



Full wwPDB X-ray Structure Validation Report ⓘ

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PDB ID : 7B27
Title : RBD domain SARS-CoV2 in complex with neutralizing nanobody NM1230
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Deposited on : 2020-11-26
Resolution : 2.90 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 : 4.02b-467
Mogul : 1.8.4, CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.36
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36

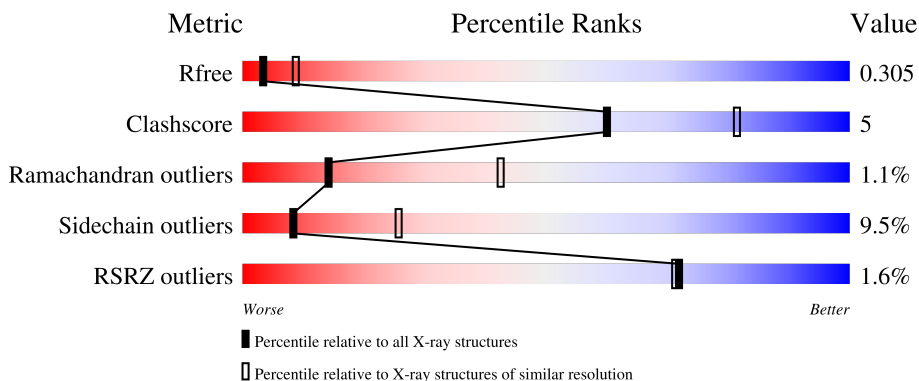
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION





The reported resolution of this entry is 2.90 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	1957 (2.90-2.90)
Clashscore	141614	2172 (2.90-2.90)
Ramachandran outliers	138981	2115 (2.90-2.90)
Sidechain outliers	138945	2117 (2.90-2.90)
RSRZ outliers	127900	1906 (2.90-2.90)

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	AAA	222	 4% 77% 12% • 9%
1	aba	222	 76% 5% 18%
2	CCC	141	 75% 13% 11%
2	DDD	141	 % 70% 13% • 13%

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 4859 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.

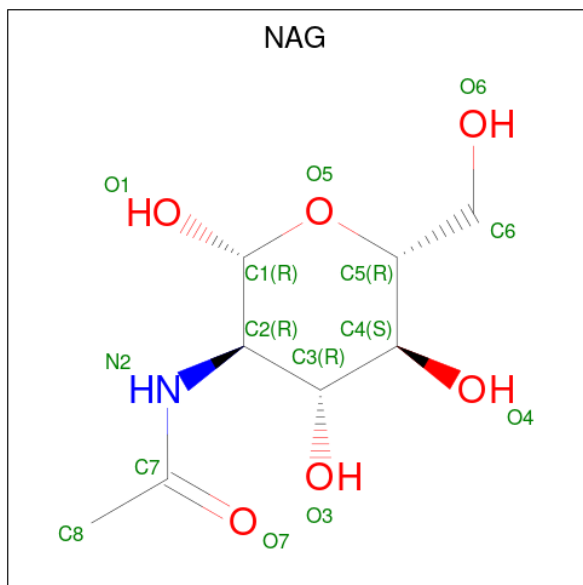
- Molecule 1 is a protein called Surface glycoprotein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	AAA	202	Total 1571	C 1006	N 260	O 296	S 9	0	0	0
1	aba	181	Total 1435	C 920	N 239	O 269	S 7	0	0	0

- Molecule 2 is a protein called neutralizing nanobody NM1230.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	CCC	125	Total 934	C 577	N 170	O 182	S 5	0	0	0
2	DDD	122	Total 891	C 553	N 164	O 169	S 5	0	0	0

- Molecule 3 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: $C_8H_{15}NO_6$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	AAA	1	Total	C	N	O	0	0
			14	8	1	5		
3	aba	1	Total	C	N	O	0	0
			14	8	1	5		

