INTERNATIONAL CRYO-EM FACILITY AT THE ESRF, THE EUROPEAN SYNCHROTRON: CURRENT STATUS AND PERSPECTIVES

EAAZHISAI KANDIAH

ESRF
The European Synchrotron

EUROPEAN (ELECTRON) PHOTON NEUTRON CAMPUS

A MODEL OF INTERNATIONAL COOPERATION - ESRF

13 Member states:

France	27.5 %
Germany	24 %
Italy	13.2 %
United Kingdom	10.5 %
Russia	6 %
Benesync (Belgium, The Netherlands)	5.8 %
Nordsync (Denmark, Finland, Norway, Sweden)	5 %
Spain	4 %
Switzerland	4 %

9 Associate countries:

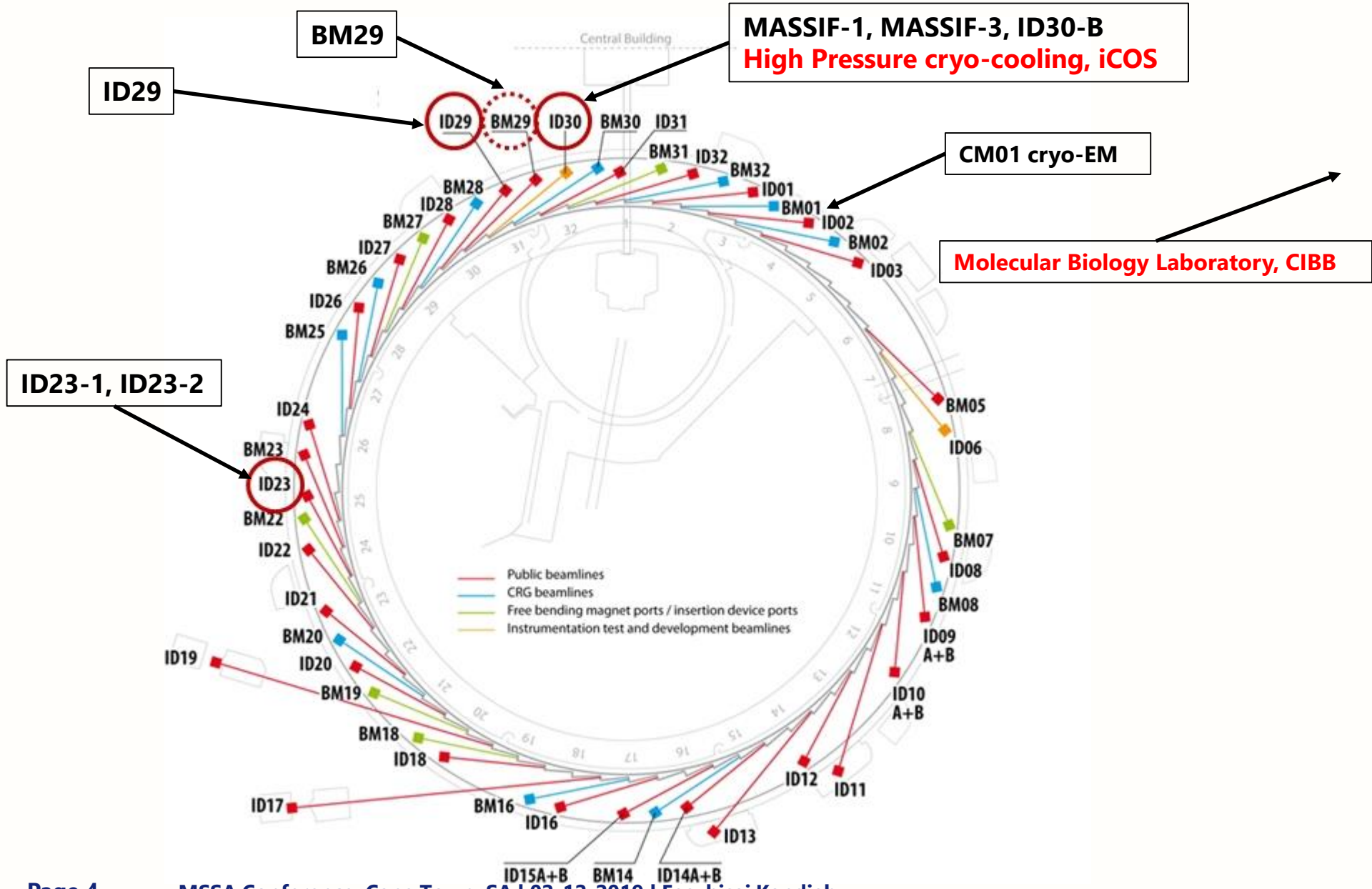
Israel	1.5 %
Austria	1.3 %
Centralsync (Czech Republic, Hungary, Slovakia)	1.05%
Poland	1 %
Portugal	1 %
India	0.66%
South Africa	0.3%

ESRF
The European Synchrotron

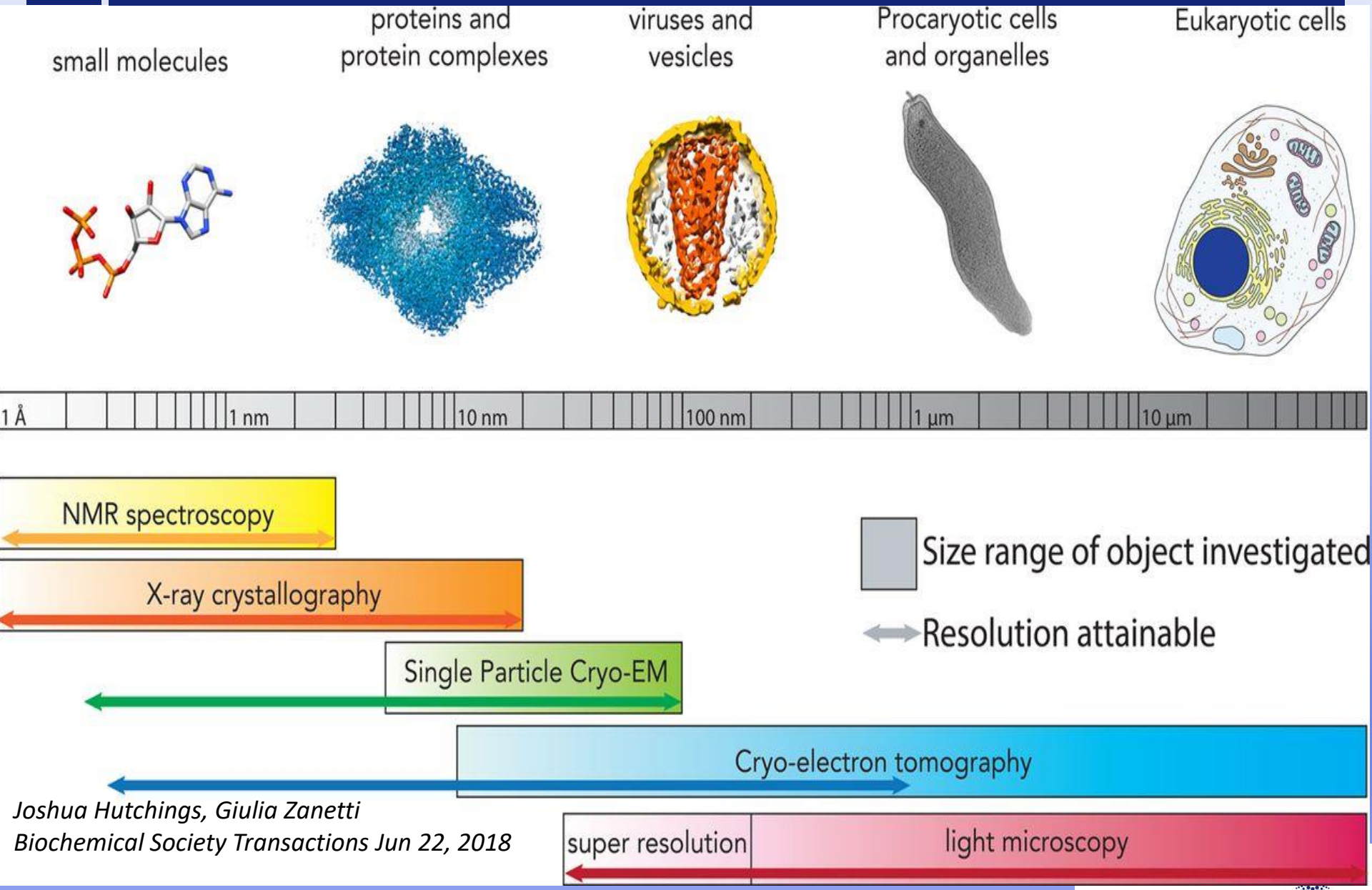
21 partner nations
Annual budget: 100 million euros
Members of staff: 630 of 40 different nationalities
Legal status: Private civil company subject to French law

Peer review access based on scientific excellence, provided free of charge for scientists from partner countries.

THE STRUCTURAL BIOLOGY BEAMLINES



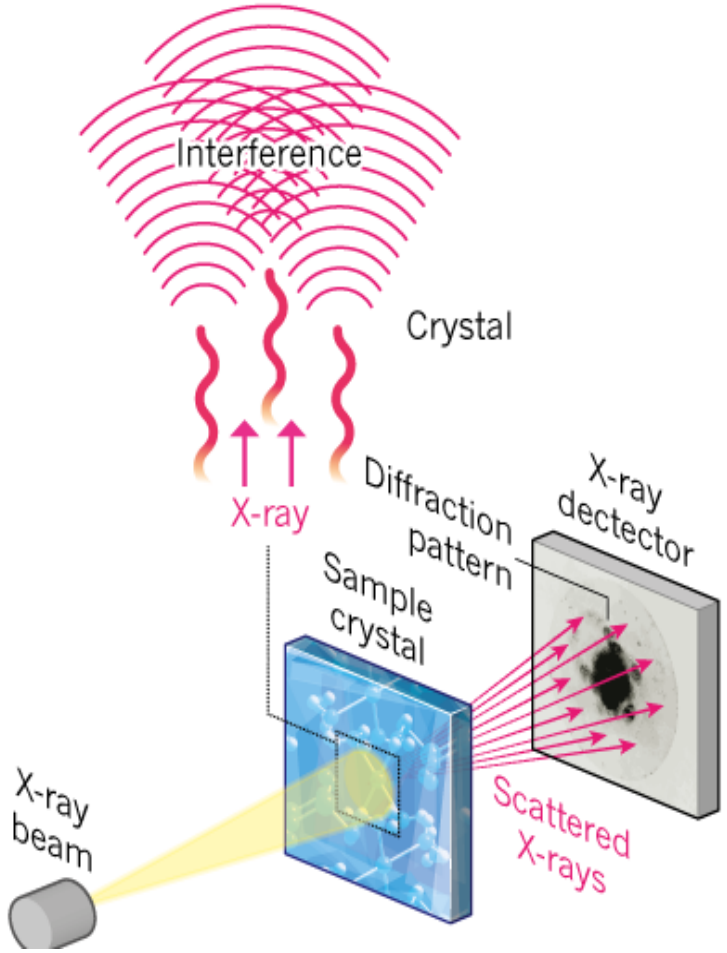
STRUCTURAL BIOLOGY SCALE!



