



Full wwPDB EM Validation Report ⓘ

Feb 20, 2025 – 07:48 AM EST

PDB ID : 2H8A
Title : Structure of Microsomal Glutathione Transferase 1 in Complex with Glutathione
Authors : Hebert, H.
Deposited on : 2006-06-07
Resolution : 3.20 Å (reported)

This is a Full wwPDB EM Validation Report for a publicly released PDB/EMDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/EMValidationReportHelp>

with specific help available everywhere you see the ⓘ 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 ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 2022.3.0, CSD as543be (2022)
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.004 (Gargrove)
Density-Fitness : 1.0.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.41.4

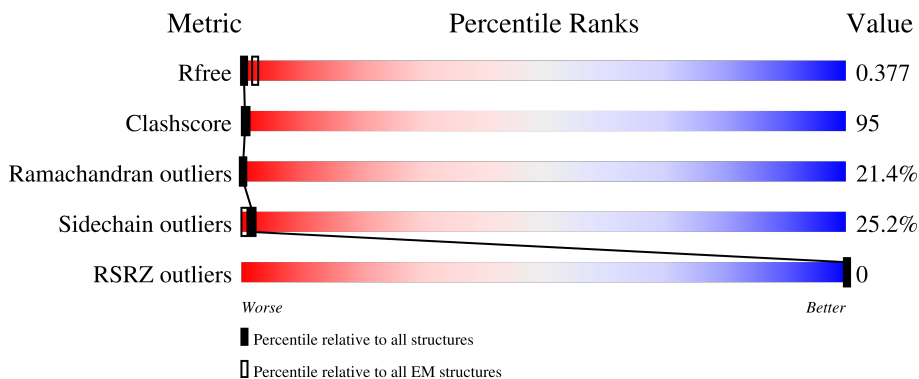
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON CRYSTALLOGRAPHY

The reported resolution of this entry is 3.20 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)	EM structures (#Entries)
R_{free}	164678	53
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415
RSRZ outliers	164674	54

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the 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 $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	A	154	

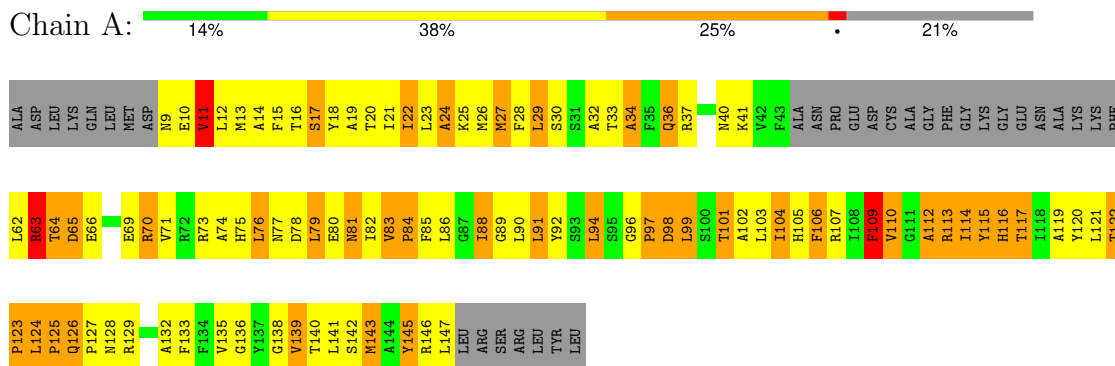
The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	GSH	A	218	X	-	X	-

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.

- Molecule 1: Microsomal glutathione S-transferase 1



4 Data and refinement statistics

Property	Value	Source
Space group	P 6	Depositor
Cell constants a, b, c, α , β , γ	81.80Å 81.80Å 100.00Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	10.00 – 3.20 10.00 – 3.20	Depositor EDS
% Data completeness (in resolution range)	79.2 (10.00-3.20) 79.2 (10.00-3.20)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.11 (at 2.97Å)	Xtrriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.339 , 0.376 0.343 , 0.377	Depositor DCC
R_{free} test set	473 reflections (9.48%)	wwPDB-VP
Wilson B-factor (Å ²)	50.7	Xtrriage
Anisotropy	0.629	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.25 , 64.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.27$, $\langle L^2 \rangle = 0.11$	Xtrriage
Estimated twinning fraction	0.377 for h,-h-k,-l	Xtrriage
F_o, F_c correlation	0.80	EDS
Total number of atoms	984	wwPDB-VP
Average B, all atoms (Å ²)	26.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.98% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

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: GSH

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	0.65	0/985	0.89	0/1334

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	964	0	995	189	0
2	A	20	0	15	11	0
All	All	984	0	1010	189	0

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 95.

