



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 08:52 AM UTC

PDB ID : 7M8H / pdb_00007m8h
Title : Structure of Memo1 C244S metal binding site mutant at 1.75Å
Authors : Boniecki, M.T.; Uhlemann, E.E.; Dmitriev, O.Y.
Deposited on : 2021-03-29
Resolution : 1.75 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 ⓘ 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 : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

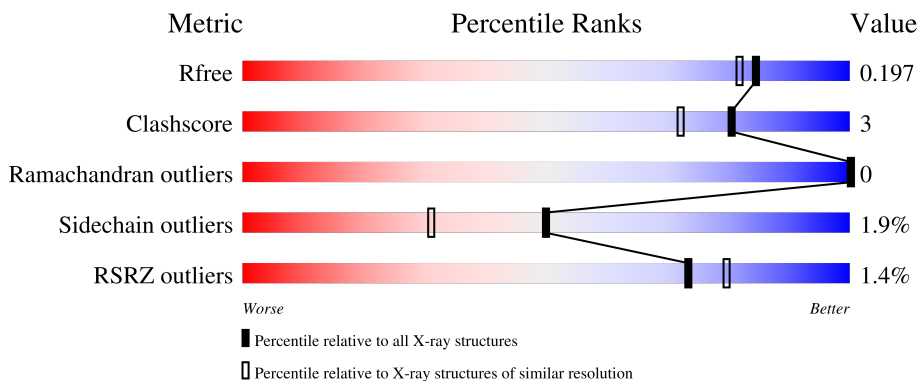
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.75 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))
R_{free}	180053	3183 (1.76-1.76)
Clashscore	190562	3299 (1.76-1.76)
Ramachandran outliers	187476	3274 (1.76-1.76)
Sidechain outliers	187428	3274 (1.76-1.76)
RSRZ outliers	180081	3183 (1.76-1.76)

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 $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	294	<div style="display: flex; align-items: center;"> <div style="width: 2%; height: 10px; background-color: red; margin-right: 2px;"></div> <div style="width: 94%; height: 10px; background-color: green; margin-right: 2px;"></div> <div style="width: 6%; height: 10px; background-color: yellow; margin-right: 2px;"></div> </div> <p style="text-align: center;">94% 6%</p>
1	B	294	<div style="display: flex; align-items: center;"> <div style="width: 2%; height: 10px; background-color: red; margin-right: 2px;"></div> <div style="width: 96%; height: 10px; background-color: green; margin-right: 2px;"></div> <div style="width: 2%; height: 10px; background-color: yellow; margin-right: 2px;"></div> </div> <p style="text-align: center;">96% .</p>
1	C	294	<div style="display: flex; align-items: center;"> <div style="width: 2%; height: 10px; background-color: red; margin-right: 2px;"></div> <div style="width: 93%; height: 10px; background-color: green; margin-right: 2px;"></div> <div style="width: 7%; height: 10px; background-color: yellow; margin-right: 2px;"></div> </div> <p style="text-align: center;">93% 7%</p>
1	D	294	<div style="display: flex; align-items: center;"> <div style="width: 2%; height: 10px; background-color: red; margin-right: 2px;"></div> <div style="width: 96%; height: 10px; background-color: green; margin-right: 2px;"></div> <div style="width: 2%; height: 10px; background-color: yellow; margin-right: 2px;"></div> </div> <p style="text-align: center;">96% .</p>

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
3	EDO	B	310	-	-	X	-
3	EDO	C	503	-	-	X	-

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 11239 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.

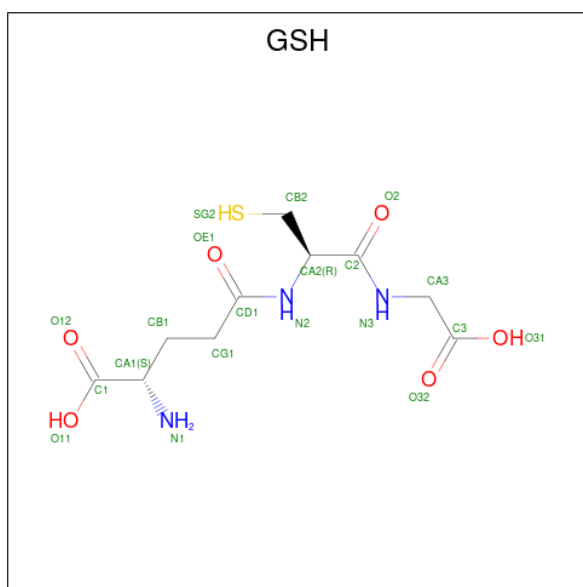
- Molecule 1 is a protein called Protein MEMO1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	294	2412	1529	413	455	15	0	15	0
1	B	294	2385	1513	408	449	15	0	10	0
1	C	294	2389	1515	408	451	15	0	11	0
1	D	294	2362	1498	401	448	15	0	8	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	244	SER	CYS	engineered mutation	UNP Q9Y316
B	244	SER	CYS	engineered mutation	UNP Q9Y316
C	244	SER	CYS	engineered mutation	UNP Q9Y316
D	244	SER	CYS	engineered mutation	UNP Q9Y316

- Molecule 2 is GLUTATHIONE (CCD ID: GSH) (formula: C₁₀H₁₇N₃O₆S) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
2	A	1	40	20	6	12	2	0	1
2	B	1	20	10	3	6	1	0	1
2	C	1	20	10	3	6	1	0	0
2	D	1	40	20	6	12	2	0	1

- Molecule 3 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: C₂H₆O₂).



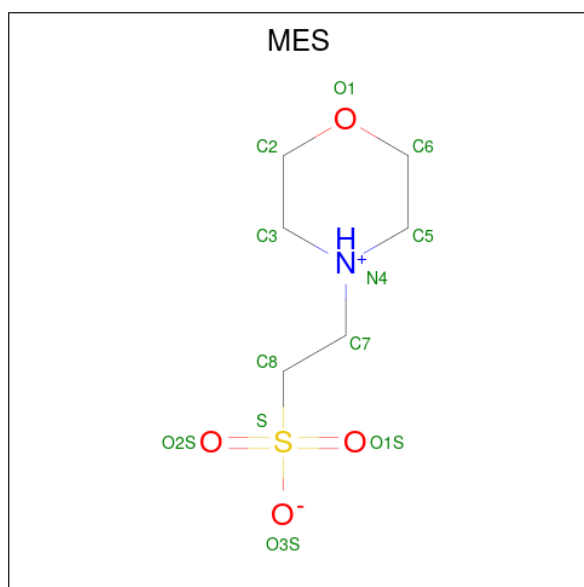
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 4 2 2	0	0
3	A	1	Total C O 4 2 2	0	0
3	A	1	Total C O 4 2 2	0	0
3	A	1	Total C O 4 2 2	0	0
3	A	1	Total C O 4 2 2	0	0
3	A	1	Total C O 4 2 2	0	0
3	A	1	Total C O 4 2 2	0	0
3	B	1	Total C O 4 2 2	0	0
3	B	1	Total C O 4 2 2	0	0
3	B	1	Total C O 4 2 2	0	0
3	B	1	Total C O 4 2 2	0	0
3	B	1	Total C O 4 2 2	0	0
3	B	1	Total C O 4 2 2	0	0
3	B	1	Total C O 4 2 2	0	0
3	B	1	Total C O 4 2 2	0	0
3	B	1	Total C O 4 2 2	0	0
3	B	1	Total C O 4 2 2	0	0
3	C	1	Total C O 4 2 2	0	0
3	C	1	Total C O 4 2 2	0	0
3	C	1	Total C O 4 2 2	0	0
3	C	1	Total C O 4 2 2	0	0
3	C	1	Total C O 4 2 2	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	C	1	Total	C	O	0	0
			4	2	2		
3	C	1	Total	C	O	0	0
			4	2	2		
3	C	1	Total	C	O	0	0
			4	2	2		
3	C	1	Total	C	O	0	0
			4	2	2		
3	D	1	Total	C	O	0	0
			4	2	2		
3	D	1	Total	C	O	0	0
			4	2	2		
3	D	1	Total	C	O	0	0
			4	2	2		
3	D	1	Total	C	O	0	0
			4	2	2		

- Molecule 4 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (CCD ID: MES) (formula: $C_6H_{13}NO_4S$).



