WORLDWIDE PDB

PROTEIN DATA BANK

wwPDB EM Validation Summary Report (i)

Jul 15, 2025 – 02:10 PM JST

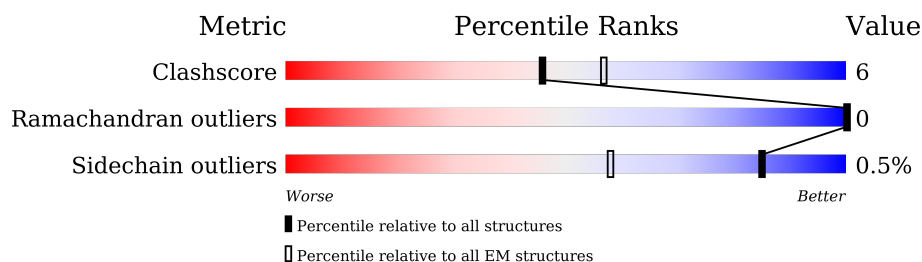|		
PDB ID	:	8ZHP / pdb_00008zhp
EMDB ID	:	EMD-60111
Title	:	Dimer of SARS-CoV-2 S1 in complex with H18 and R1-32 Fabs
Authors	:	Yan, Q.; Gao, X.; Liu, B.; Hou, R.; He, P.; Li, Z.; Chen, Q.; Wang, J.; He, J.; Chen, L.; Zhao, J.; Xiong, X.
Deposited on	:	2024-05-11
Resolution	:	3.66 Å(reported)

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 3.66 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	Percentile Ranks	Value
Clashscore		6
Ramachandran outliers		0
Sidechain outliers		0.5%

Worse   *Better*

■ Percentile relative to all structures
▯ Percentile relative to all EM structures

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 <=5%

Mol	Chain	Length	Quality of chain
1	A	666	78% 15% 7%
1	C	666	78% 15% 7%
2	B	228	84% 15%
2	D	228	86% 14%
3	E	214	84% 15%
3	F	214	85% 14%
4	I	243	76% 12% 12%
4	L	243	79% 9% 12%
5	G	243	79% 14% 8%

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Mol	Chain	Length	Quality of chain
5	H	243	78% 14% 8%

2 Entry composition ⓘ

There are 6 unique types of molecules in this entry. The entry contains 22856 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.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	C	622	Total	C	N	O	S	0	0
			4932	3162	822	927	21		
1	A	622	Total	C	N	O	S	0	0
			4932	3162	822	927	21		

- Molecule 2 is a protein called Heavy chain of R1-32 Fab.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	D	227	Total	C	N	O	S	1	0
			1663	1047	277	332	7		
2	B	227	Total	C	N	O	S	0	0
			1661	1045	277	332	7		

- Molecule 3 is a protein called Light chain of R1-32 Fab.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	E	213	Total	C	N	O	S	0	0
			1557	971	261	321	4		
3	F	213	Total	C	N	O	S	0	0
			1557	971	261	321	4		

- Molecule 4 is a protein called Light chain of H18 Fab.

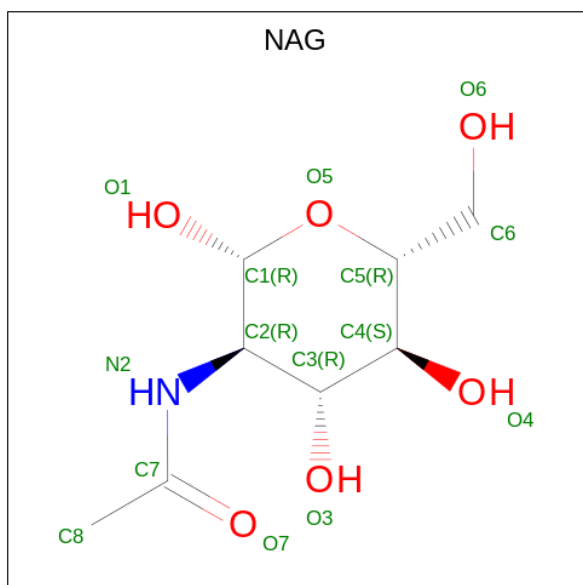| Mol	Chain	Residues	Atoms					AltConf	Trace
4	L	213	Total	C	N	O	S	0	0
			1593	989	264	335	5		
4	I	213	Total	C	N	O	S	0	0
			1593	989	264	335	5		

