Spatio-temporal dynamics of cellular decision making

David Palau-Ortin*, Pau Formosa-Jordan, José María Sancho, Marta Ibañes
Departament d'Estructura i Constituents de la Matèria.
Facultat de Física
Universitat de Barcelona
08028 Barcelona

In biology, cells change of state according to biochemical signals. This process is known as cellular decision making and can be highly stochastic[1,2]. For instance, when the same signal acts in a group of equivalent cells, not all cells respond in the same manner. Some cells do not respond, while others change of state (e.g. differentiate). The choice of which new state is reached is often stochastic too. From a theoretical point of view, cellular decision making involves multistable nonlinear stochastic dynamics[3].

Cellular decision making occurs recurrently during the development of multicellular organisms. As a result of it, spatiotemporal patterns of different cell types arise. In some cases cell differentiation takes place cell-autonomously, without cell-to-cell communication. This process can be controlled by signals which can set the final population distribution of different cell states. In contrast, some other cellular decisions occur with cell-to-cell communication, creating an ordered spatiotemporal pattern of different cell types. Once one faces this type of process theoretically, many questions can be raised: How does this decision depend on the characteristics of the signal? When is the decision made? How does it depend on stochastic gene expression? Can a pattern be selected dynamically and how? In this poster we will address all these issues[4,5].

---

* palau@ecm.ub.es

[1] Perkins TJ, Swain PS., *Mol Syst Biol* **5**, pp. 326 (2009)
[2] Balazsi G, Van Oudenaarden A, Collins JJ, *Cell* **144**, pp. 910-25 (2011)
[3] R. Guantes and J. F. Poyatos, *PLOS Comp Bio* **4**, 11, pp. 1-13 (2008)
[4] D. Palau-Ortin, M. Ibañes, *Reversibility and memory in cellular decision making*, Preprint (2012)
[5] D. Palau-Ortin, P Formosa-Jordan, JM. Sancho, M. Ibañes, *Dynamical selecction of patterns*, Preprint (2012)