



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 14, 2026 – 09:52 PM UTC

PDB ID : 6SSS / pdb_00006sss
Title : Crystal structure of Human Microsomal Glutathione S-Transferase 2
Authors : Thulasingham, M.; Nji, E.; Haeggstrom, J.Z.
Deposited on : 2019-09-09
Resolution : 2.50 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

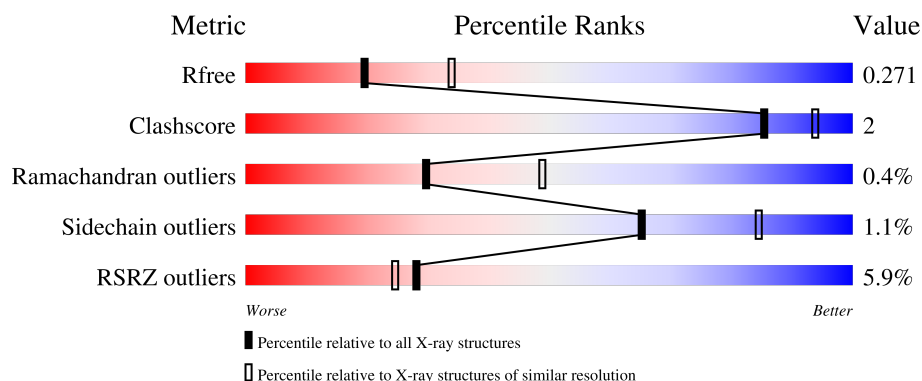
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 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	5829 (2.50-2.50)
Clashscore	190562	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)
RSRZ outliers	180081	5833 (2.50-2.50)

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	153	7% 84% 5% 11%
1	B	153	3% 80% 5% 15%
1	C	153	7% 86% • 13%
1	D	153	4% 76% 7% 16%
1	E	153	6% 73% 11% • 15%

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Mol	Chain	Length	Quality of chain
1	F	153	3% 78% 5% 16%

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 12743 atoms, of which 6338 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 Microsomal glutathione S-transferase 2.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	136	Total	C	H	N	O	S	0	2	0
			2153	716	1075	175	183	4			
1	B	130	Total	C	H	N	O	S	0	0	0
			2042	682	1023	165	168	4			
1	C	133	Total	C	H	N	O	S	0	0	0
			2114	700	1064	169	177	4			
1	D	128	Total	C	H	N	O	S	0	3	0
			2032	675	1017	167	169	4			
1	E	130	Total	C	H	N	O	S	0	3	0
			2061	683	1028	170	176	4			
1	F	129	Total	C	H	N	O	S	0	0	0
			2043	680	1025	165	169	4			

There are 42 discrepancies between the modelled and reference sequences:

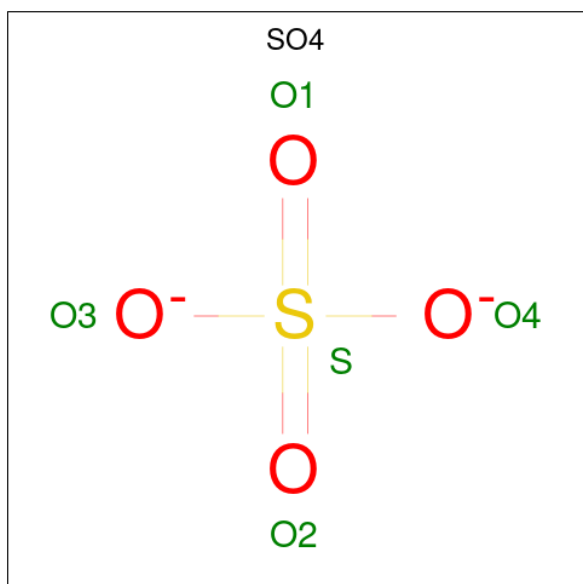
Chain	Residue	Modelled	Actual	Comment	Reference
A	-5	MET	-	initiating methionine	UNP Q99735
A	-4	HIS	-	expression tag	UNP Q99735
A	-3	HIS	-	expression tag	UNP Q99735
A	-2	HIS	-	expression tag	UNP Q99735
A	-1	HIS	-	expression tag	UNP Q99735
A	0	HIS	-	expression tag	UNP Q99735
A	1	HIS	-	expression tag	UNP Q99735
B	-5	MET	-	initiating methionine	UNP Q99735
B	-4	HIS	-	expression tag	UNP Q99735
B	-3	HIS	-	expression tag	UNP Q99735
B	-2	HIS	-	expression tag	UNP Q99735
B	-1	HIS	-	expression tag	UNP Q99735
B	0	HIS	-	expression tag	UNP Q99735
B	1	HIS	-	expression tag	UNP Q99735
C	-5	MET	-	initiating methionine	UNP Q99735
C	-4	HIS	-	expression tag	UNP Q99735
C	-3	HIS	-	expression tag	UNP Q99735

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Chain	Residue	Modelled	Actual	Comment	Reference
C	-2	HIS	-	expression tag	UNP Q99735
C	-1	HIS	-	expression tag	UNP Q99735
C	0	HIS	-	expression tag	UNP Q99735
C	1	HIS	-	expression tag	UNP Q99735
D	-5	MET	-	initiating methionine	UNP Q99735
D	-4	HIS	-	expression tag	UNP Q99735
D	-3	HIS	-	expression tag	UNP Q99735
D	-2	HIS	-	expression tag	UNP Q99735
D	-1	HIS	-	expression tag	UNP Q99735
D	0	HIS	-	expression tag	UNP Q99735
D	1	HIS	-	expression tag	UNP Q99735
E	-5	MET	-	initiating methionine	UNP Q99735
E	-4	HIS	-	expression tag	UNP Q99735
E	-3	HIS	-	expression tag	UNP Q99735
E	-2	HIS	-	expression tag	UNP Q99735
E	-1	HIS	-	expression tag	UNP Q99735
E	0	HIS	-	expression tag	UNP Q99735
E	1	HIS	-	expression tag	UNP Q99735
F	-5	MET	-	initiating methionine	UNP Q99735
F	-4	HIS	-	expression tag	UNP Q99735
F	-3	HIS	-	expression tag	UNP Q99735
F	-2	HIS	-	expression tag	UNP Q99735
F	-1	HIS	-	expression tag	UNP Q99735
F	0	HIS	-	expression tag	UNP Q99735
F	1	HIS	-	expression tag	UNP Q99735

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O₄S).

