



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 02:58 PM UTC

PDB ID : 9L6N / pdb\_00009l6n  
Title : PEDV 3CLpro mutant (C144A) in complex with nsp5/6 peptide substrate  
Authors : Zhang, Y.; Zhang, D.; Shi, Y.J.; Peng, G.Q.  
Deposited on : 2024-12-24  
Resolution : 2.30 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](mailto: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 : 4-5-2 with Phenix2.0  
Xtrriage (Phenix) : 2.0  
EDS : 3.0  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
CCP4 : 9.0.010 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49

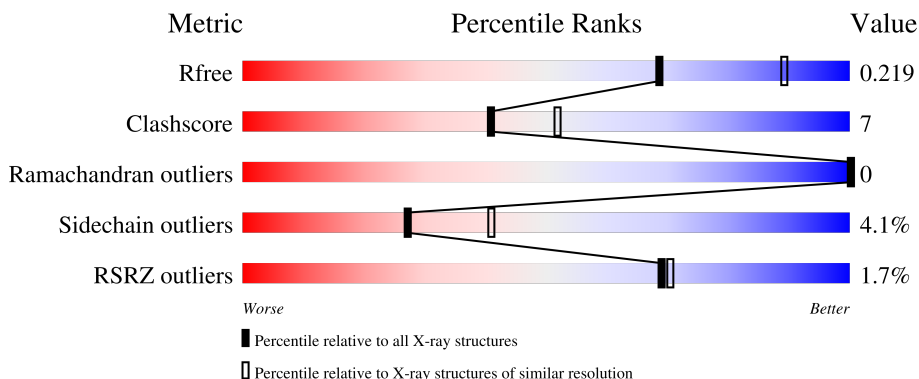
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.30 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))
$R_{free}$	180053	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

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  $\geq 3$ , 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	310	 2% 83% 13% ..
1	B	310	 % 77% 17% ..
2	C	6	 17% 50% 17% 33%

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 4680 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 ORF1ab polyprotein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	299	2279	1440	393	431	15	0	0	0
1	B	298	2272	1435	392	430	15	0	0	0

There are 24 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	MET	-	initiating methionine	UNP A0A023J7B5
A	144	ALA	CYS	engineered mutation	UNP A0A023J7B5
A	300	LEU	-	expression tag	UNP A0A023J7B5
A	301	GLU	-	expression tag	UNP A0A023J7B5
A	302	HIS	-	expression tag	UNP A0A023J7B5
A	303	HIS	-	expression tag	UNP A0A023J7B5
A	304	HIS	-	expression tag	UNP A0A023J7B5
A	305	HIS	-	expression tag	UNP A0A023J7B5
A	306	HIS	-	expression tag	UNP A0A023J7B5
A	307	HIS	-	expression tag	UNP A0A023J7B5
A	308	HIS	-	expression tag	UNP A0A023J7B5
A	309	HIS	-	expression tag	UNP A0A023J7B5
B	0	MET	-	initiating methionine	UNP A0A023J7B5
B	144	ALA	CYS	engineered mutation	UNP A0A023J7B5
B	300	LEU	-	expression tag	UNP A0A023J7B5
B	301	GLU	-	expression tag	UNP A0A023J7B5
B	302	HIS	-	expression tag	UNP A0A023J7B5
B	303	HIS	-	expression tag	UNP A0A023J7B5
B	304	HIS	-	expression tag	UNP A0A023J7B5
B	305	HIS	-	expression tag	UNP A0A023J7B5
B	306	HIS	-	expression tag	UNP A0A023J7B5
B	307	HIS	-	expression tag	UNP A0A023J7B5
B	308	HIS	-	expression tag	UNP A0A023J7B5
B	309	HIS	-	expression tag	UNP A0A023J7B5

- Molecule 2 is a protein called Replicase polyprotein 1a.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
2	C	4	27	17	5	5	0	0	0

