



Full wwPDB X-ray Structure Validation Report ⓘ

Nov 2, 2024 – 07:59 PM EDT

PDB ID : 3VKI
Title : Monoclinic Crystal Structure of Salmonella FlgA in closed form
Authors : Matsunami, H.; Samatey, F.A.; Namba, K.
Deposited on : 2011-11-16
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

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)	:	1.20.1
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

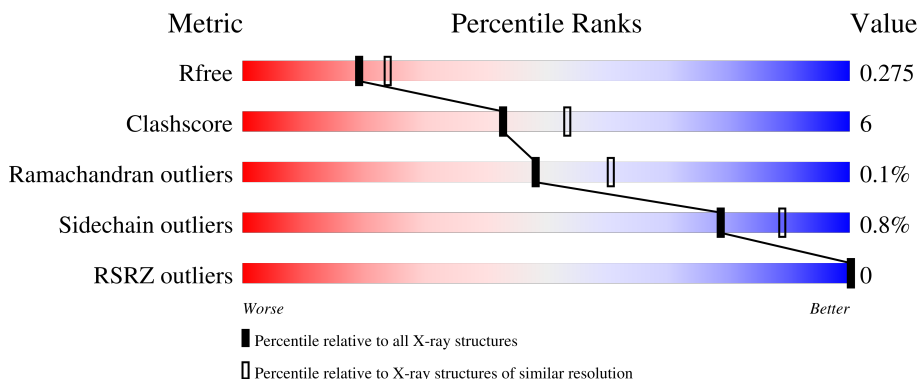
1 Overall quality at a glance

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}	164625	5963 (2.30-2.30)
Clashscore	180529	6698 (2.30-2.30)
Ramachandran outliers	177936	6640 (2.30-2.30)
Sidechain outliers	177891	6640 (2.30-2.30)
RSRZ outliers	164620	5963 (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 ≥ 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	219	
1	B	219	
1	C	219	
1	D	219	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 6166 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 Flagella basal body P-ring formation protein flgA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	198	Total	C	N	O	S	0	0	0
			1495	925	283	281	6			
1	B	198	Total	C	N	O	S	0	0	0
			1495	925	283	281	6			
1	C	198	Total	C	N	O	S	0	0	0
			1495	925	283	281	6			
1	D	198	Total	C	N	O	S	0	0	0
			1495	925	283	281	6			

There are 84 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	199	ASP	-	expression tag	UNP P40131
A	200	PRO	-	expression tag	UNP P40131
A	201	ASN	-	expression tag	UNP P40131
A	202	SER	-	expression tag	UNP P40131
A	203	SER	-	expression tag	UNP P40131
A	204	SER	-	expression tag	UNP P40131
A	205	VAL	-	expression tag	UNP P40131
A	206	ASP	-	expression tag	UNP P40131
A	207	LYS	-	expression tag	UNP P40131
A	208	LEU	-	expression tag	UNP P40131
A	209	ALA	-	expression tag	UNP P40131
A	210	ALA	-	expression tag	UNP P40131
A	211	ALA	-	expression tag	UNP P40131
A	212	LEU	-	expression tag	UNP P40131
A	213	GLU	-	expression tag	UNP P40131
A	214	HIS	-	expression tag	UNP P40131
A	215	HIS	-	expression tag	UNP P40131
A	216	HIS	-	expression tag	UNP P40131
A	217	HIS	-	expression tag	UNP P40131
A	218	HIS	-	expression tag	UNP P40131
A	219	HIS	-	expression tag	UNP P40131

