



Full wwPDB X-ray Structure Validation Report ⓘ

May 29, 2020 – 06:50 am BST

PDB ID : 5EWN
Title : Crystal structure of the human astrovirus 1 capsid protein core domain at 2.6 Å resolution
Authors : York, R.L.; Yousefi, P.A.; Bogdanoff, W.; Haile, S.; Tripathi, S.; DuBois, R.M.
Deposited on : 2015-11-20
Resolution : 2.60 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

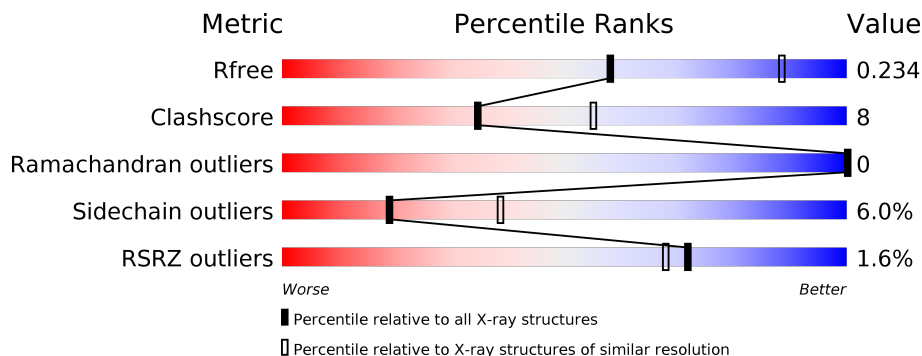
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.60 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	3163 (2.60-2.60)
Clashscore	141614	3518 (2.60-2.60)
Ramachandran outliers	138981	3455 (2.60-2.60)
Sidechain outliers	138945	3455 (2.60-2.60)
RSRZ outliers	127900	3104 (2.60-2.60)

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	375	 2% 69% 14% 14%
1	B	375	 % 66% 17% 16%

2 Entry composition i

There are 3 unique types of molecules in this entry. The entry contains 4883 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 Structural protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	321	2413	1523	412	469	9	3	0	0
1	B	315	2381	1505	409	458	9	4	0	0

There are 50 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	79	MET	-	expression tag	UNP Q82452
A	430	ALA	-	expression tag	UNP Q82452
A	431	ALA	-	expression tag	UNP Q82452
A	432	ALA	-	expression tag	UNP Q82452
A	433	GLU	-	expression tag	UNP Q82452
A	434	LEU	-	expression tag	UNP Q82452
A	435	ALA	-	expression tag	UNP Q82452
A	436	LEU	-	expression tag	UNP Q82452
A	437	VAL	-	expression tag	UNP Q82452
A	438	PRO	-	expression tag	UNP Q82452
A	439	ARG	-	expression tag	UNP Q82452
A	440	GLY	-	expression tag	UNP Q82452
A	441	SER	-	expression tag	UNP Q82452
A	442	SER	-	expression tag	UNP Q82452
A	443	ALA	-	expression tag	UNP Q82452
A	444	HIS	-	expression tag	UNP Q82452
A	445	HIS	-	expression tag	UNP Q82452
A	446	HIS	-	expression tag	UNP Q82452
A	447	HIS	-	expression tag	UNP Q82452
A	448	HIS	-	expression tag	UNP Q82452
A	449	HIS	-	expression tag	UNP Q82452
A	450	HIS	-	expression tag	UNP Q82452
A	451	HIS	-	expression tag	UNP Q82452
A	452	HIS	-	expression tag	UNP Q82452
A	453	HIS	-	expression tag	UNP Q82452

