



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 8, 2026 – 08:25 AM UTC

PDB ID : 7S07 / pdb_00007s07
Title : Crystal structure of Epstein-Barr virus glycoprotein gH/gL/gp42-peptide in complex with human neutralizing antibodies 769B10 and 769C2
Authors : Chen, W.-H.; Kanekiyo, M.; Cohen, J.I.; Joyce, M.G.
Deposited on : 2021-08-30
Resolution : 3.29 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 ⓘ 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
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

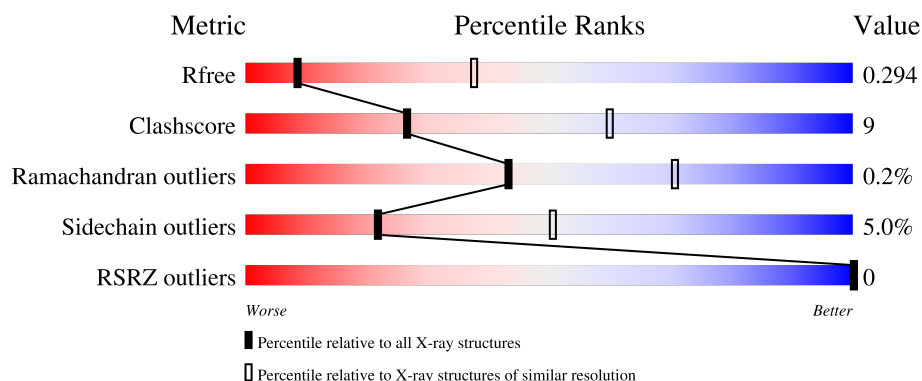
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

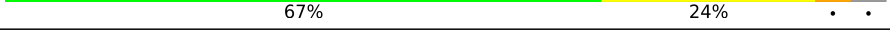
The reported resolution of this entry is 3.29 Å.

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	1169 (3.32-3.28)
Clashscore	190562	1209 (3.32-3.28)
Ramachandran outliers	187476	1188 (3.32-3.28)
Sidechain outliers	187428	1187 (3.32-3.28)
RSRZ outliers	180081	1169 (3.32-3.28)

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	657	
2	B	98	
3	C	33	
4	X	225	
5	Y	215	

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Mol	Chain	Length	Quality of chain
6	H	234	 77% 20% ..
7	L	214	 79% 18% .

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 12693 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 Envelope glycoprotein H.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	654	Total	C	N	O	S	0	0	0
			5082	3256	840	955	31			

- Molecule 2 is a protein called Envelope glycoprotein L.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	98	Total	C	N	O	S	0	0	0
			744	469	126	145	4			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	35	ALA	ARG	conflict	UNP P03212

- Molecule 3 is a protein called Soluble gp42.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	C	33	Total	C	N	O	0	0	0
			266	173	42	51			

- Molecule 4 is a protein called 769C2 Fab Heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	X	215	Total	C	N	O	S	0	0	0
			1609	1016	271	315	7			

- Molecule 5 is a protein called 769C2 Fab Light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
5	Y	212	Total	C	N	O	S	0	0	0
			1576	983	260	328	5			

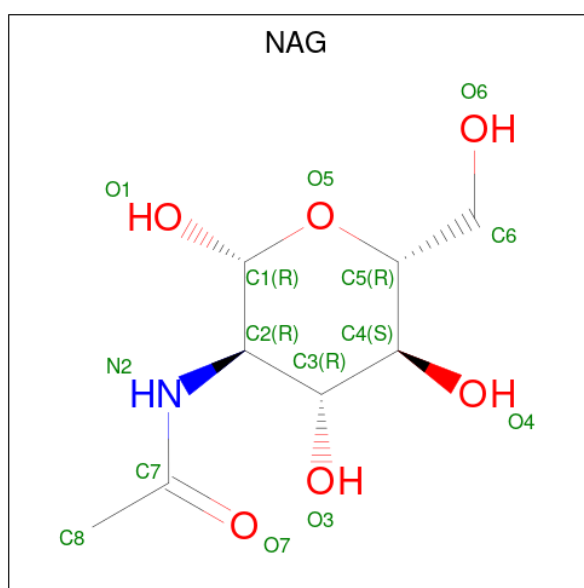
- Molecule 6 is a protein called 769B10 Fab heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
6	H	230	Total	C	N	O	S	0	0	0
			1748	1100	303	339	6			

- Molecule 7 is a protein called 769B10 Fab light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
7	L	209	Total	C	N	O	S	0	0	0
			1612	1013	267	325	7			

- Molecule 8 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).



