



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 03:47 AM UTC

PDB ID : 3A1G / pdb_00003a1g
Title : High-Resolution Crystal Structure of RNA polymerase PB1-PB2 subunits from Influenza A Virus
Authors : Sugiyama, K.; Park, S.-Y.; Obayashi, E.
Deposited on : 2009-04-02
Resolution : 1.70 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
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (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

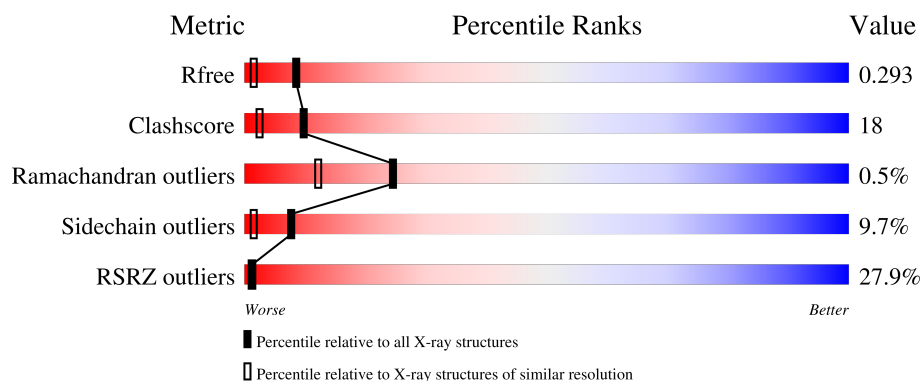
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.70 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	5551 (1.70-1.70)
Clashscore	190562	5924 (1.70-1.70)
Ramachandran outliers	187476	5846 (1.70-1.70)
Sidechain outliers	187428	5846 (1.70-1.70)
RSRZ outliers	180081	5554 (1.70-1.70)

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 ≥ 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	80	25% 60% 21% 9% 9%
1	C	80	28% 62% 20% 8% 9%
2	B	40	15% 68% 22% 5% 5%
2	D	40	25% 62% 32% 5%

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 1889 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 RNA-directed RNA polymerase catalytic subunit.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	73	Total	C	N	O	S	Se	0	0	0
			606	376	109	114	3	4			
1	C	73	Total	C	N	O	S	Se	0	0	0
			606	376	109	114	3	4			

- Molecule 2 is a protein called Polymerase basic protein 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	38	Total	C	N	O	Se	0	0	0
			307	189	58	57	3			
2	D	38	Total	C	N	O	Se	0	0	0
			307	189	58	57	3			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-2	GLY	-	expression tag	UNP P03428
B	-1	GLY	-	expression tag	UNP P03428
B	0	SER	-	expression tag	UNP P03428
D	-2	GLY	-	expression tag	UNP P03428
D	-1	GLY	-	expression tag	UNP P03428
D	0	SER	-	expression tag	UNP P03428

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	25	Total	O	0	0
			25	25		
3	B	13	Total	O	0	0
			13	13		
3	C	14	Total	O	0	0
			14	14		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	D	11	Total	O	0	0
			11	11		

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.

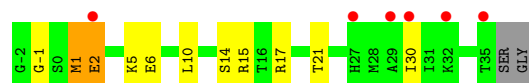
- Molecule 1: RNA-directed RNA polymerase catalytic subunit



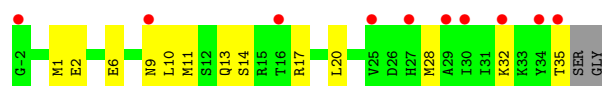
- Molecule 1: RNA-directed RNA polymerase catalytic subunit