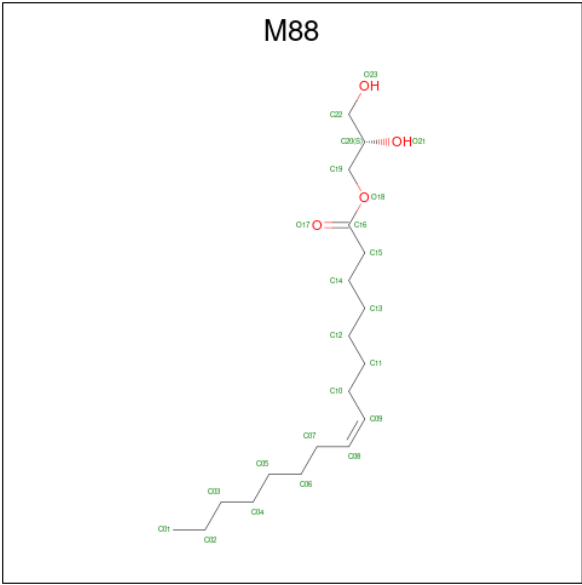


Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total O S 5 4 1	0	0
2	B	1	Total O S 5 4 1	0	0
2	C	1	Total O S 5 4 1	0	0
2	D	1	Total O S 5 4 1	0	0
2	E	1	Total O S 5 4 1	0	0
2	F	1	Total O S 5 4 1	0	0

- Molecule 3 is SODIUM ION (CCD ID: NA) (formula: Na).

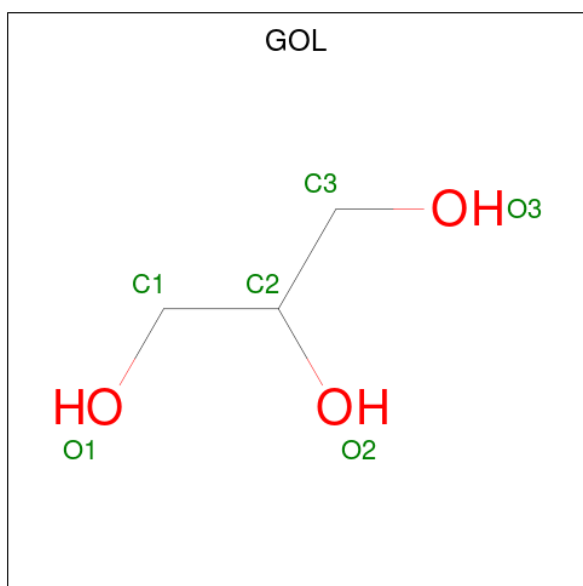
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Na 1 1	0	0
3	C	1	Total Na 1 1	0	0
3	D	1	Total Na 1 1	0	0
3	E	1	Total Na 1 1	0	0
3	F	1	Total Na 1 1	0	0

- Molecule 4 is 1-(8Z-hexadecenoyl)-sn-glycerol (CCD ID: M88) (formula: C₁₉H₃₆O₄).



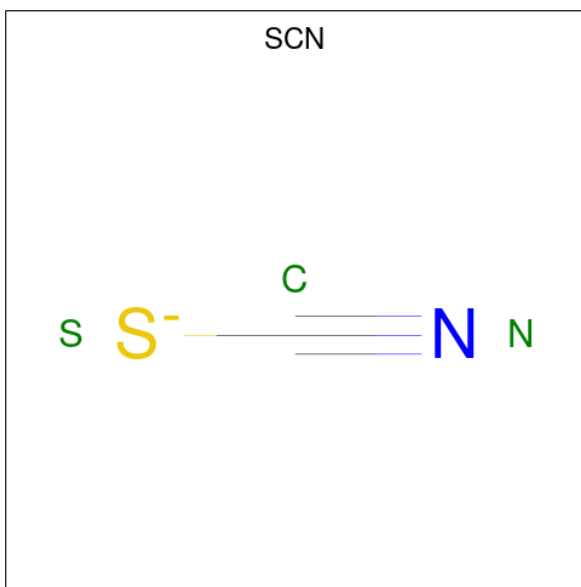
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	B	1	Total	C	H	O	0	0
			28	9	15	4		
4	B	1	Total	C	H	O	0	0
			39	13	22	4		
4	B	1	Total	C	H	O	0	0
			39	13	22	4		
4	B	1	Total	C	H		0	0
			15	6	9			
4	F	1	Total	C	H	O	0	0
			39	13	22	4		

- Molecule 5 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	C	1	Total	C	H	O	0	0
			14	3	8	3		
5	E	1	Total	C	H	O	0	0
			14	3	8	3		

- Molecule 6 is THIOCYANATE ION (CCD ID: SCN) (formula: CNS).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	E	1	Total	C	N	S	0	0
			3	1	1	1		

- Molecule 7 is POTASSIUM ION (CCD ID: K) (formula: K).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	E	1	Total	K	0	0
			1	1		

