

Curriculum Vitae
Deborah Fass

Address: Department of Structural Biology
Weizmann Institute of Science
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Date of birth: February 21, 1970, USA
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Education

1997-1998 Post-doctoral training (Structural Biology)
Whitehead Institute, Cambridge, MA, USA
Advisor: James Berger

1992-1997 Ph.D. (Structural Biology)
Massachusetts Institute of Technology, Cambridge, MA, USA
Thesis title: "The Protein Structures Underlying Receptor Binding and Membrane Fusion of Ecotropic Murine Leukemia Viruses"
Advisor: Peter Kim

1987-1991 B.A. (Biochemistry)
Harvard University, Cambridge, MA, USA
Thesis title: "hXBP-1 and ψ hXBP-1: Genomic Organization and Identification of *cis*-Regulatory Sequences from a Class II Major Histocompatibility Complex Transcription Activating Factor"
Advisor: Jack Strominger

Employment History

2013-present Professor, Department of Structural Biology
Weizmann Institute of Science, Rehovot, Israel

2006-2013 Associate Professor, Department of Structural Biology
Weizmann Institute of Science, Rehovot, Israel

1998-2006 Senior Scientist, Department of Structural Biology
Weizmann Institute of Science, Rehovot, Israel

1991-1992 Research Assistant, Department of Biochemistry
Harvard University, Cambridge, MA, USA

Teaching Experience

- 1999-present Lecturer, Protein Structure and Function
Feinberg Graduate School, Weizmann Institute
- 1995 Teaching Assistant, Graduate Biophysical Chemistry
Massachusetts Institute of Technology
- 1993 Teaching Assistant, Undergraduate Biochemistry
Massachusetts Institute of Technology
- 1992 Teaching Assistant, Undergraduate Biochemistry
Harvard University
- 1991 Teaching Assistant, Undergraduate Organic Chemistry
Harvard Summer School

Prizes and Recognition

- 2013 Elected to the European Molecular Biology Organization (EMBO)
- 2012 European Research Council (ERC) Consolidator Grant Award
- 2008 Israel Chemical Society Excellent Young Scientist Prize
- 2005 Krill Prize for Outstanding Research (awarded under the auspices of the Wolf Foundation)
- 2005 Hestrin Prize (Israel Society for Biochemistry and Molecular Biology)
- 2002 Bergmann Memorial Research Award (Binational Science Foundation)
- 1998 Sir Charles Clore Prize
- 1992 Howard Hughes Graduate Studies Fellowship
- 1992 National Science Foundation Fellowship
- 1991 Phi Beta Kappa
- 1991 Bowdoin Prize for Essay in the Natural Sciences

Patents

Douglas Lake, Benjamin Katchman, Deborah Fass.
“QSOX as an Anti-neoplastic Drug Target”
Publication number: 20160122765 (May 5, 2016)
Filed: Sept. 9, 2015

Deborah Fass, Iris Grosman, Tal Ilani, Assaf Alon.
“Compositions for Inhibition of Quiescin Sulfhydryl Oxidase (QSOX1) and Uses of Same”
Publication number: 20150110786 (March 7, 2013)
Filed: April 23, 2015

David C. Chan, Deborah Fass, Min Lu, James M. Berger, and Peter S. Kim.
“Core Structure of gp41 from the HIV Envelope Glycoprotein”
U.S. Patent Number: 6,506,554. January 14, 2003

David C. Chan, Deborah Fass, Min Lu, James M. Berger, and Peter S. Kim.
“Core Structure of gp41 from the HIV Envelope Glycoprotein”
U.S. Patent Number: 6,150,088 November 21, 2000

Conference Organizing Committees

2015	Kavli Frontiers of Science U.S.-Israel Meeting
2014	Yale-Weizmann Encounter in the Biological, Physical, and Engineering Sciences
2013	Kavli Frontiers of Science U.S.-Israel Meeting
2013	Meeting of the Israel Chemical Society
2011	Ilanit (Federation of the Israeli Societies for Experimental Biology)
2005	Meeting of the Israel Chemical Society
2002	XIX Congress of the International Union of Crystallography

Recent/Future Invited Lectures at International Meetings

2016	plenary lecture at the DFG Priority Program “Dynamics of Thiol-Based Redox Switches in Cellular Physiology,” Kloster Irsee, Germany
2016	five-year ceremony of the Buchman Institute, University of Frankfurt, Germany
2015	Lorne Conference on Protein Structure and Function, Australia
2014	Gordon Research Conference on Thiol-Based Redox Regulation, Spain
2014	Gordon Research Conference on Protein Processing and Secretion, USA
2013	Protein Society Meeting, USA
2011	Harvard Medical School Structural Biology Symposium
2011	Symposium on Protein Chemistry, Copenhagen, Denmark
2010	EMBO Conference on Endoplasmic Reticulum Functions, Spain

