



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 6, 2024 – 02:09 PM EST

PDB ID : 9DX6  
Title : Crystal structure of Plasmodium vivax (Palo Alto) PvAMA1 in complex with human Fab 826827  
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Deposited on : 2024-10-10  
Resolution : 2.40 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) : 1.20.1  
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

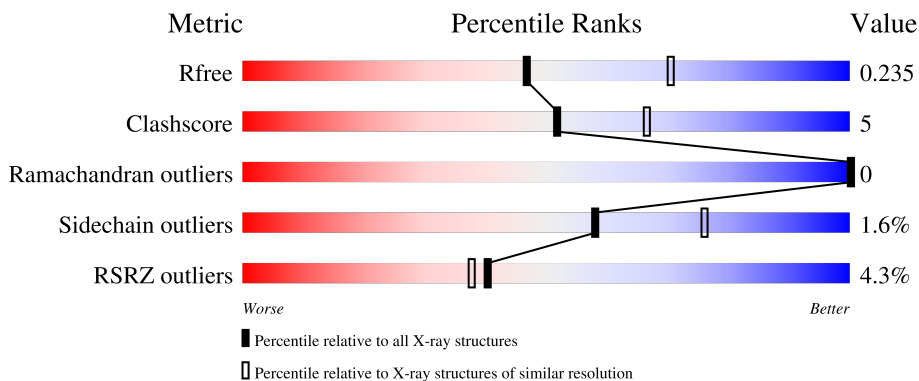
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.40 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	4642 (2.40-2.40)
Clashscore	180529	5218 (2.40-2.40)
Ramachandran outliers	177936	5158 (2.40-2.40)
Sidechain outliers	177891	5159 (2.40-2.40)
RSRZ outliers	164620	4642 (2.40-2.40)

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	471	 6% 71% 12% 16%
2	B	234	 2% 88% 10%
3	C	216	 2% 87% 11%

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 6654 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 Apical merozoite protein 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	395	3077	1937	533	582	25	0	0	0

There are 11 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	16	HIS	-	expression tag	UNP B9TXF7
A	17	HIS	-	expression tag	UNP B9TXF7
A	18	HIS	-	expression tag	UNP B9TXF7
A	19	HIS	-	expression tag	UNP B9TXF7
A	20	HIS	-	expression tag	UNP B9TXF7
A	21	HIS	-	expression tag	UNP B9TXF7
A	178	ASN	SER	engineered mutation	UNP B9TXF7
A	226	ASP	ASN	engineered mutation	UNP B9TXF7
A	441	GLN	ASN	engineered mutation	UNP B9TXF7
A	485	GLY	-	expression tag	UNP B9TXF7
A	486	SER	-	expression tag	UNP B9TXF7

- Molecule 2 is a protein called 826827 Fab Heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	231	1717	1088	279	344	6	0	0	0

- Molecule 3 is a protein called 826827 Fab Light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	214	1601	1000	271	325	5	0	0	0

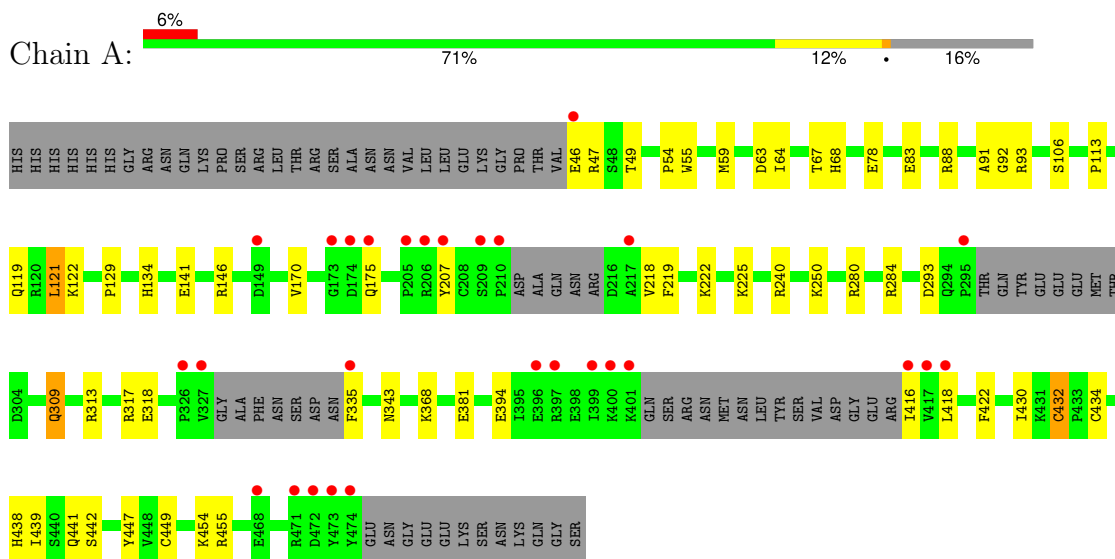
- Molecule 4 is water.

