Full wwPDB X-ray Structure Validation Report (i)

Oct 3, 2021 – 01:15 AM EDT

PDB ID	:	3LQE
Title	:	X-Ray Structure of the Murine Norovirus (MNV)-1 Capsid Protein Protruding (P) Domain
Authors	:	Rubin, J.R.; Stuckey, J.A.
Deposited on	:	2010-02-09
Resolution	:	2.00 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 (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

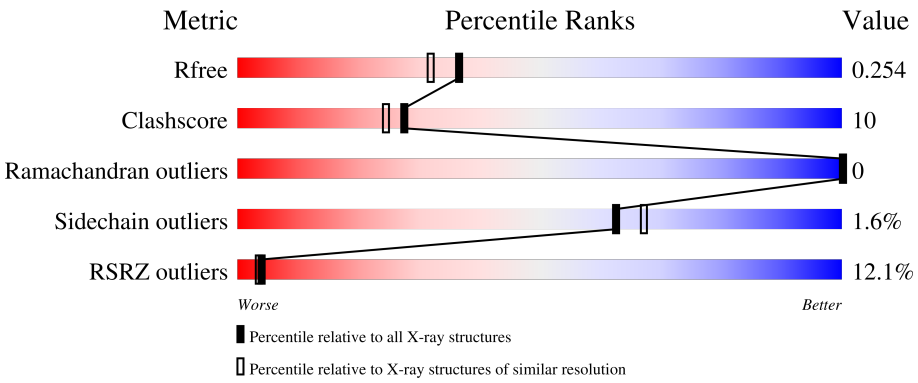
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.23.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.23.2

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

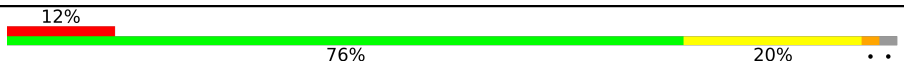
The reported resolution of this entry is 2.00 Å.

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	8085 (2.00-2.00)
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)
RSRZ outliers	127900	7900 (2.00-2.00)

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 of 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 <=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	320	

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 2530 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 Capsid protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	313	2404	1542	397	457	8	0	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	222	SER	-	expression tag	UNP Q80J94
A	223	ASN	-	expression tag	UNP Q80J94
A	224	ALA	-	expression tag	UNP Q80J94
A	225	THR	-	expression tag	UNP Q80J94
A	226	ILE	-	expression tag	UNP Q80J94
A	227	TYR	-	expression tag	UNP Q80J94
A	296	GLU	LYS	engineered mutation	UNP Q80J94
A	541	GLN	-	expression tag	UNP Q80J94

- Molecule 2 is water.

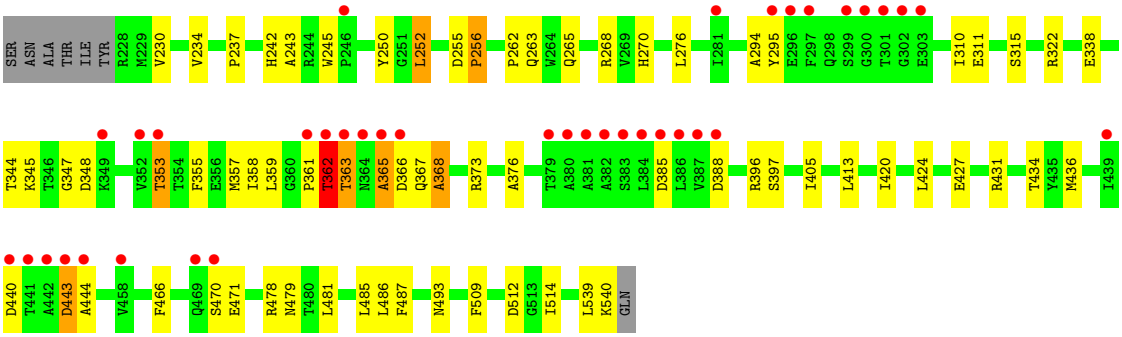
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
2	A	126	126	126	0	0

3 Residue-property plots (i)

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 and electron density. 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. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). 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: Capsid protein