List of Publications

Refereed Original Research Articles

1. Zhang, L., Cheng, Q., Zhang, L., Wang, Y., Merrill, G.F., Ilani, T., Fass, D. Arnér, E.S.J., and Zhang, J. "Serum Thioredoxin Reductase is Highly Increased in Mice with Hepatocellular Carcinoma and its Activity is Restrained by Several Mechanisms," *Free Radical Biology and Medicine*, in press.
2. Kryshtafovych, A., Moulton, J., Baslé, A., Burgin, A., Craig, T.K., Edwards, R.A., Fass, D., Hartmann, M.D., Korycinski, M., Lewis, R.J., Lorimer, D., Lupas, A.N., Newman, J., Peat, T.S., Piepenbrink, K.H., Prahlad, J., van Raaij, M.J., Rohwer, F., Segall, A.M., Seguritan, V., Sundberg, E.J., Singh, A.K., Wilson, M.A., and Schwede, T. "Some of the Most Interesting CASP11 Targets Through the Eyes of their Authors," *Proteins*, in press.
3. Grossman, I., Ilani, T., Fleishman, S.J., and Fass, D. "Overcoming a Species-specificity Barrier in Development of an Inhibitory Antibody Targeting a Modulator of Tumor Stroma," *Protein Eng. Des. Sel.* **29**, 135-147 (2016).
4. Grossman, I., Aviram, H.Y., Armony, G., Horovitz, A., Hofmann, H., Haran, G., and Fass, D. "Single-molecule Spectroscopy Exposes Hidden States in an Enzymatic Electron Relay," *Nature Comm.* **6**, 8624 (2015).
5. Moran, T., Gat, Y., and Fass, D. "Laminin L4 Domain Structure Resembles Adhesion Modules in Ephrin Receptor and Other Transmembrane Glycoproteins," *FEBS J.* **282**, 2746-2757 (2015).
6. Biran, S., Gat, Y., and Fass, D. "The Eps1p Protein Disulfide Isomerase Conserves Classic Thioredoxin Superfamily Amino Acid Motifs but Not Their Functional Geometries," *PLoS ONE*, **9**: e113431 (2014).
7. Gat, Y., Vardi-Kilshtain, A., Grossman, I., Major, D.T., and Fass, D. "Enzyme Structure Captures Four Cysteines Aligned for Disulfide Relay," *Protein Sci.* **23**, 1102-1112 (2014).
8. Kryshtafovych, A., Moulton, J., Bales, P., Bazan, J.F., Biasini, M., Burgin, A., Chen, C., Cochran, F.V., Craig, T.K., Das, R., Fass, D., Garcia-Doval, C., Herzberg, O., Lorimer, D., Luecke, H., Ma, X., Nelson, D.C., van Raaij, M.J., Rohwer, F., Segall, A., Seguritan, V., Zeth, K., and Schwede, T. "Challenging the State of the Art in Protein Structure Prediction: Highlights of Experimental Target Structures for the 10th Critical Assessment of Techniques for Protein Structure Prediction Experiment CASP10," *Proteins* **82**, Suppl. 2, 26-42 (2014).
9. Grossman, I., Alon, A., Ilani, T., and Fass, D. "An Inhibitory Antibody Blocks the First Step in the Dithiol/Disulfide Relay Mechanism of the Enzyme QSOX1," *J. Mol. Biol.* **425**, 4366-4378 (2013).
10. Ilani, T., Alon, A., Grossman, I., Horowitz, B., Kartvelishvily, E., Cohen, S.R., and Fass, D. "A Secreted Disulfide Catalyst Controls Extracellular Matrix Composition and Function," *Science* **341**, 74-76 (2013).

