

**Table S1. Thiol oxidoreductases**

PDB ID	Protein name (pdb header)	SOURCE	FOLD	Catalytic Cys (pdb numbering)
1DBY	Chloroplast Thioredoxin	<i>Chlamydomonas reinhardtii</i>	Thioredoxin	31
1QUW	Thioredoxin	<i>Alicyclobacillus acidocaldarius</i>	Thioredoxin	29
1TI3	Thioredoxin	<i>Populus tremula</i>	Thioredoxin	38
1XOA	Thioredoxin	<i>Escherichia coli</i>	Thioredoxin	32
1XW9	Thioredoxin	<i>Drosophila melanogaster</i>	Thioredoxin	32
2GZY	Thioredoxin	<i>Bacillus subtilis</i>	Thioredoxin	29
3TRX	Thioredoxin	<i>Homo sapiens</i>	Thioredoxin	32
1DE1	Glutaredoxin	<i>Bacteriophage T4</i>	Thioredoxin	14
1WJK	Glutaredoxin	<i>Mus musculus</i>	Thioredoxin	27
1EGO	Glutaredoxin	<i>Escherichia coli</i>	Thioredoxin	11
1Z7R	Glutaredoxin	<i>Populus tremula</i>	Thioredoxin	31
2FLS	Glutaredoxin 2	<i>Homo sapiens</i>	Thioredoxin	37
1QQ2	Peroxiredoxin 2	<i>Rattus norvegicus</i>	Thioredoxin	52
2PN8	Peroxiredoxin 4	<i>Homo sapiens</i>	Thioredoxin	124
1OC3	Peroxiredoxin 5	<i>Homo sapiens</i>	Thioredoxin	47
1TP9	Peroxiredoxin 2	<i>Populus tremula</i>	Thioredoxin	51
1XXU	AhpE (1-cys peroxiredoxin)	<i>Mycobacterium tuberculosis</i>	Thioredoxin	45
2C0D	Peroxiredoxin 2	<i>Plasmodium falciparum</i>	Thioredoxin	67
1X5D	Protein Disulfide Isomerase (PDI)	<i>Homo sapiens</i>	Thioredoxin	37
2DJJ	PDI	<i>Humicola insolens</i>	Thioredoxin	37
1MEK	PDI Beta subunit	<i>Homo sapiens</i>	Thioredoxin	36
1A2J	DsbA-II	<i>Escherichia coli</i>	Thioredoxin	30
1V57	DsbG	<i>Escherichia coli</i>	Thioredoxin	109
1JZD	DsbC-DsbDalpha complex	<i>Escherichia coli</i>	Thioredoxin	98
1BED	DsbA	<i>Vibrio cholera</i>	Thioredoxin	30
2OBK	SelW	<i>Pseudomonas fluorescens</i>	Thioredoxin	16
1PSQ	Thiol peroxidase (atypical 2 cys peroxiredoxin)	<i>Streptococcus pneumoniae</i>	Thioredoxin	58
2Y25	Thiol peroxidase	<i>Mycobacterium tuberculosis</i>	Thioredoxin	60*
2Z9S	Peroxiredoxin 1	<i>Rattus norvegicus</i>	Thioredoxin	52*
1Q98	Thiol peroxidase	<i>Haemophilus influenzae</i>	Thioredoxin	59
1QXH	Thiol peroxidase	<i>Escherichia coli</i>	Thioredoxin	61
1I9D	Arsenate Reductase (ArsC)	<i>Escherichia coli</i>	Thioredoxin	12
2P5R	glutathione peroxidase 5	<i>Populus tremula</i>	Thioredoxin	44
2P31	glutathione peroxidase 7	<i>Homo sapiens</i>	Thioredoxin	57
2FWE	C-terminal domain DsbD gamma	<i>Escherichia coli</i>	Thioredoxin	461
2GS3	glutathione peroxidase 4	<i>Homo sapiens</i>	Thioredoxin	73
2HE3	glutathione peroxidase 2	<i>Homo sapiens</i>	Thioredoxin	40
2I3Y	glutathione peroxidase 5	<i>Homo sapiens</i>	Thioredoxin	73
1GER	Glutathione reductase	<i>Escherichia coli</i>	FAD/NAD(P)-binding domain	42
1GRT	Glutathione reductase	<i>Homo sapiens</i>	FAD/NAD(P)-binding domain	58
1ONF	Glutathione reductase	<i>Plasmodium falciparum</i>	FAD/NAD(P)-binding domain	39
1AOG	Trypanothione reductase	<i>Trypanosoma cruzi</i>	FAD/NAD(P)-binding domain	53

