wwPDB X-ray Structure Validation Summary Report (i)

Jul 9, 2025 – 10:14 pm BST

PDB ID	:	9FYT / pdb_00009fyt
Title	:	mAbs in complex with cobratoxin at pH 4.5
Authors	:	Wade, J.; Bohn, M.F.; Laustsen, A.H.; Morth, J.P.
Deposited on	:	2024-07-03
Resolution	:	1.55 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 (i) 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 (i)) were used in the production of this report:

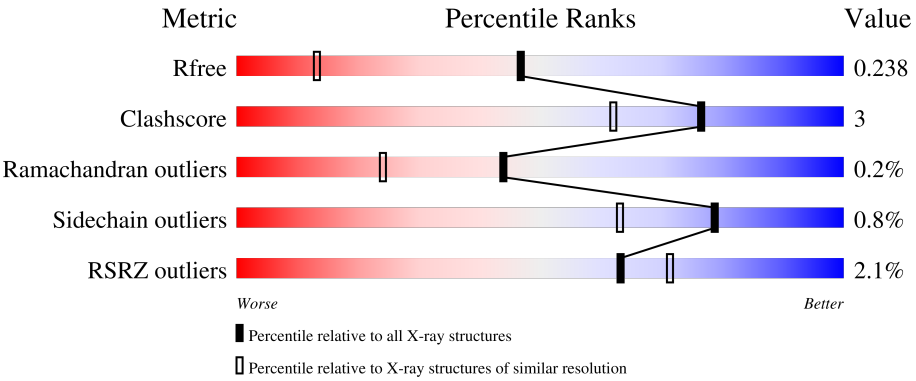
MolProbity	:	4-5-2 with Phenix2.0rc1
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	2.0rc1
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.006 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.44

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 1.55 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	1935 (1.56-1.56)
Clashscore	180529	2073 (1.56-1.56)
Ramachandran outliers	177936	2037 (1.56-1.56)
Sidechain outliers	177891	2034 (1.56-1.56)
RSRZ outliers	164620	1935 (1.56-1.56)

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	71	% 93% 7%
1	B	71	% 96% .
2	C	144	4% 81% 10% 9%
2	I	144	3% 82% 9% 9%
3	D	117	% 91% 7% .

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Mol	Chain	Length	Quality of chain
3	M	117	94%

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
4	CL	A	102	-	-	-	X

2 Entry composition (i)

There are 8 unique types of molecules in this entry. The entry contains 10132 atoms, of which 4673 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 Alpha-cobratoxin.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	71	Total	C	H	N	O	S	0	0	0
			1065	332	524	98	101	10			
1	B	71	Total	C	H	N	O	S	0	0	0
			1065	332	524	98	101	10			

- Molecule 2 is a protein called Light chain scFv A01.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	I	131	Total	C	H	N	O	S	0	7	0
			2031	655	990	173	204	9			
2	C	131	Total	C	H	N	O	S	0	3	0
			1981	640	965	166	201	9			

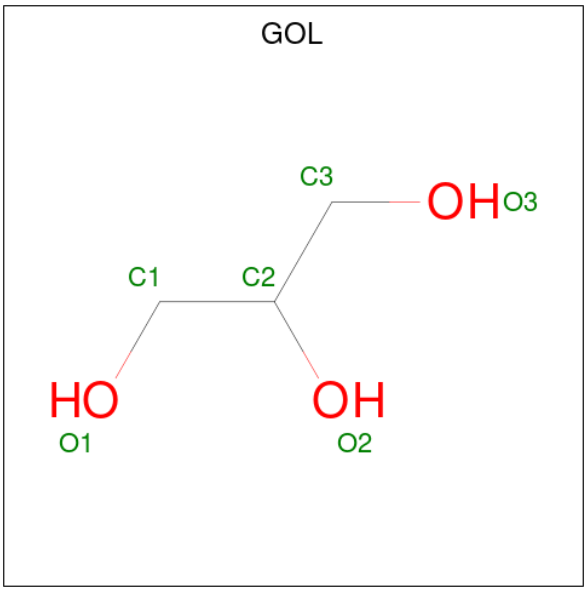
- Molecule 3 is a protein called heavy chain scFv Ao1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
3	M	114	Total	C	H	N	O	S	0	4	0
			1681	539	810	148	182	2			
3	D	114	Total	C	H	N	O	S	0	5	0
			1709	546	823	151	187	2			

