

Benjamin David Engel

Helmholtz Zentrum München
Helmholtz Pioneer Campus
Ingolstädter Landstraße 1, 85764 Neuherberg, Germany
Phone: +49 (89) 8578-2653
Email: ben.engel@helmholz-muenchen.de



Website: <https://www.cellarchlab.com/>

ORCID: <https://orcid.org/0000-0002-0941-4387>

Google Scholar: <https://scholar.google.com/citations?user=4ytQ9YIAAAAJ&hl=en>

EDUCATION

2005-2011 **UNIVERSITY OF CALIFORNIA, SAN FRANCISCO**
Ph.D. Cell Biology

1999 -2003 **UNIVERSITY OF CALIFORNIA, BERKELEY**
B.A. Molecular and Cell Biology

RESEARCH EXPERIENCE

2019-present **Principal Investigator**, Helmholtz Pioneer Campus
We are using focused ion beam milling and cryo-electron tomography to study the in situ structural biology of macromolecules within native-state frozen cellular environments.

2011-2019 **Postdoc**, Wolfgang Baumeister, MPI of Biochemistry
Project Leader 2015-2019

2010 **Visiting Scientist**, Ritsu Kamiya, University of Tokyo
I used electron microscopy to study the structure of cilia.

2005-2011 **Graduate Student**, Wallace Marshall, UC San Francisco
I studied the relationship between intraflagellar transport and flagellar length control.

2001-2005 **Research Associate**, Carolyn Larabell, Lawrence Berkeley National Laboratory
I studied cellular defense mechanisms during the early stages of breast cancer metastasis.

1998-2001 **Student Intern**, Advanced Light Source, Lawrence Berkeley National Laboratory

FUNDING AND AWARDS

2017-2020 **DFG Grant FOR2092: Biogenesis of Thylakoid Membranes**, MPI of Biochemistry

2015 **Junior Research Award**, MPI of Biochemistry

2011-2013 **Alexander von Humboldt Foundation Research Fellowship**, MPI of Biochemistry

2010 **NSF East Asia and Pacific Summer Institutes (EAPSI) Fellowship**, University of Tokyo

2008-2009 **Genentech Graduate Fellowship**, UC San Francisco

2003 **Departmental Honors**, Molecular and Cell Biology, UC Berkeley

MENTORING AND TEACHING

2014-present **Supervisor**, graduate students Sahradha Albert, Tilak Gupta, Hugo van den Hoek, Luis Kuhn Cuellar, and Chia-Wei Lee; and postdocs Wojciech Wietrzynski and Anna Rast

May 2019 **Instructor**, Advanced Workshop on Cryo-Electron Tomography; Vienna, Austria

2005-2009 **Research Mentor and Classroom Teacher**, UC San Francisco Science and Education Partnership

INVITED TALKS

Dec 2019 Plenary talk; Christmas Bioenergetics Meeting; London, United Kingdom

Oct 2019 Institut Curie seminar series; Paris, France

Oct 2019 MRC Laboratory of Molecular Biology guest lecture; Cambridge, United Kingdom

Jul 2019 SFB924 Colloquium; Freising, Germany

Jun 2019 Vrije Universiteit guest lecture; Amsterdam, the Netherlands

May 2019 Université Libre de Bruxelles guest lecture; Brussels, Belgium
 Apr 2019 BiteSizeBio Webinar: Cryo-electron Tomography for Cell Biology
<https://bitesizebio.com/webinar/cryo-electron-tomography-for-cell-biology/>
 Mar 2019 Life Sciences Institute seminar series; Ann Arbor, MI, USA
 Nov 2018 University of Vienna MFPL guest lecture; Vienna, Austria
 Nov 2018 CNRS Aviesan meeting on How Cryo-EM meets Chemical Structure; Paris, France
 Oct 2018 International Conference on Physics and Biological Systems; Gif-sur-Yvette, France
 Oct 2018 Keynote speaker; Ohio State Cryo-EM for Cancer workshop, Columbus, OH, USA
 Sep 2018 Molecular Horizons seminar; Wollongong, Australia
 Sep 2018 International Microscopy Congress; Sydney, Australia
 Sep 2018 NTU guest lecture; Singapore
 Aug 2018 ETH guest lecture; Zurich, Switzerland
 Aug 2018 Keynote speaker; ETH/PSI/Univ. Zurich BSM grad student retreat; Morschach, Switzerland
 Jun 2018 International Chlamydomonas Conference; Washington, DC, USA
 Jun 2018 Princeton special seminar; Princeton, NJ, USA
 Jun 2018 Gordon Research Conference on 3D Electron Microscopy; Newport, RI, USA
 May 2018 MPI for Terrestrial Microbiology guest lecture; Marburg, Germany
 Jan 2018 UCLA-DOE Institute guest lecture; Los Angeles, CA, USA
 Jan 2018 Western Photosynthesis Conference; Oracle, AZ, USA
 Nov 2017 CEA guest lecture; Grenoble, France
 Aug 2017 German/Austrian/Swiss Microscopy Conference; Lausanne, Switzerland
 Jul 2017 Gordon Research Conference on Photosynthesis; Newry, MN, USA
 Jul 2017 French Society of Microscopy; Bordeaux, France
 Jun 2017 Symposium on Chloroplast Metabolism and Photosynthesis; Neuchâtel, Switzerland
 Jun 2017 French Photosynthesis Society; Paris, France
 Mar 2017 SFB 1208 Retreat; Schleiden, Germany
 Nov 2016 University of Jena botanical colloquium; Jena, Germany
 Oct 2016 Nordic Photosynthesis Congress; Copenhagen, Denmark
 Aug 2016 International Congress of Photosynthesis; Maastricht, the Netherlands
 Jun 2016 International Chlamydomonas Conference; Kyoto, Japan
 Mar 2016 Michigan State Plant Research Laboratory seminar series; Lansing, MI, USA
 Dec 2015 American Society for Cell Biology minisymposium; San Diego, CA, USA
 Oct 2015 University of Sheffield molecular biology seminar series; Sheffield, United Kingdom
 Jul 2015 Gordon Research Conference on Photosynthesis; Waltham, MA, USA