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
B	79	MET	-	expression tag	UNP Q82452
B	430	ALA	-	expression tag	UNP Q82452
B	431	ALA	-	expression tag	UNP Q82452
B	432	ALA	-	expression tag	UNP Q82452
B	433	GLU	-	expression tag	UNP Q82452
B	434	LEU	-	expression tag	UNP Q82452
B	435	ALA	-	expression tag	UNP Q82452
B	436	LEU	-	expression tag	UNP Q82452
B	437	VAL	-	expression tag	UNP Q82452
B	438	PRO	-	expression tag	UNP Q82452
B	439	ARG	-	expression tag	UNP Q82452
B	440	GLY	-	expression tag	UNP Q82452
B	441	SER	-	expression tag	UNP Q82452
B	442	SER	-	expression tag	UNP Q82452
B	443	ALA	-	expression tag	UNP Q82452
B	444	HIS	-	expression tag	UNP Q82452
B	445	HIS	-	expression tag	UNP Q82452
B	446	HIS	-	expression tag	UNP Q82452
B	447	HIS	-	expression tag	UNP Q82452
B	448	HIS	-	expression tag	UNP Q82452
B	449	HIS	-	expression tag	UNP Q82452
B	450	HIS	-	expression tag	UNP Q82452
B	451	HIS	-	expression tag	UNP Q82452
B	452	HIS	-	expression tag	UNP Q82452
B	453	HIS	-	expression tag	UNP Q82452

- Molecule 2 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	B	2	Total Cl 2 2	0	0
2	A	2	Total Cl 2 2	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	50	Total O 50 50	0	0
3	B	35	Total O 35 35	0	0

4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	66.24Å 71.10Å 158.91Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.47 – 2.60 48.47 – 2.60	Depositor EDS
% Data completeness (in resolution range)	98.9 (48.47-2.60) 98.9 (48.47-2.60)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.10 (at 2.61Å)	Xtrriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.192 , 0.234 0.192 , 0.234	Depositor DCC
R_{free} test set	1209 reflections (5.15%)	wwPDB-VP
Wilson B-factor (Å ²)	37.8	Xtrriage
Anisotropy	0.140	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 47.4	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	0.93	EDS
Total number of atoms	4883	wwPDB-VP
Average B, all atoms (Å ²)	39.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.51% 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: 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	0.81	0/2467	0.74	1/3371 (0.0%)
1	B	0.84	1/2435 (0.0%)	0.76	0/3325
All	All	0.82	1/4902 (0.0%)	0.75	1/6696 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	224	GLU	CD-OE2	-5.28	1.19	1.25

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	339	PRO	C-N-CD	5.01	138.92	128.40

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	2413	0	2391	39	0
1	B	2381	0	2363	40	1
2	A	2	0	0	0	0
2	B	2	0	0	0	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	50	0	0	0	0
3	B	35	0	0	0	0
All	All	4883	0	4754	79	1

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 8.

All (79) 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:328:ASN:OD1	1:A:333:ALA:HB2	1.56	1.04
1:A:317:ARG:NH1	1:A:360:THR:OG1	1.95	1.00
1:B:293:GLU:OE2	1:B:359:ARG:NH1	2.00	0.93
1:A:115:ASP:HB3	1:A:119:SER:HB3	1.49	0.92
1:B:160:VAL:HG12	1:B:225:ILE:HG12	1.53	0.89
1:B:326:VAL:HG13	1:B:402:LEU:HD22	1.53	0.89
1:A:232:MET:HE2	1:A:239:GLN:HA	1.57	0.84
1:A:301:VAL:O	1:A:305:SER:OG	1.98	0.81
1:B:280:GLU:OE2	1:B:361:ARG:NH1	2.14	0.78
1:A:140:LEU:HD11	1:A:249:LEU:HD11	1.67	0.77
1:B:140:LEU:HD11	1:B:249:LEU:HD11	1.66	0.77
1:A:319:THR:HG22	1:A:356:ILE:HG22	1.72	0.70
1:B:262:PRO:HA	1:B:265:VAL:HG23	1.76	0.67
1:B:326:VAL:HG13	1:B:402:LEU:CD2	2.25	0.66
1:A:338:THR:HG22	1:A:339:PRO:O	1.96	0.65
1:B:89:LEU:HD13	1:B:106:ILE:HD12	1.79	0.64
1:B:273:ASN:HA	1:B:401:THR:HB	1.79	0.63
1:B:330:ALA:HB2	1:B:401:THR:HG23	1.81	0.63
1:B:89:LEU:HD11	1:B:249:LEU:HB2	1.82	0.61
1:A:328:ASN:OD1	1:A:333:ALA:CB	2.43	0.61
1:B:293:GLU:CG	1:B:365:ARG:HE	2.15	0.59
1:A:274:GLN:HA	1:A:274:GLN:OE1	2.00	0.59
1:B:293:GLU:HG2	1:B:365:ARG:HE	1.68	0.59
1:A:232:MET:CE	1:A:239:GLN:HA	2.33	0.58
1:B:342:PHE:CE2	1:B:382:ALA:HB1	2.39	0.57
1:A:230:ARG:HG2	1:A:232:MET:HE3	1.86	0.57
1:A:301:VAL:HG11	1:A:367:PHE:HE2	1.70	0.57
1:B:379:ASN:O	1:B:381:PRO:HD3	2.05	0.57
1:B:138:LYS:O	1:B:196:PRO:HG3	2.05	0.56
1:A:96:THR:O	1:A:230:ARG:NH1	2.39	0.56
1:B:114:LYS:HE2	1:B:269:LYS:HB3	1.87	0.55

