



wwPDB X-ray Structure Validation Summary Report

Mar 1, 2014 – 04:04 AM GMT

PDB ID : 3D0G
Title : Crystal structure of spike protein receptor-binding domain from the 2002-2003 SARS coronavirus human strain complexed with human-civet chimeric receptor ACE2
Authors : Li, F.
Deposited on : 2008-05-01
Resolution : 2.80 Å(reported)

This is a wwPDB validation summary report for a publicly released PDB entry.
We welcome your comments at validation@mail.wwpdb.org
A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

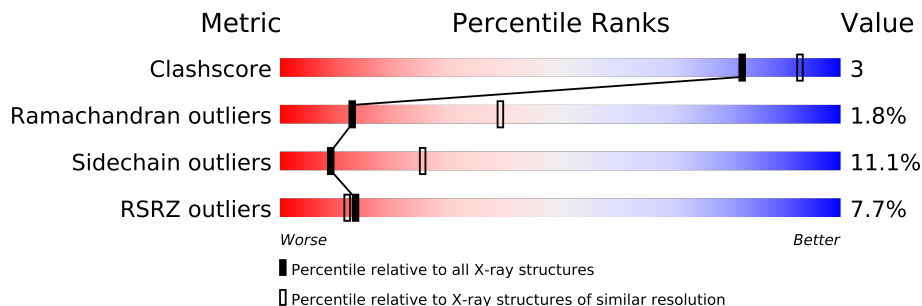
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.15 2013
Xtriage (Phenix) : dev-1323
EDS : stable22639
Percentile statistics : 21963
Refmac : 5.8.0049
CCP4 : 6.3.0 (Settle)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : stable22683

1 Overall quality at a glance

The reported resolution of this entry is 2.80 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))
Clashscore	79885	2295 (2.80-2.80)
Ramachandran outliers	78287	2252 (2.80-2.80)
Sidechain outliers	78261	2254 (2.80-2.80)
RSRZ outliers	66119	1802 (2.80-2.80)

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 on the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	597	
1	B	597	
2	E	179	
2	F	179	

The following table lists non-polymeric compounds that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
3	NDG	B	617	-	X

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 12643 atoms, of which 0 are hydrogen and 0 are deuterium.

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.

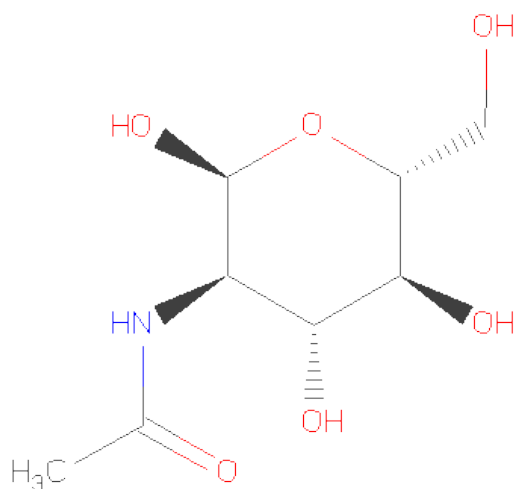
- Molecule 1 is a protein called Angiotensin-convertingenzyme 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	597	Total	C	N	O	S	0	0	0
			4864	3110	803	922	29			
1	B	597	Total	C	N	O	S	0	0	0
			4864	3110	803	922	29			

- Molecule 2 is a protein called Spike protein S1.

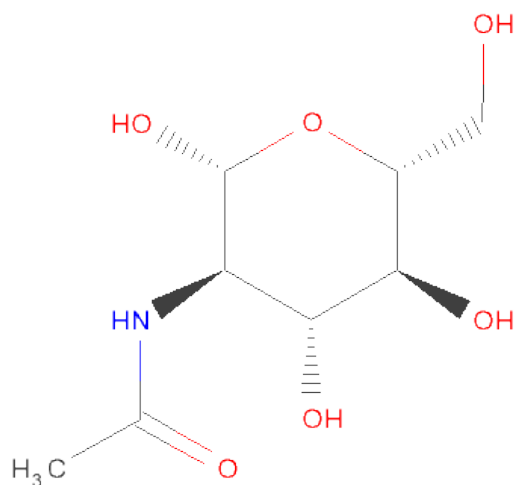
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	E	173	Total	C	N	O	S	0	0	0
			1397	906	227	258	6			
2	F	173	Total	C	N	O	S	0	0	0
			1397	906	227	258	6			