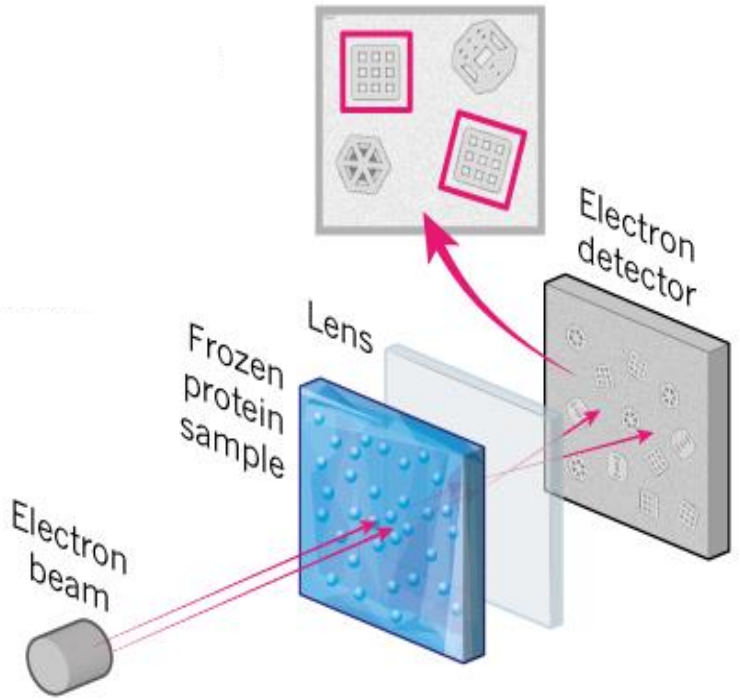
Joshua Hutchings, Giulia Zanetti
Biochemical Society Transactions Jun 22, 2018

COMPLEMENTARY HIGH RESOLUTION SB TECHNIQUES

X-ray Crystallography



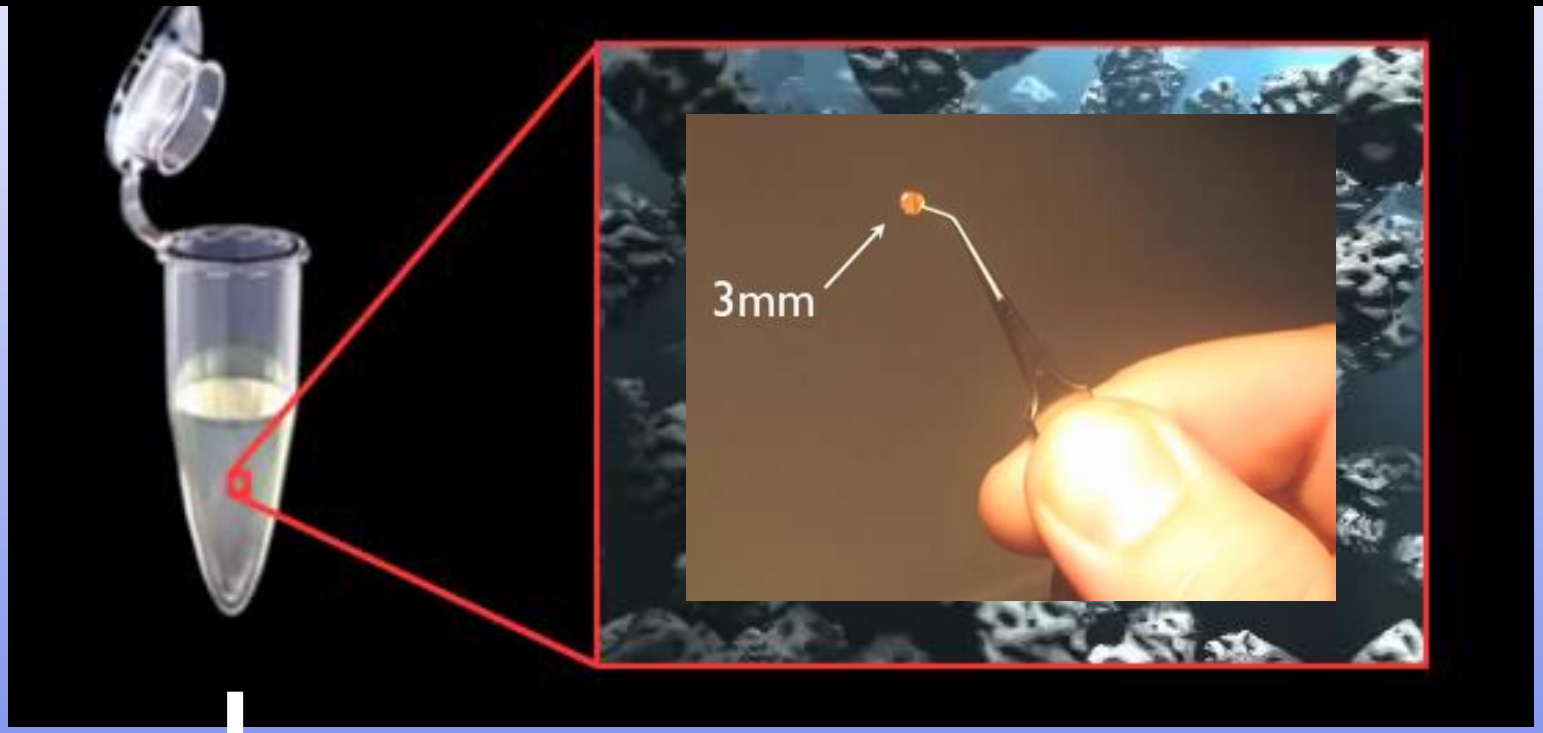
Cryo-electron Microscopy

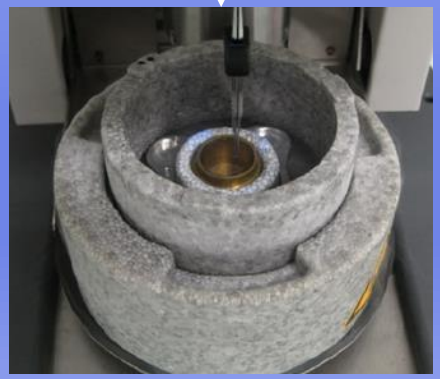


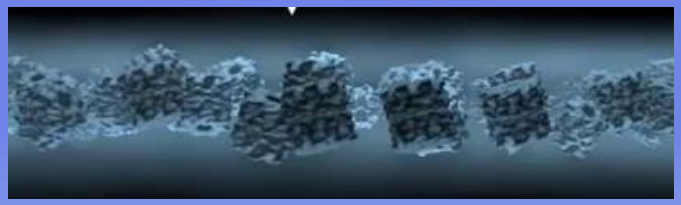
Nature, **550,**167(12 October 2017)

What is single particle analysis?

