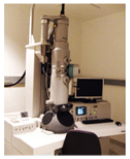
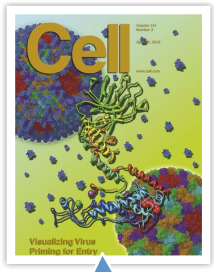
Seeing Atomic Structures of Nano-machines in 2D, 3D & 4D

– Electron Imaging Center for Nanomachines (EICN)

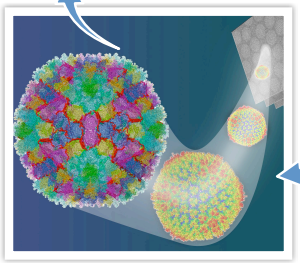
Electron Microscopes in EICN

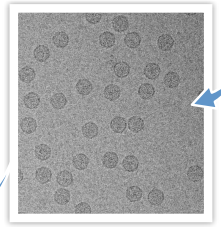
Available Titan S/TEM (FEI) Room-B122	Available Titan Krios HighRes CryoEM and CryoET Room-B140	Available TF 20 CryoEM and CryoET (FEI) Room-B146C
		
Available T12 Quick CryoEM and CryoET (FEI) Room-B122	Available CM120 regular and cryoEM (FEI) Room-B146B	Available JEM1200-EX (JEOL) Room-B146D
		

CryoEM: At a Glance



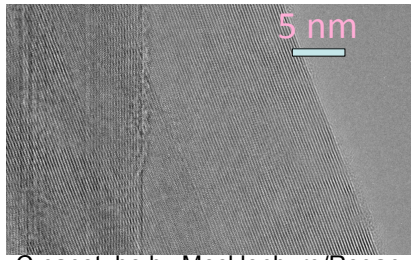
3.3 Å (0.33 nm) Highest Resolution in the World



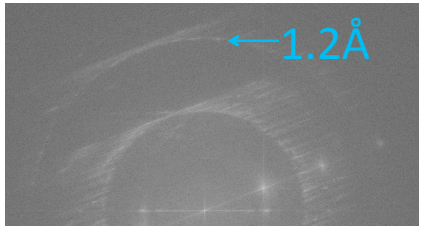


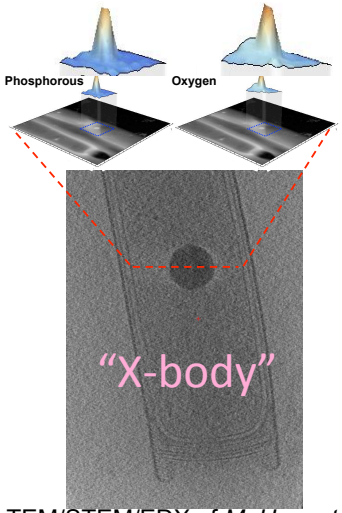
Liu, H, Zhou, Z.H, et al. (2010) , *Science*
Zhang, X, Zhou, Z.H, et al. (2010), *Cell*

2D images at atomic resolution



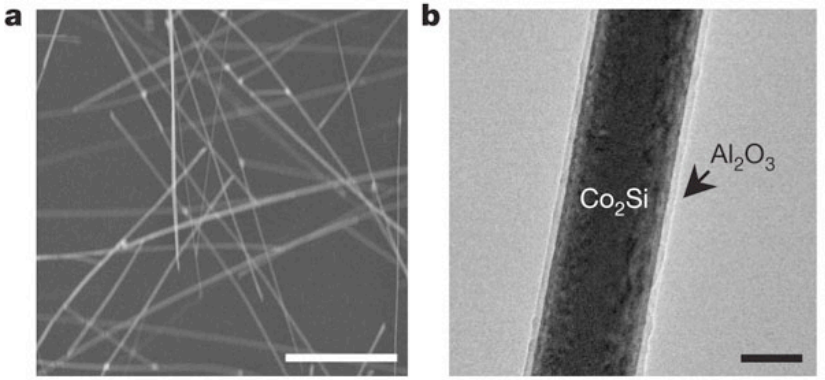
C nanotube by Mecklenburg/Regan





TEM/STEM/EDX of *M. Hungatei*
(Toso, Henstra, Gunsalus & Zhou)

