Comparative characteristics of biogenic magnetic nanoparticles in plant, fungi and animal organisms

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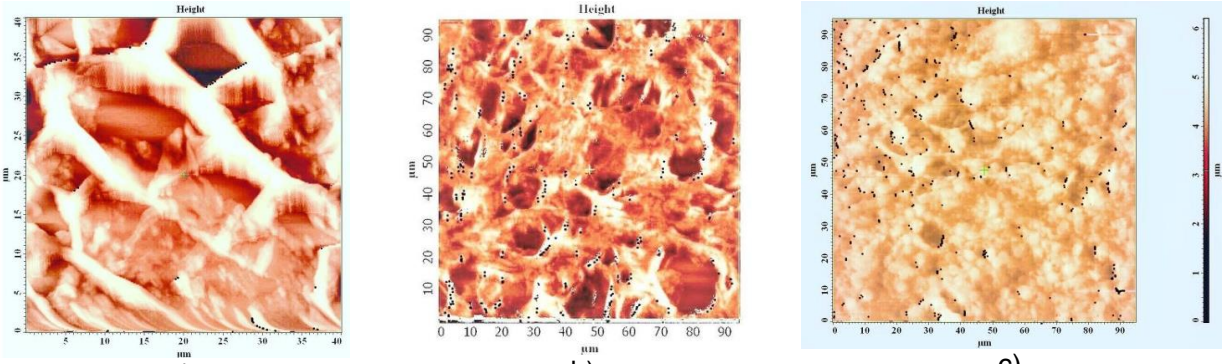
To date, biogenic magnetic nanoparticles (BMNs) have been detected in representatives of all three sub-kingdoms of living organisms: bacteria, archaea and eukaryotes, and a single biomineralization mechanism for all living organisms has been established [1]. However, experimental works to researching biogenic magnetic nanoparticles in plants are absent.

Were studied samples of the stalk of potato *Solanum tuberosum*, the pileus of agaricus *Agaricus bisporus* and the brain of european carp *Cyprinus carpio* using methods atomic force (AFM) and magnetic force microscopy (MFM). The image of the MFM reflects the spatial distribution of BMNs in the biological material, which are represented by black and white dots on MFM images (Fig. 1).



a) b) c)

Figure 1. Combined AFM and MFM image: a) – image of the stalk of potato *Solanum tuberosum; b)* – the pileus of agaricus *Agaricus bisporus*; c) – the brain of european carp *Cyprinus carpio.*

Using results what were obtained by AFM and MFM, we can value the greatest size of BMNs (as an average distance between black and white dots on the figure 1) and the number of BMNs in the chain of organisms, what were studied, for comparing with a model organism – the magnetotactic bacterium *Magnetospirillum gryphiswaldense MSR-1.* Magnetotactic bacteria: the size of BMNs – 10-40, 35-120 nm [2], the number of BMNs in the chain – 4-200; the stalk of potato: the size of BMNs – 80±20 nm, the number of BMNs in the chain – 5±3; the pileus of agaricus: the size of BMNs – 70±15 nm, the number of BMNs in the chain – 4±3; the brain of carp: the size of BMNs – 378±26 nm, the number of BMNs in the chain – 12±1.

The obtained AFM and MFM results allow to analyze of the number of BMNs in the chain, to value the size and localization of BMNs what provides an opportunity to describe similar and different features of BMNs in plant, fungi and animal organisms, what is important for closer definition of functions of BMNs.

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[1] Gorobets Dekker Encyclopedia 2014.

[2] Richter J Bacteriol 2007.