- Molecule 3 is SUGAR (2-(ACETYLAMINO)-2-DEOXY-A-D-GLUCOPYRANOSE) (three-letter code: NDG) (formula: C₈H₁₅NO₆).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			15	8	1	6		
3	B	1	Total	C	N	O	0	0
			15	8	1	6		
3	B	1	Total	C	N	O	0	0
			15	8	1	6		
3	B	1	Total	C	N	O	0	0
			15	8	1	6		
3	F	1	Total	C	N	O	0	0
			15	8	1	6		

- Molecule 4 is SUGAR (N-ACETYL-D-GLUCOSAMINE) (three-letter code: NAG) (formula: $C_8H_{15}NO_6$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	E	1	Total	C	N	O	0	0
			15	8	1	6		

- Molecule 5 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	B	1	Total	Zn	0	0
			1	1		
5	A	1	Total	Zn	0	0
			1	1		

- Molecule 6 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	B	1	Total 1	Cl 1	0	0
6	A	1	Total 1	Cl 1	0	0

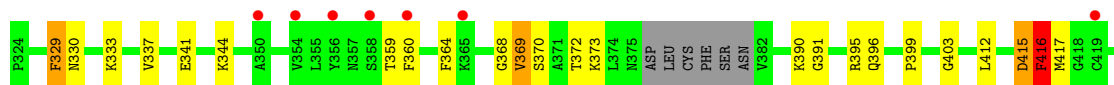
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	B	21	Total 21	O 21	0	0
7	F	6	Total 6	O 6	0	0



● Molecule 2: Spike protein S1

Chain F:



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	80.01Å 119.76Å 108.80Å 90.00° 96.22° 90.00°	Depositor
Resolution (Å)	47.14 – 2.80 47.16 – 2.79	Depositor EDS
% Data completeness (in resolution range)	93.8 (47.14-2.80) 88.7 (47.16-2.79)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.90 (at 2.77Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.214 , 0.279 0.210 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	DCC
Wilson B-factor (Å ²)	67.8	Xtriage
Anisotropy	0.238	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 37.5	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	1 of 48072 reflections (0.002%)	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	12643	wwPDB-VP
Average B, all atoms (Å ²)	74.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.68% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, NAG, NDG, CL

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	0.49	0/5000	0.60	0/6796
1	B	0.52	0/5000	0.63	2/6796 (0.0%)
2	E	0.52	0/1442	0.63	0/1963
2	F	0.51	0/1442	0.64	0/1963
All	All	0.51	0/12884	0.62	2/17518 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	456	LEU	CA-CB-CG	5.75	128.52	115.30
1	B	421	ILE	CB-CA-C	-5.23	101.14	111.60

There are no chirality outliers.

There are no planarity outliers.

5.2 Close contacts

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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	4864	0	0	16	0
1	B	4864	0	0	12	0
2	E	1397	0	0	6	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	F	1397	0	0	5	0
3	A	15	0	0	0	0
3	B	45	0	0	2	0
3	F	15	0	0	0	0
4	E	15	0	0	0	0
5	A	1	0	0	0	0
5	B	1	0	0	0	0
6	A	1	0	0	0	0
6	B	1	0	0	0	0
7	B	21	0	0	1	0
7	F	6	0	0	0	0
All	All	12643	0	0	39	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 3.

The worst 5 of 39 close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:457:GLU:OE2	1:A:460:ARG:NH1	2.16	0.78
1:B:183:TYR:OH	1:B:509:ASP:OD1	2.16	0.63
2:E:416:PHE:N	2:E:416:PHE:CD1	2.67	0.61
1:A:183:TYR:OH	1:A:509:ASP:OD1	2.20	0.58
1:B:546:ASN:ND2	3:B:618:NDG:O1L	2.37	0.58

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	A	595/597 (100%)	540 (91%)	51 (9%)	4 (1%)	30 69
1	B	595/597 (100%)	546 (92%)	40 (7%)	9 (2%)	15 46
2	E	169/179 (94%)	138 (82%)	23 (14%)	8 (5%)	4 11
2	F	169/179 (94%)	141 (83%)	22 (13%)	6 (4%)	5 17