- Molecule 2: Polymerase basic protein 2



- Molecule 2: Polymerase basic protein 2



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	60.70Å 69.99Å 61.35Å 90.00° 97.94° 90.00°	Depositor
Resolution (Å)	20.00 – 1.70 20.00 – 1.70	Depositor EDS
% Data completeness (in resolution range)	100.0 (20.00-1.70) 92.2 (20.00-1.70)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	8.01 (at 1.70Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.238 , 0.290 0.242 , 0.293	Depositor DCC
R_{free} test set	1315 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å ²)	21.5	Xtriage
Anisotropy	0.908	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.42 , 49.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	1889	wwPDB-VP
Average B, all atoms (Å ²)	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 10.10% 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

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	1.11	2/610 (0.3%)	1.31	4/802 (0.5%)
1	C	0.96	2/610 (0.3%)	1.11	2/802 (0.2%)
2	B	1.48	2/305 (0.7%)	1.19	1/399 (0.3%)
2	D	0.95	0/305	1.04	0/399
All	All	1.11	6/1830 (0.3%)	1.18	7/2402 (0.3%)

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

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1	MSE	SE-CE	-14.24	1.52	1.95
1	A	718	MSE	SE-CE	-10.22	1.64	1.95
1	C	718	MSE	SE-CE	-7.23	1.73	1.95
1	A	709	VAL	CA-CB	6.52	1.61	1.53
2	B	30	ILE	CA-CB	5.37	1.60	1.54
1	C	724	ILE	CA-CB	5.22	1.60	1.54

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	718	MSE	CG-SE-CE	-9.03	79.05	98.92
1	A	704	SER	N-CA-C	8.85	122.03	111.33
1	A	686	GLU	N-CA-C	5.96	119.23	108.69
2	B	2	GLU	CB-CG-CD	5.73	122.34	112.60
1	C	718	MSE	CG-SE-CE	-5.68	86.42	98.92
1	C	709	VAL	N-CA-CB	5.63	116.67	110.53

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	705	TYR	N-CA-C	5.16	117.85	110.68

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	703	SER	Peptide

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	606	0	606	25	0
1	C	606	0	606	24	0
2	B	307	0	332	15	0
2	D	307	0	332	16	0
3	A	25	0	0	3	0
3	B	13	0	0	0	0
3	C	14	0	0	0	0
3	D	11	0	0	4	0
All	All	1889	0	1876	65	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 18.

All (65) 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:693:CYS:SG	2:D:32:LYS:HE3	1.91	1.09
2:B:-1:GLY:O	2:B:2:GLU:HG3	1.68	0.94
2:B:-1:GLY:HA2	2:B:2:GLU:HG2	1.56	0.88
1:C:712:SER:OG	1:C:716:GLU:HG3	1.75	0.85
1:A:706:ARG:HG2	1:A:706:ARG:O	1.78	0.81
1:A:686:GLU:OE2	1:A:688:MSE:HG3	1.84	0.78
2:B:-1:GLY:HA2	2:B:2:GLU:CG	2.14	0.78

