



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2018 – 07:16 pm GMT

PDB ID : 5HBT
Title : Complex structure of Fab35 and human nAChR alpha1
Authors : Noridomi, K.; Watanabe, G.; Hansen, M.N.; Han, G.W.; Chen, L.
Deposited on : 2016-01-02
Resolution : 2.61 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.7.3 (157068), CSD as539be (2018)
Xtrriage (Phenix) : 1.13
EDS : trunk30967
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)
Refmac : 5.8.0158
CCP4 : 7.0 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk30967

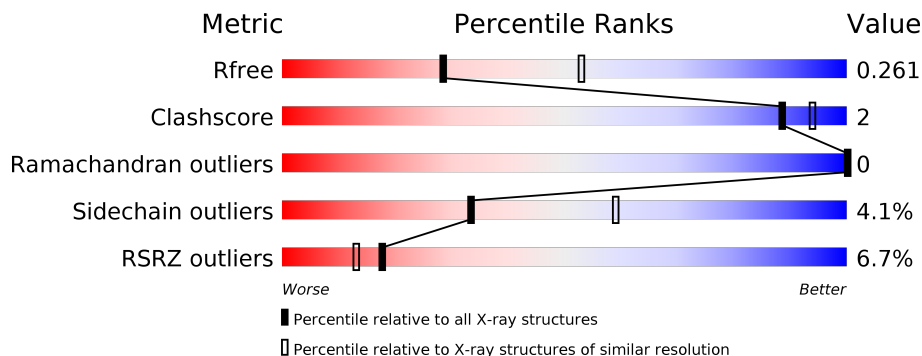
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

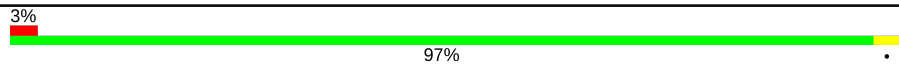
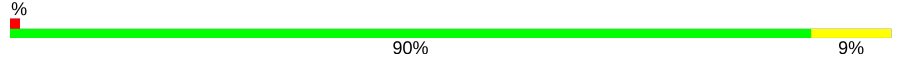

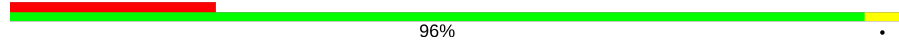
The reported resolution of this entry is 2.61 Å.

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}	111664	3285 (2.64-2.60)
Clashscore	122126	3641 (2.64-2.60)
Ramachandran outliers	120053	3586 (2.64-2.60)
Sidechain outliers	120020	3586 (2.64-2.60)
RSRZ outliers	108989	3218 (2.64-2.60)

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 on the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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	B	212	
2	C	213	
3	D	219	
4	A	74	

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 crite-

ria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
7	MAN	B	305	-	-	-	X
7	MAN	B	306	-	-	-	X

2 Entry composition [i](#)

There are 8 unique types of molecules in this entry. The entry contains 5784 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 Acetylcholine receptor subunit alpha 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	B	212	1731	1108	290	326	7	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	0	LYS	-	expression tag	UNP G5E9G9
B	8	GLU	VAL	engineered mutation	UNP G5E9G9
B	149	ARG	TRP	engineered mutation	UNP G5E9G9
B	155	ALA	VAL	engineered mutation	UNP G5E9G9

- Molecule 2 is a protein called Fab35, Light Chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	C	212	1628	1019	268	335	6	0	0	0

- Molecule 3 is a protein called Fab35, Heavy Chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	D	219	1671	1052	283	327	9	0	0	0

- Molecule 4 is a protein called Alpha-bungarotoxin isoform V31.

