



Full wwPDB X-ray Structure Validation Report ⓘ

Jan 6, 2026 – 12:20 pm GMT

PDB ID : 9QD3 / pdb_00009qd3
Title : Gluthathion-S-Transferase StyI of *Gordonia rubripertincta* CWB2
Authors : Burnik, J.; Lienkamp, A.C.; Hofmann, E.; Tischler, D.
Deposited on : 2025-03-05
Resolution : 1.70 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 : ?? (??), CSD ??CSD?? (????)
Xtriage (Phenix) : 2.0
EDS : 3.0
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
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) : 2.47

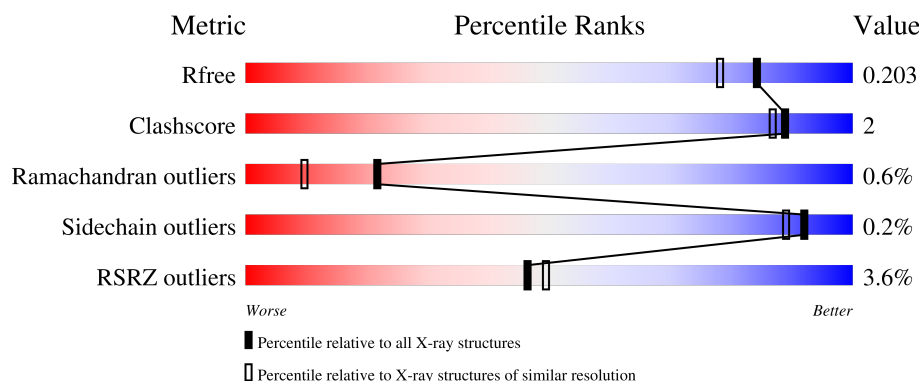
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.70 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}	164625	5161 (1.70-1.70)
Clashscore	180529	5671 (1.70-1.70)
Ramachandran outliers	177936	5594 (1.70-1.70)
Sidechain outliers	177891	5594 (1.70-1.70)
RSRZ outliers	164620	5159 (1.70-1.70)

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	259	% 89% 8%
1	B	259	4% 90% 8%
1	C	259	6% 88% 8%
1	D	259	3% 92% 5%

2 Entry composition [i](#)

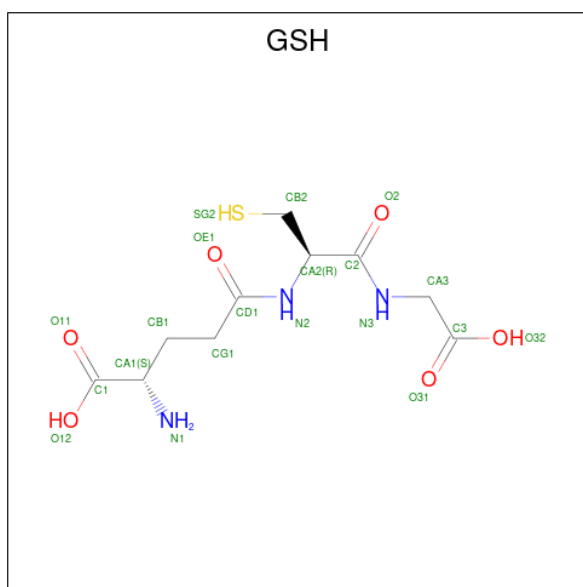
There are 4 unique types of molecules in this entry. The entry contains 16725 atoms, of which 7612 are hydrogens and 0 are deuteriums.

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 Gluthathion-S-Transferase StyI.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	239	Total	C	H	N	O	S	0	0	0
			3803	1229	1864	330	374	6			
1	C	239	Total	C	H	N	O	S	0	0	0
			3803	1229	1864	330	374	6			
1	B	239	Total	C	H	N	O	S	0	0	0
			3803	1229	1864	330	374	6			
1	D	251	Total	C	H	N	O	S	0	2	0
			4018	1302	1960	363	386	7			

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



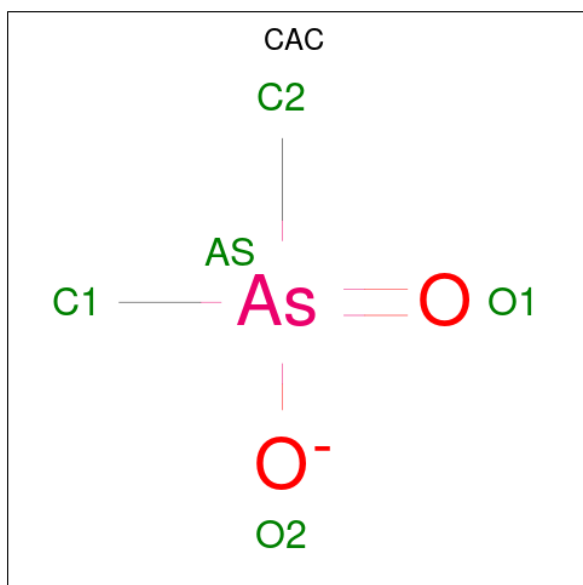
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
2	A	1	Total	C	H	N	O	S	0	0
			35	10	15	3	6	1		
2	C	1	Total	C	H	N	O	S	0	0
			35	10	15	3	6	1		