Chain A:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	86.26Å 105.22Å 84.05Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	32.84 – 2.00 32.84 – 2.00	Depositor EDS
% Data completeness (in resolution range)	93.3 (32.84-2.00) 93.3 (32.84-2.00)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	4.58 (at 2.00Å)	Xtriage
Refinement program	REFMAC 5.0	Depositor
R, R_{free}	0.215 , 0.256 0.214 , 0.254	Depositor DCC
R_{free} test set	1253 reflections (5.13%)	wwPDB-VP
Wilson B-factor (Å^2)	27.2	Xtriage
Anisotropy	0.064	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 45.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	2530	wwPDB-VP
Average B, all atoms (Å^2)	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.88% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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)

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	1.23	8/2467 (0.3%)	1.14	19/3376 (0.6%)

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	3

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	256	PRO	N-CD	10.85	1.63	1.47
1	A	405	ILE	C-N	-5.88	1.23	1.34
1	A	487	PHE	CE2-CZ	5.69	1.48	1.37
1	A	250	TYR	CD1-CE1	5.50	1.47	1.39
1	A	243	ALA	CA-CB	5.41	1.63	1.52
1	A	315	SER	CA-CB	5.21	1.60	1.52
1	A	310	ILE	C-N	-5.12	1.22	1.34
1	A	311	GLU	CB-CG	5.06	1.61	1.52

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	362	THR	C-N-CA	-11.63	92.63	121.70
1	A	362	THR	CB-CA-C	9.77	137.98	111.60
1	A	444	ALA	CB-CA-C	8.92	123.48	110.10
1	A	471	GLU	N-CA-C	8.51	133.97	111.00
1	A	481	LEU	CA-CB-CG	6.67	130.64	115.30
1	A	368	ALA	CB-CA-C	6.50	119.86	110.10
1	A	252	LEU	CB-CG-CD2	6.48	122.02	111.00
1	A	367	GLN	N-CA-C	-6.22	94.22	111.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	255	ASP	CB-CA-C	5.85	122.10	110.40
1	A	444	ALA	N-CA-CB	-5.78	102.02	110.10
1	A	322	ARG	NE-CZ-NH2	-5.74	117.43	120.30
1	A	443	ASP	N-CA-C	5.71	126.41	111.00
1	A	268	ARG	NE-CZ-NH2	-5.67	117.47	120.30
1	A	397	SER	O-C-N	-5.44	114.00	122.70
1	A	512	ASP	CB-CG-OD2	5.32	123.09	118.30
1	A	256	PRO	CA-N-CD	-5.17	104.25	111.50
1	A	431	ARG	NE-CZ-NH2	-5.11	117.74	120.30
1	A	268	ARG	NE-CZ-NH1	5.09	122.84	120.30
1	A	255	ASP	C-N-CD	-5.03	109.53	120.60

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	362	THR	Peptide
1	A	365	ALA	Peptide
1	A	385	ASP	Peptide

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	2404	0	2359	47	0
2	A	126	0	0	1	0
All	All	2530	0	2359	47	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 10.

All (47) 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:362:THR:HG23	1:A:363:THR:OG1	1.45	1.14