PUBLICATIONS *indicates corresponding author

- Le Guennec M, Klena N, Gambarotto D, Laporte MH, Tassin AM, van den Hoek H, Erdmann PS, Schaffer M, Kovacik L, Borgers S, Goldie KN, Stahlberg H, Bornens M, Azimzadeh J, **Engel BD***, Hamel V, Guichard P (2019). A helical inner scaffold provides a structural basis for centriole cohesion. *Science Advances*. [In press].
- Albert S, Wietrzynski W, Lee CW, Schaffer M, Beck F, Schuller JM, Salomé PA, Plitzko JM, Baumeister W, **Engel BD*** (2019). Direct visualization of degradation microcompartments at the ER membrane. *Proceedings of the National Academy of Sciences USA*. doi: 10.1073/pnas.1905641117. [Epub ahead of print]
- Schaffer M, Pfeffer S, Mahamid J, Kleindiek S, Laugks T, Albert S, **Engel BD**, Rummel A, Smith AJ, Baumeister W, Plitzko JM (2019). A cryo-FIB lift-out technique enables molecular-resolution cryo-ET within native *Caenorhabditis elegans* tissue. *Nature Methods*. 16: 757-762.
- Theis J, Kumar Gupta T, Klingler J, Wan W, Albert S, Keller S, **Engel BD***, Schroda M (2019). VIPP1 rods engulf membranes containing phosphatidylinositol phosphates. *Scientific Reports*. 9: 8725.
- Rast A, Schaffer M, Albert S, Wan W, Pfeffer S, Beck F, Plitzko JM, Nickelsen J, **Engel BD*** (2019). Biogenic regions of cyanobacterial thylakoids form contact sites with the plasma membrane. *Nature Plants*. 5: 436-446.
- Chicano A, Crosas E, Otón J, Melero R, **Engel BD**, Daban JR (2019). Frozen-hydrated chromatin from metaphase chromosomes has an interdigitated multilayer structure. *The EMBO Journal*. 38: e99769.
- Schuller JM, Birrell JA, Tanaka H, Konuma T, Wulfhorst H, Cox N, Schuller SK, Thiemann J, Lubitz W, Sétif P, Ikegami T, **Engel BD**, Kurisu G, Nowaczyk MM (2019). Structural adaptations of photosynthetic complex I enable ferredoxin-dependent electron transfer. *Science*. 363:257-260.