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:140:LEU:HD23	1:B:194:LEU:HD12	1.89	0.55
1:B:162:LEU:HD11	1:B:221:PRO:HB2	1.89	0.55
1:A:212:ASN:OD1	1:A:408:ASN:HB2	2.07	0.54
1:B:313:ARG:O	1:B:313:ARG:HG3	2.09	0.53
1:B:323:VAL:HG22	1:B:354:LYS:HD3	1.90	0.52
1:A:159:ARG:NH1	1:A:173:TRP:O	2.44	0.51
1:A:307:THR:O	1:A:309:THR:N	2.41	0.51
1:B:138:LYS:O	1:B:196:PRO:HD3	2.11	0.51
1:A:180:LYS:NZ	1:A:198:ASP:OD1	2.33	0.50
1:B:272:ASP:CG	1:B:275:VAL:HG22	2.31	0.50
1:B:278:THR:HG22	1:B:290:ASN:HD22	1.77	0.49
1:A:326:VAL:HG13	1:A:402:LEU:HD22	1.95	0.49
1:A:275:VAL:HG12	1:A:400:THR:O	2.14	0.48
1:B:338:THR:HG22	1:B:339:PRO:O	2.13	0.48
1:B:211:THR:HA	1:B:218:THR:HG21	1.96	0.48
1:B:212:ASN:OD1	1:B:408:ASN:HB2	2.14	0.47
1:B:273:ASN:HD22	1:B:401:THR:HB	1.82	0.45
1:A:317:ARG:HG3	1:A:368:TYR:OH	2.17	0.45
1:A:276:PRO:HA	1:A:399:THR:HA	1.99	0.45
1:B:361:ARG:HB2	1:B:364:SER:HB2	1.99	0.44
1:A:291:VAL:CG1	1:A:298:ALA:HB2	2.48	0.44
1:B:270:SER:OG	1:B:271:THR:N	2.50	0.43
1:A:317:ARG:NH1	1:A:360:THR:HG1	2.09	0.43
1:A:140:LEU:HD11	1:A:249:LEU:CD1	2.44	0.43
1:B:230:ARG:O	1:B:232:MET:HG2	2.19	0.43
1:B:287:LEU:HD13	1:B:339:PRO:HG2	2.01	0.43
1:B:293:GLU:OE2	1:B:365:ARG:NE	2.51	0.43
1:A:140:LEU:HA	1:A:140:LEU:HD12	1.76	0.43
1:A:338:THR:HG23	1:A:339:PRO:HD2	2.01	0.42
1:A:116:ALA:O	1:A:119:SER:HB2	2.19	0.42
1:B:251:SER:HB3	1:B:253:TRP:CZ3	2.54	0.42
1:B:313:ARG:NH1	1:B:313:ARG:HG2	2.33	0.42
1:B:324:TRP:CZ3	1:B:406:GLN:HB2	2.54	0.42
1:A:341:PRO:HD2	1:A:342:PHE:CD2	2.55	0.42
1:A:326:VAL:CG1	1:A:402:LEU:HD22	2.49	0.42
1:A:324:TRP:CZ3	1:A:406:GLN:HB2	2.54	0.42
1:B:299:ARG:HH11	1:B:299:ARG:HD2	1.71	0.42
1:A:310:THR:O	1:A:318:THR:HA	2.20	0.42
1:A:371:PRO:HD3	1:A:382:ALA:HB2	2.00	0.42
1:B:326:VAL:CG1	1:B:402:LEU:HD22	2.37	0.42
1:A:301:VAL:HG11	1:A:367:PHE:CE2	2.53	0.42

