



Full wwPDB X-ray Structure Validation Report ⓘ

May 16, 2020 – 05:30 am BST

PDB ID : 2UUW
Title : 2.75 angstrom structure of the D347G D348G mutant structure of Sapporo Virus RdRp Polymerase
Authors : Fullerton, S.; Robel, I.; Schuldt, L.; Gebhardt, J.; Tucker, P.; Rohayem, J.
Deposited on : 2007-03-07
Resolution : 2.76 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
Xtriage (Phenix)	:	1.13
EDS	:	2.11
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)	:	2.11

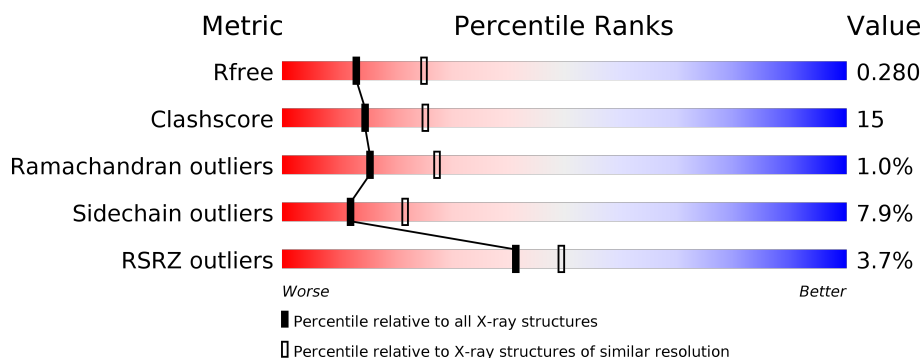
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.76 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	1235 (2.78-2.74)
Clashscore	141614	1277 (2.78-2.74)
Ramachandran outliers	138981	1257 (2.78-2.74)
Sidechain outliers	138945	1257 (2.78-2.74)
RSRZ outliers	127900	1207 (2.78-2.74)

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 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	515	<div> <div>3%</div> <div> <div></div> <div>71%</div> <div>20%</div> <div>• • 5%</div> </div> </div>

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 3902 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 RNA-DIRECTED RNA POLYMERASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	490	Total	C	N	O	S	0	0	0
			3780	2403	652	708	17			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	347	GLY	ASP	engineered mutation	UNP Q69014
A	348	GLY	ASP	engineered mutation	UNP Q69014

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	122	Total	O	0	0
			122	122		

• Molecule 1: RNA-DIRECTED RNA POLYMERASE



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	58.01Å 91.40Å 95.45Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.73 – 2.76 47.72 – 2.76	Depositor EDS
% Data completeness (in resolution range)	99.0 (47.73-2.76) 99.0 (47.72-2.76)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.26 (at 2.77Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.245 , 0.287 0.240 , 0.280	Depositor DCC
R_{free} test set	666 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å ²)	14.1	Xtriage
Anisotropy	0.126	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 26.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.29$	Xtriage
Estimated twinning fraction	0.030 for -h,l,k	Xtriage
F_o, F_c correlation	0.85	EDS
Total number of atoms	3902	wwPDB-VP
Average B, all atoms (Å ²)	13.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.33% 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

5.1 Standard geometry

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	0.45	3/3877 (0.1%)	0.53	2/5291 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	6

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	49	GLY	C-N	11.98	1.61	1.34
1	A	497	VAL	CB-CG2	-7.88	1.36	1.52
1	A	495	GLY	C-O	-5.30	1.15	1.23

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	49	GLY	CA-C-N	-6.45	103.00	117.20
1	A	384	ILE	CG1-CB-CG2	5.34	123.16	111.40

There are no chirality outliers.

All (6) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	133	GLU	Peptide
1	A	348	GLY	Peptide
1	A	49	GLY	Mainchain
1	A	491	TRP	Peptide
1	A	50	ASP	Peptide

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Mol	Chain	Res	Type	Group
1	A	52	ARG	Peptide

5.2 Too-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 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	3780	0	3735	115	0
2	A	122	0	0	0	0
All	All	3902	0	3735	115	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 15.

