

Project 3.6 Antiviral nanoparticles and polymers to selectively fight phage infections without harming bacteria and eukaryotic cells

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Background:

The proposed project within Opus-23 call focuses on fighting viruses attacking bacteria – named bacteriophages, or phages for short. Phages cause serious problems when they infect the bacteria-based biotechnological factories. Within hours a single bacteriophage can be multiplied in millions of copies utilizing the biochemical machinery of the host. In each bacterial cell, up to a few hundred copies are formed and released. This usually results in the death of bacteria. Phage infections have profound repercussions as bacteria-based processes are one of the most important in biotechnology and dominate many branches of industry which exploit the natural metabolic capabilities of bacteria to produce active substances. All factors, which affect bacteria-based factories, cause millions of dollars in losses.

The knowledge gained upon realization of the project might also be utilized against pathogenic viruses attacking humans, helping to fight against numerous diseases. Among the many bacteriophages, some (MS2, phi6, PhiX174, QBeta) are considered good surrogates for studies on eukaryotic, often dangerous, viruses.

Aim:

Here, we propose the strategy to obtain antiphagants (antibacteriophage agents) that will be safe for bacteria and eukaryotic cells. This will allow online protection against phage infections. We will synthesize, purify, and characterize “mixed” (bearing positively charged, negatively charged, neutral and hydrophobic domains) nanoparticles and polymers and test them against model phages (T1, T4, T7, M13, MS2, phi6, PhiX174, QBeta), bacteria, and eukaryotic cells. We will tune the composition of the “mixed” domains to assure efficacy against virions and safety towards cells.

Requirements:

- from our experience the background in biotechnology would be appropriate, as it allows to adapt to both chemistry and biology tasks. However, applicants with other backgrounds will be also considered based on the possible input to the project (e.g. chemists, biologists, physicists, engineers or similar),
- ability to work independently as well as in a group and proficiency in English speaking and writing are required,
- successful candidate is expected to contribute to the efficient functioning of the lab by providing help and supervision to junior members of the group and by fulfilling necessary administrative and organizational tasks.