wwPDB X-ray Structure Validation Summary Report (i)

Oct 2, 2024 – 01:38 pm BST

PDB ID	:	9EQP
Title	:	N-terminal domain of Infectious Bursal Disease Virus (IBDV) VP3
Authors	:	Ferrero, D.S.; Verdaguer, N.
Deposited on	:	2024-03-22
Resolution	:	3.50 Å(reported)

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

|		
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

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 3.50 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.
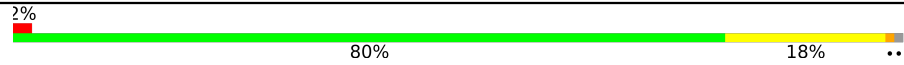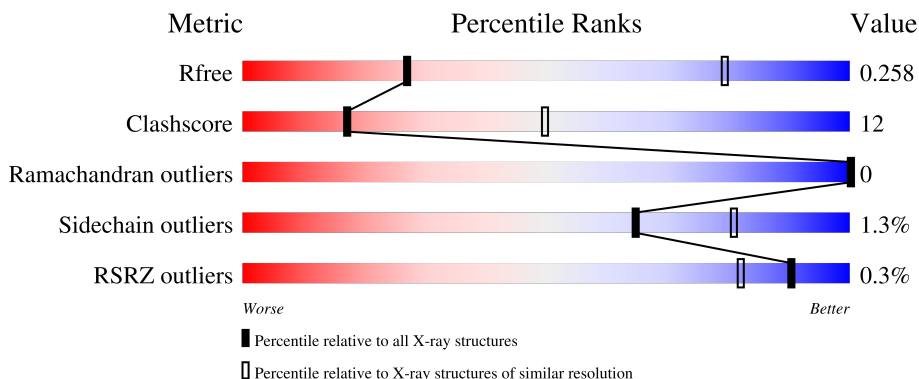

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	1094 (3.56-3.44)
Clashscore	180529	1045 (3.54-3.46)
Ramachandran outliers	177936	1032 (3.54-3.46)
Sidechain outliers	177891	1033 (3.54-3.46)
RSRZ outliers	164620	1093 (3.56-3.44)

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	131	81% 17% ··
1	B	131	76% 24% ·
1	C	131	76% 23% ·
1	D	131	.% 78% 21% ·
1	E	131	81% 18% ·

Continued on next page...

Continued from previous page...

Mol	Chain	Length	Quality of chain
1	F	131	2% 80% 18%
1	G	131	75% 22%
1	I	131	82% 17%

2 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 8353 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 VP3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	130	Total	C	N	O	S	0	0	0
			1040	650	182	203	5			
1	B	131	Total	C	N	O	S	0	0	0
			1054	657	187	205	5			
1	C	130	Total	C	N	O	S	0	0	0
			1046	653	185	203	5			
1	D	129	Total	C	N	O	S	0	0	0
			1035	647	181	202	5			
1	E	130	Total	C	N	O	S	0	0	0
			1040	650	182	203	5			
1	F	130	Total	C	N	O	S	0	0	0
			1046	653	185	203	5			
1	G	130	Total	C	N	O	S	0	0	0
			1046	653	185	203	5			
1	I	130	Total	C	N	O	S	0	0	0
			1046	653	185	203	5			

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 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 VP3

Chain A:

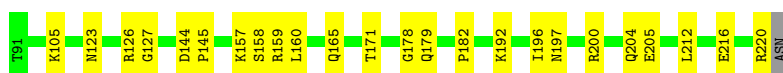- Molecule 1: Capsid protein VP3

Chain B:

- Molecule 1: Capsid protein VP3
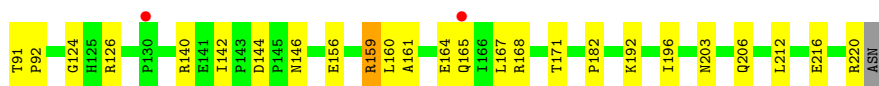
Chain C:

- Molecule 1: Capsid protein VP3

Chain D:

- Molecule 1: Capsid protein VP3

Chain E:

- Molecule 1: Capsid protein VP3

Chain F:

• Molecule 1: Capsid protein VP3

Chain G:

75%   22%

• Molecule 1: Capsid protein VP3

Chain I:

82%   17%

4 Data and refinement statistics   ⓘ

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	50.69Å 111.42Å 277.01Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.60 – 3.50 47.60 – 3.50	Depositor EDS
% Data completeness (in resolution range)	96.3 (47.60-3.50) 96.4 (47.60-3.50)	Depositor EDS
R_{merge}	0.19	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.56 (at 3.48Å)	Xtriage
Refinement program	PHENIX (dev_4788: ???)	Depositor
R, R_{free}	0.238 , 0.259 0.242 , 0.258	Depositor DCC
R_{free} test set	1030 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å^2)	98.1	Xtriage
Anisotropy	0.298	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 82.3	EDS
L-test for twinning[2]	$< |L| > = 0.45, < L^2 > = 0.28$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	8353	wwPDB-VP
Average B, all atoms (Å^2)	109.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.59% 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 ⓘ