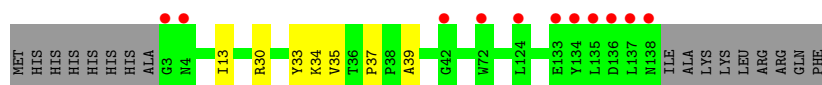
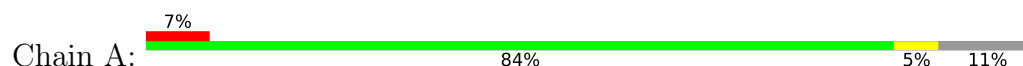
- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	18	Total	O	0	0
			18	18		
8	B	6	Total	O	0	0
			6	6		
8	C	13	Total	O	0	0
			13	13		
8	D	11	Total	O	0	0
			11	11		
8	E	13	Total	O	0	0
			13	13		
8	F	10	Total	O	0	0
			10	10		

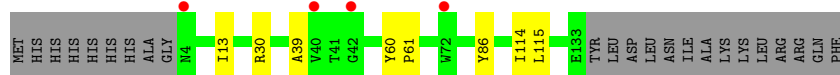
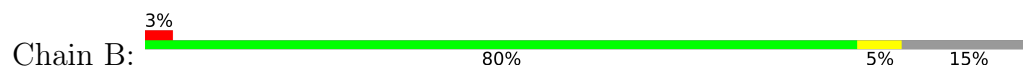
3 Residue-property plots [i](#)

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.

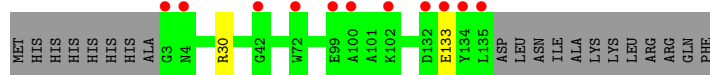
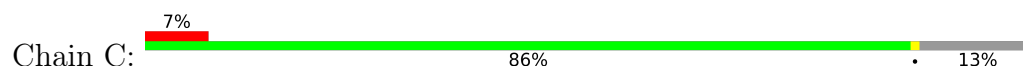
- Molecule 1: Microsomal glutathione S-transferase 2



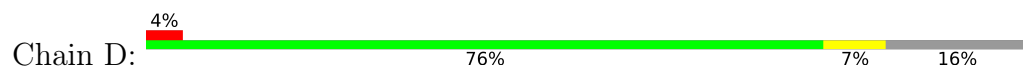
- Molecule 1: Microsomal glutathione S-transferase 2



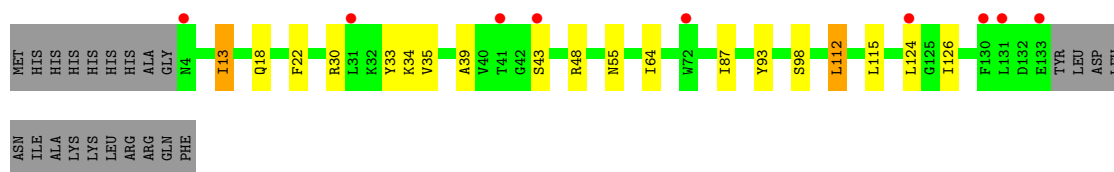
- Molecule 1: Microsomal glutathione S-transferase 2



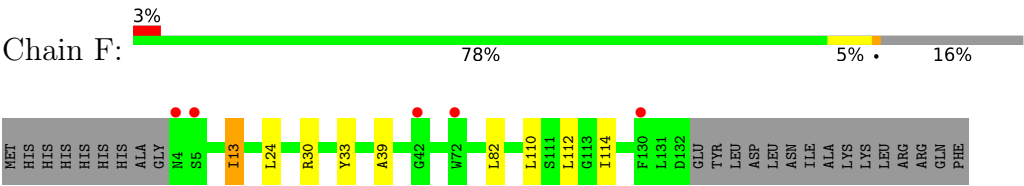
- Molecule 1: Microsomal glutathione S-transferase 2



- Molecule 1: Microsomal glutathione S-transferase 2



● Molecule 1: Microsomal glutathione S-transferase 2



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	54.89Å 72.16Å 72.69Å 67.93° 86.71° 86.86°	Depositor
Resolution (Å)	43.33 – 2.50 43.33 – 2.50	Depositor EDS
% Data completeness (in resolution range)	98.2 (43.33-2.50) 98.3 (43.33-2.50)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.30 (at 2.51Å)	Xtriage
Refinement program	PHENIX 1.9_1683	Depositor
R, R_{free}	0.218 , 0.267 0.225 , 0.271	Depositor DCC
R_{free} test set	1758 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	43.0	Xtriage
Anisotropy	0.442	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 51.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.35$	Xtriage
Estimated twinning fraction	0.000 for -h,-l,-k	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	12743	wwPDB-VP
Average B, all atoms (Å ²)	54.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.14% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: K, M88, SO4, SCN, NA, 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	0.41	0/1115	0.72	0/1515
1	B	0.41	0/1047	0.69	0/1424
1	C	0.40	0/1078	0.74	1/1463 (0.1%)
1	D	0.42	0/1059	0.73	0/1441
1	E	0.41	0/1066	0.76	0/1450
1	F	0.42	0/1046	0.74	1/1422 (0.1%)
All	All	0.41	0/6411	0.73	2/8715 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	F	33	TYR	N-CA-C	-6.32	100.63	110.17
1	C	133	GLU	N-CA-C	-5.77	104.95	112.23

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	1078	1075	1068	3	0
1	B	1019	1023	1023	3	0
1	C	1050	1064	1064	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	D	1015	1017	998	7	0
1	E	1033	1028	1022	13	0
1	F	1018	1025	1025	6	0
2	A	5	0	0	0	0
2	B	5	0	0	1	0
2	C	5	0	0	0	0
2	D	5	0	0	1	0
2	E	5	0	0	1	0
2	F	5	0	0	0	0
3	A	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
3	E	1	0	0	0	0
3	F	1	0	0	0	0
4	B	53	68	0	1	0
4	F	17	22	0	0	0
5	C	6	8	8	0	0
5	E	6	8	8	0	0
6	E	3	0	0	0	0
7	E	1	0	0	0	0
8	A	18	0	0	0	0
8	B	6	0	0	0	0
8	C	13	0	0	0	1
8	D	11	0	0	0	0
8	E	13	0	0	0	1
8	F	10	0	0	0	0
All	All	6405	6338	6216	28	1