11. Limor-Waisberg, L., Ben-Dor, S., and Fass, D. "Diversification of Quiescin Sulfhydryl Oxidase in a Preserved Framework for Redox Relay," *BMC Evol. Biol.* **13**, 70 (2013).
12. Hakim, M., Ezerina, D., Alon, A., Vonshak, O., and Fass, D. "Exploring ORFan Domains in Giant Viruses: Structure of Mimivirus Sulfhydryl Oxidase R596," *PLoS ONE* **7**, e50649 (2012).
13. Limor-Waisberg, K., Alon, A., Mehlman, T., and Fass, D. "Phylogenetics and Enzymology of Plant Quiescin Sulfhydryl Oxidase," *FEBS Lett.* **586**, 4119-4125 (2012).
14. Alon, A., Grossman, I., Kodali, V., DiMaio, F., Mehlman, T., Haran, G., Baker, D., Thorpe, C., and Fass, D. "The Dynamic Disulfide Relay of Quiescin Sulfhydryl Oxidase," *Nature* **488**, 414-418 (2012).
15. Hakim, M., Mandelbaum, A., and Fass, D. "Structure of a Baculovirus Sulfhydryl Oxidase, Highly Divergent Member of the Erv Flavoenzyme Family," *J. Virol.* **85**, 9406-9413 (2011).
16. DiMaio, F., Terwilliger, T.C., Read, R., Wlodawer, A., Oberdorfer, G., Valkov, E., Alon, A., Fass, D., Axelrod, H.L., Das, D., Vorobiev, S.M., Iwai, H., Pokkuluri, P.R., and Baker, D. "Improved Molecular Replacement by Density- and Energy-Guided Protein Structure Optimization," *Nature* **473**, 540-543 (2011).
17. Heldman, N., Vonshak, O., Sevier, C.S., Vitu, E., Mehlman, T., and Fass, D. "Steps in Reductive Activation of the Disulfide-Generating Enzyme Ero1p," *Protein Science* **19**, 1863-1876 (2010).
18. Kogan, K., Spear, E.D., Kaiser, C.A., and Fass, D. "Structural Conservation of Components in the Amino Acid Sensing Branch of the TOR Pathway in Yeast and Mammals," *J. Mol. Biol.* **402**, 388-398 (2010).
19. Blais, J.D., Chin, K.T., Zito, E., Zhang, Y., Heldman, N., Harding, H.P., Fass, D., Thorpe, C., and Ron, D. "A Small Molecule Inhibitor of Endoplasmic Reticulum Oxidation 1 (ERO1) With Selectively Reversible Thiol Reactivity," *J. Biol. Chem.* **285**, 20993-21003 (2010).
20. Vitu, E., Kim, S., Sevier, C.S., Lutzky, O., Heldman, N., Bentzur, M., Unger, T., Yona, M., Kaiser, C.A., and Fass, D. "Oxidative Activity of Yeast Ero1p on Protein Disulfide Isomerase and Related Oxidoreductases of the Endoplasmic Reticulum," *J. Biol. Chem.* **285**, 18155-18165 (2010).
21. Alon, A., Heckler, E.J., Thorpe, C., and Fass, D. "QSOX Contains a Pseudo-Dimer of Functional and Degenerate Sulfhydryl Oxidase Domains," *FEBS Lett.* **584**, 1521-1525 (2010).
22. Hakim, M. and Fass, D. "Dimer Interface Migration in a Viral Sulfhydryl Oxidase," *J. Mol. Biol.* **391**, 758-768 (2009).