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Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
2	B	1	Total	C	H	N	O	S	0	0
			35	10	15	3	6	1		
2	D	1	Total	C	H	N	O	S	0	0
			35	10	15	3	6	1		

- Molecule 3 is CACODYLATE ION (CCD ID: CAC) (formula: $C_2H_6AsO_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	As	C	O	0	0
			5	1	2	2		
3	C	1	Total	As	C	O	0	0
			5	1	2	2		
3	B	1	Total	As	C	O	0	0
			5	1	2	2		
3	D	1	Total	As	C	O	0	0
			5	1	2	2		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	306	Total	O	0	0
			306	306		
4	C	223	Total	O	0	0
			223	223		
4	B	310	Total	O	0	0
			310	310		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	D	299	Total 299	O 299	0	0

4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	51.82Å 121.58Å 178.05Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.67 – 1.70 47.67 – 1.70	Depositor EDS
% Data completeness (in resolution range)	100.0 (47.67-1.70) 89.4 (47.67-1.70)	Depositor EDS
R_{merge}	0.21	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	0.80 (at 1.70Å)	Xtriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.177 , 0.202 0.177 , 0.203	Depositor DCC
R_{free} test set	6228 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	18.9	Xtriage
Anisotropy	0.255	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 32.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	16725	wwPDB-VP
Average B, all atoms (Å ²)	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.80% 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: CAC, 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	0.18	0/1986	0.33	0/2698
1	B	0.16	0/1986	0.36	1/2698 (0.0%)
1	C	0.16	0/1986	0.32	0/2698
1	D	0.19	0/2124	0.35	0/2882
All	All	0.17	0/8082	0.34	1/10976 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	154	GLU	N-CA-C	-7.25	99.16	109.96

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	1939	1864	1863	6	0
1	B	1939	1864	1863	4	0
1	C	1939	1864	1863	6	0
1	D	2058	1960	1945	9	0
2	A	20	15	15	0	0
2	B	20	15	15	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	20	15	15	1	0
2	D	20	15	15	1	0
3	A	5	0	0	2	0
3	B	5	0	0	3	0
3	C	5	0	0	3	0
3	D	5	0	0	2	0
4	A	306	0	0	1	0
4	B	310	0	0	0	0
4	C	223	0	0	0	0
4	D	299	0	0	2	0
All	All	9113	7612	7594	28	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 2.

All (28) 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:D:22:MET:HE3	1:D:56:GLU:HG2	1.77	0.66
1:A:136:TRP:HE1	3:A:302:CAC:C1	2.13	0.61
1:A:145:TYR:OH	3:A:302:CAC:C1	2.53	0.57
1:D:22:MET:HE3	1:D:56:GLU:CG	2.35	0.56
1:D:139:LYS:NZ	4:D:404:HOH:O	2.33	0.56
1:A:29:ILE:HG13	1:A:30:PRO:HD2	1.87	0.56
1:C:186:GLN:O	1:C:189:GLU:HG3	2.10	0.52
1:C:64:THR:HG23	1:C:68:ASP:OD2	2.12	0.49
1:A:211:ASP:OD1	4:A:401:HOH:O	2.20	0.49
1:B:153:VAL:HG12	1:B:154:GLU:O	2.13	0.49
2:B:301:GSH:SG2	3:B:302:CAC:C1	3.04	0.46
1:D:59:GLU:N	1:D:59:GLU:CD	2.73	0.45
1:D:29:ILE:HG13	1:D:30:PRO:HD2	1.98	0.45
1:B:38:SER:HA	3:B:302:CAC:C1	2.46	0.45
1:A:148:ILE:HD12	1:A:231:HIS:CE1	2.52	0.44
1:C:156:THR:OG1	1:C:158:GLU:OE1	2.33	0.44
2:D:301:GSH:SG2	3:D:302:CAC:C2	3.05	0.44
1:D:38:SER:HA	3:D:302:CAC:C2	2.49	0.43
2:C:301:GSH:SG2	3:C:302:CAC:C1	3.07	0.42
1:A:158:GLU:H	1:A:158:GLU:CD	2.28	0.42
1:D:211:ASP:OD1	4:D:401:HOH:O	2.21	0.42
1:C:38:SER:HA	3:C:302:CAC:C1	2.50	0.41
1:C:86:ASN:O	1:C:87:ASP:HB3	2.21	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:39:PRO:HD2	3:C:302:CAC:C1	2.51	0.41
1:B:86:ASN:O	1:B:87:ASP:HB3	2.20	0.41
1:B:39:PRO:HD2	3:B:302:CAC:C1	2.50	0.41
1:D:23:ILE:HD13	1:D:95:LEU:HD21	2.04	0.40
1:D:146:ILE:N	1:D:147:PRO:CD	2.84	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	237/259 (92%)	231 (98%)	5 (2%)	1 (0%)	30	17
1	B	237/259 (92%)	228 (96%)	7 (3%)	2 (1%)	16	5
1	C	237/259 (92%)	230 (97%)	5 (2%)	2 (1%)	16	5
1	D	248/259 (96%)	240 (97%)	7 (3%)	1 (0%)	30	17
All	All	959/1036 (93%)	929 (97%)	24 (2%)	6 (1%)	22	10

