



**POLITECNICO
DI TORINO**

DISMA Dipartimento di
Scienze Matematiche
G. L. Lagrange
ECCELLENZA 2018 • 2022

Wednesday the **13 June 2018** at 11:00
Politecnico di Torino, DISMA, Aula Buzano (third floor)

Federico FRASCOLI

Senior Lecturer in Applied Mathematics at Swinburne University of Technology

Models of tumour-immune dynamics for therapies targeting small cancers

Prof. Lamberto Rondoni moderates the discussion

Abstract

Recent advances have opened the possibility of treating some cancers by developing preventative vaccines. Such cancer vaccines would function by training a person's immune response to recognise and eliminate early-stage tumours close to inception, by producing a memory population of immune cells against certain tumour-associated substances, called antigens. A challenge to designing preventative cancer vaccines is understanding the tumour-immune dynamics that leads to successful tumour elimination by the immune response.

In this talk, Dr Frascoli will discuss some original approaches to model this dynamics. One example will be an analytically solvable ODE (toy-) model of tumour-immune dynamics for small, solid tumours. From the mathematical point of view, this approach shows the importance of tumour geometry in shaping immune effectiveness and the likelihood of eliminating the tumour. Some findings also reveal that the tumour volume must surpass a threshold size for cancer to be completely eliminated and that a tumour can become dormant if deeply infiltrated by immune cells. A second example will be a hybrid system consisting of a partial differential equation, a delay-differential equation and an agent-based model. The system describes the vicinity of a developing tumour and the draining lymph node, where immune cells originate. This model accounts for tumour adhesion and motility properties of cancer cells, using a probabilistic framework. Results show that adhesion and motility influence therapeutic outcomes in a complicated and often unpredictable way. Finally, some snapshots of other modelling approaches for related immune-tumour scenarios and therapies will conclude the talk.

Biography

After a Laurea in Theoretical Physics from the University of Parma in 2001 and 3-year experience in the metrological industry in hometown Modena, Federico Frascoli moved to Melbourne and obtained his PhD in Mathematical Physics from Swinburne University of Technology in 2007. He was then a Postdoctoral Fellow in computational neuroscience at the Brain Sciences Institute in Melbourne, in 2007-2011, with Prof. David Liley and a Postdoctoral Researcher in mathematical biology in the Department of Mathematics, at the University of Melbourne, in 2011-2013, with Prof. Kerry Landman and Prof. Barry Hughes. He became a Lecturer in Applied Mathematics at Swinburne in 2013 and has been a Senior Lecturer since 2016. His primary research interests lie in systems out of equilibrium, in a variety of different contexts, including cellular motility, nano-confined fluids, immune-cancer dynamics and brain oscillations.

Save the date for the next event: Wednesday the 20th of June 2018