<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
4	A	130	Total 130	O 130	0	0
4	B	60	Total 60	O 60	0	0
4	C	69	Total 69	O 69	0	0

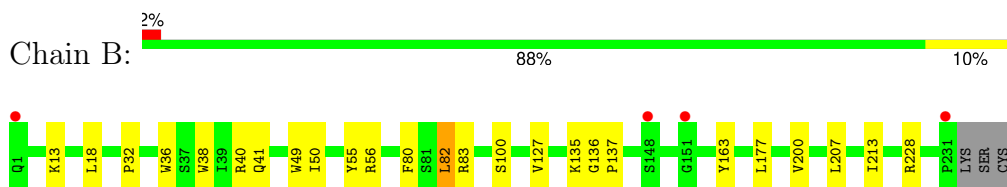
### 3 Residue-property plots [i](#)

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.

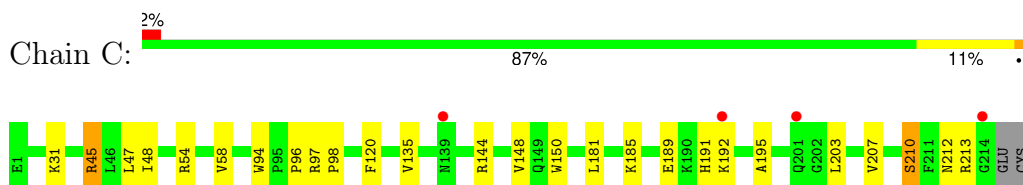
- Molecule 1: Apical merozoite protein 1



- Molecule 2: 826827 Fab Heavy chain



- Molecule 3: 826827 Fab Light chain



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	187.24Å 54.46Å 104.13Å 90.00° 97.20° 90.00°	Depositor
Resolution (Å)	47.76 – 2.40 47.76 – 2.40	Depositor EDS
% Data completeness (in resolution range)	100.0 (47.76-2.40) 100.0 (47.76-2.40)	Depositor EDS
$R_{merge}$	0.17	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.27 (at 2.39Å)	Xtrriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, $R_{free}$	0.192 , 0.235 0.192 , 0.235	Depositor DCC
$R_{free}$ test set	2062 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	43.2	Xtrriage
Anisotropy	0.158	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 44.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.51$ , $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	6654	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	47.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.02% 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	0.30	0/3141	0.51	0/4242
2	B	0.30	0/1764	0.55	0/2416
3	C	0.28	0/1638	0.56	0/2236
All	All	0.29	0/6543	0.53	0/8894