All (115) 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:46:PHE:CE2	1:A:50:ASP:HA	1.43	1.50
1:A:52:ARG:HD2	1:A:53:TYR:CE1	1.58	1.36
1:A:52:ARG:CD	1:A:53:TYR:HE1	1.47	1.27
1:A:49:GLY:O	1:A:51:LYS:CG	1.86	1.24
1:A:348:GLY:HA2	1:A:349:CYS:CB	1.63	1.22
1:A:348:GLY:CA	1:A:349:CYS:HB3	1.75	1.16
1:A:46:PHE:CE2	1:A:50:ASP:CA	2.34	1.09
1:A:46:PHE:CZ	1:A:50:ASP:HA	1.89	1.08
1:A:52:ARG:O	1:A:52:ARG:HG2	1.58	1.03
1:A:52:ARG:CD	1:A:53:TYR:CE1	2.33	0.98
1:A:49:GLY:O	1:A:51:LYS:CB	2.11	0.97
1:A:54:THR:HG22	1:A:54:THR:O	1.63	0.94
1:A:49:GLY:O	1:A:51:LYS:HG2	1.69	0.93
1:A:46:PHE:CD2	1:A:50:ASP:HA	2.03	0.92
1:A:53:TYR:O	1:A:54:THR:HB	1.68	0.90
1:A:46:PHE:CG	1:A:50:ASP:HB2	2.06	0.90
1:A:52:ARG:CG	1:A:53:TYR:CE1	2.56	0.89
1:A:213:THR:HG22	1:A:215:VAL:H	1.34	0.88
1:A:52:ARG:CB	1:A:53:TYR:HD1	1.89	0.86
1:A:348:GLY:HA2	1:A:349:CYS:HB3	0.89	0.84