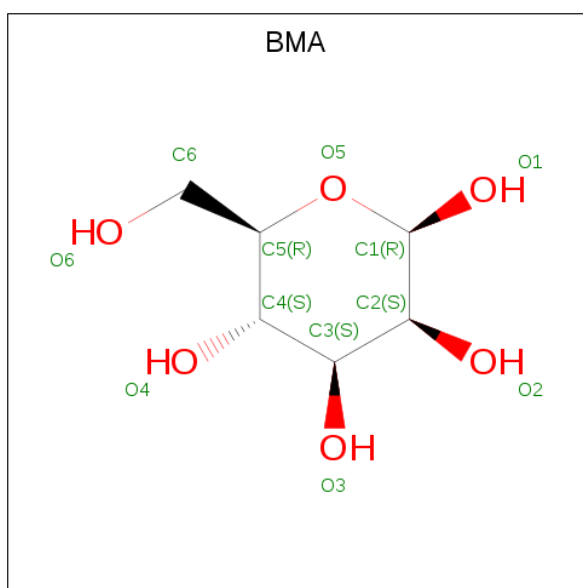
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	A	74	547	337	94	105	11	0	0	0

- Molecule 5 is N-ACETYL-D-GLUCOSAMINE (three-letter code: NAG) (formula: C₈H₁₅NO₆).



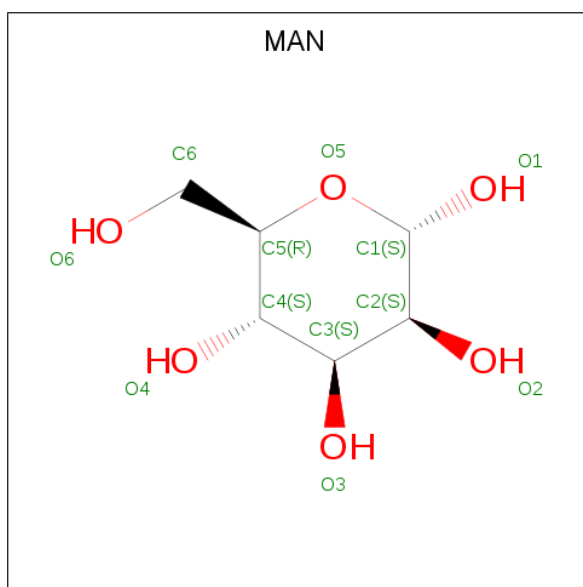
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	
5	B	1	Total	C	N	O	0	0
			14	8	1	5		
5	B	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 6 is BETA-D-MANNOSE (three-letter code: BMA) (formula: $C_6H_{12}O_6$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	B	1	Total	C	O	0	0
			11	6	5		

- Molecule 7 is ALPHA-D-MANNOSE (three-letter code: MAN) (formula: $C_6H_{12}O_6$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	B	1	Total C O 11 6 5	0	0
7	B	1	Total C O 11 6 5	0	0
7	B	1	Total C O 11 6 5	0	0
7	B	1	Total C O 11 6 5	0	0
7	B	1	Total C O 11 6 5	0	0
7	B	1	Total C O 11 6 5	0	0

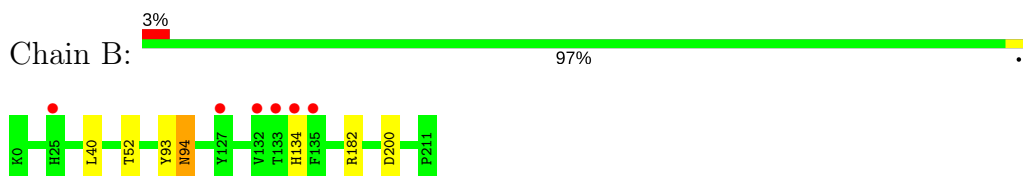
- Molecule 8 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	B	37	Total O 37 37	0	0
8	C	23	Total O 23 23	0	0
8	D	35	Total O 35 35	0	0
8	A	7	Total O 7 7	0	0

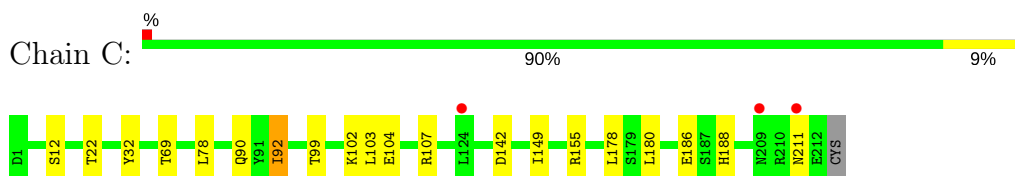
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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.

