



Full wwPDB X-ray Structure Validation Report ⓘ

Nov 11, 2021 – 12:07 pm GMT

PDB ID : 7BNV
Title : Crystal Structure of the SARS-CoV-2 Receptor Binding Domain in Complex with Antibody ION-300
Authors : Hall, G.; Cowan, R.; Carr, M.
Deposited on : 2021-01-22
Resolution : 2.35 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 : 1.8.4 (270009), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.23.2
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0267
CCP4 : 7.1.010 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.23.2

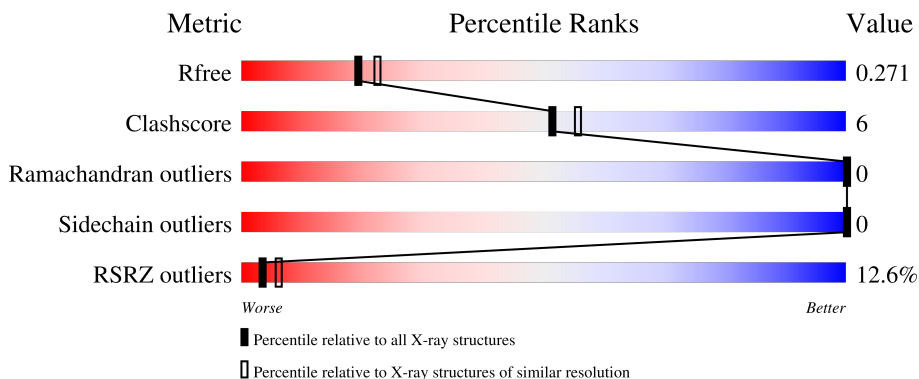
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.35 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}	130704	1164 (2.36-2.36)
Clashscore	141614	1232 (2.36-2.36)
Ramachandran outliers	138981	1211 (2.36-2.36)
Sidechain outliers	138945	1212 (2.36-2.36)
RSRZ outliers	127900	1150 (2.36-2.36)

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	234	 10% 74% 9% 17%
2	H	230	 9% 86% 11% .
3	L	219	 16% 82% 16% .

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 4977 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 Surface glycoprotein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	194	1510	968	252	282	8	0	0	0

There are 11 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	542	ALA	-	expression tag	UNP A0A6M5UN06
A	543	ALA	-	expression tag	UNP A0A6M5UN06
A	544	ALA	-	expression tag	UNP A0A6M5UN06
A	545	GLY	-	expression tag	UNP A0A6M5UN06
A	546	SER	-	expression tag	UNP A0A6M5UN06
A	547	HIS	-	expression tag	UNP A0A6M5UN06
A	548	HIS	-	expression tag	UNP A0A6M5UN06
A	549	HIS	-	expression tag	UNP A0A6M5UN06
A	550	HIS	-	expression tag	UNP A0A6M5UN06
A	551	HIS	-	expression tag	UNP A0A6M5UN06
A	552	HIS	-	expression tag	UNP A0A6M5UN06

- Molecule 2 is a protein called Heavy Chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	H	223	1658	1058	267	326	7	0	0	0

- Molecule 3 is a protein called Light Chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	L	216	1630	1018	271	335	6	0	0	0

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: C₈H₁₅NO₆).



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

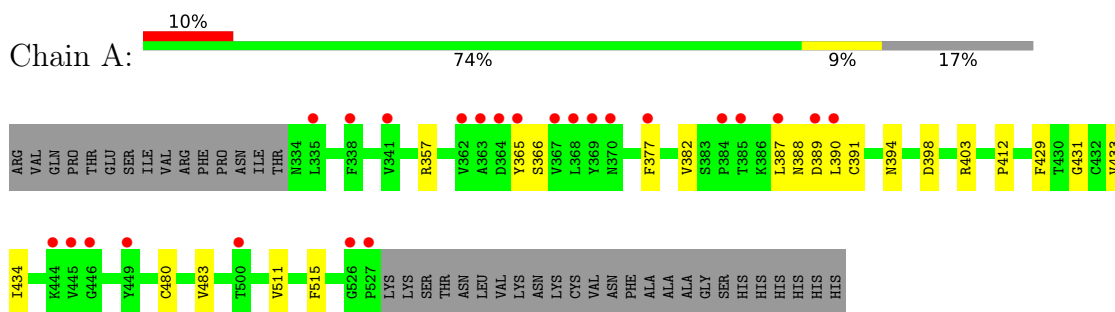
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	63	Total	O	0	0
			63	63		
5	H	74	Total	O	0	0
			74	74		
5	L	28	Total	O	0	0
			28	28		