All (189) 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:73:ARG:HB3	2:A:218:GSH:SG2	1.72	1.27
1:A:15:PHE:HA	1:A:18:TYR:CE2	1.77	1.19

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:80:GLU:HA	1:A:83:VAL:CG2	1.77	1.14
1:A:28:PHE:CZ	1:A:74:ALA:HB1	1.85	1.12
1:A:135:VAL:HG23	1:A:136:GLY:H	1.11	1.10
1:A:80:GLU:HA	1:A:83:VAL:HG23	1.06	1.05
1:A:28:PHE:HZ	1:A:74:ALA:HB1	0.92	1.04
1:A:106:PHE:HA	1:A:109:PHE:HB3	1.39	1.03
1:A:70:ARG:HH12	1:A:124:LEU:HD13	1.26	1.00
1:A:22:ILE:O	1:A:26:MET:HB3	1.61	0.99
1:A:120:TYR:HD1	1:A:128:ASN:HB3	1.27	0.99
1:A:88:ILE:HD12	1:A:140:THR:HG21	1.46	0.96
1:A:88:ILE:HD12	1:A:140:THR:CG2	1.97	0.95
1:A:28:PHE:HZ	1:A:74:ALA:CB	1.81	0.93
1:A:70:ARG:NH2	1:A:122:THR:O	2.03	0.91
1:A:80:GLU:CA	1:A:83:VAL:HG23	1.98	0.90
1:A:120:TYR:HB2	1:A:128:ASN:CG	1.90	0.90
1:A:88:ILE:HB	1:A:92:TYR:CE1	2.07	0.87
1:A:135:VAL:HG23	1:A:136:GLY:N	1.89	0.87
1:A:15:PHE:HA	1:A:18:TYR:HE2	1.41	0.86
1:A:21:ILE:HG21	1:A:86:LEU:HD13	1.56	0.86
1:A:88:ILE:HB	1:A:92:TYR:HE1	1.41	0.86
1:A:73:ARG:CB	2:A:218:GSH:SG2	2.64	0.84
1:A:81:ASN:OD1	1:A:116:HIS:CE1	2.30	0.84
1:A:25:LYS:HE2	1:A:79:LEU:HD13	1.59	0.84
1:A:124:LEU:H	1:A:125:PRO:HD3	1.42	0.83
1:A:17:SER:HA	1:A:110:VAL:HG11	1.59	0.82
1:A:92:TYR:CG	1:A:143:MET:HB3	2.15	0.82
1:A:70:ARG:NH1	1:A:124:LEU:HD13	1.95	0.81
1:A:92:TYR:CD2	1:A:143:MET:HB3	2.16	0.80
1:A:124:LEU:H	1:A:125:PRO:CD	1.95	0.80
1:A:15:PHE:HA	1:A:18:TYR:CD2	2.18	0.79
1:A:22:ILE:O	1:A:26:MET:CB	2.30	0.78
1:A:135:VAL:CG2	1:A:136:GLY:H	1.93	0.78
1:A:73:ARG:CZ	2:A:218:GSH:HB12	2.13	0.77
1:A:120:TYR:CD1	1:A:128:ASN:HB3	2.17	0.76
1:A:15:PHE:HD1	1:A:18:TYR:HE2	1.31	0.76
1:A:120:TYR:HB2	1:A:128:ASN:ND2	2.01	0.76
1:A:90:LEU:O	1:A:92:TYR:N	2.18	0.75
1:A:121:LEU:HD23	1:A:121:LEU:N	2.01	0.75
1:A:88:ILE:O	1:A:92:TYR:CD1	2.40	0.74
1:A:109:PHE:CD2	1:A:110:VAL:N	2.56	0.73
1:A:73:ARG:NH1	2:A:218:GSH:HB12	2.04	0.72

