three dimensional electron microscopy of macromolecular assemblies visualization of biological molecules in their

#3D electron microscopy #Macromolecular assemblies #Biological molecule imaging #Molecular visualization techniques #Structural biology research

Explore the advanced capabilities of three-dimensional electron microscopy for visualizing macromolecular assemblies. This powerful technique provides high-resolution insights into complex biological molecules, crucial for understanding their structure, function, and interactions within cellular environments.

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Electron Microscopy (TEM and SEM) - Electron Microscopy (TEM and SEM) by Professor Dave Explains 209,659 views 3 years ago 8 minutes, 44 seconds - We've talked **a**, lot about light **microscopy**,, but this technique has inherent limitations in resolution and magnification. **The**, next ...
Electron Microscopy
resolution of 0.2 nm
electron gun

TEM still does have specific limitations
Scanning Electron Microscopy (SEM)
SEM is for studying topography
SEM can produce 3D images
Transmission Electron Microscopy (TEM)
Yifan Cheng (UCSF & HHMI) 1: Single Particle Cryo-EM - Yifan Cheng (UCSF & HHMI) 1: Single Particle Cryo-EM by Science Communication Lab 31,512 views 6 years ago 34 minutes - Yifan Cheng overviews **the**, principles of Cryo-EM, and describes how advances in this technique have allowed scientists to solve ...
Intro
Electron microscope
Wave-particle duality of electron
Electron v.s X-ray
Reconstructing 3D object from 2D projection images
Molecular electron microscopy of biological sample
Structure of unstained crystalline specimen by electron microscopy
Single particle EM: Averaging low dose image of non-periodic objects
Frozen hydrated specimen preparation for single particle cryo-EM
Atomic resolution imaging with TEM
Image recorded with scintillator based camera
CMOS direct detection camera
Single electron counting by the K2 Summit (UCSF, LBNL, Gatan)
K2 image of frozen hydrated protein samples, archaeal 205 proteasome
Electron beam induced image motion
Direct electron detection improves image quality
Beam-induced image motion deteriorate image quality
Robust motion correction recovers high-resolution information
We achieved resolution comparable with X-ray crystallography
Local motion correction: tracking individual particles
MotionCor2: correction of global
Improved motion correction leads to better resolution
Single particle electron cry-microscopy (cryo-EM)
History of Molecular Visualizations of Biological Macromolecules - History of Molecular Visualizations of Biological Macromolecules by IIT Roorkee July 2018 795 views 2 years ago 49 minutes - A, beautiful journey of macromolecule **visualization**, has been depicted in this lecture starting from metal-made models to Byran ...
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The 2017 Nobel Prize in Chemistry: Cryo-electron microscopy explained - The 2017 Nobel Prize in Chemistry: Cryo-electron microscopy explained by Chemical & Engineering News 130,501 views 6 years ago 5 minutes - Jacques Dubochet, Joachim Frank, and Richard Henderson have claimed **the**, 2017 Nobel Prize in Chemistry for **their**, ...
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What is cryoelectron microscopy
Richard Henderson
Jacques de Vache
Why is this a chemistry prize
Dr Richard Henderson - Using electron microscopy to understand the molecules of life - Dr Richard Henderson - Using electron microscopy to understand the molecules of life by Cambridge Philosophical Society 517 views 1 year ago 49 minutes - Structural **biology**, has been highly successful during **the**, last 60 years. **The**, first protein structure of sperm whale myoglobin was ...
Introduction
Braggs Law
Structural Biology
Cytomegalovirus
Coronavirus
Why do we need electron microscopy
The potential of electron microscopy

