Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 11:23 AM UTC

PDB ID	:	3CSI / pdb_00003csi
Title	:	Crystal Structure of the Glutathione Transferase Pi allelic variant*C, I104V/A113V, in complex with the Chlorambucil-Glutathione Conjugate
Authors	:	Parker, L.J.
Deposited on	:	2008-04-09
Resolution	:	1.90 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:

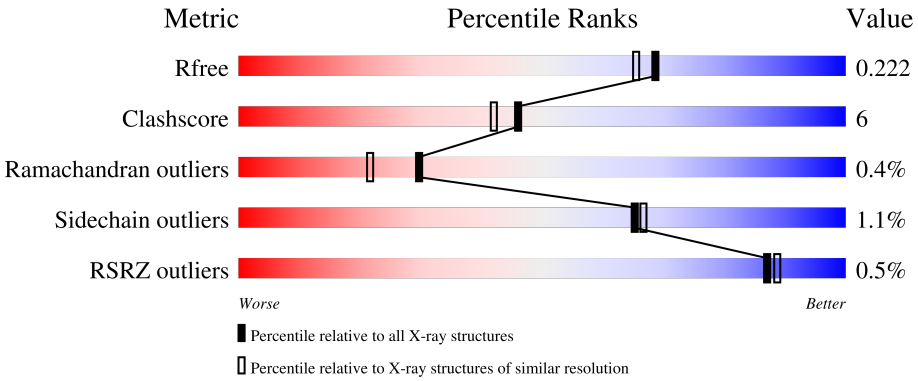
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal 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 1.90 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	7789 (1.90-1.90)
Clashscore	190562	8410 (1.90-1.90)
Ramachandran outliers	187476	8333 (1.90-1.90)
Sidechain outliers	187428	8333 (1.90-1.90)
RSRZ outliers	180081	7790 (1.90-1.90)

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% 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	209	88% 11%
1	B	209	% 89% 11%
1	C	209	88% 11%
1	D	209	% 90% 10%

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
5	GSH	A	213[B]	X	-	-	-
5	GSH	B	217[B]	X	-	-	-
5	GSH	C	212[B]	X	-	-	-
5	GSH	D	215[B]	X	-	-	-

2 Entry composition (i)

There are 9 unique types of molecules in this entry. The entry contains 7793 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 Glutathione S-transferase P.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	209	Total	C	N	O	S	0	3	0
			1660	1066	276	312	6			
1	B	209	Total	C	N	O	S	0	2	0
			1653	1061	274	311	7			
1	C	209	Total	C	N	O	S	0	0	0
			1639	1053	272	308	6			
1	D	209	Total	C	N	O	S	0	2	0
			1655	1063	275	311	6			

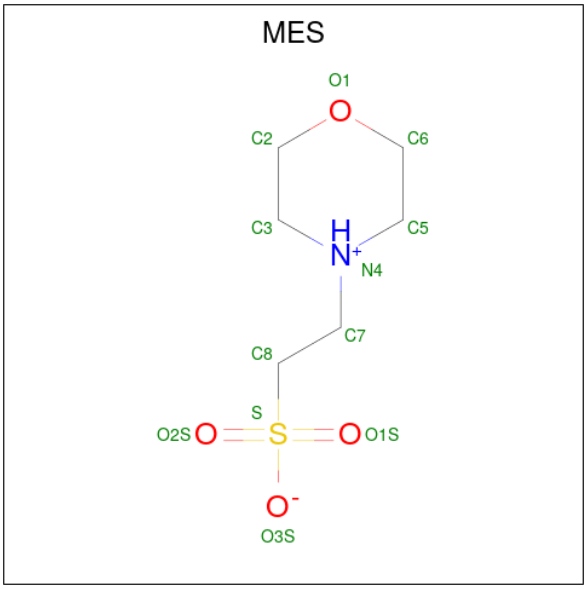
There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	104	VAL	ILE	engineered mutation	UNP P09211
A	113	VAL	ALA	engineered mutation	UNP P09211
B	104	VAL	ILE	engineered mutation	UNP P09211
B	113	VAL	ALA	engineered mutation	UNP P09211
C	104	VAL	ILE	engineered mutation	UNP P09211
C	113	VAL	ALA	engineered mutation	UNP P09211
D	104	VAL	ILE	engineered mutation	UNP P09211
D	113	VAL	ALA	engineered mutation	UNP P09211

- Molecule 2 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

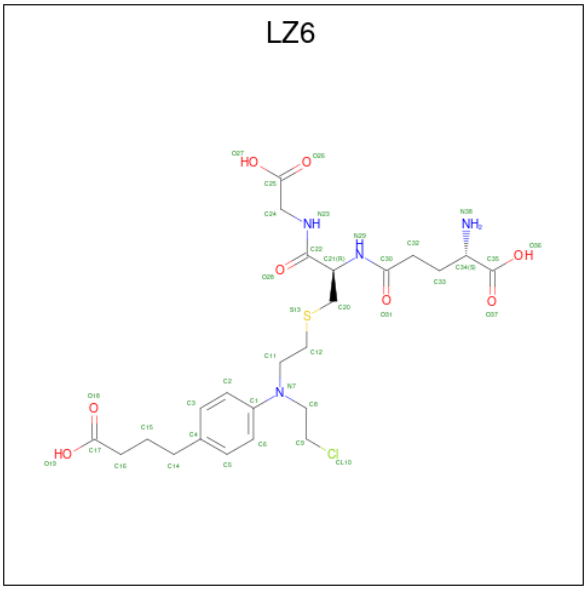
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Cl	0	0
			1	1		
2	B	1	Total	Cl	0	0
			1	1		
2	C	1	Total	Cl	0	0
			1	1		
2	D	1	Total	Cl	0	0
			1	1		

- Molecule 3 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (CCD ID: MES) (formula: $C_6H_{13}NO_4S$).



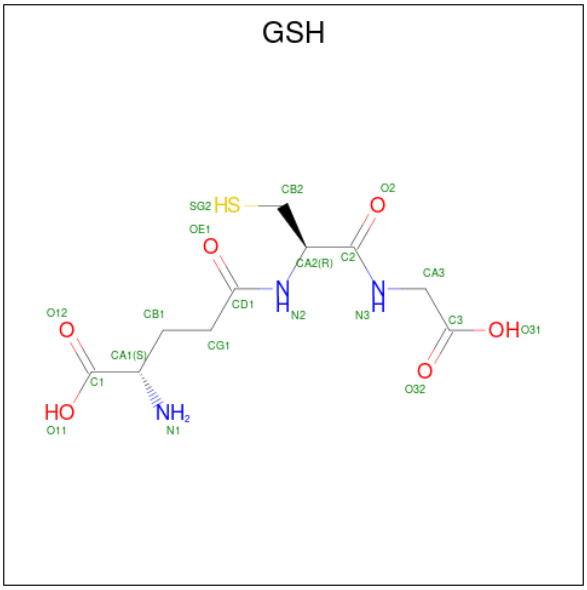
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	S	0	0
			12	6	1	4	1		
3	B	1	Total	C	N	O	S	0	0
			12	6	1	4	1		
3	D	1	Total	C	N	O	S	0	0
			12	6	1	4	1		

- Molecule 4 is L-gamma-glutamyl-S-(2-{[4-(3-carboxypropyl)phenyl](2-chloroethyl)amino}ethyl)-L-cysteinylglycine (CCD ID: LZ6) (formula: $C_{24}H_{35}ClN_4O_8S$).



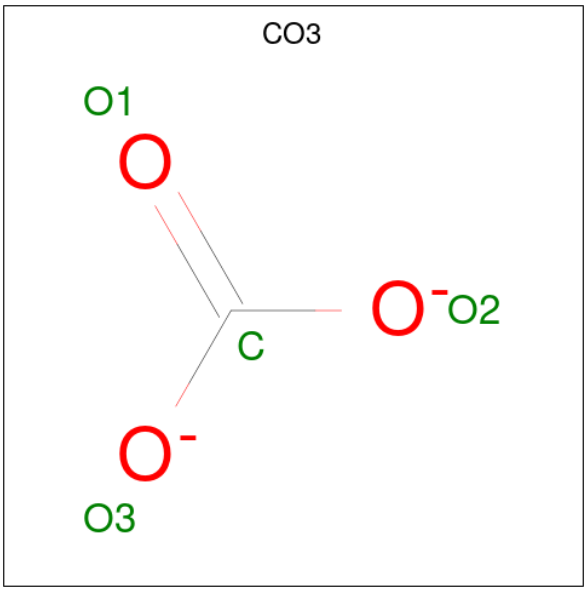
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
4	A	1	Total	C	Cl	N	O	S	0	1
			38	24	1	4	8	1		
4	B	1	Total	C	Cl	N	O	S	0	1
			38	24	1	4	8	1		
4	C	1	Total	C	Cl	N	O	S	0	1
			38	24	1	4	8	1		
4	D	1	Total	C	Cl	N	O	S	0	1
			38	24	1	4	8	1		

- Molecule 5 is GLUTATHIONE (CCD ID: GSH) (formula: $C_{10}H_{17}N_3O_6S$).