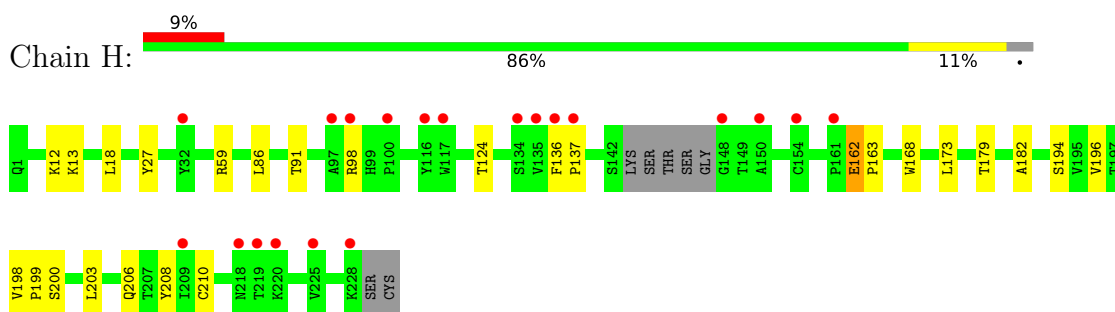
3 Residue-property plots [i](#)

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.

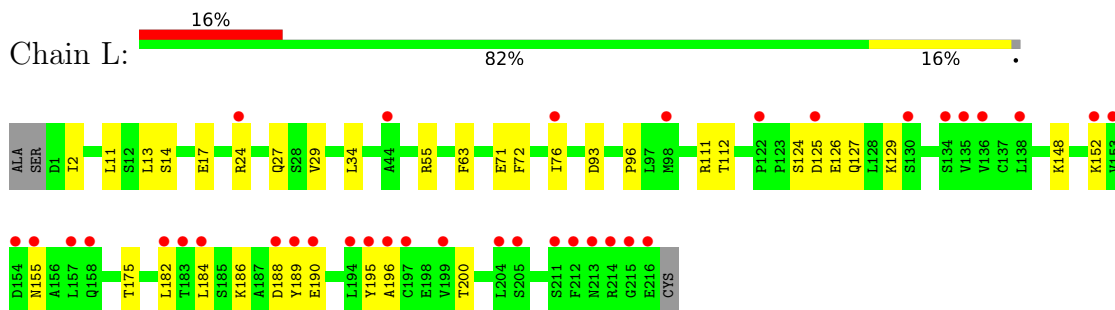
- Molecule 1: Surface glycoprotein



- Molecule 2: Heavy Chain



- Molecule 3: Light Chain



4 Data and refinement statistics

Property	Value	Source
Space group	P 43	Depositor
Cell constants a, b, c, α , β , γ	74.86Å 74.86Å 143.11Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.23 – 2.35 40.23 – 2.35	Depositor EDS
% Data completeness (in resolution range)	99.1 (40.23-2.35) 99.1 (40.23-2.35)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.69 (at 2.34Å)	Xtrriage
Refinement program	REFMAC v1, PHENIX 1.18.2_3874	Depositor
R, R_{free}	0.224 , 0.265 0.229 , 0.271	Depositor DCC
R_{free} test set	3294 reflections (10.15%)	wwPDB-VP
Wilson B-factor (Å ²)	56.5	Xtrriage
Anisotropy	0.052	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	(Not available) , (Not available)	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	0.048 for h,-k,-l	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	4977	wwPDB-VP
Average B, all atoms (Å ²)	69.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.41% 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	0.27	0/1553	0.49	0/2118
2	H	0.31	1/1707 (0.1%)	0.56	2/2332 (0.1%)
3	L	0.30	0/1667	0.55	0/2271
All	All	0.29	1/4927 (0.0%)	0.54	2/6721 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	H	13	LYS	CE-NZ	5.10	1.61	1.49

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	H	12	LYS	C-N-CA	6.20	137.19	121.70
2	H	162	GLU	C-N-CD	-5.54	108.42	120.60

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	1510	0	1409	14	0
2	H	1658	0	1576	15	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	L	1630	0	1534	26	0
4	A	14	0	13	0	0
5	A	63	0	0	1	0
5	H	74	0	0	0	0
5	L	28	0	0	0	0
All	All	4977	0	4532	52	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 6.

