C-flat™

Bibliography — Journal Articles

Title	Authors	Citation	Impact Statement/Summary
Drosophila A Virus is an Unusual RNA Virus with a T=3 Icosahedral Core and Permuted RNADependent RNA Polymerase	R. L. Ambrose, G. C. Lander, W. S. Maaty, B. Bothner, J. E. Johnson and K. N. Johnson	*J. Gen. Virol.*, v90, pp2191, 2009	C-flat carbon grids were used in cryo-electron microscopy to investigate the structure of the Drosophila A virus (DAV). It was revealed that two distinct domains exist for the protein structure
Functrionalized Silicone Nanospheres: Synthesis, Transition Metal Immobilization, and Catalytic Applications	C. A. Bradley, B. D. Yuhas, M. J. McMurdo and T. Don Tilley	*Chem. Materials*, v21, pp174, 2009	Nanospheres in the size range of 12-28 nm containing functional groups were prepared from copolymerization of $MeSi(OMe)_3$ and $RSi(OMe)_3$. Samples were dissolved in methyl chloride and imaged on C-flat carbon grids with TEM.
Functional Domains of the Bacteriophage P2 Scaffolding Protein: Identification of Residues Involved in Assembly and Protease Activity	J. R. Chang, M. S. Spilman, C. M. Rodenburg and T. Dorkland	*Virology*, v384, pp144, 2009	The bacteriophage P2 was observed using C-flat carbon grids with cryo-electron microscopy. The 284 residue gpO was imaged and its protease activity was characterized.
Assembly of Bacteriophage P2 Capsids From Capsid Protein Fused to Internal Scaffolding Protein	J.R. Chang, M.S. Spilman and T. Dokland	*Virus Genes*, v40, pp298, 2010	The C-terminal scaffolding domain of the gpO protein was fused with the gpN capsid protein in the bacteriophage HK97 to determine its potential use as a delta domain. C-flat carbon grids were used in cryo-electron microscopy to determine conformational variability.
Does contamination buildup limit throughput for automated cryoEM	A. Cheng, D. Fellmann, J. Pulokas, C. S. Potter and B. Carragher	*J. Struct. Biol.*, v154, pp303, 2006	C-flat carbon grids were used to measure ice contamination buildup on TEM grids. C-flat grids were maintained for long durations in side entry cryo stages and imaged to determine the extent of the ice layer buildup.
Holey Carbon Micro-Arrays for Transmission Electron Microscopy: A Microcontact Printing Approach	D. W. Chester, J. F. Klemic, E. Stern, F. J. Sigworth and K. G. Klemic	*Ultramicroscopy*, v107, pp685, 2007	A cost effective way of molding poly(dimethylsiloxane) elastomer stamps and printing holey patterns on plastic film was developed. The method involves floating the film onto TEM grids, evaporating carbon onto the film, and plastic removal.
Chaperonin Complex With a Newly Folded Protein Encapsulated in the Folding Chamber	D. K. Clare, P. J. Bakkes, H. van Heerikhuizen, S. M. van der Vies and H. R. Saibil	*Nature*, v457, pp107, 2009	Cryo-electron microscopy using C-flat carbon grids were used to study chaperonin complexes of denatured gp23 and GroEl. Structures of both the initial and final closed state of the complex were presented.
Multiple States of a Nucleotide-Bound Group 2 Chaperonin	D. Clare, S. Stagg, J. Quispe, G. Farr, A. Horwich and H. Saibil	*Structure*, v16, pp528, 2008	Nucleotide binding to a homo-oligomeric group 2 chaperonin from Methanococcus maripaludis (Mm) was investigated through cryo-electron microscopy. The open and closed stages of the chaperonin complex, either alone or with ADP. AlF_3, were imaged on C-flat carbon grids.
Cryo-Electron Tomography of Microtubule–Kinesin Motor Complexes	J. Cope, S. Gilbert, I. Rayment, D. Mastronarde and A. Hoenger	*J. Struct. Biol.*, v170, pp257, 2010	C-flat carbon grids were used in cryo-electron tomography to investigate microtubule structures. Three dimensional images of kinesin motor complexes, the monomeric Eg5 and heterodimeric Kar3Vik1 motor were generated.
Molecular Organization of Gram-Negative Peptidoglycan	L. Gan, S. Chen and G. J. Jensen	*PNAS*, v105, pp18953, 2008	The layered structure of the sacculus, a peptidoglycan, in bacteria was examined using electron cryotomography. The sacculi specimens were mixed with 10 nm colloidal gold beads and were observed on C-flat carbon grids.
