

**BIOGRAPHICAL SKETCH**

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NAME Kenneth H. Downing		POSITION TITLE Senior Scientist	
EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)			
INSTITUTION AND LOCATION	DEGREE (if applicable)	YEAR(s)	FIELD OF STUDY
Cornell University	B.S.	1967	Engineering Physics
Cornell University	Ph.D.	1974	Applied Physics

**A. Positions and Honors.**Professional Positions:

- 09/73 - 02/74 Postdoctoral Research Assistant, Department of Applied Physics, Cornell University, Ithaca, New York.
- 02/74 - 08/77 Research Associate, Cell Biology Institute, Swiss Federal Institute of Technology, Zurich, Switzerland.
- 10/77 - 12/87 Staff Scientist II, Biology and Medicine Division of Lawrence Berkeley Laboratory.
- 12/87 - 12/93 Staff Scientist III, Biology and Medicine Division of Lawrence Berkeley Laboratory.
- 12/93 - present Senior Scientist, Life Science Division of Lawrence Berkeley Laboratory.
- 1/04 - present Head, Biophysics and Radiation Biology Department, LSD, LBNL
- 9/06 - present Head, Structural Biogoy and GTL Department, LSD, LBNL

Awards and Other Professional Activities:

- 12/99 US Patent #5,998,790; Transmission electron microscope CCD camera
- 1999-present Faculty of the Graduate Group in Comparative Biochemistry, Univ. California, Berkeley
- 2000 President, Microscopy Society of America

**B. Selected peer-reviewed publications**

- R. Henderson, J.M. Baldwin, K.H. Downing, J. Lepault, F. Zemlin. Structure of purple membrane from *Halobacterium halobium*: recording, measurement, and evaluation of electron micrographs at 3.5Å resolution. *Ultramicroscopy* **19**, 147 - 178 (1986).
- K.H. Downing and R.M. Glaeser. Improvement in image contrast in high-resolution images of beam-sensitive specimens achieved with small-spot illumination. *Ultramicroscopy* **20**, 269 - 278 (1986).
- R. Henderson, J. M. Baldwin, T. A. Ceska, F. Zemlin, E. Beckmann and K. H. Downing. An atomic model of bacteriorhodopsin based on electron cryo-microscopy. *J. Mol. Biol.* **213**, 899 - 929 (1990).
- K.H. Downing, M. Hu, H.R. Wenk, and M. A. O'Keefe. Resolution of oxygen with the TEM: 3-D electron crystallography of staurolite. *Nature* **348**, 525 - 528 (1990)
- K.H. Downing. Spot-scan imaging in transmission electron microscopy. *Science* **251**, 53 - 59 (1991)
- K.H. Downing. Dynamic focus correction in spot-scan imaging. *Ultramicroscopy* **46**, 199 - 207 (1992).
- N.V. Hud, K.H. Downing and R. Balhorn. (1995) A Constant-radius of curvature model for the structure of DNA toroids. *Proc. Natl. Acad. Sci. USA* **92**, 3581-3585.
- E. Nogales, S.G. Wolf, I.A. Kahn, R.F. Luduena and K.H. Downing. (1995) Structure of tubulin at 6.5Å resolution and location of the taxol binding site. *Nature* **375**, 424-427.
- B.F. McEwen, K.H. Downing and R.M. Glaeser. (1995) The relevance of dose-fractionation in tomography of radiation sensitive specimens. *Ultramicroscopy* **60**, 357-373.
- E. Nogales, S. G. Wolf, and K. H. Downing (1998) Structure of the alpha-beta tubulin dimer by electron crystallography. *Nature* **391**, 199-203
- E. Nogales, K. H. Downing, L. A. Amos and J. Lowe (1998) Tubulin and FtsZ form a distinct family of GTPases. *Nature Struct. Biol.* **5**, 451-458.
- K. H. Downing and F. M. Hendrickson (1999) Performance of a 2-k CCD camera designed for electron crystallography. *Ultramicroscopy* **75**, 215-233