All (52) 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:L:24:ARG:HE	3:L:71:GLU:HG3	1.48	0.78
3:L:24:ARG:HE	3:L:71:GLU:CG	2.00	0.73
1:A:377:PHE:CD1	1:A:434:ILE:HG12	2.34	0.62
3:L:11:LEU:HD22	3:L:13:LEU:HG	1.81	0.61
3:L:148:LYS:HB3	3:L:200:THR:HB	1.82	0.61
1:A:403:ARG:NH1	5:A:702:HOH:O	2.36	0.59
3:L:182:LEU:HD22	3:L:184:LEU:HG	1.84	0.59
3:L:14:SER:N	3:L:17:GLU:OE1	2.34	0.59
2:H:162:GLU:HG2	2:H:163:PRO:HA	1.86	0.56
3:L:29:VAL:HG13	3:L:93:ASP:HB2	1.90	0.54
2:H:91:THR:HG23	2:H:124:THR:HA	1.89	0.54
1:A:357:ARG:NH1	1:A:394:ASN:OD1	2.42	0.53
3:L:111:ARG:NH1	3:L:175:THR:HG23	2.24	0.53
1:A:382:VAL:HG21	1:A:387:LEU:HD13	1.92	0.52
2:H:18:LEU:HB2	2:H:86:LEU:HD11	1.91	0.52
3:L:111:ARG:NH1	3:L:175:THR:CG2	2.73	0.52
1:A:431:GLY:HA2	1:A:515:PHE:CD1	2.45	0.51
1:A:366:SER:H	1:A:388:ASN:HD21	1.58	0.51
2:H:59:ARG:NH2	3:L:96:PRO:HG2	2.27	0.50
3:L:152:LYS:HB2	3:L:196:ALA:HB3	1.94	0.49
2:H:198:VAL:HG22	2:H:199:PRO:HD2	1.94	0.48
1:A:389:ASP:OD1	1:A:389:ASP:N	2.46	0.48
2:H:206:GLN:HG3	2:H:208:TYR:CE1	2.48	0.48
3:L:184:LEU:HD13	3:L:188:ASP:OD1	2.14	0.48
2:H:162:GLU:OE2	2:H:182:ALA:HB3	2.14	0.47
1:A:412:PRO:HG3	1:A:429:PHE:HB3	1.97	0.47
2:H:179:THR:HG23	2:H:194:SER:HB2	1.97	0.47
3:L:24:ARG:NE	3:L:71:GLU:HG3	2.24	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:377:PHE:HA	1:A:433:VAL:O	2.15	0.45
2:H:173:LEU:CD2	2:H:196:VAL:HG21	2.46	0.45
3:L:124:SER:O	3:L:126:GLU:N	2.43	0.45
3:L:189:TYR:O	3:L:195:TYR:OH	2.34	0.44
3:L:186:LYS:O	3:L:190:GLU:HG3	2.17	0.44
3:L:34:LEU:HD13	3:L:72:PHE:CD1	2.52	0.44
3:L:55:ARG:HD3	3:L:63:PHE:O	2.18	0.44
3:L:63:PHE:CD2	3:L:76:ILE:HG12	2.53	0.44
2:H:136:PHE:CE1	3:L:127:GLN:HG3	2.53	0.44
3:L:125:ASP:O	3:L:129:LYS:HG3	2.19	0.42
2:H:27:TYR:CZ	2:H:98:ARG:HD2	2.54	0.42
2:H:173:LEU:HD21	2:H:196:VAL:HG21	2.01	0.42
3:L:111:ARG:HH11	3:L:175:THR:HG23	1.83	0.42
1:A:398:ASP:O	1:A:511:VAL:HA	2.20	0.42
1:A:365:TYR:CD2	1:A:387:LEU:HG	2.55	0.42
1:A:366:SER:OG	1:A:388:ASN:ND2	2.53	0.42
1:A:390:LEU:HD12	1:A:391:CYS:H	1.85	0.41
2:H:137:PRO:HD2	3:L:124:SER:CB	2.50	0.41
2:H:200:SER:HA	2:H:203:LEU:HD13	2.02	0.41
3:L:2:ILE:HG12	3:L:27:GLN:HB2	2.01	0.41
3:L:111:ARG:CG	3:L:112:THR:N	2.83	0.41
2:H:168:TRP:CH2	2:H:210:CYS:HB3	2.56	0.41
1:A:480:CYS:O	1:A:483:VAL:HG12	2.22	0.40
3:L:152:LYS:HB3	3:L:155:ASN:HA	2.02	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	192/234 (82%)	180 (94%)	12 (6%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	H	219/230 (95%)	211 (96%)	8 (4%)	0	100	100
3	L	214/219 (98%)	204 (95%)	10 (5%)	0	100	100
All	All	625/683 (92%)	595 (95%)	30 (5%)	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	A	161/203 (79%)	161 (100%)	0	100	100
2	H	182/194 (94%)	182 (100%)	0	100	100
3	L	179/188 (95%)	179 (100%)	0	100	100
All	All	522/585 (89%)	522 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
2	H	185	GLN
3	L	80	GLN
3	L	127	GLN
3	L	202	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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