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

- Molecule 1: Envelope glycoprotein H

ALA	L392	R184	A18
LYR	L393	V185	L20
C534	H414	T186	V23
V535	T415	E187	K24
D536	V416	D190	L25
R537	T423	V197	H26
K540	G424	P205	L27
R568	V427	R208	E53
F569	R430	G209	A59
V560	E431	P210	M60
L565	Q439	V213	T62
T570	N442	T217	E63
T571	Y446	S221	D64
Y572	V462	V227	M68
L577	L463	L228	L69
S580	R464	V229	T78
V582	G465	N249	S79
A593	L466	F250	I86
G594	T470	A258	D91
E595	L480	E273	Q101
P596	K490	E282	V102
F617	S493	L283	D103
S621	M494	D284	K106
Y622	G495	T289	V107
D623	P496	E498	I112
E624	A499	K320	S113
T630	Q503	F323	L115
T631	A504	M361	A119
T632	N508	V340	L122
L643	L514	Y346	Y133
T663	L517	L355	F148
Y674	E520	E373	V158
	R521	L376	F167
	E522	R377	G171
	D523	A386	A172
	R524		M173
	N527		L178
	H528		M179
	L529		C190
	D530		

P27	V31	L40	A41	L42	I45	S46	L50	N53	Q54	T55	G58	L64	Q73	L74	V75	I76	S77	R78	C79	A80	N81	G82	L83	N84	F89	I92	L93	L100	R105	E106	L107	L108	Y115	S119	V120	E121	D122	L123	E124
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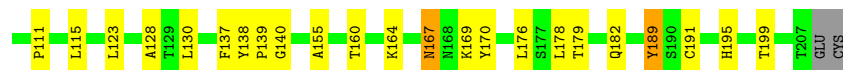
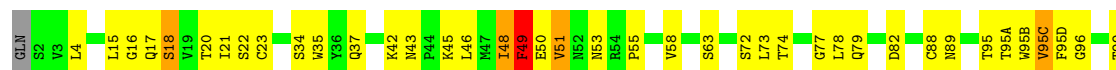
K47
D56
K65
T66
A67
E68
Q69
E70
Y71
P79

E1	E6	L11	G15	A23	A24	F27	M34	D35	W36	V37	R38	E46	W47	V48	S49	L50	I51	S52	S52A	Y58	K64	G65	N66	F67	T68	I69	S70	R71	L78	Q81	M82	N82A	S82B	L82C	R83	T87	Y91	R94	V108	P116	R120
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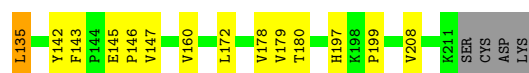
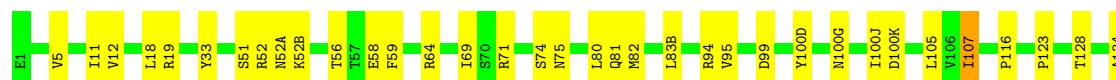
• Molecule 5: 769C2 Fab Light chain

Chain Y: 69% 26% ..



• Molecule 6: 769B10 Fab heavy chain

Chain H: 77% 20% ..



• Molecule 7: 769B10 Fab light chain

Chain L: 79% 18% .



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	90.69Å 130.37Å 93.61Å 90.00° 104.59° 90.00°	Depositor
Resolution (Å)	48.58 – 3.29 48.58 – 3.29	Depositor EDS
% Data completeness (in resolution range)	54.7 (48.58-3.29) 65.0 (48.58-3.29)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.39 (at 3.33Å)	Xtriage
Refinement program	PHENIX 1.17.1_3660	Depositor
R, R_{free}	0.243 , 0.291 0.247 , 0.294	Depositor DCC
R_{free} test set	1998 reflections (6.24%)	wwPDB-VP
Wilson B-factor (Å ²)	37.6	Xtriage
Anisotropy	0.063	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 18.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.29$	Xtriage
Estimated twinning fraction	0.037 for l,-k,h	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	12693	wwPDB-VP
Average B, all atoms (Å ²)	50.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.76% 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: NAG

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	0.19	0/5189	0.38	0/7042
2	B	0.17	0/755	0.36	0/1024
3	C	0.10	0/276	0.28	0/380
4	X	0.19	0/1647	0.49	3/2239 (0.1%)
5	Y	0.26	0/1614	0.59	7/2206 (0.3%)
6	H	0.18	0/1791	0.40	0/2437
7	L	0.13	0/1648	0.34	0/2234
All	All	0.19	0/12920	0.42	10/17562 (0.1%)

There are no bond length outliers.

The worst 5 of 10 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	Y	18	SER	N-CA-C	6.12	117.95	111.28
4	X	65	GLY	N-CA-C	-6.08	107.70	115.42
5	Y	18	SER	CA-C-N	-5.88	114.81	122.99
5	Y	18	SER	C-N-CA	-5.88	114.81	122.99
5	Y	49	PHE	CA-C-N	5.63	132.30	121.54

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	5082	0	5095	81	0
2	B	744	0	740	23	0
3	C	266	0	257	4	0
4	X	1609	0	1573	43	0
5	Y	1576	0	1512	52	0
6	H	1748	0	1703	28	0
7	L	1612	0	1554	22	0
8	A	28	0	26	2	0
8	B	28	0	26	0	0
All	All	12693	0	12486	233	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 9.

