PROGRAMMED CELL DEATH IN MICROORGANISMS: THE BIOLOGICAL SENSE AND EVOLUTIONARY SIGNIFICANCE

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Apoptosis, or programmed cell death, is a controlled process of self-destruction at the cellular level. In multicellular organisms, it plays an important role in personal development and maintenance of tissue homeostasis, and the violation of its regulation lead to the development of tumors and neurodegenerative processes.

A recent study shows that apoptosis can occur in unicellular organisms. *What is the purpose of microbes* in the process? What are the phylogenetic roots of apoptosis?

It's known that horizontal gene transfer is common *among* different types of bacteria. This fact makes the microbial biocenosis similar to populations of multicellular organisms. In such community, first appeared the number of integrating mechanisms: the system of chemical signals exchanged between prokaryotes to coordinate the behavior of elements of community, as well as the mechanism of programmed cell death.

It is suggested that in prokaryotes apoptosis has emerged as a mechanism of antiviral protection of populations and eukaryotes - after a long period of bacterial endosymbiosis in the host cell and the subsequent horizontal gene transfer between the symbionts.

In apoptotic pathway the leading role plays active forms of oxygen and Ca^{2+}, such as protein - inhibitors of apoptosis, possibly a viral origin.

Evolutionarily the first appeared caspases and apoptosis-inducing factor, and then gradually appeared other proteins, among them - the so-called death receptors. In bacteria, apoptosis plays an important role: in the lysis of vegetative cells during sporulation, the formation of fruiting bodies of slime molds, spontaneous autolysis of cells at high density colonies natural transformation in the process of genetic recombination, as well as the destruction of virus-infected cells.

Some genes of autolytic proteins that involved in apoptotic pathway in prokaryotes were recently described. It was observed that the specific substance – "implementors" in the form of fatty acids and glucosamine play an important role in apoptosis of prokaryotes. In prokaryotes, all proteins that initiate this process are encoded by plasmids and prophages.