Brochure

Cryo-EM in Biosafety Facilities for Virology Research

Expanding the scope of structural virology

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Virus research is instrumental for developing treatments and preventative measures that minimize the negative impact of viruses on our lives.

Structural virology contributes critical insights into the morphology, life cycle, and interactions of viruses with their hosts.

Cryo-EM in Virus Research

Cryo-EM has a strong history in virus research and great potential to advance structural virology

The use of cryo-electron microscopy (cryo-EM) for virus research has a long history. Almost three decades ago, researchers first used cryo-EM to image isolated virus particles in a near-native state. Since then, cryo-EM has evolved tremendously. As a result, it is now possible to study proteins at atomic resolution or in-situ within their cellular environment.

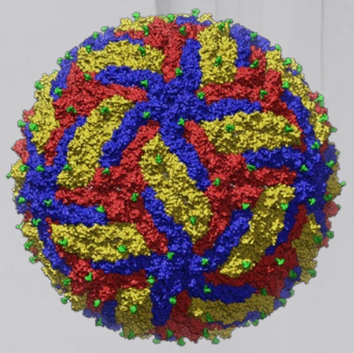
Virus research in particular benefits from cryo-EM, as vitrification can preserve the intricate structure of virions. With single-particle analysis, cryo-EM can deliver high-resolution views of structural proteins, even for precious samples, whereas cryo-electron tomography enables the investigation of sizable intact virus particles. Cryo-EM researchers have determined structures of numerous viruses, such as HIV, SARS-CoV-2, and Zika, and routinely use cryo-EM to study antibody-antigen interactions.

Highlights

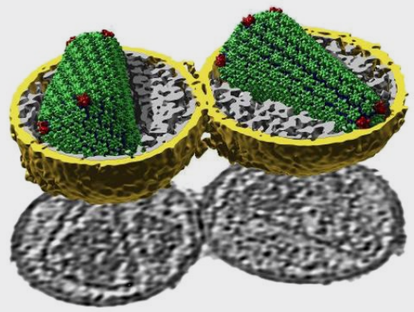
Cryo-EM has a strong history in virus research and great potential to advance structural virology.

We are dedicated to working with our customers to further virus research with cryo-EM in biosafety-level containment facilities.

The optional 60°C heat decontamination solution enables Krios G4 Cryo-TEM and Arctis Cryo-Plasma-FIB installations and support in higher biosafety-level containment facilities (e.g. BSL-3).



Single particle cryo-EM structure of mature Zika virus at 3.1 Å resolution. The three envelope glycoproteins are colored yellow, blue and red. Courtesy of Madhumati Sevvana, Purdue University.



Cryo–electron tomography structures of the HIV-1 capsid from intact, inactivated, virions. The green and red CA protein structures form the conical protective envelope of the virus genome. Courtesy of Simone Mattei, EMBL.

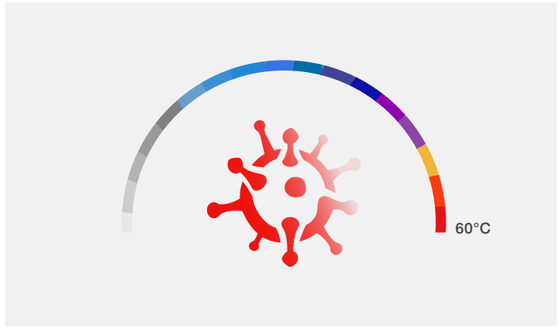
Cryo-electron tomography of murine hepatitis coronavirus (MHV) infected cell. Courtesy of Montserrat Barcena, Leiden University.

“Many questions about the processes that occur in the course of viral infections and the nature of the underlying hijacking of cellular mechanisms remain unanswered. The current advancements in cryo-EM, and the prospect of bringing them into higher-containment labs, present an exciting platform to explore these questions.”

Kay Grünewald,
Center for Structural Systems Biology Hamburg

Despite the achievements of structural virology, many viruses have not been studied yet, and questions about their life cycles and interactions with host cells remain unanswered.

Work on pathogens that pose a risk for disease requires a biosafety containment facility unless work is limited to isolated proteins or inactivated samples. High-end cryo-EM equipment is not commonly found in these facilities.



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To enable our customers to broaden the scope of structural virology research, we now also support the installation of the Thermo Scientific™ Krios™ Cryo-Transmission Electron Microscope (Cryo-TEM) and Thermo Scientific Arctis Cryo-Plasma-Focused Ion Beam (Cryo-PFIB) in higher biosafety-level containment facilities (e.g. BSL-3). For these installations, we offer a 60°C heat decontamination solution consisting of both hardware and software to heat the interior of the microscope enclosure. The hardware consists of heaters and temperature sensors. The software enables customers to bring the microscope into the state required to initiate a heating cycle, defines the duration of the process, and tracks the temperature of multiple sensors placed inside the enclosure. Additional components to prevent aerosol release and a secondary workstation, for Krios, providing microscope control from outside the containment area, complete this solution.