Higher resolution models
Adenovirus
New electron detectors
Ribosomes
Mitochondria
Hemoglobin
Protein database
Exponential growth
Comparisons
New structures
Drug design
Gproteincoupled receptors
Future of structural biology
Acknowledgements
How do Electron Microscopes Work? Taking Pictures of Atoms - How do Electron Microscopes Work? Taking Pictures of Atoms by Branch Education 2,357,785 views 5 months ago 19 minutes - The, nanoscopic world is wild!! Looking at basic objects like **a**, grain of salt under **an electron microscope**, looks like nothing you ...
The Nanoscopic World
Scanning Electron Microscope vs Transmission Electron Microscope
Basics of Transmission Electron Microscopes
Why use Electrons instead of Light?
Parts of the Electron Microscope
Magnification: Objective and Projector
Physics of a Magnetic Lens
Thermo Fisher Scientific Sponsorship
Scanning Electron Microscope
Preparation of cells for cryo-electron tomography - Preparation of cells for cryo-electron tomography by Electron Microscopy from Thermo Fisher Scientific 11,654 views 3 years ago 4 minutes, 30 seconds - The, Thermo Fisher cryo-**electron**, tomography workflow covers flash freezing cells to final 3D **visualization**,. Interior cellular regions ...
Have you ever seen an atom? - Have you ever seen an atom? by nature video 23,874,000 views 10 years ago 2 minutes, 32 seconds - Scientists at **the**, University of California Los Angeles have found **a**, way to create stunningly detailed 3D reconstructing of platinum ...
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Lysozyme
X-Ray Crystallography
Protein Production and Purification Lab
Crystallization Lab
Electron microscope | TEM | SEM | Cryo EM - Electron microscope | TEM | SEM | Cryo EM by Quick Biochemistry Basics 175,225 views 4 years ago 7 minutes, 34 seconds - An electron microscope, is **a**, microscope that uses **a**, beam of accelerated electrons as **a**, source of illumination. **The**, electron ...
Introduction
Transmission electron microscope
Scanning electron microscope
Cryo electron microscope
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Intro
Why Determine Protein Structure
Interactions with Other Macromolecules
Protein Structures
Xray Diffraction
Nuclear Magnetic Resonance

Electron Microscope
Protein Databank
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diffraction pattern
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dynamics
one structure
resolution
reflections
redundancy
noughstuffers
merge
high resolution bin
raw data
free
B factor
RMSD
2 The Principle of the Electron Microscope - 2 The Principle of the Electron Microscope by Electron Microscopy from Thermo Fisher Scientific 214,064 views 7 years ago 10 minutes, 21 seconds - How to Make **a**, Microscope, Chapter 2 Unlike **the**, optical microscope, **the**, scanning **electron microscope**, uses accelerated ...
Dr Ernst Ruska
Column of the Electron Microscope
Electron Beam
Basic Types of Electron Microscope Scanning and Transmission
The Image Quality in the Scanning Microscope
Transmission Electron Microscope (TEM) - Transmission Electron Microscope (TEM) by LD SEF 47,705 views 4 years ago 7 minutes, 50 seconds - Hi my name is Jamie riches and I'll be showing you **the**, transmission **electron microscope**, or TEM today we'll use that to look at **the**, ...
Sample Preparation for Electron Microscopy - Sample Preparation for Electron Microscopy by Medicine Technology - School of Medicine - JU 56,963 views 5 years ago 14 minutes, 13 seconds - Medicine Technology - School of Medicine - JU Dr. Hanan Jaafar.
Processing Steps for Electron Microscopy
Dehydration
Embedding
Sectioning
Staining with Urinal Acetate
Transmission electron microscopy principle and working (TEM) - Transmission electron microscopy principle and working (TEM) by Shomu's Biology 230,969 views 3 years ago 10 minutes, 35 seconds - Transmission **electron microscopy**, principle and working lecture (TEM) - This microscopy lecture is going to explain **the**, ...
R6. Macromolecular Electron Microscopy Applied to Fatty Acid Synthase - R6. Macromolecular Electron Microscopy Applied to Fatty Acid Synthase by MIT OpenCourseWare 1,453 views 4 years ago 1 hour - Guest speaker Edward Brignole discusses **electron microscopy**,: what it can do, how it can be used, how it has changed in **the**, past ...
Radiation Damage
Direct Electron Detectors
Staining
Contrast
Signal to Noise Problem
Because if You Split this Image More That's Basically Going To Be Split on the Base of Noise because There's no Other Conformational Change or the Same Thing Would Go for Orientation if You Put this on the Grid and It Landed in Three Different Orientations You Would Want To Separate Things Out Using the Same Sort of Strategy All Right so this Gets Us to the Averages like the Averages That You See in the Fatty Acid Synthase Paper There Are Also 3d Structures in the Paper So How Do You