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Chain	Residue	Modelled	Actual	Comment	Reference
B	199	ASP	-	expression tag	UNP P40131
B	200	PRO	-	expression tag	UNP P40131
B	201	ASN	-	expression tag	UNP P40131
B	202	SER	-	expression tag	UNP P40131
B	203	SER	-	expression tag	UNP P40131
B	204	SER	-	expression tag	UNP P40131
B	205	VAL	-	expression tag	UNP P40131
B	206	ASP	-	expression tag	UNP P40131
B	207	LYS	-	expression tag	UNP P40131
B	208	LEU	-	expression tag	UNP P40131
B	209	ALA	-	expression tag	UNP P40131
B	210	ALA	-	expression tag	UNP P40131
B	211	ALA	-	expression tag	UNP P40131
B	212	LEU	-	expression tag	UNP P40131
B	213	GLU	-	expression tag	UNP P40131
B	214	HIS	-	expression tag	UNP P40131
B	215	HIS	-	expression tag	UNP P40131
B	216	HIS	-	expression tag	UNP P40131
B	217	HIS	-	expression tag	UNP P40131
B	218	HIS	-	expression tag	UNP P40131
B	219	HIS	-	expression tag	UNP P40131
C	199	ASP	-	expression tag	UNP P40131
C	200	PRO	-	expression tag	UNP P40131
C	201	ASN	-	expression tag	UNP P40131
C	202	SER	-	expression tag	UNP P40131
C	203	SER	-	expression tag	UNP P40131
C	204	SER	-	expression tag	UNP P40131
C	205	VAL	-	expression tag	UNP P40131
C	206	ASP	-	expression tag	UNP P40131
C	207	LYS	-	expression tag	UNP P40131
C	208	LEU	-	expression tag	UNP P40131
C	209	ALA	-	expression tag	UNP P40131
C	210	ALA	-	expression tag	UNP P40131
C	211	ALA	-	expression tag	UNP P40131
C	212	LEU	-	expression tag	UNP P40131
C	213	GLU	-	expression tag	UNP P40131
C	214	HIS	-	expression tag	UNP P40131
C	215	HIS	-	expression tag	UNP P40131
C	216	HIS	-	expression tag	UNP P40131
C	217	HIS	-	expression tag	UNP P40131
C	218	HIS	-	expression tag	UNP P40131
C	219	HIS	-	expression tag	UNP P40131

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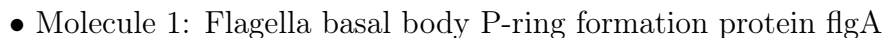
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Chain	Residue	Modelled	Actual	Comment	Reference
D	199	ASP	-	expression tag	UNP P40131
D	200	PRO	-	expression tag	UNP P40131
D	201	ASN	-	expression tag	UNP P40131
D	202	SER	-	expression tag	UNP P40131
D	203	SER	-	expression tag	UNP P40131
D	204	SER	-	expression tag	UNP P40131
D	205	VAL	-	expression tag	UNP P40131
D	206	ASP	-	expression tag	UNP P40131
D	207	LYS	-	expression tag	UNP P40131
D	208	LEU	-	expression tag	UNP P40131
D	209	ALA	-	expression tag	UNP P40131
D	210	ALA	-	expression tag	UNP P40131
D	211	ALA	-	expression tag	UNP P40131
D	212	LEU	-	expression tag	UNP P40131
D	213	GLU	-	expression tag	UNP P40131
D	214	HIS	-	expression tag	UNP P40131
D	215	HIS	-	expression tag	UNP P40131
D	216	HIS	-	expression tag	UNP P40131
D	217	HIS	-	expression tag	UNP P40131
D	218	HIS	-	expression tag	UNP P40131
D	219	HIS	-	expression tag	UNP P40131

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	41	Total	O	0	0
			41	41		
2	B	38	Total	O	0	0
			38	38		
2	C	53	Total	O	0	0
			53	53		
2	D	54	Total	O	0	0
			54	54		

- Molecule 1: Flagella basal body P-ring formation protein flgA



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	53.93Å 103.32Å 85.50Å 90.00° 107.26° 90.00°	Depositor
Resolution (Å)	25.00 – 2.30 25.00 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.3 (25.00-2.30) 94.1 (25.00-2.30)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.38 (at 2.29Å)	Xtriage
Refinement program	PHENIX 1.7.2_869	Depositor
R, R_{free}	0.251 , 0.281 0.244 , 0.275	Depositor DCC
R_{free} test set	1984 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å ²)	38.9	Xtriage
Anisotropy	0.361	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 45.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.267 for h,-k,-h-l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	6166	wwPDB-VP
Average B, all atoms (Å ²)	60.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.78% 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	0.25	0/1515	0.49	0/2060
1	B	0.24	0/1515	0.47	0/2060
1	C	0.25	0/1515	0.50	0/2060
1	D	0.25	0/1515	0.52	0/2060
All	All	0.25	0/6060	0.50	0/8240

There are no bond length outliers.

There are no bond angle outliers.