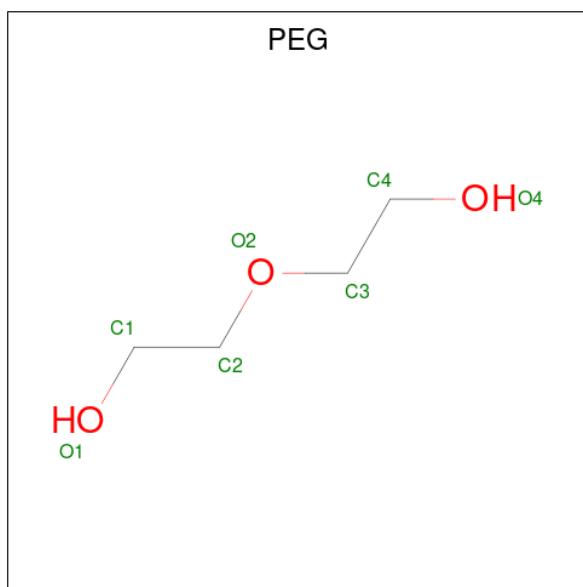
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	S	0	0
			12	6	1	4	1		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	D	1	Total	C	N	O	S	0	0
			12	6	1	4	1		
4	D	1	Total	C	N	O	S	0	0
			12	6	1	4	1		

- Molecule 5 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: C₄H₁₀O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			7	4	3		
5	C	1	Total	C	O	0	0
			7	4	3		
5	D	1	Total	C	O	0	0
			7	4	3		

- Molecule 6 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	B	1	Total C O 6 3 3	0	0
6	C	1	Total C O 6 3 3	0	0
6	D	1	Total C O 6 3 3	0	0

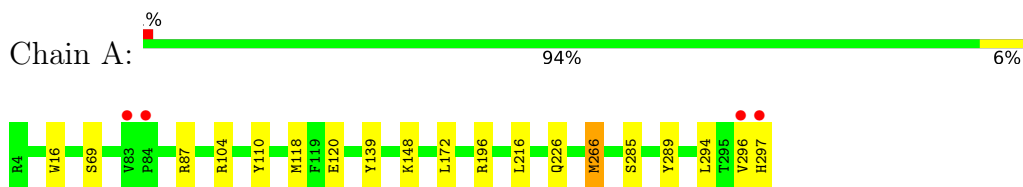
- Molecule 7 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	365	Total O 365 365	0	0
7	B	327	Total O 327 327	0	0
7	C	337	Total O 337 337	0	0
7	D	339	Total O 339 339	0	0

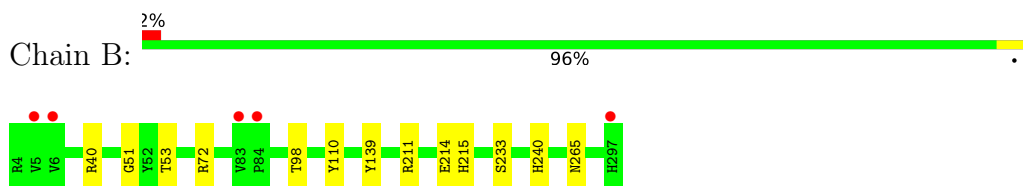
3 Residue-property plots [i](#)

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 and electron density. 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. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). 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.

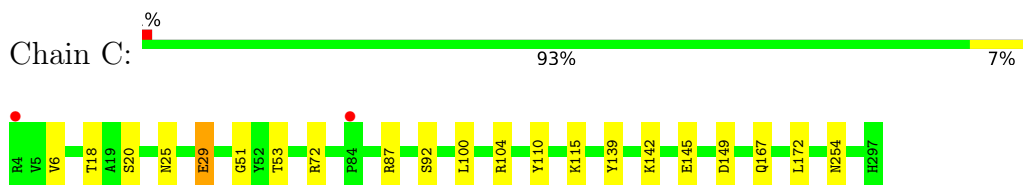
- Molecule 1: Protein MEMO1



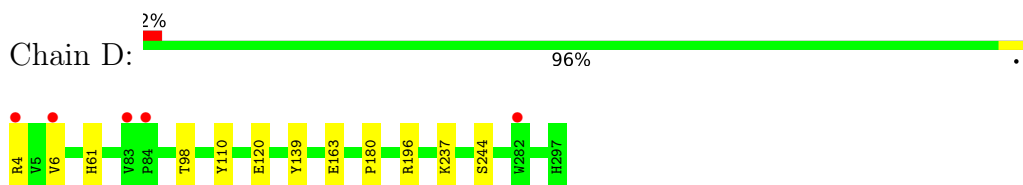
- Molecule 1: Protein MEMO1



- Molecule 1: Protein MEMO1



- Molecule 1: Protein MEMO1



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	140.00Å 89.52Å 97.54Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	42.63 – 1.75 42.63 – 1.75	Depositor EDS
% Data completeness (in resolution range)	99.9 (42.63-1.75) 94.8 (42.63-1.75)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.14 (at 1.75Å)	Xtrriage
Refinement program	PHENIX 1.19.1_4122	Depositor
R, R_{free}	0.154 , 0.187 0.169 , 0.197	Depositor DCC
R_{free} test set	6187 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å ²)	17.1	Xtrriage
Anisotropy	0.334	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 46.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	11239	wwPDB-VP
Average B, all atoms (Å ²)	22.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 40.15 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 2.8547e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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, PEG, MES, EDO, GOL

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	0.36	0/2519	0.53	0/3406
1	B	0.31	0/2477	0.50	0/3355
1	C	0.33	0/2484	0.51	0/3362
1	D	0.31	0/2448	0.50	0/3316
All	All	0.33	0/9928	0.51	0/13439

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	2412	0	2366	15	0
1	B	2385	0	2311	11	0
1	C	2389	0	2316	19	0
1	D	2362	0	2270	6	0
2	A	40	0	30	2	0
2	B	20	0	15	1	0
2	C	20	0	15	1	0
2	D	40	0	30	1	0
3	A	28	0	42	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	40	0	60	7	0
3	C	36	0	54	7	0
3	D	24	0	36	1	0
4	A	12	0	12	0	0
4	D	24	0	24	0	0
5	A	7	0	10	0	0
5	C	7	0	10	0	0
5	D	7	0	10	0	0
6	B	6	0	8	1	0
6	C	6	0	8	3	0
6	D	6	0	8	0	0
7	A	365	0	0	4	0
7	B	327	0	0	0	0
7	C	337	0	0	3	0
7	D	339	0	0	4	0
All	All	11239	0	9635	50	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 3.