Go from from Information like this to a 3d Structure So I Mentioned One Way Is if You'Ve Got Lots of Different Orientations of the Molecule on the Grid
So this Is Actually a Fairly Old Method I Think It's It's Still Widely Used and Very Elegant because It's Basically Just Two Images of the Same Thing and Then You Can Get a Reconstruction That's Pretty Easy To Get Out There's There's a One Disadvantage to this Approach One Major Disadvantage Which Is that You Can Only Tilt the Stage So Far So if You Could Tilt the Stage up to 90 Degrees Then You Would Have Views Exactly All the Way Around and You Could Have a Reconstruction That that's Sort Of Fully Complete in this Case You Can Only Tilt 270 Degrees and So You'Ve Got Sort of a Missing Cone of of Information in the Reconstruction
The Key to a Sole Synthase in the Melon Oil Transferase They'Ve Sort Of Come Up Close to Where the Acyl Carrier Protein Would Be so You Could Say and at the Same Time this Side Is Sort Of Closed Off so It Would Have a Harder Time Doing Processing on this Side So at the Same Time over Here the Sides Opened Up the Acyl Carrier Protein Can Easily Get In Here To Do the Processing but these Enzymes over Here Are out of Reach of the Elongation Enzymes So What this Means Is like One Side Could Be Elongated while the Other Sides Processing
We Can Tell the Difference between whether the Lower Portion Has Flipped 180 Degrees Relative to the Top or Not because It Would Look the Same but the Fact that We Can See these Go 90 Degrees Is Suggestive that that It Could Probably Unravel and Go the Rest of the Way Around So in the Crystal Structure the Way It Had Them Is They Were Sort Of Coiled like this and So It's Pretty Easy To Imagine that They Were Just Sort Of Uncoil One Other Line of Evidence That I Think Is Telling so Our Collaborator Has Made a Mutant That Has all of the Active Sites and the Acyl Carrier Protein Knocked out of One Subunit
Cryo-Electron Microscopy (Scientific Standards Hub) - Cryo-Electron Microscopy (Scientific Standards Hub) by Frederick National Laboratory for Cancer Research - Leidos Biomedical Research, Inc. 145 views 1 year ago 2 minutes, 8 seconds - Cryo-**electron microscopy**,, or cryo-EM, is **a**, growing imaging technology that allows **visualization**, of **macromolecular assemblies**, in ...
What is Cryo-Electron Microscopy (Cryo-EM)? - What is Cryo-Electron Microscopy (Cryo-EM)? by UC San Francisco (UCSF) 137,841 views 8 years ago 2 minutes, 37 seconds - http://www.ucsf.edu/news/2015/05/129836/resolution-revolution-building-better-**microscope**,-see-atomic-level There are ...
What is Cryo EM?
Studying structural biology in intact cells by cryo electron microscopy - W Baumeister, ICCB 2018 - Studying structural biology in intact cells by cryo electron microscopy - W Baumeister, ICCB 2018 by CSIR - Centre for Cellular and Molecular Biology 1,005 views 5 years ago 46 minutes - Biochemists, so far, have mostly studied **the**, cellular machines - **the**, proteins, in isolation from **the**, other interactors. However, in **a**, ...
Cryo-Electron Tomography
Principles of Cryo-Electron Tomography
Radiation Sensitivity of Biological Samples
Denoising
Focused Ion Beam Milling
Face Plate
Nuclear Pore Complexes
The Nuclear Periphery
Nuclear Lamina
Protein Degradation
Protein Degradation Pathway
Hippocampal Neurons
Degradation Centers
Vitrification
The Symptoms of Als
Public Lecture | Cryo-EM: Amazing 3-D Views of Life's Molecular Machines - Public Lecture | Cryo-EM: Amazing 3-D Views of Life's Molecular Machines by SLAC National Accelerator Laboratory 6,284 views 5 years ago 1 hour, 29 minutes - Description: Cryogenic **electron microscopy**, (cryo-EM) is **a**, revolutionary technology for making 3D images of **the**, inner workings of ...
Intro
What Is a Molecular Machine?
Protein Folding Machine
Size of Objects