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	151	PRO
1	A	87	ASP
1	C	87	ASP
1	B	87	ASP
1	D	87	ASP
1	B	155	VAL

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	205/222 (92%)	205 (100%)	0	100	100
1	B	205/222 (92%)	205 (100%)	0	100	100
1	C	205/222 (92%)	204 (100%)	1 (0%)	86	82
1	D	218/222 (98%)	217 (100%)	1 (0%)	86	82
All	All	833/888 (94%)	831 (100%)	2 (0%)	92	89

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	21	HIS
1	D	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	53	GLN
1	B	244	GLN

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 ⓘ

8 ligands are modelled in this entry.

There are no bond length outliers.

There are no bond angle outliers.

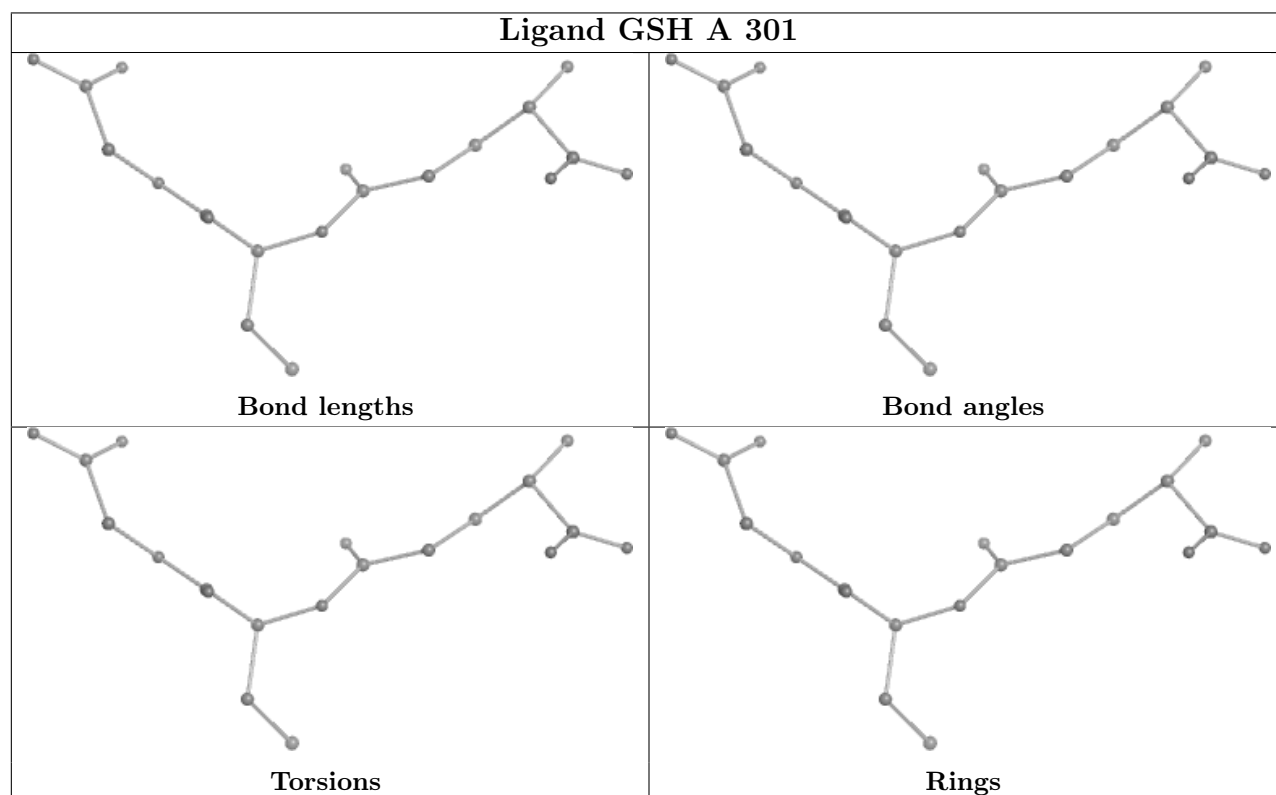
There are no chirality outliers.

