



Full wwPDB EM Validation Report ⓘ

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PDB ID : 8ZHG / pdb_00008zhg
EMDB ID : EMD-60102
Title : SARS-CoV-2 spike trimer (6P) in complex with R1-26 Fab, focused refinement of RBD-Fab region
Authors : Yan, Q.; Gao, X.; Liu, B.; Hou, R.; He, P.; Li, Z.; Chen, Q.; Wang, J.; He, J.; Chen, L.; Zhao, J.; Xiong, X.
Deposited on : 2024-05-10
Resolution : 3.51 Å(reported)

This is a Full wwPDB EM 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/EMValidationReportHelp>
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:

EMDB validation analysis : **FAILED**
Mogul : 1.8.5 (274361), CSD as541be (2020)
MolProbity : 4-5-2 with Phenix2.0rc1
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ : **FAILED**
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.44

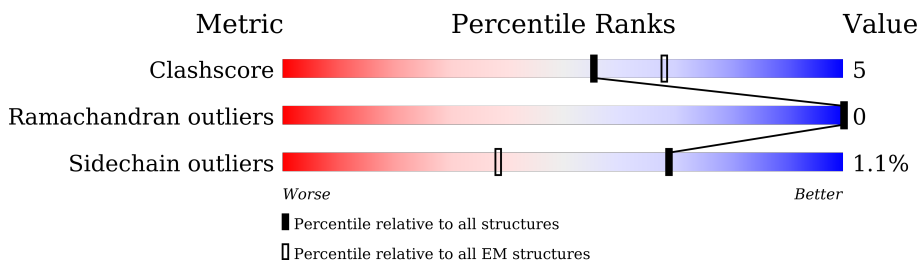
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.51 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)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the 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 $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	C	1278	
2	H	139	
3	L	126	
4	A	2	

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 3326 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, 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 Spike glycoprotein,Fibritin,Expression Tag.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	C	196	Total	C	N	O	S	0	0
			1552	995	259	290	8		

There are 11 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	682	GLY	ARG	conflict	UNP P0DTC2
C	683	SER	ARG	conflict	UNP P0DTC2
C	685	SER	ARG	conflict	UNP P0DTC2
C	817	PRO	PHE	conflict	UNP P0DTC2
C	892	PRO	ALA	conflict	UNP P0DTC2
C	899	PRO	ALA	conflict	UNP P0DTC2
C	942	PRO	ALA	conflict	UNP P0DTC2
C	986	PRO	LYS	variant	UNP P0DTC2
C	987	PRO	VAL	variant	UNP P0DTC2
C	1209	GLY	-	linker	UNP P0DTC2
C	1210	SER	-	linker	UNP P0DTC2

- Molecule 2 is a protein called Heavy chain of R1-26 Fab.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	H	120	Total	C	N	O	S	0	0
			926	586	159	177	4		

- Molecule 3 is a protein called Light chain of R1-26 Fab.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	L	109	Total	C	N	O	S	0	0
			820	503	136	178	3		

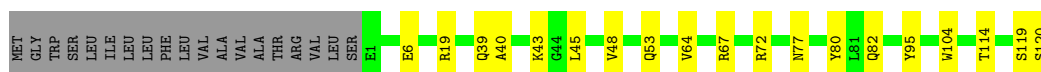
- Molecule 4 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



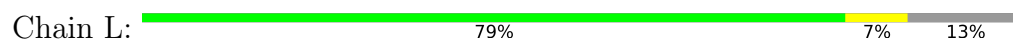
Mol	Chain	Residues	Atoms				AltConf	Trace
4	A	2	Total	C	N	O	0	0
			28	16	2	10		



- Molecule 2: Heavy chain of R1-26 Fab



- Molecule 3: Light chain of R1-26 Fab



- Molecule 4: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	1166919	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	81000	Depositor
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor

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	C	0.15	0/1596	0.36	0/2172
2	H	0.12	0/948	0.33	0/1285
3	L	0.14	0/839	0.36	0/1144
All	All	0.14	0/3383	0.35	0/4601