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	3077	0	2875	35	0
2	B	1717	0	1638	14	0
3	C	1601	0	1501	15	0
4	A	130	0	0	5	0
4	B	60	0	0	1	0
4	C	69	0	0	3	0
All	All	6654	0	6014	62	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 (62) 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:47:ARG:NH2	1:A:430:ILE:O	2.19	0.76
3:C:45:ARG:NH1	4:C:301:HOH:O	2.25	0.70
1:A:146:ARG:NH1	4:A:502:HOH:O	2.25	0.70
1:A:170:VAL:HG11	1:A:175:GLN:HA	1.74	0.69
3:C:191:HIS:O	3:C:213:ARG:NE	2.19	0.68
3:C:144:ARG:HH11	3:C:144:ARG:HG2	1.59	0.67
2:B:41:GLN:NE2	4:B:302:HOH:O	2.27	0.64
1:A:141:GLU:OE2	4:A:501:HOH:O	2.14	0.64
1:A:207:TYR:CD1	1:A:218:VAL:HG21	2.33	0.63
1:A:113:PRO:HB3	1:A:129:PRO:HA	1.82	0.60
1:A:439:ILE:HB	1:A:442:SER:HB2	1.86	0.58
2:B:49:TRP:CE3	3:C:98:PRO:HD2	2.39	0.57
3:C:195:ALA:HB2	3:C:210:SER:HB3	1.86	0.57
1:A:49:THR:OG1	1:A:455:ARG:NH1	2.36	0.57
1:A:432:CYS:HB3	1:A:434:CYS:H	1.70	0.56
1:A:54:PRO:HB3	1:A:394:GLU:HG2	1.87	0.56
1:A:454:LYS:NZ	4:A:509:HOH:O	2.37	0.55
1:A:46:GLU:N	1:A:416:ILE:O	2.40	0.54
2:B:137:PRO:HB3	2:B:163:TYR:HB3	1.89	0.54
2:B:18:LEU:HD13	2:B:127:VAL:HG11	1.90	0.54
3:C:48:ILE:HD13	3:C:54:ARG:HA	1.88	0.53
2:B:213:ILE:CD1	2:B:228:ARG:HG3	2.41	0.50
1:A:422:PHE:HB3	1:A:449:CYS:HB3	1.94	0.49
3:C:185:LYS:O	3:C:189:GLU:HG3	2.13	0.49
2:B:177:LEU:HD21	2:B:200:VAL:HG21	1.94	0.49
1:A:280:ARG:NH1	4:A:506:HOH:O	2.32	0.49
1:A:454:LYS:HE2	4:A:513:HOH:O	2.11	0.49
1:A:55:TRP:HB3	1:A:59:MET:HG2	1.94	0.49
1:A:170:VAL:CG1	1:A:175:GLN:HA	2.42	0.49
3:C:31:LYS:NZ	4:C:305:HOH:O	2.44	0.48
1:A:63:ASP:O	1:A:67:THR:HG22	2.14	0.47
2:B:55:TYR:CE2	2:B:56:ARG:HD3	2.49	0.47
1:A:438:HIS:HB2	1:A:447:TYR:CE2	2.49	0.47
1:A:47:ARG:NH1	1:A:418:LEU:HB3	2.31	0.46
2:B:40:ARG:HB3	2:B:50:ILE:HD11	1.96	0.46
1:A:93:ARG:O	1:A:240:ARG:HG3	2.16	0.46
1:A:225:LYS:HB2	1:A:284:ARG:HG3	1.98	0.45
1:A:121:LEU:H	1:A:309:GLN:NE2	2.14	0.45
3:C:150:TRP:CE2	3:C:181:LEU:HB2	2.52	0.45
2:B:207:LEU:HD23	2:B:207:LEU:HA	1.84	0.45
1:A:88:ARG:NH2	1:A:293:ASP:O	2.50	0.44
1:A:64:ILE:HD13	1:A:343:ASN:HB3	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:134:HIS:HB3	1:A:146:ARG:HH21	1.84	0.43
1:A:368:LYS:HE3	1:A:441:GLN:HA	2.02	0.42
2:B:135:LYS:HD3	2:B:136:GLY:O	2.19	0.42
3:C:203:LEU:HD13	3:C:207:VAL:HG23	2.01	0.42
3:C:120:PHE:HB2	3:C:135:VAL:HB	2.02	0.42
1:A:121:LEU:HD22	1:A:219:PHE:CG	2.55	0.41
1:A:119:GLN:O	1:A:313:ARG:NH1	2.53	0.41
1:A:318:GLU:CD	2:B:32:PRO:HG2	2.40	0.41
1:A:250:LYS:HD3	1:A:381:GLU:HB3	2.01	0.41
1:A:78:GLU:HB2	1:A:91:ALA:HB2	2.03	0.41
2:B:82:LEU:HD22	2:B:83:ARG:N	2.36	0.41
2:B:38:TRP:CE2	2:B:82:LEU:HB2	2.56	0.41
3:C:47:LEU:HA	3:C:58:VAL:HG21	2.03	0.41
3:C:94:TRP:CE3	3:C:96:PRO:HD3	2.56	0.41
3:C:192:LYS:O	3:C:212:ASN:HA	2.20	0.41
1:A:106:SER:HB2	1:A:122:LYS:HG2	2.03	0.41
3:C:97:ARG:HD2	4:C:303:HOH:O	2.21	0.41
1:A:68:HIS:CE1	1:A:92:GLY:HA3	2.56	0.40
1:A:83:GLU:OE1	1:A:317:ARG:NH2	2.49	0.40
2:B:36:TRP:HB3	2:B:80:PHE:CZ	2.56	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	385/471 (82%)	367 (95%)	18 (5%)	0	100	100
2	B	229/234 (98%)	225 (98%)	4 (2%)	0	100	100
3	C	212/216 (98%)	206 (97%)	6 (3%)	0	100	100
All	All	826/921 (90%)	798 (97%)	28 (3%)	0	100	100

