# 4.10.2017:

## **The Nobel Prize in Chemistry 2017**

Cryo electron microscopy





The Gordon Research Conference (GRC) in 3D-EM, 1985





## Sample preparation:

"If you have them in ice, or if you have them without water, the molecules, like fish, are dead" ...how to introduce water into the microscope... and into the microscopy field ...avoid crystalline water... → vitreous water

Jacques Dubochet University of Lausanne (Gordon Conf., Girona, Spain, 2014)

## 4.10.2017:

The Nobel Prize in Chemistry 2017 was awarded to Jacques Dubochet, Joachim Frank and Richard Henderson "for developing cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution".





Joachim Frank Columbia University

#### **Image processing and 3D reconstruction:**

"...three-dimensional reconstruction... But these are two-dimensional averages and how to get to threedimensions requires two steps. One was to find relative orientations between the molecules which is difficult if you don't know the structure. So it's like a chicken and egg problem."

"...molecular machines..."

"...would be one of the many states..."

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Richard Henderson LMB Cambridge

### **Detectors & direct structure determination:**

"But the difference is there are quite a lot of structures in biology that were resistant, were recalcitrant to the other methods, like Xray crystallography or NMR. So it has opened up essentially a kind of new, previously unapproachable area of structural biology. "

"...membrane proteins... difficult to crystalize"

"The real power has come from the images where you don't need crystals, so you just take a picture, you look at it, you process it, you average structures"

"so it is a much more direct method..." <u>+ detector developments</u>

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**Sample preparation** 

Image processing

**Structure determination**