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:105:HIS:NE2	1:A:139:VAL:HA	2.04	0.72
1:A:19:ALA:O	1:A:23:LEU:HG	1.90	0.72
1:A:10:GLU:HA	1:A:13:MET:HG2	1.72	0.71
1:A:120:TYR:C	1:A:123:PRO:HD2	2.11	0.71
1:A:26:MET:C	1:A:28:PHE:H	1.95	0.70
1:A:85:PHE:HA	1:A:88:ILE:HD11	1.71	0.70
1:A:98:ASP:O	1:A:99:LEU:HG	1.92	0.69
1:A:73:ARG:HH22	2:A:218:GSH:C1	2.05	0.69
1:A:106:PHE:CA	1:A:109:PHE:HB3	2.19	0.69
1:A:25:LYS:HZ3	1:A:79:LEU:HD22	1.58	0.68
1:A:25:LYS:NZ	1:A:79:LEU:HB2	2.07	0.68
1:A:80:GLU:O	1:A:82:ILE:N	2.25	0.68
1:A:117:THR:O	1:A:121:LEU:HG	1.93	0.68
1:A:116:HIS:HE2	1:A:132:ALA:HB2	1.58	0.67
1:A:26:MET:HA	1:A:29:LEU:HG	1.75	0.67
1:A:15:PHE:CD1	1:A:18:TYR:HE2	2.12	0.67
1:A:138:GLY:O	1:A:140:THR:N	2.28	0.66
1:A:119:ALA:O	1:A:123:PRO:CD	2.45	0.65
1:A:32:ALA:HB1	1:A:71:VAL:HG13	1.78	0.65
1:A:73:ARG:NH2	2:A:218:GSH:C1	2.60	0.65
1:A:113:ARG:HA	1:A:116:HIS:HB3	1.79	0.65
1:A:18:TYR:O	1:A:21:ILE:HG13	1.97	0.64
1:A:25:LYS:HZ3	1:A:79:LEU:HB2	1.62	0.64
1:A:105:HIS:O	1:A:109:PHE:CB	2.45	0.64
1:A:90:LEU:C	1:A:92:TYR:H	2.01	0.63
1:A:88:ILE:O	1:A:92:TYR:HD1	1.81	0.63
1:A:85:PHE:O	1:A:88:ILE:HG12	1.97	0.63
1:A:28:PHE:HE2	1:A:74:ALA:O	1.81	0.62
1:A:65:ASP:O	1:A:69:GLU:N	2.22	0.62
1:A:120:TYR:O	1:A:123:PRO:HD2	1.99	0.62
1:A:105:HIS:O	1:A:109:PHE:HB2	1.99	0.62
1:A:81:ASN:OD1	1:A:116:HIS:NE2	2.33	0.62
1:A:81:ASN:O	1:A:113:ARG:NE	2.32	0.62
1:A:73:ARG:O	2:A:218:GSH:SG2	2.58	0.61
1:A:143:MET:O	1:A:147:LEU:HD12	2.00	0.61
1:A:119:ALA:O	1:A:123:PRO:HD3	1.99	0.61
1:A:88:ILE:HD12	1:A:140:THR:HG22	1.79	0.60
1:A:65:ASP:O	1:A:69:GLU:HB2	2.02	0.60
1:A:80:GLU:C	1:A:82:ILE:H	2.05	0.60
1:A:136:GLY:O	1:A:140:THR:CG2	2.50	0.59
1:A:23:LEU:O	1:A:27:MET:N	2.31	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:66:GLU:HA	1:A:69:GLU:HB2	1.85	0.59
1:A:21:ILE:HD13	1:A:86:LEU:HD22	1.84	0.59
1:A:25:LYS:O	1:A:28:PHE:HB3	2.04	0.58
1:A:82:ILE:HG23	1:A:86:LEU:CB	2.33	0.57
1:A:26:MET:HA	1:A:29:LEU:CG	2.35	0.57
1:A:25:LYS:HE3	1:A:29:LEU:CD2	2.34	0.57
1:A:90:LEU:C	1:A:92:TYR:N	2.56	0.57
