Study of the evolution of Cellular communities through Cellular Simulation.

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Cell simulation emerges as a new perspective to simulate the growth and development of cell colonies, and thus study their properties. In cell simulation, ideas and techniques already developed in the field of molecular or colloidal simulation are used. In this way, starting from the defining characteristics of the basic agents of the system, the cells in this case, an attempt is made to obtain information on the emerging properties of the cell colonies. In this approach, in addition to being necessary to have an adequate description of the interaction between cells and their dynamics, it is important to model the process of cell growth and division, which converts developing cell colonies into systems out of equilibrium. We will present a summary of recent research using cell simulation strategies. Results of studies on the development of bacterial colonies will be shown, discussing the consequences of competition between growth/division processes and cell diffusion [1]. We will also present results on the influence of high concentrations of polymers in the medium on the structure of growing bacterial colonies[2]. Finally, we will show how these techniques can also be applied to the study of organ development [2].

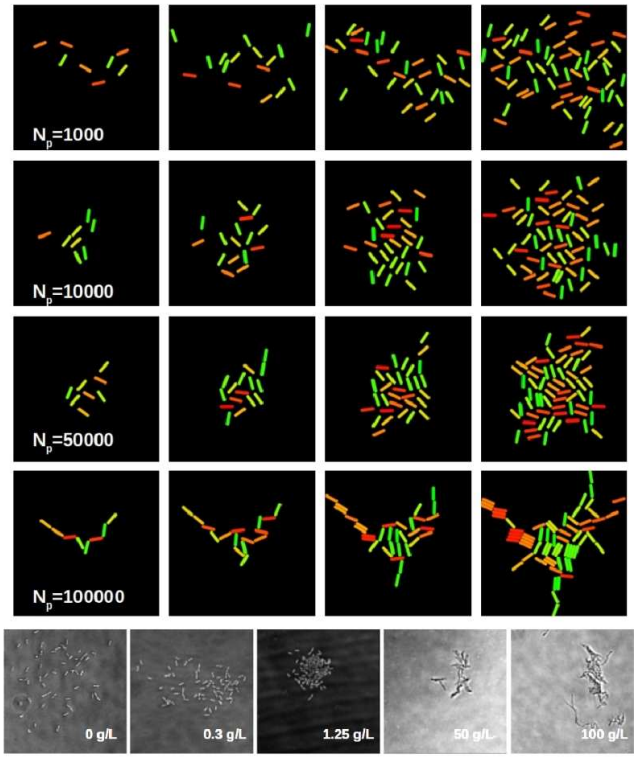

Fig. 1. Top rows:Simulation of bacterial biofilm evolution growing in media with different numbers of polymeric particles N_p. Bottom row:Micrographs of microcolonies containing 40 cells of Δ*fle*Q *P. putida* strain MRB52 at different dextran sulfate concentration. [2]

[1] R. D. Acemel, F. Govantes y A. Cuetos. *Computer simulation study of early bacterial biofilm development*. Scientific Reports, **8**, 5340 (2018).

[2] F. J. Lobo-Cabrera, A. Patti, F. Govantes, and A. Cuetos, *Polymer-induced microcolony compaction in early biofilms: A computer simulation study*. Phys. Rev. E **103**, 052407 (2021).

[3] F. J. Lobo-Cabrera, T. Navarro, A. Iannini, F. Casares and A. Cuetos. *Quantitative relationships between growth, differentiation, and shape that control drosophila eye development and its variation*. Front. Cell Dev. Biol. **9**, 68193 (2021).