Cryo-EM : The 2017 Nobel Prize in Chemistry

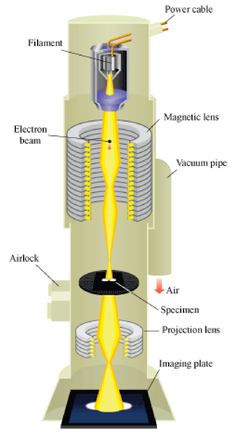
Chen Sun
Department of Biological Sciences
Purdue University, West Lafayette, IN 47907

INTRODUCTION

❖What is TEM (Transmission Electron Microscope)?

TEM is a type of microscope that uses a high-energy electron beam to pass through ultra-thin samples, allowing visualization of internal structures at atomic or near-atomic resolution.

www.hitachi-hightech.com

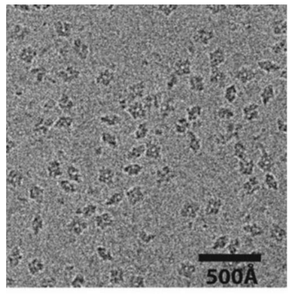


www.hk-phy.org/atomic_world/tem/tem02_e.html

❖What is cryo-EM?

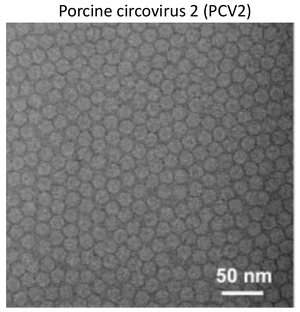
cryo-EM is a technique that uses a TEM to image rapidly frozen biological samples at near-atomic resolution without the need for staining or crystallization.

Beta Galactosidase



https://doi.org/10.1017/S0033583516000068

Porcine circovirus 2 (PCV2)



doi: 10.1016/j.str.2015.12.006

WORKFLOW

Sample purification

↓

Plunge freezing

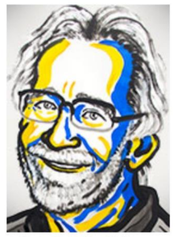
↓

Data collection

↓

Image processing

CONTRIBUTIONS of NOBEL LAUREATES



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Jacques Dubochet

Prize share: 1/3

DUBOCHET'S VITRIFICATION METHOD

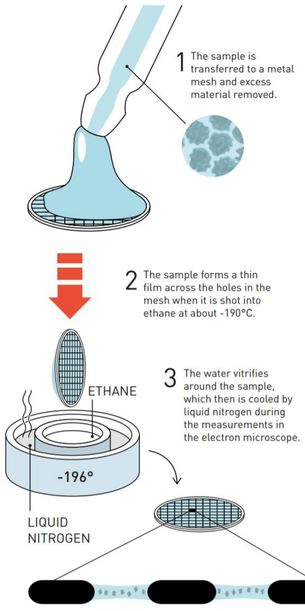

Illustration: ©Johan Jarnestad/The Royal Swedish Academy of Sciences

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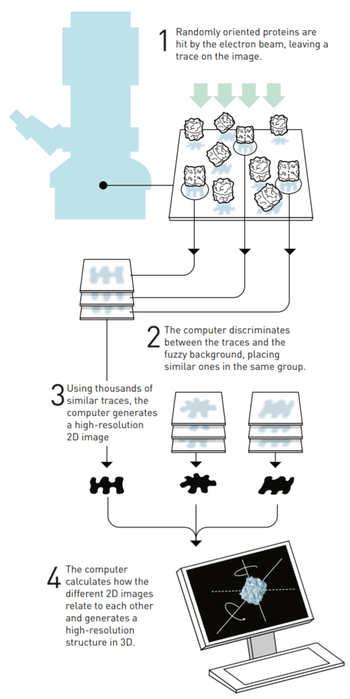
Joachim Frank

Prize share: 1/3

FRANK'S IMAGE ANALYSIS FOR 3D STRUCTURES



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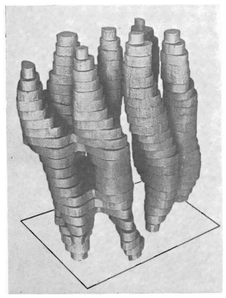
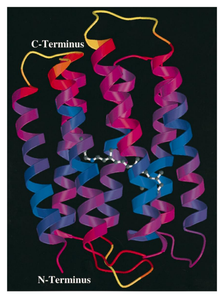
Richard Henderson

Prize share: 1/3

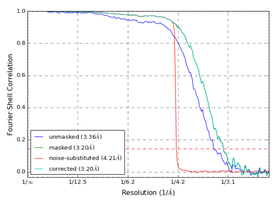
1975, 7 Å
Purple membrane



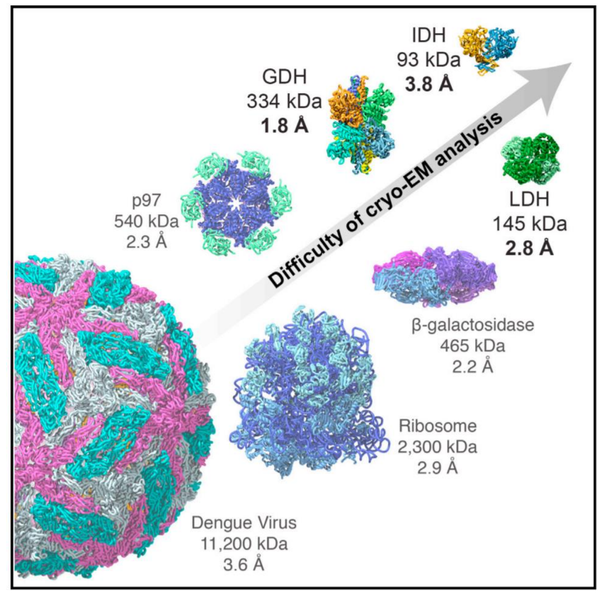
1990, 3.5 Å
Bacteriorhodopsin



Fourier Shell Correlation (FSC)



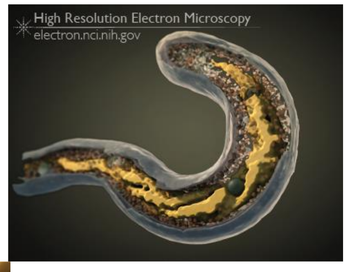
ACHIEVEMENTS

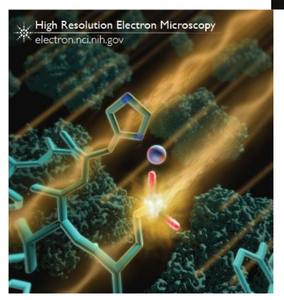


Merk et al., 2016, Cell 165, 1698–1707

FUTURE

❖Cryo-ET (Electron Tomography) would allow us to study the protein-protein interaction inside of the cell.





❖Higher resolution would be beneficial to drug discovery and protein function studies.

BIO PURDUE