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:49:GLY:O	1:A:51:LYS:HG3	1.76	0.83
1:A:52:ARG:HD2	1:A:53:TYR:HE1	0.68	0.82
1:A:46:PHE:H	1:A:50:ASP:HB2	1.45	0.81
1:A:52:ARG:CB	1:A:53:TYR:CD1	2.64	0.81
1:A:46:PHE:CD2	1:A:50:ASP:CA	2.63	0.80
1:A:276:ILE:O	1:A:280:SER:HB2	1.81	0.80
1:A:440:SER:OG	1:A:474:LEU:HD22	1.83	0.78
1:A:46:PHE:H	1:A:50:ASP:CB	1.97	0.77
1:A:52:ARG:CG	1:A:52:ARG:O	2.32	0.76
1:A:250:GLN:HE21	1:A:312:ASN:HD22	1.34	0.76
1:A:440:SER:O	1:A:444:GLU:HG2	1.87	0.75
1:A:453:HIS:HB3	1:A:457:MET:HG2	1.68	0.75
1:A:52:ARG:HB3	1:A:53:TYR:CD1	2.22	0.74
1:A:52:ARG:CG	1:A:53:TYR:CD1	2.71	0.74
1:A:54:THR:O	1:A:54:THR:CG2	2.35	0.73
1:A:52:ARG:C	1:A:53:TYR:CD1	2.62	0.73
1:A:348:GLY:CA	1:A:349:CYS:CB	2.46	0.73
1:A:52:ARG:CA	1:A:53:TYR:HD1	2.03	0.71
1:A:52:ARG:HG2	1:A:53:TYR:CD1	2.25	0.70
1:A:87:VAL:O	1:A:91:ILE:HG23	1.91	0.70
1:A:491:TRP:O	1:A:495:GLY:N	2.24	0.69
1:A:52:ARG:HG2	1:A:53:TYR:CE1	2.26	0.69
1:A:209:VAL:O	1:A:212:MET:HB2	1.92	0.69
1:A:49:GLY:O	1:A:51:LYS:CA	2.41	0.68
1:A:46:PHE:N	1:A:50:ASP:HB2	2.10	0.65
1:A:360:ILE:O	1:A:363:THR:HG22	1.95	0.65
1:A:10:VAL:HG21	1:A:290:ILE:HD13	1.81	0.63
1:A:50:ASP:CG	1:A:50:ASP:O	2.38	0.62
1:A:453:HIS:HB3	1:A:457:MET:CG	2.29	0.62
1:A:46:PHE:CD2	1:A:50:ASP:HB2	2.35	0.61
1:A:52:ARG:C	1:A:53:TYR:HD1	2.03	0.61
1:A:22:THR:O	1:A:424:ARG:NH2	2.34	0.60
1:A:47:GLY:N	1:A:50:ASP:HB3	2.17	0.60
1:A:151:LYS:HB3	1:A:156:ILE:HB	1.84	0.59
1:A:31:ALA:HB2	1:A:471:GLY:HA3	1.85	0.59
1:A:79:LEU:HD11	1:A:323:GLN:HB2	1.85	0.58
1:A:405:ARG:HG3	1:A:452:GLN:HE21	1.67	0.58
1:A:400:THR:OG1	1:A:403:GLY:O	2.19	0.58
1:A:226:MET:HG3	1:A:406:ALA:HB2	1.86	0.57
1:A:46:PHE:CD2	1:A:50:ASP:CB	2.89	0.56
1:A:49:GLY:O	1:A:51:LYS:N	2.39	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:488:TYR:O	1:A:491:TRP:HB2	2.09	0.52
1:A:169:GLU:OE2	1:A:182:ARG:HD3	2.10	0.52
1:A:91:ILE:HA	1:A:94:ILE:CD1	2.39	0.52
1:A:348:GLY:HA2	1:A:349:CYS:HB2	1.78	0.52
1:A:360:ILE:O	1:A:363:THR:CG2	2.58	0.52
1:A:462:ARG:HG3	1:A:479:THR:O	2.11	0.51
1:A:103:LEU:HB2	1:A:197:ALA:HA	1.93	0.51
1:A:343:HIS:O	1:A:349:CYS:HA	2.10	0.51
1:A:72:THR:HG22	1:A:251:ASN:HD22	1.74	0.51
1:A:439:ARG:NH1	1:A:443:LEU:HD21	2.26	0.51
1:A:66:LYS:O	1:A:69:THR:HG22	2.12	0.50
1:A:217:VAL:HA	1:A:345:TYR:CE1	2.46	0.50
1:A:91:ILE:HD12	1:A:95:ILE:HG12	1.94	0.49
1:A:172:PRO:HG2	1:A:175:LYS:HE2	1.94	0.49
1:A:52:ARG:O	1:A:53:TYR:CD1	2.66	0.48
1:A:86:HIS:HD2	1:A:336:VAL:H	1.61	0.48
1:A:340:GLU:HG2	1:A:353:VAL:HG12	1.95	0.48
1:A:313:HIS:CE1	1:A:349:CYS:HB2	2.48	0.48
1:A:142:ALA:O	1:A:146:GLU:HG2	2.14	0.48
1:A:27:HIS:HE1	1:A:423:ASN:O	1.98	0.47
1:A:52:ARG:HB3	1:A:53:TYR:HD1	1.58	0.47
1:A:113:GLU:OE1	1:A:115:THR:HB	2.14	0.47
1:A:46:PHE:CA	1:A:50:ASP:HB2	2.44	0.47
1:A:49:GLY:O	1:A:51:LYS:HB2	2.08	0.46
1:A:279:LEU:HD21	1:A:303:PRO:HG2	1.98	0.46
1:A:81:SER:O	1:A:85:THR:CG2	2.64	0.46
1:A:284:GLU:HG2	1:A:293:VAL:HG22	1.98	0.46
1:A:46:PHE:H	1:A:50:ASP:CG	2.18	0.46
1:A:46:PHE:CD1	1:A:50:ASP:HB2	2.50	0.45
1:A:143:ASN:O	1:A:147:GLN:HG2	2.16	0.45
1:A:247:ASP:O	1:A:298:LEU:N	2.50	0.45
1:A:279:LEU:HD22	1:A:302:MET:HE2	1.99	0.45
1:A:50:ASP:OD1	1:A:50:ASP:O	2.34	0.45
1:A:167:LYS:HG3	1:A:184:LEU:HB2	1.99	0.45
1:A:316:TYR:CG	1:A:373:LEU:HD11	2.52	0.44
1:A:483:GLN:HA	1:A:483:GLN:HE21	1.81	0.44
1:A:72:THR:OG1	1:A:372:GLY:HA3	2.18	0.44
1:A:49:GLY:O	1:A:50:ASP:C	2.56	0.44
1:A:466:ILE:O	1:A:470:GLN:HG2	2.17	0.44
1:A:220:ASN:H	1:A:225:GLN:NE2	2.16	0.43
1:A:81:SER:O	1:A:85:THR:HG22	2.18	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:420:LEU:HD21	1:A:432:PRO:HG3	2.01	0.43
1:A:250:GLN:NE2	1:A:312:ASN:HD22	2.09	0.43
1:A:400:THR:HB	1:A:401:PRO:HD2	2.00	0.43
1:A:49:GLY:C	1:A:51:LYS:HG2	2.32	0.43
1:A:52:ARG:CB	1:A:53:TYR:CE1	2.98	0.43
1:A:478:ASN:HD22	1:A:483:GLN:HG3	1.84	0.43
1:A:492:PHE:C	1:A:492:PHE:CD2	2.92	0.42
1:A:40:THR:HG23	1:A:41:HIS:ND1	2.34	0.42
1:A:52:ARG:HB3	1:A:53:TYR:CE1	2.53	0.42
1:A:98:HIS:O	1:A:205:ARG:NH2	2.50	0.41
1:A:50:ASP:OD1	1:A:53:TYR:HB3	2.19	0.41
1:A:478:ASN:OD1	1:A:487:THR:HG21	2.21	0.41
1:A:6:LYS:HB2	1:A:62:VAL:HG21	2.04	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	486/515 (94%)	464 (96%)	17 (4%)	5 (1%)	15	27