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:E:30:ARG:NH2	1:E:39:ALA:O	2.12	0.82
1:E:55[B]:ASN:ND2	2:E:201:SO4:O4	2.19	0.75
1:E:48:ARG:NH1	1:E:98:SER:O	2.21	0.73
1:A:30:ARG:NH2	1:A:39:ALA:O	2.22	0.73
1:F:110:LEU:O	1:F:114:ILE:HD12	2.02	0.59
1:E:33:TYR:HB3	1:E:43:SER:CB	2.39	0.52
1:B:86:TYR:HB2	1:B:114:ILE:HG21	1.95	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:201:SO4:O3	1:C:30:ARG:NH2	2.45	0.49
1:D:60:TYR:HB3	1:D:61:PRO:HD3	1.94	0.49
1:B:30:ARG:NH1	1:B:39:ALA:O	2.43	0.48
1:D:104:ARG:NE	2:D:201:SO4:O1	2.47	0.47
1:D:126:ILE:HD12	1:E:13:ILE:HD12	1.97	0.47
4:B:202:M88:C13	1:E:124:LEU:HD23	2.45	0.47
1:F:30:ARG:NH1	1:F:39:ALA:O	2.47	0.46
1:A:33:TYR:O	1:A:35:VAL:N	2.49	0.46
1:D:33:TYR:O	1:D:35:VAL:HG23	2.17	0.45
1:E:55[B]:ASN:OD1	1:E:93:TYR:OH	2.33	0.45
1:E:126:ILE:HD12	1:F:13:ILE:HD12	1.98	0.45
1:E:33:TYR:O	1:E:35:VAL:N	2.50	0.44
1:F:82:LEU:HB3	1:F:114:ILE:HG23	1.99	0.44
1:D:24:LEU:HD21	1:F:112:LEU:HD21	2.00	0.43
1:B:60:TYR:HB3	1:B:61:PRO:HD3	2.00	0.42
1:E:18:GLN:OE1	1:E:87:ILE:HG23	2.20	0.42
1:E:112:LEU:HD21	1:F:24:LEU:HD21	2.01	0.42
1:A:30:ARG:HD3	1:A:37:PRO:HG3	2.01	0.41
1:D:14:LEU:HD22	1:D:87:ILE:HD13	2.02	0.41
1:E:18:GLN:HE21	1:E:22:PHE:HZ	1.67	0.41
1:D:65:ILE:HD11	1:E:64:ILE:HG13	2.03	0.41

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
8:C:309:HOH:O	8:E:308:HOH:O[1_546]	2.13	0.07

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	136/153 (89%)	130 (96%)	5 (4%)	1 (1%)	18	34
1	B	128/153 (84%)	125 (98%)	3 (2%)	0	100	100
1	C	131/153 (86%)	127 (97%)	4 (3%)	0	100	100
1	D	129/153 (84%)	124 (96%)	4 (3%)	1 (1%)	16	31
1	E	131/153 (86%)	126 (96%)	4 (3%)	1 (1%)	16	31
1	F	127/153 (83%)	123 (97%)	4 (3%)	0	100	100
All	All	782/918 (85%)	755 (96%)	24 (3%)	3 (0%)	30	49

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	34	LYS
1	D	34	LYS
1	E	34	LYS

5.3.2 Protein sidechains ⓘ

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	109/126 (86%)	108 (99%)	1 (1%)	70	87
1	B	100/126 (79%)	98 (98%)	2 (2%)	48	75
1	C	107/126 (85%)	107 (100%)	0	100	100
1	D	103/126 (82%)	103 (100%)	0	100	100
1	E	104/126 (82%)	101 (97%)	3 (3%)	37	65
1	F	101/126 (80%)	100 (99%)	1 (1%)	68	86
All	All	624/756 (82%)	617 (99%)	7 (1%)	65	84

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	13	ILE
1	B	13	ILE

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Mol	Chain	Res	Type
1	B	115	LEU
1	E	13	ILE
1	E	112	LEU
1	E	115	LEU
1	F	13	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	91	HIS
1	C	18	GLN
1	C	25	GLN
1	C	91	HIS
1	E	4	ASN
1	E	76	GLN
1	E	91	HIS

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, 6 are monoatomic - leaving 14 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
2	SO4	D	201	-	4,4,4	0.24	0	6,6,6	0.23	0
4	M88	B	204	-	16,16,22	0.87	1 (6%)	17,17,23	0.81	1 (5%)
5	GOL	E	203	-	5,5,5	0.43	0	5,5,5	0.25	0
2	SO4	C	201	-	4,4,4	0.24	0	6,6,6	0.17	0
5	GOL	C	203	-	5,5,5	0.40	0	5,5,5	0.21	0
4	M88	B	205	-	5,5,22	0.14	0	4,4,23	0.21	0
2	SO4	A	201	-	4,4,4	0.24	0	6,6,6	0.16	0
4	M88	F	202	-	16,16,22	0.87	1 (6%)	17,17,23	0.97	1 (5%)
6	SCN	E	204	-	1,2,2	0.82	0	0,1,1	-	-
2	SO4	F	201	-	4,4,4	0.25	0	6,6,6	0.14	0
4	M88	B	202	-	12,12,22	0.94	1 (8%)	13,13,23	0.95	1 (7%)
2	SO4	B	201	-	4,4,4	0.22	0	6,6,6	0.18	0
2	SO4	E	201	-	4,4,4	0.25	0	6,6,6	0.22	0
4	M88	B	203	-	16,16,22	0.85	1 (6%)	17,17,23	0.90	1 (5%)

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
4	M88	B	204	-	-	8/16/16/22	-
5	GOL	E	203	-	-	2/4/4/4	-
5	GOL	C	203	-	-	2/4/4/4	-
4	M88	F	202	-	-	4/16/16/22	-
4	M88	B	202	-	-	4/12/12/22	-
4	M88	B	205	-	-	1/3/3/22	-
4	M88	B	203	-	-	4/16/16/22	-

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	F	202	M88	O18-C16	2.80	1.41	1.33
4	B	204	M88	O18-C16	2.76	1.41	1.33
4	B	203	M88	O18-C16	2.67	1.41	1.33
4	B	202	M88	O18-C16	2.62	1.41	1.33

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	F	202	M88	O18-C16-C15	2.81	120.40	111.83
4	B	203	M88	O18-C16-C15	2.62	119.83	111.83
4	B	202	M88	O18-C16-C15	2.50	119.46	111.83
4	B	204	M88	O18-C16-C15	2.05	118.07	111.83

There are no chirality outliers.