Preparation of macromolecular complexes for cryo-electron microscopy	R. A. Grassucci, D. J. Taylor and J Frank	*Nat. Protoc.*, v2, pp3239, 2007	A protocol for coating grid surfaces with a holey carbon film using a Formvar film template was described. Methods for depositing a homogeneous sample through plunge freezing with cryogen were also discussed.
Electron Cryo-Microscopy and Single-Particle Averaging of Rift Valley Fever Virus: Evidence for GN-GC Glycoprotein Heterodimers	J. T. Huiskonen, A. K. Överby, F. Weber, and K. Grünewald	*J. Virol.*, v83, pp3762, 2009	C-flat carbon grids were used to study the structural units of the Rift Valley fever virus (RVFV). Glycoprotein capsomers were analyzed with cryo-microscopy and 3D images were constructed.
Structure of Flexible Filamentous Plant Viruses	A. Kendall, M. McDonald, Wen Bian, T. Bowles, S, C. Baumgarten, J. Shi, P. L. Stewart, E. Bullitt, D. Gore, T. C. Irving, W. M. Havens, S. A. Ghabrial, J. S. Wall and G. Stubbs	*J. Virol.*, v82, pp9546, 2008	C-flat carbon grids were used to study the structural units of the Rift Valley fever virus (RVFV). Glycoprotein capsomers were analyzed with cryo-microscopy and 3D images were constructed.
Structure of Flexible Filamentous Plant Viruses	A. Kendall, M. McDonald, Wen Bian, T. Bowles, S, C. Baumgarten, J. Shi, P. L. Stewart, E. Bullitt, D. Gore, T. C. Irving, W. M. Havens, S. A. Ghabrial, J. S. Wall and G. Stubbs	*J. Virol.*, v82, pp9546, 2008	Cryo-electron microscopy, using C-flat carbon grids, was used to discover the symmetry of two plant viruses, potyvirus and potexvirus. The purified virons were applied to C-flat grids and imaged with cryo-electron microscopy
Preparation and Characterization of Bio-Nanocomposite Films Based on Soy Protein Isolate and Montmorillonite Sing Melt Extrusion	P. Kumar, K.P. Sandeep, , S. Alavi, V.D. Truong and R.E. Gorga	*J. Food Eng.*, v100, pp480, 2010	The morphology of bio-nanocomposite films, potentially used as plastic packaging material, was studied. The SPI-MMT bio-nanocomposite films were ground into powder and analyzed with TEM using C-flat carbon grids.
Bacteriophage Lambda Stabilization by Auxiliary Protein gpD: Timing, Location, and Mechanism of Attachment Determined by CryoEM	G.C. Lander, A. Evilevitch, M. Jeembaeva, C.S. Potter, B. Carragher and J. E. Johnson	*Structure*, v16, pp1399, 2008	The bacteriophage lambda was prepared on C-flat carbon grids for analysis with cryo-EM. The 20-A-capsid containing the dsDNA genome was observed to analyze capsid stabilization.
Architecture of a Nascent Viral Fusion Pore	K. K. Lee	*The EMBO Journal*, v29, pp1299, 2010	C-flat carbon grids were used in cryo-electron tomography to investigate proteins used for virus-cell adhesion. Three dimensional images of the Haemagglutinin fusion glycoproteins from the influenza virus were created and studied.
Colloidal Amphiphile Self-Assembly Particles Composed of Gadolinium Oleate and Myverol: Evaluation as Contrast Agents for Magnetic Resonance Imaging	G. Liu, C. E. Conn, L. J. Waddington, S. T. Mudie and C. J. Drummond	*Langmuir*, v26, pp2383, 2010	Cry-electron microscopy with C-flat carbon grids was used to study the Myverol lipid system. Nanosized particles formed from the incorporation of Gd oleate with Myverol was characterized.
Native 3D Intermediates of Membrane Fusion in Herpes Simplex Virus 1 Entry	U. E. Maurer, S. Sodeik and K. Grünewald	*PNAS*, v105, pp10559, 2008	Rat kangaroo kidney cells, HFF cells, or Vero cells were cultured on C-flat carbon grids and infected with HSV-1. Cry-electron tomography was used to generate 3D images of virus intermediates fused to the plasma membranes.
Hydrocarbon lithography on graphene membranes	J. C. Meyer, C.O. Girit, M.F. Crommie and a. Zettl	*Appl. Phys. Lett.*, vol. 92, 2008	A method of depositing arbitrary patterns of hydrocarbons on graphene membranes was investigated using C-flat carbon grids. Graphene membranes with the deposited carbon can be used as microelectronic material.