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	C	1552	0	1472	16	0
2	H	926	0	892	11	0
3	L	820	0	755	6	0
4	A	28	0	25	0	0
All	All	3326	0	3144	31	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 (31) 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:H:39:GLN:HB3	2:H:45:LEU:HD23	1.82	0.62
2:H:6:GLU:HG3	2:H:114:THR:HG23	1.81	0.62
1:C:442:ASP:O	1:C:448:ASN:ND2	2.37	0.58
1:C:396:TYR:HB2	1:C:514:SER:HB2	1.89	0.55
1:C:391:CYS:HB2	1:C:525:CYS:HA	1.89	0.54
2:H:19:ARG:HE	2:H:80:TYR:HB3	1.75	0.51
1:C:340:GLU:OE1	1:C:340:GLU:N	2.37	0.51
3:L:88:ASP:OD1	3:L:88:ASP:N	2.43	0.51
1:C:412:PRO:HG3	1:C:425:LEU:HD23	1.93	0.50
1:C:452:LEU:HB3	1:C:492:LEU:HG	1.93	0.49
2:H:119:SER:OG	2:H:120:SER:N	2.46	0.49
1:C:409:GLN:HE22	1:C:418:ILE:H	1.61	0.49
2:H:40:ALA:HB3	2:H:43:LYS:HB2	1.96	0.48
2:H:48:VAL:HG13	2:H:64:VAL:HG11	1.96	0.48
2:H:53:GLN:O	2:H:72:ARG:NH1	2.47	0.47
1:C:442:ASP:OD1	1:C:451:TYR:OH	2.27	0.46
3:L:28:SER:HA	3:L:72:ASN:HD21	1.81	0.46
1:C:455:LEU:HD21	1:C:493:GLN:HB3	1.98	0.46
1:C:430:THR:OG1	1:C:515:PHE:O	2.35	0.45
1:C:398:ASP:OD2	1:C:423:TYR:OH	2.34	0.45
3:L:50:TYR:HD2	3:L:56:PRO:HG3	1.82	0.45
2:H:19:ARG:HG3	2:H:82:GLN:HB2	1.99	0.44
1:C:405:ASP:OD1	1:C:405:ASP:N	2.37	0.44
3:L:39:GLN:HG2	3:L:45:PRO:HG3	2.00	0.43
1:C:467:ASP:OD1	1:C:467:ASP:N	2.41	0.43
3:L:2:PHE:HD1	3:L:26:SER:HB2	1.84	0.43
2:H:95:TYR:HE2	3:L:45:PRO:HD3	1.84	0.42
1:C:342:PHE:HE1	1:C:434:ILE:HG21	1.84	0.42
2:H:45:LEU:HD23	2:H:45:LEU:HA	1.88	0.42
1:C:369:TYR:HA	2:H:104:TRP:HE1	1.86	0.41
1:C:384:PRO:HA	1:C:387:LEU:HG	2.03	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 PDB entries followed by that with respect to all EM entries.

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	C	194/1278 (15%)	186 (96%)	8 (4%)	0	100	100
2	H	118/139 (85%)	113 (96%)	5 (4%)	0	100	100
3	L	107/126 (85%)	102 (95%)	5 (5%)	0	100	100
All	All	419/1543 (27%)	401 (96%)	18 (4%)	0	100	100

There are no Ramachandran outliers to report.

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 PDB entries followed by that with respect to all EM entries.

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	C	169/1106 (15%)	167 (99%)	2 (1%)	67	82
2	H	97/113 (86%)	95 (98%)	2 (2%)	48	70
3	L	95/108 (88%)	95 (100%)	0	100	100
All	All	361/1327 (27%)	357 (99%)	4 (1%)	69	83

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	427	ASP
1	C	495	TYR
2	H	67	ARG
2	H	77	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	409	GLN
1	C	439	ASN
1	C	481	ASN

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Mol	Chain	Res	Type
2	H	84	ASN
3	L	32	ASN
3	L	38	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

2 monosaccharides 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	$\# Z > 2$
4	NAG	A	1	1,4	14,14,15	0.27	0	17,19,21	0.47	0
4	NAG	A	2	4	14,14,15	0.26	0	17,19,21	0.43	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
4	NAG	A	1	1,4	-	0/6/23/26	0/1/1/1
4	NAG	A	2	4	-	2/6/23/26	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