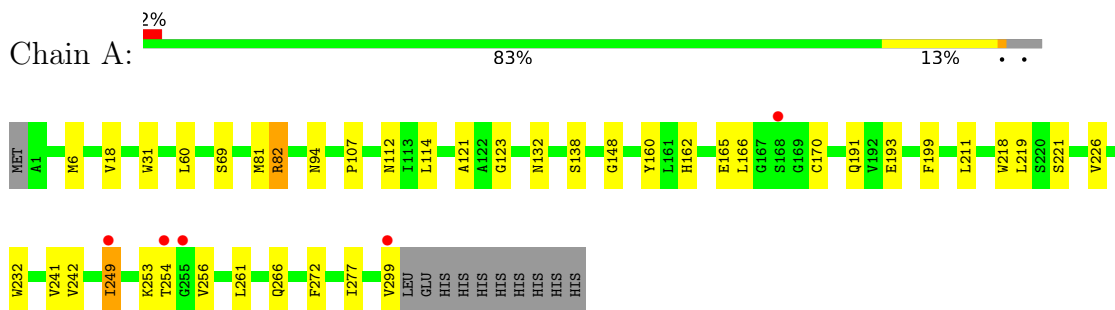
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	44	44	44	0	0
3	B	58	58	58	0	0

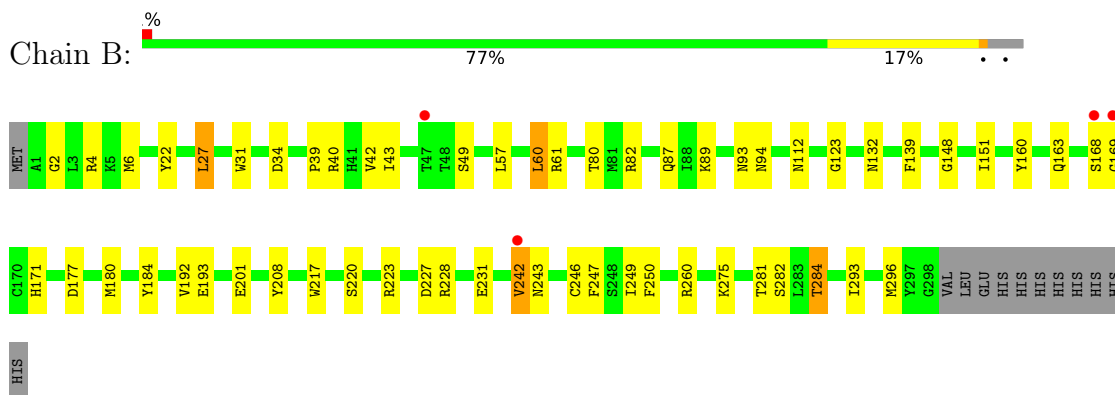
### 3 Residue-property plots [i](#)

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.

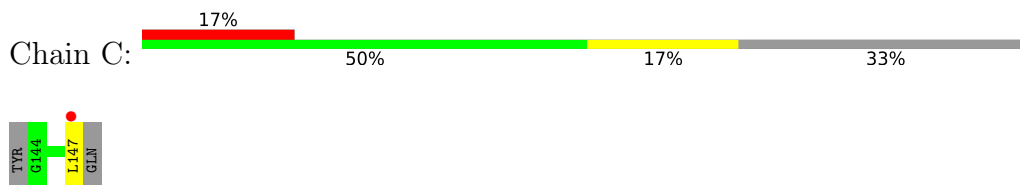
- Molecule 1: ORF1ab polyprotein



- Molecule 1: ORF1ab polyprotein



- Molecule 2: Replicase polyprotein 1a



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	55.13Å 85.37Å 57.91Å 90.00° 98.94° 90.00°	Depositor
Resolution (Å)	36.70 – 2.30 36.70 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.0 (36.70-2.30) 99.0 (36.70-2.30)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.25 (at 2.29Å)	Xtrriage
Refinement program	PHENIX (1.20.1_4487: ???)	Depositor
R, $R_{free}$	0.169 , 0.224 0.172 , 0.219	Depositor DCC
$R_{free}$ test set	1191 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	27.5	Xtrriage
Anisotropy	0.477	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 35.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	0.033 for l,-k,h	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	4680	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	31.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.36% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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](#)