Direct Imaging of Lattice Atoms and Topological Defects in Graphene Membranes	J. C. Meyer, C. Kisielowski, R. Erni, M. D. Rossell, M. F. Crommie and A. Zettl	*Nano Lett.*, pp. A-E, 2008	Graphene membranes, crystalline foils one atom thick, were resolved using C-flat holey carbon grids. Individual atoms and Stone-Wales defects could be observed in situ.
Graphene oxide: A substrate for optimizing preparations of frozenhydrated samples	R. S. Pantelic, J. C. Meyer, U. Kaiser, W. Baumeister and J.M. Plitzko	*J. Struct. Biol.*, v170, pp152, 2010	The use of graphene oxide as a macromolecule substrate for electron microscopy was investigated using C-flat carbon grids. Graphene oxide was applied to the grids and imaged with TEM.

C-flat™

Bibliography — Journal Articles

Title	Authors	Citation	Impact Statement/Summary
Visualization of 80s Ribosome in situ Using Cryo Electron Tomography of Vitreous Sections	J. Peirson, J.J. Fern.ndez, E. Bos, H. Gnaegi, J.L. Carrascosa, M. Vos and P.J. Peters	EMC 2008 14th European Microscopy Congress, vol. 3, 2008	C-flat holey carbon grids were used in cryo-electron tomography to examine the native structure of the 80s ribosome. High resolution reconstructions were possible through a technique of that allowed for quality alignment of images using markers on the carbon film.
Improved Holey Carbon Film for Cryo-Electron Microscopy	J. Quispe, J. Damiano, S. E. Mick, D. P. Nackashi, D. Fellmann, T. G. Ajero, B. Carragher and C. S. Potter	*Microsc. Microanal.*, v13, pp365, 2007	An improved method over consumable templates with soft material, a method for incorporating a holey carbon film over a hard template was devised. These carbon films have improved purity and flatness with greater distribution of single particles in vitreous ice without residue accumulation affecting imaging through cryo-electron microscopy.
Micromachining Tools and Correlative Approaches for Cellular Cryo-Electron Tomography	A. Rigort, F.J.B. B.uerlein, A. Leis, M. Gruska, C. Hoffmann, T. Laugks, U. B.hm, M. Eibauer, H. Gnaegi, W. Baumeister and J. M. Plitzko	*J. Struct. Biol.*, v172, pp169, 2010	C-flat holey carbon grids were used to demonstrate focused ion beam instrumentation as a method of thinning frozen specimens without mechanical deformation. A novel method of thinning vitreous ice, cryo-planing, was also introduced.
Solubilization of Sagopilone, a Poorly Water-Soluble Anticancer Drug, Using Polymeric Micelles for Parenteral Delivery	A. Richter, C. Olbrich, M. Krause and T. Kissel	*Int. J. Pharm.*, v389, pp244, 2010	C-flat carbon grids were used in cry-electron microscopy to polymeric micelles used as a drug delivery mechanism for the cancer drug Sagopilone. Characteristics of the polymers, such as size, solubility, and stability were investigated.
The Holin of Bacteriophage Lambda Forms Rings With Large Diameter	C. G. Savva, J. S. Dewey, J. Deaton, R. L. White, D. K. Struck, A. Holzenburg and R. Young	*Mol. Microbiol.*, v69, pp784, 2008	Cryo-electron microscopy and single particle analysis was used to characterize the bacteriophage λ holin (S105). Negatively stained protein samples were imaged on C-flat carbon grids.
Mitochondrial Outer Membrane Proteins Assist Bid in Bax-mediated Lipidic Pore Formation	B. Schafer, J. Quispe, V. Choudhary, J.E. Chipuk, T.G. Ajero, H. Du, R. Schneiter and T. Kuwana	MBoC in Press, vol. 20, pp. 2276-2285, 2009	Cardiolipin-liposomes were applied to C-flat holey carbon grids and imaged with cryoEM. This led to the understanding of the role of cardiolipins in mitochondrial outer membrane permeabilization.
Segrosome Structure Revealed by a Complex of ParR with Centromere DNA	M. A. Schumacher, T. C. Glover, A. J. Brzoska, S. O. Jensen, T. D. Dunham, R.A. Skurray and N. Firth	*Nature,* v450, pp1268, 2007	The structure of the ParR-DNA complex was imaged on C-flat carbon grids with STEM. Specifically, the pSK41 segrosome structure was revealed.