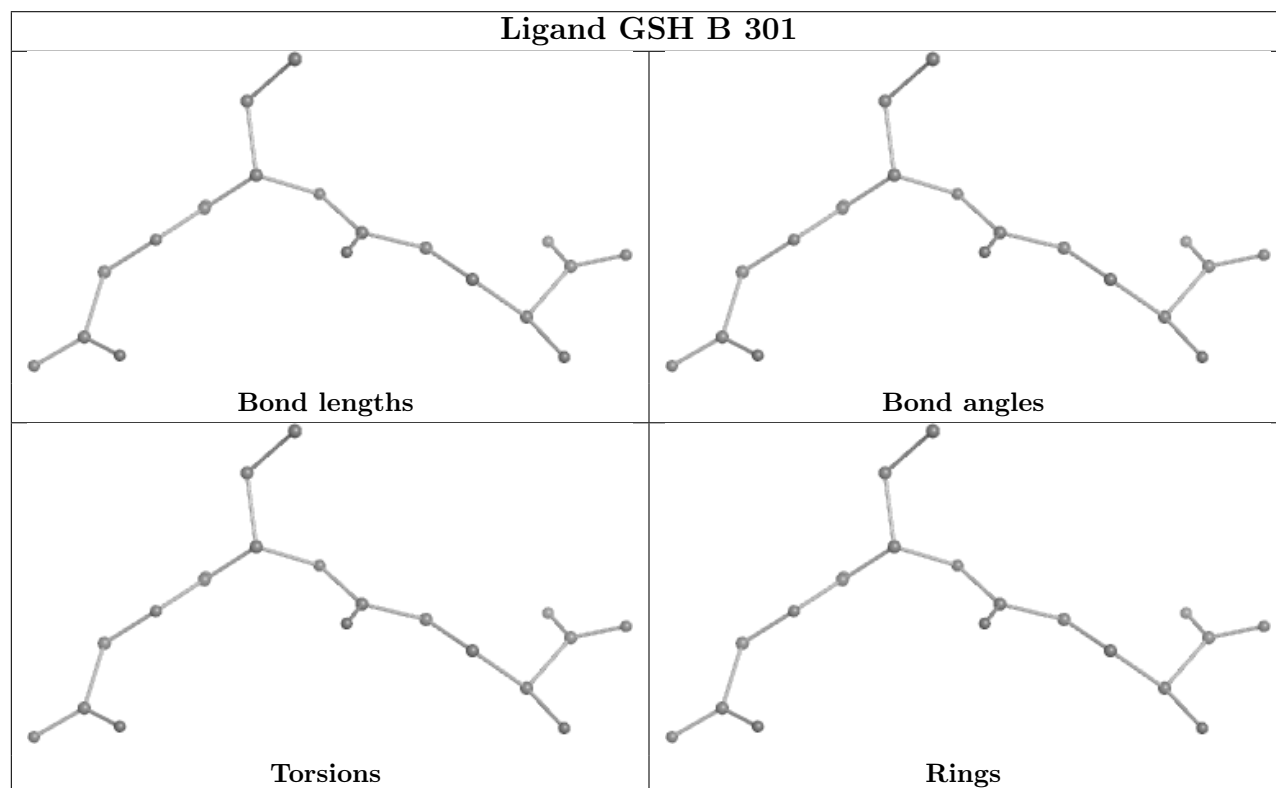
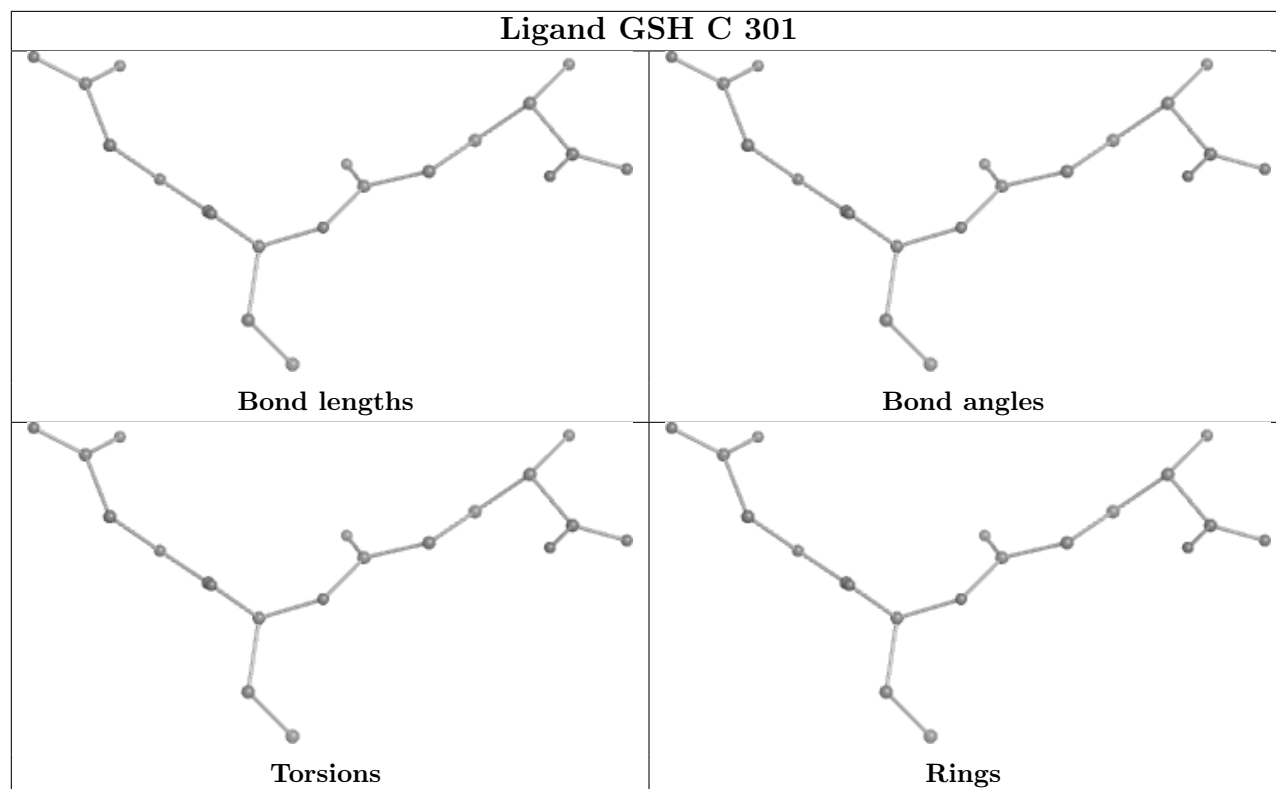
There are no torsion outliers.

