Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

TRINITY CENTRE FOR BIOENGINEERING SEMINAR SERIES 2018

Optimizing the Performance of Endovascular Stents: Cells, Vessels, and Connected Devices

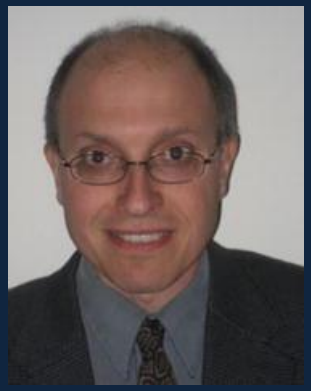
Speaker: **Abdul Barakat, CNRS Director of Research - Hydrodynamics Laboratory(LadHyX), AXA Professor of Mechanics and Biology, Ecole Polytechnique, FRANCE**

When: **4pm, Friday 7th of December 2018**

Where: **B2.36 – B2.38, Trinity Biomedical Sciences Institute**

The pathological complications of atherosclerosis, namely heart attacks and strokes, are the leading cause of mortality in the world. The most common treatment for atherosclerosis is the implantation of a stent, a wiremesh structure that is deployed on a balloon catheter and expanded at the location of arterial obstruction to restore blood flow. Most stents deployed in coronary arteries today are drug-eluting stents (DES) that release a drug into the arterial wall in a controlled manner in order to prevent the occurrence of certain complications. However, despite the widespread use of DES, there is a persistent risk of serious complications including instent restenosis (vessel re-blockage), late stent thrombosis (blood clot formation), and stent fracture.

Minimizing the incidence of these complications requires devising optimal DES designs that strike a fine balance among a myriad of competing considerations including drug release dynamics, stent strut dimensions, and stent surface characteristics that accelerate device cellular coverage. In this talk, I will describe a multivariable optimization approach to optimize DES design. I will also present a stentable coronary artery mimic that we have developed in order to experimentally test the predictions of the computational optimization. This arterial mimic contains the relevant cells of the arterial wall and allows cellular monitoring as well as detailed characterization of arterial flow fields using particle image velocimetry. Finally, I will describe two novel approaches for radically improving stent performance: 1) patterning stent surfaces to accelerate device cellular coverage, and 2) developing smart and communicating stents that can detect the onset of stent restenosis or thrombosis and communicate the information wirelessly to the outside world.



Abdul Barakat is CNRS Director of Research and the AXA Endowed Professor of Mechanics and Biology at Ecole Polytechnique in France. He is also an adjunct professor of Mechanical and Manufacturing Engineering at the University of New South Wales in Sydney, Australia. Prof. Barakat obtained a Ph.D. in biofluid mechanics from MIT in 1994. He subsequently spent a year as an NIH Postdoctoral Fellow at the University of Chicago. In 1995, he was recruited as Assistant Professor in the Department of Mechanical and Aerospace Engineering at the University of California, Davis. He was promoted to Associate Professor in 2001 and to Full Professor in 2006. At UC Davis, he was also on the faculty of the Biomedical Engineering, Biophysics, and Applied Mathematics graduate programs. He relocated to France in 2010. In 2014, Prof. Barakat co-founded the startup company Sensome (previously Instent), which develops state-of-the-art sensor technologies to equip medical devices. Prof. Barakat is a recipient of a Pfizer-Parke Davis Atorvastatin Research Award as well as a permanently endowed Chair from the AXA Research Fund and is an elected Fellow of the American Institute for Medical and Biological Engineering. He has published over 230 peer-reviewed journal and conference papers and has delivered over 130 invited presentations in the fields of cardiovascular bioengineering, cellular mechanobiology, and endovascular devices.