1:A:15:PHE:HD1	1:A:18:TYR:CE2	2.19	0.57
1:A:85:PHE:HA	1:A:88:ILE:CD1	2.35	0.57
1:A:15:PHE:CA	1:A:18:TYR:CE2	2.70	0.56
1:A:20:THR:O	1:A:24:ALA:HB3	2.05	0.56
1:A:78:ASP:OD1	1:A:78:ASP:N	2.36	0.56
1:A:98:ASP:O	1:A:99:LEU:CG	2.53	0.56
1:A:116:HIS:ND1	1:A:116:HIS:C	2.60	0.55
1:A:103:LEU:O	1:A:107:ARG:HB2	2.06	0.55
1:A:15:PHE:O	1:A:16:THR:C	2.45	0.55
1:A:25:LYS:HD3	1:A:79:LEU:HA	1.90	0.54
1:A:80:GLU:C	1:A:82:ILE:N	2.58	0.54
1:A:13:MET:CE	1:A:102:ALA:HB1	2.37	0.54
1:A:28:PHE:CZ	1:A:74:ALA:CB	2.70	0.54
1:A:77:ASN:ND2	1:A:120:TYR:CD2	2.76	0.54
1:A:82:ILE:HG23	1:A:86:LEU:HB3	1.90	0.53
1:A:20:THR:O	1:A:24:ALA:CB	2.57	0.53
1:A:23:LEU:O	1:A:27:MET:HG2	2.09	0.53
1:A:65:ASP:N	1:A:65:ASP:OD1	2.42	0.53
1:A:70:ARG:NH2	1:A:121:LEU:O	2.42	0.52
1:A:120:TYR:HD1	1:A:128:ASN:CB	2.11	0.52
1:A:14:ALA:O	1:A:17:SER:HB3	2.09	0.52
1:A:88:ILE:CB	1:A:92:TYR:HE1	2.18	0.52
1:A:122:THR:OG1	1:A:123:PRO:HD3	2.09	0.52
1:A:138:GLY:C	1:A:140:THR:H	2.13	0.52
1:A:23:LEU:O	1:A:24:ALA:C	2.48	0.52
1:A:124:LEU:N	1:A:125:PRO:HD3	2.18	0.52
1:A:26:MET:C	1:A:28:PHE:N	2.61	0.51
1:A:138:GLY:C	1:A:140:THR:N	2.64	0.51
1:A:101:THR:OG1	1:A:146:ARG:NH1	2.44	0.51
1:A:139:VAL:O	1:A:143:MET:HG2	2.12	0.50
1:A:116:HIS:NE2	1:A:132:ALA:HB2	2.26	0.49
1:A:25:LYS:HA	1:A:78:ASP:HB2	1.94	0.49
1:A:63:ARG:O	1:A:64:THR:C	2.50	0.49
1:A:20:THR:O	1:A:24:ALA:N	2.45	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:135:VAL:CG2	1:A:136:GLY:N	2.61	0.48
1:A:21:ILE:O	1:A:25:LYS:HB3	2.13	0.48
1:A:9:ASN:N	1:A:99:LEU:HD22	2.27	0.48
1:A:78:ASP:CG	1:A:79:LEU:H	2.16	0.48
1:A:73:ARG:HA	2:A:218:GSH:HB23	1.95	0.47
1:A:13:MET:O	1:A:14:ALA:C	2.51	0.47
1:A:78:ASP:OD1	1:A:79:LEU:N	2.38	0.47
1:A:78:ASP:CG	1:A:79:LEU:N	2.68	0.47
1:A:105:HIS:O	1:A:109:PHE:HB3	2.13	0.47
1:A:109:PHE:CG	1:A:110:VAL:N	2.83	0.47
1:A:22:ILE:HG22	1:A:26:MET:SD	2.56	0.46
1:A:22:ILE:H	1:A:22:ILE:HD12	1.80	0.46
1:A:81:ASN:HA	1:A:113:ARG:NH2	2.31	0.46
1:A:82:ILE:HG23	1:A:86:LEU:HB2	1.97	0.46
1:A:73:ARG:HD3	2:A:218:GSH:N2	2.31	0.46
