

“ORDER FOR NOTHING”, THE BACTERIAL CELL CYCLE AND WATER

Vic Norris

Laboratory of Microbiology Signals and Microenvironment, Department of Biology,
University of Rouen, 76821 Mont Saint Aignan, France

The regulation of the bacterial cell cycle (which comprises the initiation of DNA replication, DNA segregation and cell division) and the generation of a broad range of coherent phenotypes are fundamental problems. We have used an experimental technique based on *Secondary Ion Mass Spectrometry* along with simulation to support the hypothesis that a major function of the cell cycle is to maintain a diversity of phenotypes so that cells can both survive in hell and prosper in heaven [1]. In this hypothesis, bacteria initiate DNA replication by sensing both the intensity with which their constituents are working and the quantity of material they have accumulated [2]. This sensing occurs at the level of spatially extended assemblies of molecules and macromolecules alias *hyperstructures* [3]. The segregation of hyperstructures physically coupled to the DNA strands, followed by cell division, then generates phenotypic diversity and, in particular, growth rate diversity. This constitutes, I suggest, an example of Kauffman’s “order for nothing” [4]. I also use simulation to show how water structures could help determine hyperstructure dynamics and hence cell cycle events.

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3. Norris, V., et al. (2007). Toward a hyperstructure taxonomy. *Annual Review of Microbiology* 61, 309–329.
4. Kauffman, S. (1996). *At home in the Universe, the search for the laws of complexity*. Penguin, London.