<b>1H6V</b>	Thioredoxin reductase	<i>Rattus norvegicus</i>	FAD/NAD(P)-binding domain	59
<b>2NVK</b>	Thioredoxin reductase	<i>Drosophila melanogaster</i>	FAD/NAD(P)-binding domain	62
<b>1VDC</b>	Thioredoxin reductase	<i>Arabidopsis thaliana</i>	FAD/NAD(P)-binding domain	138
<b>2Q0K</b>	Thioredoxin reductase	<i>Helicobacter pylori</i>	FAD/NAD(P)-binding domain	136
<b>2A87</b>	Thioredoxin reductase	<i>Mycobacterium tuberculosis</i>	FAD/NAD(P)-binding domain	148
<b>1TRB</b>	Thioredoxin reductase	<i>Escherichia coli</i>	FAD/NAD(P)-binding domain	105
<b>1JR8</b>	Erv2p	<i>Saccharomyces cerevisiae</i>	ERO1-like	83
<b>2HJ3</b>	Erv1p	<i>Arabidopsis thaliana</i>	Four-helical up-and-down bundle	83
<b>1RP4</b>	Ero1p	<i>Saccharomyces cerevisiae</i>	Four-helical up-and-down bundle	352
<b>1XM0</b>	Methionine sulfoxide reductase B (MsrB)	<i>Bacillus subtilis</i>	Mss4-like	115
<b>1L1D</b>	Pil MsrB	<i>Neisseria gonorrhoeae</i>	Mss4-like	495
<b>1NWA</b>	MsrA	<i>Mycobacterium tuberculosis</i>	Ferredoxin-like	13
<b>2GT3</b>	MsrA	<i>Escherichia coli</i>	Ferredoxin-like	51
<b>1FVA</b>	MsrA	<i>Bos taurus</i>	Ferredoxin-like	72
<b>2J89</b>	MsrA	<i>Populus tremula</i>	Ferredoxin-like	46
<b>1VHM</b>	Free Methionine sulfoxide reductase GAF domain	<i>Escherichia coli</i>	Profilin-like	118
<b>1F5M</b>	Free Methionine sulfoxide reductase GAF domain	<i>Saccharomyces cerevisiae</i>	Profilin-like	125
<b>1LJL</b>	Arsenate reductase	<i>Staphylococcus aureus</i>	Phosphotyrosine protein phosphatases I-like	10
<b>1Y1L</b>	Arsenate reductase	<i>Archaeoglobus fulgidus</i>	Phosphotyrosine protein phosphatases I-like	6
<b>1JL3</b>	Arsenate reductase	<i>Bacillus subtilis</i>	Phosphotyrosine protein phosphatases I-like	10
<b>1QWI</b>	OsmC	<i>Escherichia coli</i>	OsmC-like	59
<b>1ZB9</b>	Organic peroxide resistance protein (OhR)	<i>Xylella fastidiosa</i>	OsmC-like	61
<b>2OPL</b>	OsmC	<i>Geobacter sulfurreducens</i>	OsmC-like	56
<b>2D7V</b>	OsmC-like Protein VCA03	<i>Vibrio cholerae</i>	OsmC-like	76
<b>1USP</b>	OhR	<i>Deinococcus radiodurans</i>	OsmC-like	57
<b>1N2F</b>	OhR	<i>Pseudomonas aeruginosa</i>	OsmC-like	60
<b>2PRR</b>	alkyl hydroperoxidase (AhpD)	<i>Ralstonia eutropha</i>	AhpD-like	89
<b>2OUW</b>	AhpD	<i>Rhodospirillum rubrum</i>	AhpD-like	86
<b>2CWQ</b>	conserved protein TTHA0727 (AhpD-like)	<i>Thermus thermophilus</i>	AhpD-like	73
<b>2GMY</b>	AhpD	<i>Agrobacterium tumefaciens</i>	AhpD-like	51
<b>1KNC</b>	AhpD	<i>Mycobacterium tuberculosis</i>	AhpD-like	133
<b>1JPE</b>	DsbD-alpha ( N-terminal domain of DsbD)	<i>Escherichia coli</i>	Immunoglobulin-like beta-sandwich	109

\* These proteins have the catalytic Cys mutated to serine in the structure. They have been *in silico* mutated to restore the catalytic Cys, with standard modeling techniques (see Methods in the main text)