All (50) 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:C:53:THR:HB	3:C:503:EDO:H11	1.69	0.75
1:C:167:GLN:HE21	6:C:501:GOL:H32	1.52	0.73
1:A:226:GLN:HA	1:D:180:PRO:HG3	1.72	0.72
1:A:285:SER:H	3:A:307:EDO:H12	1.56	0.69
1:B:53:THR:HB	3:B:310:EDO:H22	1.76	0.68
1:C:51:GLY:HA3	3:C:503:EDO:H12	1.80	0.64
1:C:254:ASN:HD21	6:C:501:GOL:H31	1.65	0.62
1:A:266:MET:HG3	1:A:296:VAL:HG22	1.82	0.61
1:B:240:HIS:HD2	3:B:308:EDO:H12	1.66	0.61
1:C:18[A]:THR:HG22	1:C:20:SER:H	1.66	0.59
1:A:118[A]:MET:SD	1:A:172:LEU:HD12	2.44	0.58
1:D:196:ARG:NH2	7:D:404:HOH:O	2.34	0.58
1:A:69[A]:SER:OG	1:B:40[A]:ARG:NH1	2.37	0.57
1:C:25:ASN:HD22	1:C:100:LEU:HD22	1.71	0.56
1:C:53:THR:CB	3:C:503:EDO:H11	2.36	0.55
1:C:92[A]:SER:HB2	3:C:510:EDO:H21	1.90	0.54
1:B:51:GLY:HA3	3:B:310:EDO:H21	1.91	0.53
1:B:215:HIS:HB2	3:B:304:EDO:H22	1.91	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:240:HIS:CD2	3:B:308:EDO:H12	2.43	0.53
2:B:301[A]:GSH:HN12	3:B:310:EDO:H12	1.75	0.52
1:C:167:GLN:NE2	6:C:501:GOL:H32	2.24	0.51
1:A:266:MET:CG	1:A:296:VAL:HG22	2.40	0.51
1:C:104[B]:ARG:NE	7:C:611:HOH:O	2.44	0.51
2:D:301[A]:GSH:SG2	7:D:406:HOH:O	2.43	0.50
1:B:233:SER:HB2	6:B:303:GOL:H32	1.93	0.50
1:C:29[A]:GLU:HG3	1:C:142:LYS:CE	2.43	0.48
1:C:149:ASP:OD2	7:C:601:HOH:O	2.20	0.48
1:B:211:ARG:NH1	1:B:214:GLU:OE1	2.46	0.48
1:D:61:HIS:HD2	7:D:694:HOH:O	1.96	0.47
1:C:29[A]:GLU:OE2	7:C:602:HOH:O	2.21	0.47
1:A:266:MET:HG2	1:A:294:LEU:HD11	1.95	0.46
1:C:6:VAL:H	3:C:507:EDO:H12	1.80	0.46
1:C:92[B]:SER:HB3	3:C:510:EDO:H21	1.97	0.46
1:B:265:ASN:HB2	1:C:72[A]:ARG:CZ	2.46	0.46
1:A:16:TRP:CE2	2:A:301[A]:GSH:HA1	2.51	0.46
1:C:142:LYS:NZ	1:C:145:GLU:OE2	2.49	0.46
1:A:196:ARG:NH2	7:A:412:HOH:O	2.49	0.45
1:D:196:ARG:NH1	7:D:412:HOH:O	2.47	0.45
1:D:244:SER:HA	3:D:305:EDO:H11	1.99	0.45
1:C:29[A]:GLU:OE2	1:C:142:LYS:NZ	2.44	0.44
3:C:503:EDO:HO2	2:C:511:GSH:HN12	1.61	0.44
1:A:87:ARG:NH2	1:A:120[B]:GLU:HG2	2.32	0.44
1:A:297:HIS:C	1:B:72:ARG:HE	2.26	0.42
1:A:148:LYS:HE2	7:A:567:HOH:O	2.20	0.42
1:B:53:THR:CB	3:B:310:EDO:H22	2.49	0.42
1:C:29[A]:GLU:HG3	1:C:142:LYS:HE2	2.02	0.41
1:D:163:GLU:OE2	1:D:237:LYS:NZ	2.48	0.41
1:A:289:TYR:OH	2:A:301[B]:GSH:O2	2.34	0.41
1:A:104[A]:ARG:HD3	7:A:585:HOH:O	2.19	0.41
1:A:297:HIS:HB3	7:A:518:HOH:O	2.21	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 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	307/294 (104%)	302 (98%)	5 (2%)	0	100	100
1	B	302/294 (103%)	297 (98%)	5 (2%)	0	100	100
1	C	303/294 (103%)	299 (99%)	4 (1%)	0	100	100
1	D	300/294 (102%)	295 (98%)	5 (2%)	0	100	100
All	All	1212/1176 (103%)	1193 (98%)	19 (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	271/256 (106%)	267 (98%)	4 (2%)	57	41
1	B	262/256 (102%)	259 (99%)	3 (1%)	65	52
1	C	263/256 (103%)	256 (97%)	7 (3%)	39	19
1	D	258/256 (101%)	252 (98%)	6 (2%)	44	24
All	All	1054/1024 (103%)	1034 (98%)	20 (2%)	50	31

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	110	TYR
1	A	139	TYR
1	A	216	LEU
1	A	266	MET
1	B	98	THR
1	B	110	TYR
1	B	139	TYR
1	C	29[A]	GLU

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Mol	Chain	Res	Type
1	C	29[B]	GLU
1	C	87	ARG
1	C	110	TYR
1	C	115	LYS
1	C	139	TYR
1	C	172	LEU
1	D	4	ARG
1	D	6	VAL
1	D	98	THR
1	D	110	TYR
1	D	120	GLU
1	D	139	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (17) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	265	ASN
1	A	278	GLN
1	B	23	GLN
1	B	147	HIS
1	B	240	HIS
1	B	260	GLN
1	B	262	ASN
1	B	265	ASN
1	B	278	GLN
1	C	167	GLN
1	C	195	GLN
1	C	226	GLN
1	C	260	GLN
1	D	61	HIS
1	D	107	GLN
1	D	262	ASN
1	D	265	ASN

5.3.3 RNA

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](#)

47 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
3	EDO	C	510	-	3,3,3	0.42	0	2,2,2	0.44	0
3	EDO	B	310	-	3,3,3	0.44	0	2,2,2	0.39	0
5	PEG	A	308	-	6,6,6	0.52	0	5,5,5	0.39	0
2	GSH	D	301[B]	-	18,19,19	2.09	4 (22%)	21,24,24	1.66	3 (14%)
3	EDO	C	509	-	3,3,3	0.44	0	2,2,2	0.74	0
6	GOL	D	309	-	5,5,5	1.07	0	5,5,5	1.09	0
3	EDO	B	305	-	3,3,3	0.41	0	2,2,2	0.54	0
4	MES	A	304	-	12,12,12	2.10	1 (8%)	15,16,16	2.27	5 (33%)
2	GSH	C	511	-	18,19,19	2.13	4 (22%)	21,24,24	1.75	2 (9%)
3	EDO	C	507	-	3,3,3	0.40	0	2,2,2	0.65	0
3	EDO	B	308	-	3,3,3	0.46	0	2,2,2	0.24	0
3	EDO	C	505	-	3,3,3	0.44	0	2,2,2	0.30	0
3	EDO	C	508	-	3,3,3	0.37	0	2,2,2	0.51	0
3	EDO	C	503	-	3,3,3	0.38	0	2,2,2	0.50	0
2	GSH	D	301[A]	-	18,19,19	2.13	3 (16%)	21,24,24	1.41	4 (19%)
3	EDO	D	308	-	3,3,3	0.47	0	2,2,2	0.27	0
2	GSH	A	301[B]	-	18,19,19	2.10	4 (22%)	21,24,24	1.42	3 (14%)
3	EDO	B	304	-	3,3,3	0.52	0	2,2,2	0.40	0
3	EDO	A	302	-	3,3,3	0.36	0	2,2,2	0.54	0
3	EDO	C	502	-	3,3,3	0.40	0	2,2,2	0.60	0
3	EDO	B	306	-	3,3,3	0.36	0	2,2,2	0.56	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	EDO	A	306	-	3,3,3	0.43	0	2,2,2	0.36	0
3	EDO	D	304	-	3,3,3	0.42	0	2,2,2	0.64	0
3	EDO	A	303	-	3,3,3	0.34	0	2,2,2	0.89	0
3	EDO	A	305	-	3,3,3	0.46	0	2,2,2	0.34	0
3	EDO	C	506	-	3,3,3	0.38	0	2,2,2	0.38	0
3	EDO	B	312	-	3,3,3	0.42	0	2,2,2	0.43	0
5	PEG	C	504	-	6,6,6	0.50	0	5,5,5	0.30	0
6	GOL	C	501	-	5,5,5	1.38	1 (20%)	5,5,5	1.02	0
4	MES	D	306	-	12,12,12	2.11	1 (8%)	15,16,16	2.12	5 (33%)
3	EDO	D	302	-	3,3,3	0.41	0	2,2,2	0.43	0
3	EDO	B	311	-	3,3,3	0.42	0	2,2,2	0.40	0
3	EDO	D	310	-	3,3,3	0.43	0	2,2,2	0.42	0
2	GSH	A	301[A]	-	18,19,19	2.12	4 (22%)	21,24,24	1.90	4 (19%)
3	EDO	C	512	-	3,3,3	0.43	0	2,2,2	0.42	0
3	EDO	B	302	-	3,3,3	0.26	0	2,2,2	0.54	0
6	GOL	B	303	-	5,5,5	1.09	0	5,5,5	1.56	1 (20%)
4	MES	D	307	-	12,12,12	2.17	1 (8%)	15,16,16	2.30	5 (33%)
3	EDO	A	310	-	3,3,3	0.43	0	2,2,2	0.36	0
2	GSH	B	301[A]	-	18,19,19	2.13	4 (22%)	21,24,24	1.86	4 (19%)
3	EDO	D	311	-	3,3,3	0.45	0	2,2,2	0.34	0
3	EDO	A	309	-	3,3,3	0.45	0	2,2,2	0.25	0
3	EDO	A	307	-	3,3,3	0.49	0	2,2,2	0.31	0
5	PEG	D	303	-	6,6,6	0.50	0	5,5,5	0.28	0
3	EDO	D	305	-	3,3,3	0.41	0	2,2,2	0.53	0
3	EDO	B	309	-	3,3,3	0.42	0	2,2,2	0.38	0
3	EDO	B	307	-	3,3,3	0.25	0	2,2,2	0.08	0