- Molecule 5 is a protein called Heavy chain of H18 Fab.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	H	224	Total 1670	C 1058	N 276	O 330	S 6	0	0
5	G	224	Total 1670	C 1058	N 276	O 330	S 6	0	0

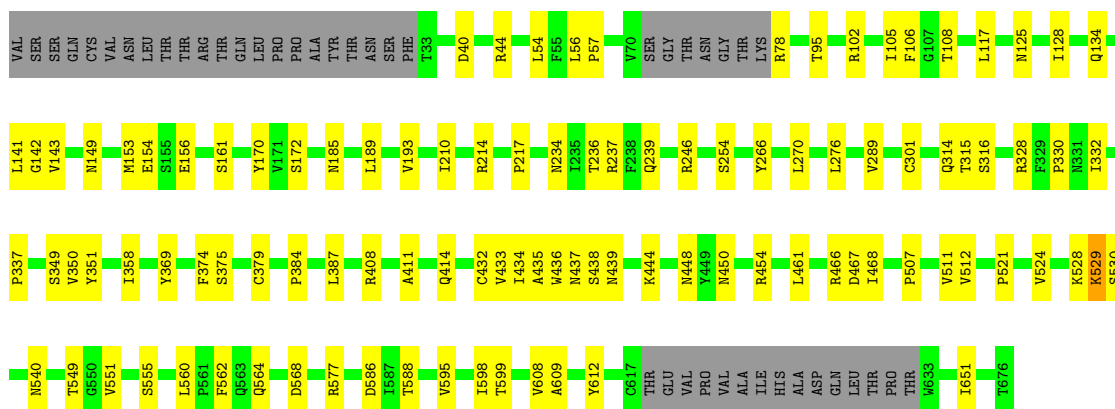- Molecule 6 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).

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

3 Residue-property plots ⓘ

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. 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. 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: Spike glycoprotein

Chain C:

- Molecule 1: Spike glycoprotein

Chain A:

- Molecule 2: Heavy chain of R1-32 Fab

Chain D:

V222 D228

● Molecule 2: Heavy chain of R1-32 Fab

Chain B: 84%   15%

GLU V2 S16 S17 V18 K19 A33 R38 Q39 A40 Q43 E46 P53 I57 Y60 R67 I70 Y80 S85 L86 R87 D90 C96 A97 Y102 G106 F111 D112 L113 W114 G115 P134 F157 N166 A169 V174 V193
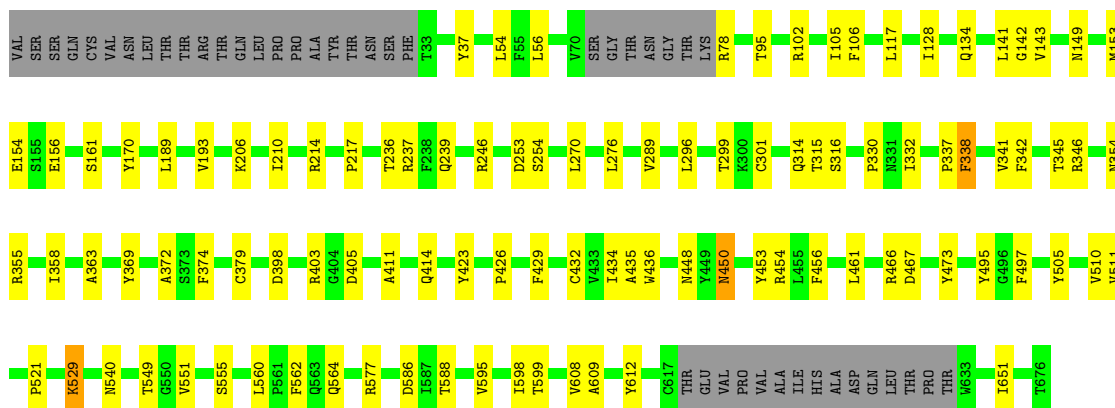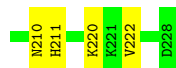
N210 H211 K220 K221 V222 D228