- Molecule 4 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

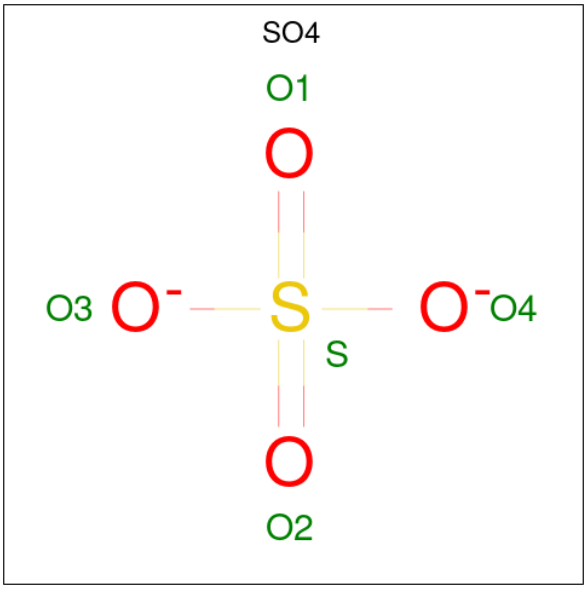
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	3	Total	Cl	0	1
			4	4		

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



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	B	1	Total C H O 13 3 7 3	0	0
5	B	1	Total C H O 14 3 8 3	0	0
5	M	1	Total C H O 14 3 8 3	0	0
5	D	1	Total C H O 13 3 7 3	0	0
5	D	1	Total C H O 13 3 7 3	0	0

- Molecule 6 is SULFATE ION (CCD ID: SO4) (formula: O_4S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	I	1	Total O S 5 4 1	0	0

- Molecule 7 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	M	1	Total Na 1 1	0	0
7	D	1	Total Na 1 1	0	0

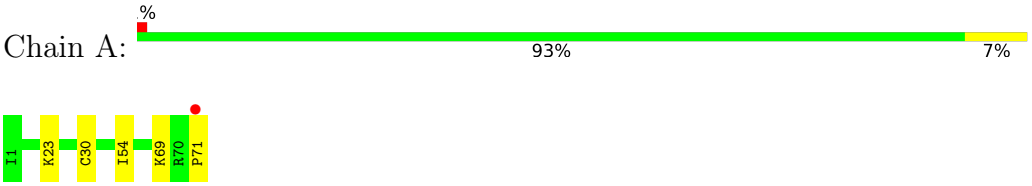
- Molecule 8 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	59	Total O 59 59	0	0
8	B	60	Total O 60 60	0	0
8	I	98	Total O 98 98	0	0
8	M	107	Total O 108 108	0	1
8	C	87	Total O 87 87	0	0
8	D	110	Total O 110 110	0	0

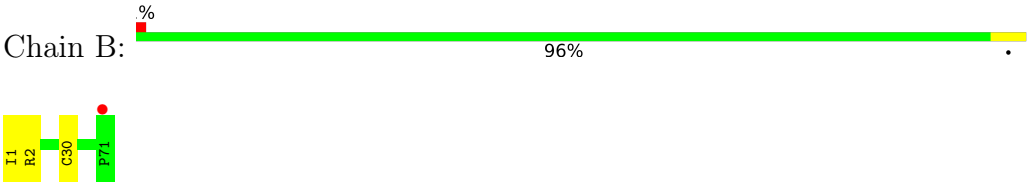
3 Residue-property plots (i)

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.