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
3	EDO	C	510	-	-	1/1/1/1	-
3	EDO	B	310	-	-	1/1/1/1	-
5	PEG	A	308	-	-	2/4/4/4	-
2	GSH	D	301[B]	-	-	1/24/24/24	-
3	EDO	C	509	-	-	1/1/1/1	-
6	GOL	D	309	-	-	0/4/4/4	-
3	EDO	B	305	-	-	0/1/1/1	-
4	MES	A	304	-	-	4/6/14/14	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	GSH	C	511	-	-	4/24/24/24	-
3	EDO	C	507	-	-	1/1/1/1	-
3	EDO	B	308	-	-	1/1/1/1	-
3	EDO	C	505	-	-	0/1/1/1	-
3	EDO	C	508	-	-	1/1/1/1	-
3	EDO	C	503	-	-	0/1/1/1	-
2	GSH	D	301[A]	-	-	0/24/24/24	-
3	EDO	D	308	-	-	1/1/1/1	-
2	GSH	A	301[B]	-	-	0/24/24/24	-
3	EDO	B	304	-	-	0/1/1/1	-
3	EDO	A	302	-	-	1/1/1/1	-
3	EDO	C	502	-	-	1/1/1/1	-
3	EDO	B	306	-	-	0/1/1/1	-
3	EDO	A	306	-	-	0/1/1/1	-
3	EDO	D	304	-	-	1/1/1/1	-
3	EDO	A	303	-	-	1/1/1/1	-
3	EDO	A	305	-	-	0/1/1/1	-
3	EDO	C	506	-	-	1/1/1/1	-
3	EDO	B	312	-	-	1/1/1/1	-
5	PEG	C	504	-	-	2/4/4/4	-
6	GOL	C	501	-	-	0/4/4/4	-
4	MES	D	306	-	-	4/6/14/14	0/1/1/1
3	EDO	D	302	-	-	0/1/1/1	-
3	EDO	B	311	-	-	0/1/1/1	-
3	EDO	D	310	-	-	1/1/1/1	-
2	GSH	A	301[A]	-	-	1/24/24/24	-
3	EDO	C	512	-	-	1/1/1/1	-
3	EDO	B	302	-	-	0/1/1/1	-
6	GOL	B	303	-	-	2/4/4/4	-
4	MES	D	307	-	-	5/6/14/14	0/1/1/1
3	EDO	A	310	-	-	1/1/1/1	-
2	GSH	B	301[A]	-	-	5/24/24/24	-
3	EDO	D	311	-	-	0/1/1/1	-
3	EDO	A	309	-	-	0/1/1/1	-
3	EDO	A	307	-	-	0/1/1/1	-
5	PEG	D	303	-	-	1/4/4/4	-
3	EDO	D	305	-	-	0/1/1/1	-
3	EDO	B	309	-	-	0/1/1/1	-
3	EDO	B	307	-	-	1/1/1/1	-

All (27) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	D	307	MES	C8-S	-7.20	1.67	1.77
4	A	304	MES	C8-S	-7.01	1.67	1.77
4	D	306	MES	C8-S	-7.00	1.67	1.77
2	C	511	GSH	CD1-N2	5.85	1.46	1.34
2	B	301[A]	GSH	CD1-N2	5.70	1.46	1.34
2	D	301[A]	GSH	CD1-N2	5.65	1.46	1.34
2	A	301[B]	GSH	CD1-N2	5.60	1.45	1.34
2	D	301[B]	GSH	CD1-N2	5.58	1.45	1.34
2	A	301[A]	GSH	CD1-N2	5.55	1.45	1.34
2	D	301[A]	GSH	C2-N3	5.34	1.46	1.33
2	B	301[A]	GSH	C2-N3	5.33	1.46	1.33
2	D	301[B]	GSH	C2-N3	5.28	1.46	1.33
2	A	301[B]	GSH	C2-N3	5.27	1.46	1.33
2	C	511	GSH	C2-N3	5.23	1.45	1.33
2	A	301[A]	GSH	C2-N3	5.19	1.45	1.33
2	A	301[A]	GSH	OE1-CD1	-2.44	1.18	1.23
2	B	301[A]	GSH	O2-C2	-2.42	1.18	1.23
6	C	501	GOL	C1-C2	2.35	1.60	1.51
2	A	301[A]	GSH	O2-C2	-2.31	1.19	1.23
2	D	301[A]	GSH	O2-C2	-2.31	1.19	1.23
2	B	301[A]	GSH	OE1-CD1	-2.24	1.18	1.23
2	D	301[B]	GSH	O2-C2	-2.23	1.19	1.23
2	C	511	GSH	OE1-CD1	-2.19	1.18	1.23
2	A	301[B]	GSH	OE1-CD1	-2.19	1.18	1.23
2	C	511	GSH	O2-C2	-2.15	1.19	1.23
2	A	301[B]	GSH	O2-C2	-2.09	1.19	1.23
2	D	301[B]	GSH	OE1-CD1	-2.02	1.19	1.23

All (36) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	511	GSH	CA2-CB2-SG2	-5.96	107.44	114.16
2	A	301[A]	GSH	CA2-CB2-SG2	-5.37	108.11	114.16
2	D	301[B]	GSH	CA2-CB2-SG2	-5.21	108.28	114.16
2	B	301[A]	GSH	CA2-CB2-SG2	-5.17	108.34	114.16
4	D	307	MES	C5-N4-C3	4.94	119.49	108.84
4	A	304	MES	C5-N4-C3	4.93	119.47	108.84
4	D	306	MES	C5-N4-C3	4.69	118.95	108.84
4	A	304	MES	O2S-S-C8	4.01	112.78	106.73
4	D	306	MES	O2S-S-C8	3.58	112.14	106.73
2	D	301[A]	GSH	CA2-CB2-SG2	-3.49	110.22	114.16
4	D	306	MES	C7-N4-C3	3.39	120.27	111.24
2	A	301[B]	GSH	CA2-CB2-SG2	-3.38	110.35	114.16

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	D	307	MES	C2-C3-N4	-3.23	105.22	110.12
4	A	304	MES	C7-N4-C5	3.19	119.75	111.24
2	B	301[A]	GSH	CA2-C2-N3	3.17	123.34	116.54
4	D	307	MES	C7-N4-C3	3.05	119.35	111.24
4	D	307	MES	C7-N4-C5	2.98	119.18	111.24
2	A	301[A]	GSH	CG1-CD1-N2	2.98	121.11	115.86
2	A	301[A]	GSH	CA2-C2-N3	2.96	122.90	116.54
6	B	303	GOL	C3-C2-C1	-2.89	101.18	111.80
4	D	307	MES	O1S-S-C8	2.88	111.08	106.73
4	A	304	MES	C2-C3-N4	-2.79	105.87	110.12
4	A	304	MES	C7-N4-C3	2.69	118.42	111.24
2	A	301[A]	GSH	OE1-CD1-N2	-2.50	118.73	122.95
4	D	306	MES	C6-C5-N4	-2.41	106.46	110.12
2	B	301[A]	GSH	CG1-CD1-N2	2.39	120.08	115.86
2	B	301[A]	GSH	O2-C2-N3	-2.37	117.96	122.98
2	D	301[A]	GSH	CA2-C2-N3	2.35	121.57	116.54
2	D	301[B]	GSH	CA2-C2-N3	2.33	121.54	116.54
4	D	306	MES	C7-N4-C5	2.24	117.21	111.24
2	C	511	GSH	CA2-C2-N3	2.16	121.18	116.54
2	A	301[B]	GSH	CA2-C2-N3	2.13	121.11	116.54
2	A	301[B]	GSH	CG1-CD1-N2	2.08	119.53	115.86
2	D	301[A]	GSH	O31-C3-CA3	2.03	120.55	112.81
2	D	301[A]	GSH	CG1-CD1-N2	2.02	119.42	115.86
2	D	301[B]	GSH	O31-C3-CA3	2.02	120.47	112.81

There are no chirality outliers.