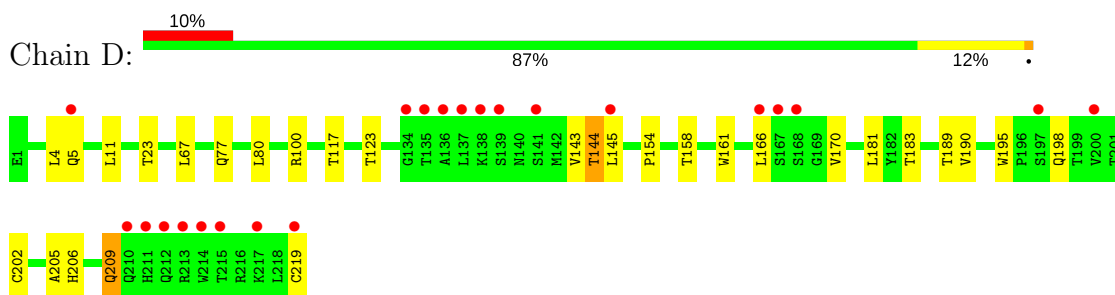
- Molecule 1: Acetylcholine receptor subunit alpha 1



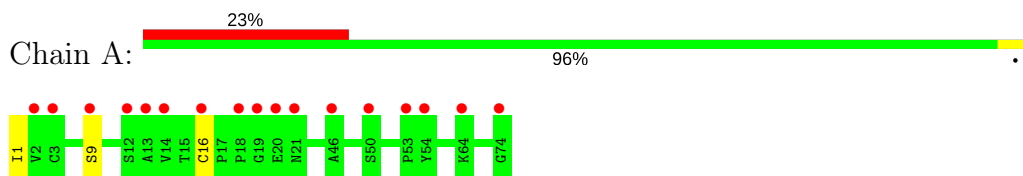
- Molecule 2: Fab35, Light Chain



- Molecule 3: Fab35, Heavy Chain



- Molecule 4: Alpha-bungarotoxin isoform V31



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	160.01Å 42.14Å 136.49Å 90.00° 117.05° 90.00°	Depositor
Resolution (Å)	50.01 – 2.61 40.52 – 2.61	Depositor EDS
% Data completeness (in resolution range)	99.5 (50.01-2.61) 99.6 (40.52-2.61)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.08 (at 2.61Å)	Xtrriage
Refinement program	REFMAC 5.8.0158	Depositor
R, R_{free}	0.207 , 0.260 0.210 , 0.261	Depositor DCC
R_{free} test set	1231 reflections (4.89%)	wwPDB-VP
Wilson B-factor (Å ²)	48.6	Xtrriage
Anisotropy	0.263	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 51.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	5784	wwPDB-VP
Average B, all atoms (Å ²)	58.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.21% 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: BMA, NAG, MAN

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	B	0.44	0/1778	0.66	0/2422
2	C	0.41	0/1660	0.65	0/2257
3	D	0.43	0/1715	0.67	0/2346
4	A	0.40	0/561	0.60	0/763
All	All	0.42	0/5714	0.66	0/7788

