



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 30, 2026 – 01:06 PM JST

PDB ID : 9UBD / pdb_00009ubd
Title : The Structural Basis of the Recognition of the Histone Variant H2A.Z by the SRCAP Catalytic Subunit
Authors : Tan, W.S.; Jiang, J.S.; Hong, J.J.
Deposited on : 2025-04-02
Resolution : 2.53 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 : 4-5-2 with Phenix2.0
Xtrriage (Phenix) : 2.0
EDS : 3.0
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
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) : 2.48.1

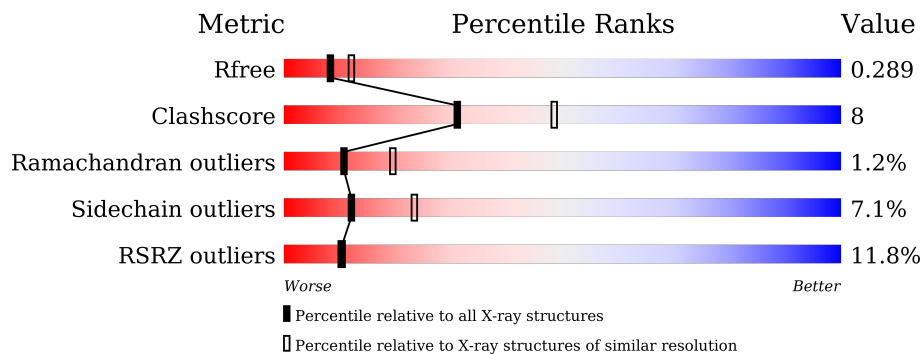
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.53 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	6935 (2.54-2.50)
Clashscore	180529	7778 (2.54-2.50)
Ramachandran outliers	177936	7674 (2.54-2.50)
Sidechain outliers	177891	7676 (2.54-2.50)
RSRZ outliers	164620	6935 (2.54-2.50)

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 $\leq 5\%$. 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	98	9% (Poor fit) 66% (0 outliers) 20% (1 outlier) 12% (2+ outliers)
1	D	98	12% (Poor fit) 81% (0 outliers) 11% (1 outlier) 8% (2+ outliers)
2	B	94	14% (Poor fit) 67% (0 outliers) 27% (1 outlier) 7% (2+ outliers)
2	E	94	9% (Poor fit) 73% (0 outliers) 18% (1 outlier) 7% (2+ outliers)
3	C	30	3% (Poor fit) 23% (0 outliers) 7% (1 outlier) 67% (2+ outliers)

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 2685 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 Histone H2A.Z.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
1	A	86	623	385	119	119	0	0	0
1	D	90	640	398	120	122	0	0	0

- Molecule 2 is a protein called Histone H2B type 1-J.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	E	87	640	406	107	125	2	0	0	0
2	B	92	673	423	117	131	2	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	126	SER	-	expression tag	UNP P06899
E	127	SER	-	expression tag	UNP P06899
B	126	SER	-	expression tag	UNP P06899
B	127	SER	-	expression tag	UNP P06899

- Molecule 3 is a protein called Helicase SRCAP.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	C	10	74	51	10	13	0	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	7	Total	O	0	0
			7	7		

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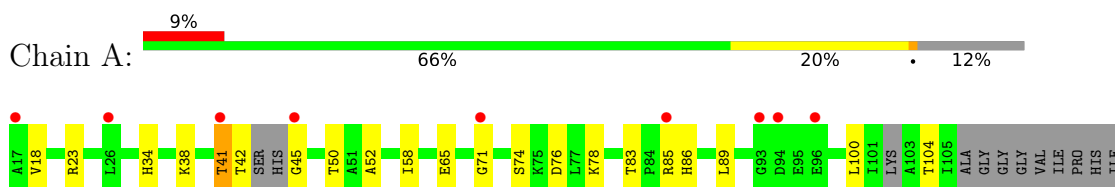
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	E	12	Total 12	O 12	0	0
4	C	1	Total 1	O 1	0	0
4	D	7	Total 7	O 7	0	0
4	B	8	Total 8	O 8	0	0