All (48) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	511	GSH	C2-CA2-CB2-SG2
4	A	304	MES	C8-C7-N4-C5
4	A	304	MES	C7-C8-S-O3S
4	D	306	MES	C8-C7-N4-C3
4	D	307	MES	C8-C7-N4-C3
4	D	307	MES	C7-C8-S-O1S
4	D	307	MES	C7-C8-S-O3S
6	B	303	GOL	O1-C1-C2-C3
6	B	303	GOL	O1-C1-C2-O2
4	D	306	MES	C7-C8-S-O3S
2	B	301[A]	GSH	C2-CA2-CB2-SG2
3	A	310	EDO	O1-C1-C2-O2
3	B	308	EDO	O1-C1-C2-O2

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Mol	Chain	Res	Type	Atoms
3	C	506	EDO	O1-C1-C2-O2
3	D	308	EDO	O1-C1-C2-O2
5	A	308	PEG	O2-C3-C4-O4
3	A	302	EDO	O1-C1-C2-O2
3	B	307	EDO	O1-C1-C2-O2
3	D	310	EDO	O1-C1-C2-O2
4	D	307	MES	C8-C7-N4-C5
2	D	301[B]	GSH	C2-CA2-CB2-SG2
3	B	310	EDO	O1-C1-C2-O2
4	A	304	MES	C7-C8-S-O1S
4	A	304	MES	C7-C8-S-O2S
4	D	306	MES	C7-C8-S-O1S
4	D	306	MES	C7-C8-S-O2S
4	D	307	MES	C7-C8-S-O2S
2	B	301[A]	GSH	O11-C1-CA1-CB1
2	C	511	GSH	O11-C1-CA1-CB1
3	C	508	EDO	O1-C1-C2-O2
3	C	512	EDO	O1-C1-C2-O2
2	C	511	GSH	O12-C1-CA1-CB1
2	B	301[A]	GSH	O12-C1-CA1-CB1
3	B	312	EDO	O1-C1-C2-O2
3	C	507	EDO	O1-C1-C2-O2
5	C	504	PEG	C4-C3-O2-C2
3	C	502	EDO	O1-C1-C2-O2
5	A	308	PEG	O1-C1-C2-O2
3	A	303	EDO	O1-C1-C2-O2
3	C	510	EDO	O1-C1-C2-O2
5	D	303	PEG	O1-C1-C2-O2
2	A	301[A]	GSH	O32-C3-CA3-N3
5	C	504	PEG	O1-C1-C2-O2
3	C	509	EDO	O1-C1-C2-O2
3	D	304	EDO	O1-C1-C2-O2
2	C	511	GSH	O11-C1-CA1-N1
2	B	301[A]	GSH	O12-C1-CA1-N1
2	B	301[A]	GSH	O11-C1-CA1-N1

There are no ring outliers.

15 monomers are involved in 23 short contacts:

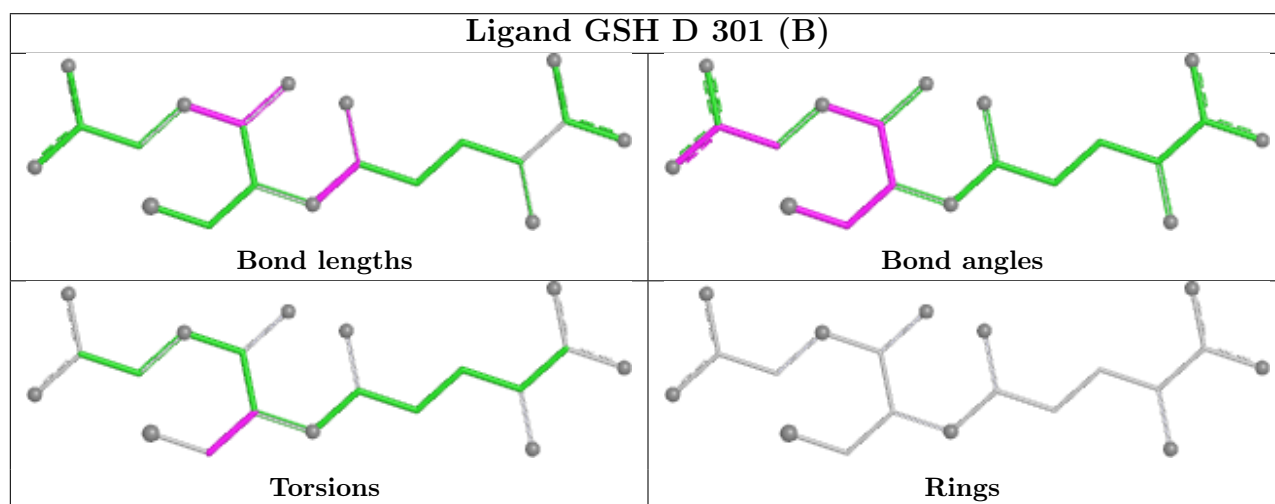
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	510	EDO	2	0
3	B	310	EDO	4	0