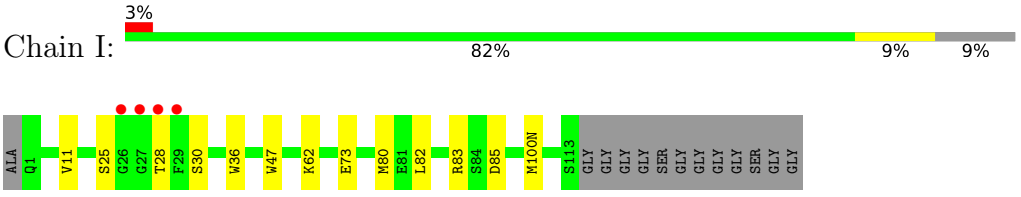
• Molecule 1: Alpha-cobratoxin



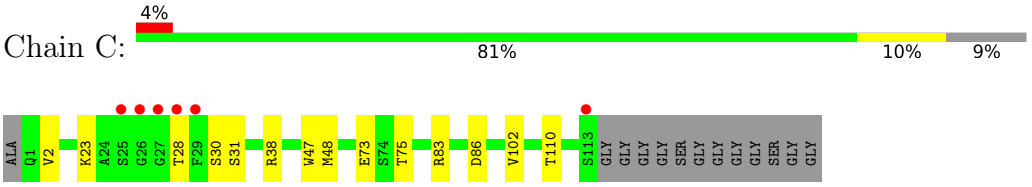
• Molecule 1: Alpha-cobratoxin



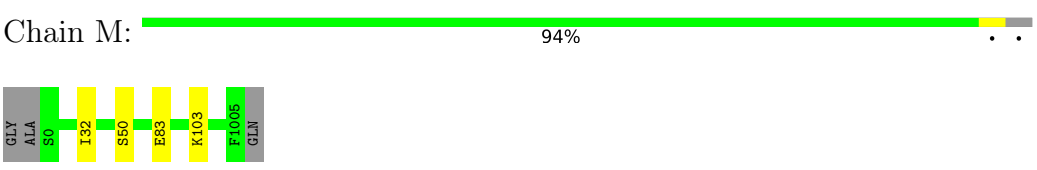
• Molecule 2: Light chain scFv A01



• Molecule 2: Light chain scFv A01

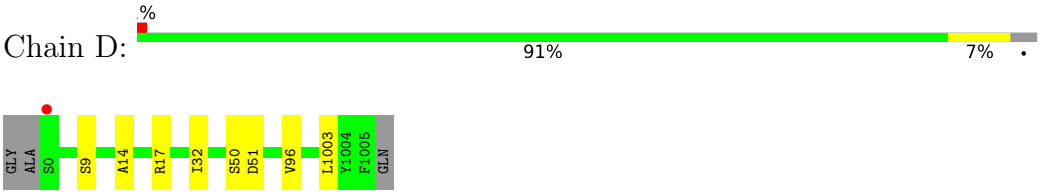


• Molecule 3: heavy chain scFv Ao1



• Molecule 3: heavy chain scFv Ao1

Chain D:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	76.86Å 83.86Å 98.65Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	42.52 – 1.55 42.52 – 1.55	Depositor EDS
% Data completeness (in resolution range)	99.3 (42.52-1.55) 99.3 (42.52-1.55)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.32 (at 1.55Å)	Xtriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.185 , 0.237 0.187 , 0.238	Depositor DCC
R_{free} test set	4769 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å^2)	21.5	Xtriage
Anisotropy	0.594	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.38 , 40.2	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	10132	wwPDB-VP
Average B, all atoms (Å^2)	36.0	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 56.54 % 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 2.6985e-05. 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: CL, NA, SO4, 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	0.44	0/553	0.63	0/750
1	B	0.42	0/553	0.60	0/750
2	C	0.43	0/1043	0.60	0/1412
2	I	0.45	0/1084	0.62	1/1466 (0.1%)
3	D	0.42	0/917	0.56	0/1253
3	M	0.43	0/910	0.59	0/1244
All	All	0.43	0/5060	0.60	1/6875 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	I	100(N)	MET	N-CA-CB	-5.27	101.72	110.47

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	541	524	524	3	0
1	B	541	524	524	3	0
2	C	1016	965	962	7	0
2	I	1041	990	984	8	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	D	886	823	819	6	0
3	M	871	810	796	2	0
4	A	4	0	0	0	0
5	B	12	15	16	1	0
5	D	12	14	16	0	0
5	M	6	8	8	0	0
6	I	5	0	0	0	0
7	D	1	0	0	0	0
7	M	1	0	0	0	0
8	A	59	0	0	0	0
8	B	60	0	0	1	0
8	C	87	0	0	0	0
8	D	110	0	0	0	0
8	I	98	0	0	3	0
8	M	108	0	0	0	0
All	All	5459	4673	4649	27	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.

The worst 5 of 27 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)
2:I:30:SER:OG	2:I:73:GLU:OE2	1.68	1.11
2:I:83[B]:ARG:NH2	8:I:301:HOH:O	2.13	0.81
2:C:30:SER:OG	2:C:73:GLU:OE2	2.20	0.58
3:D:14:ALA:HB3	3:D:17:ARG:HG3	1.86	0.57
1:B:1:ILE:N	5:B:101:GOL:H2	2.26	0.50

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	69/71 (97%)	66 (96%)	3 (4%)	0	100 100
1	B	69/71 (97%)	66 (96%)	3 (4%)	0	100 100
2	C	132/144 (92%)	128 (97%)	4 (3%)	0	100 100
2	I	136/144 (94%)	129 (95%)	6 (4%)	1 (1%)	19 5
3	D	117/117 (100%)	112 (96%)	5 (4%)	0	100 100
3	M	116/117 (99%)	111 (96%)	5 (4%)	0	100 100
All	All	639/664 (96%)	612 (96%)	26 (4%)	1 (0%)	44 24