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:741:THR:O	1:C:745:LYS:HG2	1.89	0.73
2:D:9:ASN:HB2	3:D:41:HOH:O	1.88	0.72
1:C:693:CYS:HG	2:D:32:LYS:HE3	1.59	0.67
2:D:13:GLN:HG2	3:D:43:HOH:O	1.95	0.66
1:C:712:SER:OG	1:C:716:GLU:CG	2.43	0.66
2:B:14:SER:H	1:C:745:LYS:HZ2	1.43	0.65
1:A:706:ARG:HE	1:A:721:ARG:HH22	1.44	0.65
1:C:714:MSE:O	1:C:718:MSE:HG3	1.96	0.64
2:B:14:SER:H	1:C:745:LYS:NZ	1.95	0.64
2:B:1:MSE:HE2	2:B:5:LYS:HE3	1.80	0.64
1:C:737:LYS:C	1:C:737:LYS:HD3	2.24	0.63
1:A:686:GLU:HG2	3:A:58:HOH:O	1.97	0.63
2:B:-1:GLY:C	2:B:2:GLU:HG3	2.24	0.62
1:A:695:LEU:HD12	1:A:698:LYS:HD2	1.82	0.61
1:A:702:SER:C	1:A:704:SER:N	2.59	0.60
1:A:712:SER:HB3	1:A:716:GLU:HG3	1.83	0.60
1:A:745:LYS:NZ	1:A:745:LYS:HB3	2.17	0.59
1:C:739:GLU:HG3	2:D:1:MSE:HE2	1.84	0.59
1:C:737:LYS:HD3	1:C:738:GLU:N	2.19	0.58
1:A:751:GLU:O	1:A:755:ARG:HD2	2.06	0.56
1:A:686:GLU:OE2	1:A:688:MSE:CG	2.54	0.55
2:D:28:MSE:O	2:D:32:LYS:HB2	2.07	0.55
1:A:736:LYS:HG3	3:A:52:HOH:O	2.07	0.54
1:A:695:LEU:HD22	2:B:6:GLU:HG2	1.90	0.53
1:C:686:GLU:N	1:C:686:GLU:OE2	2.41	0.53
1:A:745:LYS:HB3	1:A:745:LYS:HZ2	1.74	0.52
2:B:14:SER:HB3	1:C:745:LYS:HZ1	1.74	0.52
1:A:745:LYS:HZ1	2:D:14:SER:HB3	1.75	0.51
1:C:686:GLU:H	1:C:686:GLU:CD	2.19	0.51
2:D:9:ASN:CB	3:D:41:HOH:O	2.54	0.51
1:C:753:LEU:O	2:D:17:ARG:NH2	2.44	0.50
1:A:702:SER:O	1:A:704:SER:N	2.44	0.50
1:A:745:LYS:HZ2	2:D:14:SER:H	1.60	0.50
2:D:6:GLU:O	2:D:10:LEU:HD13	2.11	0.50
1:A:745:LYS:NZ	2:D:14:SER:H	2.09	0.49
1:C:750:ILE:HG23	2:D:11:MSE:HG3	1.94	0.49
1:A:703:SER:O	1:A:706:ARG:NH1	2.46	0.49
3:A:40:HOH:O	2:B:15:ARG:HD3	2.13	0.48
1:A:706:ARG:CG	1:A:721:ARG:HH12	2.27	0.48
1:C:709:VAL:HG22	1:C:712:SER:HB2	1.96	0.47
1:A:745:LYS:NZ	1:A:745:LYS:CB	2.78	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:693:CYS:O	1:C:697:GLU:HG2	2.15	0.46
1:A:701:PRO:O	1:A:704:SER:HA	2.16	0.45
1:C:696:PHE:HA	1:C:718:MSE:HE3	1.99	0.45
2:B:1:MSE:CE	2:B:5:LYS:HE3	2.45	0.44
1:A:756:GLN:HB3	1:C:752:GLU:OE2	2.18	0.44
2:D:32:LYS:N	2:D:32:LYS:HD3	2.33	0.43
1:A:741:THR:O	1:A:745:LYS:HG3	2.18	0.43
1:A:757:LYS:O	2:B:21:THR:HG21	2.19	0.43
1:C:693:CYS:SG	2:D:32:LYS:CE	2.84	0.43
1:C:737:LYS:O	1:C:741:THR:HG23	2.19	0.43
2:D:9:ASN:CA	3:D:41:HOH:O	2.66	0.43
2:B:17:ARG:O	2:B:21:THR:HG23	2.19	0.42
2:B:-1:GLY:CA	2:B:2:GLU:CG	2.93	0.42
1:C:751:GLU:O	1:C:755:ARG:HD2	2.20	0.42
2:B:-1:GLY:HA2	2:B:2:GLU:HG3	2.00	0.42
1:A:713:SER:OG	1:A:716:GLU:HG2	2.20	0.41
1:C:745:LYS:NZ	1:C:745:LYS:HB3	2.36	0.41

There are no symmetry-related clashes.