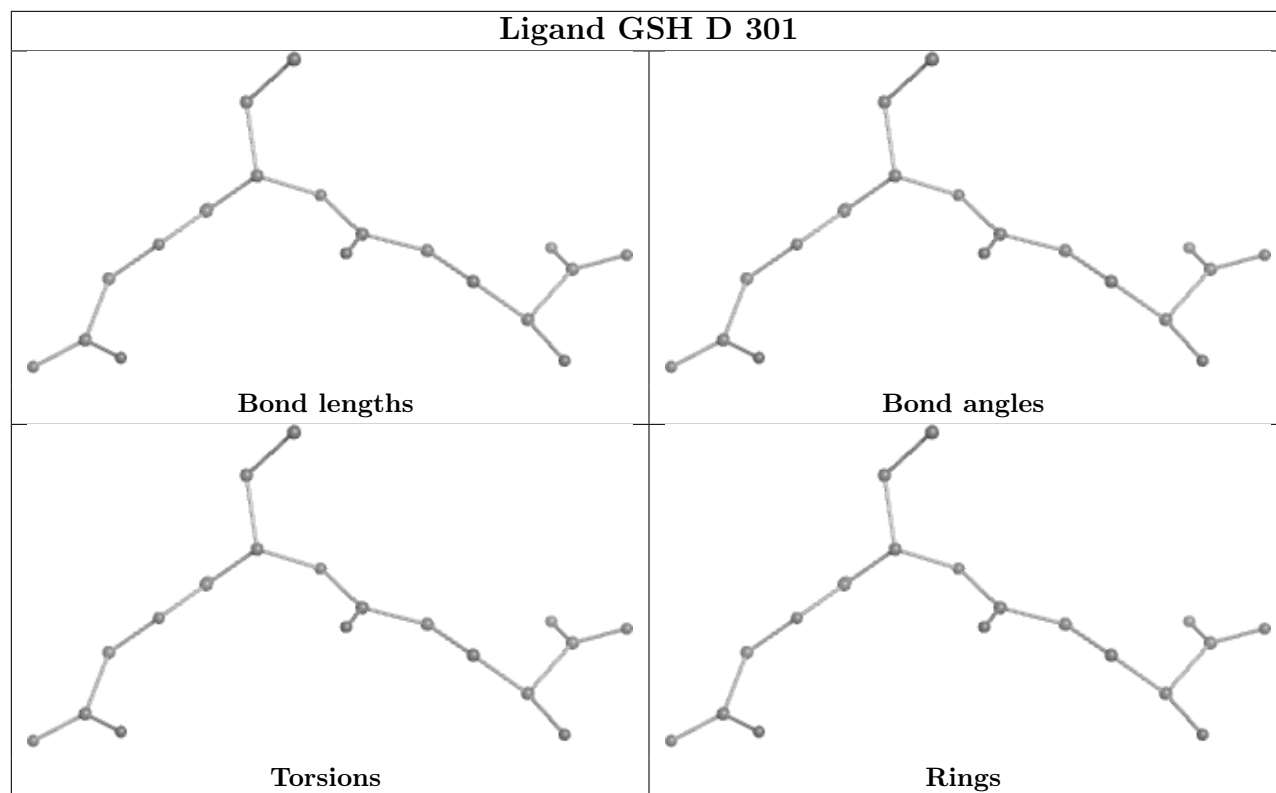
There are no ring outliers.