● Molecule 3: Light chain of R1-32 Fab

Chain E: 84%   15%

GLN S2 V3 L4 A13 Q16 R17 V18 I29 H36 L41 L48 L49 I50 Y51 R63 T78 G79 L80 D84 E85 A86 Q91 S98 T109 V110 L111 P118 L137 P146 A152 W153 K154 P169 L183 R194 Q199 H202

T214

● Molecule 3: Light chain of R1-32 Fab

Chain F: 85%   14%

GLN S2 V3 L4 A13 Q16 N28 I29 Y33 D34 V35 H36 L41 L48 Y51 R63 T78 G79 E85 A86 Q91 S95 S96 L97 S100 T109 L137 P146 A152 W153 K154 P169 L183 R194 Q199 T214

● Molecule 4: Light chain of H18 Fab

Chain L: 79%   9%   12%

MET GLY TRP SER CYS ILE ILE LEU PHE LEU VAL ALA THR ALA THR GLY VAL HIS SER ALA N1 Q6 P14 V18 E51 Q54 L81 Y90 Y94 V99 G102 K106 V109 L110 GLY THR LYS LEU THR VAL LEU G118 Q119 T127 L128 F129

L146 D162 T173 Q178 N181 K182 S186 T220 GLU CYS SER

● Molecule 4: Light chain of H18 Fab

Chain I: 76%   12%   12%

MET GLY TRP SER CYS ILE ILE LEU PHE LEU VAL ALA THR ALA THR GLY VAL HIS SER ALA N1 Q6 V18 R62 L81 K82 T83 E84 D85 Y90 G102 V109 L110 GLY THR LYS LEU THR VAL LEU G118 Q119 V126 T127 L128 F129 P130 L146 D162

T173 Q178 N181 K182 S186 Q195 Y202 S203 C204 Q205 E214 K215 T216 V217 T220 GLU CYS SER

• Molecule 5: Heavy chain of H18 Fab

Chain H:

78% 14% 8%

MET GLY TRP SER LEU ILE LEU LEU PHE LEU VAL ALA VAL ALA THR ARG VAL LEU SER Q1 S7 V12 K13 E16 T17 L18 T21 S30 R40 Q41 G46 L47 I50 I53 Y54 Y55 T59 I71 S72 V73 L82 K83 L84 R99 W102

D108 F129 P130 L131 S134 S137 A144 L145 G146 C147 L148 A175 V176 L185 V188 K208 D224

• Molecule 5: Heavy chain of H18 Fab

Chain G:

79% 14% 8%

MET GLY TRP SER LEU ILE LEU LEU PHE LEU VAL ALA VAL ALA THR ARG VAL LEU SER Q1 S19 S30 I39 R40 Q41 G46 L47 I50 G51 C52 I53 Y54 Y55 T59 N60 Y61 K66 I71 L82 Y96 R99 Q100 L101 W102 L103 R104 G105 R106 F107

