

Implantation of a cryo electron microscope in BSL3 environment

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Considering outbreaks over the past and the environmental changes induced by human activities, future outbreaks can be considered [1-3]. In this context, the development of medical countermeasures for treatment of diseases is still need. It implies a better understanding of pathogen structures and its biological function. The development of new therapies will be benefit for both the military force during missions in the field and the civil population during an outbreak.

Several criteria defines the biohazardous properties of a pathogen (pathogenicity, infectious dose, transmission mode and host range, preventive health measures, availability of preventive measures) resulting the categorization of biological agents in 4 levels of risk groups, and implying its manipulation in adapted biosafety laboratories BSL1 to BSL4 [4].

Sample preparation of pathogens for electron microscopy (EM) analysis implied a chemical or a physical inactivation step to ensure their manipulation in safety health environment (BSL1). All inactivation procedures induce a modification of the fine structure of biological samples [5]. To avoid these limitations and to be able to observe the pathogen in its “*alive native state*”, EM observation has to be performed directly in BSL3 environment [6]. Moreover, the cryo preparation is the best issue to avoid the degradation of the structural integrity of the sample, which has not to be dehydrated and embedded to be studied.

In this context, the implantation of a Cryo-electron microscope (TITAN Krios[®]) in a BSL3 environment was planned. The opportunity of a new building at IRBA with biosafety facilities allowed the project feasibility. This project arises several challenges concerning the infrastructure facilities (building, individual protection equipment (IEP), work rules, standard operating procedure (SOP)); cryo and microscope load grids handling (liquid nitrogen, tweeze-stick injuries) and human environment (low dexterity and reduce eye's range induced by de IEP, thigh space). To overcome all these challenges and to anticipate all constraints (financial, infrastructure, biosafety), the presence of experts in different fields (infrastructure, BSL3 safety, cryo preparation, electron microscopy, administration and legislation) is required from the start of the project. A close collaboration with experts from the microscope supplier (FEI/ThermoFischer) is the key to succeed the implantation of a cryo-microscope in a BSL3 environment, complying the biosafety and the integrity of the microscope.

References

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