Vitrification of Biological Sample

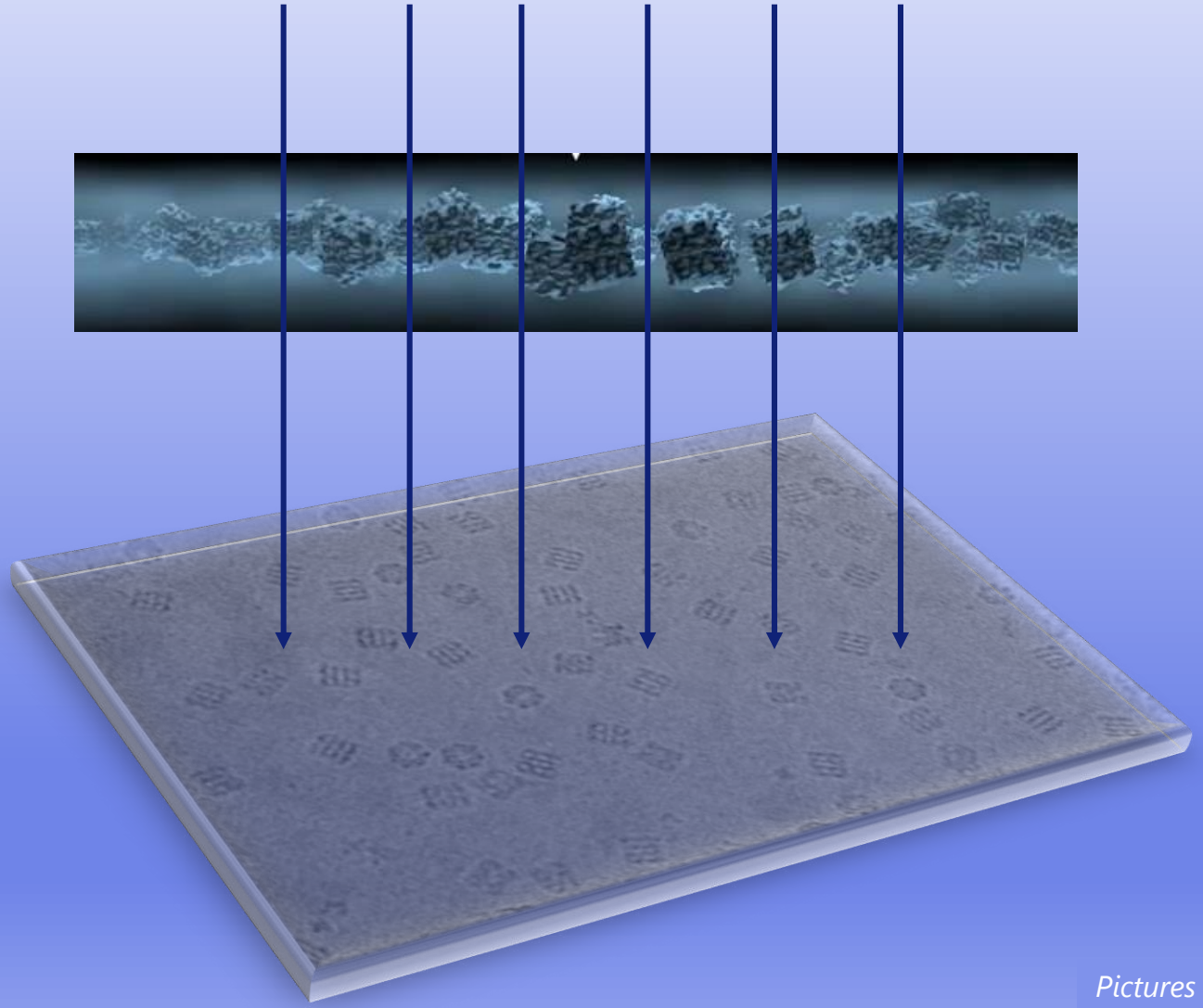




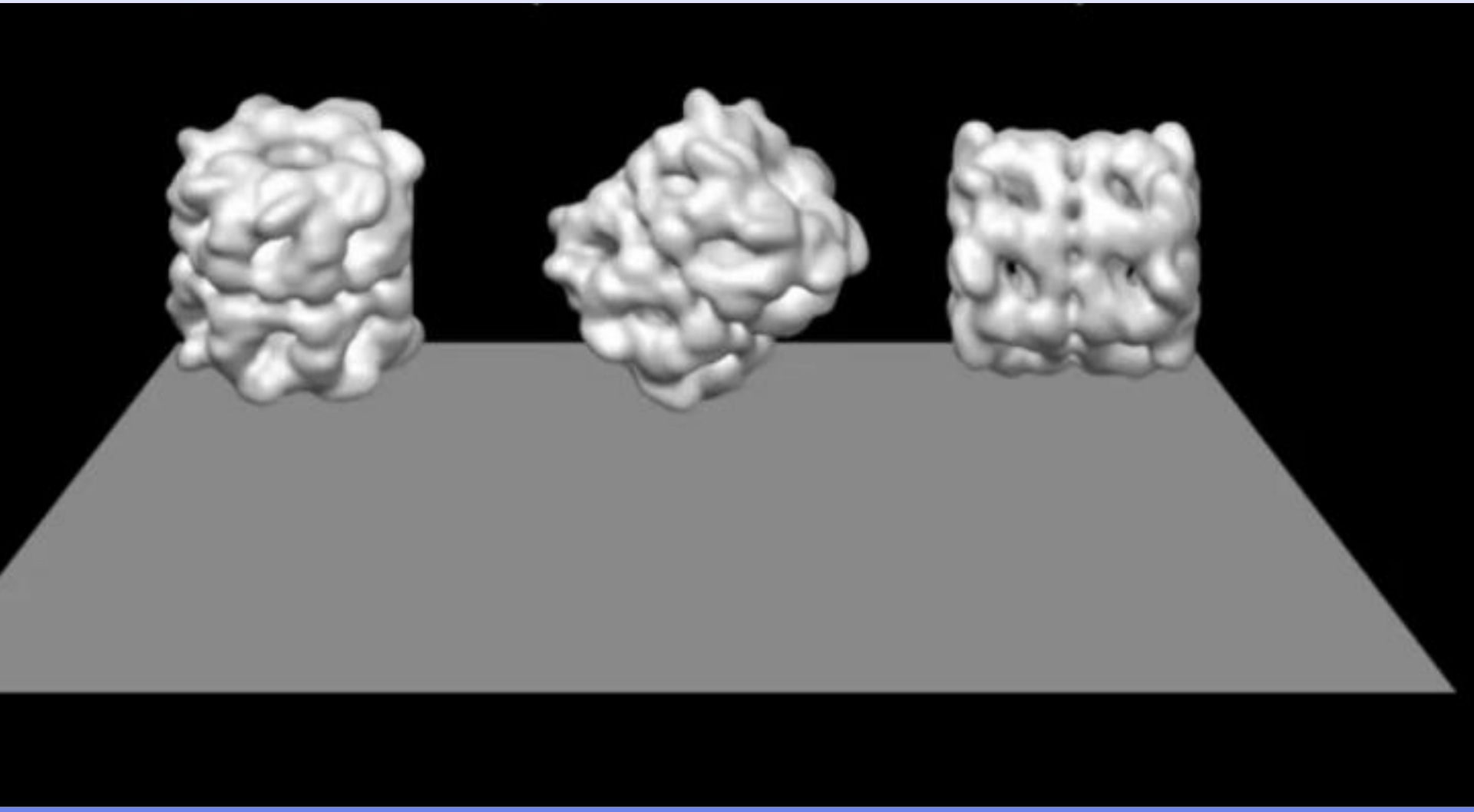


Pictures and Video Courtesy Gabriel Lander, Scripps

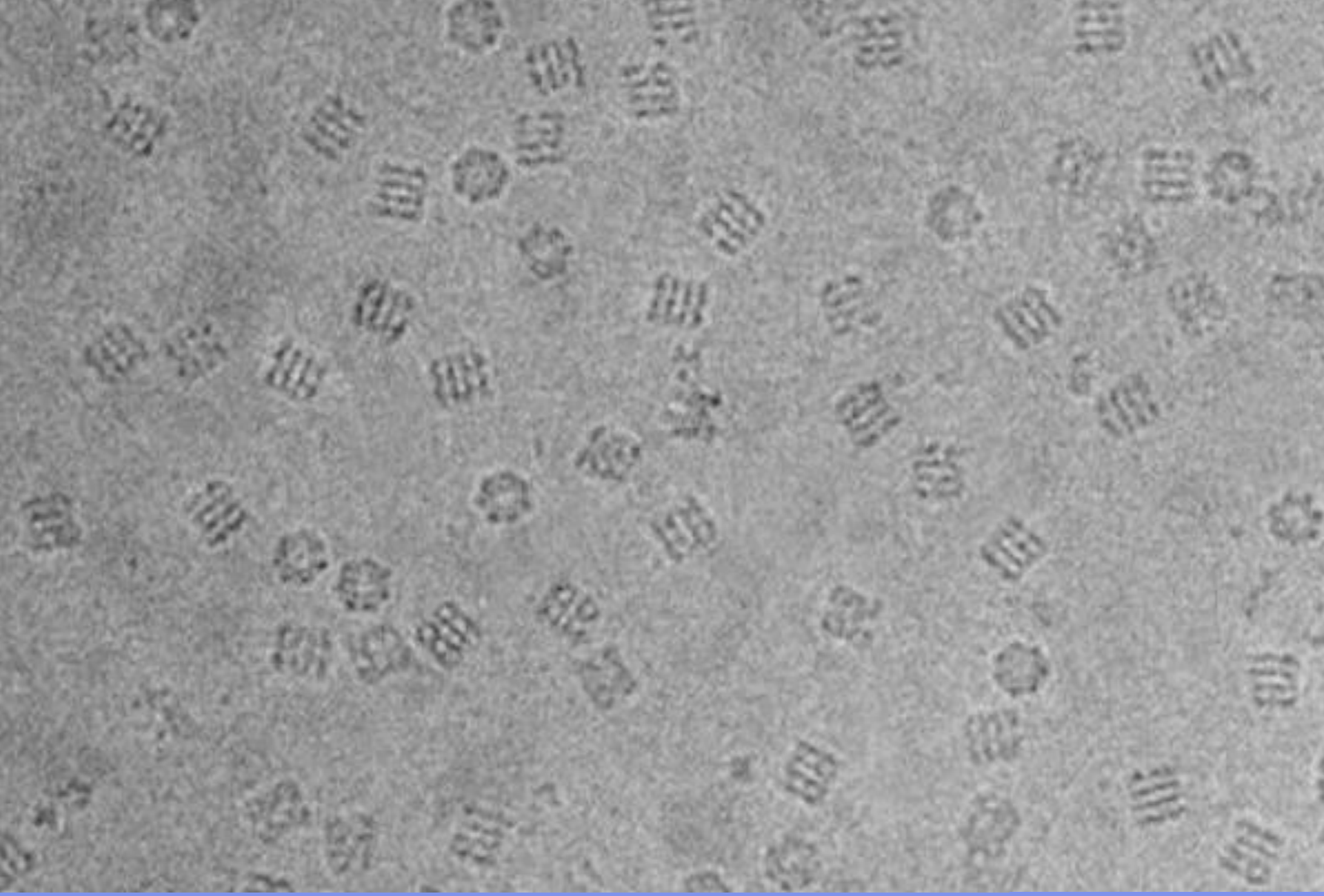
IMAGING BY TEM



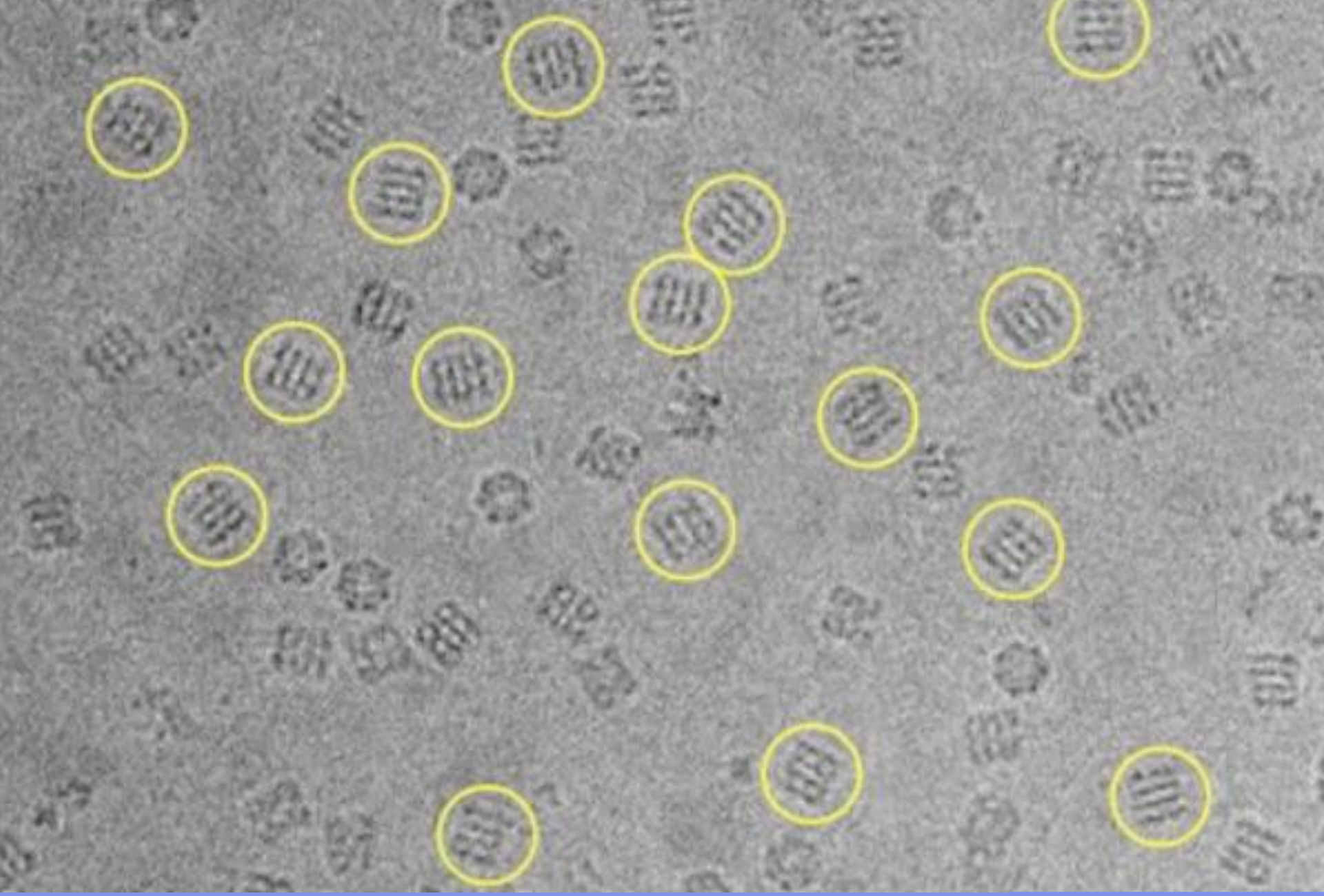
Pictures and Video Courtesy
Gabriel Lander, Scripps



