



THE SCIENCE BEHIND THE ART

These images are part of a series of remarkable patterns that bacteria form when grown in a petri dish. While the colors and shading are artistic additions, the image templates are actual colonies of tens of billions of these microorganisms. The colony structures form as adaptive responses to laboratory-imposed stresses that mimic hostile environments faced in nature. They illustrate the coping strategies that bacteria have learned to employ, strategies that involve cooperation through communication. These selfsame strategies are used by the bacteria in their struggle to defeat our best antibiotics. Thus, if we understand the mechanisms behind the patterns, we can learn how to outsmart the bacteria - for example, by tampering with their communication - in our ongoing battle for our health.

The images come from the laboratory of Prof Eshel Ben-Jacob, of the Tel-Aviv University (<http://star.tau.ac.il/~inon/baccyber0.html>) as part of a collaboration with Prof. Herbert Levine of UCSD's National Science Foundation Frontier Center for Theoretical Biological Physics (ctbp.ucsd.edu). The goal of this research is to unravel the adaptation secrets enabling bacterial survival against all odds. Their efforts build upon progress in two disparate fields - pattern formation in complex dynamical systems and the molecular biology and biophysics of bacteria.

In a sense, the strikingly beautiful organization of the pattern reflects the underlying social intelligence of the bacteria. The once controversial idea that bacteria cooperate to solve challenges has become commonplace, with the discovery of specific channels of communication between the cells and specific mechanisms facilitating the exchange of genetic information. Retrospectively, these capabilities should not have been seen as so surprising, as bacteria set the stage for all life on Earth and indeed invented most of the processes of biology. As we try to stay ahead of the disease-causing varieties of these versatile creatures, we must use our own intelligence to understand them.

These images remind us never to underestimate our opponent.

Seasons Greetings

from the

Center for Theoretical Biological Physics