No monomer is involved in short contacts.

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

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, 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	239/259 (92%)	-0.41	2 (0%) 82 85	17, 24, 38, 76	0
1	B	239/259 (92%)	-0.18	11 (4%) 38 41	19, 27, 50, 98	0
1	C	239/259 (92%)	-0.01	15 (6%) 27 28	19, 28, 57, 92	0
1	D	251/259 (96%)	-0.35	7 (2%) 55 58	12, 23, 42, 91	1 (0%)
All	All	968/1036 (93%)	-0.24	35 (3%) 46 49	12, 26, 47, 98	1 (0%)

All (35) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	21	HIS	5.3
1	B	155	VAL	4.5
1	B	153	VAL	4.4
1	C	155	VAL	4.2
1	C	21	HIS	4.2
1	D	21	HIS	4.0
1	B	21	HIS	3.9
1	D	1	MET	3.8
1	D	11	HIS	3.5
1	C	152	GLY	3.4
1	D	12	HIS	2.9
1	C	22	MET	2.7
1	C	153	VAL	2.7
1	C	151	PRO	2.6
1	C	150	ALA	2.6
1	B	159	LEU	2.6
1	C	162	PHE	2.5
1	C	102	LYS	2.5
1	B	156	THR	2.5
1	D	2	GLY	2.4
1	C	159	LEU	2.4

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Mol	Chain	Res	Type	RSRZ
1	B	152	GLY	2.3
1	D	97	GLU	2.3
1	B	157	PRO	2.2
1	C	154	GLU	2.2
1	C	160	ALA	2.2
1	D	22	MET	2.1
1	A	255	GLU	2.1
1	B	189	GLU	2.1
1	B	158	GLU	2.1
1	B	204	GLU	2.1
1	C	157	PRO	2.1
1	C	23	ILE	2.0
1	B	160	ALA	2.0
1	C	211	ASP	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](#)

