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Taxonomy, Biotechnological Potential and Ecological Properties of Obligately Marine Heterotrophic Bacteria

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Prokaryotes are the most widely distributed organisms on the Earth. But their diversity is studied much less than the diversity of, for example, animals and plants. Today nearly 6,500 species of bacteria and about 500 species of archaea (this list is now growing very fast, from the vision of C. Woese) are validly described. For comparison - about 70,000 species of true fungi are described, not to mention animals, which are more than a million of species. Experts estimate that the number species of bacteria will grow very soon to 40,000, fungi - 1,500,000, algae - 60,000 (it is now about 40,000 species described), viruses - 130,000 (now about 5,000). Thus, studied and potential taxonomic diversity of prokaryotes is relatively low. It is necessary to note that in contrast to taxonomic diversity, genetic and especially ecological diversity of bacteria is high. As to prokaryotes, these perfect creatures of the nature do not need to evolve too fast: they are very adapted to the environmental conditions and often can themselves create many factors of environment. But the point is not only here. Microbiologists know very well that the majority of bacteria and archaea do not grow on the nutrient media in laboratory conditions and hence can not be studied. The percent of "culturability" is: seawater - 0.1, freshwater - 0.25, soil - 0.3. Till recently there was no acceptable way out of this paradoxical situation. But about 15 years ago some scientists offered methods of studying the microorganisms directly in the environment -"phylogenetic staining"(determination of phylotype). The successes of the microbiology led to the appearance of a

real biogeography of prokaryotes, to the growth of the meaning of knowledge about the world of microorganisms in the field of biospherology. The idea of L. Pasteur, S.N. Winogradsky, M.W. Beijerinck and V.I. Vernadsky about the Earth being the planet of microbes had finally been established. For us, microbophiles (M. Dworkin's word), the main aim of microbiology today is to study biosphere and its creators - prokaryotes - in detail. Some stenobiontic species need some care *in situ* and they can disappear together with disappearance of their life places. That is why studying and keeping microorganisms as gene pool *ex situ* is an important thing. It is also comfortable to study the biotechnological potential and ecological properties of prokaryotes in the collections. There is no exaggeration in saying that biotechnology is a product of biodiversity. The biotechnological boom, we can see these days, is followed by a splash of interest to the problems of biosystematics and ecology. This economical interest undoubtedly will bring a new knowledge about fundamental unit "biodiversity ↔ biotechnology."

Marine microbiology, ecology and biotechnology of sea microbes are rapidly developing now. Ocean is the biggest reservoir of biota. Only a few species of prokaryotes inhabiting it are described. The focus of our research in marine microbiology is to isolate microbial producers of novel secondary matabolites and of poducers of enzymes. At least three (bio)ecological problems have arise in this connection: 1) what specific factors of sea environment are and how these factors affect the distribution, physiological activity, and culturability of marine microorganisms; 2) the impact of macrohydrocoles metabolites on microorganisms, and the opposite situation; 3) other important questions address the role of symbiotic microbes in the production of metabolites previously ascribed to marine macrobiota. The Collection of Marine Microorganisms of the PIBOC was created in 1985 (WFCC acronym is KMM). That year was favorable to the beginning of such work, because the research vessel "Akademik Oparin" specially equipped for chemical, biochemical and microbiological studies was built. KMM contains about 5,000 (from many regions of the World Ocean) strains of marine heterotrophic aerobic and facultatively anaerobic bacteria (as well as fungi-micromycetes, about 1,000 strains). KMM is a fundamental base to search for bioactive substances. Several thousand strains of marine microorganisms isolated from sea environment were studied. Promising producers of some significant enzymes (highly active alkaline phosphatases, RNAses, polyuridyl-specific RNAse, restriction endonucleases, β-1,3-glucanases, α-galactosidases (including enzyme that change one blood group to another), α-N-acetylgalactosaminidases, elastase, keratinase and as well as new secondary metabolites were found among them. Unexpectedly large number of strains synthesizing anti tumor (cytotoxins) and antiviral compounds (differ from soil strains); producers of new antibiotics, pH-dependent cytostatics and biosurfactants were isolated. Microbial producers of enzymes were most often among the bacteria from the Northern areas of the World Ocean, whereas producers of cytotoxins and antibiotics were collected mostly in tropical zones. Many bacteria from KMM were described as new species and genera.

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