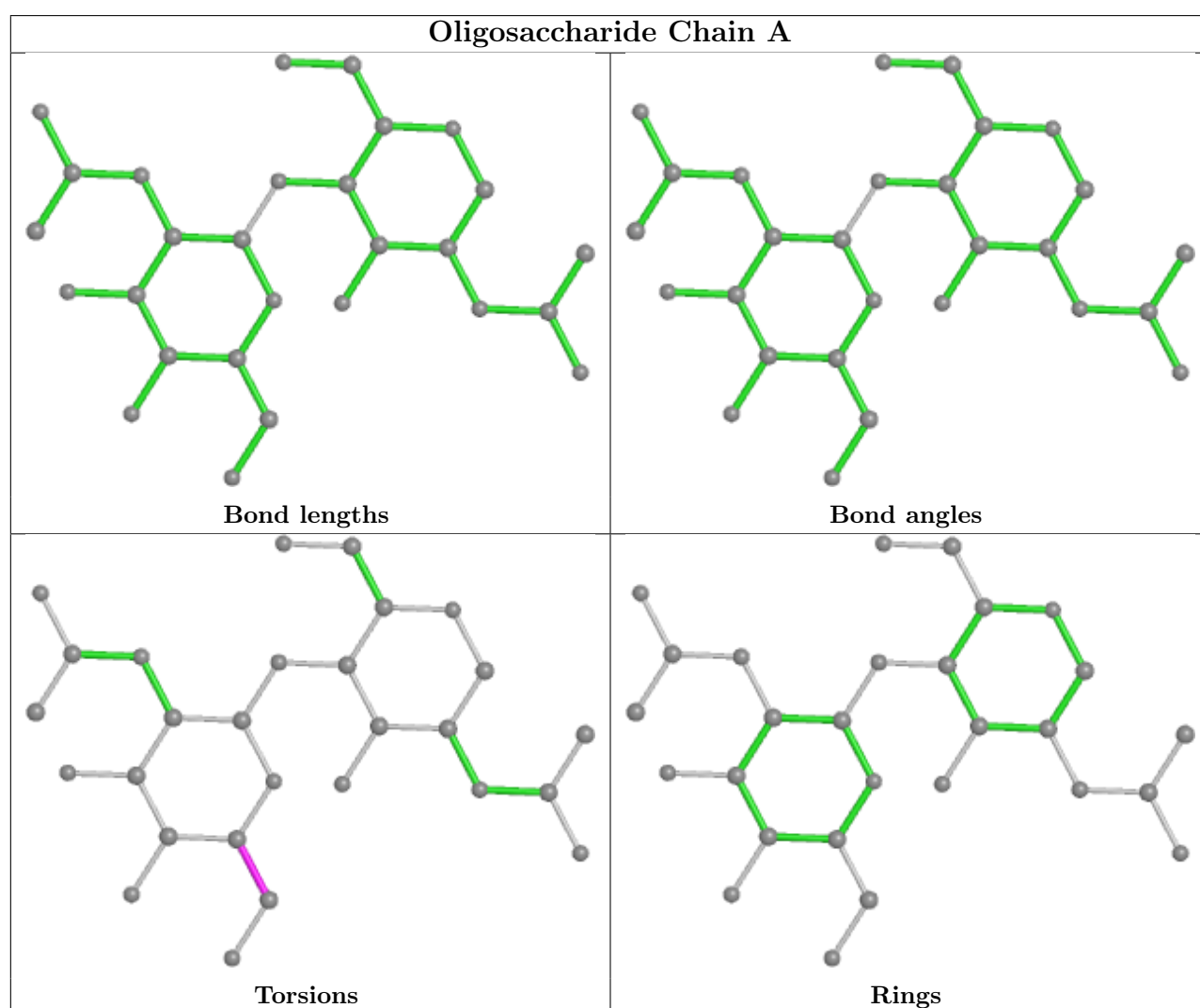
All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	2	NAG	C4-C5-C6-O6
4	A	2	NAG	O5-C5-C6-O6

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.



5.6 Ligand geometry [i](#)

There are no ligands in this entry.

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.