Service solutions tailored for your unique needs

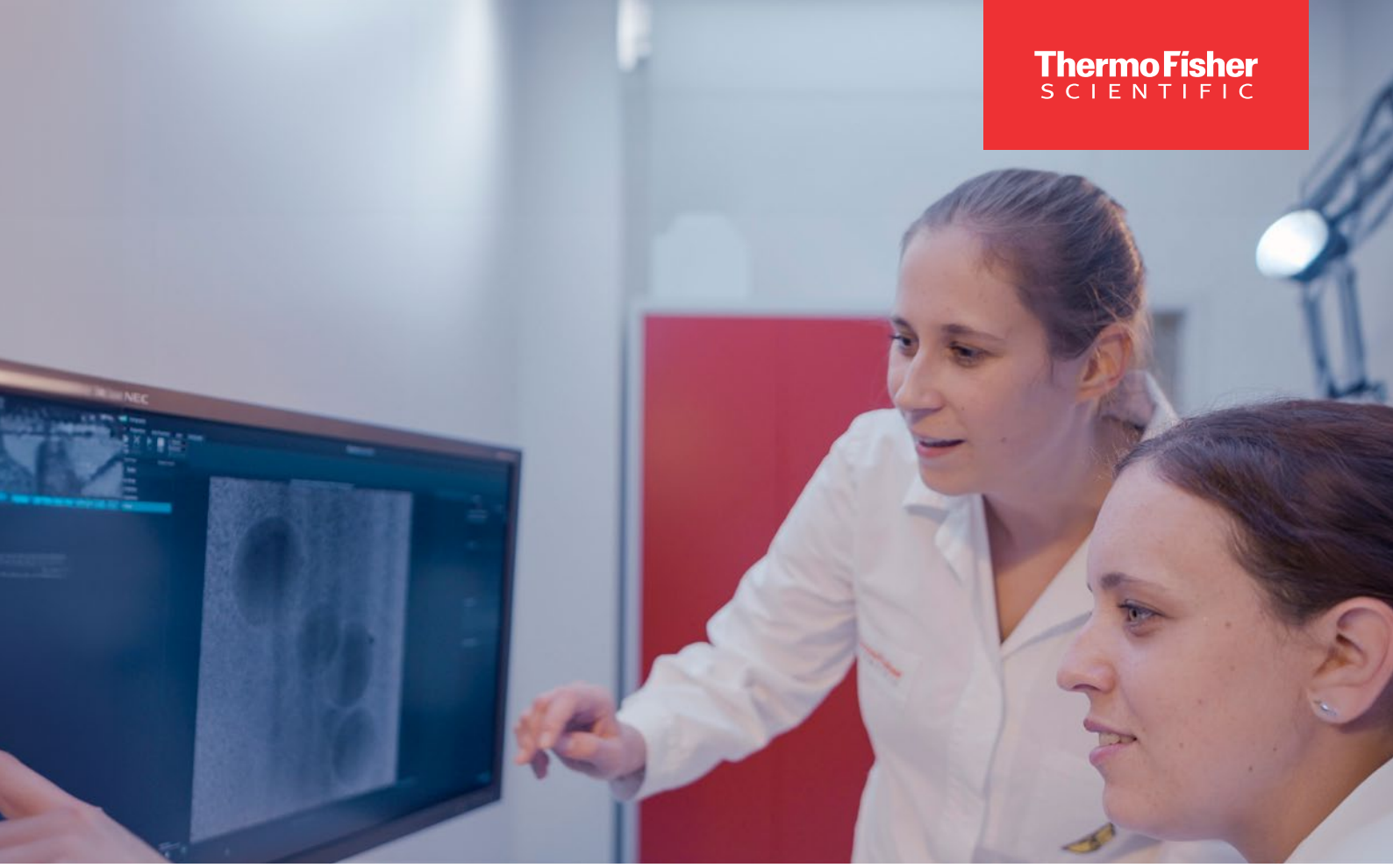
Excellent support is available for systems in a higher biosafety-level containment facility, including BSL-3, through a comprehensive set of service solutions tailored to the circumstances of your location. Protocols and processes specific to the biosafety level of your lab secure a safe working environment for our engineers and our complete supply chain. Whenever possible, we will employ our remote diagnostics and repair capabilities, accelerating the time to solution and reducing the need for physical access to the system. On-site support is available and is provided under your authority to ensure the safety of our service personnel. Connected Care services and applications support packages are available to accelerate your research and enhance productivity.

Research Highlight:

Unprecedented spike flexibility revealed by BSL3 Cryo-ET of active SARS-CoV-2 virions

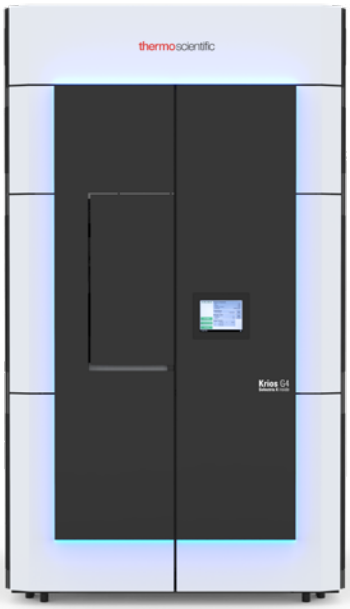
Researchers at Hokkaido University used the Krios G4 Cryo-TEM in a BSL-3 facility to uncover significant flexibility of the spike protein on active virions to facilitate the design of broadly effective vaccines and drugs.

Fukuhara, *et al*. *bioRxiv* (2023) **doi: 10.1101/2023.10.10.561643**



Thermo Fisher Scientific is dedicated to working with you to further virus research with cryo-EM in biosafety-level containment facilities.

Many viruses have not been studied yet, and questions about their life cycles and interactions with host cells remain unanswered. Nevertheless, these studies are essential as they lay the foundation to prepare interventions against the next major virus.



Krios G4 Cryo-TEM

Arctis Cryo-PFIB

Learn more at **thermofisher.com/cryo-em-biosafety**

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