Project 3.20. Bacteriophage-based biosensors for bacteria detection

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Background:

Bacterial infections cause a serious socio-economic burden. In 2005 1.8 million people died due to the consumption of infected food or water. Only in the USA number of infections and illnesses originating in food reaches 76 million. Among them, 325 000 are admitted to hospitals, and 5200 died. To make the situation even worse, hospitals are a natural place of occurrence of pathogenic bacteria. The European Centre for Disease Prevention and Control reports that in Europe, 4.1 million patients are affected by healthcare-associated infections each year. In the USA, nosocomial infections cause around 100 000 deaths per year.
The additional costs of treatment of hospital-related infections are enormous. It is estimated to be around 7.5 billion euros in the EU and around $5 billion in the USA. Moreover, targeted treatment of infections becomes a must as new bacteria strains, resistant to antibiotics, emerge. Modest estimates (up to $2.7 billion in the USA and $1.5 billion in the EU) have recently been reported.
In the majority of cases, serious repercussions can be avoided thanks to the fast and reliable detection of bacteria. The conventional detection method depends on the culturing and isolation of the target bacteria. Classical methods, although cheap and straightforward, require up to 72 h to obtain a reliable output. In many cases, this is far too long. Thus the development of sensitive, specific, and rapid methods for bacteria detection is a must.

Aim:

We propose to develop and test bacteriophage-based biosensors for bacteria detection to improve the quality and time of analyses significantly. Bacteriophages (phages for short) are viruses whose host organisms are bacteria. Their natural affinity to host cells can be used to design highly specific tools for bacteria detection. Within the proposed project, we will: 1) prepare new designs, and 2) utilize developed sensors to detect pathogenic bacteria in “real world” samples.

Requirements:

The project is highly interdisciplinary and combines essential methods of biotechnology, molecular biology, physical chemistry, and nanotechnology. The successful candidate is expected to show scientific initiative, perform experiments independently, plan the workflow, maintain research notes, and participate in the decision-making process. He/she will need to build experimental setups, calibrate them, plan and perform control experiments, and analyze the data. Contribution through regular reporting and publishing, taking part in, and presenting at group meetings and conferences is mandatory.

From our experience, the background in biotechnology would be appropriate, as it allows us to adapt to both chemistry and biology tasks. However, applicants with other backgrounds will also be 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. The 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.