



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 11, 2023 – 09:27 PM EDT

PDB ID : 7RSS  
Title : Kod-RI incorporating DNA, n+2  
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Deposited on : 2021-08-11  
Resolution : 2.71 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>.

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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 : 2.35.1  
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) : 2.35.1

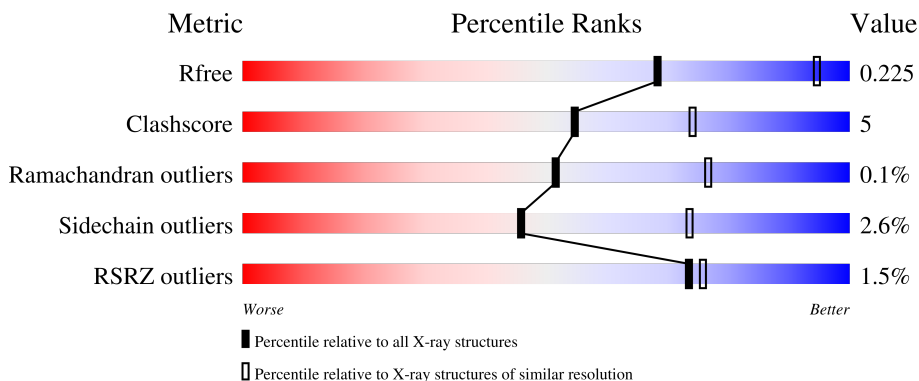
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.71 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	3359 (2.74-2.70)
Clashscore	141614	3686 (2.74-2.70)
Ramachandran outliers	138981	3622 (2.74-2.70)
Sidechain outliers	138945	3623 (2.74-2.70)
RSRZ outliers	127900	3276 (2.74-2.70)

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	774	 82% 16% ..
2	T	16	 88% 6% 6%
3	P	13	 8% 77% 23%

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 6883 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 DNA polymerase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	756	6225	4009	1057	1143	16	0	1	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	141	ALA	ASP	conflict	UNP D0VWU9
A	143	ALA	GLU	conflict	UNP D0VWU9
A	147	HIS	GLU	conflict	UNP D0VWU9
A	485	ARG	ALA	conflict	UNP D0VWU9
A	584	LYS	GLU	conflict	UNP D0VWU9
A	664	ILE	GLU	conflict	UNP D0VWU9

- Molecule 2 is a DNA chain called Template.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	T	15	305	146	55	89	15	0	0	0

- Molecule 3 is a DNA chain called Primer.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	P	13	268	126	54	75	13	0	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	78	Total O 78 78	0	0
4	T	6	Total O 6 6	0	0

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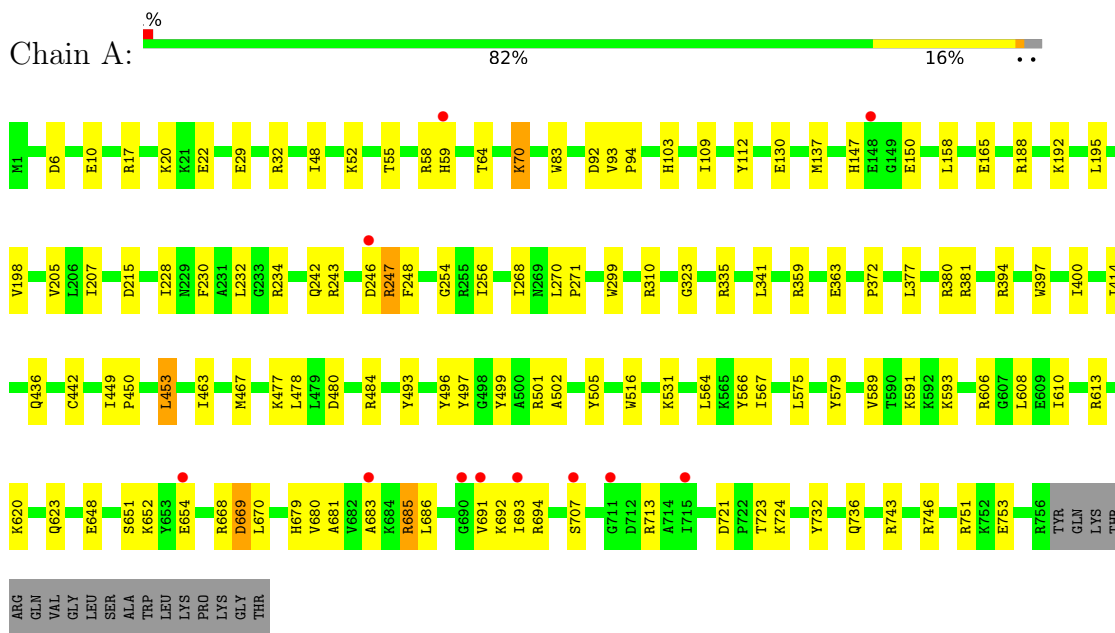
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<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
4	P	1	Total	O	0	0
			1	1		

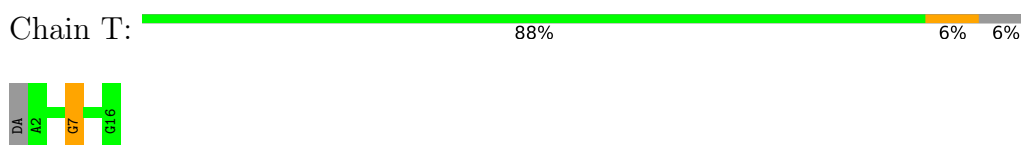
### 3 Residue-property plots [i](#)

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.