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:365:ALA:HB1	1:A:366:ASP:CB	1.79	1.12
1:A:440:ASP:HB3	1:A:443:ASP:HB2	1.18	1.12
1:A:365:ALA:CB	1:A:366:ASP:HB2	1.85	1.07
1:A:365:ALA:HB1	1:A:366:ASP:HB2	1.02	0.99
1:A:440:ASP:CB	1:A:443:ASP:HB2	1.91	0.99
1:A:252:LEU:HD23	1:A:509:PHE:HB2	1.55	0.88
1:A:362:THR:CG2	1:A:363:THR:OG1	2.30	0.78
1:A:539:LEU:O	1:A:540:LYS:HB2	1.84	0.77
1:A:294:ALA:HA	1:A:388:ASP:CG	2.06	0.75
1:A:362:THR:HA	1:A:363:THR:OG1	1.88	0.74
1:A:294:ALA:HA	1:A:388:ASP:OD1	1.91	0.70
1:A:338:GLU:HB2	1:A:396:ARG:HD2	1.74	0.70
1:A:344:THR:HB	1:A:348:ASP:OD2	1.97	0.65
1:A:365:ALA:HB1	1:A:366:ASP:CA	2.25	0.65
1:A:368:ALA:O	1:A:373:ARG:O	2.15	0.65
1:A:362:THR:HG23	1:A:363:THR:CB	2.28	0.63
1:A:470:SER:O	1:A:493:ASN:ND2	2.35	0.60
1:A:424:LEU:HD12	1:A:427:GLU:OE1	2.02	0.60
1:A:295:TYR:N	1:A:388:ASP:OD1	2.34	0.59
1:A:362:THR:HG23	1:A:363:THR:HG1	1.65	0.56
1:A:362:THR:CG2	1:A:363:THR:CB	2.83	0.56
1:A:478:ARG:CZ	1:A:485:LEU:HD21	2.37	0.55
1:A:358:ILE:HD12	1:A:358:ILE:N	2.23	0.53
1:A:357:MET:HE2	1:A:359:LEU:CD2	2.40	0.51
1:A:263:GLN:O	1:A:265:GLN:NE2	2.41	0.51
1:A:353:THR:HB	1:A:355:PHE:CE2	2.46	0.51
1:A:270:HIS:CD2	1:A:276:LEU:HD11	2.48	0.49
1:A:344:THR:HG22	1:A:345:LYS:HG2	1.94	0.48
1:A:252:LEU:HD23	1:A:509:PHE:CB	2.38	0.48
1:A:262:PRO:HG2	1:A:420:ILE:HD12	1.96	0.48
1:A:486:LEU:HD12	1:A:486:LEU:N	2.29	0.48
1:A:347:GLY:O	1:A:348:ASP:C	2.53	0.47
1:A:361:PRO:C	1:A:362:THR:OG1	2.54	0.46
1:A:295:TYR:HE1	1:A:355:PHE:CZ	2.34	0.45
1:A:295:TYR:HE1	1:A:355:PHE:HZ	1.64	0.45
1:A:357:MET:HE2	1:A:359:LEU:HD23	1.98	0.45
1:A:361:PRO:O	1:A:362:THR:OG1	2.30	0.43
1:A:234:VAL:HG12	1:A:514:ILE:HD12	2.00	0.43
1:A:478:ARG:HG2	1:A:479:ASN:N	2.32	0.43
1:A:295:TYR:CE1	1:A:355:PHE:HZ	2.38	0.42
1:A:230:VAL:HB	1:A:466:PHE:CD2	2.54	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:245:TRP:CD2	1:A:436:MET:HG2	2.55	0.42
1:A:242:HIS:CD2	1:A:434:THR:HG22	2.54	0.42
1:A:263:GLN:OE1	2:A:111:HOH:O	2.22	0.41
1:A:357:MET:HB2	1:A:376:ALA:HB2	2.03	0.41
1:A:413:LEU:HD23	1:A:413:LEU:HA	1.91	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	311/320 (97%)	298 (96%)	13 (4%)	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	257/263 (98%)	253 (98%)	4 (2%)	62 67

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

Mol	Chain	Res	Type
1	A	237	PRO

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Mol	Chain	Res	Type
1	A	256	PRO
1	A	353	THR
1	A	363	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	263	GLN
1	A	526	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 monosaccharides 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)

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	313/320 (97%)	0.53	38 (12%) 4 3	11, 25, 55, 63	18 (5%)

All (38) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	442	ALA	14.2
1	A	364	ASN	10.1
1	A	382	ALA	8.7
1	A	379	THR	6.4
1	A	381	ALA	6.4
1	A	387	VAL	5.5
1	A	385	ASP	5.4
1	A	386	LEU	5.1
1	A	441	THR	4.9
1	A	297	PHE	4.9
1	A	303	GLU	4.8
1	A	388	ASP	4.8
1	A	383	SER	4.5
1	A	299	SER	4.4
1	A	301	THR	4.2
1	A	295	TYR	3.8
1	A	444	ALA	3.6
1	A	384	LEU	3.5
1	A	361	PRO	3.5
1	A	362	THR	3.3
1	A	302	GLY	3.1
1	A	365	ALA	3.1
1	A	443	ASP	2.9
1	A	353	THR	2.9
1	A	366	ASP	2.9
1	A	363	THR	2.7
1	A	349	LYS	2.5

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Mol	Chain	Res	Type	RSRZ
1	A	300	GLY	2.5
1	A	469	GLN	2.4
1	A	296	GLU	2.4
1	A	380	ALA	2.4
1	A	439	ILE	2.1
1	A	246	PRO	2.1
1	A	281	ILE	2.1
1	A	470	SER	2.1
1	A	352	VAL	2.0
1	A	440	ASP	2.0
1	A	458	VAL	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 monosaccharides 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.