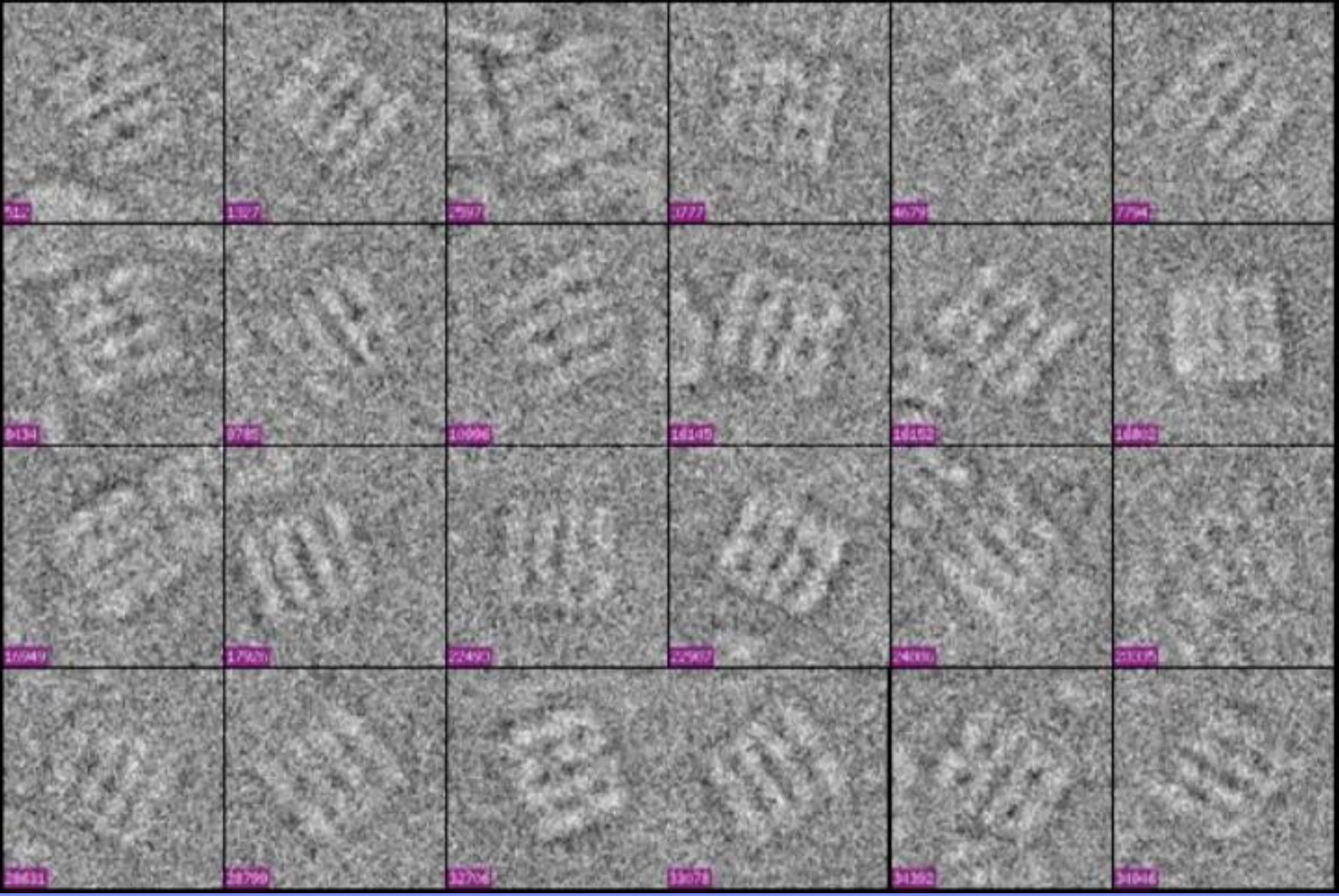
Pictures and Video Courtesy Gabriel Lander, Scripps



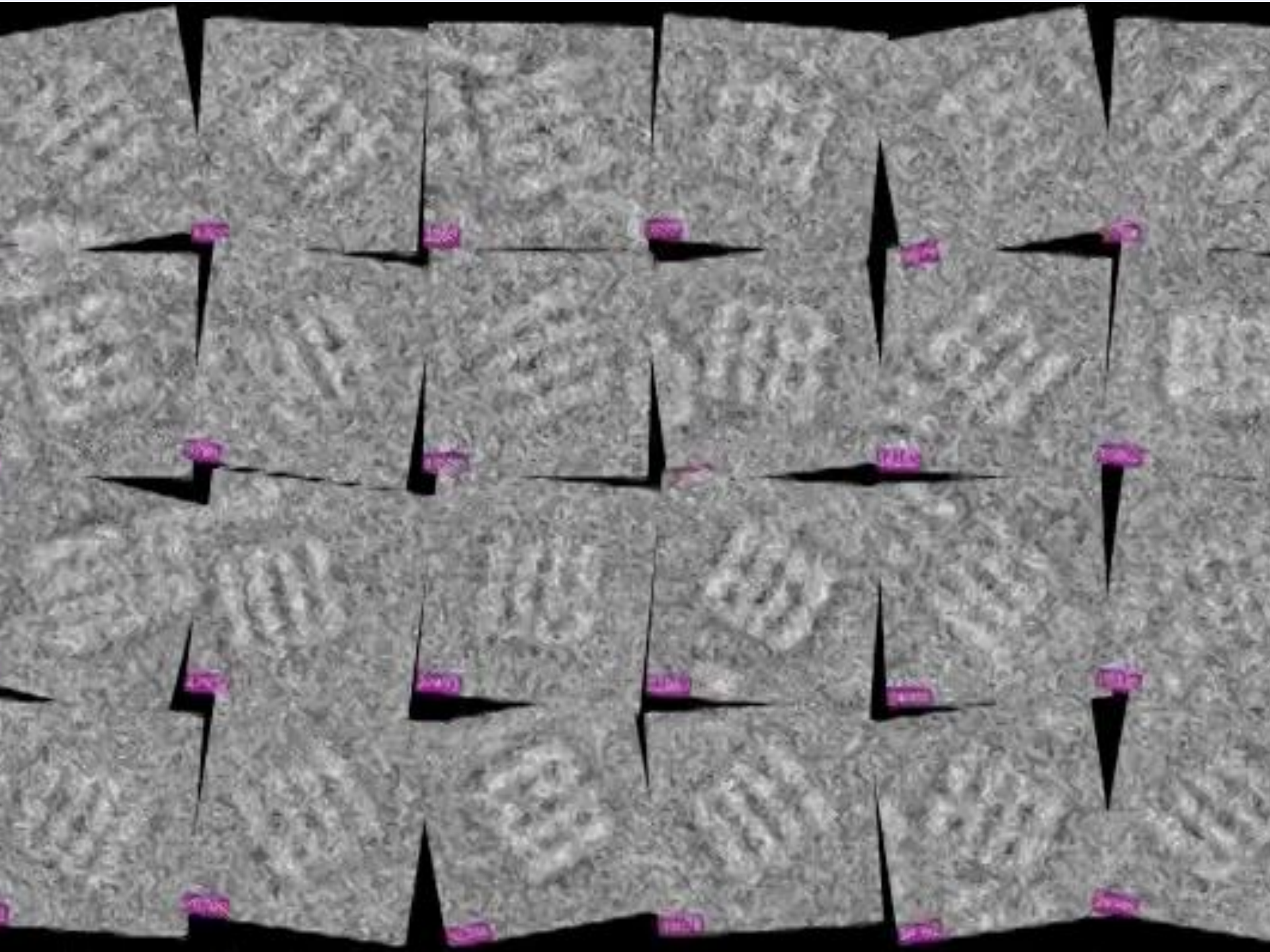
Pictures and Video Courtesy Gabriel Lander, Scripps



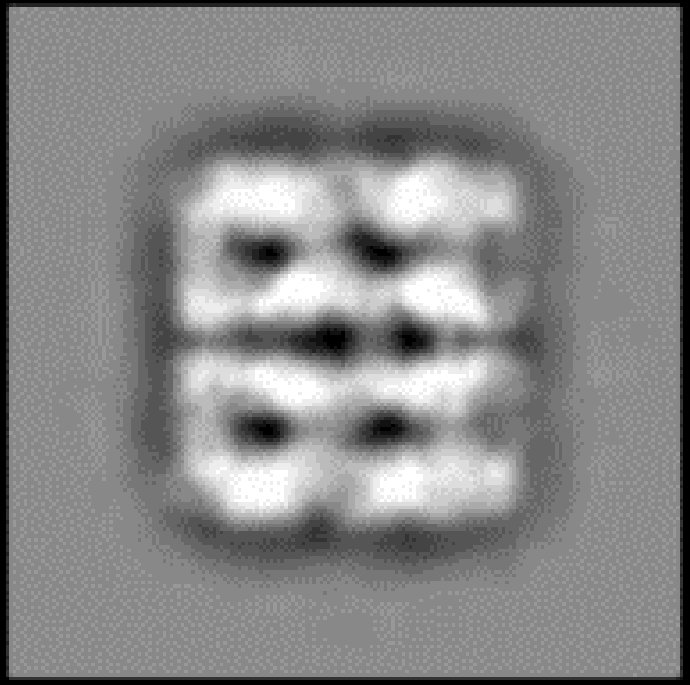
Pictures and Video Courtesy Gabriel Lander, Scripps