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

- Molecule 6 is CARBONATE ION (CCD ID: CO3) (formula: CO_3).

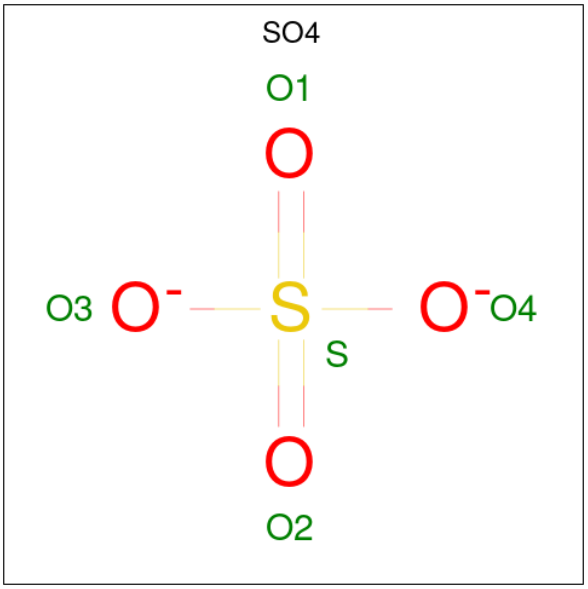


Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	B	1	Total C O 4 1 3	0	0

- Molecule 7 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	B	1	Total Ca 1 1	0	0
7	D	2	Total Ca 2 2	0	0

- Molecule 8 is SULFATE ION (CCD ID: SO4) (formula: O_4S).



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

- Molecule 9 is water.

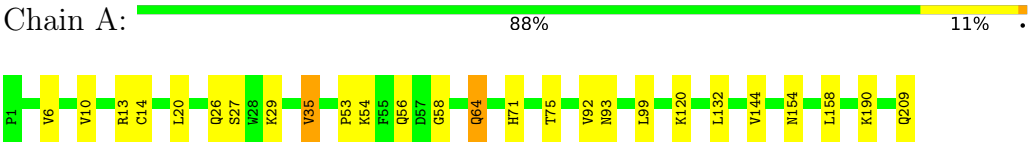
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	A	226	Total O 226 226	0	0
9	B	225	Total O 225 225	0	0
9	C	234	Total O 234 234	0	0
9	D	217	Total O 217 217	0	0

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.

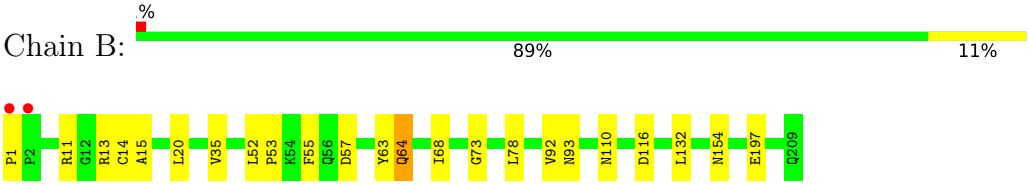
• Molecule 1: Glutathione S-transferase P

Chain A:



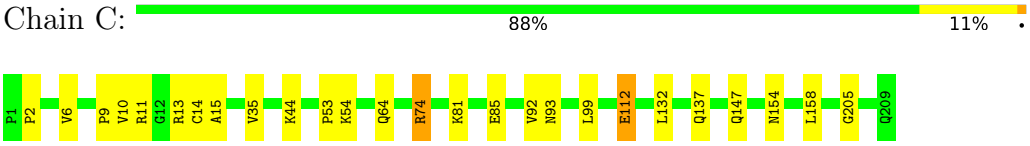
• Molecule 1: Glutathione S-transferase P

Chain B:



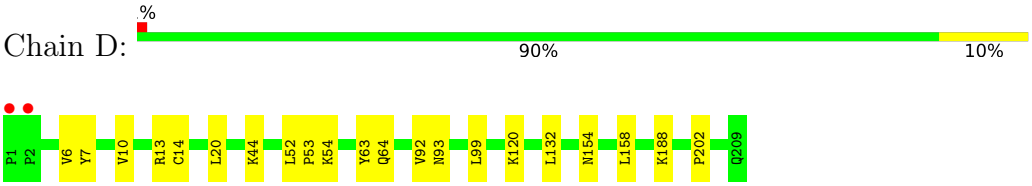
• Molecule 1: Glutathione S-transferase P

Chain C:



• Molecule 1: Glutathione S-transferase P

Chain D:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	68.80Å 89.16Å 74.50Å 90.00° 96.99° 90.00°	Depositor
Resolution (Å)	25.98 – 1.90 25.98 – 1.90	Depositor EDS
% Data completeness (in resolution range)	97.7 (25.98-1.90) 97.6 (25.98-1.90)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.93 (at 1.91Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.166 , 0.222 0.167 , 0.222	Depositor DCC
R_{free} test set	3475 reflections (4.94%)	wwPDB-VP
Wilson B-factor (Å^2)	19.1	Xtriage
Anisotropy	0.044	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 46.2	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	7793	wwPDB-VP
Average B, all atoms (Å^2)	18.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 42.44 % 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 2.0404e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: CO3, CA, CL, MES, LZ6, SO4, 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	0.94	1/1698 (0.1%)	0.96	0/2302
1	B	0.88	0/1688	0.96	0/2289
1	C	0.89	0/1674	0.95	0/2271
1	D	0.93	0/1690	0.99	0/2293
All	All	0.91	1/6750 (0.0%)	0.97	0/9155

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	144	VAL	CA-CB	5.03	1.61	1.54

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

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	1660	0	1669	21	0
1	B	1653	0	1657	17	0
1	C	1639	0	1645	22	0
1	D	1655	0	1660	15	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	1	0	0	0	0
2	D	1	0	0	0	0
3	A	12	0	12	0	0
3	B	12	0	12	1	0
3	D	12	0	12	0	0
4	A	38	0	32	5	0
4	B	38	0	32	5	0
4	C	38	0	32	9	0
4	D	38	0	32	2	0
5	A	20	0	15	3	0
5	B	20	0	15	3	0
5	C	20	0	15	2	0
5	D	20	0	15	3	0
6	B	4	0	0	0	0
7	B	1	0	0	0	0
7	D	2	0	0	0	0
8	B	5	0	0	0	0
9	A	226	0	0	3	0
9	B	225	0	0	1	0
9	C	234	0	0	4	0
9	D	217	0	0	1	0
All	All	7793	0	6855	80	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 6.

All (80) 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:10:VAL:HG11	4:C:211[A]:LZ6:H5	1.58	0.85
1:C:10:VAL:CG1	4:C:211[A]:LZ6:H5	2.07	0.84
1:D:13:ARG:HD2	5:D:215[B]:GSH:HG13	1.69	0.75
1:B:13:ARG:HD2	5:B:217[B]:GSH:HG13	1.67	0.74
1:C:112:GLU:HG2	9:C:292:HOH:O	1.89	0.73
1:A:10:VAL:CG1	4:A:212[A]:LZ6:H5	2.21	0.70
1:A:29:LYS:HE2	9:A:347:HOH:O	1.93	0.68
1:C:99:LEU:HD23	1:C:158:LEU:HD21	1.76	0.68
1:B:35:VAL:HG23	4:B:216[A]:LZ6:H5	1.77	0.67
1:A:93:ASN:ND2	1:A:154:ASN:HD22	1.93	0.66
1:A:35:VAL:HG23	4:A:212[A]:LZ6:H3	1.81	0.63
1:D:6:VAL:HB	1:D:54:LYS:HB3	1.81	0.63