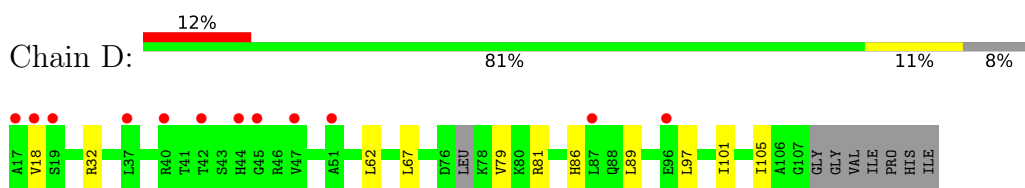
3 Residue-property plots

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.

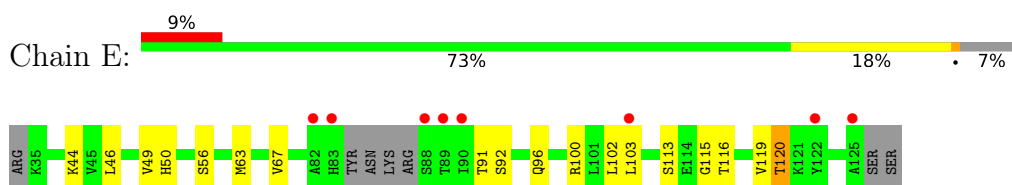
- Molecule 1: Histone H2A.Z



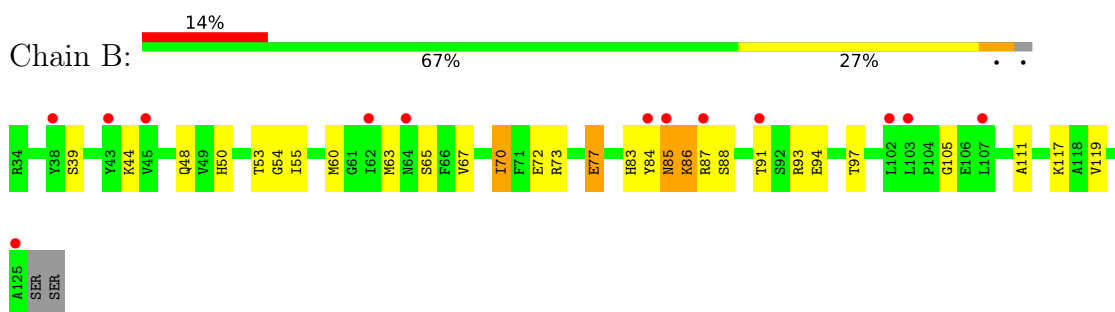
- Molecule 1: Histone H2A.Z



- Molecule 2: Histone H2B type 1-J



- Molecule 2: Histone H2B type 1-J



- Molecule 3: Helicase SRCAP



SER	GLU	ASP	ALA	GLN	SER	GLN	SER	GLN	ALA	ASP	GLU	GLU	GLU	GLU	ASP	ASP	ASP	F5549	G5540	V5551	E5552	L5555	E5558	GLU	GLU
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4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	77.33Å 102.19Å 67.37Å 90.00° 114.78° 90.00°	Depositor
Resolution (Å)	35.10 – 2.53 35.10 – 2.53	Depositor EDS
% Data completeness (in resolution range)	92.3 (35.10-2.53) 92.3 (35.10-2.53)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.52 (at 2.54Å)	Xtrriage
Refinement program	PHENIX (1.20.1_4487_000)	Depositor
R, R_{free}	0.252 , 0.288 0.264 , 0.289	Depositor DCC
R_{free} test set	583 reflections (3.96%)	wwPDB-VP
Wilson B-factor (Å ²)	35.2	Xtrriage
Anisotropy	0.724	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 69.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.28$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.90	EDS
Total number of atoms	2685	wwPDB-VP
Average B, all atoms (Å ²)	45.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 17.37% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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	0.55	0/628	0.83	0/849
1	D	0.42	0/646	0.62	0/876
2	B	0.57	0/684	0.89	0/926
2	E	0.49	0/648	0.71	1/876 (0.1%)
3	C	0.58	0/75	1.10	0/101
All	All	0.51	0/2681	0.78	1/3628 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
2	E	113	SER	N-CA-C	-5.23	105.66	111.36

