



# Full wwPDB X-ray Structure Validation Report ⓘ

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PDB ID : 4ZLE  
Title : Cellobionic acid phosphorylase - ligand free structure  
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Deposited on : 2015-05-01  
Resolution : 2.10 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
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.37.1
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)	:	2.37.1

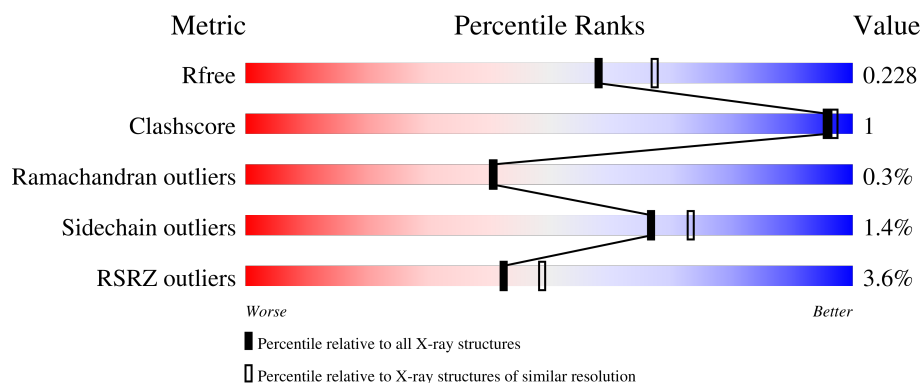
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.10 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	5197 (2.10-2.10)
Clashscore	141614	5710 (2.10-2.10)
Ramachandran outliers	138981	5647 (2.10-2.10)
Sidechain outliers	138945	5648 (2.10-2.10)
RSRZ outliers	127900	5083 (2.10-2.10)

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	796	<div> <div>4%</div> <div>93%</div> <div>5% ..</div> </div>

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 6750 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 Putative b-glycan phosphorylase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	784	6224	3963	1059	1170	32	0	0	0

There are 9 discrepancies between the modelled and reference sequences:

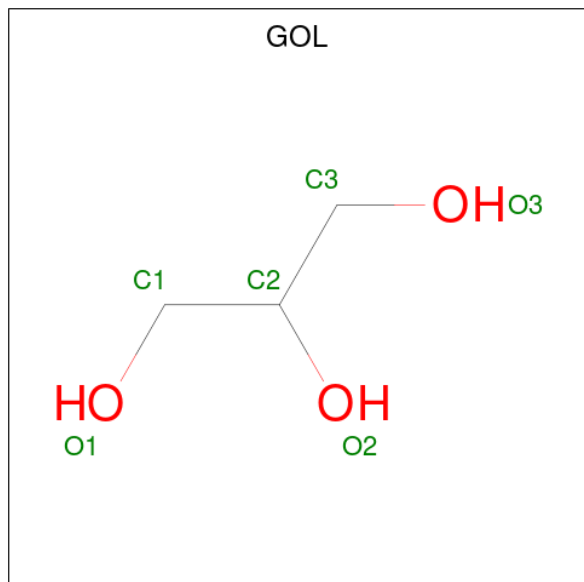
Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	MET	engineered mutation	UNP Q21MB1
A	789	LEU	-	expression tag	UNP Q21MB1
A	790	GLU	-	expression tag	UNP Q21MB1
A	791	HIS	-	expression tag	UNP Q21MB1
A	792	HIS	-	expression tag	UNP Q21MB1
A	793	HIS	-	expression tag	UNP Q21MB1
A	794	HIS	-	expression tag	UNP Q21MB1
A	795	HIS	-	expression tag	UNP Q21MB1
A	796	HIS	-	expression tag	UNP Q21MB1

- Molecule 2 is SULFATE ION (three-letter code: SO<sub>4</sub>) (formula: O<sub>4</sub>S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total O S 5 4 1	0	0
2	A	1	Total O S 5 4 1	0	0
2	A	1	Total O S 5 4 1	0	0
2	A	1	Total O S 5 4 1	0	0
2	A	1	Total O S 5 4 1	0	0
2	A	1	Total O S 5 4 1	0	0

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula:  $C_3H_8O_3$ ).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 6 3 3	0	0
3	A	1	Total C O 6 3 3	0	0
3	A	1	Total C O 6 3 3	0	0

- Molecule 4 is CHLORIDE ION (three-letter code: CL) (formula:  $Cl$ ).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total Cl 1 1	0	0