Transmission Electron Microscope
Hurdles to Use Electron Microscope for Biological Specimens
Electron Radiation Damage
What is Cryo-Electron Microscopy (Cryo-EM)
Cryo-EM Workflow
Cryo-EM: 2017 Nobel Prize in Chemistry
Commercial Direct Detector Technology
Movie-Mode Imaging
Assembly Process for ds-DNA Viruses Outside and Inside the Host Bacterium
Direct Electron Detector (DE20) Image of P22 Bacteriophages Embedded in Ice
3.3 A Cryo-EM Structure of P22 Bacteriophage
De Novo Model of Single Protein Subunit of P22 Bacteriophage
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Interactions Between Adjacent Proteins Within a Hexon or a Penton Via Salt Bridges
Cryo-EM of Mature P22 Bacteriophage
7A Cryo-EM Structure of P22 Bacteriophage
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Conformational Changes in Capsid Proteins
P22 Bacteriophage Expansion Upon Maturation
Interactions between Scaffolding and Coat Proteins in P22 Procapsid
Conventional Cryo-EM of Cell
Zernike Phase Contrast Cryo-EM of Cell
Principle of Electron Cryo-Tomography
Zernike Phase Contrast Cryo-ET of Cyanobacteria Infected with Cyanophage
ZPC Cryo-ET of Syn5 Infected Cell at Various Stages of Infection
Five Types of Syn5 Particles Classified from Subtomograms in the Cell
Opportunities of Cryo-EM for Research in Biomedical Sciences
Investigating the dynamics of molecular machines using automated electron microscopy - Investigating the dynamics of molecular machines using automated electron microscopy by Scripps Research 595 views 9 years ago 46 minutes - Presented by Bridget Carragher, Professor at **The**, Scripps Research Institute and Director of **the**, National Resource for Automated ...
Introduction
Welcome
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What can we do
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Time to change
First prototype
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Translationally corrected images
Acknowledgement
Ohad Medalia (University of Zürich) Basic principle in three-dimensional electron microscopy - Ohad Medalia (University of Zu rich) Basic principle in three-dimensional electron microscopy by Israel Institute for Advanced Studies 393 views 8 years ago 59 minutes - Ohad Medalia (University of Zürich) Basic principle in **three**,-**dimensional electron microscopy**,.

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Low Resolution
High-Pressure Freezer
Adhesion Machinery
Correlative Microscopy
Resolution of Individual Tomogram
Adhesion
Platelets
Missing Wedge Effect
High Pressure Freezing
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Structure Elucidation from Imaging
Quasi Atomic Models via Single Particle Cryo-EM
Single Particle Cryo-EM Reconstruction
3D EM Reconstruction and Structure Elucidation
Single Particle Cryo-EM: Automatic Structure Elucidation
Secondary Structure Elucidation (I)
Challenge #2: Analysis of Molecular Function Computational Problems
Algebraic Spline: Triangular Free-form Prisms
Born Radii Approximation
SCALABILITY with Accuracy-Speed Tradeoff
Neurotoxins 101: Snake Venoms
The Chemical Synapse at the Neuro-Muscular Junction
Free Energy & Binding Free Energy
Conformational Docking/Binding
Translational Search using FFT (alternatively nFFT)
Benchmark Dataset and Measures of Performance
Computers and Science for Accelerated Drug Discovery
Verification & Validation
A 3-D Cell Reconstructed with Electron Microscopy - A 3-D Cell Reconstructed with Electron Microscopy by The Explorer's Guide to Biology 661 views 3 years ago 7 minutes, 29 seconds - Jennifer Lippincott-Schwartz describes Focused Ion Beam Scanning **Electron Microscopy**, (FIB-SEM) and **its**, application to cell ...
High-resolution 3D electron microscopy: Progress and new opportunities - High-resolution 3D electron microscopy: Progress and new opportunities by International Union of Crystallography 3,335 views 7 years ago 25 minutes - P,lenary Lecture by Sriram Subramaniam. Biennial Meeting of **the**, British Biophysical Society, Liverpool, 6 July 2016. Recent ...
Intro
nature methods
Cryo-EM looks easy
Crossing the "sound" barrier: the trek beyond 3 A resolution
Mapping ligand interactions: PETG localization
Glutamate receptor gating cycle
Desensitized glutamate receptor at 3.8 A resolution
Discovery of "desensitization ring"
AMPA/kainate receptor gating mechanism
CorA: 200 kDa magnesium channel
Structure of CorA in the Mg2+-bound state
Unexpected Symmetry Break Upon Gating
p97 AAA ATPase - A Moving Cancer Target
2.3 A resolution cryo-EM structure of human p97 and mechanism of allosteric inhibition
Three co-existing p97 conformations
p97 - A Moving Cancer Target
Small Proteins, Impossible Targets?
Drug Localization by Cryo-EM in 145 kDa LDHB