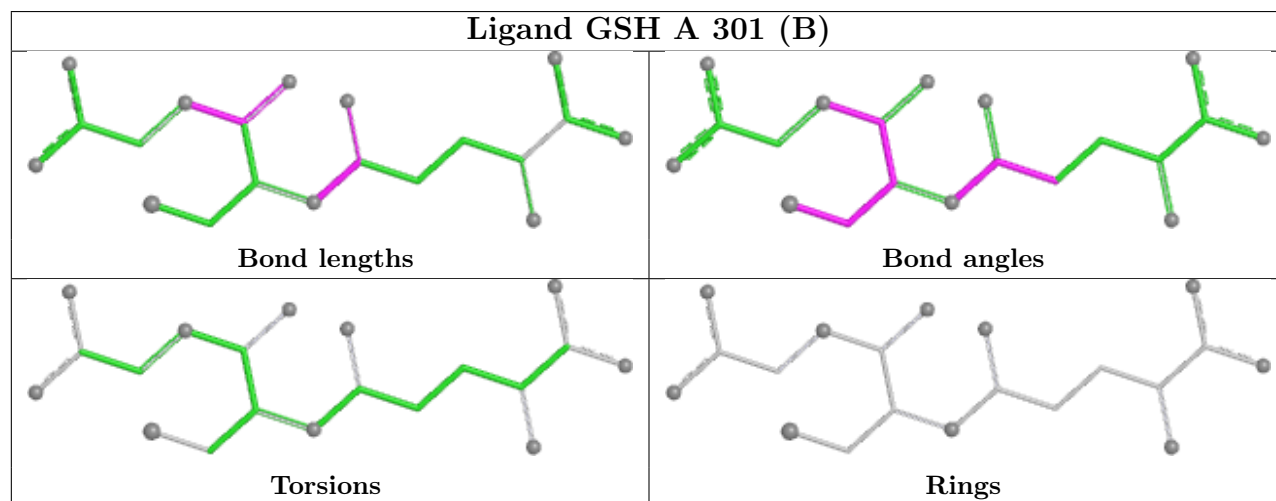
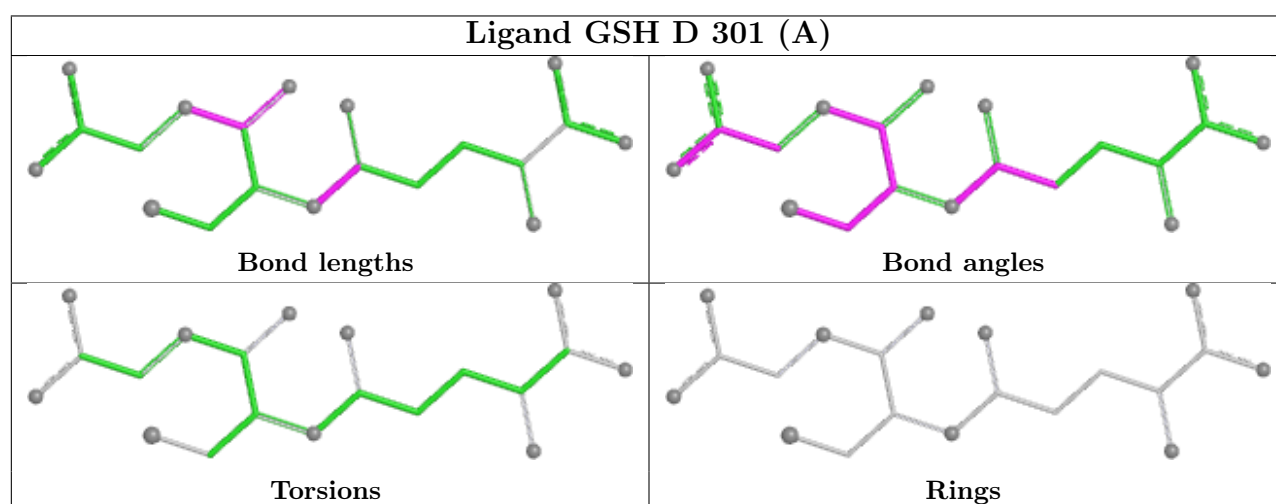
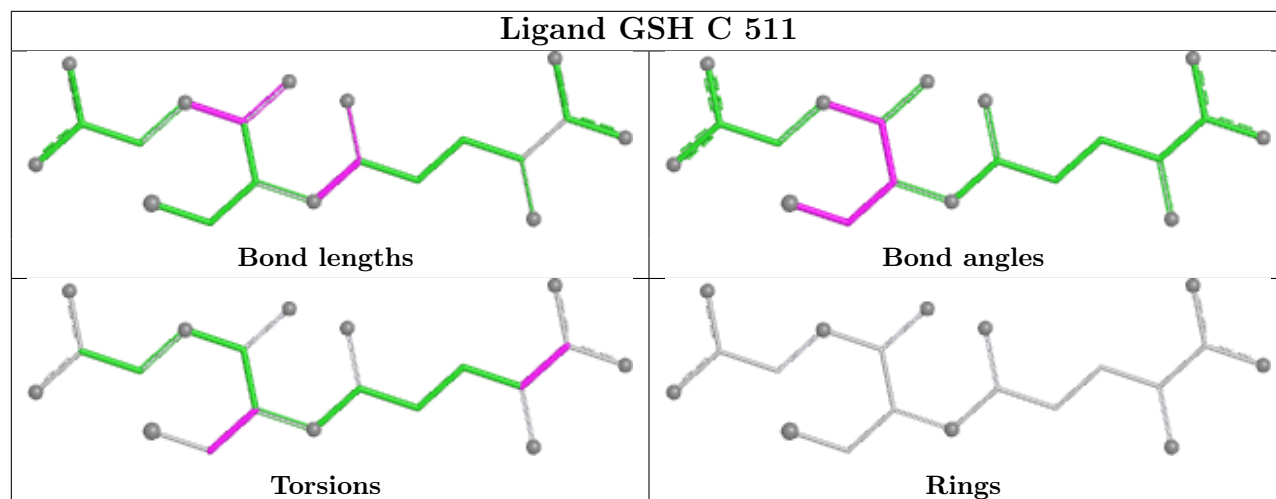
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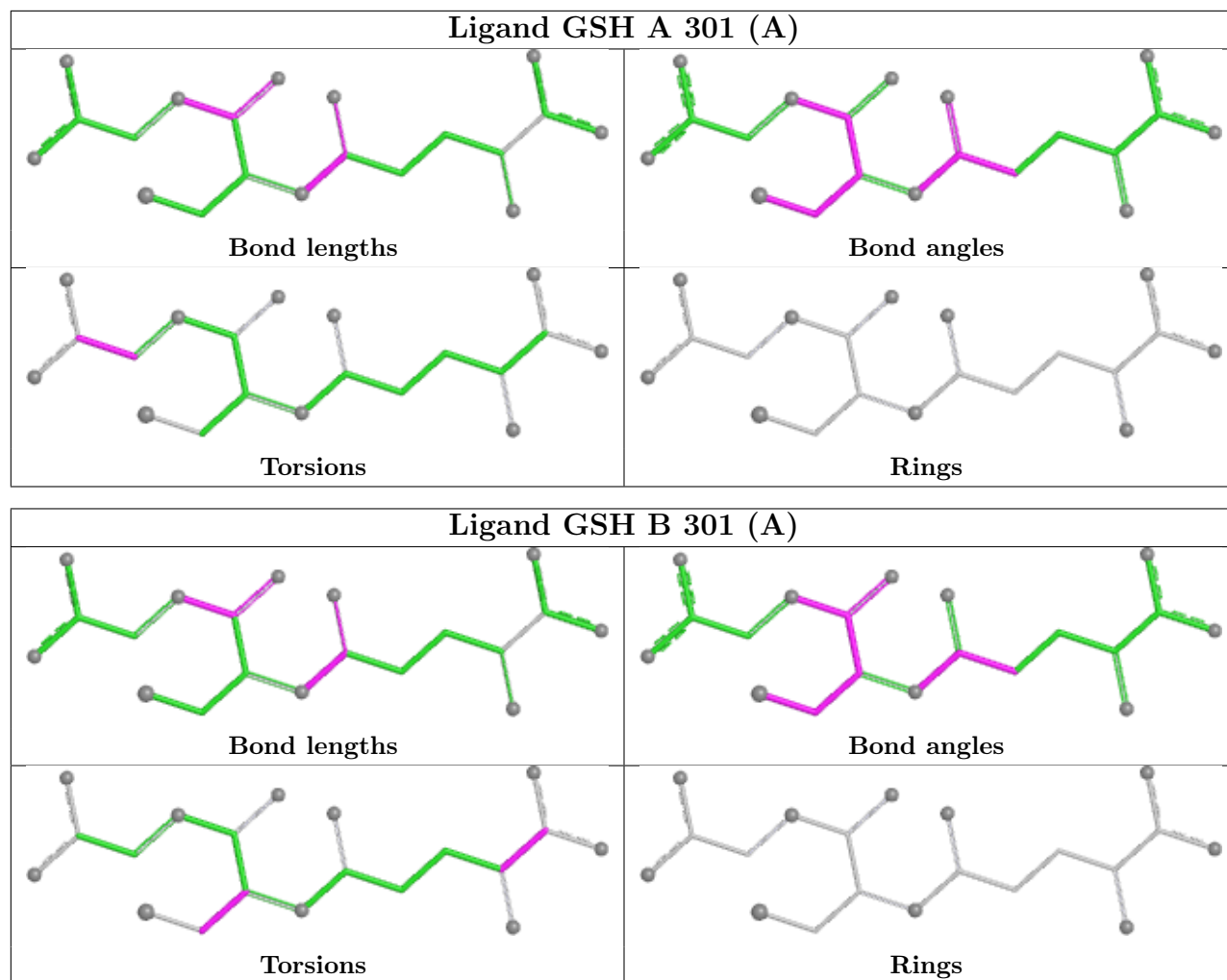
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Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	511	GSH	1	0
3	C	507	EDO	1	0
3	B	308	EDO	2	0
3	C	503	EDO	4	0
2	D	301[A]	GSH	1	0
2	A	301[B]	GSH	1	0
3	B	304	EDO	1	0
6	C	501	GOL	3	0
2	A	301[A]	GSH	1	0
6	B	303	GOL	1	0
2	B	301[A]	GSH	1	0
3	A	307	EDO	1	0
3	D	305	EDO	1	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.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	294/294 (100%)	-0.43	4 (1%) 73 80	10, 17, 33, 52	17 (5%)
1	B	294/294 (100%)	-0.33	5 (1%) 69 75	10, 19, 33, 59	14 (4%)
1	C	294/294 (100%)	-0.42	2 (0%) 84 88	11, 18, 28, 55	14 (4%)
1	D	294/294 (100%)	-0.30	5 (1%) 69 75	12, 20, 34, 67	12 (4%)
All	All	1176/1176 (100%)	-0.37	16 (1%) 73 80	10, 18, 33, 67	57 (4%)

All (16) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	84	PRO	6.8
1	D	84	PRO	6.3
1	C	84	PRO	5.0
1	B	84	PRO	4.9
1	A	83	VAL	3.4
1	B	297	HIS	3.1
1	D	282	TRP	2.7
1	A	296	VAL	2.6
1	D	6	VAL	2.6
1	D	83	VAL	2.5
1	B	6	VAL	2.5
1	D	4	ARG	2.4
1	C	4	ARG	2.3
1	A	297	HIS	2.2
1	B	83	VAL	2.1
1	B	5	VAL	2.0

