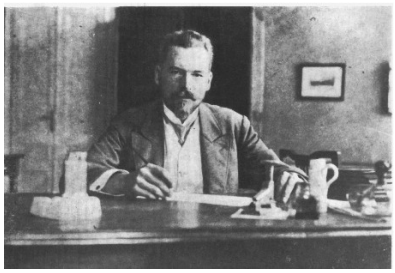

Contribution ID: **4** Type: **Talk**

Competition between cancer and immune system cells in an inhomogeneous system: A thermostatted kinetic theory approach

Thursday, September 19, 2019 10:20 AM (20 minutes)

The treatment of cancer by boosting the immune system is a recent and promising therapeutic strategy. During interactions, the immune system cells learn to recognize cancer cells. Analogously, the cancer cells can develop the ability to blend into the surrounding tissue and mislead the immune system cells.

I will present a model of cell interactions in the framework of thermostatted kinetic theory [1,2]. Cell activation, learning processes, and memory loss due to cell death are reproduced by regulating the cell activity introduced in the model. By analogy with energy dissipation in a mechanical system, the control of the activity fluctuations is achieved by a so-called thermostat. Proliferation of cancer cells is reproduced by autocatalytic processes. For each cell type, I will write down the thermostatted kinetic equations for the distribution functions of position, velocity, and activity and explain how the direct simulation Monte Carlo (DSMC) method has been adapted to solve them.

The numbers and activities of cancer cells and immune system cells are followed for different initial distributions of cells. The effect of the thermostat on cancer evolution will be compared to unexplained clinical observations. I will show that the model is able to reproduce an apparent elimination of the tumor preceding a long period of equilibrium, eventually followed by the proliferation of the cancer cells, according to a process identified as “the three E’s” of immunoediting, for “Elimination, Equilibrium and Escape” [3,4].

1. C. Bianca and A. Lemarchand, Commun. Nonlinear Sci. Numer. Simul. 20, 14 (2015).
2. C. Bianca, C. Dogbe, and A. Lemarchand, Acta Appl. Math. 189, 1 (2015).
3. C. Bianca and A. Lemarchand, J. Chem. Phys. 145, 154108 (2016).
4. L. Masurel, C. Bianca, and A. Lemarchand, Physica A 506, 462 (2018).

Summary

Primary author: Dr LEMARCHAND, Annie (Sorbonne Université, CNRS)

Co-author: Mr MASUREL, Léon (Sorbonne Université)

Presenter: Dr LEMARCHAND, Annie (Sorbonne Université, CNRS)

Session Classification: Session 2