



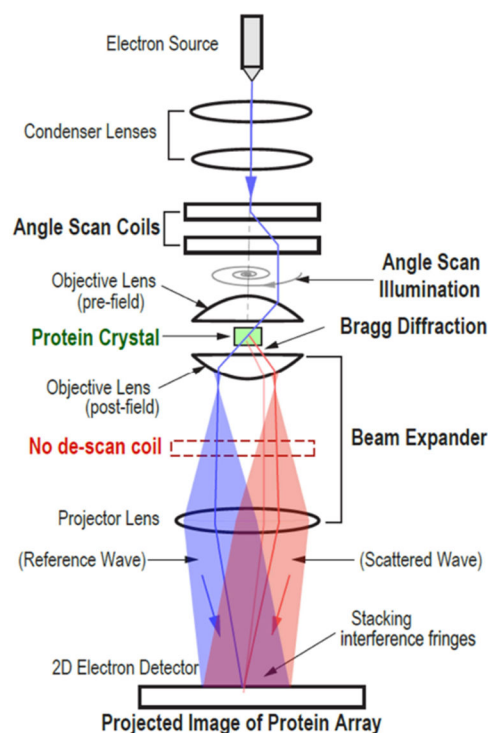
Revolutionizing Molecular Imaging with Advanced Cryo-EM Technology

Summary

Solving the structure of proteins and other biological macromolecules is crucial for decoding their functions and propelling the development of targeted drugs. While X-ray crystallography has traditionally been the preferred technique for unveiling these structures, it has its limitations, notably the requirement for large, high-quality crystals and the challenge known as the "phase problem." Micro electron diffraction (MicroED) has emerged as a powerful alternative, yet it is generally confined to smaller proteins and constrained by underdeveloped phase determination methods. A breakthrough introduced by Prof. Tsumoru Shintake's research team enables visualization of proteins and other molecules, even in microcrystals, providing a fresh paradigm in structural biology that circumvents many limitations of existing methods.

Technology

This technology utilizes a specialized setup known as precession electron diffraction (PED) to gather diffraction patterns using a transmission electron microscope (TEM). By combining high signal-to-noise ratio diffraction patterns with phase information derived from the Fast Fourier Transform (FFT) of real images, it achieves enhanced resolution and effectively overcomes the notorious "phase problem." The sample stage undergoes tilting, allowing collection of enough data for a 3D reconstruction of a density map, thereby enabling the determination of structures within minute crystals, inaccessible to X-ray crystallography. With just a microcrystal of less than a few micrometers in size, this method can resolve the structure of a broad spectrum of molecules, including small proteins that are often evade cryo-EM single-particle techniques.



Schematic illustration of instrumentation for molecular imaging of protein crystals.

Applications

- Imaging of biological macromolecules
- Drug discovery
- Materials science

Advantages

- Overcomes the phase problem
- Visualizes microcrystals of mere micrometers or less in size
- Encompasses a broad range of molecular sizes

Category

Physics & Optics

Lead Researcher

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Intellectual Property

Patent Pending

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