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

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

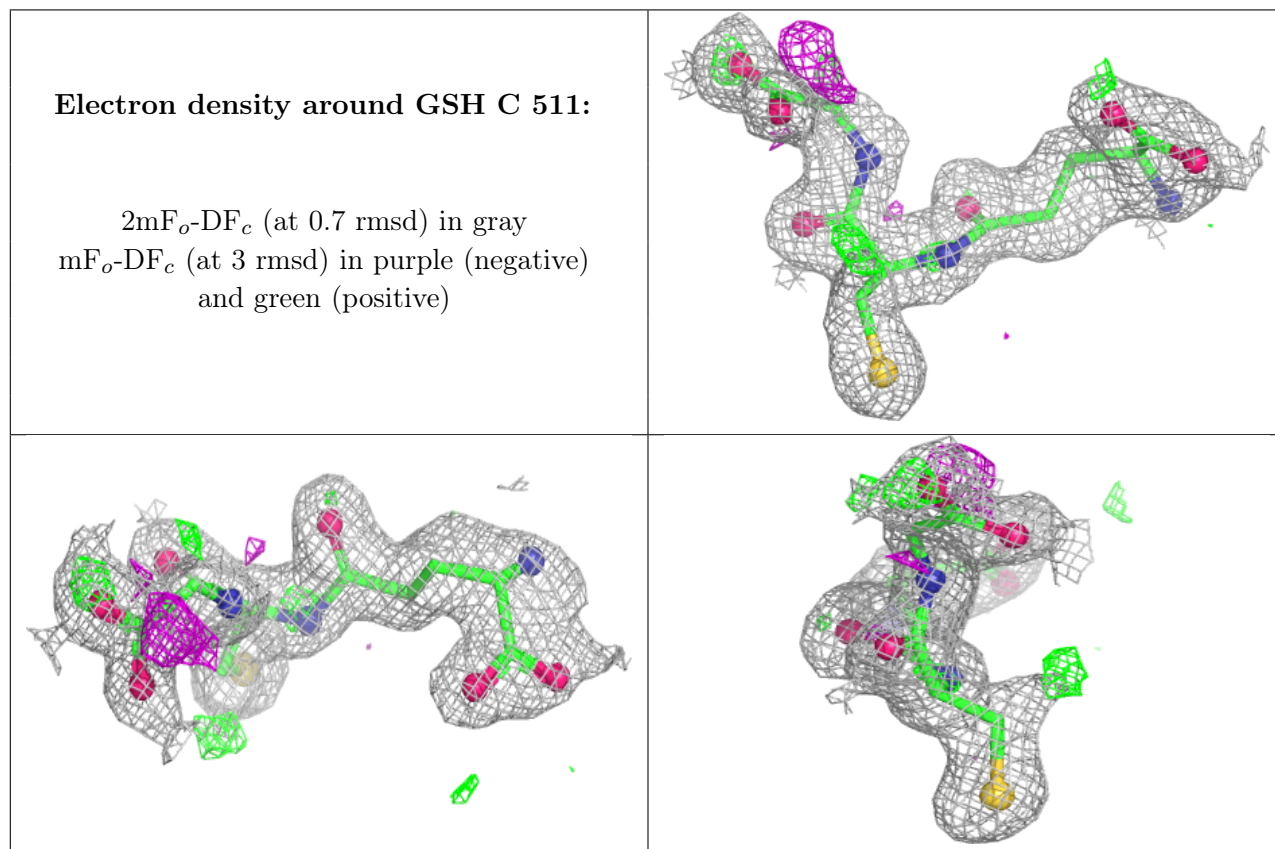
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	EDO	B	305	4/4	0.69	0.20	34,46,48,58	0
3	EDO	A	307	4/4	0.72	0.21	31,38,50,50	0
3	EDO	B	309	4/4	0.74	0.18	39,50,54,60	0
3	EDO	D	308	4/4	0.74	0.17	47,54,57,57	0
3	EDO	A	309	4/4	0.75	0.17	57,59,59,62	0
3	EDO	A	310	4/4	0.76	0.15	58,59,59,66	0
5	PEG	A	308	7/7	0.76	0.16	31,43,48,49	0
3	EDO	C	506	4/4	0.77	0.18	37,46,52,54	0
3	EDO	D	304	4/4	0.78	0.17	37,39,47,51	0
3	EDO	A	305	4/4	0.78	0.16	35,43,45,52	0
3	EDO	B	306	4/4	0.78	0.17	32,34,48,56	0
5	PEG	C	504	7/7	0.78	0.14	37,45,52,61	0
5	PEG	D	303	7/7	0.78	0.14	34,42,51,57	0
3	EDO	C	510	4/4	0.79	0.14	42,47,49,54	0
3	EDO	C	505	4/4	0.80	0.14	41,42,42,53	0
3	EDO	D	311	4/4	0.80	0.13	38,45,48,58	0
4	MES	D	307	12/12	0.80	0.18	29,47,52,53	12
3	EDO	D	310	4/4	0.81	0.12	41,45,45,54	0
3	EDO	C	502	4/4	0.81	0.16	31,43,47,50	0
3	EDO	B	311	4/4	0.81	0.15	38,49,52,53	0
3	EDO	C	507	4/4	0.82	0.16	34,34,51,52	0
3	EDO	D	305	4/4	0.82	0.18	35,44,48,56	0
3	EDO	B	304	4/4	0.82	0.17	26,33,46,50	0
3	EDO	B	308	4/4	0.83	0.16	36,42,43,54	0
2	GSH	C	511	20/20	0.83	0.16	47,49,57,64	0
3	EDO	C	512	4/4	0.83	0.16	33,41,44,46	0
2	GSH	D	301[B]	20/20	0.84	0.20	35,49,52,58	20
3	EDO	C	503	4/4	0.84	0.17	23,26,33,35	0
2	GSH	D	301[A]	20/20	0.84	0.20	52,54,58,58	20
3	EDO	B	307	4/4	0.84	0.16	28,32,43,45	0
3	EDO	B	310	4/4	0.85	0.15	29,30,31,53	0
3	EDO	C	508	4/4	0.86	0.17	29,36,40,41	0

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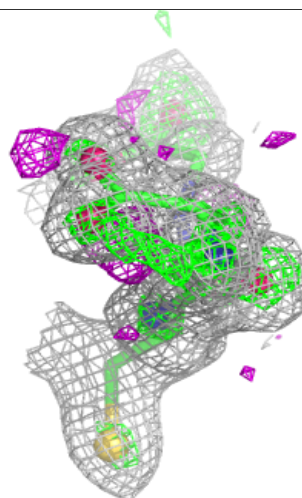
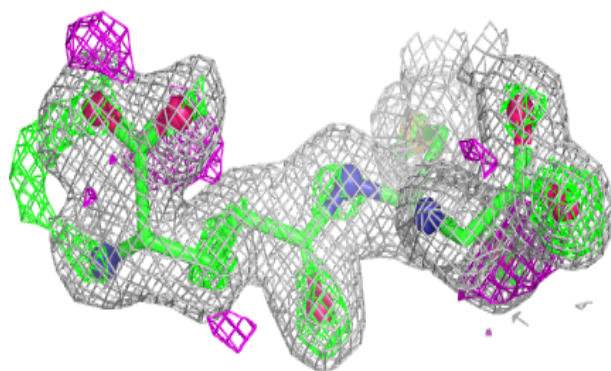
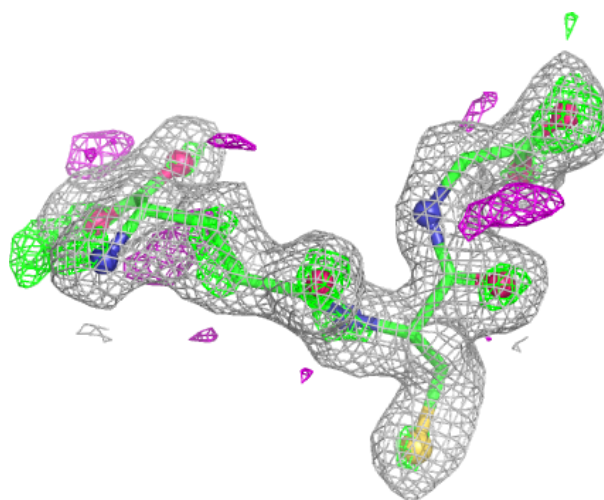
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
6	GOL	B	303	6/6	0.86	0.17	14,39,43,45	0
4	MES	D	306	12/12	0.87	0.18	24,41,50,50	12
3	EDO	B	312	4/4	0.87	0.12	38,47,49,61	0
3	EDO	D	302	4/4	0.88	0.16	25,43,55,56	0
3	EDO	A	303	4/4	0.88	0.14	25,41,41,41	0
6	GOL	C	501	6/6	0.88	0.13	19,29,38,44	0
6	GOL	D	309	6/6	0.88	0.13	20,36,42,47	0
2	GSH	B	301[A]	20/20	0.89	0.12	20,31,39,40	20
3	EDO	C	509	4/4	0.89	0.14	21,39,39,48	0
3	EDO	A	302	4/4	0.91	0.13	25,28,30,37	0
4	MES	A	304	12/12	0.91	0.15	19,34,38,40	12
2	GSH	A	301[A]	20/20	0.93	0.09	14,21,28,32	20
2	GSH	A	301[B]	20/20	0.93	0.09	15,21,24,27	20
3	EDO	B	302	4/4	0.93	0.18	21,28,33,45	0
3	EDO	A	306	4/4	0.94	0.09	24,24,28,42	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.