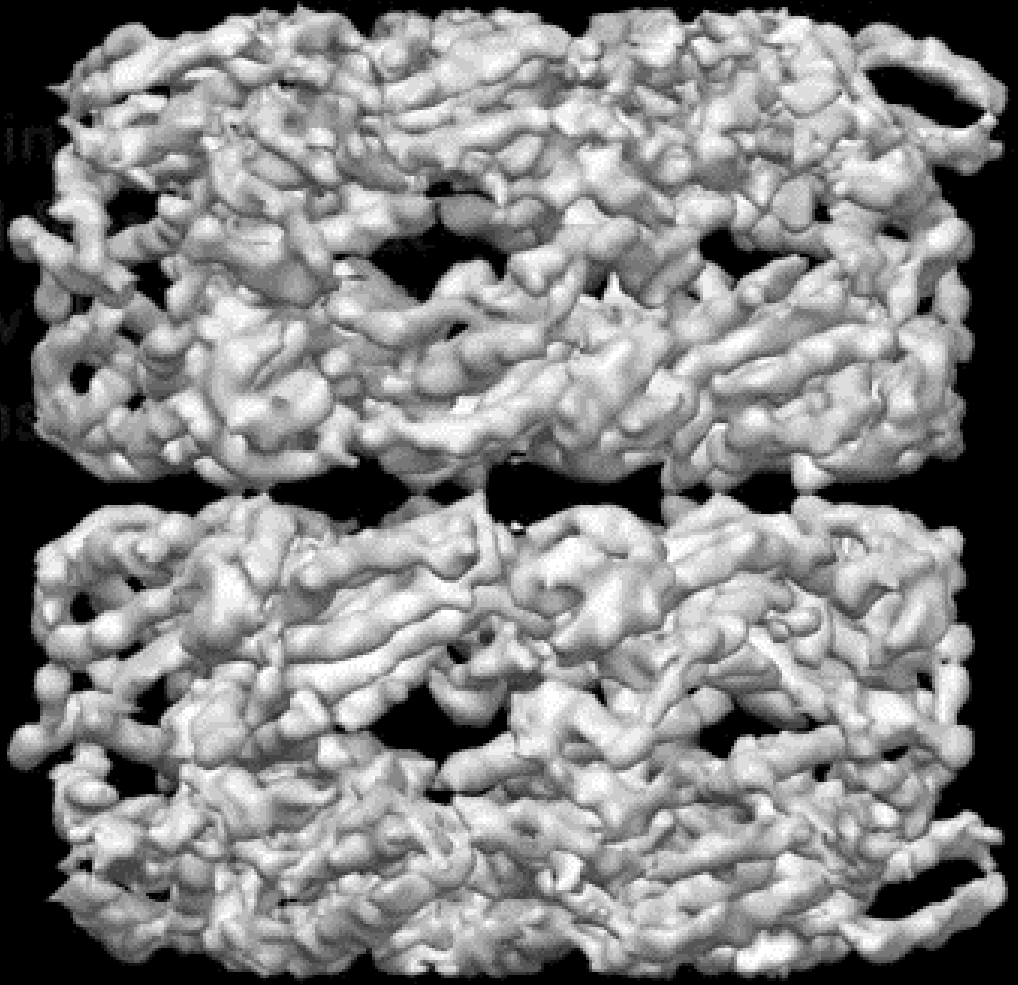
Pictures and Video Courtesy
Gabriel Lander, Scripps



This summed image provides a more detailed view of the molecule in this orientation



Then we gather all these views and combine them computationally



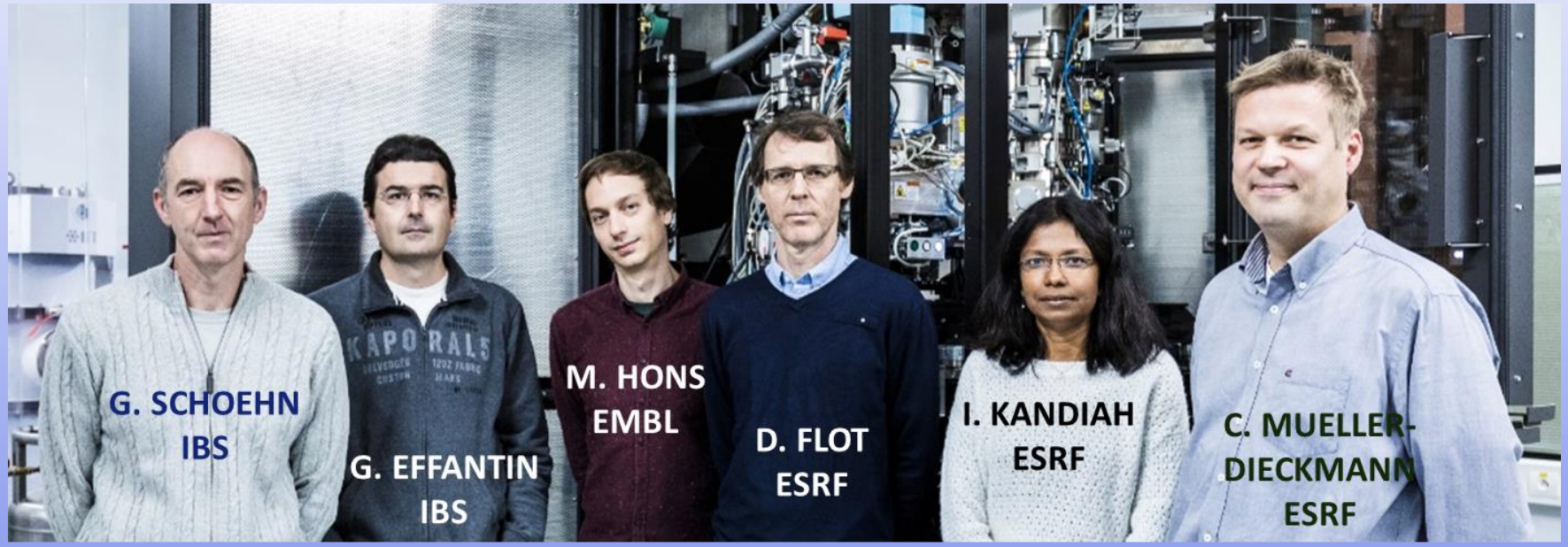
This provides us with a 3D reconstruction of our molecule

Cryo-EM @ ESRF

Photo by Cande

- Titan Krios G3
- Quantum LS energy filter
- K2 summit direct detector
- Volta phase plate

THE CRYO-EM PLATFORM CM01 – THE TEAM



D. TRAORE
ILL

cryo-em@esrf.fr
kandiah@esrf.fr

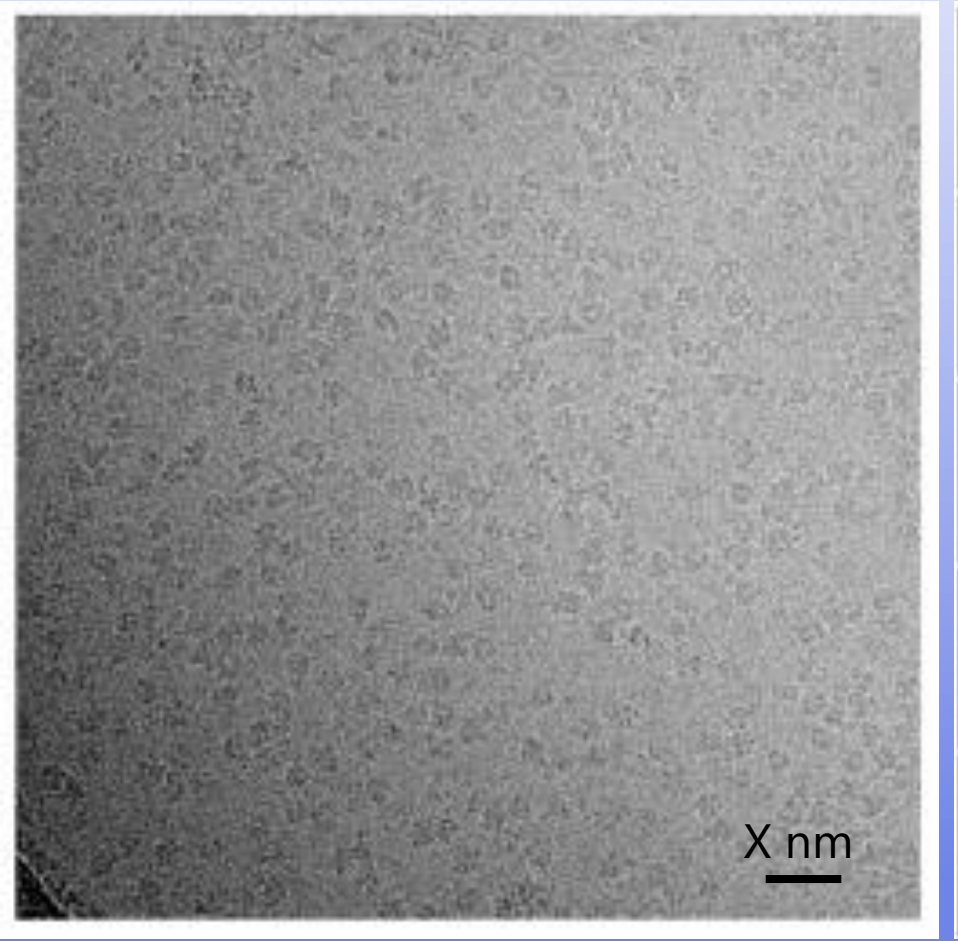
Cryo-EM @ ESRF

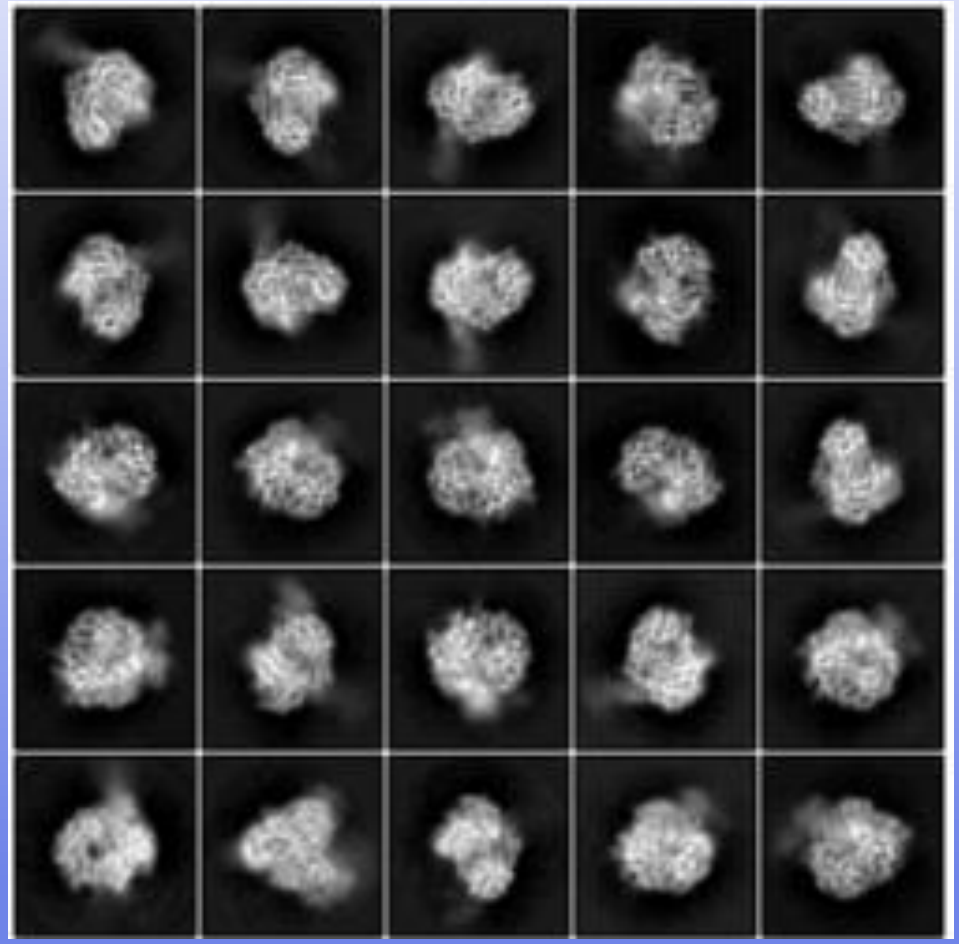
Photo by Cande

CM01 Access Model: User support

- **Single particle experiments** only
- **Rolling access proposals** at any time (direct ESRF submission)
- Beam time granted by BTAP
- **ESRF covers travel and accommodation** for either 2 users or 1 user and 1 shipping
- **Pre-characterised samples only**
- 2-3 days experiment

