

1. Abstract

Diagnostics of viral infection generally depends on detection of virus parts such as proteins or genetic material which does not necessarily reflect the presence of the complete, functional pathogen. In other cases the occurrence of antiviral antibodies is detected but these may only indicate prior, but not present exposure to the pathogen. Alternatively, viral infections are evaluated on the basis of consequences of infection such as cytopathic effects in cell culture, a procedure that is time consuming and not applicable in all cases. We are developing a two-step diagnostic strategy that could be used to detect and quantify viral loads as complete virus particles, thus indicating presence of the whole pathogen. The strategy will be applicable to a broad range of viral species, including influenza and human immunodeficiency virus (HIV). Both veterinary and human pathogens can be analysed. The first step is concerned with sample preparation and utilizes a technique termed viral molecular painting (VMP), which can be used to modify the surface of and as such “label” enveloped viruses. Marked viral particles will be enriched and purified with the help of magnetic particles. The second step employs a technique known as scanning ion occlusion spectroscopy (SIOS). SIOS was originally developed for applications in nanotechnology, where it is used to characterize and quantify a wide range of nanoparticles. As viral particles share the same size range with nanoparticles (approximately 100nm), they are considered suitable for analysis with SIOS. Initial experiments have proven promising but further research is needed. In this module we shall optimize SIOS application for viral detection and quantification. Specific detection can be achieved by binding antibodies to viral particles and investigating the resulting increase in diameter of the viral particles by means of SIOS. Sample preparation and safety issues will be a strong emphasis throughout the project. All initial experiments will be carried out with virus strains that are non-pathogenic to humans. The Institute of Virology at the University of Veterinary Medicine is especially well suited for carrying out this project. Not only have the researchers involved established the VMP technique but also one of the few SIOS devices in Europe is housed at the Institute. In addition, easy access to laboratory (recombinant) viral particles as well as wild-type (patient) virus samples from the routine diagnostics laboratories of VetMedUni Vienna is ensured. High safety standards are guaranteed. The benefit of the approach for patients will be the possibility to accumulate data on virus infections more quickly and with increased clinical relevance.