Drug Localization by Cryo-EM in 93 kDa IDHI
Glutamate dehydrogenase, a dynamic enzyme
1.8 A Resolution Structure of GDH by Cryo-EM
Emerging applications of cryo-EM to drug discovery
The cryo-EM revolution - The cryo-EM revolution by NIH VideoCast 2,239 views 5 years ago 1 hour, 1 minute - The, cryo-EM revolution Air date: Wednesday, April 11, 2018, **3**,:00:00 PM Category: WALS - Wednesday Afternoon Lectures ...
Intro
Imaging gaps in biology and medicine
A research program to bridge the imaging gap
Two modes of imaging with transmission electron microscopy
Electron crystallography of 2D crystals of bacteriorhodopsin
Electron crystallography of the oxalate transporter
Structural biology of receptor arrays in intact cells
Visualizing the bacterial genome in 3D
Cryo-electron tomography of HIV
Mechanisms of antibody neutralization and Env plasticity
Cryo-EM of influenza virus and universal vaccine design
Characterization of ZMapp cocktail antibodies bound to Ebola GP
Focused ion beam scanning electron microscopy: 3D imaging of cells and tissue
HIV transfer to fetal astrocytes
Voyage into a melanoma cell
Visualizing the muscle mitochondrial power grid
Automated identification of mitochondrial networks and connectivity
Crossing the "sound" barrier for cryo-EM resolution
Mapping ligand interactions: PETG localization
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Unexpected Symmetry Break Upon Gating
Cryo-EM structure of Csy CRISPR-Cas complex with bound dsDNA
DNA binding induces dramatic change in pitch
Cryo-EM structure of CENP-N complex with CENP-A nucleosome
Advanced image processing methods to further improve cryo-EM resolution
Amino acid sidechains at atomic resolution
Cryo-EM of light-induced structural changes in seven-helix proteins
The cryo-EM revolution: The dawn of a golden era
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Transmission electron microscopy (TEM) is a microscopy technique in which a beam of electrons is transmitted through a specimen to form an image. The specimen... 117 KB (15,013 words) - 21:56, 17 January 2024

Cryogenic electron microscopy Image resolution Frank, Joachim (2006). Three-dimensional electron microscopy of macromolecular assemblies: visualization of biological... 12 KB (1,121 words) - 10:41, 1 March 2024

Joachim (2006). Three-dimensional electron microscopy of macromolecular assemblies: visualization of biological molecules in their native state. Oxford:... 22 KB (2,737 words) - 21:23, 19 February 2024

specifically 3-dimensional electron microscopy (3DEM), is gaining popularity in structural biology. The utility of transmission electron cryomicroscopy... 24 KB (3,034 words) - 02:29, 1 December 2023

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adapter molecules in binding pockets within the ribosome. The new polypeptide then folds into a functional three-dimensional protein molecule. Unicellular... 62 KB (6,354 words) - 09:56, 9 March 2024

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are macromolecular machines, found within all cells, that perform biological protein synthesis (messenger RNA translation). Ribosomal RNA is found in the... 65 KB (7,277 words) - 01:53, 14 February 2024

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systems nanothermodynamics: a simple macromolecular partition problem with a statistical perspective". Journal of Biological Physics. 38 (2): 201–207. doi:10... 38 KB (4,340 words) - 17:26, 4 January 2024

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including the movement of secretory vesicles, organelles, and intracellular macromolecular assemblies. They are also involved in cell division (by mitosis... 64 KB (7,838 words) - 06:58, 22 February 2024

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