Full wwPDB X-ray Structure Validation Report (i)

Sep 28, 2024 – 11:08 AM EDT

PDB ID	:	1QUP
Title	:	CRYSTAL STRUCTURE OF THE COPPER CHAPERONE FOR SUPEROXIDE DISMUTASE
Authors	:	Lamb, A.L.; Wernimont, A.K.; Pufahl, R.A.; O'Halloran, T.V.; Rosenzweig, A.C.
Deposited on	:	1999-07-01
Resolution	:	1.80 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

The following versions of software and data (see references (i)) were used in the production of this report:

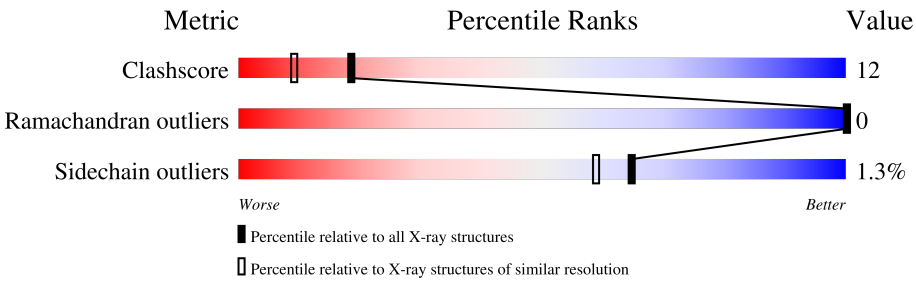
MolProbity	:	4.02b-467
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.80 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	180529	8162 (1.80-1.80)
Ramachandran outliers	177936	8077 (1.80-1.80)
Sidechain outliers	177891	8076 (1.80-1.80)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	222	78% 21% •
1	B	222	81% 18% •

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 3746 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

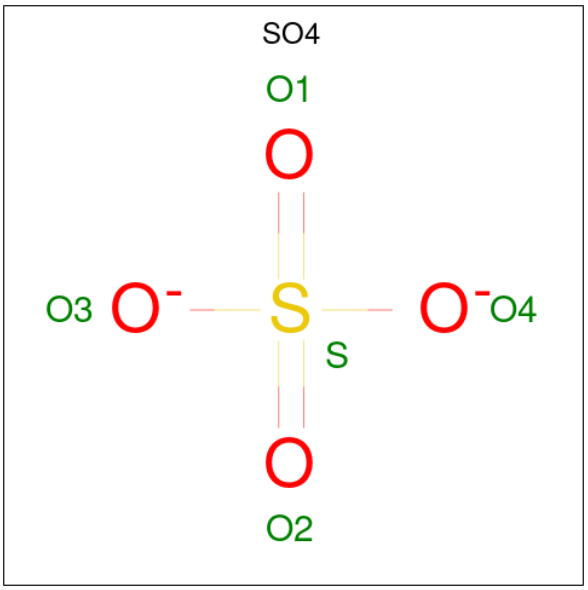
- Molecule 1 is a protein called SUPEROXIDE DISMUTASE 1 COPPER CHAPERONE.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
1	A	221	1698	1068	290	333	5	2	0	0	0
1	B	219	1686	1061	287	331	5	2	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	15	MSE	MET	modified residue	UNP P40202
A	46	MSE	MET	modified residue	UNP P40202
B	15	MSE	MET	modified residue	UNP P40202
B	46	MSE	MET	modified residue	UNP P40202

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	S		
2	A	1	5	4	1	0	0
			Total	O	S		
2	B	1	5	4	1	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	181	181	181	0	0
			Total	O		
3	B	171	171	171	0	0

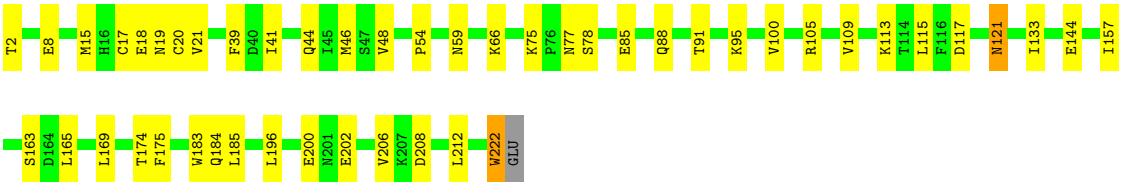
3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

Note EDS was not executed.