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	0.32	0/1065	0.53	0/1442
1	B	0.39	1/1079 (0.1%)	0.53	0/1460
1	C	0.31	0/1071	0.51	0/1449
1	D	0.32	0/1060	0.57	1/1435 (0.1%)
1	E	0.29	0/1065	0.50	0/1442
1	F	0.29	0/1071	0.51	0/1449
1	G	0.35	1/1071 (0.1%)	0.57	1/1449 (0.1%)
1	I	0.28	0/1071	0.47	0/1449
All	All	0.32	2/8553 (0.0%)	0.52	2/11575 (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	2
1	B	0	1
1	F	0	1
1	G	0	1
1	I	0	1
All	All	0	6

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	133	LEU	C-N	7.74	1.51	1.34
1	G	203	ASN	C-N	5.91	1.47	1.34

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	181	GLU	N-CA-CB	-5.58	100.55	110.60

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	G	204	GLN	O-C-N	-5.42	114.03	122.70

There are no chirality outliers.

5 of 6 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	159	ARG	Sidechain
1	A	220	ARG	Sidechain
1	B	159	ARG	Sidechain
1	F	159	ARG	Sidechain
1	G	200	ARG	Sidechain

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	1040	0	998	42	0
1	B	1054	0	1015	41	0
1	C	1046	0	1009	36	0
1	D	1035	0	996	34	1
1	E	1040	0	998	25	3
1	F	1046	0	1009	32	2
1	G	1046	0	1009	46	0
1	I	1046	0	1009	14	0
All	All	8353	0	8043	204	3

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 12.

The worst 5 of 204 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:C:105:LYS:HD2	1:E:220:ARG:NH2	1.26	1.48
1:F:165:GLN:NE2	1:F:168:ARG:NH2	1.77	1.31
1:A:216:GLU:HG3	1:B:108:GLU:OE2	1.35	1.24

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:165:GLN:HE22	1:F:168:ARG:NH2	1.30	1.21
1:A:159:ARG:HG3	1:A:200:ARG:NH1	1.58	1.18

All (3) 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:E:204:GLN:NE2	1:F:164:GLU:OE2[3_644]	1.53	0.67
1:E:204:GLN:NE2	1:F:164:GLU:CD[3_644]	1.89	0.31
1:D:147:GLU:OE1	1:E:158:SER:O[3_554]	2.02	0.18

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	128/131 (98%)	124 (97%)	4 (3%)	0	100	100
1	B	129/131 (98%)	127 (98%)	2 (2%)	0	100	100
1	C	128/131 (98%)	123 (96%)	5 (4%)	0	100	100
1	D	127/131 (97%)	122 (96%)	5 (4%)	0	100	100
1	E	128/131 (98%)	124 (97%)	4 (3%)	0	100	100
1	F	128/131 (98%)	124 (97%)	4 (3%)	0	100	100
1	G	128/131 (98%)	125 (98%)	3 (2%)	0	100	100
1	I	128/131 (98%)	127 (99%)	1 (1%)	0	100	100
All	All	1024/1048 (98%)	996 (97%)	28 (3%)	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 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	109/111 (98%)	108 (99%)	1 (1%)	75	86
1	B	111/111 (100%)	110 (99%)	1 (1%)	75	86
1	C	110/111 (99%)	108 (98%)	2 (2%)	54	74
1	D	109/111 (98%)	108 (99%)	1 (1%)	75	86
1	E	109/111 (98%)	108 (99%)	1 (1%)	75	86
1	F	110/111 (99%)	108 (98%)	2 (2%)	54	74
1	G	110/111 (99%)	108 (98%)	2 (2%)	54	74
1	I	110/111 (99%)	109 (99%)	1 (1%)	75	86
All	All	878/888 (99%)	867 (99%)	11 (1%)	65	81

5 of 11 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	146	ASN
1	G	126	ARG
1	I	137	GLN
1	G	164	GLU
1	D	179	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 6 such sidechains are listed below:

Mol	Chain	Res	Type
1	F	165	GLN
1	F	197	ASN
1	F	206	GLN
1	B	179	GLN
1	A	146	ASN

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 ⓘ

There are no ligands in this entry.

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(Å²)	Q<0.9
1	A	130/131 (99%)	-0.37	0	100	100	56, 83, 139, 158	0
1	B	131/131 (100%)	-0.30	0	100	100	59, 82, 141, 198	0
1	C	130/131 (99%)	-0.34	0	100	100	65, 92, 161, 184	0
1	D	129/131 (98%)	-0.23	1 (0%)	82	67	77, 109, 174, 190	0
1	E	130/131 (99%)	-0.39	0	100	100	69, 105, 181, 203	0
1	F	130/131 (99%)	-0.32	2 (1%)	71	53	78, 105, 174, 239	0
1	G	130/131 (99%)	-0.29	0	100	100	70, 110, 173, 199	0
1	I	130/131 (99%)	-0.41	0	100	100	65, 129, 179, 193	0
All	All	1040/1048 (99%)	-0.33	3 (0%)	90	82	56, 103, 171, 239	0

All (3) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	F	165	GLN	2.5
1	D	180	ALA	2.1
1	F	130	PRO	2.1

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 monosaccharides in this entry.

6.4 Ligands ⓘ

There are no ligands in this entry.

6.5 Other polymers ⓘ

There are no such residues in this entry.