4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	63.29Å 63.29Å 411.91Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 2.90 46.53 – 2.90	Depositor EDS
% Data completeness (in resolution range)	93.4 (30.00-2.90) 93.6 (46.53-2.90)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.52 (at 2.91Å)	Xtrriage
Refinement program	REFMAC 5.8.0232 2018/13/08	Depositor
R, R_{free}	0.266 , 0.305 0.266 , 0.305	Depositor DCC
R_{free} test set	1295 reflections (7.00%)	wwPDB-VP
Wilson B-factor (Å ²)	65.1	Xtrriage
Anisotropy	0.727	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 27.3	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	0.91	EDS
Total number of atoms	4859	wwPDB-VP
Average B, all atoms (Å ²)	74.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.15% 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	AAA	0.66	0/1613	0.72	0/2196
1	aba	0.65	0/1475	0.71	0/2005
2	CCC	0.67	0/951	0.73	0/1287
2	DDD	0.68	0/908	0.76	0/1232
All	All	0.66	0/4947	0.73	0/6720

There are no bond length outliers.

There are no bond angle outliers.

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	AAA	1571	0	1476	12	0
1	aba	1435	0	1352	0	0
2	CCC	934	0	903	6	0
2	DDD	891	0	858	10	0
3	AAA	14	0	13	0	0
3	aba	14	0	13	0	0
All	All	4859	0	4615	28	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 5.

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:AAA:367:CYS:HG	1:AAA:420:CYS:HG	0.86	0.81
1:AAA:348:ASN:N	1:AAA:511:THR:OG1	2.12	0.81
1:AAA:348:ASN:H	1:AAA:511:THR:HG1	1.29	0.77
2:DDD:4:LEU:HD22	2:DDD:96:CYS:SG	2.29	0.72
2:CCC:4:LEU:HD22	2:CCC:22:CYS:SG	2.44	0.57
2:DDD:4:LEU:CD2	2:DDD:96:CYS:SG	2.93	0.56
2:DDD:62:GLU:N	2:DDD:63:PRO:HD2	2.24	0.52
1:AAA:324:CYS:HG	1:AAA:349:CYS:CB	2.23	0.52
1:AAA:379:CYS:HG	1:AAA:513:CYS:HG	1.59	0.50
1:AAA:379:CYS:SG	1:AAA:513:CYS:SG	3.09	0.50
2:DDD:33:ALA:HB1	2:DDD:51:ILE:O	2.13	0.48
1:AAA:367:CYS:HA	1:AAA:420:CYS:HA	1.95	0.47
2:DDD:2:VAL:HG23	2:DDD:102:ARG:HH11	1.79	0.47
2:CCC:62:GLU:N	2:CCC:63:PRO:HD2	2.29	0.47
2:DDD:117:GLN:HE21	2:DDD:117:GLN:HA	1.80	0.46
1:AAA:426:SER:CB	1:AAA:497:ARG:HD2	2.47	0.45
1:AAA:383:VAL:HG21	1:AAA:512:VAL:HG21	1.99	0.45
1:AAA:442:ARG:NH2	1:AAA:455:ASP:O	2.46	0.45
2:CCC:53:ASN:O	2:CCC:72:ARG:CZ	2.65	0.44
2:DDD:2:VAL:O	2:DDD:102:ARG:NH1	2.50	0.43
2:DDD:94:TYR:CD1	2:DDD:118:VAL:CG1	3.02	0.43
2:CCC:57:LEU:HD12	2:CCC:57:LEU:HA	1.93	0.42
2:CCC:30:SER:CB	2:CCC:74:ASN:HD22	2.32	0.42
2:DDD:57:LEU:HD23	2:DDD:57:LEU:HA	1.93	0.41
1:AAA:348:ASN:N	1:AAA:511:THR:HG1	2.04	0.41
2:DDD:118:VAL:O	2:DDD:118:VAL:HG13	2.21	0.41
1:AAA:345:ARG:NH1	1:AAA:382:ASN:OD1	2.55	0.40
2:CCC:37:TYR:HB3	2:CCC:45:LEU:HD22	2.02	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	AAA	198/222 (89%)	177 (89%)	20 (10%)	1 (0%)	29	61
1	aba	179/222 (81%)	158 (88%)	21 (12%)	0	100	100
2	CCC	123/141 (87%)	110 (89%)	12 (10%)	1 (1%)	19	51
2	DDD	120/141 (85%)	111 (92%)	4 (3%)	5 (4%)	3	10
All	All	620/726 (85%)	556 (90%)	57 (9%)	7 (1%)	14	42