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	93	TYR	Peptide

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	B	1731	0	1684	2	0
2	C	1628	0	1582	5	0
3	D	1671	0	1622	15	0
4	A	547	0	525	1	0
5	B	28	0	24	0	0
6	B	11	0	8	0	0
7	B	66	0	56	0	0
8	A	7	0	0	0	0
8	B	37	0	0	0	0
8	C	23	0	0	0	0
8	D	35	0	0	0	0
All	All	5784	0	5501	23	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 (23) 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)
3:D:23:THR:HG22	3:D:77:GLN:HE21	1.55	0.72
3:D:206:HIS:ND1	3:D:209:GLN:OE1	2.23	0.70
3:D:144:THR:HG22	3:D:189:THR:HG22	1.80	0.64
1:B:94:ASN:O	1:B:94:ASN:ND2	2.34	0.60
3:D:67:LEU:HD22	3:D:80:LEU:HD11	1.90	0.54
3:D:166:LEU:HD12	3:D:170:VAL:HG21	1.90	0.54
3:D:158:THR:HG22	3:D:205:ALA:HB3	1.89	0.54
4:A:1:ILE:HG23	4:A:16:CYS:HB2	1.91	0.52
3:D:23:THR:CG2	3:D:77:GLN:HE21	2.24	0.50
2:C:32:TYR:HB2	2:C:92:ILE:HG13	1.95	0.49
3:D:11:LEU:HD23	3:D:123:THR:HG23	1.94	0.48
3:D:144:THR:CG2	3:D:189:THR:HG22	2.44	0.48
2:C:78:LEU:HD11	2:C:103:LEU:HD21	1.94	0.47
3:D:143:VAL:N	3:D:190:VAL:O	2.47	0.47
3:D:158:THR:CG2	3:D:205:ALA:HB3	2.45	0.46
3:D:209:GLN:C	3:D:209:GLN:HE21	2.21	0.43
2:C:178:LEU:HD11	2:C:180:LEU:HD21	2.00	0.43
3:D:154:PRO:O	3:D:206:HIS:NE2	2.45	0.43
2:C:12:SER:HA	2:C:104:GLU:O	2.19	0.43
3:D:145:LEU:HD21	3:D:195:TRP:CE2	2.54	0.42
3:D:161:TRP:CZ3	3:D:202:CYS:HB3	2.55	0.42
2:C:149:ILE:HD13	2:C:188:HIS:CD2	2.56	0.40
1:B:40:LEU:CD2	1:B:52:THR:HG22	2.51	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	B	210/212 (99%)	205 (98%)	5 (2%)	0	100	100
2	C	210/213 (99%)	200 (95%)	10 (5%)	0	100	100
3	D	217/219 (99%)	205 (94%)	12 (6%)	0	100	100
4	A	72/74 (97%)	69 (96%)	3 (4%)	0	100	100
All	All	709/718 (99%)	679 (96%)	30 (4%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	196/197 (100%)	192 (98%)	4 (2%)	58	80
2	C	186/189 (98%)	175 (94%)	11 (6%)	21	41
3	D	190/191 (100%)	180 (95%)	10 (5%)	25	47
4	A	65/66 (98%)	64 (98%)	1 (2%)	67	84
All	All	637/643 (99%)	611 (96%)	26 (4%)	33	59

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	94	ASN
1	B	134	HIS
1	B	182	ARG
1	B	200	ASP
2	C	22	THR
2	C	69	THR
2	C	90	GLN
2	C	92	ILE
2	C	99	THR
2	C	102	LYS
2	C	107	ARG
2	C	142	ASP
2	C	155	ARG
2	C	186	GLU
2	C	211	ASN
3	D	4	LEU
3	D	5	GLN
3	D	100	ARG
3	D	117	THR
3	D	144	THR
3	D	181	LEU
3	D	183	THR
3	D	198	GLN
3	D	209	GLN
3	D	219	CYS
4	A	9	SER

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
2	C	209	ASN
3	D	77	GLN
3	D	198	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 carbohydrates in this entry.

5.6 Ligand geometry [i](#)

9 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	NAG	B	301	1,5	14,14,15	0.33	0	17,19,21	1.05	1 (5%)
5	NAG	B	302	5,6	14,14,15	0.38	0	17,19,21	0.99	1 (5%)
6	BMA	B	303	5,7	11,11,12	0.42	0	15,15,17	0.69	0
7	MAN	B	304	7,6	11,11,12	0.43	0	15,15,17	1.55	2 (13%)
7	MAN	B	305	7	11,11,12	0.45	0	15,15,17	0.77	1 (6%)
7	MAN	B	306	7	11,11,12	0.39	0	15,15,17	0.83	1 (6%)
7	MAN	B	307	7,6	11,11,12	0.34	0	15,15,17	0.89	1 (6%)
7	MAN	B	308	7	11,11,12	0.39	0	15,15,17	0.99	2 (13%)
7	MAN	B	309	7	11,11,12	0.33	0	15,15,17	1.30	1 (6%)

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	NAG	B	301	1,5	-	0/6/23/26	0/1/1/1
5	NAG	B	302	5,6	-	0/6/23/26	0/1/1/1
6	BMA	B	303	5,7	-	0/2/19/22	0/1/1/1
7	MAN	B	304	7,6	-	0/2/19/22	0/1/1/1
7	MAN	B	305	7	-	0/2/19/22	0/1/1/1
7	MAN	B	306	7	-	0/2/19/22	0/1/1/1
7	MAN	B	307	7,6	-	0/2/19/22	0/1/1/1
7	MAN	B	308	7	-	0/2/19/22	0/1/1/1
7	MAN	B	309	7	-	0/2/19/22	0/1/1/1

There are no bond length outliers.

