Full wwPDB X-ray Structure Validation Report ⓘ

Aug 8, 2024 – 10:11 am BST

PDB ID	:	9FSB
Title	:	Coxsackievirus B3 3C protease in P121 spacegroup
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Deposited on	:	2024-06-20
Resolution	:	1.59 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 types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

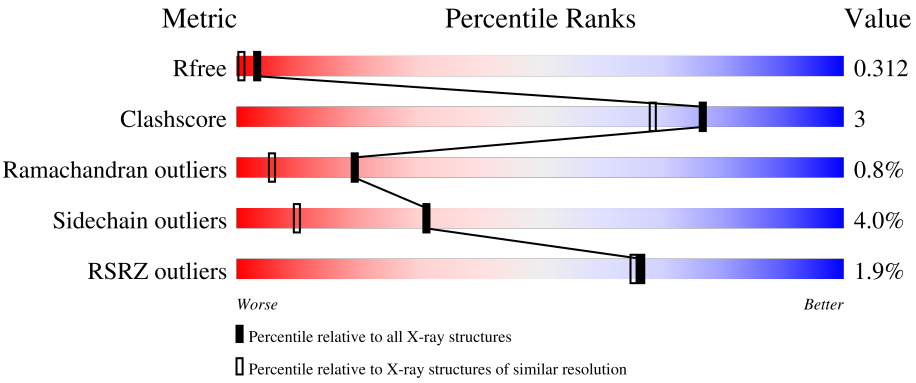
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.37.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

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 1.59 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	3398 (1.60-1.60)
Clashscore	141614	3665 (1.60-1.60)
Ramachandran outliers	138981	3564 (1.60-1.60)
Sidechain outliers	138945	3563 (1.60-1.60)
RSRZ outliers	127900	3321 (1.60-1.60)

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 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	183	2% 79% 16% • • •
1	B	183	2% 81% 15% • •

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 5599 atoms, of which 2756 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 Genome polyprotein.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	180	Total	C	H	N	O	S	0	0	0
			2775	893	1378	239	256	9			
1	B	180	Total	C	H	N	O	S	0	0	0
			2775	893	1378	239	256	9			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	33	LYS	ARG	conflict	UNP E3SVR4
A	55	SER	GLY	conflict	UNP E3SVR4
B	33	LYS	ARG	conflict	UNP E3SVR4
B	55	SER	GLY	conflict	UNP E3SVR4

- Molecule 2 is water.

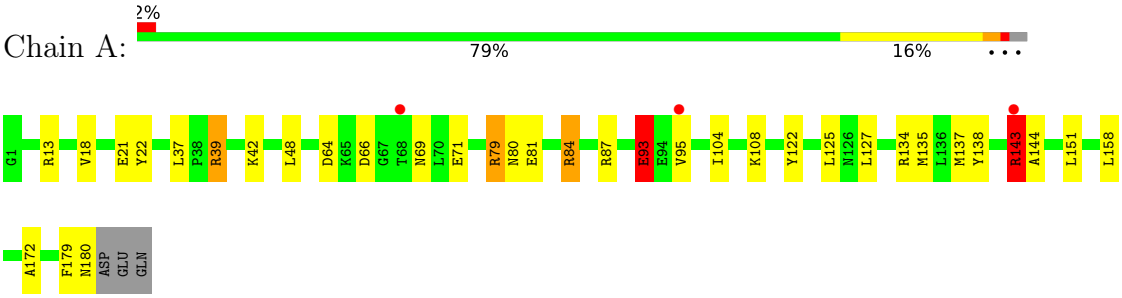
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	24	Total	O	0	0
			24	24		
2	B	25	Total	O	0	0
			25	25		

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.