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	I	28	THR

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	64/64 (100%)	64 (100%)	0	100 100
1	B	64/64 (100%)	64 (100%)	0	100 100
2	C	108/108 (100%)	107 (99%)	1 (1%)	75 58
2	I	112/108 (104%)	109 (97%)	3 (3%)	40 12
3	D	100/96 (104%)	99 (99%)	1 (1%)	73 53
3	M	99/96 (103%)	99 (100%)	0	100 100
All	All	547/536 (102%)	542 (99%)	5 (1%)	79 58

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	I	11	VAL
2	I	62[A]	LYS
2	I	62[C]	LYS
2	C	110	THR

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Mol	Chain	Res	Type
3	D	9	SER

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

Mol	Chain	Res	Type
2	I	96	ASN
2	C	61	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 (i)

Of 12 ligands modelled in this entry, 6 are monoatomic - leaving 6 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	$\#\|Z\| > 2$
5	GOL	D	1101	-	5,5,5	0.86	0	5,5,5	1.19	1 (20%)
5	GOL	B	102	-	5,5,5	0.85	0	5,5,5	0.89	0
5	GOL	D	1102	-	5,5,5	0.72	0	5,5,5	1.23	0
5	GOL	M	1101	-	5,5,5	0.71	0	5,5,5	0.98	0
5	GOL	B	101	-	5,5,5	0.82	0	5,5,5	0.86	0
6	SO4	I	201	-	4,4,4	0.16	0	6,6,6	0.36	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
5	GOL	D	1101	-	-	1/4/4/4	-
5	GOL	B	102	-	-	4/4/4/4	-
5	GOL	D	1102	-	-	2/4/4/4	-
5	GOL	M	1101	-	-	1/4/4/4	-
5	GOL	B	101	-	-	1/4/4/4	-

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	D	1101	GOL	C3-C2-C1	-2.20	103.16	111.70

There are no chirality outliers.

5 of 9 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	B	102	GOL	O1-C1-C2-C3
5	D	1102	GOL	C1-C2-C3-O3
5	D	1102	GOL	O2-C2-C3-O3
5	B	102	GOL	C1-C2-C3-O3
5	B	102	GOL	O2-C2-C3-O3

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	B	101	GOL	1	0

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, 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	71/71 (100%)	0.00	1 (1%) 73 80	26, 34, 54, 82	0
1	B	71/71 (100%)	0.12	1 (1%) 73 80	27, 35, 62, 83	0
2	C	131/144 (90%)	0.04	6 (4%) 38 45	13, 34, 64, 95	2 (1%)
2	I	131/144 (90%)	-0.01	4 (3%) 51 59	13, 32, 55, 82	5 (3%)
3	D	114/117 (97%)	-0.09	1 (0%) 81 86	15, 33, 52, 96	4 (3%)
3	M	114/117 (97%)	-0.10	0 100 100	19, 34, 51, 91	2 (1%)
All	All	632/664 (95%)	-0.01	13 (2%) 63 71	13, 34, 59, 96	13 (2%)

The worst 5 of 13 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	I	27	GLY	4.0
2	C	28	THR	3.9
2	C	27	GLY	3.7
1	B	71	PRO	3.6
1	A	71	PRO	3.4

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 (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, 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
5	GOL	D	1102	6/6	0.66	0.29	44,89,113,136	0
4	CL	A	103[B]	1/1	0.71	0.25	44,44,44,44	1
4	CL	A	103[A]	1/1	0.71	0.25	65,65,65,65	1
5	GOL	B	102	6/6	0.75	0.26	42,96,146,146	0
4	CL	A	102	1/1	0.77	0.40	93,93,93,93	0
4	CL	A	101	1/1	0.83	0.19	65,65,65,65	0
7	NA	M	1102	1/1	0.86	0.18	41,41,41,41	0
5	GOL	D	1101	6/6	0.88	0.14	40,82,97,100	0
5	GOL	B	101	6/6	0.89	0.16	31,40,97,116	0
5	GOL	M	1101	6/6	0.90	0.14	40,68,125,125	0
7	NA	D	1103	1/1	0.91	0.13	36,36,36,36	0
6	SO4	I	201	5/5	0.92	0.12	32,38,44,53	0

6.5 Other polymers (i)

There are no such residues in this entry.