D108 Y109 W110 K124 G125 L131 S134 S137 A144 L145 G146 V176 V188 D224

4 Experimental information ⓘ

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	144598	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 $(e^-/\text{Å}^2)$	50	Depositor
Minimum defocus (nm)	600	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	130000	Depositor
Image detector	FEI FALCON IV (4k 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	A	0.19	0/5062	0.35	0/6889
1	C	0.14	0/5062	0.31	0/6889
2	B	0.14	0/1698	0.33	0/2312
2	D	0.12	0/1704	0.29	0/2320
3	E	0.11	0/1595	0.32	0/2181
3	F	0.23	0/1595	0.39	0/2181
4	I	0.12	0/1630	0.32	0/2225
4	L	0.12	0/1630	0.32	0/2225
5	G	0.10	0/1713	0.29	0/2339
5	H	0.10	0/1713	0.29	0/2339
All	All	0.15	0/23402	0.32	0/31900

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	A	4932	0	4748	62	0
1	C	4932	0	4748	63	0
2	B	1661	0	1631	22	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	D	1663	0	1635	19	0
3	E	1557	0	1498	22	0
3	F	1557	0	1498	21	0
4	I	1593	0	1524	19	0
4	L	1593	0	1524	17	0
5	G	1670	0	1643	23	0
5	H	1670	0	1643	23	0
6	A	14	0	13	0	0
6	C	14	0	13	0	0
All	All	22856	0	22118	269	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.

The worst 5 of 269 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:A:379:CYS:HA	1:A:432:CYS:HB3	1.64	0.80
1:C:379:CYS:HA	1:C:432:CYS:HB3	1.68	0.75
1:A:411:ALA:HB3	1:A:414:GLN:HG3	1.72	0.70
1:A:448:ASN:HB2	1:A:497:PHE:HB2	1.73	0.70
1:C:411:ALA:HB3	1:C:414:GLN:HG3	1.74	0.68

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 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	A	616/666 (92%)	593 (96%)	23 (4%)	0	100	100
1	C	616/666 (92%)	594 (96%)	22 (4%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	B	225/228 (99%)	216 (96%)	9 (4%)	0	100	100
2	D	226/228 (99%)	219 (97%)	7 (3%)	0	100	100
3	E	211/214 (99%)	202 (96%)	9 (4%)	0	100	100
3	F	211/214 (99%)	202 (96%)	9 (4%)	0	100	100
4	I	209/243 (86%)	198 (95%)	11 (5%)	0	100	100
4	L	209/243 (86%)	201 (96%)	8 (4%)	0	100	100
5	G	222/243 (91%)	218 (98%)	4 (2%)	0	100	100
5	H	222/243 (91%)	218 (98%)	4 (2%)	0	100	100
All	All	2967/3188 (93%)	2861 (96%)	106 (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	A	548/587 (93%)	541 (99%)	7 (1%)	65	77
1	C	548/587 (93%)	545 (100%)	3 (0%)	86	92
2	B	184/186 (99%)	184 (100%)	0	100	100
2	D	185/186 (100%)	185 (100%)	0	100	100
3	E	174/177 (98%)	174 (100%)	0	100	100
3	F	174/177 (98%)	172 (99%)	2 (1%)	70	81
4	I	184/208 (88%)	184 (100%)	0	100	100
4	L	184/208 (88%)	184 (100%)	0	100	100
5	G	192/209 (92%)	192 (100%)	0	100	100
5	H	192/209 (92%)	192 (100%)	0	100	100
All	All	2565/2734 (94%)	2553 (100%)	12 (0%)	85	92

5 of 12 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	346	ARG
1	A	450	ASN
3	F	100	SER
1	A	529	LYS
1	A	56	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 44 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	580	GLN
2	B	166	ASN
1	A	641	ASN
2	B	43	GLN
3	F	81	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 ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

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	$\#|Z| > 2$
6	NAG	C	701	1	14,14,15	0.26	0	17,19,21	0.46	0
6	NAG	A	701	1	14,14,15	0.29	0	17,19,21	0.47	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
6	NAG	C	701	1	-	0/6/23/26	0/1/1/1
6	NAG	A	701	1	-	0/6/23/26	0/1/1/1

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 ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.