

## International Symposium on Present-Day Problems in the Biochemistry and Biotechnology of Microorganisms

The International Symposium on Present-Day Problems in the Biochemistry and Biotechnology of Microorganisms was held in Pushchino, Moscow region, on June 25–30, 2000. The symposium was devoted to the 70th anniversary of I.S. Kulaev, a distinguished Russian biochemist. In this regard, the basic sessions of the symposium dealt with recent advances in the fields of microbial biochemistry and biotechnology, in which Kulaev has been working for more than 40 years: the biochemistry and biotechnology of inorganic polyphosphates, the biochemistry and molecular organization of the cell surface of microorganisms, and the transport of proteins, ions, and metabolites through the cell membranes.

The latest achievements in other areas of the biochemistry and biotechnology of microorganisms were also discussed. Thus, A.S. Spirin (Pushchino, Russia) spoke about the progress in developing the cell-free system for protein synthesis based on the components of the bacterial cell. V. Kolba (Pushchino, Russia) concentrated on the cotranslational folding of proteins. A. Chetverin (Pushchino, Russia) considered the amplification of nucleic acids, with the use of molecular colonies, grown on solid media. B. Wanner (West Lafayette, USA) presented recent data on the genetics of phosphate transport in bacteria. V. Studitskii (Detroit, USA) analyzed the interaction of bacterial RNA-polymerase with chromatin.

There was an extended discussion concerning the problems of the biochemistry and biotechnology of inorganic polyphosphates. Advances in this area are particularly noticeable. One of these is the discovery by R. Reusch (East Lansing, USA) of special channels in bacterial membranes made up of inorganic polyphosphates and polyhydroxybutyrate molecules bound by  $\text{Ca}^{2+}$  ions, through which DNA molecules penetrate into bacterial cells in the process of their genetic transformation. Reusch also found that these channels may provide for the transport of biologically important ions, such as calcium and potassium cations. The existence of polyphosphate–polyhydroxybutyrate channels in the membranes of bacterial and eukaryotic cells was confirmed by a team from the laboratory of Arthur Kornberg at Stanford University in the United States. Reusch's report on this subject stimulated extensive discussion at the symposium.

N. Rao (United States) summarized the data on the biochemistry of polyphosphates obtained in Kornberg's laboratory in the last few years. He presented

compelling evidence that polyphosphates are involved in the metabolic changes occurring in bacterial cells during their transition from the logarithmic to the stationary growth phase. Polyphosphates were proved to be necessary for the motility of pathogenic bacteria and for the formation of biofilms: the mutants of the pathogenic bacteria defective in polyphosphate kinase, the enzyme that is responsible for the ATP-dependent synthesis of polyphosphates in bacteria, lost pathogenicity and the ability to form the biofilms. The fact that inorganic polyphosphates do regulate the activity of the enzymes involved in the metabolism of negatively charged biopolymers, including nucleic acids, was convincingly proved in experiments with the ATP-dependent proteinase (the report of A. Kuroda, Hiroshima, Japan) and RNA-polymerase (the report of T. Shiba, Sapporo, Japan).

A new approach, which takes into account cell compartmentation, to the study of polyphosphate metabolism and its enzymes in eukaryotic cells was the subject matter of the report read by Kulaev and his coworkers. They showed that different organelles of yeast cells contain specific polyphosphates that differ from each other not only in the catalytic properties, but also in the molecular structure. The biotechnological aspects of polyphosphates were discussed at the symposium by H. Ohtake (Hiroshima, Japan), G. Kortstee (Wageningen, the Netherlands), and J. Keasling (Berkeley, United States), who presented recent evidence that mutant microorganisms with an improved ability to accumulate inorganic polyphosphates can be employed for the efficient removal of excess phosphorus from industrial sewage. H.Y. Kim (Seoul, Korea) spoke about the possible application of polyphosphates in medicine, namely, for the regeneration of bone tissues.

It should be noted that the structure, biosynthesis, and the physiological role of the cell surface components of prokaryotic and eukaryotic microorganisms are far from being understood well. For this reason, the data reported by A. Severin (New York, United States), I. Naumova, Yu. Knirel', V. Shibaev, and T. Kalebina (Moscow, Russia) on this subject attracted the particular interest of symposium participants.

V. Farkas (Bratislava, Slovakia) and A. Tsiomenko (Pushchino, Russia) reported on the mechanisms of the yeast cell response to osmotic and heat stresses, respectively.

Of great interest was the report read by M. Nesmeyanova (Pushchino, Russia) at the session devoted to

protein secretion. She summarized recent data on the role of membrane phospholipids and certain regions of proteins in their secretion through bacterial membranes.

The report of M. Bogdanov (Houston, United States), which stimulated great discussion, was devoted to the chaperone and antishaperone functions of membrane phospholipids. He presented evidence that the phospholipids may either facilitate or hinder the folding of membrane proteins.

New data on the P-type biogenesis of ATPases in yeasts were reported by C. Slayman (New Haven, United States). She found that the ATPase of *Saccharomyces cerevisiae*, which is located in the plasma membrane, is synthesized, like that of animals, in the endoplasmic reticulum and then transferred to the cell surface by special vesicles.

Other contributions that should be mentioned here are the excellent report read by L. Okorokov (Campos dos Goytacazes, Brasil), which was devoted to the homeostasis of  $\text{Ca}^{2+}$  ions in yeast cells and to the mechanisms of  $\text{Ca}^{2+}$  transport to different cell compartments; the report of A. Bogachev (Moscow, Russia) on the mechanisms of  $\text{Na}^{+}$  transport in microorganisms and on the electrochemical gradient of  $\text{Na}^{+}$  cations across the cell membrane; the report of L. Yaguzhinskii (Moscow, Russia) on the phase transitions in the mitochondrial membrane; and the report of M. Kritskii and T. Beloz-

erskaya (Moscow, Russia) on the mechanisms of photoreception in various organisms.

At the session devoted to the latest advances in the biochemistry and molecular biology of microorganisms, of interest were the reports read by A. Kaprel'yants (Moscow, Russia) on the role of bacterial cytokinins, by D. Ostrovskii (Moscow, Russia) on the role of 2-C-methyl-D-erythol-2,4-cyclopyrophosphate in the bacterial response to oxidative stress, and by M. Ter-Avanesyan (Moscow, Russia) on the detection and physiological role of prions in yeast cells.

Modern biotechnological techniques for the bioremediation of the environment were discussed by A.M. Boronin (Pushchino, Russia). K.G. Skryabin (Moscow, Russia) reported on the potential of transgenic plants harboring useful microbial genes.

The program of the symposium included not only plenary lectures and reports, but also a poster session, where numerous posters written by Russian and foreign researchers were presented.

Many of the participants emphasized the high scientific and organizational level of the symposium. This forum has demonstrated the importance of cooperation between Russian scientists and their colleagues working abroad.

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