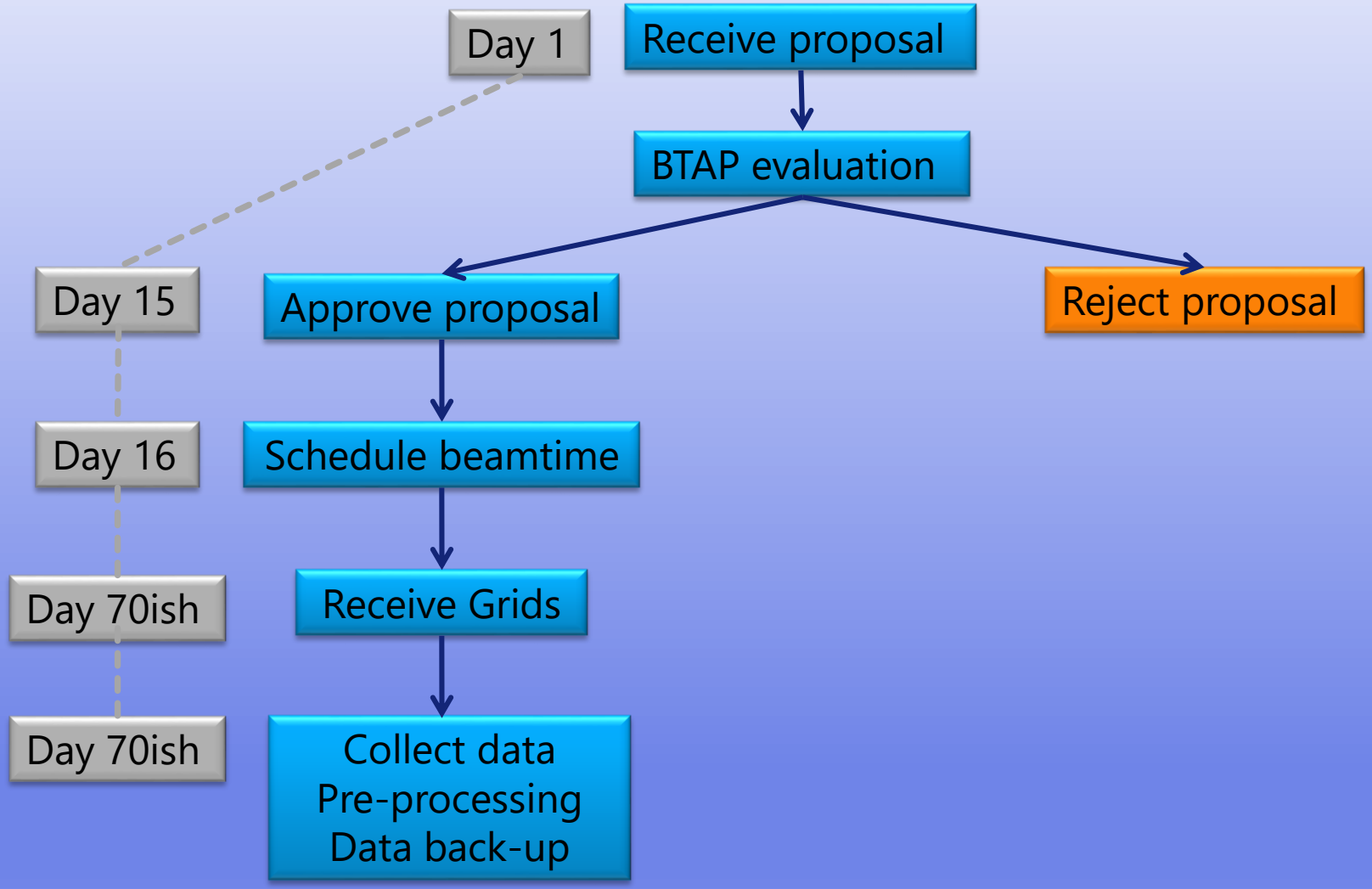
Beamtime allocation- minimum requirements



