

Bacteria Origin of Self-Organization and Swarming Intelligence

By

Eshel Ben-Jacob

Bacteria, the first and most fundamental of all organisms, lead rich social life in complex hierarchical communities. Collectively, they gather information from the environment, learn from past experience, and take decisions. Bacteria do not store genetically all the information required for efficient responding to all possible environmental conditions. To solve the new encountered problems (challenges) posed by the environment, they first assess the problem via collective sensing, recall stored information of past experience and then execute distributed information processing of the 10^{9-12} bacteria in the colony thus turning the colony into super-brain. Super-brain, because the billions of bacteria in the colony use sophisticated communication strategies to link the intracellular computation networks of each bacterium (including signaling path ways of billions of molecules) into a network of networks. I will then show illuminating movies of swarming intelligence of live bacteria in which they solve challenging optimization problems for collective decision making.