HERIOT WATT UNIVERSITY | IMPEE Lecture Series

Mechanobiology of bone regeneration in osteoporotic conditions

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Abstract: Fragility fractures are the main consequence of osteoporosis, the most prevalent bone disease, and occur without a prior diagnosis in up to 80% of cases. The healing of these fractures often involves major complications in osteoporotic patients, including delayed healing and non-union. In such challenging clinical scenarios, bone transport—based on the principle of distraction osteogenesis—is considered a gold-standard treatment. Despite the potential of distraction osteogenesis and the high prevalence of fragility fractures among elderly patients, knowledge of this bone regeneration process under osteoporotic conditions remains very limited. This research addresses this knowledge gap by employing a distraction osteogenesis model to treat a surgically created critical-size bone defect in the metatarsus of osteoporosis-induced sheep. The osteoporotic woven bone tissue formed within the distraction callus has been analysed using different approaches, including in vivo experiments (CT and X-ray follow-up, callus viscoelastic relaxation, and gait analysis), ex vivo characterisation (Raman spectroscopy, nanoindentation testing, micro-CT, and chemical composition analysis among other techniques), and in silico finite element modelling based on CT data

Biography: Juan José Toscano Angulo is a final-year PhD student at the University of Seville (Spain). He obtained a BEng in Mechanical Engineering and a MSc in Industrial Engineering from the University of Huelva (Spain) between 2014 and 2021. In 2021, he joined the Department of Mechanical Engineering and Manufacturing at the University of Seville as a research assistant, providing technical support for projects in biomechanics and mechanobiology. In 2022, he began his PhD thesis in the same department under the supervision of Dr Esther Reina Romo and Dr Juan Mora Macías, within the Mechanobiology Lab research group. His research mainly focuses on the mechanobiological influence of osteoporosis on the bone regeneration process. His highly multidisciplinary work involves close collaboration with clinicians and veterinary teams as well as and different engineering departments.

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Time: 14:00-15:00

Location: JN1.16