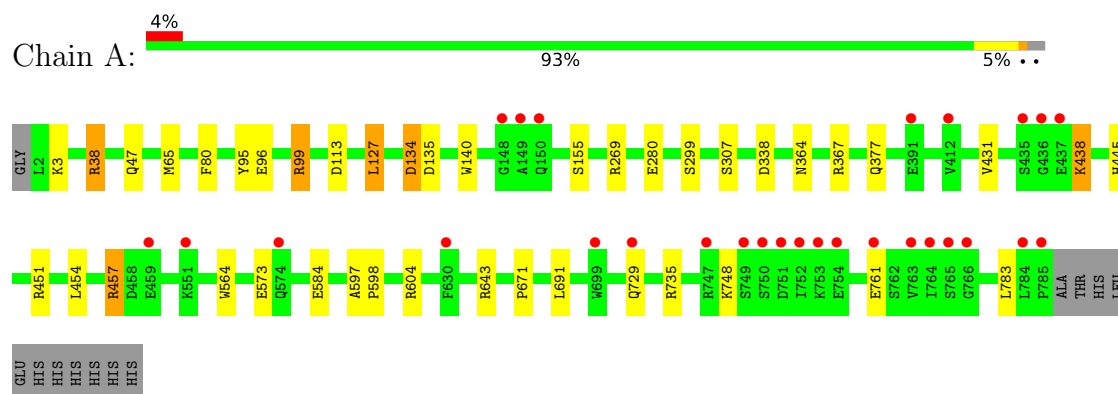
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	477	Total 477	O 477	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: Putative b-glycan phosphorylase



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	106.93Å 106.93Å 185.34Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	41.44 – 2.10 41.44 – 2.10	Depositor EDS
% Data completeness (in resolution range)	92.8 (41.44-2.10) 92.8 (41.44-2.10)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.11	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.77 (at 2.10Å)	Xtriage
Refinement program	REFMAC 5.8.0107	Depositor
R, $R_{free}$	0.170 , 0.219 0.183 , 0.228	Depositor DCC
$R_{free}$ test set	3385 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	23.9	Xtriage
Anisotropy	0.002	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.40 , 57.0	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	0.022 for -h,-k,l	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	6750	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	30.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.84% 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 ⓘ

### 5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: CL, SO4, GOL

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	1.00	3/6389 (0.0%)	0.98	16/8678 (0.2%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	564	TRP	CB-CG	6.62	1.62	1.50
1	A	307	SER	CB-OG	6.53	1.50	1.42
1	A	280	GLU	CD-OE2	-5.88	1.19	1.25

All (16) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	457	ARG	NE-CZ-NH1	9.39	125.00	120.30
1	A	134	ASP	CB-CG-OD2	-8.80	110.38	118.30
1	A	457	ARG	NE-CZ-NH2	-8.52	116.04	120.30
1	A	735	ARG	NE-CZ-NH1	7.99	124.30	120.30
1	A	367	ARG	NE-CZ-NH1	7.69	124.14	120.30
1	A	113	ASP	CB-CG-OD1	6.49	124.14	118.30
1	A	65	MET	CG-SD-CE	6.45	110.52	100.20
1	A	338	ASP	CB-CG-OD1	-6.19	112.73	118.30
1	A	99	ARG	NE-CZ-NH2	-5.68	117.46	120.30
1	A	269	ARG	NE-CZ-NH1	5.64	123.12	120.30
1	A	604	ARG	NE-CZ-NH2	-5.50	117.55	120.30
1	A	438	LYS	CA-CB-CG	5.35	125.16	113.40
1	A	338	ASP	CB-CG-OD2	5.32	123.08	118.30
1	A	451	ARG	NE-CZ-NH1	5.31	122.95	120.30
1	A	38	ARG	NE-CZ-NH1	5.08	122.84	120.30
1	A	135	ASP	CB-CG-OD2	5.08	122.87	118.30

There are no chirality outliers.



There are no planarity outliers.

## 5.2 Too-close contacts

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	6224	0	5997	13	0
2	A	30	0	0	1	0
3	A	18	0	23	0	0
4	A	1	0	0	0	0
5	A	477	0	0	1	0
All	All	6750	0	6020	13	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 1.