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	623	0	601	15	0
1	D	640	0	616	5	0
2	B	673	0	638	20	0
2	E	640	0	633	8	0
3	C	74	0	66	2	0
4	A	7	0	0	0	0
4	B	8	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	C	1	0	0	0	0
4	D	7	0	0	0	0
4	E	12	0	0	1	0
All	All	2685	0	2554	42	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 8.

All (42) 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)
3:C:555:LEU:HD11	1:D:105:ILE:HG13	1.74	0.69
1:A:71:GLY:HA3	2:B:50:HIS:CD2	2.27	0.68
1:A:41:THR:HG1	1:A:45:GLY:N	1.94	0.66
1:A:100:LEU:HD11	2:B:70:ILE:HD11	1.78	0.65
2:B:83:HIS:O	2:B:85:ASN:N	2.29	0.64
2:B:44:LYS:O	2:B:48:GLN:HG2	2.00	0.61
1:D:79:VAL:HG12	1:D:81:ARG:H	1.67	0.60
1:A:18:VAL:HB	1:A:23:ARG:HG3	1.83	0.59
2:E:116:THR:O	2:E:120:THR:OG1	2.23	0.56
2:B:77:GLU:OE2	2:B:77:GLU:HA	2.05	0.56
2:B:83:HIS:C	2:B:85:ASN:H	2.14	0.56
1:A:34:HIS:CE1	1:A:38:LYS:HZ1	2.24	0.55
2:B:91:THR:HG23	2:B:93:ARG:H	1.72	0.55
2:E:46:LEU:HB2	1:D:67:LEU:HD13	1.91	0.52
2:B:50:HIS:HB3	2:B:53:THR:OG1	2.10	0.52
1:A:74:SER:OG	1:A:86:HIS:ND1	2.43	0.51
1:A:85:ARG:O	1:A:89:LEU:HG	2.09	0.51
2:E:102:LEU:HD23	2:E:103:LEU:HD12	1.92	0.50
1:A:42:THR:O	1:A:45:GLY:N	2.44	0.50
2:B:83:HIS:C	2:B:85:ASN:N	2.70	0.50
2:B:55:ILE:HG21	2:B:60:MET:HE2	1.94	0.49
2:B:91:THR:HG22	2:B:94:GLU:OE1	2.15	0.47
2:E:49:VAL:HG23	2:E:50:HIS:ND1	2.31	0.46
2:E:115:GLY:O	2:E:119:VAL:HG12	2.14	0.46
1:D:86:HIS:HA	1:D:89:LEU:HD12	1.97	0.45
2:B:70:ILE:HD13	2:B:70:ILE:HA	1.76	0.45
2:B:63:MET:O	2:B:67:VAL:HG23	2.16	0.45
2:B:86:LYS:HE3	2:B:86:LYS:HB3	1.80	0.44
1:A:83:THR:HG23	1:A:86:HIS:H	1.82	0.44
3:C:552:GLU:HA	3:C:555:LEU:HD12	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:87:ARG:O	2:B:88:SER:C	2.62	0.43
1:A:58:ILE:HD12	2:B:111:ALA:HB1	1.99	0.43
1:A:104:THR:HA	2:B:73:ARG:NE	2.34	0.42
1:A:104:THR:HA	2:B:73:ARG:HD3	2.01	0.42
2:E:96:GLN:O	2:E:100:ARG:HG3	2.20	0.41
2:E:44:LYS:NZ	4:E:204:HOH:O	2.54	0.41
1:A:76:ASP:C	1:A:78:LYS:H	2.28	0.41
1:A:50:THR:HG23	2:B:119:VAL:HG22	2.03	0.41
2:B:53:THR:HG22	2:B:54:GLY:O	2.21	0.41
2:E:63:MET:O	2:E:67:VAL:HG23	2.21	0.41
1:D:97:LEU:O	1:D:101:ILE:HG12	2.21	0.40
1:A:34:HIS:HB2	1:A:52:ALA:CB	2.51	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	80/98 (82%)	75 (94%)	5 (6%)	0	100	100
1	D	86/98 (88%)	83 (96%)	2 (2%)	1 (1%)	11	19
2	B	90/94 (96%)	82 (91%)	5 (6%)	3 (3%)	3	4
2	E	83/94 (88%)	81 (98%)	2 (2%)	0	100	100
3	C	8/30 (27%)	7 (88%)	1 (12%)	0	100	100
All	All	347/414 (84%)	328 (94%)	15 (4%)	4 (1%)	11	19