- E. Nogales, M. Whittaker, R. A. Milligan and K. H. Downing (1999) High-resolution model of the microtubule. *Cell* **96**, 79-88
- S. Chang, T. Head-Gordon, R. M. Glaeser and K. H. Downing (1999) Chemical bonding effects in the determination of protein structure by electron crystallography. *Acta Cryst.* **A55**, 305-313
- P. Giannakakou, R. Gussio, E. Nogales, K. H. Downing, D. Zaharevitz, D. L. Sackett and T. Fojo A common pharmacophore for epothilone and Taxol: molecular basis for drug resistance conferred by tubulin mutations in cancer cells. *Proc. Natl. Acad. Sci. USA* **97**, 2904-2909 (2000)
- K. Richards, K. R. Anders, E. Nogales, K. Schwartz, K. H. Downing and D. Botstein Systematic mutagenesis of the alpha-tubulin gene *TUB1* in *S. cerevisia*. *Mol. Biol. Cell* **11**, 1887-1903 (2000)
- M. R. Shen, K.H. Downing, R. Balhorn and N. V. Hud Nucleation of DNA condensation by static loops: Formation of DNA toroids with reduced dimensions. *J. Am. Chem. Soc.* **122**, 4833-4834 (2000)
- K. H. Downing Structural basis for the interaction of tubulin and drugs that affect microtubule dynamics. *Ann Rev. Cell. Dev. Biol.* **16**, 89-111 (2000)
- H. W. Detrich, S. K. Parker, R. C. Williams, E. Nogales and K. H. Downing Cold adaptation of microtubule assembly and dynamics – Structural interpretation of primary sequence changes present in the alpha- and beta-tubulins of antarctic fishes. *J. Biol. Chem.* **275**, 37038-37047 (2000)
- J. P. Snyder, J. H. Nettles, B. Cornett, K. H. Downing and E. Nogales The binding conformation of Taxol. *Proc. Natl. Acad. Sci. USA* **98**, 5312-5316 (2001)
- J. Löwe, H. Li, K. H. Downing, and E. Nogales Refined structure of  $\alpha\beta$ -tubulin at 3.5 Å. *J. Mol. Biol.* **313**, 1045-1057 (2001)
- N. V. Hud and K. H. Downing Cryoelectron microscopy of  $\lambda$  phage DNA condensates in vitreous ice: The fine Structure of DNA toroids. *Proc. Natl. Acad. Sci. USA* **98**, 14925-14930 (2001)
- S. Zhong, V. M. Dادرlat, T. Head-Gordon, R. M. Glaeser and K. H. Downing Modeling chemical bonding effects for protein electron crystallography: The transferable fragmental electrostatic potential (TFESP) method. *Acta Cryst.* **A58**, 162-170 (2002)
- H. Li, D. J. DeRosier, W. V. Nicholson, E. Nogales and k. H. Downing Microtubule structure at 8 Å resolution. *Structure* **10**, 1317–1328 (2002).
- K. H. Downing, M. R. McCartney and R. M. Glaeser. Experimental characterization and mitigation of specimen charging on thin films with one conducting layer. *Microsc. Microanalysis*, in press.
- J. C. H. Spence, U. Weierstall, T. T. Fricke, R. M. Glaeser and K. H. Downing Three-dimensional diffractive imaging for crystalline monolayers with one-dimensional compact support. *J. Struct. Biol.* **144**, 209-219 (2003)
- J. L. Paluh, A. N. Killilea, H. W. Detrich, and K. H. Downing Meiosis-specific failure of cell cycle progression in fission yeast by mutation of a conserved beta-tubulin residue. *Mol. Biol. Cell.* **15**, 1160-71 (2004)
- J. H. Nettles, H. Li, B. Cornett, J. Krahn, J. P. Snyder and K. H. Downing The electron crystallographic conformation and binding mode of epothilone A on  $\alpha\beta$ -tubulin: A distributed pharmacophore. *Science* **305**, 866-869 (2004).
- T. K. Kim, J. Wells, C. Kirkegaard, Z. Li, S. V. Hoffmann, J. E. Gayone, I. Fernandez-Torrente, P. Haberle, J. I. Pascual, K.T. Moore, A.J. Schwartz, H. He, J. C. H. Spence, K. H. Downing, S. Lazar, F. D. Tichelaar, S. V. Borisenko, M. Knupfer, and Ph. Hofmann Evidence against a charge density wave on Bi(111). *Physical Review B* **72**, (2005)
- E. M. Judd, L. R. Comolli, J. C. Chen, K. H. Downing, W. E. Moerner, H. H. McAdams Distinct constrictive processes, separated in time and space, divide *Caulobacter* inner and outer membranes *J. Bacteriol.* **187** 6874-82 (2005)
- L. R. Comolli and K. H. Downing Dose Tolerance at helium and nitrogen temperatures for whole cell electron tomography *J. Struct. Biol.* **152** 149-56 (2005)
- H. Sui and K. H. Downing Molecular architecture of axenomal microtubule doublets revealed by cryoelectron tomography. *Nature* **442** 475-478 (2006)
- L. R. Comolli, M. Kundman and K. H. Downing Characterization of Intact Subcellular Bodies in Whole Bacteria by Cryo Electron Tomography and Spectroscopic Imaging. *J. Microsc.* **223** 40-52 (2006)
- R. Cambie, K. H. Downing, D. Typke, R. M. Glaeser and J. Jin Design of a microfabricated, two-electrode phase-contrast element suitable for electron microscopy *Ultramicroscopy* **107**, 329-39 (2007)
- K. H. Downing and P. E. Mooney A charge-coupled device camera with electron decelerator for intermediate voltage electron microscopy. *Rev. Sci. Instrum.* **79**, 043702 (2008)