1:A:80:GLU:O	1:A:84:PRO:HD2	2.16	0.46
1:A:103:LEU:O	1:A:107:ARG:CB	2.64	0.45
1:A:78:ASP:O	1:A:82:ILE:HD13	2.16	0.45
1:A:101:THR:HA	1:A:104:ILE:HD12	1.98	0.45
1:A:73:ARG:NH2	2:A:218:GSH:HB12	2.30	0.45
1:A:83:VAL:HB	1:A:84:PRO:CD	2.47	0.45
1:A:76:LEU:O	1:A:79:LEU:HB3	2.16	0.45
1:A:109:PHE:O	1:A:110:VAL:C	2.54	0.45
1:A:30:SER:O	1:A:33:THR:HG22	2.17	0.45
1:A:88:ILE:HA	1:A:91:LEU:HB2	1.99	0.44
1:A:13:MET:HG3	1:A:14:ALA:N	2.32	0.44
1:A:25:LYS:CE	1:A:79:LEU:HD13	2.40	0.44
1:A:106:PHE:HA	1:A:109:PHE:CB	2.27	0.44
1:A:25:LYS:HD2	1:A:78:ASP:OD2	2.17	0.44
1:A:128:ASN:O	1:A:129:ARG:C	2.55	0.44
1:A:98:ASP:O	1:A:99:LEU:HD23	2.18	0.44
1:A:21:ILE:HD13	1:A:86:LEU:CD2	2.48	0.44
1:A:79:LEU:O	1:A:82:ILE:HB	2.18	0.44
1:A:88:ILE:HG12	1:A:89:GLY:N	2.33	0.44
1:A:126:GLN:N	1:A:127:PRO:HD3	2.33	0.43
1:A:145:TYR:O	1:A:147:LEU:N	2.51	0.43
1:A:25:LYS:HG3	1:A:29:LEU:HD21	2.00	0.43
1:A:88:ILE:CD1	1:A:140:THR:HG22	2.47	0.43
1:A:88:ILE:CD1	1:A:140:THR:CG2	2.83	0.43
1:A:94:LEU:HA	1:A:94:LEU:HD23	1.55	0.42
1:A:123:PRO:HB2	1:A:125:PRO:HD2	2.01	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:9:ASN:C	1:A:11:VAL:N	2.72	0.42
1:A:92:TYR:CD2	1:A:143:MET:O	2.72	0.42
1:A:96:GLY:O	1:A:97:PRO:O	2.37	0.42
1:A:37:ARG:HD2	1:A:64:THR:HG22	2.02	0.42
1:A:109:PHE:HD2	1:A:110:VAL:H	1.58	0.42
1:A:101:THR:HG1	1:A:146:ARG:HH12	1.66	0.42
1:A:70:ARG:O	1:A:74:ALA:CB	2.68	0.42
1:A:136:GLY:O	1:A:140:THR:HG23	2.20	0.42
1:A:18:TYR:O	1:A:21:ILE:N	2.48	0.41
1:A:139:VAL:HA	1:A:142:SER:HG	1.85	0.41
1:A:75:HIS:O	1:A:75:HIS:CG	2.74	0.41
1:A:115:TYR:O	1:A:119:ALA:N	2.52	0.41
1:A:124:LEU:HD11	2:A:218:GSH:SG2	2.61	0.41
1:A:104:ILE:O	1:A:107:ARG:N	2.53	0.41
1:A:14:ALA:O	1:A:18:TYR:HD2	2.04	0.41
1:A:29:LEU:O	1:A:32:ALA:HB3	2.21	0.41
1:A:34:ALA:C	1:A:36:GLN:N	2.74	0.40
1:A:136:GLY:O	1:A:140:THR:HG21	2.20	0.40
1:A:123:PRO:O	1:A:124:LEU:HD12	2.21	0.40
1:A:13:MET:C	1:A:15:PHE:N	2.74	0.40
1:A:70:ARG:NH1	1:A:124:LEU:CD1	2.75	0.40
1:A:70:ARG:O	1:A:74:ALA:N	2.54	0.40
1:A:112:ALA:O	1:A:114:ILE:N	2.55	0.40