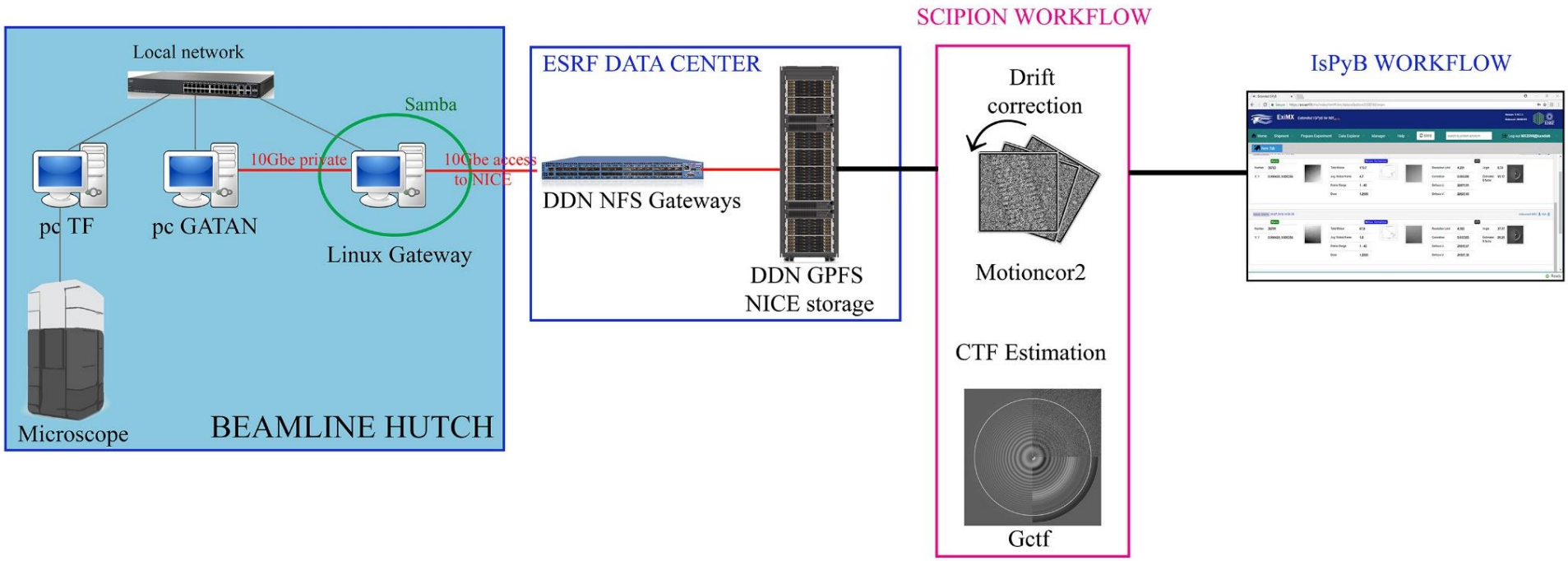


Kouba et al, NSMB, 2019

CM01 Access Model

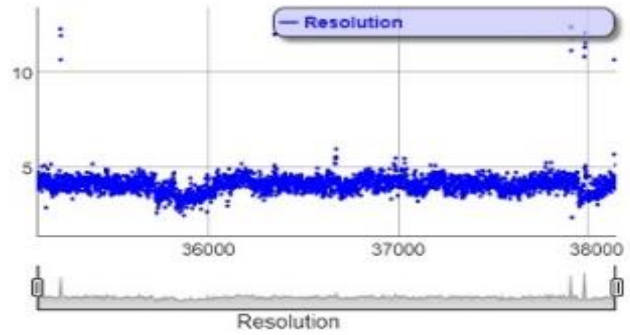


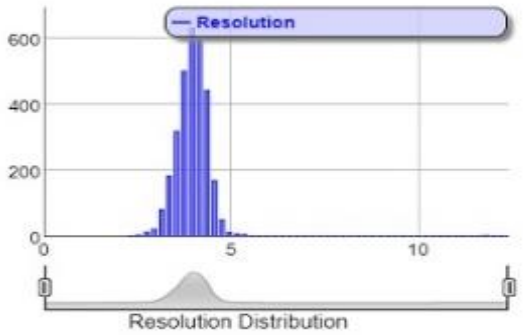
USER SUPPORT: DATA MANAGEMENT



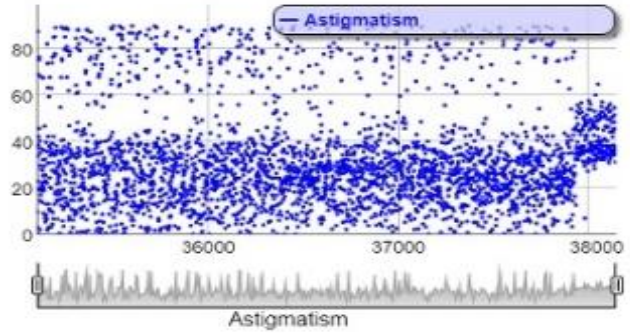
USER SUPPORT: DATA MANAGEMENT

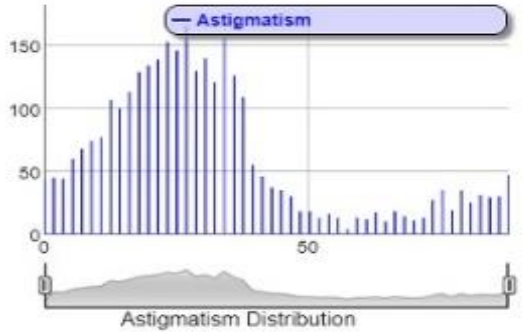
Resolution





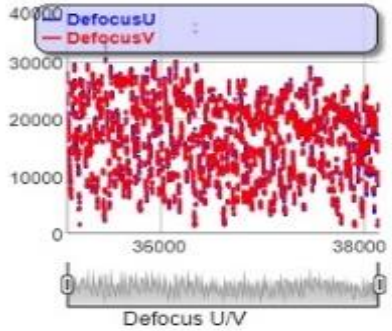
Astigmatism

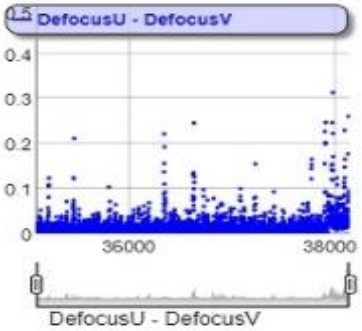


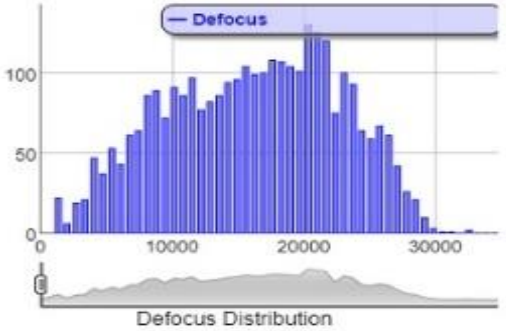


Kandiah et al, ActaD, 2019

Defocus







CM01 PUBLICATIONS

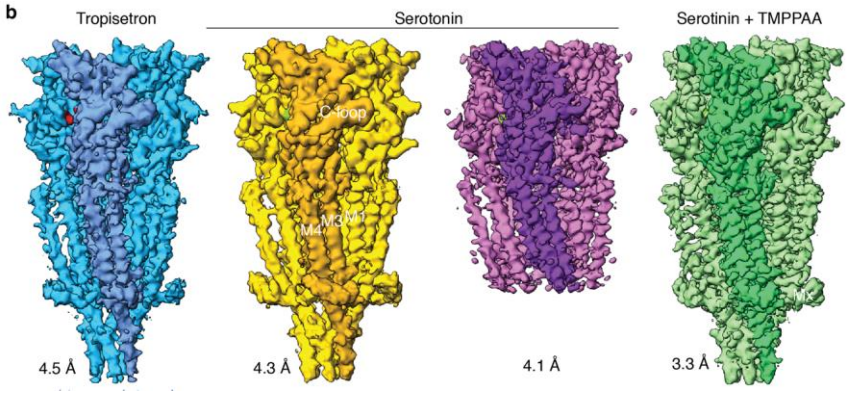
nature
International journal of science

Letter | Published: 31 October 2018

Conformational transitions of the serotonin 5-HT_3 receptor

Lucie Polovinkin, Ghérici Hassaine, Jonathan Perot, Emmanuelle Neumann, Anders A. Jensen, Solène N. Lefebvre, Pierre-Jean Corringer, Jacques Neyton ✉, Christophe Chipot, Francois Dehez, Guy Schoehn & Hugues Nury ✉

Nature **563**, 275–279 (2018) | Download Citation

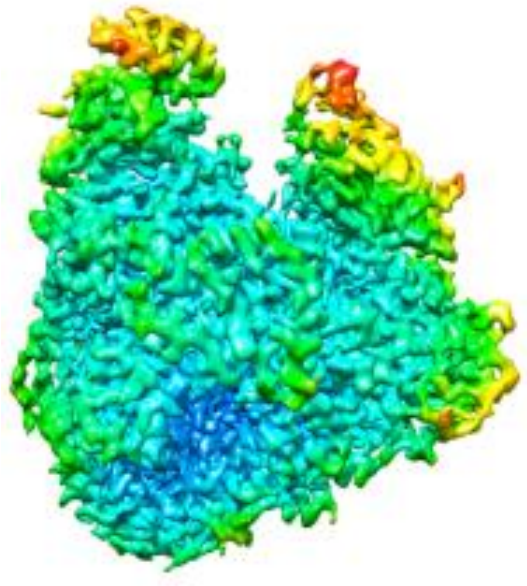


nature structural & molecular biology

Article | Published: 03 June 2019

Structural snapshots of actively transcribing influenza polymerase

Tomas Kouba, Petra Drncová & Stephen Cusack ✉



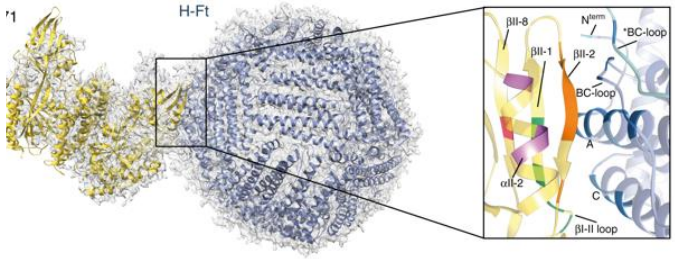
CM01 PUBLICATIONS

nature COMMUNICATIONS

Cryo-EM structure of the human ferritin–transferrin receptor 1 complex

Linda Celeste Montemiglio, Claudia Testi, Pierpaolo Ceci, Elisabetta Falvo, Martina Pitea, Carmelinda Savino, Alessandro Arcovito, Giovanna Peruzzi, Paola Baiocco, Filippo Mancia, Alberto Boffi, Amédée des Georges ✉ & Beatrice Vallone ✉

Nature Communications **10**, Article number: 1121 (2019) | Download Citation

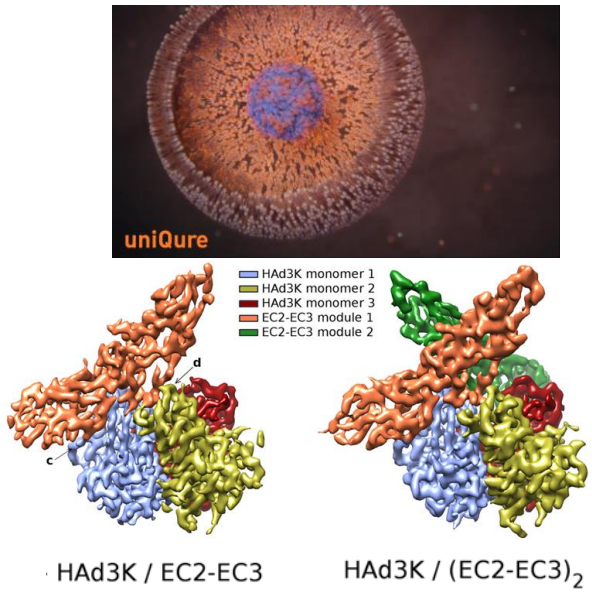


nature COMMUNICATIONS

CryoEM structure of adenovirus type 3 fibre with desmoglein 2 shows an unusual mode of receptor engagement

Emilie Vassal-Stermann, Gregory Effantin, Chloe Zubieta, Wim Burmeister, Frédéric Iseni, Hongjie Wang, André Lieber ✉, Guy Schoehn & Pascal Fender ✉

Nature Communications **10**, Article number: 1181 (2019) | Download Citation



CM01 PUBLICATIONS

Science Home News Journals Topics Careers

REPORT

The structure of a membrane adenylyl cyclase bound to an activated stimulatory G protein

Chao Qi[1,2], Simona Sorrentino[3], Ohad Medalia[3,4], Volodymyr M. Korkhov[1,2,*]

[1]Institute of Biochemistry, ETH Zurich, Zurich, Switzerland.

[2]Laboratory of Biomolecular Research, Division of Biology and Chemistry, Paul Scherrer Institute, Villigen, Switzerland.

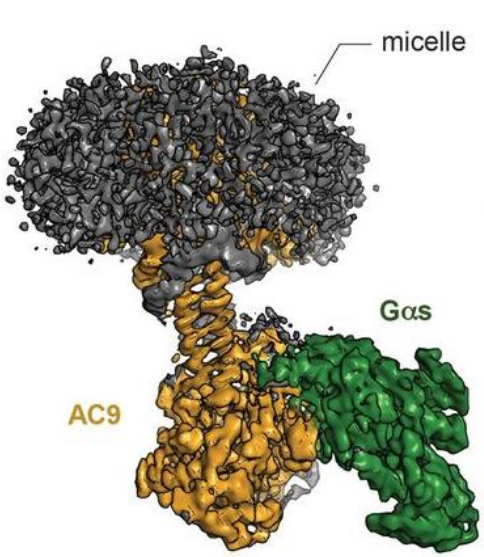
[3]Institute of Biochemistry, University of Zurich, Zurich, Switzerland.

[4]Department of Life Sciences and the National Institute for Biotechnology in the Negev, Ben Gurion University of the Negev, Beer-Sheva, Israel.

*Corresponding author. Email: volodymyr.korkhov@psi.ch

– Hide authors and affiliations

Science 26 Apr 2019:
Vol. 364, Issue 6438, pp. 389-394
DOI: 10.1126/science.aav0778

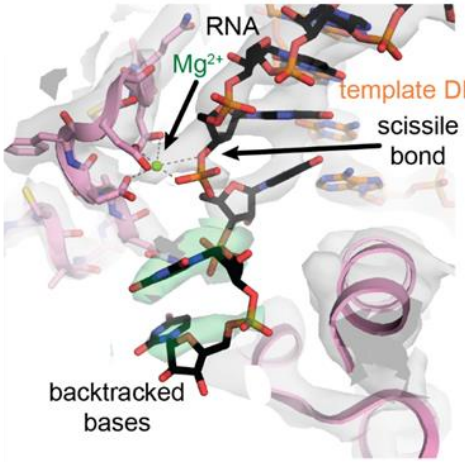


Molecular Cell

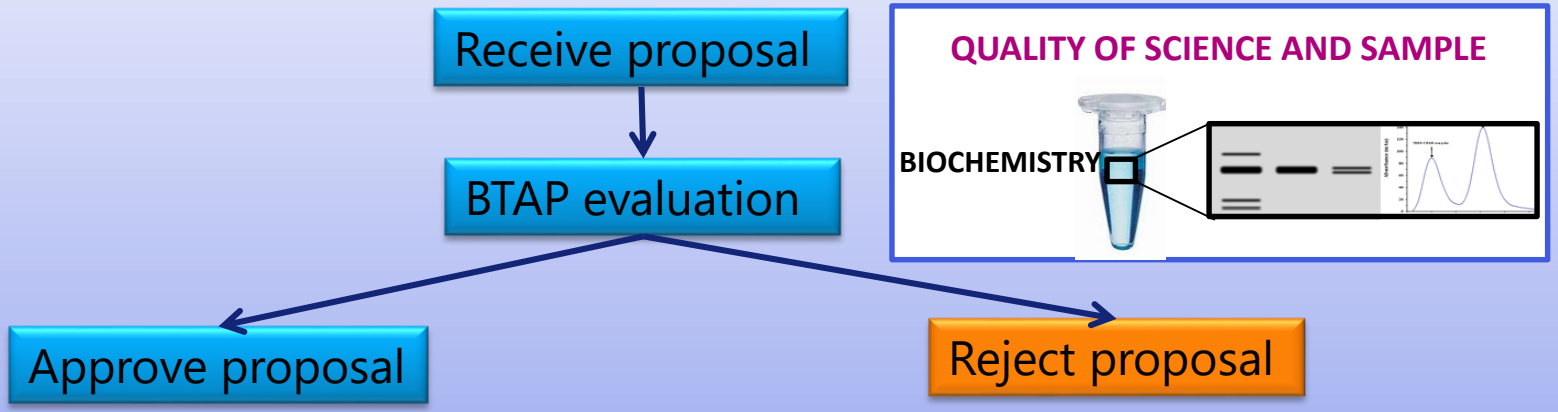
Structural Basis of Transcription: RNA Polymerase Backtracking and Its Reactivation

Mo'men Abdelkareem • Charlotte Saint-André • Maria Takacs • ... Xieyang Guo [5] • Julio Ortiz [6] • Albert Weixlbaumer [7] • Show all authors • Show footnotes