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:93:ASN:ND2	1:B:154:ASN:HD22	1.97	0.63
1:C:13:ARG:HD2	5:C:212[B]:GSH:HG13	1.81	0.62
1:A:93:ASN:HD21	1:A:154:ASN:HD22	1.49	0.61
1:A:64:GLN:HE22	5:A:213[B]:GSH:HN11	1.49	0.61
1:A:13:ARG:HD2	5:A:213[B]:GSH:HG13	1.82	0.60
1:A:10:VAL:HG13	4:A:212[A]:LZ6:H5	1.83	0.59
1:A:10:VAL:HG11	4:A:212[A]:LZ6:H5	1.84	0.59
1:A:56[B]:GLN:HG3	1:A:58:GLY:O	2.04	0.58
1:A:35:VAL:CG2	4:A:212[A]:LZ6:H3	2.34	0.57
1:B:93:ASN:HD21	1:B:154:ASN:HD22	1.51	0.57
1:D:93:ASN:ND2	1:D:154:ASN:HD22	2.03	0.57
1:D:93:ASN:HD21	1:D:154:ASN:HD22	1.52	0.57
1:C:6:VAL:HB	1:C:54:LYS:HB3	1.88	0.56
1:A:71:HIS:O	1:A:75:THR:HG23	2.06	0.56
1:D:44:LYS:NZ	5:D:215[B]:GSH:O32	2.35	0.55
1:C:35:VAL:CG2	4:C:211[A]:LZ6:H3	2.37	0.55
1:B:35:VAL:CG2	4:B:216[A]:LZ6:H5	2.36	0.55
1:B:92:VAL:HG22	1:B:132:LEU:HD13	1.89	0.54
1:C:10:VAL:HG13	4:C:211[A]:LZ6:H5	1.88	0.54
1:D:99:LEU:HD23	1:D:158:LEU:HD21	1.88	0.53
1:A:92:VAL:HG22	1:A:132:LEU:HD13	1.91	0.53
1:D:92:VAL:HG22	1:D:132:LEU:HD13	1.92	0.52
1:C:93:ASN:ND2	1:C:154:ASN:HD22	2.09	0.50
1:D:14:CYS:SG	1:D:53:PRO:HB3	2.51	0.50
1:A:14:CYS:SG	1:A:53:PRO:HB3	2.53	0.48
1:A:99:LEU:HD23	1:A:158:LEU:HD21	1.94	0.48
1:C:92:VAL:HG22	1:C:132:LEU:HD13	1.96	0.48
1:C:44:LYS:NZ	5:C:212[B]:GSH:O31	2.35	0.48
1:A:26:GLN:OE1	1:C:2:PRO:HD3	2.13	0.47
4:B:216[A]:LZ6:C2	4:B:216[A]:LZ6:H12	2.44	0.47
1:B:20:LEU:C	1:B:20:LEU:HD23	2.40	0.46
1:D:7:TYR:CE2	1:D:10[A]:VAL:HG23	2.51	0.46
1:C:147:GLN:HG3	9:C:223:HOH:O	2.16	0.45
1:B:52:LEU:O	5:B:217[B]:GSH:HG12	2.16	0.45
1:D:63:TYR:O	1:D:64:GLN:HB2	2.16	0.45
1:A:20:LEU:C	1:A:20:LEU:HD23	2.42	0.44
1:D:13:ARG:CD	5:D:215[B]:GSH:HG13	2.44	0.44
4:C:211[A]:LZ6:H8	4:C:211[A]:LZ6:S13	2.57	0.44
1:B:13:ARG:CD	5:B:217[B]:GSH:HG13	2.45	0.44
1:C:74:ARG:NH2	9:C:232:HOH:O	2.42	0.43
1:D:10[A]:VAL:HG12	1:D:202:PRO:HG2	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:B:216[A]:LZ6:H12	4:B:216[A]:LZ6:H2	2.00	0.43
1:B:73:GLY:HA2	1:B:78:LEU:HB2	2.00	0.43
4:B:216[A]:LZ6:H8A	4:B:216[A]:LZ6:H6	1.76	0.43
1:D:52:LEU:HB3	1:D:53:PRO:HA	2.01	0.43
1:C:9:PRO:HG2	4:C:211[A]:LZ6:H16	1.99	0.43
1:C:137:GLN:NE2	9:C:348:HOH:O	2.50	0.43
1:B:55:PHE:HB2	1:B:68:ILE:CD1	2.49	0.43
1:B:197:GLU:OE2	3:B:215:MES:H72	2.18	0.43
1:C:35:VAL:HG23	4:C:211[A]:LZ6:H15	2.00	0.43
1:B:63:TYR:O	1:B:64:GLN:HB2	2.18	0.43
1:C:11:ARG:HB3	1:C:15:ALA:HB2	2.00	0.42
1:C:81:LYS:HG2	1:C:85:GLU:CD	2.44	0.42
4:D:214[A]:LZ6:H6	4:D:214[A]:LZ6:H8A	1.68	0.42
1:B:11:ARG:NH2	9:B:412:HOH:O	2.52	0.42
1:D:120:LYS:HG3	9:D:546:HOH:O	2.19	0.41
1:A:13:ARG:CD	5:A:213[B]:GSH:HG13	2.50	0.41
1:A:190[B]:LYS:NZ	9:A:276:HOH:O	2.54	0.41
1:B:14:CYS:SG	1:B:53:PRO:HB3	2.60	0.41
1:A:209:GLN:OE1	9:A:348:HOH:O	2.22	0.41
4:D:214[A]:LZ6:H8	4:D:214[A]:LZ6:N23	2.35	0.41
1:C:35:VAL:HG23	4:C:211[A]:LZ6:C15	2.51	0.41
1:A:6:VAL:HB	1:A:54:LYS:HB3	2.01	0.41
1:B:1:PRO:HB3	1:B:57:ASP:OD1	2.21	0.41
1:C:205:GLY:HA3	4:C:211[A]:LZ6:C5	2.50	0.41
1:C:14:CYS:SG	1:C:53:PRO:HB3	2.61	0.41
1:B:11:ARG:HB3	1:B:15:ALA:HB2	2.02	0.40
1:D:20:LEU:HD23	1:D:20:LEU:C	2.47	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	210/209 (100%)	204 (97%)	5 (2%)	1 (0%)	24 16
1	B	209/209 (100%)	203 (97%)	5 (2%)	1 (0%)	24 16
1	C	207/209 (99%)	202 (98%)	4 (2%)	1 (0%)	24 16
1	D	209/209 (100%)	201 (96%)	8 (4%)	0	100 100
All	All	835/836 (100%)	810 (97%)	22 (3%)	3 (0%)	30 22

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	64	GLN
1	B	64	GLN
1	C	64	GLN

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	180/177 (102%)	177 (98%)	3 (2%)	53 52
1	B	179/177 (101%)	177 (99%)	2 (1%)	65 67
1	C	177/177 (100%)	175 (99%)	2 (1%)	65 67
1	D	179/177 (101%)	178 (99%)	1 (1%)	78 81
All	All	715/708 (101%)	707 (99%)	8 (1%)	65 67

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	27	SER
1	A	35	VAL
1	A	120	LYS
1	B	110	ASN
1	B	116	ASP
1	C	74	ARG
1	C	112	GLU
1	D	188	LYS

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	64	GLN
1	A	93	ASN
1	A	125	GLN
1	A	204	ASN
1	B	84	GLN
1	B	93	ASN
1	B	110	ASN
1	B	204	ASN
1	C	24	GLN
1	C	56	GLN
1	C	84	GLN
1	C	93	ASN
1	C	137	GLN
1	C	147	GLN
1	D	93	ASN
1	D	135	GLN
1	D	204	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)

Of 20 ligands modelled in this entry, 7 are monoatomic - leaving 13 for Mogul analysis.

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	MES	D	213	-	12,12,12	2.05	1 (8%)	15,16,16	2.23	3 (20%)
4	LZ6	A	212[A]	-	37,38,38	0.80	0	45,48,48	0.96	2 (4%)
8	SO4	B	213	-	4,4,4	0.22	0	6,6,6	0.23	0
5	GSH	A	213[B]	-	18,19,19	3.22	2 (11%)	21,24,24	0.92	2 (9%)
6	CO3	B	210	-	3,3,3	0.81	0	2,3,3	0.23	0
3	MES	A	211	-	12,12,12	2.09	1 (8%)	15,16,16	2.50	5 (33%)
5	GSH	B	217[B]	-	18,19,19	3.30	2 (11%)	21,24,24	1.18	3 (14%)
4	LZ6	B	216[A]	-	37,38,38	0.81	1 (2%)	45,48,48	0.95	1 (2%)
4	LZ6	C	211[A]	-	37,38,38	0.70	0	45,48,48	1.09	2 (4%)
4	LZ6	D	214[A]	-	37,38,38	0.70	0	45,48,48	1.12	2 (4%)
3	MES	B	215	-	12,12,12	1.81	1 (8%)	15,16,16	2.63	4 (26%)
5	GSH	C	212[B]	-	18,19,19	3.20	2 (11%)	21,24,24	1.24	2 (9%)
5	GSH	D	215[B]	-	18,19,19	3.17	2 (11%)	21,24,24	1.33	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
3	MES	D	213	-	-	3/6/14/14	0/1/1/1
4	LZ6	A	212[A]	-	-	5/42/42/42	0/1/1/1
5	GSH	A	213[B]	-	1/1/6/8	11/24/24/24	-
3	MES	A	211	-	-	4/6/14/14	0/1/1/1
5	GSH	B	217[B]	-	1/1/6/8	9/24/24/24	-
4	LZ6	B	216[A]	-	-	7/42/42/42	0/1/1/1
4	LZ6	C	211[A]	-	-	3/42/42/42	0/1/1/1
4	LZ6	D	214[A]	-	-	4/42/42/42	0/1/1/1
3	MES	B	215	-	-	2/6/14/14	0/1/1/1
5	GSH	C	212[B]	-	1/1/6/8	6/24/24/24	-
5	GSH	D	215[B]	-	1/1/6/8	6/24/24/24	-