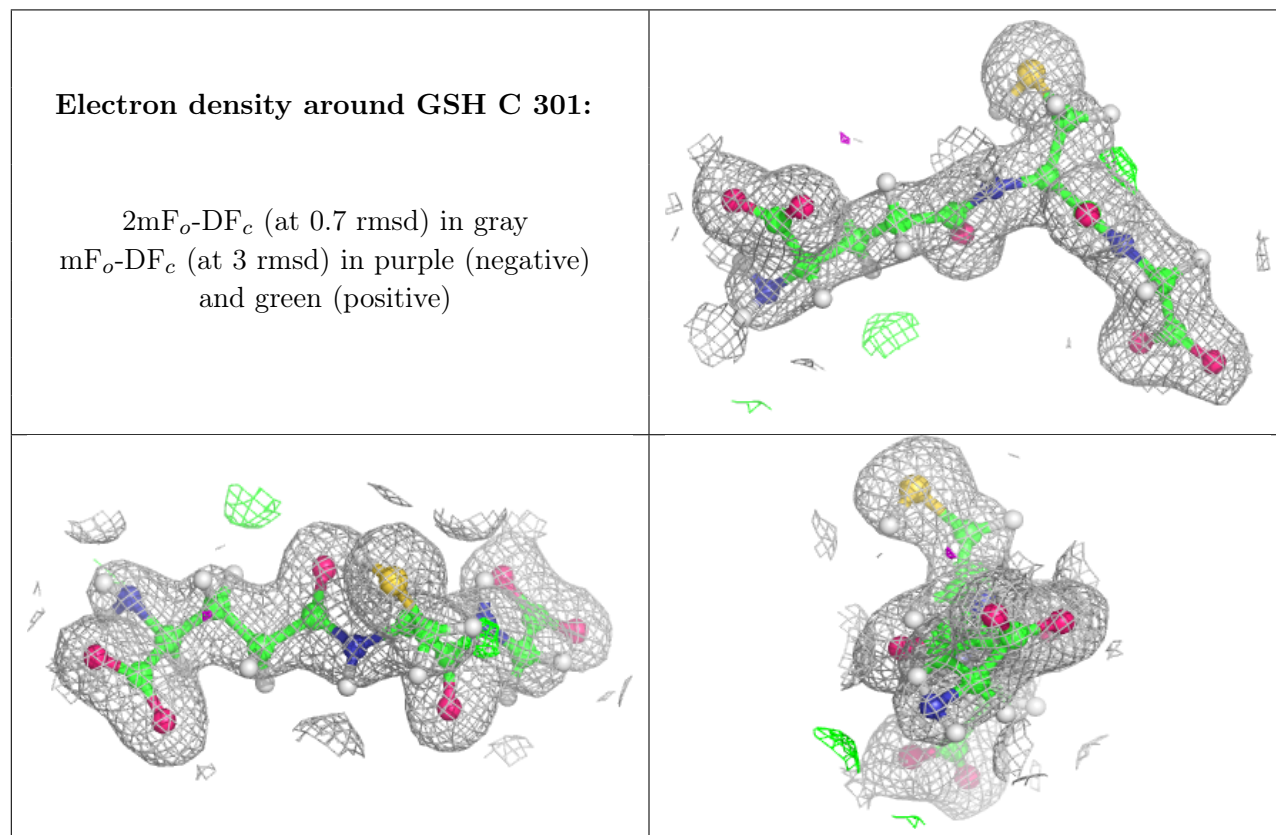
There are no oligosaccharides in this entry.

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.

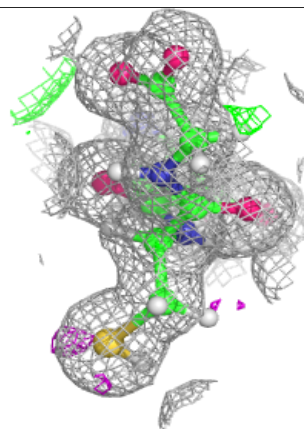
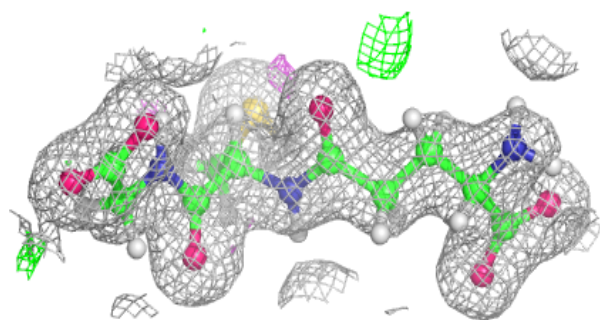
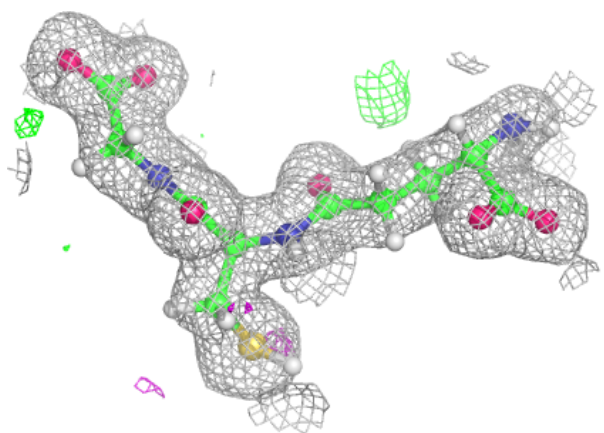
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	GSH	C	301	20/20	0.97	0.06	18,23,28,29	0
2	GSH	A	301	20/20	0.98	0.04	15,20,23,26	0
2	GSH	B	301	20/20	0.98	0.05	16,21,25,26	0
2	GSH	D	301	20/20	0.98	0.04	15,18,22,24	0
3	CAC	A	302	5/5	0.99	0.06	13,21,24,28	0
3	CAC	C	302	5/5	0.99	0.07	22,23,28,28	0
3	CAC	B	302	5/5	0.99	0.06	18,22,27,28	0
3	CAC	D	302	5/5	0.99	0.06	17,20,22,27	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.



