Tuesday the 06 November 2018 at 10:00
Politecnico di Torino, DISMA, Aula Buzano (third floor)

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Cancer, immune system and therapies: insights from mathematical modelling

Prof. Davide Carlo Ambrosi introduces the seminar

Abstract

Different mathematical models of multicellular systems are developed from an evolutionary viewpoint, and several applications related to biology and medicine are carried out. Examples are the study of tumour cells dynamic, the role of specific therapeutic agents, the action of the immune system, the competition between tumour cells and the immune system, and the resistance to therapies. The mathematical formalism covers different tools according to biology problems: population dynamics (ordinary differential equations), structured populations (integrodifferential equations), Agent-Based Models (ABM) and Hybrid Models (delay differential equations and ABM).

The first part of the talk involves the modelling of tumour resistance to therapies concerning different clonal composition and the action of the immune system. Different types of treatments, schedules and doses, applied to various types of cancer, are analysed to increase their effectiveness. Dr Piretto will show a calibration of the model from biological data, and an interpretation of the results will be presented using the model as an "in silico" laboratory, [1, 2]. Computational techniques are used to obtain the best-personalised protocol. The second part of the talk focuses on the problem of clonal mutations during cancer development, with particular attention to the relation between the morphology of a tumour and the emerging behaviours. Some applications of the model will be proposed on the "abscopal effect". This rare effect, in which the radiotherapy elicits the immune response, is controversial and poorly understood. The study suggests and supports a new interpretation of this effect based on the mutation characteristics of cancer cells in relation to the immune system, [3].

1. E. Piretto, M. Delitala, and M. Combination. Journal of Theoretical Biology, 446:149-159, 2018.
2. E. Piretto, M. Delitala, and M. Ferraro. Letters in Biomathematics, 2018.
3. E. Piretto, M. Delitala, P.S. Kim, and F. Frascoli. Preprint, 2018.

Biography

Elena Piretto obtained her Master Degree in Physics of Complex Systems (2015) at the Università degli Studi di Torino with the thesis: *Irreversibility in the direct cascade of enstrophy*, under the supervision of Prof. Guido Boffetta and Dr Stefano Musacchio. Currently, she is finishing her PhD program in Pure and Applied Mathematics at the Universittà degli Studi di Torino and Politecnico di Torino under the supervision of Prof. Marcello Delitala. She is also enrolled in a Partner PhD with the Swinburne University of Technology, Melbourne, AU, under the supervision of Dr Federico Frascoli. Her principal interest is in the mathematical modelling of biological systems and specifically tumour growth dynamics with the interaction of the immune system.

Save the date for the next event: November 13, 2018   *More info on www.polito.it/disma-excellence*