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	217[B]	GSH	OE1-CD1	9.74	1.42	1.23
5	C	212[B]	GSH	O2-C2	9.70	1.42	1.23
5	D	215[B]	GSH	OE1-CD1	9.55	1.42	1.23
5	B	217[B]	GSH	O2-C2	9.50	1.41	1.23
5	A	213[B]	GSH	O2-C2	9.47	1.41	1.23
5	A	213[B]	GSH	OE1-CD1	9.39	1.41	1.23
5	D	215[B]	GSH	O2-C2	9.07	1.40	1.23
5	C	212[B]	GSH	OE1-CD1	9.00	1.41	1.23
3	D	213	MES	C8-S	-6.90	1.67	1.77
3	A	211	MES	C8-S	-6.89	1.67	1.77
3	B	215	MES	C8-S	-5.83	1.69	1.77
4	B	216[A]	LZ6	O37-C35	2.49	1.29	1.22

All (29) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	211	MES	C5-N4-C3	6.71	123.30	108.84
3	D	213	MES	C5-N4-C3	5.69	121.10	108.84
3	B	215	MES	O1S-S-C8	5.56	115.14	106.73
3	B	215	MES	C7-N4-C3	5.48	125.85	111.24
3	D	213	MES	C7-N4-C3	4.87	124.21	111.24
3	B	215	MES	C5-N4-C3	4.58	118.70	108.84
3	A	211	MES	O1S-S-C8	4.16	113.01	106.73
4	D	214[A]	LZ6	C20-S13-C12	3.42	112.42	102.26
4	A	212[A]	LZ6	C20-S13-C12	3.24	111.88	102.26
3	A	211	MES	C7-N4-C5	3.21	119.80	111.24
4	B	216[A]	LZ6	C20-S13-C12	3.13	111.54	102.26
5	C	212[B]	GSH	CA2-CB2-SG2	-3.06	110.72	114.16
4	C	211[A]	LZ6	C20-S13-C12	3.01	111.20	102.26
3	B	215	MES	O2S-S-O1S	-2.86	104.52	113.82
5	C	212[B]	GSH	O11-C1-O12	-2.83	117.66	124.08
4	D	214[A]	LZ6	C8-N7-C1	-2.73	116.82	121.15
5	B	217[B]	GSH	O11-C1-O12	-2.61	118.16	124.08
4	C	211[A]	LZ6	C8-C9-CL10	-2.38	102.00	110.22
5	D	215[B]	GSH	O11-C1-O12	-2.38	118.69	124.08
5	A	213[B]	GSH	O11-C1-O12	-2.28	118.91	124.08
5	B	217[B]	GSH	CA2-CB2-SG2	-2.24	111.63	114.16
3	D	213	MES	C6-C5-N4	-2.24	106.72	110.12
5	D	215[B]	GSH	O31-C3-CA3	2.21	121.22	112.81
3	A	211	MES	C2-C3-N4	-2.20	106.77	110.12
4	A	212[A]	LZ6	O19-C17-C16	2.18	120.88	114.00
5	D	215[B]	GSH	CG1-CB1-CA1	-2.15	108.92	113.86
3	A	211	MES	C7-N4-C3	2.08	116.78	111.24

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	B	217[B]	GSH	CG1-CB1-CA1	-2.06	109.14	113.86
5	A	213[B]	GSH	O31-C3-CA3	2.03	120.52	112.81

All (4) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
5	A	213[B]	GSH	CA1
5	B	217[B]	GSH	CA1
5	C	212[B]	GSH	CA1
5	D	215[B]	GSH	CA1

All (60) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	211	MES	C8-C7-N4-C5
3	A	211	MES	C7-C8-S-O2S
3	A	211	MES	C7-C8-S-O3S
3	B	215	MES	C8-C7-N4-C3
3	D	213	MES	C8-C7-N4-C3
4	A	212[A]	LZ6	N7-C8-C9-CL10
4	C	211[A]	LZ6	N7-C8-C9-CL10
5	A	213[B]	GSH	N1-CA1-CB1-CG1
5	C	212[B]	GSH	O12-C1-CA1-N1
5	D	215[B]	GSH	O11-C1-CA1-CB1
5	B	217[B]	GSH	CA2-C2-N3-CA3
4	B	216[A]	LZ6	C4-C14-C15-C16
5	D	215[B]	GSH	CA1-CB1-CG1-CD1
5	B	217[B]	GSH	O2-C2-N3-CA3
5	C	212[B]	GSH	O11-C1-CA1-N1
4	D	214[A]	LZ6	C4-C14-C15-C16
5	B	217[B]	GSH	CA1-CB1-CG1-CD1
5	C	212[B]	GSH	CA1-CB1-CG1-CD1
5	A	213[B]	GSH	CA1-CB1-CG1-CD1
5	B	217[B]	GSH	O11-C1-CA1-N1
5	D	215[B]	GSH	O11-C1-CA1-N1
5	A	213[B]	GSH	OE1-CD1-N2-CA2
5	A	213[B]	GSH	O31-C3-CA3-N3
5	D	215[B]	GSH	O12-C1-CA1-CB1
4	D	214[A]	LZ6	C14-C15-C16-C17
5	A	213[B]	GSH	O11-C1-CA1-N1
5	A	213[B]	GSH	CG1-CD1-N2-CA2
3	B	215	MES	C8-C7-N4-C5

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Mol	Chain	Res	Type	Atoms
4	A	212[A]	LZ6	O31-C30-N29-C21
5	D	215[B]	GSH	O12-C1-CA1-N1
4	A	212[A]	LZ6	N29-C21-C22-O28
5	A	213[B]	GSH	O32-C3-CA3-N3
4	D	214[A]	LZ6	N29-C21-C22-O28
3	A	211	MES	C7-C8-S-O1S
3	D	213	MES	C7-C8-S-O2S
5	A	213[B]	GSH	C1-CA1-CB1-CG1
4	A	212[A]	LZ6	N29-C21-C22-N23
5	C	212[B]	GSH	O11-C1-CA1-CB1
4	D	214[A]	LZ6	N29-C21-C22-N23
5	B	217[B]	GSH	N1-CA1-CB1-CG1
5	B	217[B]	GSH	O12-C1-CA1-CB1
5	C	212[B]	GSH	O12-C1-CA1-CB1
4	B	216[A]	LZ6	N29-C21-C22-O28
5	B	217[B]	GSH	O11-C1-CA1-CB1
4	B	216[A]	LZ6	C11-C12-S13-C20
5	A	213[B]	GSH	O12-C1-CA1-CB1
4	A	212[A]	LZ6	C32-C30-N29-C21
4	B	216[A]	LZ6	C15-C16-C17-O18
4	B	216[A]	LZ6	C15-C16-C17-O19
4	C	211[A]	LZ6	N29-C21-C22-O28
5	A	213[B]	GSH	O11-C1-CA1-CB1
4	B	216[A]	LZ6	N29-C21-C22-N23
4	C	211[A]	LZ6	N29-C21-C22-N23
5	C	212[B]	GSH	C2-CA2-N2-CD1
5	B	217[B]	GSH	C1-CA1-CB1-CG1
5	D	215[B]	GSH	C3-CA3-N3-C2
4	B	216[A]	LZ6	C14-C15-C16-C17
3	D	213	MES	C7-C8-S-O3S
5	A	213[B]	GSH	O12-C1-CA1-N1
5	B	217[B]	GSH	O12-C1-CA1-N1

There are no ring outliers.