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	AAA	408	ASP
2	CCC	65	LYS
2	DDD	53	ASN
2	DDD	91	THR
2	DDD	108	ARG
2	DDD	118	VAL
2	DDD	100	GLY

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	AAA	168/195 (86%)	152 (90%)	16 (10%)	8	26
1	aba	154/195 (79%)	142 (92%)	12 (8%)	12	34
2	CCC	96/114 (84%)	89 (93%)	7 (7%)	14	38
2	DDD	89/114 (78%)	76 (85%)	13 (15%)	3	9
All	All	507/618 (82%)	459 (90%)	48 (10%)	8	26

All (48) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	AAA	323	LEU

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Mol	Chain	Res	Type
1	AAA	329	VAL
1	AAA	355	VAL
1	AAA	358	ASN
1	AAA	365	PHE
1	AAA	370	VAL
1	AAA	403	THR
1	AAA	432	LYS
1	AAA	433	VAL
1	AAA	442	ARG
1	AAA	443	LEU
1	AAA	448	ASN
1	AAA	459	GLU
1	AAA	477	TYR
1	AAA	511	THR
1	AAA	512	VAL
1	aba	346	ILE
1	aba	350	VAL
1	aba	378	LEU
1	aba	396	ARG
1	aba	412	LYS
1	aba	438	ASN
1	aba	450	LYS
1	aba	471	VAL
1	aba	477	TYR
1	aba	486	GLN
1	aba	491	VAL
1	aba	494	GLN
2	CCC	2	VAL
2	CCC	18	LEU
2	CCC	23	VAL
2	CCC	67	ARG
2	CCC	75	ASP
2	CCC	123	GLU
2	CCC	124	GLN
2	DDD	2	VAL
2	DDD	3	GLN
2	DDD	4	LEU
2	DDD	18	LEU
2	DDD	23	VAL
2	DDD	51	ILE
2	DDD	53	ASN
2	DDD	61	GLU

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Mol	Chain	Res	Type
2	DDD	70	ILE
2	DDD	89	GLU
2	DDD	103	VAL
2	DDD	117	GLN
2	DDD	120	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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](#)

2 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	$\# Z > 2$
3	NAG	AAA	601	1	14,14,15	0.35	0	17,19,21	1.40	3 (17%)
3	NAG	aba	601	1	14,14,15	0.42	0	17,19,21	1.41	2 (11%)

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
3	NAG	AAA	601	1	-	2/6/23/26	0/1/1/1
3	NAG	aba	601	1	-	0/6/23/26	0/1/1/1

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	aba	601	NAG	C1-O5-C5	4.15	117.82	112.19
3	AAA	601	NAG	C1-O5-C5	3.29	116.64	112.19
3	AAA	601	NAG	O5-C1-C2	2.99	116.02	111.29
3	aba	601	NAG	O5-C1-C2	2.61	115.40	111.29
3	AAA	601	NAG	C3-C4-C5	2.39	114.51	110.24

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	AAA	601	NAG	C4-C5-C6-O6
3	AAA	601	NAG	O5-C5-C6-O6

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 [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	AAA	202/222 (90%)	0.31	8 (3%) 38 33	47, 71, 114, 134	0
1	aba	181/222 (81%)	0.21	1 (0%) 89 89	45, 73, 104, 120	0
2	CCC	125/141 (88%)	0.25	0 100 100	43, 63, 93, 115	0
2	DDD	122/141 (86%)	0.22	1 (0%) 86 86	60, 81, 103, 113	0
All	All	630/726 (86%)	0.25	10 (1%) 72 71	43, 72, 106, 134	0

All (10) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	AAA	522	VAL	3.8
1	AAA	526	CYS	3.4
1	AAA	323	LEU	3.0
1	AAA	509	PRO	2.8
1	AAA	351	ALA	2.5
1	AAA	358	ASN	2.5
2	DDD	10	GLY	2.3
1	AAA	326	PHE	2.3
1	aba	326	PHE	2.3
1	AAA	493	TYR	2.1

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
3	NAG	AAA	601	14/15	0.80	0.34	87,106,112,113	0
3	NAG	aba	601	14/15	0.85	0.26	97,113,120,125	0

6.5 Other polymers [i](#)

There are no such residues in this entry.