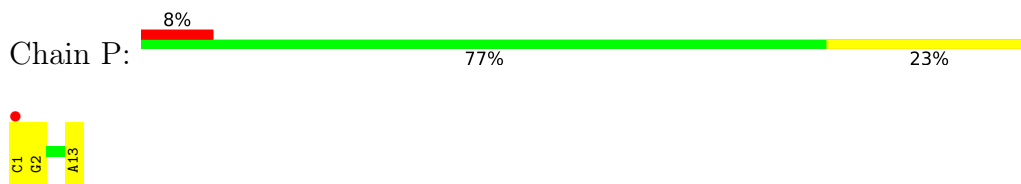
- Molecule 1: DNA polymerase



- Molecule 2: Template



- Molecule 3: Primer



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 2 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	66.26Å 112.00Å 149.20Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	62.09 – 2.71 62.09 – 2.71	Depositor EDS
% Data completeness (in resolution range)	99.4 (62.09-2.71) 99.4 (62.09-2.71)	Depositor EDS
$R_{merge}$	0.03	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.35 (at 2.73Å)	Xtrriage
Refinement program	PHENIX 1.13_2998	Depositor
R, $R_{free}$	0.159 , 0.225 0.159 , 0.225	Depositor DCC
$R_{free}$ test set	2000 reflections (6.51%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	47.1	Xtrriage
Anisotropy	0.477	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 48.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	6883	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	52.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.74% 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	0.42	0/6364	0.58	0/8584
2	T	0.87	0/341	1.03	1/522 (0.2%)
3	P	0.83	1/301 (0.3%)	0.90	0/462
All	All	0.48	1/7006 (0.0%)	0.63	1/9568 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	P	13	DA	C3'-O3'	-5.34	1.37	1.44

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	T	7	DG	C1'-O4'-C4'	-5.07	105.03	110.10

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	6225	0	6280	68	0
2	T	305	0	170	1	0
3	P	268	0	145	2	0
4	A	78	0	0	3	0
4	P	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	T	6	0	0	0	0
All	All	6883	0	6595	70	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 5.