9 monomers are involved in 33 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	212[A]	LZ6	5	0
5	A	213[B]	GSH	3	0
5	B	217[B]	GSH	3	0
4	B	216[A]	LZ6	5	0
4	C	211[A]	LZ6	9	0

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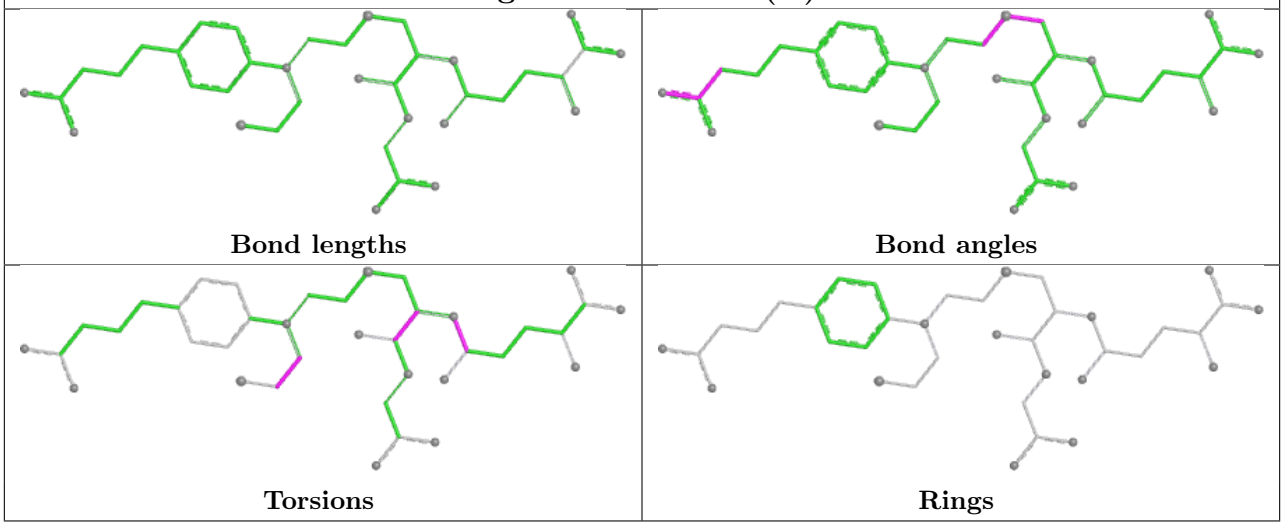
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	D	214[A]	LZ6	2	0
3	B	215	MES	1	0
5	C	212[B]	GSH	2	0
5	D	215[B]	GSH	3	0

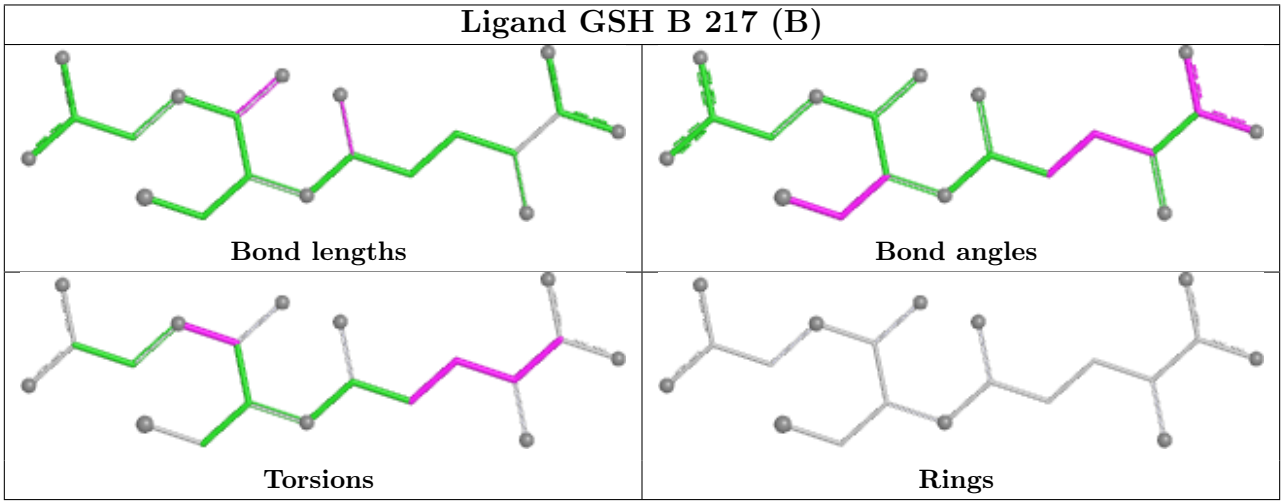
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 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.

Ligand LZ6 A 212 (A)

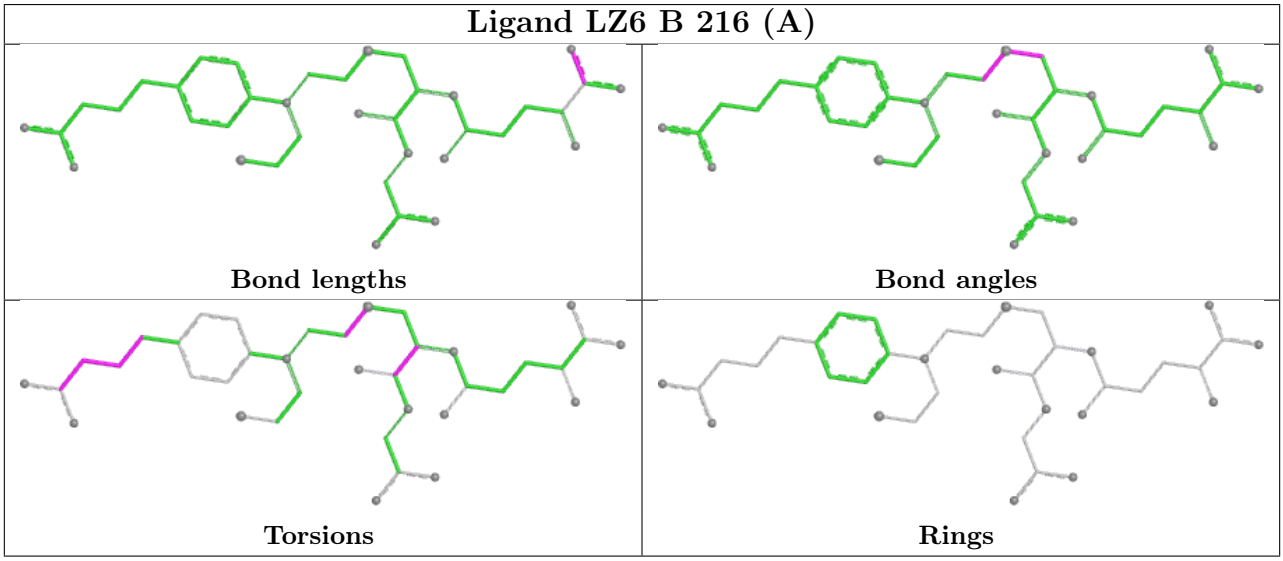


Ligand GSH A 213 (B)

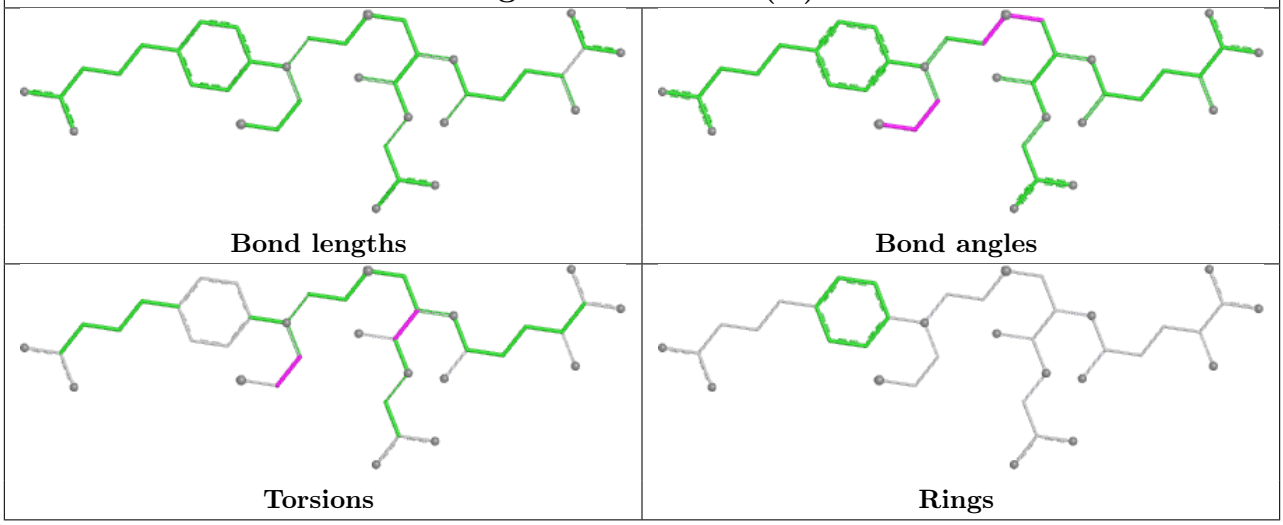
Ligand GSH B 217 (B)