Published: May 15, 2019 • DOI: https://doi.org/10.1016/j.molcel.2019.04.029



PSB PIPELINE ACCESS MODEL



PSB PIPELINE ACCESS MODEL

Receive proposal

BTAP evaluation

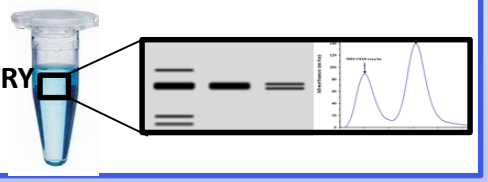
Approve proposal

NS-EM service

IBS EM Platform

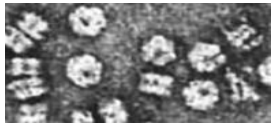
QUALITY OF SCIENCE AND SAMPLE

BIOCHEMISTRY



QUALITY OF SAMPLE FOR EM

NEGATIVE STAIN ELECTRON MICROSCOPY



PSB PIPELINE ACCESS MODEL

Receive proposal

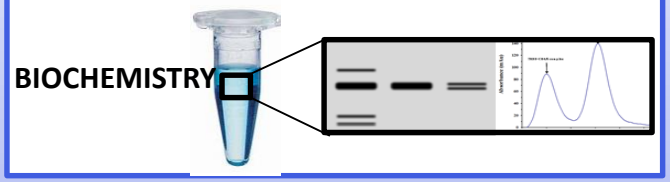
BTAP evaluation

Approve proposal

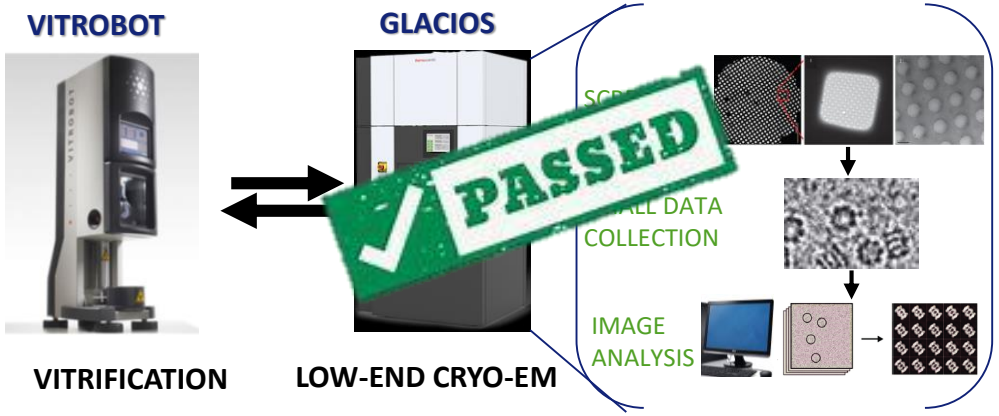
IBS EM Platform — NS-EM service

IBS EM Platform — Vitrification and Screening

QUALITY OF SCIENCE AND SAMPLE



SAMPLE PREPARATION FOR HIGH END CRYO-EM



PSB PIPELINE ACCESS MODEL

Receive proposal

BTAP evaluation

Approve proposal

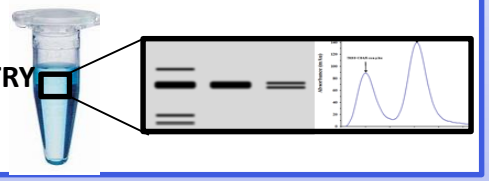
IBS EM Platform — NS-EM service

IBS EM Platform — Vitrification and Screening

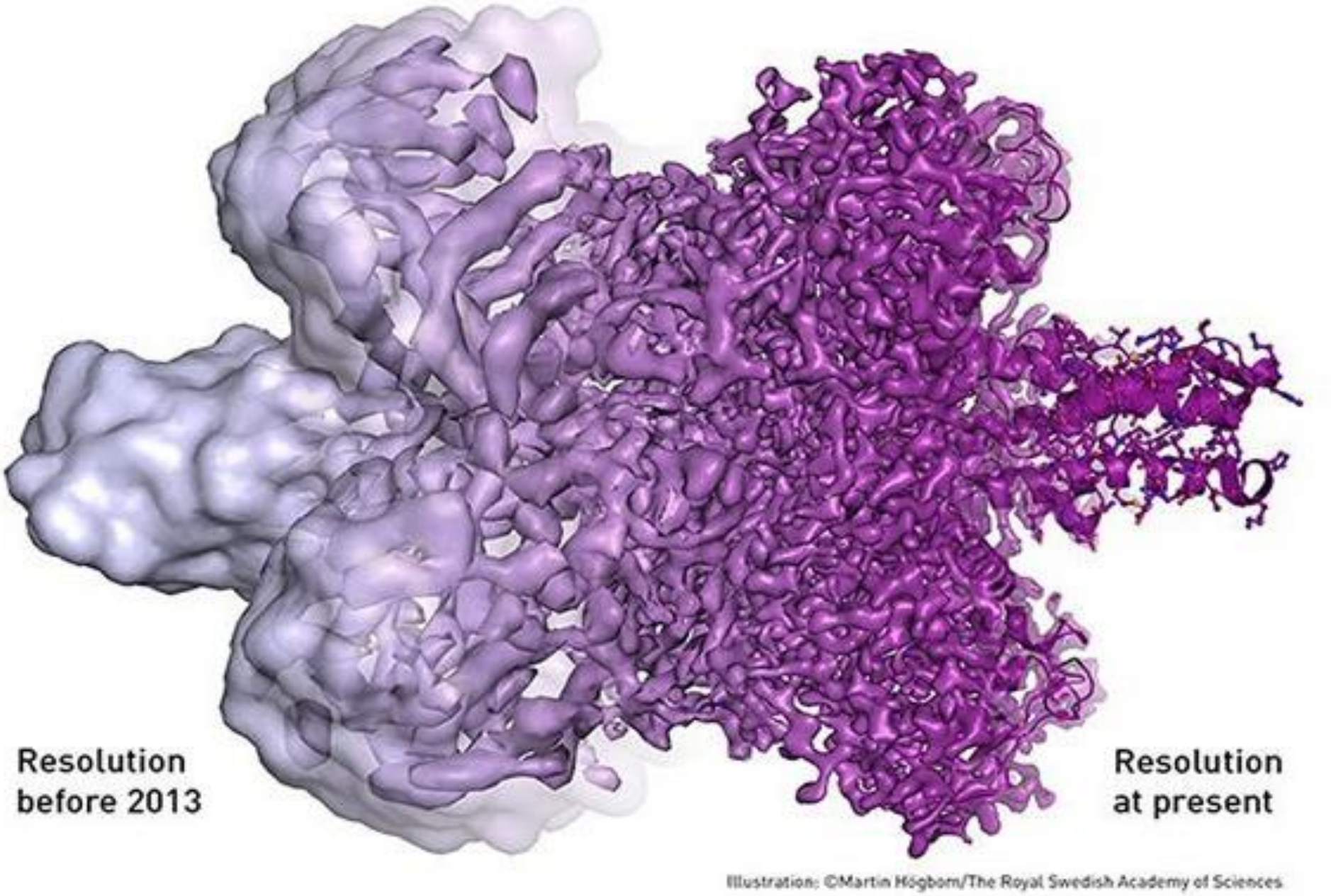
Schedule beamtime In Krios

QUALITY OF SCIENCE AND SAMPLE

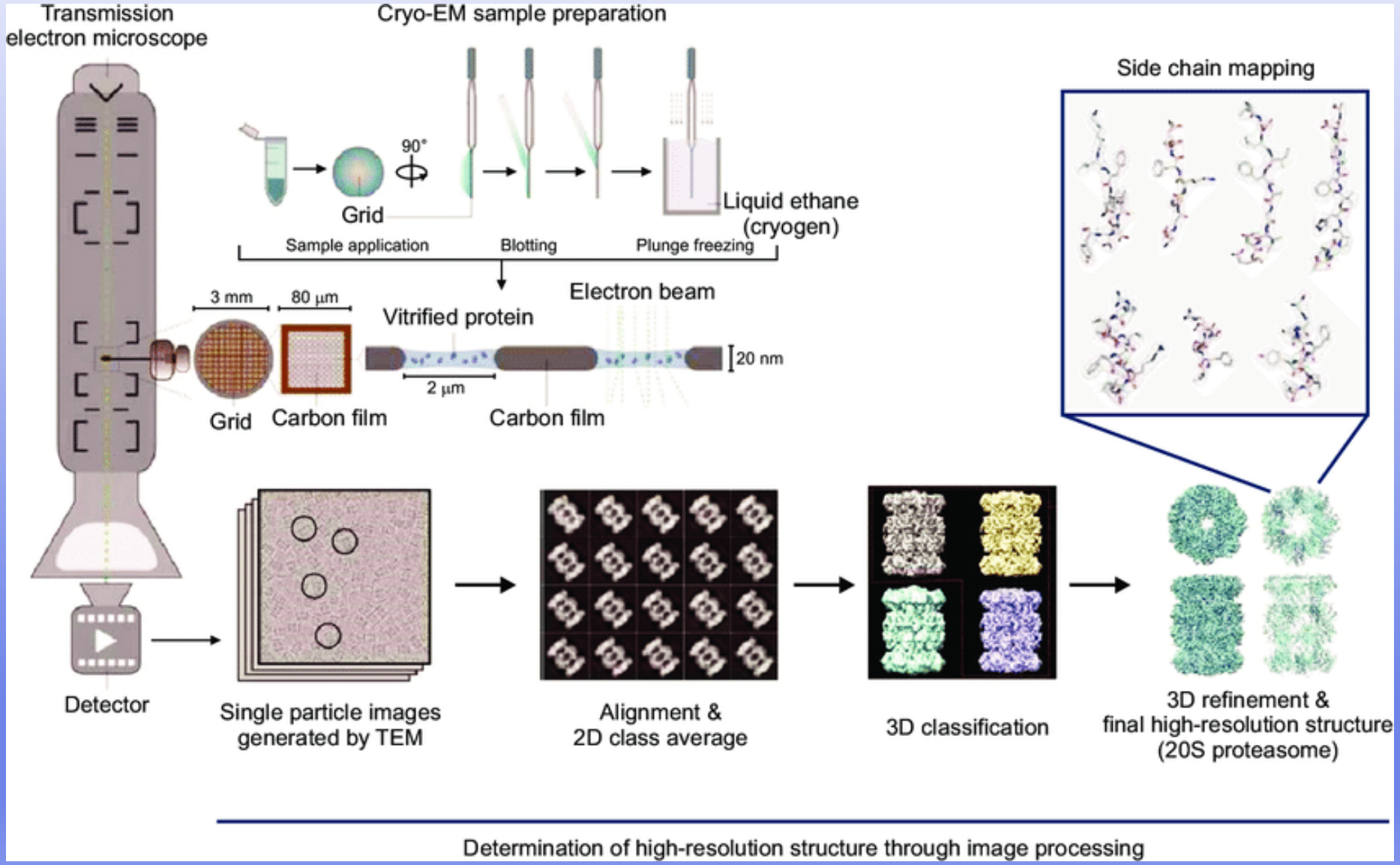
BIOCHEMISTRY



So, what's next? Perspective



SO, WHAT'S NEXT? PERSPECTIVE



The Nobel Prize in Chemistry 2017: High-Resolution Cryo-Electron Microscopy - Scientific Figure on ResearchGate.