The worst 5 of 233 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)
5:Y:35:TRP:HB2	5:Y:48:ILE:HG22	1.14	1.08
5:Y:35:TRP:HB2	5:Y:48:ILE:CG2	1.89	1.01
1:A:60:ASN:HB3	1:A:63:GLU:HB2	1.59	0.83
5:Y:17:GLN:CA	5:Y:77:GLY:HA2	2.10	0.81
2:B:119:SER:HB2	2:B:122:ASP:HB3	1.65	0.79

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	650/657 (99%)	606 (93%)	44 (7%)	0	100	100
2	B	96/98 (98%)	88 (92%)	8 (8%)	0	100	100
3	C	31/33 (94%)	29 (94%)	2 (6%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
4	X	211/225 (94%)	190 (90%)	19 (9%)	2 (1%)	14	43
5	Y	210/215 (98%)	176 (84%)	32 (15%)	2 (1%)	12	40
6	H	228/234 (97%)	211 (92%)	17 (8%)	0	100	100
7	L	205/214 (96%)	191 (93%)	14 (7%)	0	100	100
All	All	1631/1676 (97%)	1491 (91%)	136 (8%)	4 (0%)	43	71

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
4	X	82(C)	LEU
5	Y	51	VAL
5	Y	50	GLU
4	X	154	GLY

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	560/562 (100%)	541 (97%)	19 (3%)	32	59
2	B	87/87 (100%)	81 (93%)	6 (7%)	14	41
3	C	31/31 (100%)	28 (90%)	3 (10%)	8	28
4	X	181/189 (96%)	168 (93%)	13 (7%)	13	40
5	Y	180/183 (98%)	162 (90%)	18 (10%)	7	27
6	H	196/200 (98%)	189 (96%)	7 (4%)	31	58
7	L	184/188 (98%)	179 (97%)	5 (3%)	39	63
All	All	1419/1440 (98%)	1348 (95%)	71 (5%)	22	50

5 of 71 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
5	Y	189	TYR
6	H	5	VAL

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Mol	Chain	Res	Type
6	H	135	LEU
2	B	76	ILE
2	B	74	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 14 such sidechains are listed below:

Mol	Chain	Res	Type
5	Y	69	ASN
6	H	161	HIS
7	L	199	GLN
7	L	124	GLN
7	L	137	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](#)

4 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	$\# Z > 2$
8	NAG	B	202	2	14,14,15	0.48	0	17,19,21	1.00	1 (5%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
8	NAG	A	702	1	14,14,15	2.39	1 (7%)	17,19,21	2.43	2 (11%)
8	NAG	A	701	1	14,14,15	0.97	1 (7%)	17,19,21	0.79	1 (5%)
8	NAG	B	201	2	14,14,15	0.76	1 (7%)	17,19,21	1.06	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
8	NAG	B	202	2	-	3/6/23/26	0/1/1/1
8	NAG	A	702	1	-	0/6/23/26	0/1/1/1
8	NAG	A	701	1	-	2/6/23/26	0/1/1/1
8	NAG	B	201	2	-	0/6/23/26	0/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
8	A	702	NAG	O5-C1	8.70	1.58	1.43
8	A	701	NAG	O5-C1	3.33	1.49	1.43
8	B	201	NAG	O5-C1	2.59	1.48	1.43

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
8	A	702	NAG	C1-O5-C5	9.20	124.52	112.19
8	B	201	NAG	C1-O5-C5	3.60	117.01	112.19
8	A	701	NAG	C1-O5-C5	2.50	115.53	112.19
8	B	202	NAG	C2-N2-C7	2.38	126.10	122.90
8	A	702	NAG	O3-C3-C2	2.26	114.11	109.40

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
8	B	202	NAG	C1-C2-N2-C7
8	A	701	NAG	O5-C5-C6-O6
8	B	202	NAG	O5-C5-C6-O6
8	A	701	NAG	C4-C5-C6-O6
8	B	202	NAG	C3-C2-N2-C7

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
8	A	701	NAG	2	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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	654/657 (99%)	-1.40	0 100 100	15, 37, 76, 102	0
2	B	98/98 (100%)	-1.31	0 100 100	19, 43, 91, 135	0
3	C	33/33 (100%)	-1.39	0 100 100	30, 53, 76, 108	0
4	X	215/225 (95%)	-1.26	0 100 100	30, 58, 84, 117	0
5	Y	212/215 (98%)	-1.15	0 100 100	35, 65, 110, 147	0
6	H	230/234 (98%)	-1.25	0 100 100	23, 54, 105, 126	0
7	L	209/214 (97%)	-1.40	0 100 100	17, 42, 83, 101	0
All	All	1651/1676 (98%)	-1.32	0 100 100	15, 49, 92, 147	0

There are no RSRZ outliers to report.

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($\text{\AA}^2$)	Q<0.9
8	NAG	A	701	14/15	0.98	0.05	20,33,40,47	0
8	NAG	A	702	14/15	0.98	0.05	32,38,49,50	0
8	NAG	B	202	14/15	0.98	0.04	26,42,49,49	0
8	NAG	B	201	14/15	0.99	0.04	25,41,51,54	0

6.5 Other polymers [i](#)

There are no such residues in this entry.