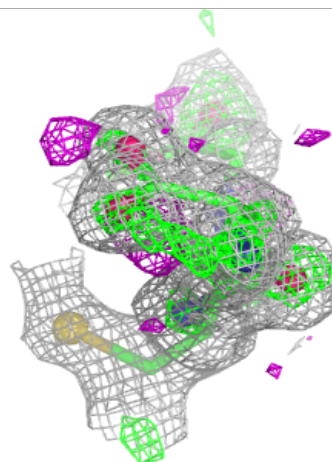
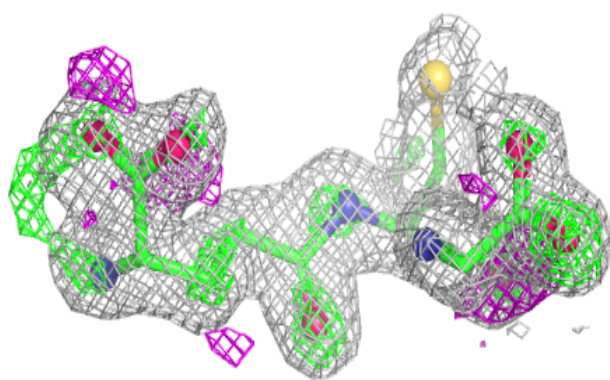
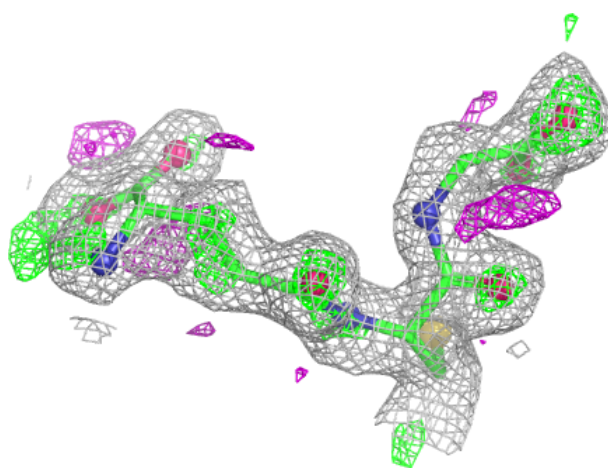
Electron density around GSH D 301 (B):

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



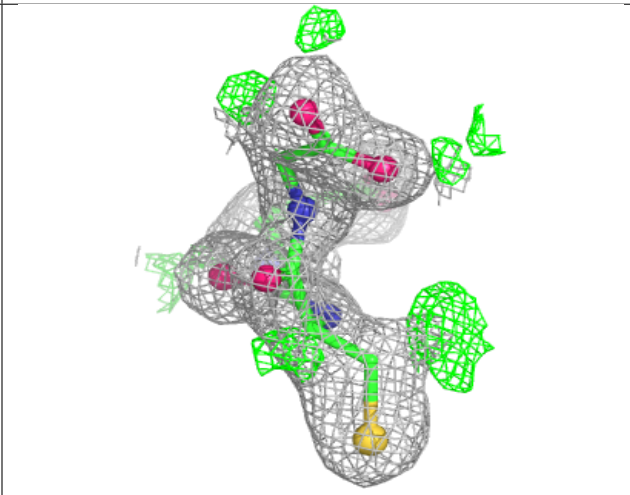
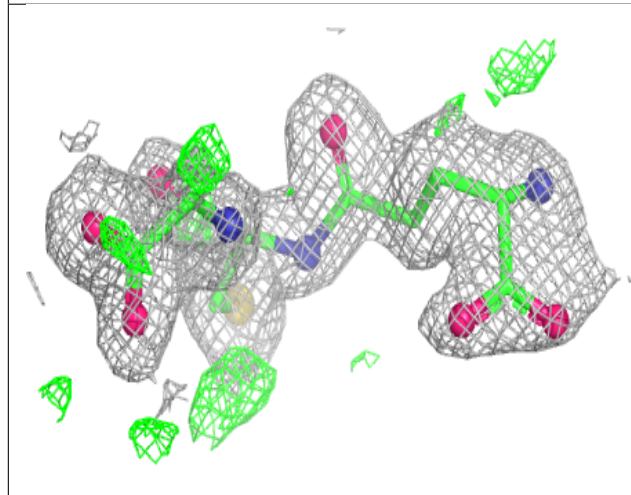
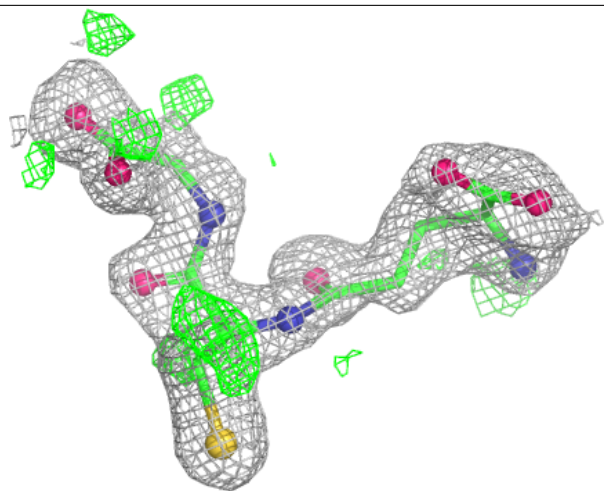
Electron density around GSH D 301 (A):

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



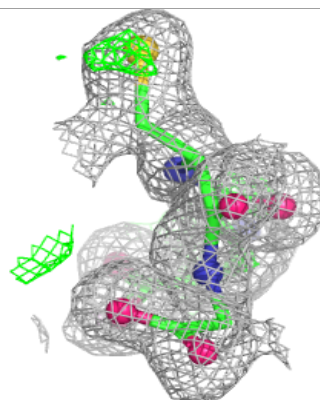
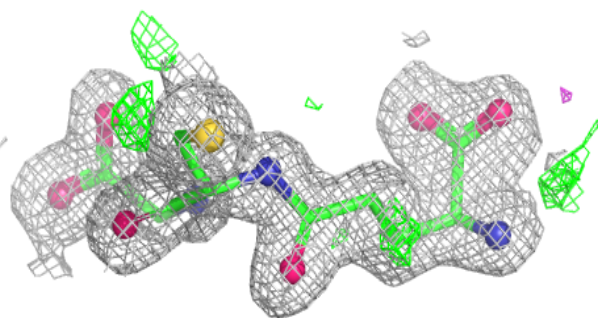
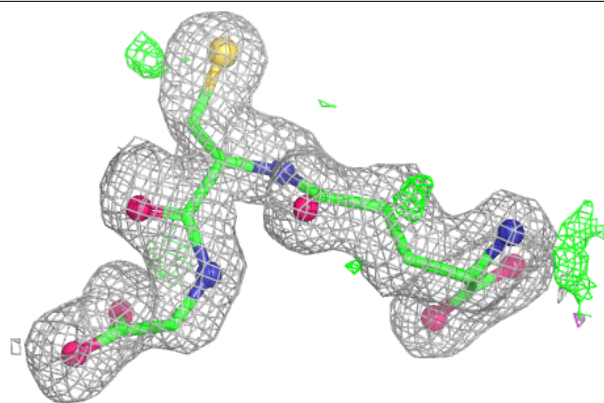
Electron density around GSH B 301 (A):

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

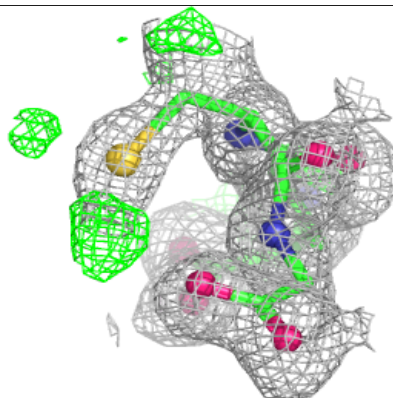
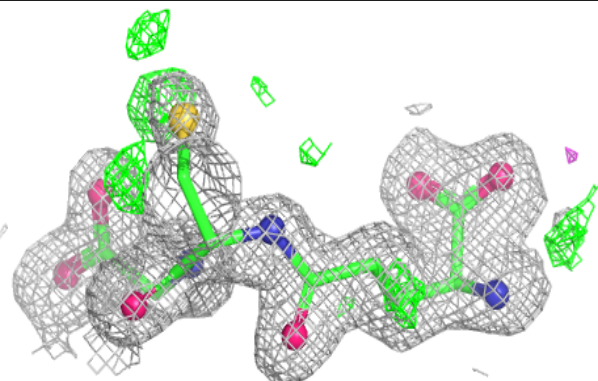
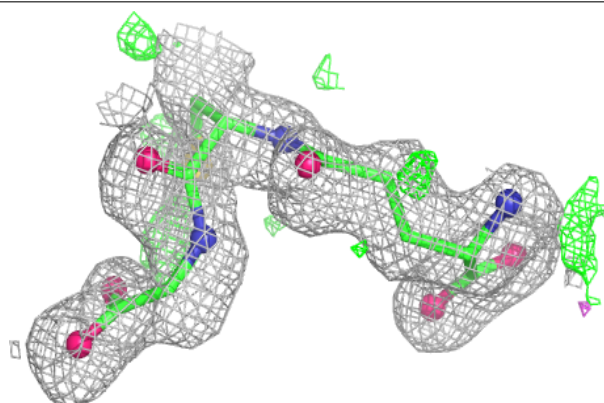


Electron density around GSH A 301 (A):

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

**Electron density around GSH A 301 (B):**

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



6.5 Other polymers [i](#)

There are no such residues in this entry.