Structure of the Mite-Transmitted Blackcurrant Reversion Nepovirus Using Electron Cryo-Microscopy	Jani J.T. Seitsonena, Petri Susib, Anne Lemmettyc and Sarah J. Butchera	*Virology*, v378, pp162, 2008	The structure of the Blackcurrant Reversion Nepovirus (BRV) was determined through cryo-electron microscopy. Viral samples were loaded onto C-flat carbon grids and analyzed with image reconstruction.
The Structure of Western Equine Encephalitis Virus	M.B. Sherman and S.C. Weaver	*Microsc. Microanal.*, v14, pp1584, 2008	A suspension of Western Equine Encephalitis Virus particles was applied to Cflat carbon grids and imaged using cryoEM. This was the first successful attempt at imaging this alphavirus with electron microscopy.
Automated CryoEM Data Acquisition and Analysis of 284 742 Particles of GroEL	S. M. Stagg, G. C. Lander, J. Pulokas, D. Fellmann, A. Cheng, J. D. Quispe, S. P. Mallick, R. M. Avila, B. Carragher and C.S. Potter	*J. Struct. Biol.*, v155, pp470, 2006	An automated procedure for 3D imaging was demonstrated that increases the speed and ease of acquiring macromolecular images. C-flat carbon grids were loaded with GroEl protein and 3D maps were generated from a series of image acquisitions.
An Improved Cryogen for Plunge Freezing	W. F. Tivola, A. Briegela, and G. J. Jensen	*Microsc. Microanal.*, v14, pp375, 2008	An equal mixture of propane and ethane is demonstrated as being a superior cryogen when compared with others. It was shown that damage to the substrate of C-flat carbon grids was greatly reduced with this method.
A Toolbox for ab initio 3-D Reconstructions in Single-Particle Electron Microscopy	N. R. Voss, D. Lyumkis, A. Cheng, P. W. Lau, A. Mulder, G., C. Lander, E. J. Brignole, D. Fellmann, C. Irving, E. L., Jacovetty, A. Leung, J. Pulokas, J. D. Quispe, H. Winkler, C. Yoshioka, B. Carragher and C. S. Potter	*J. Struct. Biol.*, v169, pp389, 2010	Techniques for generating 3D images from single-particle electron were tested. C-flat grids were used to analyze 50S ribosomal subunits to test the reconstruction methods.
Orientation and Structure of the Ndc80 Complex on the Microtubule Lattice	E. M. Wilson-Kubalek, I. M. Cheeseman, C. Yoshioka, A. Desai and R. A. Milligan	*J. Cell. Biol.*, v182, pp1055, 2008	Microtubules with Ndc80/Nuf2 dimers were imaged on C-flat carbon grids with cryo-electron microscopy. The binding strength of the microtubule/dimer interaction was determined and may have implications for stabilization and polarity for kinetochore-bound microtubules.
Cryomesh™: A New Substrate for Cryo-Electron Microscopy	C. Yoshioka, B. Carragher and C. S. Potter	*Microsc. Microanal.*, v16, pp43, 2010	Cryomesh is a new type of grid for cryo-electron microscopy made from silicon carbide that reduces the effect of beam-induced movement in tilted cryopreserved specimens.
Automation of Random Canonical Tilt and Orthogonal Tilt Data Collection Using Feature-Based Correlation	C. Yoshioka, J. Pulokas, D. Fellmann, C. S. Potter, R. A. Milligan and B. Carragher	*J. Struct. Biol.*, v159, pp335, 2007	An automated method of random conical and orthogonal tilt (RCT/ORT) that reduced the need for difficult manual collection and increases quality of images was investigated. The GroEL chaperone complex was imaged on C-flat carbon grids.
Contrast Transfer Function Correction Applied to Cryo-Electron Tomography and Sub-Tomogram Averaging	G. Zanetti, J. D. Riches, S. D. Fuller and J. A.G. Briggs	*J. Struct. Biol.*, v168, pp305, 2009	C-flat carbon grids were used in cryo-electron tomography to image PRD1 bactriophages. Methods for improving image resolution were tested.
Near-Atomic Resolution Using Electron Cryomicroscopy and Single-Particle Reconstruction	X. Zhang, E. Settembre, C. Xu, P. R. Dormitzer, R. Bellamy, S. C. Harrison and N. Grigorieff	*PNAS*, v15, pp1867, 2008	The rotavirus inner capsid particle was imaged on C-flat carbon grids through single particle electron microscopy. The high resolution capabilities of single particle analysis were discussed.