23. Farver, O., Vitu, E., Wherland, S., Fass, D., and Pecht, I. "Electron Transfer Reactivity of the *Arabidopsis thaliana* Sulfhydryl Oxidase AtErv1," *J. Biol. Chem.* **284**, 2098-2105 (2009).
24. Vitu, E., Gross, E., Greenblatt, H. M., Sevier, C., Kaiser, C., and Fass, D. "Yeast Mpd1p Reveals the Structural Diversity of the Protein Disulfide Isomerase Family," *J. Mol. Biol.* **384**, 631-640 (2008).
25. Bar, M., Celik, Y., Fass, D., and Braslavsky, I. "Interactions of β -Helical Antifreeze Protein Mutants with Ice," *Cryst. Growth Des.* **8**, 2954-2963 (2008).
26. Portnaya, I., Ben-Shoshan, E., Cogan, U., Khaflin, R., Fass, D., Ramon, O., and Danino, D. "Self-Assembly of Bovine Beta-Casein Below the Isoelectric pH," *J. Agric. Food Chem.* **56**, 2192-2198 (2008).
27. Heckler, E.J., Alon, A., Fass, D., and Thorpe, C. "Human Quiescin-Sulfhydryl Oxidase, QSOX1: Probing Internal Redox Steps by Mutagenesis," *Biochem.* **47**, 4955-4963 (2008).
28. Bar, M., Scherf, T., and Fass, D. "Two-Dimensional Surface Display of Functional Groups on a β -helical Antifreeze Protein Scaffold," *Protein Eng. Des. Sel.* **21**, 107-114 (2008).
29. Magdiovich, E., Orr, I., Fass, D., Abdu, U., and Yifrach, O. "Intrinsic Disorder in the C-terminal Domain of the Shaker Voltage-Activated K⁺ Channel Modulates Its Interaction With Scaffold Proteins," *Proc. Natl. Acad. Sci. USA* **104**, 13022-13027 (2007).
30. Sevier, C.S., Qu, H., Heldman, N., Gross, E., Fass, D., and Kaiser C.A. "Modulation of cellular disulfide-bond formation and the ER redox environment by feedback regulation of Ero1," *Cell* **129**, 333-344 (2007).
31. Frenkiel-Krispin, D., Grayer Wolf, S., Albeck, S., Unger, T., Peleg, Y., Jacobovitch, J., Michael, Y., Daube, S., Sharon, M., Robinson, C.V., Svergun, D.I., Fass, D., Tzfira, T., and Elbaum, M. "Plant transformation by *Agrobacterium tumefaciens*: Modulation of ssDNA-VirE2 complex assembly by VirE1," *J. Biol. Chem.* **282**, 3458-3462 (2007).
32. Ben-Shem, A., Fass, D., and Bibi, E. "Structural Basis for Intramembrane Proteolysis by Rhomboid Serine Proteases," *Proc. Natl. Acad. Sci. USA* **104**, 462-466 (2007).
33. Sirkis, R., Gerst, J. E., and Fass, D. "A Eukaryotic Protein With the Retroviral Protease Fold," *J. Mol. Biol.* **364**, 376-387 (2006).
34. Vitu, E., Bentzur, M., Lisowsky, T., Kaiser, C.A., and Fass, D. "Gain of Function in an ERV/ALR Sulfhydryl Oxidase by Molecular Engineering of the Shuttle Disulfide," *J. Mol. Biol.* **362**, 89-101 (2006).
35. Bar, M., Bar-Ziv, R., Scherf, T., and Fass, D. "Efficient Production of a Folded and Functional, Highly Disulfide-Bonded β -helix Antifreeze Protein in Bacteria," *Protein Expression and Purification* **48**, 243-252 (2006).

36. Gross, E., Sevier, C.S., Heldman, N., Vitu, E., Bentzur, M., Kaiser, C.A., Thorpe, C., and Fass, D. "Generating Disulfides Enzymatically: Reaction Products and Electron Acceptors of the Endoplasmic Reticulum Thiol Oxidase Ero1p," *Proc. Natl. Acad. Sci. USA* **103**, 299-304 (2006).
37. Sevier, C.S., Kadokura, H., Tam, V.C., Beckwith, J., Fass, D., and Kaiser, C.A. "The Prokaryotic Enzyme DsbB May Share Key Structural Features with Eukaryotic Disulfide Bond Forming Oxidoreductases," *Protein Science* **14**, 1630-1642 (2005).
38. Förster, F., Medalia, O., Zauberman, N., Baumeister, W., and Fass, D. "Retrovirus Envelope Protein Complex Structure *in Situ* Studied by Cryo-Electron Tomography," *Proc. Natl. Acad. Sci. USA* **102**, 4729-4734 (2005).
39. Gross, E., Kastner, D.B., Kaiser, C.A., and Fass, D. "Structure of Ero1p, Source of Disulfide Bonds for Oxidative Protein Folding in the Cell," *Cell* **117**, 601-610 (2004).
40. Barnett, A.L., Wensel, D.L., Li, W., Fass, D., and Cunningham, J. M. "Structure and Mechanism of a Co-receptor for Infection by a Pathogenic Feline Retrovirus," *J. Virol.*, **77**, 2717-2729 (2003).
41. Gross, E., Sevier, C.S., Vala, A., Kaiser, C.A., and Fass, D. "New FAD-Binding Fold and Intersubunit Disulfide Shuttle in the Thiol Oxidase Erv2p," *Nature Struct. Biol.* **9**, 61-67 (2002).
42. Paz, Y., Elazar, Z., and Fass, D. "Structure of GATE-16, Membrane Transport Modulator and Mammalian Ortholog of Autophagocytosis Factor Aut7p," *J. Biol. Chem.* **275**, 25445-25450 (2000).
43. Babor, S.M., and Fass, D. "Crystal Structure of the Sec18p N-terminal Domain," *Proc. Natl. Acad. Sci. USA* **96**, 14759-14764 (1999).
44. Fass, D., Bogden, C.E., and Berger, J.M. "Crystal Structure of the N-terminal Domain of the DnaB Hexameric Helicase," *Structure* **7**, 691-698 (1999).
45. Bogden, C.E., Fass, D., Bergman, N., Nichols, M.D., and Berger, J.M. "Structural Basis for Terminator Recognition by the Rho Transcription Termination Factor," *Molecular Cell* **3**, 487-493 (1999).
46. Fass, D., Bogden, C.E., and Berger, J.M. "Quaternary Changes in Topoisomerase II may Direct Orthogonal Movement of Two DNA Strands," *Nature Struct. Biol.* **6**, 322-326 (1999).
47. Berger, J.M., Fass, D., Wang, J.C., and Harrison, S.C. "Structural Similarities Between Topoisomerases that Cleave One or Both DNA Strands," *Proc. Natl. Acad. Sci. USA* **95**, 7876-7881 (1998).
48. Fass, D., Davey, R.A., Hamson, C.A., Kim, P.S., Cunningham, J.M., and Berger, J.M. "Structure of a Murine Leukemia Virus Receptor-Binding Glycoprotein at 2.0 Å Resolution," *Science* **277**, 1662-1666 (1997).