All (25) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	E	203	GOL	O1-C1-C2-C3
4	B	204	M88	O18-C19-C20-O21
4	B	203	M88	C15-C16-O18-C19
4	B	204	M88	C15-C16-O18-C19
4	F	202	M88	C15-C16-O18-C19
4	B	204	M88	O17-C16-O18-C19
4	F	202	M88	O17-C16-O18-C19
4	B	203	M88	O17-C16-O18-C19
4	B	202	M88	C19-C20-C22-O23
5	E	203	GOL	O1-C1-C2-O2
4	B	204	M88	C11-C12-C13-C14
4	B	203	M88	C13-C14-C15-C16
4	F	202	M88	C13-C14-C15-C16
4	B	202	M88	O21-C20-C22-O23
5	C	203	GOL	O1-C1-C2-O2
5	C	203	GOL	O1-C1-C2-C3
4	B	204	M88	C12-C13-C14-C15
4	B	204	M88	C10-C11-C12-C13
4	B	202	M88	O17-C16-O18-C19
4	B	204	M88	O18-C19-C20-C22
4	B	202	M88	C15-C16-O18-C19
4	F	202	M88	C08-C09-C10-C11
4	B	204	M88	C08-C09-C10-C11
4	B	203	M88	C09-C10-C11-C12
4	B	205	M88	C12-C13-C14-C15

There are no ring outliers.

4 monomers are involved in 4 short contacts:

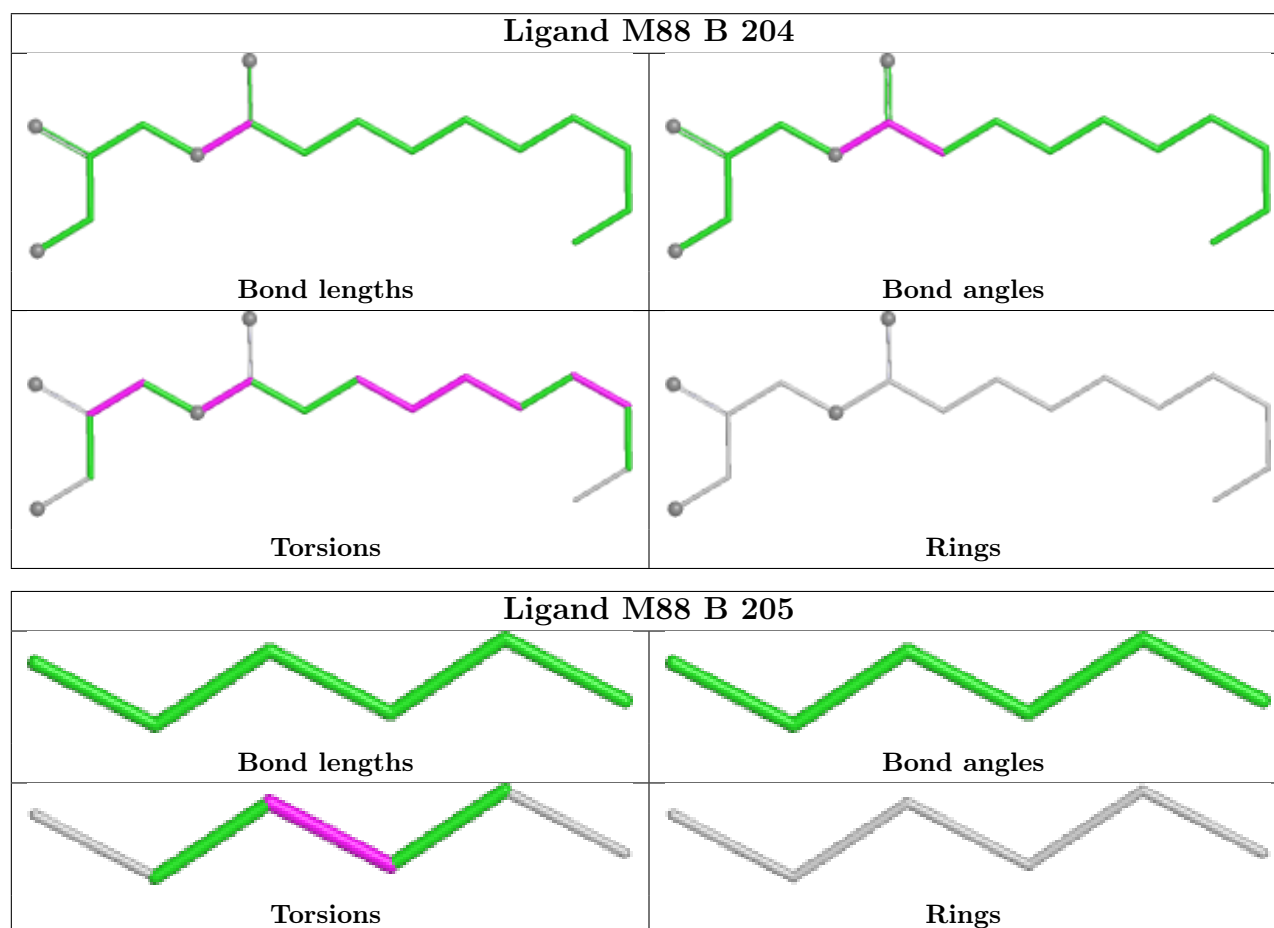
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	D	201	SO4	1	0
4	B	202	M88	1	0
2	B	201	SO4	1	0

