

---

---

CRITICISM

---

---

**O. V. Bukharin, A. L. Gintsburg, Yu. M. Romanova,  
and G. I. El'-Registan,**  
*The Mechanisms of Bacterial Survival,*  
**Moscow: Meditsina, 2005, 367 pages**

DOI: 10.1134/S0026261706040230

The book deals with the adaptation of microorganisms to varying environmental conditions and their transition to the resting state, which is considered as a universal form of adaptation that allows an organism to survive under unfavorable conditions. Various microbial resting forms are described with emphasis on the nonculturable state, its epidemiological significance, the underlying molecular-genetic mechanisms, and the persistence of pathogens in host organisms. Sufficient attention is given to the recent concept of the microbial population as a multicellular organism in which cells communicate with each other through chemical interactions at the intra- and interspecies levels and which develops as an integral cellular system exhibiting some properties that may be lacking in individual cells.

The book consists of an introductory section and three parts, each split into chapters. Part I, written by G.I. El'-Registan, is concerned with dormancy as a form of microbial adaptation. Part II, written by A.L. Gintzburg and Yu.M. Romanova, describes nonculturable forms of pathogenic bacteria. Part III, written by O.V. Bukharin, discusses the persistence of bacterial pathogens as a survival strategy of species.

The first part of the book presents new concepts of the microbial population as a multicellular organism in which each cell functions not autonomously, but in cooperation with the other cells of the population. This provides for the stability of microbial populations and the survival of species under stressful environmental conditions. The inhibition of its metabolism causes the cell to transit to a resting state (escape from active life), and thus to avoid the impact of stressful factors. Four forms of resting bacterial cells are considered: (1) stationary-phase (proliferatively resting) cells, (2) reproductively resting cells, including some special forms, (3) cyst-like cells of non-spore-forming bacteria, and (4) cells that have irreversibly lost their viability (mummified cells or micromummies).

Particular consideration in Part I is given to the autoregulatory mechanisms involved in the formation of resting cells, communicative behavior of cells, quorum sensing effects, and the mechanisms responsible for anabiosis and cell resuscitation (germination of resting cells). Relevant hypotheses available in the literature

are discussed. Of great interest are experimental data on the mechanism of anabiosis and the effect of autoregulatory factors (alkyl hydroxybenzenes), particularly  $d_1$  factors, which possess antioxidant and radioprotecting properties and are capable of intermolecular hydrogen bonding and hydrophobic and electrostatic interactions. These interactions and the capability for hydrogen bonding are responsible for the formation of complexes between  $d_1$  factors and enzymes, DNA, and membrane lipids, and thus for the modification of their structure and functional activity. Perhaps, for a better understanding of this material, the author should have devoted more attention to the role of phospholipids and specialized protecting compounds in the protection of membranes during transition to anabiosis and reactivation of resting cells. The final chapter of this part of the book deals with the problem of detecting resting bacterial forms in natural ecosystems and new relevant approaches. The suggested criteria for differentiating microbial cells in different physiological states are their portrait diagnostics and a comparative study of their elemental composition. The present-day viewpoint on the problem of nonculturable cells is also discussed.

Part II of the book is concerned with nonculturable bacterial forms, methods for their detection, and the genetic aspects of pathogenic bacteria. The authors describe the properties of nonculturable bacterial forms and the ability of pathogens to transit to these forms, to reverse to the vegetative state, and to interact with the host cells. The role of cytokins in these processes is also discussed. Of special interest are pages devoted to the formation of biofilms, their composition, and specific structures. These tower- and mushroom-like structures provide for an enhanced tolerance of bacterial films to antimicrobial agents as compared to free-living bacterial cells. The occurrence of resting pathogens in reservoirs of infection and the epidemiological significance of this phenomenon is discussed in the final chapter of this part of the book.

Part III of the book is dedicated to the strategy of the long-term survival of disease-causing microorganisms in the host organisms. Parasitism and its biological and ecological aspects, as well as experimental simulation of intracellular parasitism, are discussed. The chapter

devoted to bacterial persistence as a result of disease treatment considers the chemical structure of peptidoglycan, its biological function as an immunological target, and its role in the persistence of pathogens. The subjects of comprehensive analysis are the survival mechanisms of pathogenic bacteria, such as the protection of the cell wall, the production of secretory factors, antigenic mimicry, and apoptosis control. The final chapter is devoted to the applied aspects of microbial persistence.

To conclude, the book is devoted to one of the most important biological problems—the ability of microorganisms to adapt to the environment and to survive in unfavorable environmental conditions. The book, written by recognized authorities in this field, allows the reader to get a modern idea of the mechanisms of bac-

terial survival. The clear layout and the logical presentation of the material, as well as the conclusions at the end of each part of the book, make it easily readable. It should be emphasized that the writing of this book not only required considerable effort and deep knowledge of the authors, but also allowed them to outline potential directions of further research in this area. The book will be of great practical significance to researchers working in the fields of microbiology, biotechnology, biochemistry, medicine, dietology, and ecology.

**E.P. Feofilova,**  
*Winogradsky Institute of Microbiology,  
Russian Academy of Sciences, Moscow*