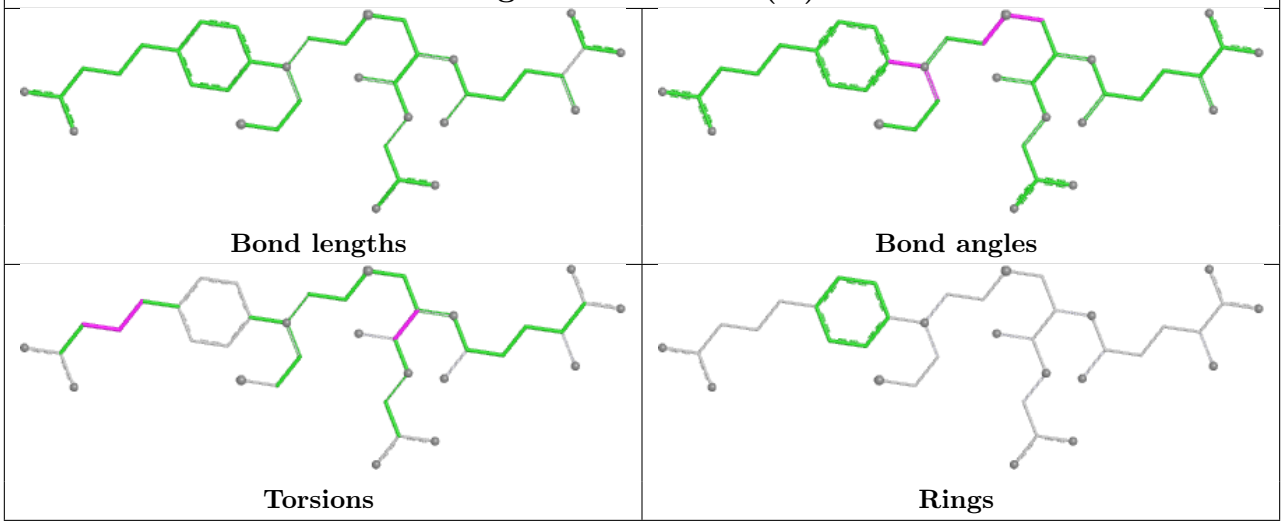
Ligand LZ6 B 216 (A)



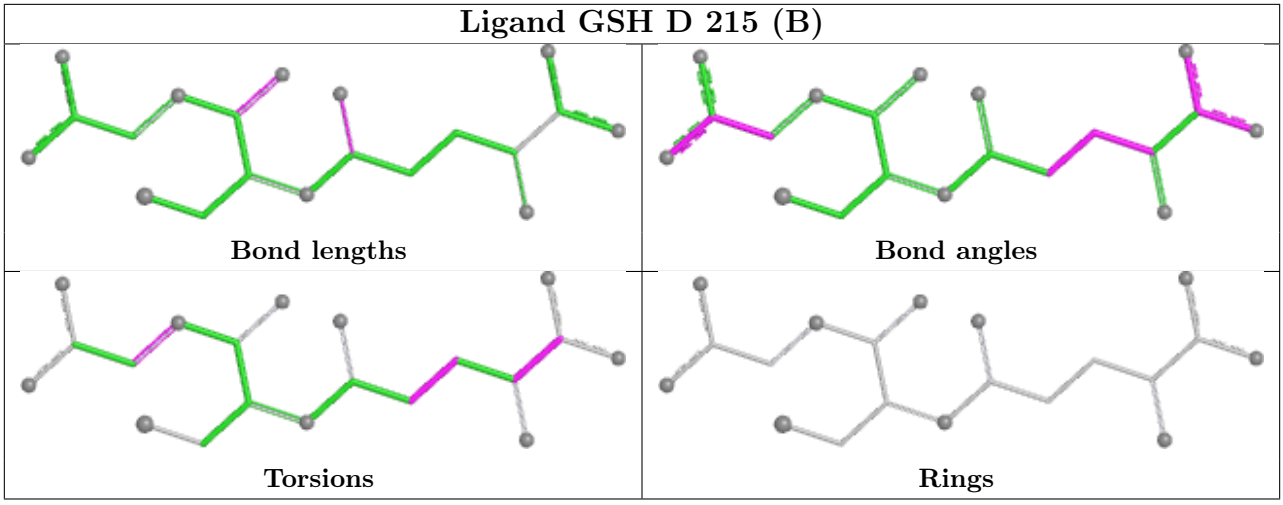
Ligand LZ6 C 211 (A)



Ligand LZ6 D 214 (A)



Ligand GSH C 212 (B)



5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

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, 95^{th} 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	209/209 (100%)	-0.64	0 100 100	7, 15, 25, 34	3 (1%)
1	B	209/209 (100%)	-0.50	2 (0%) 79 82	6, 16, 30, 40	2 (0%)
1	C	209/209 (100%)	-0.53	0 100 100	7, 17, 29, 36	0
1	D	209/209 (100%)	-0.59	2 (0%) 79 82	7, 15, 25, 37	2 (0%)
All	All	836/836 (100%)	-0.56	4 (0%) 87 89	6, 16, 28, 40	7 (0%)

All (4) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	1	PRO	3.6
1	B	2	PRO	3.4
1	D	1	PRO	3.2
1	D	2	PRO	2.6

6.2 Non-standard residues in protein, DNA, RNA chains

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

6.3 Carbohydrates

There are no oligosaccharides in this entry.

6.4 Ligands

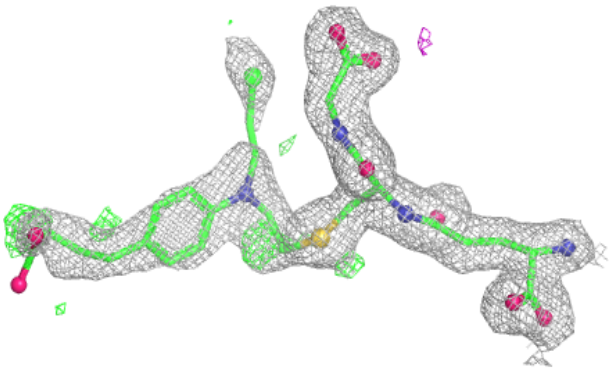
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9'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

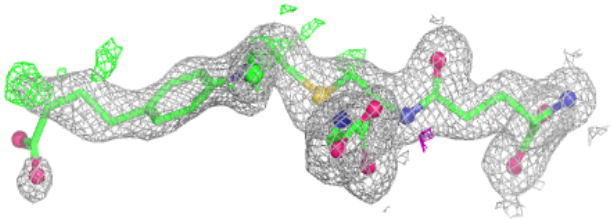
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
6	CO3	B	210	4/4	0.82	0.13	29,30,31,32	4
3	MES	A	211	12/12	0.91	0.09	25,29,36,36	0
4	LZ6	B	216[A]	38/38	0.92	0.10	5,25,37,41	38
3	MES	B	215	12/12	0.92	0.09	18,22,34,37	0
8	SO4	B	213	5/5	0.92	0.07	22,25,28,28	5
4	LZ6	A	212[A]	38/38	0.93	0.10	5,24,36,42	38
4	LZ6	C	211[A]	38/38	0.93	0.11	5,25,39,45	38
4	LZ6	D	214[A]	38/38	0.94	0.10	6,22,44,44	38
5	GSH	C	212[B]	20/20	0.95	0.07	8,9,10,13	20
3	MES	D	213	12/12	0.95	0.08	24,26,29,29	0
5	GSH	A	213[B]	20/20	0.95	0.07	7,12,13,15	20
5	GSH	D	215[B]	20/20	0.97	0.06	2,6,9,9	20
5	GSH	B	217[B]	20/20	0.97	0.06	12,15,17,17	20
2	CL	C	210	1/1	0.97	0.04	25,25,25,25	0
7	CA	D	211	1/1	0.98	0.06	29,29,29,29	0
2	CL	A	210	1/1	0.98	0.03	22,22,22,22	0
7	CA	B	211	1/1	0.99	0.03	25,25,25,25	1
2	CL	B	214	1/1	0.99	0.06	26,26,26,26	0
2	CL	D	212	1/1	0.99	0.04	24,24,24,24	0
7	CA	D	210	1/1	1.00	0.02	22,22,22,22	0

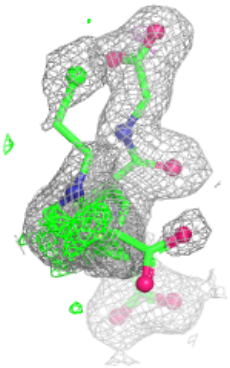
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around LZ6 B 216 (A):

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

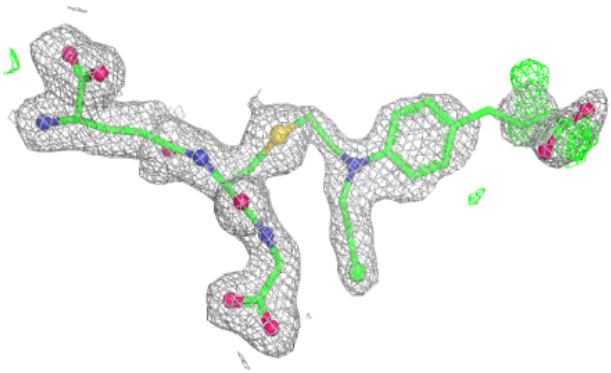


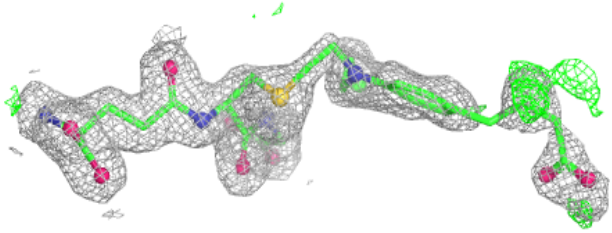


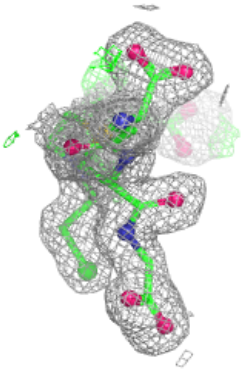


Electron density around LZ6 A 212 (A):

