



Fall 9-17-2018

Science in the News "The Rise of Cryo-EM"

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Recommended Citation

Vermillion, Austin J., "Science in the News "The Rise of Cryo-EM"" (2018). *CHEM151*. 5.
<https://scholarlycommons.pacific.edu/biochem/5>

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9/17/18

Cryo EM

Cryo-Electron Microscopy is a technique that has been perfected over the last forty years by a variety of scientists. Cryo-EM starts with vitrification of a protein allowing an undamaged and crystalline structure to form. Next, series of images of the structure are attained which are then put into computer software producing “accurate, detailed, 3D models of intricate biological structures...” Previously, lack of technology has hindered the ability of cryo-EM but with new innovations, cryo-EM is poised to become the first-choice option over X-ray crystallography and NMR.

The first cryo-EM apparatus was constructed in 1980 and all models were put in the PDB (Protein Data Base). The thing that separates cryo-EM from many other techniques is that it can “regularly break the 3 Angstrom barrier” which allows for ultra-high-resolution shots. A stand-out trait of cryo-EM is that it can analyze “large, complex and flexible structures.” These structures could not be analyzed before due to them being too large for X-ray crystallography or too complex for NMR. Jacques Dubochet said “in 1977 when I started developing this technique, I never expected it to win me a Nobel Prize.”

As said above three scientists, all adding their own specialty to cryo-EM, won the Nobel Prize in 2017. Joachim Frank has been working on turning images into clean 3D structures since 1975. Jacques Dubochet successfully vitrified water in the early 1980’s allowing for the first step to be done. Finally, Richard Henderson was the first person to use an electron microscope to generate a 3D image of a protein. Huge developments have already been made such as the imaging/structure of the Herpes capsid and also the protein ATM (Ataxia Telangiectasia mutated) which is an initiate protein in DNA in cancer patients. One of the takeaways I got from Jacques Dubochet’s acceptance speech was him saying “ We are three biophysicist’s... us three have never been good chemists nevertheless we obtain a Nobel Prize in chemistry...perhaps this is a beautiful illustration of the unity of science.” This shows science overlaps and flows through every aspect of life.

Citations

-ThermoFisher Scientific on Cryo-Electron Microscopy

Anderson, Mark. "The History of Cryo-EM." *TEM / Thermo Fisher Scientific*, 14 June 2018, www.fei.com/life-sciences/history-of-cryo-em/.

-Jacques Dubochet 2017 Nobel Prize Acceptance Speech

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