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	71/80 (89%)	68 (96%)	2 (3%)	1 (1%)	9	2
1	C	71/80 (89%)	70 (99%)	1 (1%)	0	100	100
2	B	36/40 (90%)	36 (100%)	0	0	100	100
2	D	36/40 (90%)	35 (97%)	1 (3%)	0	100	100
All	All	214/240 (89%)	209 (98%)	4 (2%)	1 (0%)	24	12

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	703	SER

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	68/70 (97%)	61 (90%)	7 (10%)	7	1
1	C	68/70 (97%)	59 (87%)	9 (13%)	4	1
2	B	35/33 (106%)	34 (97%)	1 (3%)	37	20
2	D	35/33 (106%)	32 (91%)	3 (9%)	10	2
All	All	206/206 (100%)	186 (90%)	20 (10%)	8	1

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

Mol	Chain	Res	Type
1	A	697	GLU
1	A	705	TYR
1	A	706	ARG
1	A	709	VAL
1	A	736	LYS
1	A	737	LYS
1	A	745	LYS
2	B	10	LEU
1	C	685	ASP
1	C	697	GLU
1	C	709	VAL
1	C	727	ARG
1	C	736	LYS
1	C	737	LYS
1	C	745	LYS
1	C	751	GLU
1	C	755	ARG
2	D	2	GLU
2	D	20	LEU
2	D	35	THR

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

Mol	Chain	Res	Type
1	A	687	GLN

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	69/80 (86%)	1.52	20 (28%) 1 1	20, 33, 61, 63	0
1	C	69/80 (86%)	1.67	22 (31%) 1 1	23, 37, 58, 62	0
2	B	35/40 (87%)	1.13	6 (17%) 4 3	21, 28, 40, 43	0
2	D	35/40 (87%)	1.70	10 (28%) 1 1	25, 34, 48, 54	0
All	All	208/240 (86%)	1.53	58 (27%) 1 1	20, 34, 58, 63	0

All (58) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	704	SER	6.1
1	A	702	SER	5.9
1	A	705	TYR	5.9
1	C	705	TYR	5.1
2	D	35	THR	5.0
1	A	709	VAL	4.5
1	C	709	VAL	4.3
2	D	34	TYR	3.9
1	C	687	GLN	3.7
1	C	685	ASP	3.7
1	C	689	TYR	3.7
2	B	35	THR	3.6
2	B	29	ALA	3.6
1	C	757	LYS	3.5
1	A	753	LEU	3.5
1	C	756	GLN	3.5
1	A	686	GLU	3.3
2	D	29	ALA	3.3
1	A	757	LYS	3.2
1	A	703	SER	3.1
1	C	711	ILE	3.1

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Mol	Chain	Res	Type	RSRZ
1	A	706	ARG	3.1
2	D	27	HIS	2.9
1	A	711	ILE	2.7
1	A	693	CYS	2.6
1	C	733	GLY	2.6
2	B	2	GLU	2.6
1	A	685	ASP	2.5
1	C	710	GLY	2.5
1	C	706	ARG	2.5
1	C	697	GLU	2.5
1	A	756	GLN	2.5
2	D	16	THR	2.5
1	C	708	PRO	2.5
1	A	708	PRO	2.4
1	A	755	ARG	2.4
1	A	689	TYR	2.4
1	C	707	ARG	2.4
1	C	728	ILE	2.3
1	C	686	GLU	2.3
2	D	9	ASN	2.3
1	A	691	ARG	2.2
1	C	753	LEU	2.2
2	D	30	ILE	2.2
1	A	697	GLU	2.2
1	C	704	SER	2.2
2	D	-2	GLY	2.1
1	C	736	LYS	2.1
2	B	30	ILE	2.1
2	B	32	LYS	2.1
2	D	25	VAL	2.1
1	A	687	GLN	2.1
1	A	734	ARG	2.1
1	C	755	ARG	2.1
2	B	27	HIS	2.1
1	C	735	ILE	2.1
1	C	690	GLN	2.0
2	D	32	LYS	2.0

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 [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.