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

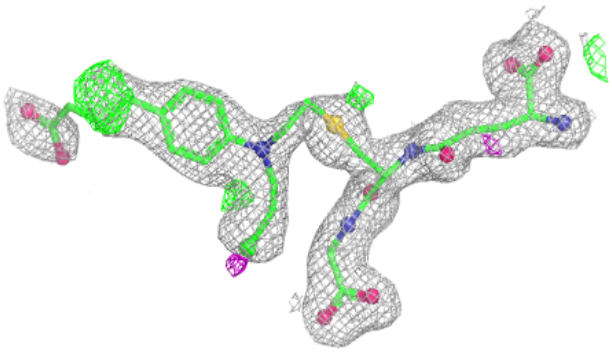


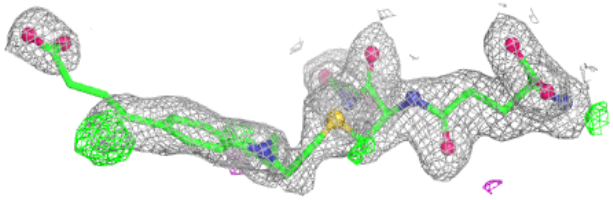


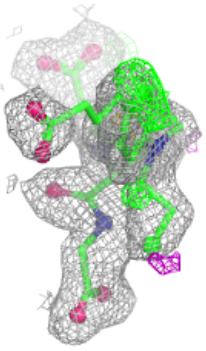


Electron density around LZ6 C 211 (A):

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

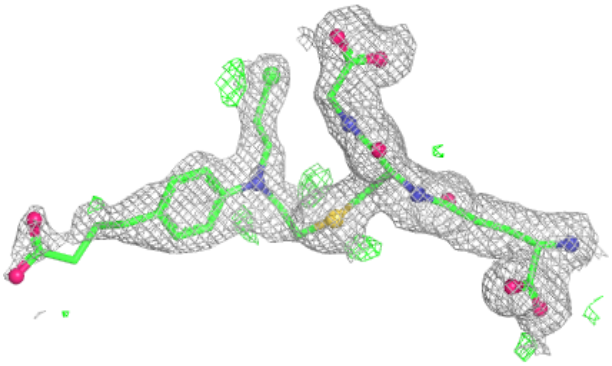


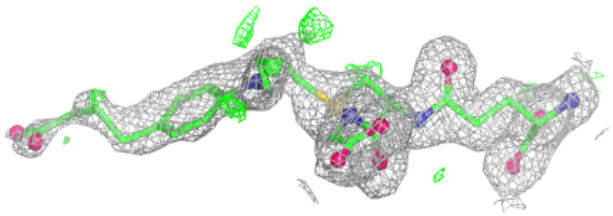


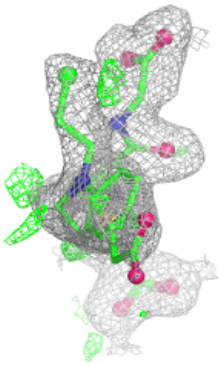


Electron density around LZ6 D 214 (A):