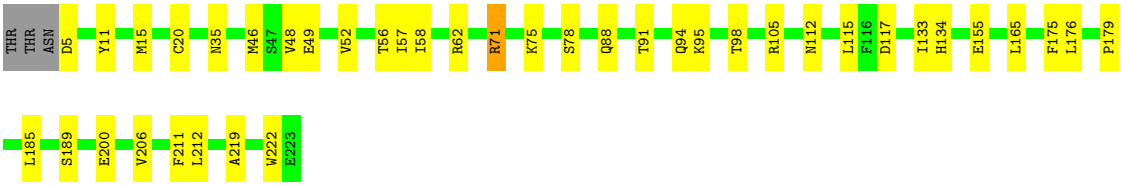
• Molecule 1: SUPEROXIDE DISMUTASE 1 COPPER CHAPERONE

Chain A:



• Molecule 1: SUPEROXIDE DISMUTASE 1 COPPER CHAPERONE

Chain B:



4 Data and refinement statistics (i)

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α, β, γ	87.45Å 111.45Å 52.80Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 1.80	Depositor
% Data completeness (in resolution range)	94.8 (30.00-1.80)	Depositor
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	CNS 0.4	Depositor
R, R_{free}	0.213 , 0.238	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	3746	wwPDB-VP
Average B, all atoms (Å^2)	28.0	wwPDB-VP

5 Model quality (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: SO4

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\#\|Z\|>5$	RMSZ	$\#\|Z\|>5$
1	A	0.34	0/1730	0.60	0/2344
1	B	0.35	0/1718	0.60	0/2325
All	All	0.35	0/3448	0.60	0/4669

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts (i)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1698	0	1672	46	0
1	B	1686	0	1658	33	0
2	A	5	0	0	0	0
2	B	5	0	0	0	0
3	A	181	0	0	10	2
3	B	171	0	0	9	1
All	All	3746	0	3330	79	2

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 12.

All (79) close contacts within the same asymmetric unit are listed below, sorted by their clash

magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:8:GLU:HB3	3:A:488:HOH:O	1.64	0.95
1:A:15:MSE:HE1	1:A:39:PHE:HB3	1.56	0.87
1:A:41:ILE:H	1:A:41:ILE:HD12	1.41	0.84
1:A:15:MSE:HE2	1:A:41:ILE:HA	1.59	0.83
1:B:88:GLN:HE22	1:B:206:VAL:HG21	1.47	0.80
1:B:75:LYS:HG2	3:B:514:HOH:O	1.86	0.76
1:B:94:GLN:HG2	3:B:498:HOH:O	1.87	0.74
1:A:196:LEU:HD13	1:A:202:GLU:HG3	1.72	0.71
1:A:157:ILE:HG12	1:A:174:THR:HG21	1.74	0.69
1:B:133:ILE:HD13	1:B:185:LEU:HD22	1.76	0.68
1:A:95:LYS:NZ	1:A:165:LEU:HD13	2.08	0.67
1:A:17:CYS:O	1:A:20:CYS:HB2	1.94	0.66
1:A:75:LYS:HG3	1:A:78:SER:HB3	1.78	0.66
1:A:2:THR:HG23	3:A:517:HOH:O	1.96	0.66
1:A:133:ILE:HD13	1:A:185:LEU:HD22	1.78	0.64
1:A:200:GLU:H	1:A:200:GLU:CD	2.01	0.64
1:B:75:LYS:HG3	1:B:78:SER:HB3	1.80	0.63
1:B:88:GLN:NE2	1:B:206:VAL:HG21	2.13	0.62
1:A:59:ASN:HB2	3:A:500:HOH:O	1.99	0.62
1:A:15:MSE:H	1:A:44:GLN:HE21	1.45	0.62
1:A:41:ILE:H	1:A:41:ILE:CD1	2.13	0.61
1:B:71:ARG:HD3	3:B:474:HOH:O	2.02	0.60
1:A:54:PRO:HG2	1:A:115:LEU:HD21	1.84	0.59
1:B:57:ILE:HD12	3:B:429:HOH:O	2.01	0.59
1:A:41:ILE:HD12	1:A:41:ILE:N	2.14	0.59
1:B:155:GLU:HB2	1:B:176:LEU:CD2	2.32	0.59
1:A:212:LEU:HD23	1:A:212:LEU:N	2.19	0.58
1:B:105:ARG:HH11	1:B:222:TRP:HB3	1.68	0.58
1:B:105:ARG:HB2	1:B:117:ASP:HB3	1.86	0.57
1:A:15:MSE:HE3	1:A:21:VAL:HG22	1.87	0.56
1:B:46:MSE:HE3	1:B:48:VAL:CG2	2.36	0.56
1:B:155:GLU:HB2	1:B:176:LEU:HD21	1.88	0.55
1:B:212:LEU:N	1:B:212:LEU:HD23	2.21	0.55
1:A:88:GLN:HE22	1:A:206:VAL:HG21	1.72	0.55
1:A:59:ASN:CB	3:A:500:HOH:O	2.53	0.54
1:A:15:MSE:HE2	1:A:41:ILE:CA	2.35	0.53
1:A:75:LYS:HG2	3:A:436:HOH:O	2.08	0.53
1:A:95:LYS:HZ2	1:A:165:LEU:HD13	1.71	0.52
1:B:62:ARG:HG3	1:B:62:ARG:HH11	1.74	0.52
1:A:144:GLU:HG2	3:A:508:HOH:O	2.10	0.51
1:A:109:VAL:O	1:A:113:LYS:HB3	2.11	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:59:ASN:ND2	3:A:500:HOH:O	2.44	0.50
1:B:165:LEU:HD21	3:B:471:HOH:O	2.11	0.49
1:A:91:THR:HB	1:A:202:GLU:OE2	2.12	0.49
1:B:91:THR:HB	3:B:524:HOH:O	2.11	0.49
1:A:85:GLU:HG2	1:A:100:VAL:HG22	1.94	0.49
1:B:200:GLU:H	1:B:200:GLU:CD	2.15	0.48
1:B:15:MSE:HA	1:B:20:CYS:HB3	1.96	0.47
1:A:15:MSE:H	1:A:44:GLN:NE2	2.11	0.47
1:A:46:MSE:HE3	1:A:48:VAL:CG2	2.45	0.47
1:A:115:LEU:HB3	1:A:175:PHE:CZ	2.50	0.46
1:B:46:MSE:HE3	1:B:48:VAL:HG21	1.97	0.46
1:A:2:THR:N	3:A:517:HOH:O	2.48	0.46
1:B:112:ASN:O	1:B:179:PRO:HA	2.16	0.45
1:B:115:LEU:HD13	1:B:175:PHE:HZ	1.81	0.44
1:A:54:PRO:HG2	1:A:115:LEU:HD11	1.99	0.44
1:A:183:TRP:CZ3	1:A:184:GLN:HG2	2.52	0.44
1:A:41:ILE:HD11	3:A:450:HOH:O	2.17	0.44
1:B:35:ASN:HD22	1:B:49:GLU:HG2	1.81	0.44
1:A:105:ARG:CZ	1:A:222:TRP:HB2	2.48	0.44
1:B:48:VAL:HG11	1:B:57:ILE:HD13	1.99	0.43
1:A:105:ARG:HB2	1:A:117:ASP:HB3	2.00	0.43
1:B:155:GLU:HB2	1:B:176:LEU:HD22	2.00	0.43
1:B:88:GLN:HE22	1:B:206:VAL:CG2	2.23	0.42
1:A:15:MSE:HE3	1:A:21:VAL:CG2	2.48	0.42
1:A:18:GLU:HG3	1:A:19:ASN:H	1.85	0.42
1:B:11:TYR:CE2	1:B:58:ILE:HD11	2.56	0.41
1:A:163:SER:HB3	1:A:169:LEU:HB2	2.02	0.41
1:B:134:HIS:HB2	1:B:189:SER:OG	2.20	0.41
1:A:121:ASN:ND2	1:A:163:SER:OG	2.53	0.41
1:A:206:VAL:HG12	1:A:208:ASP:H	1.86	0.41
1:A:18:GLU:HG3	1:A:19:ASN:N	2.35	0.41
1:A:66:LYS:HD2	3:A:520:HOH:O	2.21	0.41
1:B:5:ASP:N	3:B:499:HOH:O	2.53	0.41
1:B:95:LYS:HE3	1:B:98:THR:CG2	2.51	0.41
1:A:105:ARG:NH1	1:A:222:TRP:HB2	2.36	0.41
1:B:5:ASP:HB3	3:B:418:HOH:O	2.20	0.41
1:B:219:ALA:HB3	3:B:411:HOH:O	2.21	0.40
1:B:52:VAL:HG12	1:B:56:THR:HB	2.03	0.40