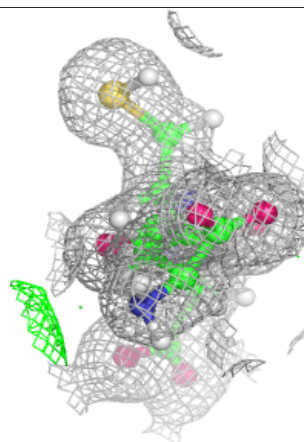
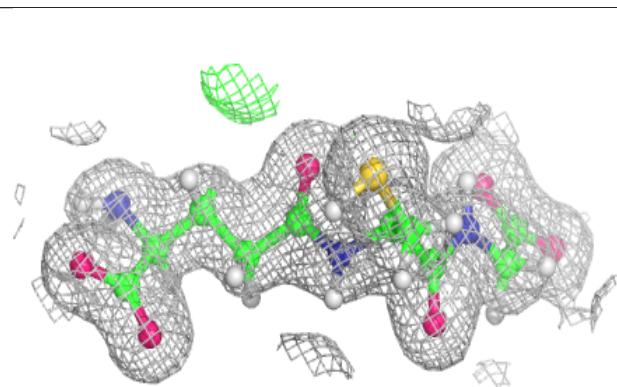
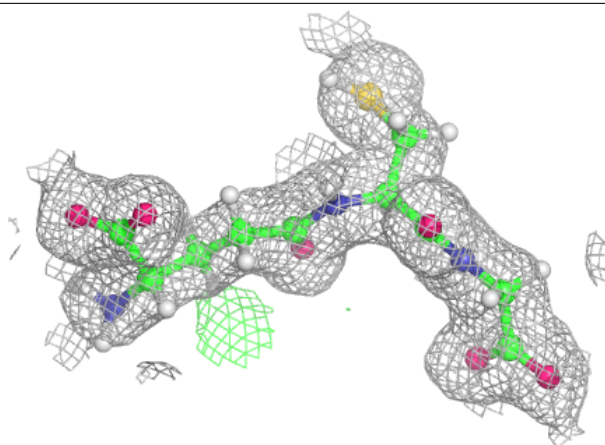
Electron density around GSH A 301:

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



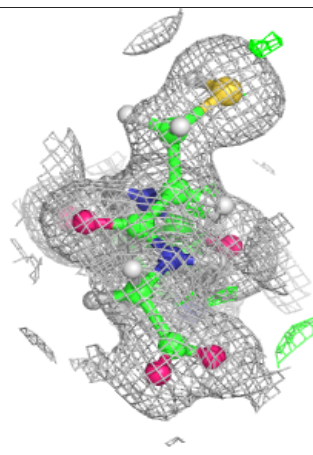
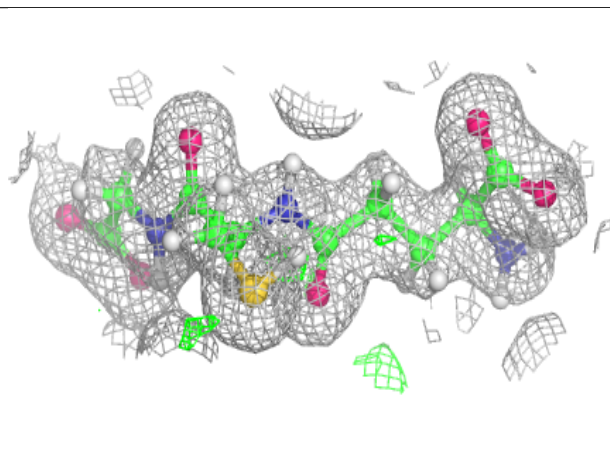
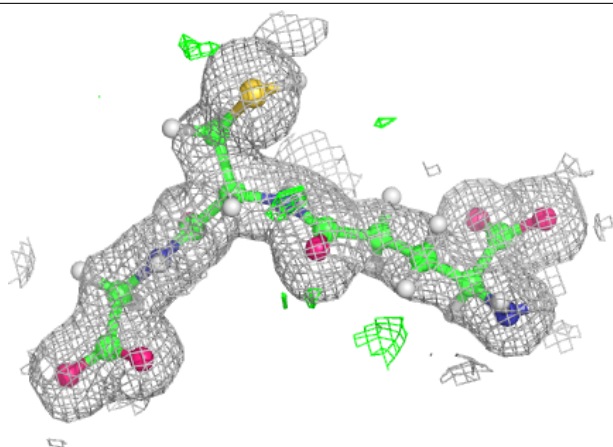
Electron density around GSH B 301:

$2mF_o-DF_c$ (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:

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



6.5 Other polymers ⓘ

There are no such residues in this entry.