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	0.41	0/2326	0.64	0/3159
1	B	0.46	0/2319	0.71	0/3149
2	C	0.43	0/26	0.68	0/34
All	All	0.43	0/4671	0.67	0/6342

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	1
1	B	0	2
All	All	0	3

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	82	ARG	Sidechain
1	B	4	ARG	Sidechain
1	B	61	ARG	Sidechain

### 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	2279	0	2230	25	0
1	B	2272	0	2221	38	0
2	C	27	0	28	2	0
3	A	44	0	0	0	0
3	B	58	0	0	2	0
All	All	4680	0	4479	59	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 7.

All (59) 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:34:ASP:OD2	1:B:89:LYS:HE3	1.93	0.69
1:A:123:GLY:HA3	1:B:6:MET:HE3	1.77	0.66
1:B:217:TRP:CE2	1:B:275:LYS:HD3	2.32	0.64
1:A:114:LEU:HD11	1:A:121:ALA:HB1	1.82	0.62
1:B:34:ASP:OD1	1:B:34:ASP:N	2.33	0.60
1:B:22:TYR:CZ	1:B:60:LEU:HD22	2.37	0.59
1:B:281:THR:HG22	1:B:282:SER:O	2.02	0.59
1:B:87:GLN:NE2	3:B:402:HOH:O	2.34	0.58
1:A:162:HIS:NE2	2:C:147:LEU:HD12	2.19	0.58
1:B:43:ILE:HG21	1:B:60:LEU:HD11	1.89	0.55
1:B:208:TYR:CD1	1:B:250:PHE:HB3	2.42	0.55
1:A:254:THR:HG23	1:A:256:VAL:H	1.75	0.52
1:A:148:GLY:HA3	1:A:160:TYR:HB3	1.92	0.51
1:B:201:GLU:HG3	1:B:247:PHE:CZ	2.45	0.51
1:A:132:ASN:ND2	1:A:193:GLU:HG3	2.26	0.50
1:A:31:TRP:CE2	1:A:94:ASN:HB2	2.47	0.50
1:A:6:MET:HE2	1:B:123:GLY:HA3	1.94	0.49
1:A:132:ASN:HD22	1:A:193:GLU:HG3	1.78	0.49
1:B:201:GLU:HG3	1:B:247:PHE:HZ	1.78	0.49
1:B:228:ARG:HD3	1:B:231:GLU:OE1	2.13	0.49
1:B:242:VAL:HG23	1:B:243:ASN:H	1.78	0.48
1:B:27:LEU:HD21	1:B:42:VAL:HB	1.95	0.48
1:A:218:TRP:CD1	1:A:218:TRP:H	2.30	0.48
1:B:223:ARG:NH2	3:B:403:HOH:O	2.46	0.48
1:B:112:ASN:O	1:B:148:GLY:HA2	2.15	0.47
1:A:18:VAL:HG12	1:A:69:SER:HB2	1.97	0.47
1:B:27:LEU:HD13	1:B:39:PRO:HD2	1.97	0.46
1:A:114:LEU:HD12	1:A:123:GLY:O	2.15	0.46
1:B:132:ASN:ND2	1:B:193:GLU:OE2	2.49	0.45