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

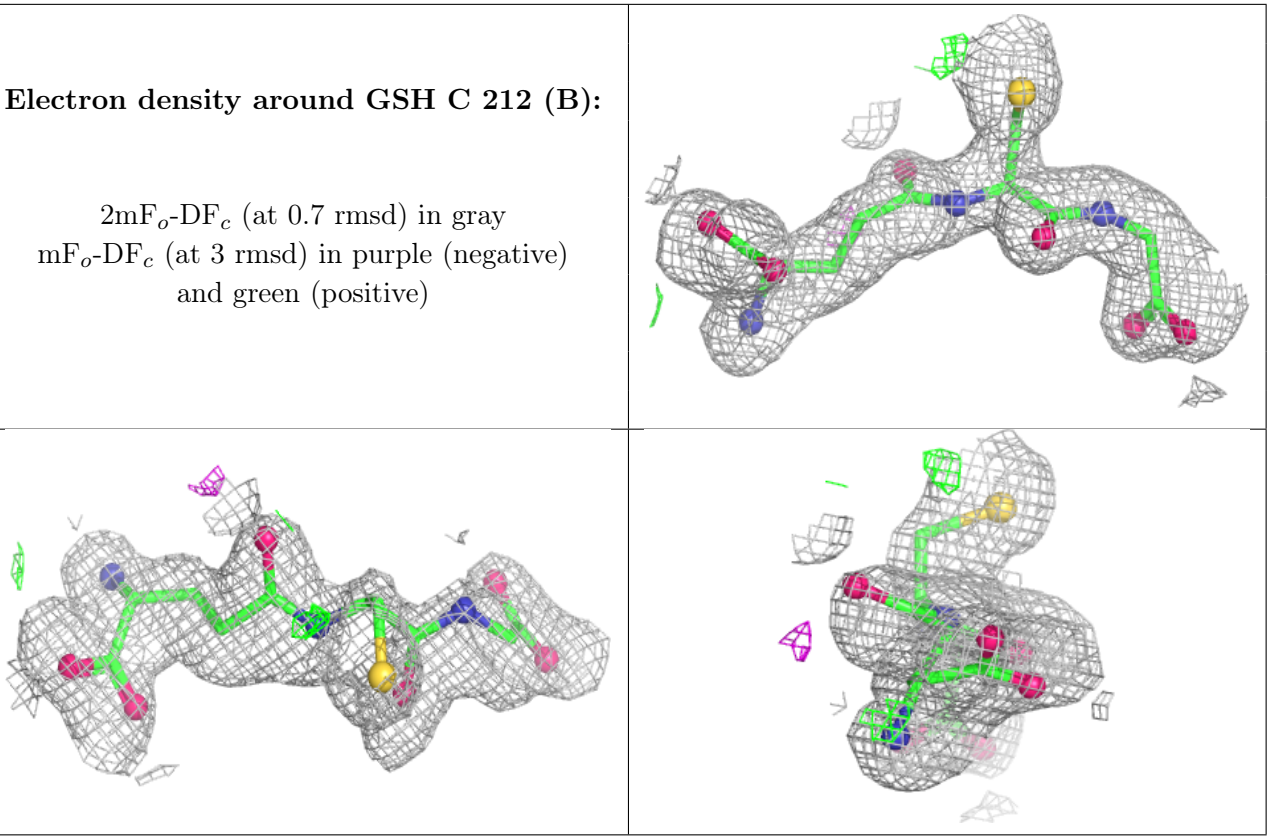






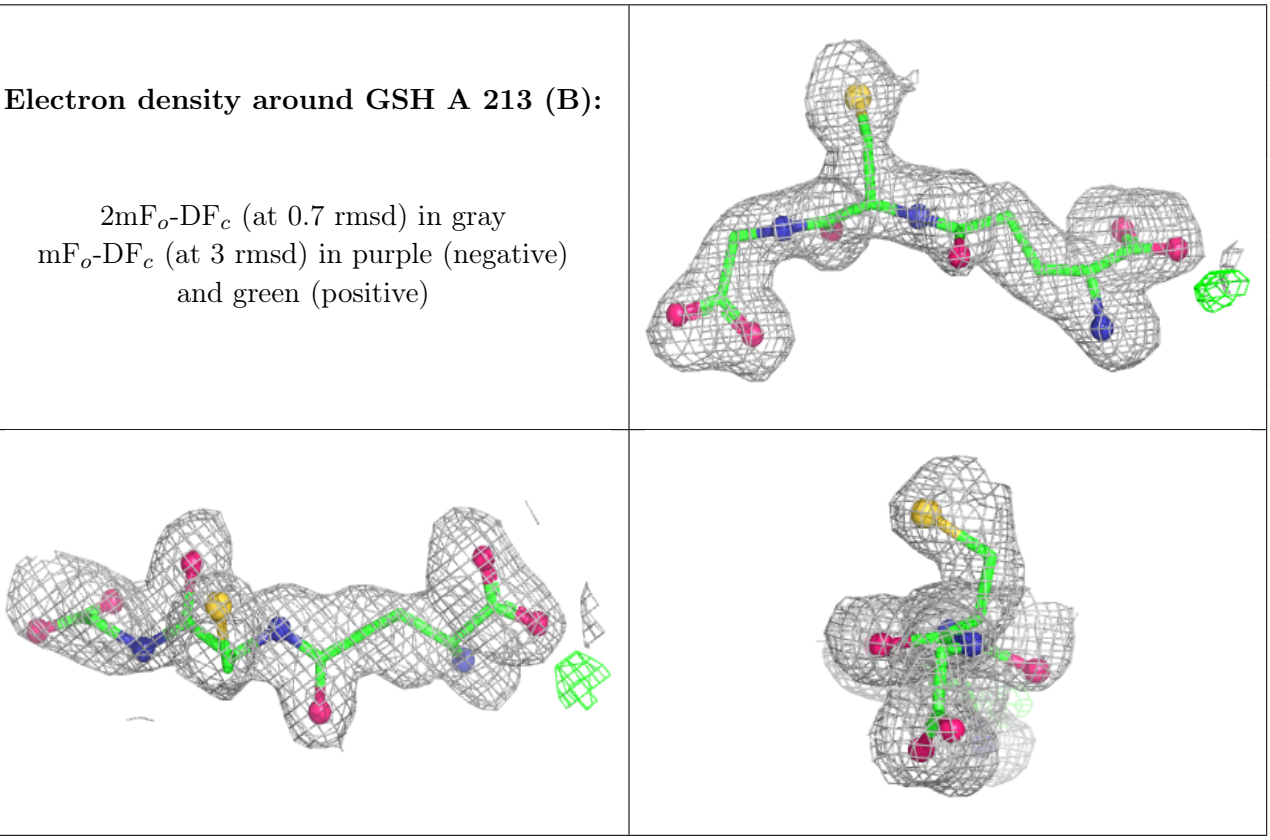
Electron density around GSH C 212 (B):

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



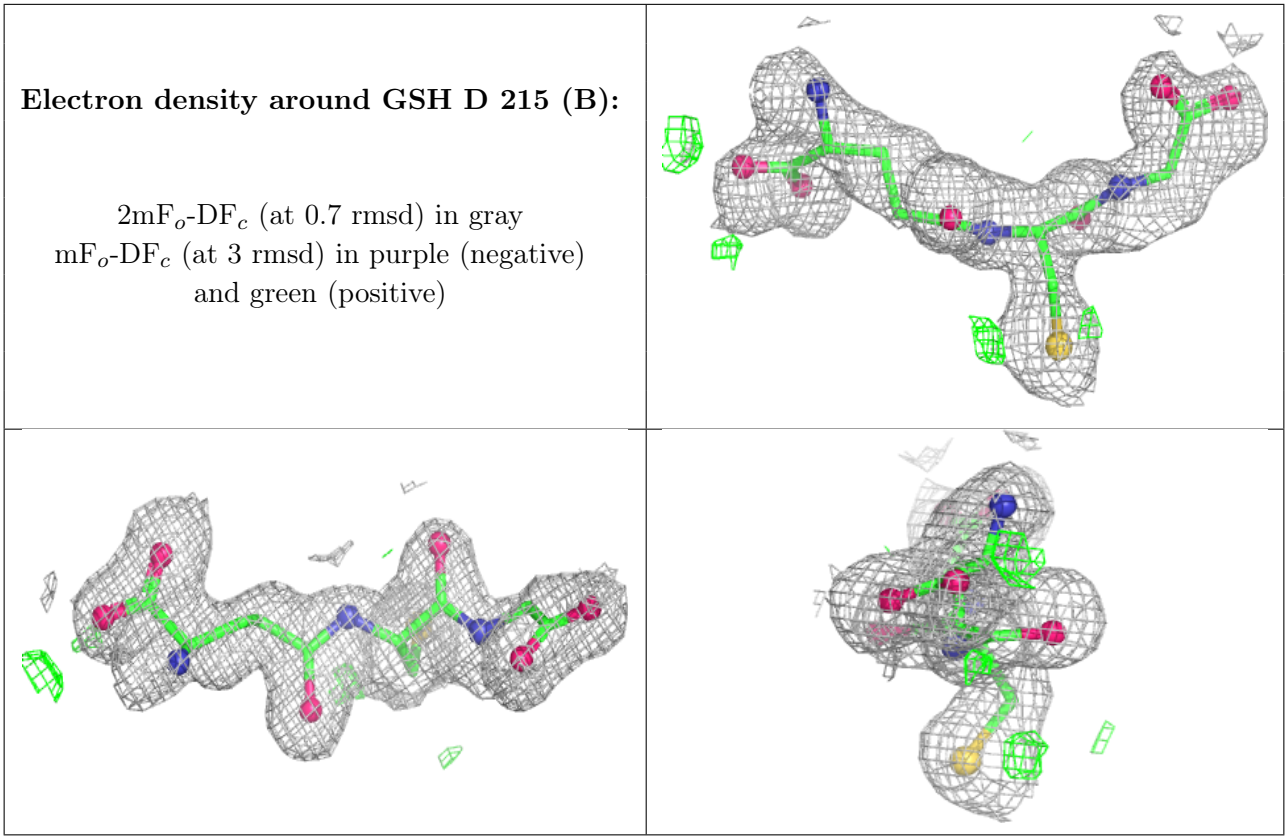
Electron density around GSH A 213 (B):

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



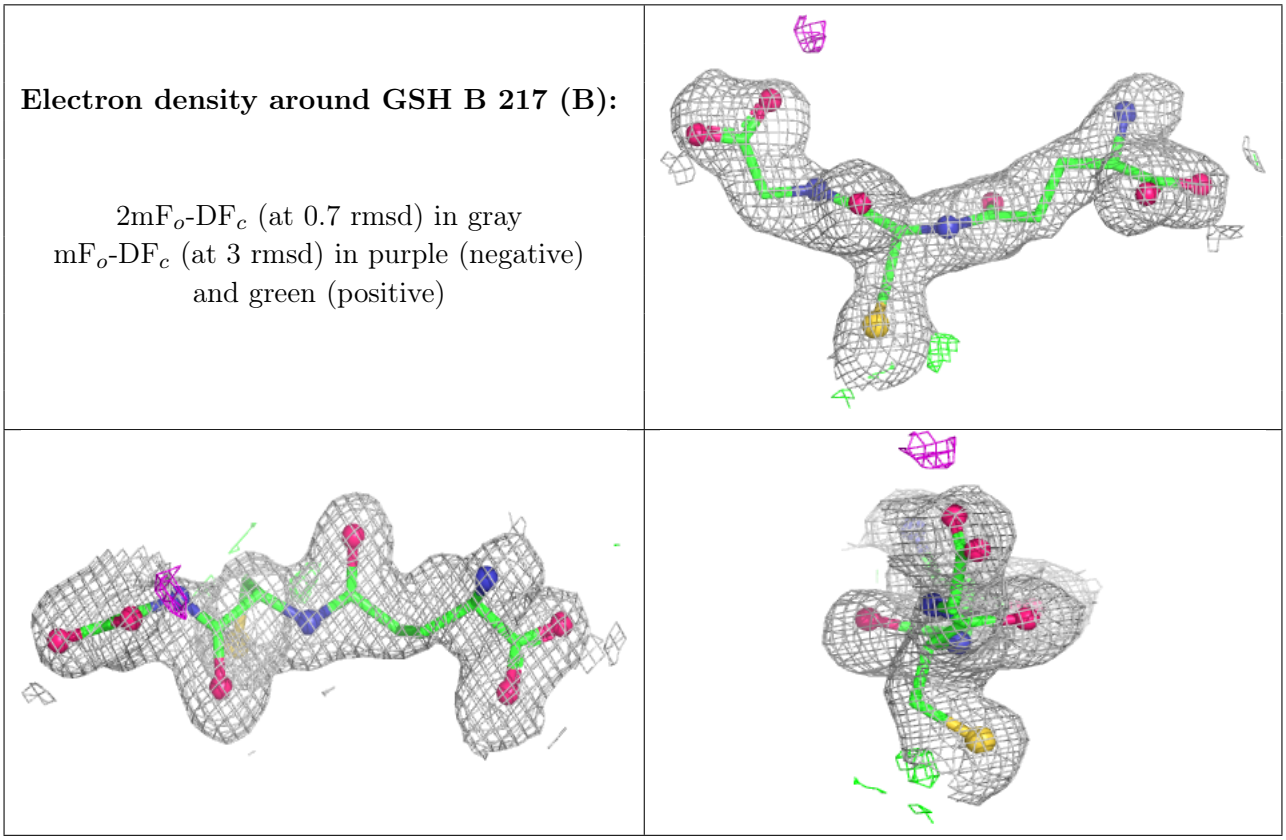
Electron density around GSH D 215 (B):

$2mF_o$-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 B 217 (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.