All (70) 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:414:ILE:HD11	1:A:453:LEU:HB3	1.64	0.80
1:A:591:LYS:HD3	2:T:7:DG:H5''	1.65	0.77
1:A:103:HIS:O	4:A:801:HOH:O	2.14	0.63
1:A:58:ARG:NH1	1:A:92:ASP:OD1	2.30	0.63
1:A:93:VAL:HG22	1:A:94:PRO:HD3	1.81	0.61
1:A:692:LYS:HD3	1:A:694:ARG:NE	2.15	0.61
1:A:20:LYS:NZ	1:A:29:GLU:OE2	2.34	0.61
1:A:681:ALA:O	1:A:685:ARG:HD3	2.01	0.61
1:A:589:VAL:HG21	1:A:608:LEU:HD21	1.84	0.60
1:A:243:ARG:HG2	1:A:248:PHE:HE1	1.66	0.60
1:A:137:MET:HG2	1:A:205:VAL:HB	1.83	0.59
1:A:158:LEU:HD22	1:A:299:TRP:CD2	2.38	0.58
1:A:158:LEU:HD22	1:A:299:TRP:CE2	2.39	0.58
1:A:243:ARG:HG2	1:A:248:PHE:CE1	2.38	0.57
1:A:195:LEU:HD21	1:A:230:PHE:HD1	1.70	0.57
1:A:394:ARG:HH12	1:A:743[A]:ARG:HH21	1.52	0.57
1:A:195:LEU:HD21	1:A:230:PHE:CD1	2.41	0.56
1:A:610:ILE:HG13	1:A:623:GLN:OE1	2.06	0.56
1:A:109:ILE:HG13	1:A:112:TYR:CD2	2.41	0.56
1:A:268:ILE:HG13	1:A:270:LEU:HG	1.88	0.56
1:A:531:LYS:NZ	1:A:566:TYR:OH	2.39	0.55
1:A:6:ASP:OD1	1:A:17:ARG:HB2	2.06	0.55
1:A:686:LEU:HB3	1:A:691:VAL:HG21	1.87	0.55
1:A:610:ILE:HA	1:A:620:LYS:HG2	1.89	0.53
1:A:130:GLU:HG2	1:A:335:ARG:HD2	1.89	0.53
1:A:359:ARG:O	1:A:363:GLU:HG3	2.09	0.53
3:P:1:DC:H1'	3:P:2:DG:N7	2.25	0.52
1:A:496:TYR:CZ	1:A:502:ALA:HB1	2.45	0.51
1:A:652:LYS:HB2	1:A:654:GLU:OE2	2.11	0.50
1:A:147:HIS:HB2	1:A:150:GLU:OE1	2.11	0.50
1:A:198:VAL:HG11	1:A:232:LEU:HD22	1.93	0.50
1:A:380:ARG:HG2	1:A:505:TYR:CE2	2.47	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:55:THR:HG22	1:A:64:THR:HG22	1.95	0.49
1:A:256:ILE:HG21	1:A:341:LEU:HD22	1.96	0.48
1:A:397:TRP:HB2	1:A:400:ILE:HD11	1.95	0.48
1:A:679:HIS:CE1	1:A:680:VAL:HG23	2.50	0.47
1:A:246:ASP:CG	1:A:247:ARG:HE	2.18	0.47
1:A:70:LYS:HG3	1:A:83:TRP:CZ2	2.51	0.46
1:A:499:TYR:CZ	1:A:501:ARG:HB2	2.51	0.46
1:A:10:GLU:OE2	1:A:32:ARG:NH1	2.35	0.45
1:A:751:ARG:HG2	1:A:753:GLU:OE1	2.15	0.45
1:A:480:ASP:O	1:A:484:ARG:HG3	2.17	0.44
1:A:463:ILE:O	1:A:467:MET:HG3	2.18	0.44
1:A:670:LEU:H	1:A:670:LEU:HD12	1.83	0.44
1:A:207:ILE:HD13	1:A:323:GLY:HA3	2.00	0.43
1:A:436:GLN:NE2	4:A:811:HOH:O	2.49	0.43
1:A:372:PRO:HG2	1:A:377:LEU:HD13	2.00	0.43
1:A:48:ILE:O	1:A:52:LYS:HB2	2.19	0.43
1:A:188:ARG:HG3	1:A:228:ILE:HD11	2.01	0.42
1:A:234:ARG:HB2	1:A:254:GLY:HA3	2.01	0.42
1:A:478:LEU:HD23	1:A:478:LEU:HA	1.88	0.42
1:A:683:ALA:HB1	1:A:693:ILE:HG21	2.01	0.42
1:A:449:ILE:HB	1:A:450:PRO:HD3	2.00	0.42
1:A:564:LEU:HD11	1:A:579:TYR:HB2	2.01	0.42
1:A:668:ARG:HG3	1:A:669:ASP:O	2.20	0.42
1:A:567:ILE:HD12	1:A:567:ILE:HA	1.86	0.42
3:P:1:DC:H6	3:P:1:DC:H2'	1.71	0.42
1:A:453:LEU:HG	1:A:493:TYR:CD1	2.55	0.41
1:A:707:SER:HA	1:A:713:ARG:HD3	2.01	0.41
1:A:732:TYR:O	1:A:736:GLN:HB2	2.20	0.41
1:A:70:LYS:HG2	1:A:83:TRP:CD2	2.54	0.41
1:A:593:LYS:HA	1:A:606:ARG:O	2.20	0.41
1:A:310:ARG:NE	4:A:815:HOH:O	2.54	0.41
1:A:20:LYS:HD2	1:A:22:GLU:OE1	2.21	0.41
1:A:192:LYS:HB3	1:A:192:LYS:HE2	1.86	0.41
1:A:648:GLU:OE2	1:A:652:LYS:NZ	2.53	0.41
1:A:453:LEU:HD23	1:A:453:LEU:HA	1.80	0.40
1:A:686:LEU:HB3	1:A:691:VAL:CG2	2.50	0.40
1:A:271:PRO:HA	1:A:613:ARG:HB2	2.03	0.40
1:A:721:ASP:OD2	1:A:723:THR:OG1	2.31	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	755/774 (98%)	734 (97%)	20 (3%)	1 (0%)	51 77

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	59	HIS

### 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	659/673 (98%)	642 (97%)	17 (3%)	46 73

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	70	LYS
1	A	165	GLU
1	A	215	ASP
1	A	242	GLN
1	A	247	ARG
1	A	381	ARG
1	A	442	CYS
1	A	453	LEU
1	A	477	LYS
1	A	497	TYR

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Mol	Chain	Res	Type
1	A	516	TRP
1	A	575	LEU
1	A	651	SER
1	A	669	ASP
1	A	685	ARG
1	A	724	LYS
1	A	746	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 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, 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	756/774 (97%)	-0.01	11 (1%) 73 76	24, 47, 82, 116	0
2	T	15/16 (93%)	-0.19	0 100 100	40, 53, 94, 98	0
3	P	13/13 (100%)	-0.03	1 (7%) 13 12	45, 61, 119, 146	0
All	All	784/803 (97%)	-0.01	12 (1%) 73 76	24, 48, 85, 146	0

All (12) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	690	GLY	3.5
1	A	59	HIS	3.0
3	P	1	DC	3.0
1	A	246	ASP	2.9
1	A	683	ALA	2.9
1	A	715	ILE	2.7
1	A	691	VAL	2.6
1	A	693	ILE	2.4
1	A	711	GLY	2.3
1	A	148	GLU	2.3
1	A	654	GLU	2.0
1	A	707	SER	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

There are no ligands in this entry.

## 6.5 Other polymers

There are no such residues in this entry.