

# Atomic Force Microscopy in Applied Biological Research

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Atomic force microscope can be successfully used for simple and fast solution of many applied biological problems. In our paper we survey the results of the application of the atomic force microscope **SolverP47BIO** at the State Research Center of Virology and Biotechnology "Vector" during two past years. The AFM has been used:

- in applied virology for count of viral particles and examination of virus-cell interaction;
- in microbiology for measurements and identification of bacteria;
- in biotechnology for control of biotechnological processes and determination of particle dimension distribution in viral and bacterial diagnostic assays.

Recently we showed the limitations of AFM ability to identify viral particles [1]. Therefore, AFM was used in addition to electron microscopic examinations for quantitative characterization of virus-containing suspensions. The method had a good reproducibility and 10-20% accuracy for counting the physical titer, which is a very important characteristic for virology. Quantitative characterization of vaccines and diagnostics (determination of particle dimension distribution) was a similar task. The latter problem is very important for the development of commercial preparations. So AFM was used for characterization of HbsAg in blood plasma and vaccines during the development and certification of National Reference and Control HBsAg Serum Panels.

In microbiology AFM was used for identification of bacterial cells and spores both in native preparations (water of Baikal Lake) and dry powders. This procedure was very effective. The atomic force microscope **SolverP47BIO** has a light inverted microscope as an integral part; the latter can be used for preliminary analysis of the sample. We applied it to find the objects of interest, and then AFM was used for detailed examination. Application of AFM to model experiment on sterilization of "lipidocid" powder by electron radiation shows its ability to identify spores in the powder and to reveal morphological changes. A powerful dose of radiation led to distortion of the shape and clinking of spores. This process lasted not more than 1 hour.

Atomic force microscopy can be effective for express analysis of bacterial strains for peptide production when it is necessary to try a plenty of variants. Morphological analysis gave the ability to choose perspective strains, to define optimal technological conditions and to estimate the production.

AFM has been used for examination of morphological changes of red blood cells (RBC) during a disease and after the virus-RBC interaction.

Four kinds of changes in RBC structure can be seen after incubation with viruses:

- shape deformation of RBC;
- change of fine structure of RBC membrane;
- well-ordered structures on the edge of RBC;
- viral particles on the surface of RBC membrane.

Examination of the patients' blood gave the volume distribution of RBC and detected changes in the shape.

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1. B.N. Zaitsev, E.V. Bessmeltseva, E.I. Ryabchicova. Proc. Intern. Workshop "SPM-2001", p. 173-175. Nizhny Novgorod, 26.02-01.03.2001.