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:A:519:HOH:O	3:B:415:HOH:O[2_664]	1.55	0.65
3:A:531:HOH:O	3:A:531:HOH:O[2_665]	2.19	0.01

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	219/222 (99%)	215 (98%)	4 (2%)	0	100	100
1	B	217/222 (98%)	213 (98%)	4 (2%)	0	100	100
All	All	436/444 (98%)	428 (98%)	8 (2%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	190/189 (100%)	187 (98%)	3 (2%)	58	50
1	B	188/189 (100%)	186 (99%)	2 (1%)	70	65
All	All	378/378 (100%)	373 (99%)	5 (1%)	65	59

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	77	ASN
1	A	121	ASN

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Mol	Chain	Res	Type
1	A	222	TRP
1	B	71	ARG
1	B	211	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	44	GLN
1	A	77	ASN
1	A	121	ASN
1	A	161	ASN
1	B	35	ASN
1	B	88	GLN
1	B	121	ASN
1	B	134	HIS
1	B	161	ASN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates (i)

There are no oligosaccharides in this entry.

5.6 Ligand geometry (i)

2 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
2	SO4	B	354	-	4,4,4	0.38	0	6,6,6	0.07	0
2	SO4	A	353	-	4,4,4	0.43	0	6,6,6	0.04	0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data (i)

6.1 Protein, DNA and RNA chains (i)

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains (i)

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates (i)

EDS was not executed - this section is therefore empty.

6.4 Ligands (i)

EDS was not executed - this section is therefore empty.

6.5 Other polymers (i)

EDS was not executed - this section is therefore empty.