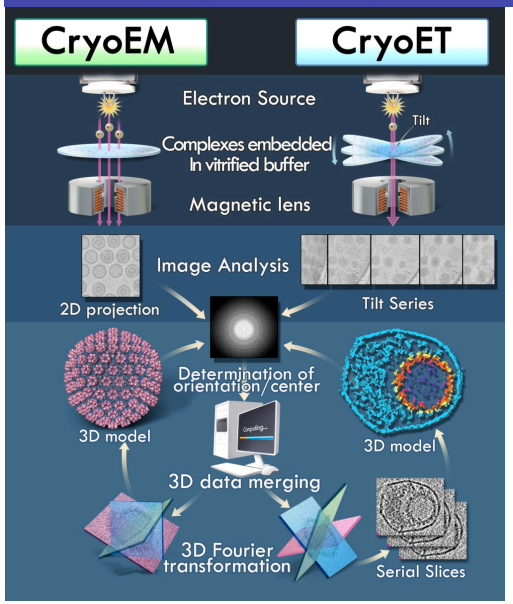
High-speed graphene transistors with a self-aligned nanowire gate



Liao *et al. Nature* (2010);467:305-8

nature

Seeing in 3D: Cryo Electron Microscopy &



Single-particle cryoEM:

- Averaging of 10,000 **identical, "single"** complexes
- Near atomic resolution (3-5 Å, *i.e.*, 0.3-0.5 nm)
- Suitable for complexes > 100kDa

CryoET or ET:

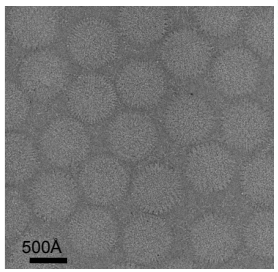
- Pleomorphic/dynamic structures
- Averaging not possible
- Tilting the sample, not camera
- Molecular resolution (2-5 nm) for biological samples, atomic resolution for materials
- Molecules, to devices, to cells (<1 µm thickness)

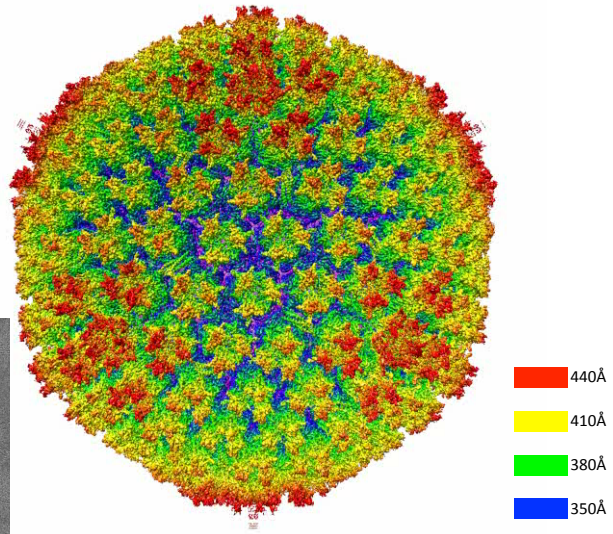
3D Structure of Human Adenovirus by cryoEM