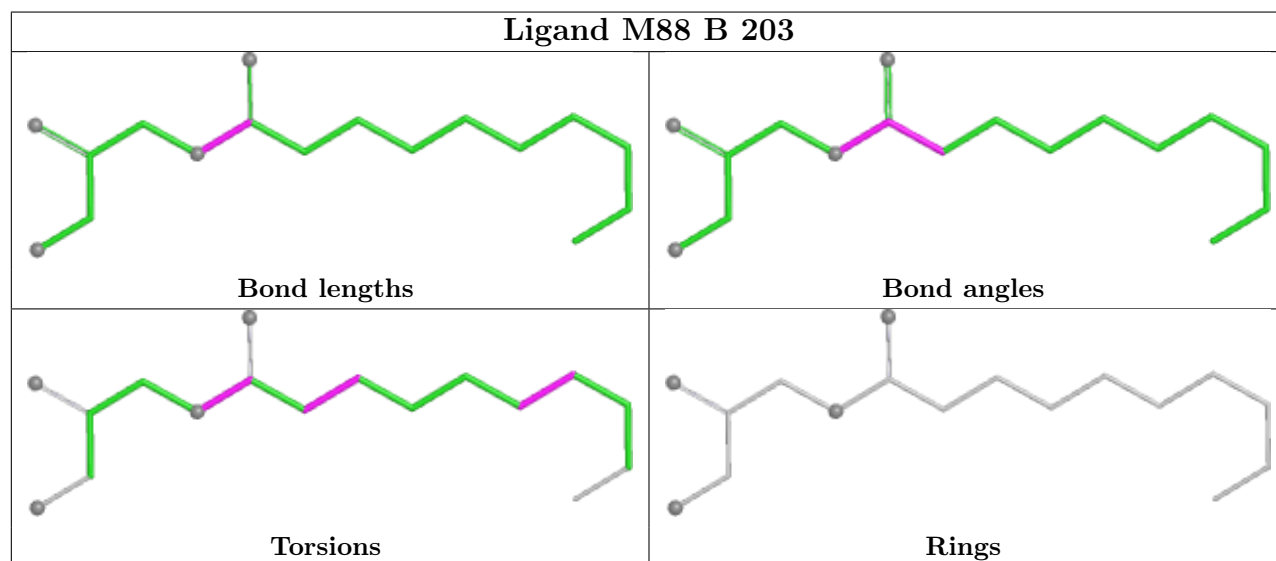
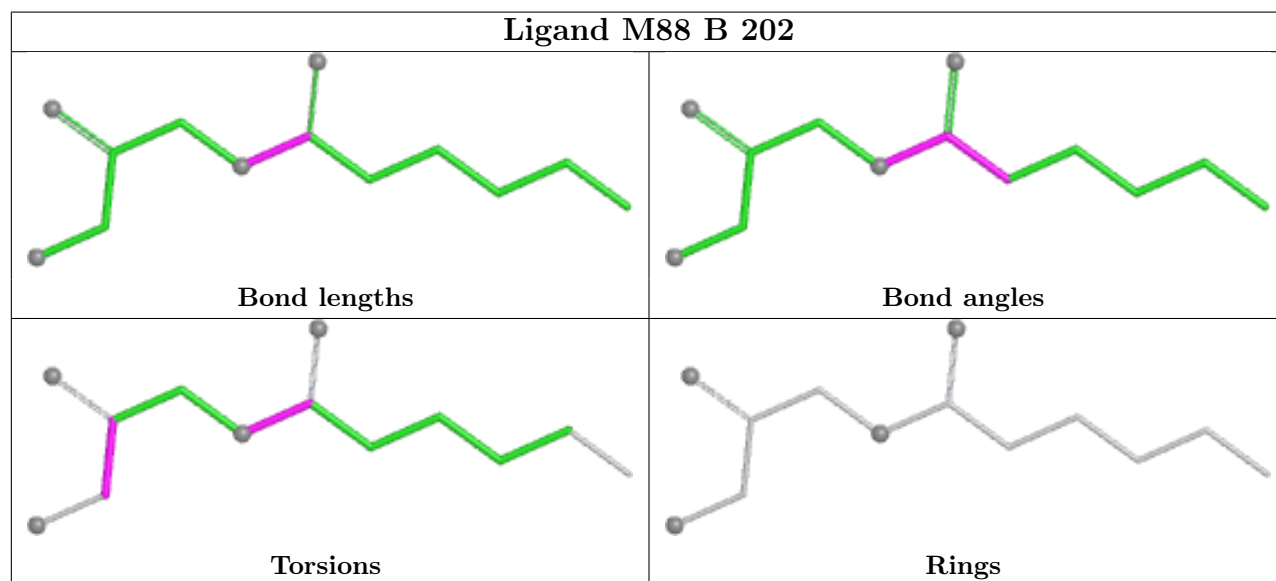
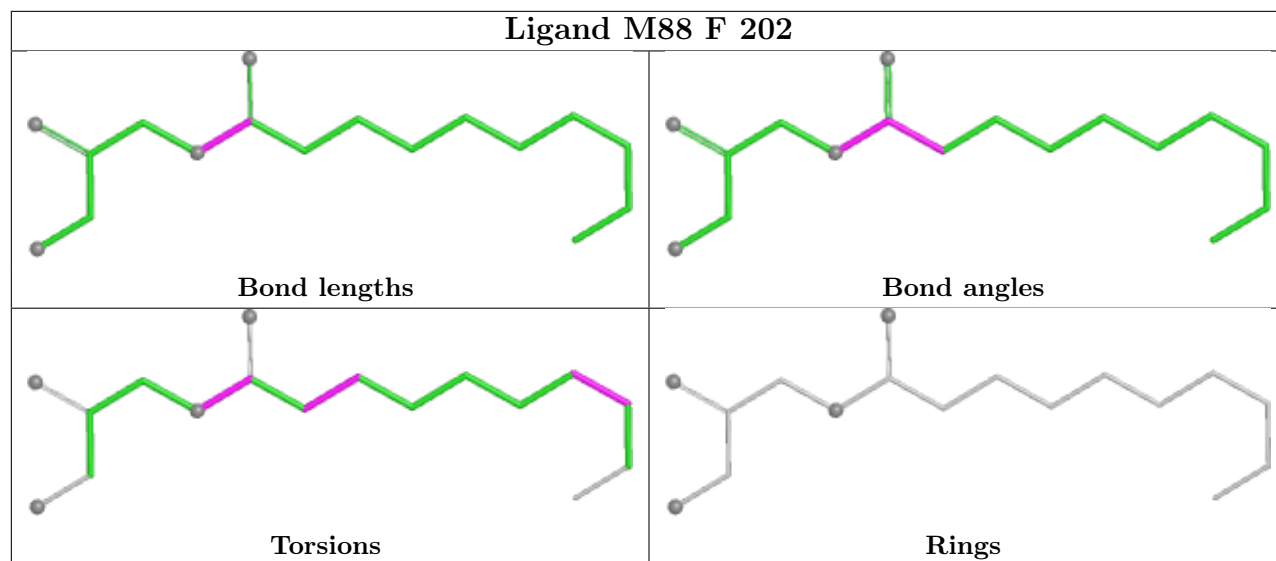
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Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	E	201	SO4	1	0