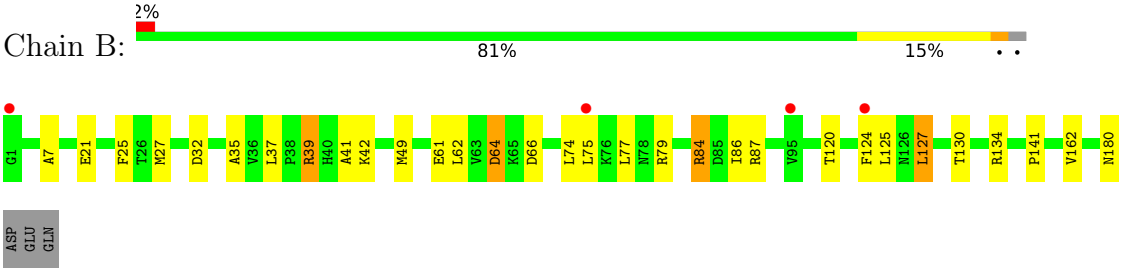
• Molecule 1: Genome polyprotein

Chain A:



• Molecule 1: Genome polyprotein

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	51.48Å 45.97Å 66.88Å 90.00° 101.56° 90.00°	Depositor
Resolution (Å)	50.44 – 1.59 50.44 – 1.59	Depositor EDS
% Data completeness (in resolution range)	68.1 (50.44-1.59) 68.1 (50.44-1.59)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	0.97 (at 1.59Å)	Xtriage
Refinement program	REFMAC 5.8.0425	Depositor
R, R_{free}	0.209 , 0.301 0.224 , 0.312	Depositor DCC
R_{free} test set	1384 reflections (4.92%)	wwPDB-VP
Wilson B-factor (Å^2)	24.8	Xtriage
Anisotropy	0.206	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.45 , 41.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.47$, $< L^2 > = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	5599	wwPDB-VP
Average B, all atoms (Å^2)	35.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.00% 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	0.91	2/1426 (0.1%)	1.40	15/1924 (0.8%)
1	B	0.91	2/1426 (0.1%)	1.42	18/1924 (0.9%)
All	All	0.91	4/2852 (0.1%)	1.41	33/3848 (0.9%)

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
1	B	0	3
All	All	0	6

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	180	ASN	C-O	5.91	1.34	1.23
1	A	104	ILE	CB-CG1	5.57	1.69	1.54
1	A	143	ARG	NE-CZ	5.40	1.40	1.33
1	B	21	GLU	CD-OE1	5.14	1.31	1.25

All (33) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	143	ARG	CD-NE-CZ	11.37	139.52	123.60
1	B	84	ARG	NE-CZ-NH2	9.79	125.19	120.30
1	B	87	ARG	NE-CZ-NH2	-9.01	115.79	120.30
1	B	64	ASP	CB-CA-C	8.67	127.73	110.40
1	A	143	ARG	CB-CG-CD	8.03	132.49	111.60
1	B	134	ARG	NE-CZ-NH2	-7.94	116.33	120.30
1	A	137	MET	CG-SD-CE	7.46	112.13	100.20
1	A	134	ARG	NE-CZ-NH1	7.35	123.98	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	49	MET	CG-SD-CE	-7.06	88.91	100.20
1	B	79	ARG	N-CA-CB	-6.90	98.18	110.60
1	A	64	ASP	CB-CA-C	6.57	123.54	110.40
1	B	32	ASP	CB-CA-C	6.40	123.20	110.40
1	A	87	ARG	CD-NE-CZ	6.34	132.48	123.60
1	A	143	ARG	NE-CZ-NH1	6.21	123.40	120.30
1	B	7	ALA	CB-CA-C	6.11	119.27	110.10
1	A	127	LEU	CB-CG-CD2	6.04	121.27	111.00
1	A	39	ARG	NE-CZ-NH1	5.99	123.30	120.30
1	A	125	LEU	CB-CG-CD2	5.98	121.17	111.00
1	B	127	LEU	CB-CG-CD2	5.95	121.12	111.00
1	B	134	ARG	NE-CZ-NH1	5.73	123.17	120.30
1	B	134	ARG	CD-NE-CZ	5.68	131.55	123.60
1	B	39	ARG	NE-CZ-NH2	-5.57	117.52	120.30
1	B	141	PRO	N-CD-CG	-5.47	94.99	103.20
1	B	61	GLU	OE1-CD-OE2	5.47	129.86	123.30
1	A	93	GLU	CB-CA-C	5.43	121.27	110.40
1	A	21	GLU	CB-CA-C	5.38	121.17	110.40
1	B	79	ARG	CG-CD-NE	-5.34	100.59	111.80
1	B	75	LEU	CB-CA-C	5.33	120.33	110.20
1	A	21	GLU	CB-CG-CD	5.20	128.25	114.20
1	B	130	THR	OG1-CB-CG2	-5.11	98.26	110.00
1	A	79	ARG	NE-CZ-NH1	5.09	122.84	120.30
1	B	120	THR	CA-CB-OG1	-5.06	98.37	109.00
1	A	158	LEU	CB-CG-CD2	5.05	119.59	111.00

There are no chirality outliers.