All (13) 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:454:LEU:O	1:A:457:ARG:HD3	1.85	0.76
1:A:584:GLU:OE1	1:A:643:ARG:NH2	2.29	0.65
1:A:80:PHE:CE1	1:A:127:LEU:HD21	2.39	0.57
1:A:729:GLN:HE22	1:A:748:LYS:HE2	1.75	0.51
1:A:99:ARG:NH2	2:A:806:SO4:O3	2.39	0.51
1:A:454:LEU:HA	1:A:457:ARG:HD2	1.93	0.50
1:A:377:GLN:OE1	1:A:445:HIS:ND1	2.44	0.48
1:A:38:ARG:HB3	1:A:96:GLU:HG2	1.95	0.48
1:A:573:GLU:CD	1:A:573:GLU:H	2.18	0.47
1:A:671:PRO:HA	1:A:691:LEU:O	2.18	0.44
1:A:597:ALA:HA	1:A:598:PRO:C	2.40	0.42
1:A:438:LYS:CB	5:A:1127:HOH:O	2.68	0.42
1:A:127:LEU:HD22	1:A:140:TRP:CZ3	2.56	0.41

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	782/796 (98%)	757 (97%)	23 (3%)	2 (0%)	41	41

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	95	TYR
1	A	47	GLN

### 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	655/665 (98%)	646 (99%)	9 (1%)	67	73

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	3	LYS
1	A	127	LEU
1	A	134	ASP
1	A	155	SER
1	A	299	SER
1	A	364	ASN
1	A	431	VAL
1	A	761	GLU
1	A	783	LEU

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	729	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 monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 10 ligands modelled in this entry, 1 is monoatomic - leaving 9 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z  > 2$	Counts	RMSZ	$\# Z  > 2$
2	SO4	A	802	-	4,4,4	0.10	0	6,6,6	0.95	0
3	GOL	A	807	-	5,5,5	0.61	0	5,5,5	0.77	0
3	GOL	A	808	-	5,5,5	0.95	0	5,5,5	1.53	1 (20%)
2	SO4	A	805	-	4,4,4	0.51	0	6,6,6	0.57	0
2	SO4	A	804	-	4,4,4	0.72	0	6,6,6	0.94	0
3	GOL	A	809	-	5,5,5	1.06	0	5,5,5	0.58	0
2	SO4	A	801	-	4,4,4	0.50	0	6,6,6	1.84	1 (16%)
2	SO4	A	803	-	4,4,4	0.18	0	6,6,6	0.70	0
2	SO4	A	806	-	4,4,4	0.67	0	6,6,6	0.92	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral

centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	GOL	A	809	-	-	1/4/4/4	-
3	GOL	A	807	-	-	0/4/4/4	-
3	GOL	A	808	-	-	4/4/4/4	-

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	801	SO4	O4-S-O3	-3.81	92.79	109.06
3	A	808	GOL	C3-C2-C1	-2.84	100.68	111.70

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	808	GOL	C1-C2-C3-O3
3	A	808	GOL	O1-C1-C2-O2
3	A	808	GOL	O2-C2-C3-O3
3	A	809	GOL	C1-C2-C3-O3
3	A	808	GOL	O1-C1-C2-C3

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	806	SO4	1	0

## 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, 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	784/796 (98%)	-0.09	28 (3%)	42 49	18, 28, 47, 75	0

All (28) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	750	SER	6.3
1	A	751	ASP	5.2
1	A	752	ILE	5.0
1	A	749	SER	4.8
1	A	753	LYS	4.5
1	A	754	GLU	4.0
1	A	436	GLY	3.7
1	A	437	GLU	3.5
1	A	574	GLN	3.1
1	A	149	ALA	2.9
1	A	148	GLY	2.9
1	A	765	SER	2.7
1	A	459	GLU	2.7
1	A	630	PHE	2.6
1	A	412	VAL	2.6
1	A	699	TRP	2.6
1	A	763	VAL	2.5
1	A	761	GLU	2.5
1	A	150	GLN	2.4
1	A	764	ILE	2.3
1	A	729	GLN	2.3
1	A	766	GLY	2.2
1	A	785	PRO	2.1
1	A	551	LYS	2.1
1	A	391	GLU	2.1
1	A	784	LEU	2.1
1	A	747	ARG	2.0

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Mol	Chain	Res	Type	RSRZ
1	A	435	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 [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
3	GOL	A	808	6/6	0.91	0.21	32,33,34,37	0
2	SO4	A	804	5/5	0.94	0.20	45,45,58,66	0
3	GOL	A	809	6/6	0.94	0.11	30,37,38,38	0
2	SO4	A	805	5/5	0.95	0.19	58,59,70,76	0
2	SO4	A	806	5/5	0.95	0.10	63,79,86,93	0
3	GOL	A	807	6/6	0.96	0.10	29,31,34,35	0
2	SO4	A	802	5/5	0.98	0.10	36,42,46,54	0
4	CL	A	810	1/1	0.98	0.16	27,27,27,27	0
2	SO4	A	803	5/5	0.99	0.10	45,46,48,57	0
2	SO4	A	801	5/5	0.99	0.15	23,26,33,38	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.