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Simulating the structure of soft human tissue with advanced engineering materials for surgical training

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Virtual experiments could soon be helping new surgeons hone their skills before they start work with live patients. This is the exciting research objective of European Research Council (ERC) fellow Stéphane Bordas, a Professor of Computational Mechanics who joined the University of Luxembourg at the end of 2013.

Stéphane Bordas, along with collaborators at Cardiff University in the UK, was awarded a prestigious 1.3 million euro Starting Grant from the ERC in 2012 for this project. He is now continuing his research at the University of Luxembourg, bringing to this country the first ERC grant since the creation of the University.

Bordas' long term aim is to develop real-time simulators, akin to flight simulators, which will help train surgeons, assist them during operations and contribute to enhancing surgical planning. By constructing virtual, 'in silico' replicas of the patients, such tools have the potential to reduce errors and post-operative complications and could eventually lead to robot-assisted and robot-led surgery.

The project itself is entitled "RealTcut" (reality cut) and was born from the realisation of similarities between the structure of soft human tissue and that of advanced engineering materials such as those developed for the aerospace industry."The ultimate goal is to be able to simulate surgical cutting for the first time in quasi real time, thereby allowing

trainee surgeons to hone their skills in a virtual environment before beginning work with live patients,"explains Bordas.

The main challenge of the research is to enable both realistic and real-time simulation of phenomena such as cutting in soft tissue and which are, today, still poorly understood. Bordas is hopeful that this research project, which runs until 2017, and has already led to the first real-time error controlled simulator of cutting in soft tissue, will bring substantial fundamental advances as well as medical and industrial benefits.

Provided by University of Luxembourg