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	1528/1552 (98%)	1365 (89%)	136 (9%)	27 (2%)	13	39

5 of 27 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	212	VAL
2	E	404	VAL
2	F	369	VAL
2	F	370	SER
1	B	536	GLU

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	527/527 (100%)	474 (90%)	53 (10%)	11	30
1	B	527/527 (100%)	473 (90%)	54 (10%)	11	29
2	E	151/157 (96%)	129 (85%)	22 (15%)	5	13
2	F	151/157 (96%)	129 (85%)	22 (15%)	5	13
All	All	1356/1368 (99%)	1205 (89%)	151 (11%)	9	25

5 of 151 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	240	LEU
1	B	410	LEU
2	F	373	LYS
1	B	290	ASN
1	B	343	VAL

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

5.3.3 RNA ⓘ

There are no RNA chains 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 carbohydrates in this entry.

5.6 Ligand geometry ⓘ

Of 10 ligands modelled in this entry, 4 are monoatomic - leaving 6 for Mogul analysis.

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	NDG	A	616	-	15,15,15	0.47	0	21,21,21	1.21	2 (9%)
3	NDG	B	616	-	15,15,15	0.41	0	21,21,21	0.74	0
3	NDG	B	617	-	15,15,15	0.73	0	21,21,21	1.44	1 (4%)
3	NDG	B	618	-	15,15,15	0.55	0	21,21,21	2.11	3 (14%)
4	NAG	E	91	-	15,15,15	0.52	0	21,21,21	1.63	5 (23%)
3	NDG	F	91	-	15,15,15	0.47	0	21,21,21	1.06	2 (9%)

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	NDG	A	616	-	-	0/6/26/26	0/1/1/1
3	NDG	B	616	-	-	0/6/26/26	0/1/1/1
3	NDG	B	617	-	-	0/6/26/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	NDG	B	618	-	-	0/6/26/26	0/1/1/1
4	NAG	E	91	-	-	0/6/26/26	0/1/1/1
3	NDG	F	91	-	-	0/6/26/26	0/1/1/1

There are no bond length outliers.

The worst 5 of 13 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	618	NDG	O-C1-C2	7.79	117.51	109.61
3	B	617	NDG	O-C1-C2	4.26	113.93	109.61
4	E	91	NAG	C1-O5-C5	3.78	120.17	113.40
4	E	91	NAG	O5-C1-C2	3.56	113.22	109.61
3	B	618	NDG	C1-O-C5	3.18	119.09	113.40

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

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.

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	597/597 (100%)	0.43	50 (8%) 11 9	41, 69, 119, 141	0
1	B	597/597 (100%)	0.37	37 (6%) 20 19	37, 65, 119, 139	0
2	E	173/179 (96%)	0.71	24 (13%) 4 3	54, 79, 123, 135	0
2	F	173/179 (96%)	0.39	9 (5%) 26 26	55, 80, 122, 134	0
All	All	1540/1552 (99%)	0.43	120 (7%) 13 11	37, 70, 121, 141	0

The worst 5 of 120 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	339	VAL	8.2
1	A	105	SER	7.4
1	B	86	GLN	7.3
2	E	501	PHE	5.9
1	A	290	ASN	5.7

6.2 Non-standard residues in protein, DNA, RNA chains

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

6.3 Carbohydrates

There are no carbohydrates in this entry.

6.4 Ligands

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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	RSR	LLDF	B-factors(\AA^2)	Q<0.9
3	NDG	B	617	15/15	0.21	8.80	79,88,90,90	0
5	ZN	A	901	1/1	0.21	1.54	85,85,85,85	0
6	CL	A	902	1/1	0.22	0.99	66,66,66,66	0
3	NDG	B	618	15/15	0.18	0.14	68,71,76,77	0
3	NDG	A	616	15/15	0.22	-0.30	109,109,110,111	0
3	NDG	B	616	15/15	0.26	-0.58	97,97,98,98	0
5	ZN	B	901	1/1	0.24	-0.96	81,81,81,81	0
6	CL	B	902	1/1	0.15	-1.28	53,53,53,53	0
3	NDG	F	91	15/15	0.25	-	118,119,119,120	0
4	NAG	E	91	15/15	0.34	-	127,128,129,129	0

6.5 Other polymers ⓘ

There are no such residues in this entry.