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

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, 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	136/153 (88%)	0.52	11 (8%)	18 15	16, 50, 83, 110	1 (0%)
1	B	130/153 (84%)	0.42	4 (3%)	51 47	32, 50, 75, 95	0
1	C	133/153 (86%)	0.61	11 (8%)	17 15	36, 55, 83, 105	0
1	D	128/153 (83%)	0.52	6 (4%)	36 32	28, 52, 80, 100	1 (0%)
1	E	130/153 (84%)	0.55	9 (6%)	23 20	20, 54, 79, 105	2 (1%)
1	F	129/153 (84%)	0.33	5 (3%)	43 38	33, 49, 74, 97	0
All	All	786/918 (85%)	0.49	46 (5%)	28 24	16, 51, 80, 110	4 (0%)

All (46) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	131	LEU	5.4
1	B	4	ASN	4.8
1	C	135	LEU	4.2
1	A	135	LEU	4.1
1	B	42	GLY	3.6
1	D	72	TRP	3.6
1	C	132	ASP	3.5
1	F	130	PHE	3.4
1	A	3	GLY	3.4
1	E	133	GLU	3.4
1	C	3	GLY	3.3
1	A	4	ASN	3.3
1	D	42	GLY	3.3
1	E	4	ASN	3.2
1	F	72	TRP	3.0
1	C	134	TYR	3.0
1	E	41	THR	2.9
1	B	72	TRP	2.9
1	A	133	GLU	2.9

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Mol	Chain	Res	Type	RSRZ
1	C	42	GLY	2.8
1	F	4	ASN	2.7
1	A	137	LEU	2.7
1	A	138	ASN	2.7
1	F	5	SER	2.7
1	C	99	GLU	2.6
1	C	133	GLU	2.6
1	E	31	LEU	2.6
1	A	136	ASP	2.5
1	D	128	ASN	2.5
1	D	109[A]	ARG	2.5
1	E	43	SER	2.5
1	E	72	TRP	2.5
1	C	102	LYS	2.4
1	A	42	GLY	2.4
1	C	4	ASN	2.4
1	A	134	TYR	2.3
1	D	130	PHE	2.3
1	C	100	ALA	2.2
1	A	72	TRP	2.2
1	C	72	TRP	2.1
1	F	42	GLY	2.1
1	B	40	VAL	2.1
1	E	124	LEU	2.0
1	E	130	PHE	2.0
1	A	124	LEU	2.0
1	E	131	LEU	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,

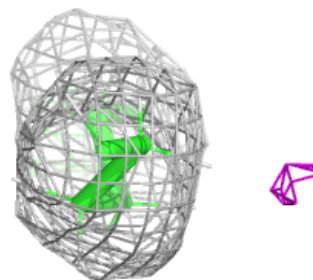
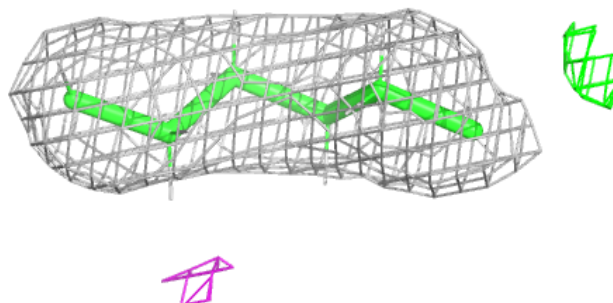
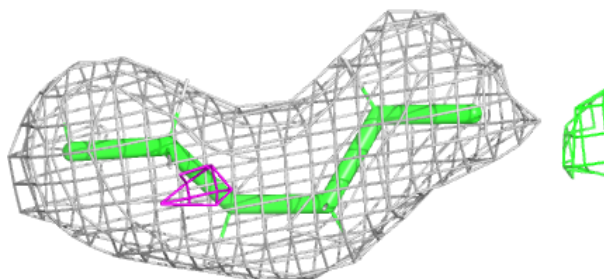
median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	GOL	E	203	6/6	0.74	0.16	53,63,74,74	0
4	M88	B	205	6/23	0.79	0.21	43,52,59,59	0
4	M88	B	204	17/23	0.80	0.20	33,49,59,71	39
4	M88	B	202	13/23	0.82	0.18	39,50,59,71	28
4	M88	F	202	17/23	0.83	0.19	44,55,66,66	39
4	M88	B	203	17/23	0.84	0.18	41,55,71,73	39
5	GOL	C	203	6/6	0.85	0.13	55,66,76,78	0
2	SO4	D	201	5/5	0.87	0.17	48,66,72,74	0
3	NA	E	202	1/1	0.88	0.19	60,60,60,60	0
2	SO4	A	201	5/5	0.90	0.14	57,61,63,72	0
2	SO4	E	201	5/5	0.90	0.12	44,58,62,65	0
3	NA	A	202	1/1	0.91	0.11	55,55,55,55	0
2	SO4	B	201	5/5	0.91	0.12	50,59,65,65	0
2	SO4	C	201	5/5	0.91	0.11	66,67,70,77	0
6	SCN	E	204	3/3	0.92	0.12	43,43,48,76	0
3	NA	C	202	1/1	0.94	0.10	44,44,44,44	0
3	NA	F	203	1/1	0.94	0.14	34,34,34,34	0
2	SO4	F	201	5/5	0.95	0.08	50,53,57,58	0
7	K	E	205	1/1	0.95	0.13	66,66,66,66	0
3	NA	D	202	1/1	0.96	0.10	45,45,45,45	0