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	B	301	NAG	O5-C1-C2	-2.81	107.64	111.52
7	B	306	MAN	C1-O5-C5	2.06	115.03	112.19
7	B	308	MAN	C1-C2-C3	2.07	112.28	109.66
7	B	305	MAN	C1-O5-C5	2.09	115.07	112.19
7	B	304	MAN	C3-C4-C5	2.15	114.09	110.24
7	B	308	MAN	C1-O5-C5	2.27	115.31	112.19
7	B	307	MAN	C1-O5-C5	2.40	115.50	112.19
5	B	302	NAG	C1-O5-C5	2.59	115.75	112.19
7	B	309	MAN	C1-O5-C5	4.17	117.92	112.19
7	B	304	MAN	C1-O5-C5	4.72	118.69	112.19

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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	B	212/212 (100%)	0.17	6 (2%) 53 46	29, 42, 74, 115	0
2	C	212/213 (99%)	-0.02	3 (1%) 75 71	32, 56, 86, 112	0
3	D	219/219 (100%)	0.31	22 (10%) 7 4	31, 57, 108, 135	0
4	A	74/74 (100%)	1.16	17 (22%) 0 0	45, 89, 113, 118	0
All	All	717/718 (99%)	0.26	48 (6%) 18 13	29, 54, 103, 135	0

All (48) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	D	214	TRP	6.3
4	A	74	GLY	6.1
4	A	3	CYS	5.0
1	B	134	HIS	5.0
1	B	133	THR	4.5
4	A	64	LYS	4.4
3	D	137	LEU	4.3
4	A	46	ALA	4.2
4	A	14	VAL	4.0
4	A	54	TYR	4.0
3	D	139	SER	3.9
4	A	2	VAL	3.9
3	D	219	CYS	3.7
1	B	135	PHE	3.5
3	D	167	SER	3.5
3	D	141	SER	3.5
1	B	132	VAL	3.3
4	A	21	ASN	3.2
3	D	211	HIS	3.1
3	D	200	VAL	3.1
3	D	134	GLY	3.0

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Mol	Chain	Res	Type	RSRZ
3	D	136	ALA	3.0
4	A	19	GLY	3.0
4	A	16	CYS	3.0
4	A	12	SER	2.8
3	D	166	LEU	2.8
3	D	135	THR	2.8
3	D	145	LEU	2.7
4	A	9	SER	2.7
3	D	213	ARG	2.6
1	B	25	HIS	2.5
2	C	124	LEU	2.5
4	A	20	GLU	2.5
3	D	217	LYS	2.3
2	C	211	ASN	2.2
3	D	210	GLN	2.2
3	D	168	SER	2.2
3	D	5	GLN	2.2
1	B	127	TYR	2.1
3	D	212	GLN	2.1
3	D	215	THR	2.1
3	D	138	LYS	2.1
4	A	50	SER	2.1
2	C	209	ASN	2.0
3	D	197	SER	2.0
4	A	18	PRO	2.0
4	A	13	ALA	2.0
4	A	53	PRO	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 carbohydrates 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
7	MAN	B	306	11/12	0.42	0.54	122,125,126,126	0
7	MAN	B	305	11/12	0.53	0.41	111,113,115,121	0
7	MAN	B	309	11/12	0.79	0.30	89,91,92,92	0
7	MAN	B	304	11/12	0.84	0.18	90,93,94,102	0
7	MAN	B	308	11/12	0.88	0.31	84,85,88,88	0
7	MAN	B	307	11/12	0.91	0.16	76,78,81,84	0
6	BMA	B	303	11/12	0.94	0.14	64,71,74,81	0
5	NAG	B	301	14/15	0.95	0.17	42,43,45,47	0
5	NAG	B	302	14/15	0.98	0.14	46,47,51,57	0

6.5 Other polymers [i](#)

There are no such residues in this entry.