

*Ninth Workshop Dynamical Systems Applied  
to Biology and Natural Sciences DSABNS 2018  
Turin, Italy, February 7-9, 2018*

# DELAYED NONLOCAL REACTION-DIFFUSION MODEL FOR HEMATOPOIETIC STEM CELL DYNAMICS WITH DIRICHLET BOUNDARY CONDITIONS

Mostafa Adimy, Abdennasser Chekroun\* and Toshikazu Kuniya

Inria, Université de Lyon, Institut Camille Jordan, Villeurbanne, France.

Laboratoire d'Analyse Nonlinéaire et Mathématiques Appliquées, Université de Tlemcen,  
Algeria.

Graduate School of System Informatics, Kobe University, Japan.

mostafa.adimy@inria.fr, chekroun@math.univ-lyon1.fr (\*corresponding author) and tkuniya@port.kobe-u.ac.jp

The talk will focus on the mathematical analysis and modeling of hematopoietic stem cell (HSC) dynamics that lead to the production and regulation of blood cells in the bone marrow. The HSC population is seen as a continuous medium structured in age and space. Using the method of characteristics, we can reduce the age-structured system to a reaction-diffusion equation containing a nonlocal spatial term and a time delay. We obtain a threshold condition for the global asymptotic stability of the trivial steady state by using a Lyapunov functional and the characteristic equation. We give sufficient conditions for the existence and uniqueness of the positive steady state by using the sub- and super- solutions method. Finally, the uniform persistence of the system when the trivial steady state is unstable is proved. Joint work with Mostafa Adimy and Toshikazu Kuniya.

## References

- [1] M. Adimy, A. Chekroun and B. Kazmierczak. (2017). *Traveling waves in a coupled reaction-diffusion and difference model of hematopoiesis*, Journal of Differential Equations, 262 (7), 4085–4128.
- [2] M. Adimy, A. Chekroun and T. Kuniya. (2017). *Delayed nonlocal reaction-diffusion model for hematopoietic stem cell dynamics with Dirichlet boundary conditions*, Mathematical Modelling of Natural Phenomena, Accepted.

*Ninth Workshop Dynamical Systems Applied  
to Biology and Natural Sciences DSABNS 2018  
Turin, Italy, February 7-9, 2018*

- [3] M. C. Mackey. (1978). *Unified hypothesis for the origin of aplastic anemia and periodic hematopoiesis*, *Blood*, 51 (5), 941–956.