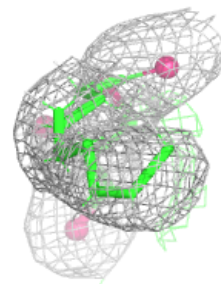
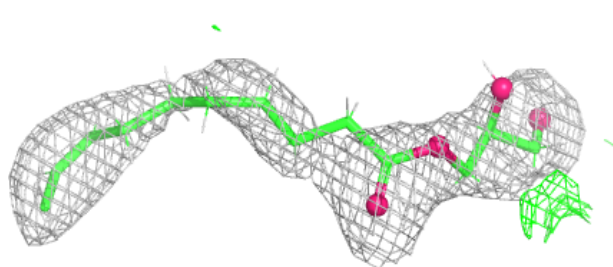
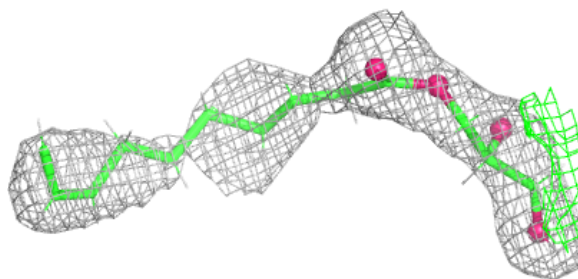
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around M88 B 205:

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

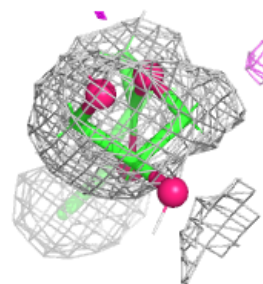
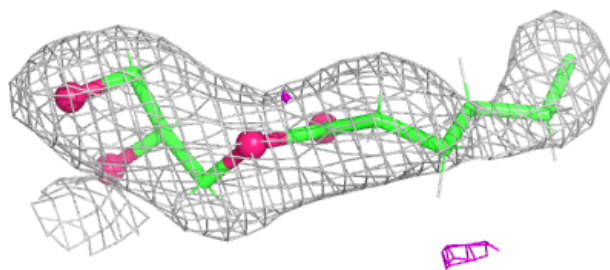
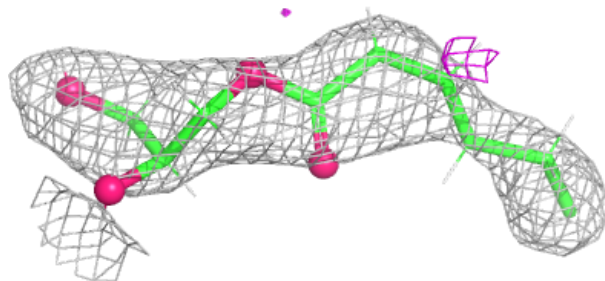
**Electron density around M88 B 204:**

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

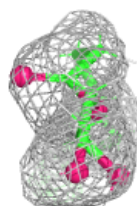
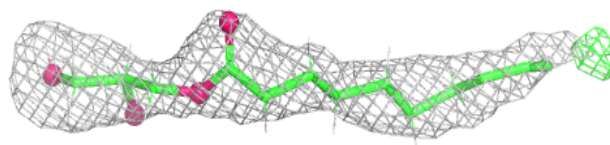
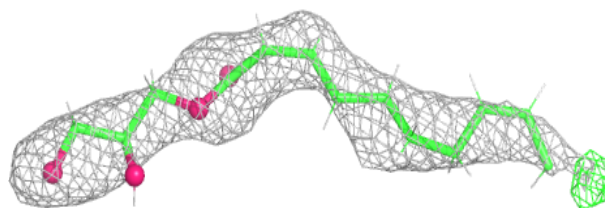


Electron density around M88 B 202:

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

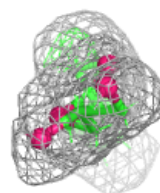
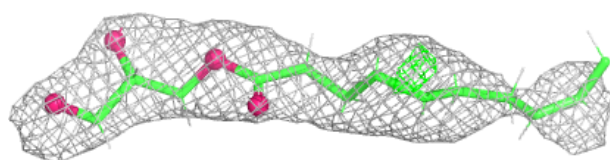
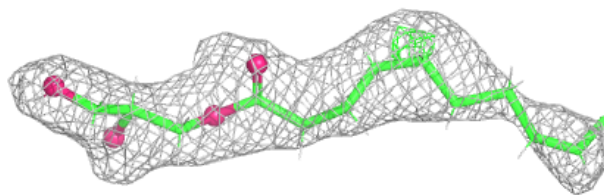
**Electron density around M88 F 202:**

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



Electron density around M88 B 203:

$2mF_o-DF_c$ (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.