



Western University
Department of Physics and Astronomy

PHYSICS & ASTRONOMY COLLOQUIUM

Date: **Thursday, 18 March 2021**

Time: **1:30 p.m.**

via Zoom: <https://westernuniversity.zoom.us/j/93847279873?pwd=ZlB6Nkr0Y0Ztc2t0WmV6WmpsUU5lQT09>

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“Physics of cell mechanics: Cells, cell division and spreading of cancer cells from the mechanobiological perspective”

ABSTRACT

In cells, cytoskeleton and the cellular membrane provide cells with physical boundaries, integrity and rigidity. Their properties are fundamental to understanding cell division, cancer growth, drug delivery and a plethora of other fundamental processes. Importantly, these phenomena occur over a wide range of time and length scales. In this talk, I will discuss modeling of cells in these different length scales. Special focus will be on cytoskeleton and cell division.

The cytoskeleton is perhaps the most spectacular example of filament networks: It allows for cell division to occur by dynamically adjusting the degree of cross-linking (by molecular motors) depending on the degree of external and internal stresses. We discuss a full three-dimensional model that includes molecular motors and demonstrate that filament networks show formation of stress fibres, strain hardening, aster formation and that they display a texture dependent secondary stiffness transition. We demonstrate that from a mechanistic point of view, cell division does not require polymerization. Such systems are inherently multiscale and we demonstrate that our model captures the relevant phenomena.

For cell division, I'll focus on the importance of mechanical properties and how they influence, e.g., spreading of cancer cells in healthy tissue. I will also discuss our efforts in building the CellSim3D software that uses GPUs and is capable of performing million cell simulations.

Host: **Prof. R. J. Sica**