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:359:ARG:HG3	1:A:360:THR:N	2.34	0.41
1:B:370:TYR:CD2	1:B:376:ALA:HA	2.54	0.41
1:A:304:ARG:HA	1:A:304:ARG:HD3	1.82	0.41
1:A:115:ASP:CB	1:A:119:SER:HB3	2.34	0.41
1:A:370:TYR:CD2	1:A:381:PRO:HA	2.56	0.41
1:A:291:VAL:HG12	1:A:298:ALA:HB2	2.04	0.40
1:B:344:TRP:CG	1:B:345:LEU:N	2.90	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:147:MET:O	1:B:361:ARG:NH2[4_565]	2.18	0.02

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	315/375 (84%)	311 (99%)	4 (1%)	0	100	100
1	B	307/375 (82%)	300 (98%)	7 (2%)	0	100	100
All	All	622/750 (83%)	611 (98%)	11 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	A	268/305 (88%)	250 (93%)	18 (7%)	16	33
1	B	265/305 (87%)	251 (95%)	14 (5%)	22	45
All	All	533/610 (87%)	501 (94%)	32 (6%)	19	39

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

Mol	Chain	Res	Type
1	A	120	THR
1	A	171	THR
1	A	172	SER
1	A	180	LYS
1	A	186	VAL
1	A	278	THR
1	A	285	SER
1	A	291	VAL
1	A	304	ARG
1	A	305	SER
1	A	309	THR
1	A	310	THR
1	A	329	THR
1	A	347	LYS
1	A	359	ARG
1	A	380	LYS
1	A	387	SER
1	A	401	THR
1	B	91	THR
1	B	143	LYS
1	B	197	SER
1	B	213	ASP
1	B	261	ASN
1	B	278	THR
1	B	291	VAL
1	B	304	ARG
1	B	313	ARG
1	B	364	SER
1	B	365	ARG
1	B	388	THR
1	B	399	THR
1	B	401	THR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such

sidechains are listed below:

Mol	Chain	Res	Type
1	A	121	GLN
1	A	154	ASN
1	A	261	ASN
1	B	121	GLN
1	B	154	ASN
1	B	273	ASN
1	B	328	ASN

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](#)

Of 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

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 [i](#)

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 [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	321/375 (85%)	-0.23	6 (1%) 66 62	13, 36, 80, 98	1 (0%)
1	B	315/375 (84%)	-0.29	4 (1%) 77 73	17, 34, 66, 89	1 (0%)
All	All	636/750 (84%)	-0.26	10 (1%) 72 68	13, 34, 75, 98	2 (0%)

All (10) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	311	LEU	3.0
1	B	314	ALA	2.9
1	B	313	ARG	2.9
1	A	310	THR	2.8
1	A	274	GLN	2.5
1	A	299	ARG	2.5
1	A	398	VAL	2.5
1	A	360	THR	2.2
1	A	309	THR	2.2
1	B	80	ALA	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 carbohydrates 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
2	CL	B	502	1/1	0.92	0.10	30,30,30,30	0
2	CL	B	501	1/1	0.96	0.06	30,30,30,30	0
2	CL	A	501	1/1	0.96	0.11	30,30,30,30	0
2	CL	A	502	1/1	0.98	0.16	30,30,30,30	0

6.5 Other polymers [i](#)

There are no such residues in this entry.