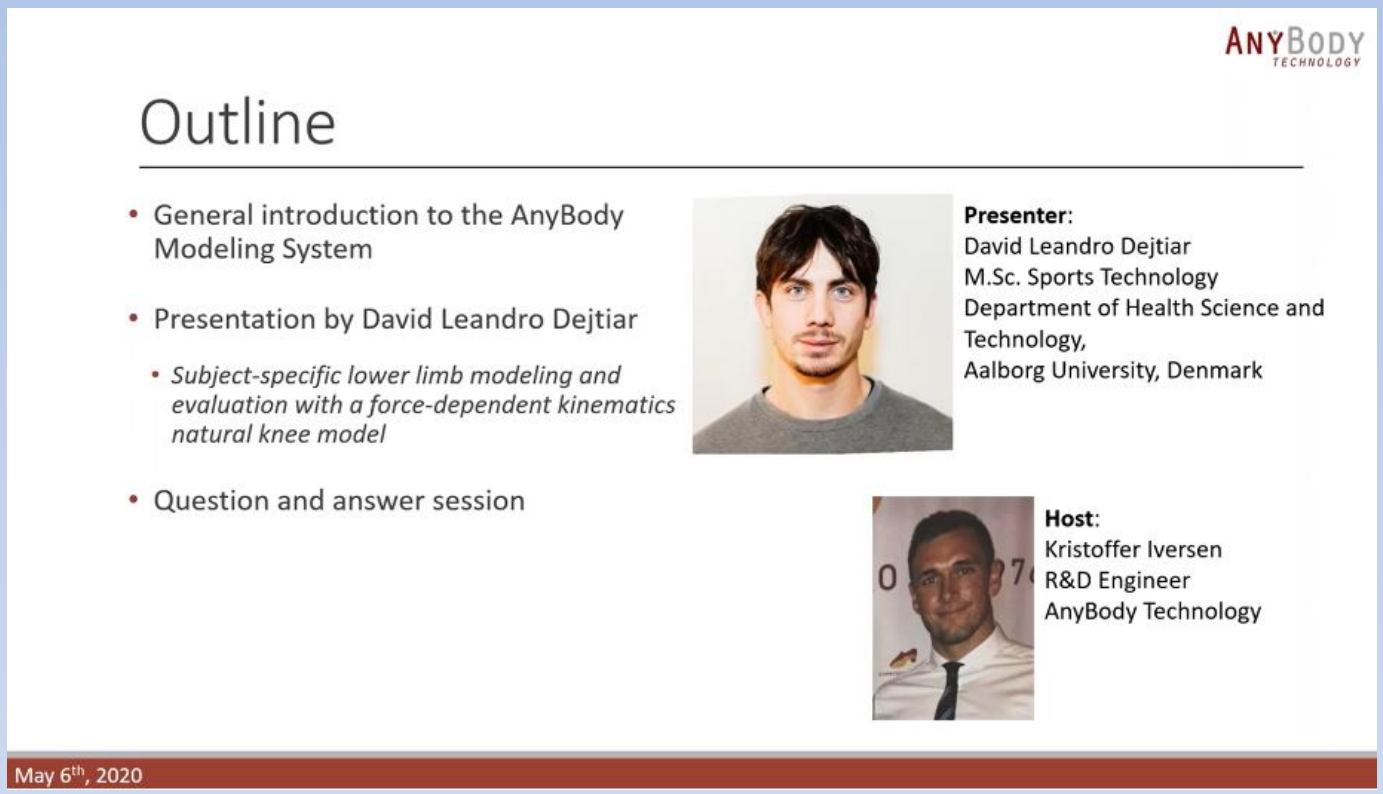
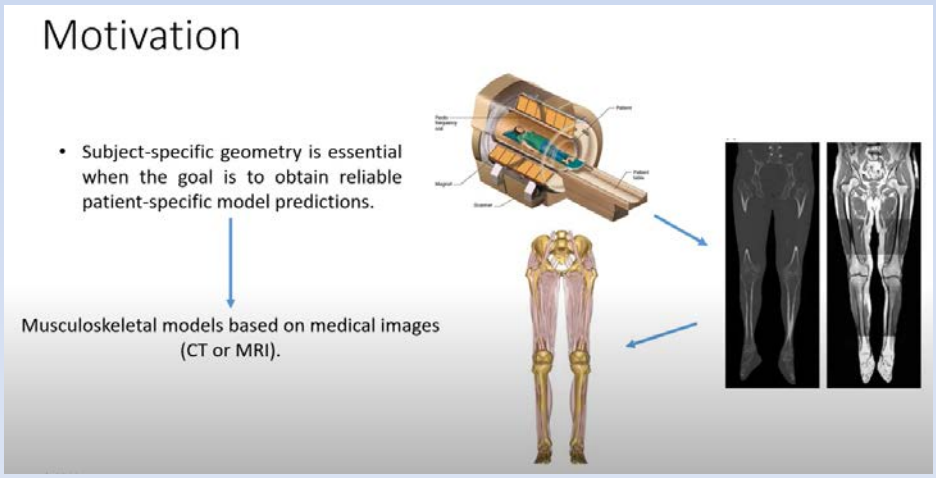
Webinar by ESR 6 David Leandro Dejtiar

Dissemination is also possible using exclusively online tools: our ESR David Leandro Dejtiar held a webinar on **how to create a specific musculoskeletal model of the subject from magnetic resonance images and simulate knee biomechanics in detail, along with a clinical application**.

link to the webinar (english)
link to the webinar (spanish)





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OUTREACH: VIDEO

We are currently producing a video explaining the Curabone Project and the Research work carried out by all the ESRs and will soon launch it. Because **“Science isn’t’ finished until it’s communicated”.**

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