*Continued on next page...*

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:249:ILE:HG21	1:B:293:ILE:HD11	1.98	0.45
1:A:226:VAL:HG13	1:A:241:VAL:HG13	1.99	0.45
1:B:40:ARG:O	1:B:43:ILE:HG12	2.17	0.45
1:B:2:GLY:O	1:B:296:MET:HE1	2.17	0.45
1:B:31:TRP:CE2	1:B:94:ASN:HB2	2.52	0.45
1:B:80:THR:HG23	1:B:87:GLN:HB3	1.98	0.45
1:B:180:MET:HG2	1:B:184:TYR:O	2.17	0.45
1:B:168:SER:OG	1:B:169:GLY:N	2.50	0.44
1:B:163:GLN:HG3	1:B:180:MET:SD	2.58	0.44
1:A:249:ILE:H	1:A:249:ILE:HG12	1.46	0.44
1:A:112:ASN:O	1:A:148:GLY:HA2	2.18	0.43
1:B:22:TYR:OH	1:B:60:LEU:HD22	2.18	0.43
1:A:6:MET:CE	1:B:123:GLY:HA3	2.49	0.43
1:A:107:PRO:HB2	1:A:199:PHE:HZ	1.83	0.43
1:A:232:TRP:CG	1:A:266:GLN:HE21	2.37	0.43
1:B:57:LEU:HA	1:B:60:LEU:HG	2.00	0.42
1:B:281:THR:O	1:B:284:THR:HG22	2.19	0.42
1:A:211:LEU:HD11	1:A:261:LEU:HD21	2.00	0.42
1:A:31:TRP:CD2	1:A:94:ASN:HB2	2.55	0.42
1:B:148:GLY:HA3	1:B:160:TYR:HB3	2.02	0.41
1:B:227:ASP:O	1:B:231:GLU:HG3	2.19	0.41
1:A:123:GLY:HA3	1:B:6:MET:CE	2.47	0.41
1:A:272:PHE:CE2	1:A:277:ILE:HD12	2.56	0.41
1:A:219:LEU:HD11	1:A:256:VAL:HG11	2.03	0.41
1:B:139:PHE:HD2	1:B:171:HIS:CG	2.39	0.41
1:A:81:MET:HE2	1:A:81:MET:HB2	1.99	0.41
1:B:82:ARG:HH11	1:B:177:ASP:HA	1.86	0.40
1:A:165:GLU:HB2	2:C:147:LEU:HD11	2.04	0.40
1:B:220:SER:O	1:B:260:ARG:HD2	2.21	0.40
1:B:284:THR:HG22	1:B:284:THR:H	1.68	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	297/310 (96%)	288 (97%)	9 (3%)	0	100	100
1	B	296/310 (96%)	286 (97%)	10 (3%)	0	100	100
2	C	2/6 (33%)	2 (100%)	0	0	100	100
All	All	595/626 (95%)	576 (97%)	19 (3%)	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	245/256 (96%)	234 (96%)	11 (4%)	24	37
1	B	244/256 (95%)	235 (96%)	9 (4%)	30	45
2	C	3/5 (60%)	3 (100%)	0	100	100
All	All	492/517 (95%)	472 (96%)	20 (4%)	27	41

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	60	LEU
1	A	82	ARG
1	A	138	SER
1	A	166	LEU
1	A	170	CYS
1	A	191	GLN
1	A	221	SER
1	A	242	VAL
1	A	249	ILE
1	A	253	LYS
1	A	299	VAL
1	B	27	LEU
1	B	49	SER

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type
1	B	60	LEU
1	B	93	ASN
1	B	151	ILE
1	B	192	VAL
1	B	242	VAL
1	B	246	CYS
1	B	284	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	153	ASN
1	A	236	ASN
1	A	269	HIS
1	B	92	GLN
1	B	152	ASN
1	B	235	HIS
1	B	236	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 oligosaccharides 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

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	299/310 (96%)	-0.01	5 (1%) 69 70	17, 29, 54, 73	0
1	B	298/310 (96%)	-0.09	4 (1%) 75 76	16, 27, 51, 72	0
2	C	4/6 (66%)	1.16	1 (25%) 2 2	34, 36, 37, 38	0
All	All	601/626 (96%)	-0.04	10 (1%) 69 70	16, 28, 52, 73	0

All (10) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	299	VAL	4.0
1	B	242	VAL	3.4
1	A	254	THR	2.8
1	B	169	GLY	2.7
1	B	47	THR	2.6
2	C	147	LEU	2.4
1	A	249	ILE	2.3
1	A	168	SER	2.3
1	A	255	GLY	2.1
1	B	168	SER	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 oligosaccharides 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.