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	84	TYR
2	B	105	GLY

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Mol	Chain	Res	Type
2	B	85	ASN
1	D	18	VAL

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	58/76 (76%)	56 (97%)	2 (3%)	32	56
1	D	58/76 (76%)	56 (97%)	2 (3%)	32	56
2	B	66/80 (82%)	58 (88%)	8 (12%)	4	7
2	E	66/80 (82%)	62 (94%)	4 (6%)	15	30
3	C	6/26 (23%)	4 (67%)	2 (33%)	0	0
All	All	254/338 (75%)	236 (93%)	18 (7%)	12	23

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	41	THR
1	A	65	GLU
2	E	56	SER
2	E	91	THR
2	E	92	SER
2	E	120	THR
3	C	551	VAL
3	C	552	GLU
1	D	32	ARG
1	D	62	LEU
2	B	39	SER
2	B	65	SER
2	B	70	ILE
2	B	72	GLU
2	B	77	GLU
2	B	86	LYS
2	B	97	THR

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Mol	Chain	Res	Type
2	B	117	LYS

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

Mol	Chain	Res	Type
2	E	110	HIS

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 [i](#)

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(Å ²)	Q<0.9
1	A	86/98 (87%)	1.10	9 (10%) 13 13	30, 43, 63, 78	0
1	D	90/98 (91%)	1.06	12 (13%) 8 8	22, 44, 78, 92	0
2	B	92/94 (97%)	1.12	13 (14%) 7 8	33, 45, 68, 85	0
2	E	87/94 (92%)	0.86	8 (9%) 16 16	23, 38, 67, 81	0
3	C	10/30 (33%)	1.34	1 (10%) 14 14	44, 52, 63, 67	0
All	All	365/414 (88%)	1.05	43 (11%) 10 10	22, 44, 71, 92	0

All (43) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	84	TYR	4.0
2	B	43	TYR	3.9
2	B	125	ALA	3.9
2	E	88	SER	3.7
1	D	44	HIS	3.3
2	E	89	THR	3.3
1	A	41	THR	3.2
1	A	17	ALA	3.2
1	D	37	LEU	3.1
1	D	17	ALA	3.1
1	D	18	VAL	2.9
2	B	91	THR	2.9
2	E	83	HIS	2.9
1	D	42	THR	2.9
2	B	87	ARG	2.8
1	D	47	VAL	2.8
2	E	125	ALA	2.8
1	A	71	GLY	2.6
1	A	94	ASP	2.6
2	B	102	LEU	2.5

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Mol	Chain	Res	Type	RSRZ
1	D	51	ALA	2.4
1	A	93	GLY	2.4
2	B	107	LEU	2.4
1	D	45	GLY	2.4
1	A	45	GLY	2.3
2	B	103	LEU	2.3
1	A	96	GLU	2.3
2	B	85	ASN	2.3
1	D	19	SER	2.2
3	C	551	VAL	2.2
1	D	40	ARG	2.2
2	B	38	TYR	2.2
2	E	103	LEU	2.2
1	A	26	LEU	2.1
1	A	85	ARG	2.1
2	B	45	VAL	2.1
2	E	90	ILE	2.1
2	B	64	ASN	2.0
1	D	87	LEU	2.0
2	E	82	ALA	2.0
1	D	96	GLU	2.0
2	E	122	TYR	2.0
2	B	62	ILE	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 oligosaccharides 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.