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	1495	0	1522	20	2
1	B	1495	0	1522	17	2
1	C	1495	0	1522	19	2
1	D	1495	0	1522	20	2
2	A	41	0	0	11	0
2	B	38	0	0	7	0
2	C	53	0	0	12	1
2	D	54	0	0	4	1
All	All	6166	0	6088	74	5

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 6.

All (74) 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:71:GLN:NE2	2:C:243:HOH:O	1.91	0.97
1:B:9:THR:O	2:B:228:HOH:O	1.87	0.92
1:D:134:MET:SD	2:D:223:HOH:O	2.30	0.90
1:C:134:MET:SD	2:C:228:HOH:O	2.31	0.89
1:C:123:ASP:OD1	2:C:244:HOH:O	1.91	0.88
1:C:165:MET:SD	2:C:262:HOH:O	2.37	0.82
1:A:51:GLY:N	2:A:249:HOH:O	2.15	0.80
1:B:64:ARG:NH1	2:B:252:HOH:O	2.18	0.76
1:B:10:TRP:O	2:B:247:HOH:O	2.04	0.75
1:C:116:GLN:O	2:C:241:HOH:O	2.06	0.73
1:C:114:GLN:OE1	2:C:246:HOH:O	2.08	0.71
1:B:36:CYS:N	1:B:59:CYS:SG	2.61	0.71
1:A:82:PRO:HD2	2:A:250:HOH:O	1.91	0.69
1:A:36:CYS:N	1:A:59:CYS:SG	2.68	0.67
1:A:139:TRP:O	2:A:244:HOH:O	2.14	0.66
1:A:95:THR:OG1	2:A:246:HOH:O	2.14	0.65
1:C:20:ASP:OD2	2:C:271:HOH:O	2.13	0.65
1:C:116:GLN:OE1	2:C:259:HOH:O	2.15	0.63
1:D:48:LYS:HB3	1:D:53:VAL:HG12	1.81	0.62
1:A:96:LEU:O	2:A:246:HOH:O	2.16	0.62
1:A:38:GLN:OE1	1:D:98:ARG:NE	2.34	0.61
1:B:98:ARG:NE	1:C:38:GLN:OE1	2.33	0.60
1:C:127:GLY:O	2:C:265:HOH:O	2.17	0.58
1:C:88:LYS:HE3	1:C:117:ASP:HA	1.84	0.58
1:A:48:LYS:NZ	1:A:50:TRP:O	2.33	0.58
1:A:100:ARG:NH2	1:A:102:ASP:OD2	2.27	0.56
1:C:20:ASP:CG	2:C:271:HOH:O	2.43	0.56
1:B:90:THR:H	1:B:93:ASN:HB2	1.70	0.55
1:A:60:ALA:N	2:A:239:HOH:O	2.39	0.55
1:A:76:TYR:HA	1:A:110:LEU:HA	1.89	0.55
1:D:90:THR:H	1:D:93:ASN:HB2	1.72	0.54
1:C:140:ARG:NH1	2:C:240:HOH:O	2.41	0.53
1:D:11:PHE:HB2	1:D:24:VAL:HG21	1.89	0.53
1:B:12:SER:N	2:B:228:HOH:O	2.42	0.52
1:D:85:ARG:HE	1:D:122:ARG:HA	1.73	0.52
1:D:36:CYS:N	1:D:59:CYS:SG	2.81	0.51
1:A:50:TRP:HB2	2:A:249:HOH:O	2.10	0.51
1:D:56:VAL:HG22	1:D:65:TYR:CE1	2.46	0.51
1:A:85:ARG:HE	1:A:122:ARG:HA	1.75	0.51
1:D:173:ASN:ND2	2:D:260:HOH:O	2.23	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:85:ARG:HE	1:B:122:ARG:HA	1.77	0.49
1:A:114:GLN:NE2	2:A:231:HOH:O	2.33	0.49
1:C:90:THR:H	1:C:93:ASN:HB2	1.76	0.49
1:A:131:GLN:NE2	2:A:234:HOH:O	2.14	0.48
1:B:132:LEU:HD23	1:B:135:ILE:HD11	1.95	0.48
1:D:38:GLN:O	1:D:38:GLN:HG3	2.13	0.48
1:C:165:MET:HE3	1:C:175:ARG:HG2	1.96	0.47
1:A:102:ASP:CB	2:A:249:HOH:O	2.62	0.47
1:B:76:TYR:HA	1:B:110:LEU:HA	1.97	0.47
1:C:116:GLN:NE2	2:C:266:HOH:O	2.26	0.46
1:B:14:ARG:HB2	2:B:247:HOH:O	2.16	0.46
1:D:165:MET:HE3	1:D:175:ARG:HG2	1.97	0.46
1:D:140:ARG:NH1	2:D:233:HOH:O	2.48	0.46
1:D:101:LEU:HA	1:D:104:LEU:HD12	1.98	0.45
1:A:102:ASP:HB3	2:A:249:HOH:O	2.17	0.44
1:B:50:TRP:CD1	1:B:102:ASP:HA	2.52	0.43
1:D:64:ARG:NH2	1:D:65:TYR:O	2.51	0.43
1:C:56:VAL:HG22	1:C:65:TYR:CE1	2.54	0.43
1:A:34:PRO:HB2	1:A:59:CYS:HB2	2.01	0.43
1:B:10:TRP:CE3	2:B:247:HOH:O	2.71	0.42
1:B:32:LEU:HB3	1:B:64:ARG:NH2	2.34	0.42
1:B:139:TRP:CD2	1:B:167:ASN:HB3	2.55	0.42
1:D:24:VAL:HG13	1:D:70:VAL:HG22	2.02	0.42
1:C:139:TRP:CD2	1:C:167:ASN:HB3	2.55	0.42
1:B:13:GLN:N	2:B:228:HOH:O	2.01	0.42
1:C:101:LEU:HA	1:C:104:LEU:HD12	2.02	0.42
1:D:32:LEU:HB3	1:D:64:ARG:CZ	2.50	0.41
1:D:64:ARG:HE	1:D:64:ARG:HB3	1.69	0.41
1:B:34:PRO:HB2	1:B:59:CYS:HB2	2.02	0.41
1:D:83:ILE:HG12	1:D:93:ASN:OD1	2.20	0.41
1:D:139:TRP:CD2	1:D:167:ASN:HB3	2.56	0.41
1:A:100:ARG:HE	1:A:102:ASP:CG	2.21	0.40
1:D:45:GLY:HA2	2:D:257:HOH:O	2.20	0.40
1:A:42:SER:OG	1:A:56:VAL:HB	2.21	0.40