There are no Ramachandran outliers to report.

### 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	322/421 (76%)	317 (98%)	5 (2%)	58	76
2	B	193/201 (96%)	190 (98%)	3 (2%)	58	76
3	C	173/187 (92%)	170 (98%)	3 (2%)	56	75
All	All	688/809 (85%)	677 (98%)	11 (2%)	58	76

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	121	LEU
1	A	222	LYS
1	A	309	GLN
1	A	335	PHE
1	A	432	CYS
2	B	13	LYS
2	B	82	LEU
2	B	100	SER
3	C	45	ARG
3	C	148	VAL
3	C	210	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	309	GLN
1	A	314	GLN
2	B	41	GLN
3	C	38	GLN
3	C	154	ASN

### 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, 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	395/471 (83%)	0.13	28 (7%) 23 21	31, 44, 73, 89	0
2	B	231/234 (98%)	-0.05	4 (1%) 69 65	31, 45, 65, 84	0
3	C	214/216 (99%)	0.09	4 (1%) 66 62	30, 48, 74, 84	0
All	All	840/921 (91%)	0.07	36 (4%) 40 38	30, 45, 72, 89	0

All (36) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	401	LYS	4.4
1	A	472	ASP	4.4
1	A	327	VAL	3.7
1	A	416	ILE	3.6
1	A	399	ILE	3.5
1	A	207	TYR	3.5
1	A	209	SER	3.5
3	C	214	GLY	3.5
1	A	210	PRO	3.4
1	A	174	ASP	3.3
1	A	397	ARG	3.3
1	A	295	PRO	3.3
2	B	148	SER	3.2
1	A	468	GLU	3.2
1	A	471	ARG	3.0
1	A	335	PHE	3.0
1	A	149	ASP	3.0
2	B	1	GLN	2.9
1	A	474	TYR	2.9
1	A	326	PRO	2.9
3	C	139	ASN	2.9
1	A	400	LYS	2.7
1	A	173	GLY	2.6

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Mol	Chain	Res	Type	RSRZ
1	A	206	ARG	2.6
2	B	151	GLY	2.4
1	A	175	GLN	2.4
3	C	192	LYS	2.4
1	A	205	PRO	2.3
1	A	473	TYR	2.3
1	A	46	GLU	2.2
1	A	217	ALA	2.2
3	C	201	GLN	2.2
1	A	418	LEU	2.1
2	B	231	PRO	2.1
1	A	396	GLU	2.1
1	A	417	VAL	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](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.