All (6) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	143	ARG	Peptide,Sidechain
1	A	179	PHE	Peptide
1	B	37	LEU	Mainchain
1	B	39	ARG	Sidechain
1	B	86	ILE	Mainchain

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	1397	1378	1407	9	1
1	B	1397	1378	1407	8	1
2	A	24	0	0	1	0
2	B	25	0	0	0	0
All	All	2843	2756	2814	17	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 3.

All (17) 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:B:124:PHE:CD1	1:B:125:LEU:N	2.68	0.61
1:A:135:MET:HE2	1:A:172:ALA:HA	1.88	0.56
1:B:124:PHE:CD1	1:B:124:PHE:C	2.84	0.50
1:B:25:PHE:CZ	1:B:41:ALA:HA	2.50	0.46
1:A:39:ARG:NH1	1:A:69:ASN:OD1	2.50	0.45
1:B:127:LEU:HD11	1:B:162:VAL:HG23	2.01	0.43
1:A:71:GLU:OE1	1:A:71:GLU:HA	2.19	0.42
1:A:135:MET:CE	2:A:202:HOH:O	2.68	0.42
1:B:27:MET:HE1	1:B:77:LEU:HD11	2.01	0.42
1:A:18:VAL:HA	1:A:48:LEU:O	2.20	0.41
1:B:27:MET:CE	1:B:77:LEU:HD11	2.50	0.41
1:A:138:TYR:CE2	1:A:151:LEU:HD22	2.56	0.41
1:B:62:LEU:HD21	1:B:74:LEU:HD12	2.03	0.41
1:A:18:VAL:HG11	1:A:37:LEU:HD11	2.03	0.40
1:A:22:TYR:CD2	1:A:42:LYS:HB2	2.57	0.40
1:A:13:ARG:HB2	1:A:84:ARG:NH2	2.37	0.40
1:B:35:ALA:O	1:B:74:LEU:HD23	2.21	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:A:81:GLU:OE2	1:B:42:LYS:HZ3[1_455]	1.54	0.06

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	178/183 (97%)	169 (95%)	6 (3%)	3 (2%)	9 1
1	B	178/183 (97%)	175 (98%)	3 (2%)	0	100 100
All	All	356/366 (97%)	344 (97%)	9 (2%)	3 (1%)	19 6

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	143	ARG
1	A	144	ALA
1	A	93	GLU

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	149/152 (98%)	140 (94%)	9 (6%)	19 4
1	B	149/152 (98%)	146 (98%)	3 (2%)	55 31
All	All	298/304 (98%)	286 (96%)	12 (4%)	31 10

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	66	ASP
1	A	79	ARG
1	A	80	ASN

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Mol	Chain	Res	Type
1	A	84	ARG
1	A	93	GLU
1	A	95	VAL
1	A	108	LYS
1	A	122	TYR
1	A	180	ASN
1	B	64	ASP
1	B	66	ASP
1	B	84	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	139	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 monosaccharides 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, 95^{th} 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	180/183 (98%)	0.27	3 (1%)	70	69	23, 34, 53, 72	0
1	B	180/183 (98%)	0.28	4 (2%)	62	60	22, 33, 51, 75	0
All	All	360/366 (98%)	0.27	7 (1%)	66	65	22, 33, 53, 75	0

All (7) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	95	VAL	4.6
1	B	95	VAL	4.2
1	B	1	GLY	4.2
1	B	75	LEU	3.4
1	A	143	ARG	2.7
1	A	68	THR	2.6
1	B	124	PHE	2.5

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 (i)

There are no such residues in this entry.