Diameter:
~920Å

Molecule weight:
~150MDa

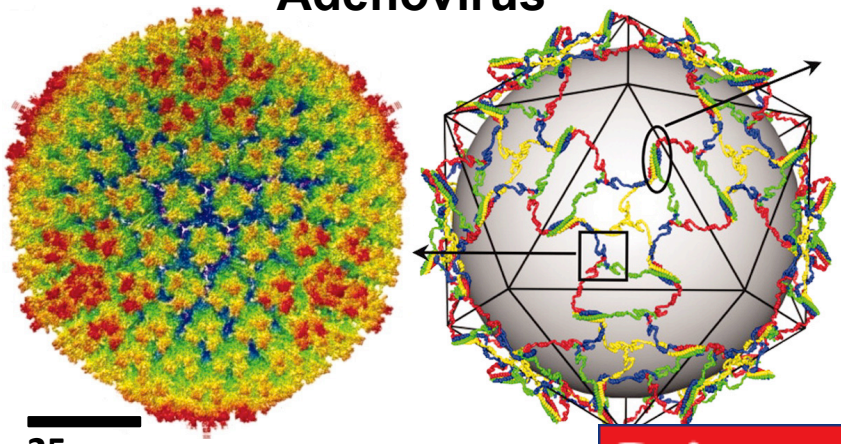
Resolution
3.6Å





cryoEM atomic Structure of a natural nano-machine

Adenovirus



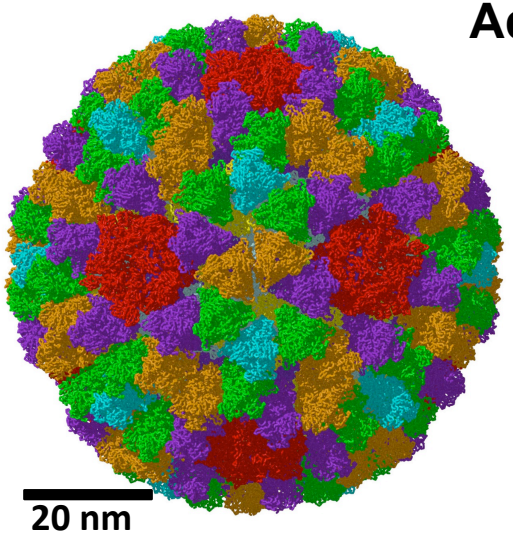
Science
AAAS

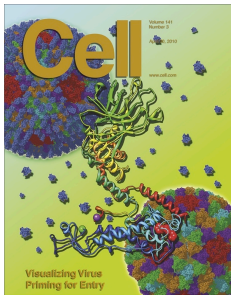
Published by AAAS

Liu et al. *Science* 2010(329):1038-1043

cryoEM atomic Structure of a natural nano-machine

Aquareovirus

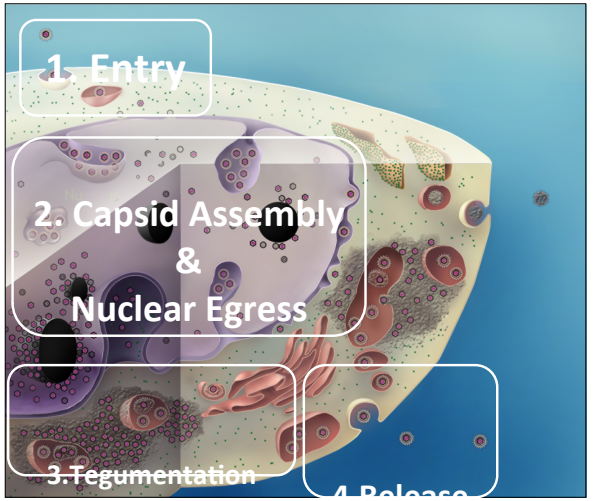


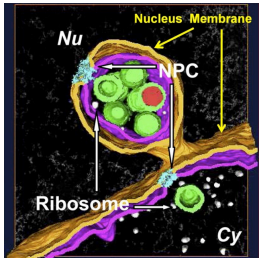


Zhang et al. *Cell* 2010(141):472-482

Tomography in 4D

-- Infection Cycle of a Tumor Herpesvirus





Egress of capsid

L. Peng, S. Ryazantsev, R. Sun & Hong Zhou. ***Structure***. 2010,18(1):47-58