1 ligand is 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.

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	194/234 (82%)	0.73	24 (12%) 4 6	42, 60, 104, 158	0
2	H	223/230 (96%)	0.66	20 (8%) 9 14	41, 59, 102, 141	0
3	L	216/219 (98%)	1.00	36 (16%) 1 2	47, 73, 117, 135	0
All	All	633/683 (92%)	0.80	80 (12%) 3 6	41, 66, 112, 158	0

All (80) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	L	195	TYR	8.8
1	A	445	VAL	7.9
3	L	212	PHE	7.2
2	H	135	VAL	6.8
2	H	136	PHE	6.5
3	L	189	TYR	5.3
3	L	216	GLU	5.0
1	A	365	TYR	5.0
3	L	153	VAL	4.5
3	L	215	GLY	4.1
1	A	387	LEU	3.9
3	L	197	CYS	3.8
3	L	125	ASP	3.8
1	A	527	PRO	3.8
2	H	161	PRO	3.6
1	A	369	TYR	3.5
1	A	367	VAL	3.5
3	L	194	LEU	3.5
3	L	213	ASN	3.5
3	L	157	LEU	3.5
3	L	183	THR	3.4
1	A	370	ASN	3.4
3	L	196	ALA	3.4

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Mol	Chain	Res	Type	RSRZ
3	L	205	SER	3.4
3	L	214	ARG	3.4
3	L	184	LEU	3.2
3	L	155	ASN	3.2
3	L	136	VAL	3.2
1	A	364	ASP	3.2
3	L	182	LEU	3.1
1	A	363	ALA	3.1
3	L	152	LYS	3.1
3	L	24	ARG	3.1
1	A	335	LEU	3.0
3	L	204	LEU	3.0
1	A	377	PHE	3.0
3	L	122	PRO	2.9
1	A	449	TYR	2.9
1	A	362	VAL	2.9
2	H	148	GLY	2.8
2	H	150	ALA	2.8
1	A	384	PRO	2.8
3	L	211	SER	2.8
2	H	134	SER	2.8
1	A	444	LYS	2.8
2	H	228	LYS	2.8
3	L	130	SER	2.8
1	A	446	GLY	2.7
1	A	526	GLY	2.7
3	L	135	VAL	2.7
1	A	341	VAL	2.7
1	A	368	LEU	2.6
1	A	500	THR	2.5
1	A	390	LEU	2.5
2	H	98	ARG	2.5
2	H	137	PRO	2.5
3	L	188	ASP	2.5
2	H	117	TRP	2.4
3	L	190	GLU	2.3
3	L	154	ASP	2.3
2	H	97	ALA	2.3
1	A	389	ASP	2.2
3	L	134	SER	2.2
1	A	385	THR	2.2
2	H	32	TYR	2.2

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Mol	Chain	Res	Type	RSRZ
2	H	116	TYR	2.2
2	H	220	LYS	2.2
3	L	199	VAL	2.2
3	L	158	GLN	2.2
3	L	44	ALA	2.2
2	H	209	ILE	2.2
2	H	219	THR	2.1
2	H	100	PRO	2.1
2	H	218	ASN	2.1
3	L	76	ILE	2.1
2	H	225	VAL	2.1
3	L	138	LEU	2.1
1	A	338	PHE	2.0
2	H	154	CYS	2.0
3	L	98	MET	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 monosaccharides 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
4	NAG	A	601	14/15	0.66	0.22	93,103,111,116	0

6.5 Other polymers [i](#)

There are no such residues in this entry.