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	52	ARG
1	A	53	TYR
1	A	54	THR
1	A	349	CYS
1	A	50	ASP

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	405/425 (95%)	373 (92%)	32 (8%)	12	22

All (32) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	10	VAL
1	A	17	VAL
1	A	50	ASP
1	A	54	THR
1	A	56	SER
1	A	58	THR
1	A	61	LEU
1	A	66	LYS
1	A	72	THR
1	A	85	THR
1	A	91	ILE
1	A	94	ILE
1	A	102	VAL
1	A	132	GLU
1	A	133	GLU
1	A	138	THR
1	A	209	VAL
1	A	212	MET
1	A	264	ARG
1	A	267	GLU
1	A	280	SER
1	A	295	ARG
1	A	349	CYS
1	A	352	SER
1	A	369	THR
1	A	376	THR
1	A	384	ILE
1	A	424	ARG
1	A	457	MET
1	A	470	GLN

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Mol	Chain	Res	Type
1	A	482	ASP
1	A	483	GLN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	27	HIS
1	A	86	HIS
1	A	136	GLN
1	A	225	GLN
1	A	250	GLN
1	A	362	HIS
1	A	452	GLN
1	A	453	HIS
1	A	463	GLN
1	A	470	GLN
1	A	478	ASN
1	A	480	ASN
1	A	483	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 carbohydrates in this entry.

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](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	A	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	49:GLY	C	50:ASP	N	1.61

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	A	490/515 (95%)	0.19	18 (3%)	41 49	2, 11, 28, 36	0

All (18) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	53	TYR	6.5
1	A	50	ASP	6.2
1	A	52	ARG	4.3
1	A	51	LYS	3.9
1	A	37	PRO	3.4
1	A	133	GLU	3.1
1	A	34	GLU	3.1
1	A	135	GLN	2.8
1	A	35	GLU	2.7
1	A	430	SER	2.6
1	A	431	PRO	2.6
1	A	376	THR	2.5
1	A	48	SER	2.4
1	A	38	GLY	2.3
1	A	437	GLN	2.2
1	A	33	PRO	2.1
1	A	77	PRO	2.0
1	A	177	LYS	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 carbohydrates in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.