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On the trail of viruses: understanding virus research

Solution worksheet A: Virus video XFEL

Research at European XFEL and structural elucidation of SARS-CoV-2 proteins

Open questions

1. Describe the purpose of European XFEL and why researchers from all over the world use this facility.

The European XFEL is an international research centre for X-ray lasers near Hamburg. Researchers from all over the world use it to conduct experiments, particularly to elucidate biological structures.

2. Explain why the structure of proteins is so important for understanding their function.

The structure of proteins determines their function; only when their exact spatial arrangement is known can their mode of action be understood.

3. How does the study of the PLpro and Mpro (also known as M) proteins help to develop strategies against the coronavirus?

By understanding the structure of PL Pro and Mpro, inhibitors can be developed that specifically prevent the virus from multiplying.

4. Explain the process by which the structure of protein crystals is visualised with the help of the European XFEL.

The X-ray laser is used to irradiate protein crystals with extremely short pulses. The resulting diffraction pattern is evaluated to determine the three-dimensional structure of the proteins.

5. Why are extremely short and high-frequency X-ray pulses necessary to observe molecular processes?

Extremely short X-ray pulses are necessary to be able to image fast molecular processes ‘sharply’, similar to a short exposure time in a camera.

Multiple-choice questions

1. What is the main objective of the experiments at the European XFEL in relation to SARS-CoV-2?

   c) Understanding protein structure for the development of drugs

2. What is the function of the PLpro and Mpro proteins in the life cycle of the coronavirus?

   b) They cut amino acid chains into functional pieces

3. Why are proteins crystallised before they are examined with the X-ray laser?

   c) The ordered structure provides

4. What makes the X-ray pulses of the European XFEL so special?

   b) They are ultra-short and enable sharp images of fast processes.

5. What is a "molecular movie" in the context of research at the European XFEL?

   b) A series of still images showing how a protein reacts

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