49. Fass, D., Blacklow, S., Kim, P.S., and Berger, J.M. "Structure of a Calcium-Coordinating LDL Receptor Module," *Nature* **388**, 691-693 (1997).
50. Chan, D.C., Fass, D., Berger, J.M., and Kim, P.S. "Core Structure of gp41 from the HIV Envelope Glycoprotein," *Cell* **89**, 263-273 (1997).
51. Fass, D., Harrison, S.C., and Kim, P.S. "Retrovirus Envelope Domain at 1.7 Å Resolution," *Nature Struc. Biol.* **3**, 465-469 (1996).
52. Fass, D., and Kim, P.S. "Dissection of a Retrovirus Envelope Protein Reveals Structural Similarity to Influenza Hemagglutinin," *Current Biol.* **5**, 1377-1383 (1995).
53. Ellenberger, T., Fass, D., Arnaud, M., and Harrison, S.C. "Crystal Structure of Transcription Factor E47 E-box Recognition by a Basic Region Helix-Loop-Helix Dimer," *Genes and Dev.* **8**, 970-980 (1994).
54. Ponath, P.D., Fass, D., Liou, H.C., Glimcher, L.H., and Strominger, J.L. "The Regulatory Gene, hXBP-1, and its target, HLA-DRA, Utilize Both Common and Distinct Regulatory Elements and Protein Complexes," *J. Biol. Chem.* **268**, 17074-17082 (1993).
55. Gupta, S., Fass, D., Shimizu, M., and Vayuvegula, B. "Potentiation of Immunosuppressive Effects of Cyclosporin A by 1 α ,25-Dihydroxyvitamin D₃," *Cellular Immunol.* **121**, 290-297 (1989).

Review Articles

1. Alon, A. and Fass, D., "Catalysis of Disulfide Bond Formation by the Quiescin Sulfhydryl Oxidases," eLS Wiley Online Library (2012)
DOI: 10.1002/9780470015902.a0024168.
2. Fass, D., "Disulfide Bonding in Protein Biophysics," *Ann. Rev. Biophys* **41**, 63-79 (2012).
3. Hakim, M. and Fass, D. "Cytosolic Disulfide Bond Formation in Cells Infected With Large Nucleocytoplasmic DNA Viruses," *Antiox. Redox Signal.* **13**, 1261-1271 (2010).
4. Erez, E., Fass, D., and Bibi, E. "How Intramembrane Proteases Bury Hydrolytic Reactions in the Membrane," *Nature* **459**, 371-378 (2009).
5. Fass, D. "The Erv Family of Sulfhydryl Oxidases," *Biochim. Biophys. Acta* **1783**, 371-378 (2008).
6. Fass, D. "Conformational Changes in Enveloped Virus Surface Proteins During Cell Entry," *Adv. Prot. Chem.* **64**, 325-362 (2003).

Book Chapter

1. Fass, D. and Sevier, C.S. "The Ero1 Sulfhydryl Oxidase and the Oxidizing Potential of the Endoplasmic Reticulum," in *Oxidative Folding of Peptides and Proteins*. J. Buchner and L. Moroder, editors, RSC Publishing, 2009, pp. 105-120.

Commentaries and editorials

1. Fass, D. and Rittinger, K. "Multi-protein Assemblies in Signaling," *Curr. Opin. Struct. Biol.* **29**, vi-viii (2014).
2. Ilani, T. and Fass, D. "Now at the Met: Fine Art of Reversible Sulfoxidation," *Mol. Cell* **51**, 281-282 (2013).
3. Fass, D. "Hunting for Alternative Disulfide Bond Formation Pathways: Endoplasmic Reticulum Janitor Turns Professor and Teaches a Lesson," *Mol. Cell* **40**, 685-686 (2010).