There are no symmetry-related clashes.

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 PDB entries followed by that with respect to all EM entries.

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	117/154 (76%)	60 (51%)	32 (27%)	25 (21%)	0 0

All (25) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	11	VAL
1	A	34	ALA
1	A	64	THR
1	A	79	LEU
1	A	91	LEU
1	A	97	PRO
1	A	98	ASP
1	A	124	LEU
1	A	125	PRO
1	A	139	VAL
1	A	17	SER
1	A	36	GLN
1	A	81	ASN
1	A	99	LEU
1	A	109	PHE
1	A	113	ARG
1	A	114	ILE
1	A	143	MET
1	A	63	ARG
1	A	84	PRO
1	A	112	ALA
1	A	123	PRO
1	A	24	ALA
1	A	27	MET
1	A	104	ILE

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 PDB entries followed by that with respect to all EM entries.

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	103/129 (80%)	77 (75%)	26 (25%)	0 2

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	11	VAL
1	A	12	LEU

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Mol	Chain	Res	Type
1	A	22	ILE
1	A	29	LEU
1	A	40	ASN
1	A	41	LYS
1	A	62	LEU
1	A	63	ARG
1	A	65	ASP
1	A	70	ARG
1	A	76	LEU
1	A	83	VAL
1	A	88	ILE
1	A	94	LEU
1	A	101	THR
1	A	106	PHE
1	A	109	PHE
1	A	110	VAL
1	A	115	TYR
1	A	116	HIS
1	A	117	THR
1	A	122	THR
1	A	126	GLN
1	A	133	PHE
1	A	141	LEU
1	A	145	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	77	ASN
1	A	128	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](#)

1 ligand is 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	GSH	A	218	-	18,19,19	3.37	2 (11%)	21,24,24	1.36	3 (14%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	GSH	A	218	-	1/1/6/8	8/24/24/24	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	218	GSH	OE1-CD1	9.99	1.43	1.23
2	A	218	GSH	O2-C2	9.54	1.41	1.23

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	218	GSH	O12-C1-O11	-2.77	117.80	124.08
2	A	218	GSH	CB2-CA2-C2	-2.59	103.88	109.50
2	A	218	GSH	CG1-CB1-CA1	2.08	118.64	113.86

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
2	A	218	GSH	CA1

All (8) torsion outliers are listed below:

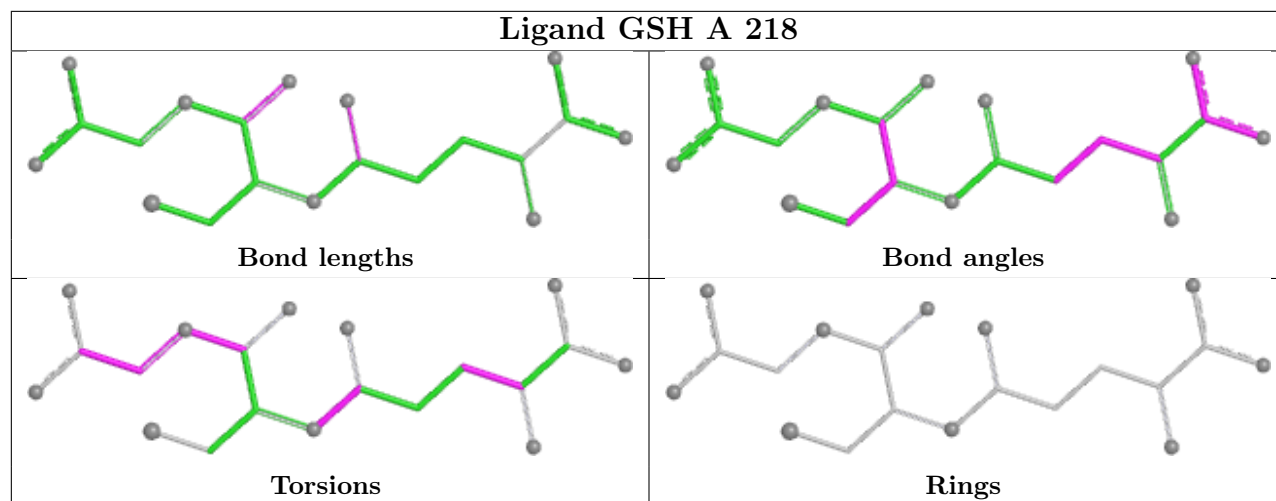
Mol	Chain	Res	Type	Atoms
2	A	218	GSH	N1-CA1-CB1-CG1
2	A	218	GSH	CG1-CD1-N2-CA2
2	A	218	GSH	OE1-CD1-N2-CA2
2	A	218	GSH	C1-CA1-CB1-CG1
2	A	218	GSH	O32-C3-CA3-N3
2	A	218	GSH	O31-C3-CA3-N3
2	A	218	GSH	C3-CA3-N3-C2
2	A	218	GSH	O2-C2-N3-CA3

There are no ring outliers.

1 monomer is involved in 11 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	218	GSH	11	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



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.