All (5) 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)
2:C:238:HOH:O	2:D:243:HOH:O[2_545]	1.90	0.30

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:61:ASN:OD1	1:D:65:TYR:OH[1_655]	1.97	0.23
1:B:65:TYR:OH	1:C:61:ASN:OD1[1_655]	2.14	0.06
1:A:65:TYR:OH	1:D:61:ASN:OD1[1_655]	2.16	0.04
1:B:61:ASN:OD1	1:C:65:TYR:OH[1_655]	2.16	0.04

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	196/219 (90%)	188 (96%)	8 (4%)	0	100	100
1	B	196/219 (90%)	188 (96%)	8 (4%)	0	100	100
1	C	196/219 (90%)	188 (96%)	8 (4%)	0	100	100
1	D	196/219 (90%)	186 (95%)	9 (5%)	1 (0%)	25	32
All	All	784/876 (90%)	750 (96%)	33 (4%)	1 (0%)	48	60

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	46	SER

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	160/178 (90%)	159 (99%)	1 (1%)	84	92

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	160/178 (90%)	159 (99%)	1 (1%)	84	92
1	C	160/178 (90%)	159 (99%)	1 (1%)	84	92
1	D	160/178 (90%)	158 (99%)	2 (1%)	65	79
All	All	640/712 (90%)	635 (99%)	5 (1%)	79	89

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	121	LEU
1	B	121	LEU
1	C	121	LEU
1	D	121	LEU
1	D	185	SER

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 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, 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	198/219 (90%)	-1.03	0 100 100	22, 61, 88, 113	0
1	B	198/219 (90%)	-1.03	0 100 100	20, 56, 93, 115	0
1	C	198/219 (90%)	-0.87	0 100 100	20, 54, 114, 123	0
1	D	198/219 (90%)	-0.94	0 100 100	19, 52, 110, 124	0
All	All	792/876 (90%)	-0.97	0 100 100	19, 56, 110, 124	0

There are no RSRZ outliers to report.

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 [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.