- Kovtun O, Leneva N, Bykov YS, Ariotti N, Teasdale RD, Schaffer M, **Engel BD**, Owen DJ, Briggs JAB, Collins BM (2018). Structure of the membrane-assembled retromer coat by cryo-electron tomography. *Nature*. 561: 561-564.
- Delarue M, Brittingham GP, Pfeffer S, Surovtsev IV, Pinglay S, Kennedy KJ, Schaffer M, Gutierrez JI, Sang D, Poterewicz G, Chung JK, Plitzko JM, Groves JT, Jacobs-Wagner C, **Engel BD***, Holt LJ (2018). mTORC1 controls phase separation and the biophysical properties of the cytoplasm by tuning crowding. *Cell*. 174: 338-349.e320.
- Mosalaganti S, Kosinski J, Albert S, Schaffer M, Strenkert D, Salomé PA, Merchant SS, Plitzko JM, Baumeister W, **Engel BD***, Beck M (2018). In situ architecture of the algal nuclear pore complex. *Nature Communications*. 9: 2361.
- Albert S, Schaffer M, Beck F, Mosalaganti S, Asano S, Thomas HF, Plitzko JM, Beck M, Baumeister W, **Engel BD*** (2017). Proteasomes tether to two distinct sites at the nuclear pore complex. *Proceedings of the National Academy of Sciences USA*. 114: 13726-13731.
- Bykov YS, Schaffer M, Dodonova SO, Albert S, Plitzko JM, Baumeister W, **Engel BD***, Briggs JAG (2017). The structure of the COPI coat determined within the cell. *eLife*. 6: e32493.
- Freeman Rosenzweig ES, Xu B, Kuhn Cuellar L, Martinez-Sanchez A, Schaffer M, Strauss M, Cartwright HN, Ronceray P, Plitzko JM, Förster F, Wingreen NS, **Engel BD***, Mackinder LCM, Jonikas MC (2017). The Eukaryotic CO₂-Concentrating Organelle Is Liquid-like and Exhibits Dynamic Reorganization. *Cell*. 171: 148-162.e19.
- Albanese P, Melero R, **Engel BD**, Grinzato A, Berto P, Manfredi M, Chiodoni A, Vargas J, Sorzano CÓS, Marengo E, Saracco G, Zanotti G, Carazo JM, Pagliano C (2017). Pea PSII-LHCII supercomplexes form pairs by making connections across the stromal gap. *Scientific Reports*. 7: 10067.
- Pfeffer S, Dudek J, Schaffer M, Ng BG, Albert S, Plitzko JM, Baumeister W, Zimmermann R, Freeze HH, **Engel BD***, Förster F (2017). Dissecting the molecular organization of the translocon-associated protein complex. *Nature Communications*. 8: 14516.
- Schaffer M, Mahamid J, **Engel BD**, Laugks T, Baumeister W, Plitzko J (2017). Optimized cryo-focused ion beam sample preparation aimed at in situ structural studies of membrane proteins. *Journal of Structural Biology*. 197: 73-82.
- Asano S, **Engel BD**, Baumeister W (2016). In situ cryo-electron tomography: a post-reductionist approach to structural biology. *Journal of Molecular Biology*. 428: 332-343.
- Engel BD***, Schaffer M, Albert S, Asano S, Plitzko JM, Baumeister W (2015). In situ structural analysis of Golgi intracisternal protein arrays. *Proceedings of the National Academy of Sciences USA*. 112: 11264-11269.
- Schaffer M, **Engel BD**, Laugks T, Mahamid J, Plitzko JM, Baumeister W (2015). Cryo-focused ion beam sample preparation for imaging vitreous cells by cryo-electron tomography. *Bio-protocol*. 5: e1575.
- Engel BD***, Schaffer M, Cuellar LK, Villa E, Plitzko JM, Baumeister W (2015). Native architecture of the Chlamydomonas chloroplast revealed by in situ cryo-electron tomography. *eLife*. 4: e04889.
- Bhogaraju S, Weber K, **Engel BD**, Lehtreck KF, Lorentzen E (2014). Getting tubulin to the tip of the cilium: one IFT train, many different tubulin cargo-binding sites? *Bioessays*. 36: 463-467.
- Bhogaraju S, **Engel BD**, Lorentzen E (2013). Intraflagellar transport complex structure and cargo interactions. *Cilia*. 2: 10.
- Shih SM, **Engel BD**, Kocabas F, Bilyard T, Gennerich A, Marshall WF, Yildiz A (2013). Intraflagellar transport drives flagellar surface motility. *eLife*. 2: e00744.
- Engel BD**, Ishikawa H, Wemmer KA, Geimer S, Wakabayashi K, Hirono M, Craige B, Pazour GJ, Witman GB, Kamiya R, Marshall WF (2012). The role of retrograde intraflagellar transport in flagellar assembly, maintenance, and function. *The Journal of Cell Biology*. 199: 151-167.
- Rigort A, Villa E, Bäuerlein FJ, **Engel BD**, Plitzko JM (2012). Integrative approaches for cellular cryo-electron

tomography: correlative imaging and focused ion beam micromachining. *Methods in Cell Biology*. 111: 259-281.

Mizuno N, Taschner M, **Engel BD**, Lorentzen E (2012). Structural studies of ciliary components. *Journal of Molecular Biology*. 422: 163-180.

Engel BD, Ishikawa H, Feldman JL, Wilson CW, Chuang PT, Snedecor J, Williams J, Sun Z, Marshall WF (2011). A cell-based screen for inhibitors of flagella-driven motility in *Chlamydomonas* reveals a novel modulator of ciliary length and retrograde actin flow. *Cytoskeleton*. 68: 188-203.

Engel BD, Ludington WB, Marshall WF (2009). Intraflagellar transport particle size scales inversely with flagellar length: revisiting the balance-point length control model. *The Journal of Cell Biology*. 187: 81-89.

Engel BD, Lehtreck KF, Sakai T, Ikebe M, Witman GB, Marshall WF (2009). Total internal reflection fluorescence (TIRF) microscopy of *Chlamydomonas* flagella. *Methods in Cell Biology*. 93: 155-176.

REFERENCES

Wolfgang Baumeister

Postdoc Supervisor

Dept. of Molecular Structural Biology
Max Planck Institute of Biochemistry
Am Klopferspitz 18
82152 Martinsried, Germany
Phone: +49 (89) 8578-2642
Fax: +49 (89) 8578-2641
Email: baumeist@biochem.mpg.de

Wallace Marshall

Ph.D. Supervisor

Dept. of Biochemistry and Biophysics
University of California, San Francisco
600 16th Street
San Francisco, CA 94158, USA
Phone: +1 (15) 514-4304
Fax: +1 (41) 502-4315
Email: wallace.marshall@ucsf.edu