Introduction:

After more than 100 years of virus research, we still do not understand transmission, i.e. how viruses spread before they infect a cell. This process is not always biological, but can be based purely on physics (as known for example for aerosols). For newly emerging viruses, measures against transmission are based on a small number of new studies, or on comparisons to similar viruses, or on generalized assumptions. Nanoscale investigations in realistic environments are extremely rare, and for most viruses non-existent.

Three environmental parameters influence the transmission: Temperature, humidity, and the contact with surfaces (mucus, skin, but also polymers and inorganics). We will concentrate on humidity and on actual application surfaces (mucus and skin models, polymers, metals), and follow the fate of adsorbed viruses.

Outcome:

Our goals are insights on

- denaturation of dry viruses
- nanoscale water pools on viruses
- transmission mechanisms
- new strategies against transmission

This basic research project will have significant impact on public health. The Self-Assembly group at nanogune has many years of experience with surface analysis and physics of plant viruses, and works with cooperation partners at biomagune in Donostia, Uni Potsdam and FHI Berlin (MPI) in Germany on a nonbiological particle systems for the "survival" and transmission of influenza viruses in dry/wet weather, with a broad scale of nanoscale imaging and spectroscopy tools. We now plan to employ harmless attenuated viruses, such as used in several vaccines.

Job description:

Standard biophysical methods will be expanded to nanoscale imaging techniques, namely Atomic Force Microscopy (AFM) and Scanning Transmission Electron Microscopy (STEM) in water vapour. The novel aspects are on the instrumental side (wetSTEM and new AFM setups), but also on methodologies, such as virus immobilization/surface transfer.

The work will comprise setting up new experiments, instrument improvements, but mainly sample preparation and imaging. The main techniques will be Atomic Force

Microscopy (AFM) and Scanning Transmission Electron Microscopy (STEM), two nanoscale imaging techniques, which are established since decades for the imaging of surfaces and ultrathin films, respectively. Their application in dry and humid atmospheres, however, is quite new, and based on modern state of the art equipment:

- AFM is carried out in a humidity chamber at ambient temperature. The technological challenge is high resolution on very soft objects (viruses).
- "WetSTEM", i.e. STEM in water vapour, is based on a novel modification of an electron microscope, and poses similar challenges as AFM, plus using ultrathin samples.

The Self-Assembly group has more than 20 years' experience in AFM and STEM of viruses, mainly plant viruses. All our projects are based on intensive collaboration with other groups at nanogune, e.g. electron microscopy and nanooptics.

Application information:

If you are a master student and you are interested in this project, please get in touch with the Self-Assembly Group leader, Ikerbasque Prof. Alexander Bittner (a.bittner@nanogune.eu).

See also:

- www.linkedin.com/in/alex-bittner-59595468/
- www.researchgate.net/profile/Alexander-Bittner

To apply for a **master position** fill in the form below and follow the instructions and recomendations of the general call (**open until 30 June 2023**).

NOTES:

(i) All applicants will receive an answer after the end of the selection process; but please note that due to the large number of submissions that are expected, we cannot provide individual feedback.

(ii) Additional information about nanoGUNE's commitment towards HR excellence in Research and Gender Equality are available on our website.

(iii) We encourage you to subscribe to our HR mailing list to receive information related to nanoGUNE's open positions and open calls for different training and talent attraction programs.


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