WORLDWIDE wwPDB PROTEIN DATA BANK

wwPDB X-ray Structure Validation Summary Report (i)

Sep 26, 2023 – 05:57 AM EDT

PDB ID	:	6B9J
Title	:	Structure of vaccinia virus D8 protein bound to human Fab vv138
Authors	:	Zajonc, D.M.
Deposited on	:	2017-10-10
Resolution	:	2.90 Å(reported)

The following versions of software and data (see references (i)) 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	:	2.35.1
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)	:	2.35.1

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 2.90 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.
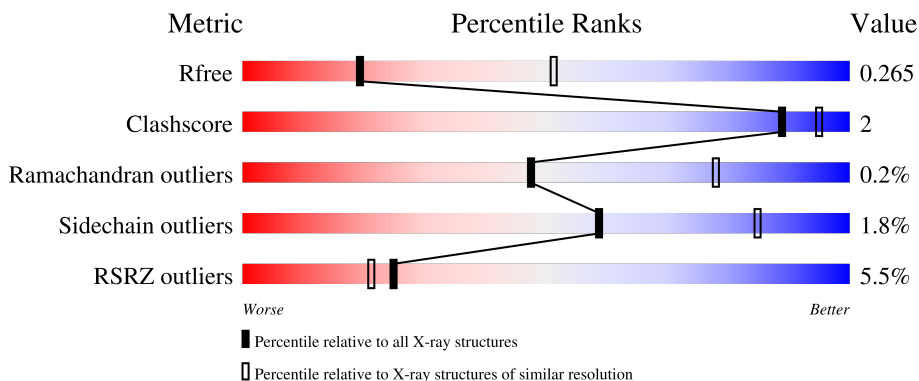
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1957 (2.90-2.90)
Clashscore	141614	2172 (2.90-2.90)
Ramachandran outliers	138981	2115 (2.90-2.90)
Sidechain outliers	138945	2117 (2.90-2.90)
RSRZ outliers	127900	1906 (2.90-2.90)

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 <=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	X	241	% 93% · 5%
1	Y	241	% 92% · 5%
2	A	217	4% 94% · ·
2	H	217	5% 94% · ·
3	B	215	10% 90% 8% ··

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Mol	Chain	Length	Quality of chain
3	L	215	12% 88% 8%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
5	NA	X	302	-	-	-	X
5	NA	Y	302	-	-	-	X

2 Entry composition ⓘ

There are 6 unique types of molecules in this entry. The entry contains 9990 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 IMV membrane protein.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
1	X	228	Total 1847	C 1196	N 300	O 351	0	1	0
1	Y	228	Total 1858	C 1203	N 302	O 353	0	1	0

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
X	236	HIS	-	expression tag	UNP Q1M1K6
X	237	HIS	-	expression tag	UNP Q1M1K6
X	238	HIS	-	expression tag	UNP Q1M1K6
X	239	HIS	-	expression tag	UNP Q1M1K6
X	240	HIS	-	expression tag	UNP Q1M1K6
X	241	HIS	-	expression tag	UNP Q1M1K6
Y	236	HIS	-	expression tag	UNP Q1M1K6
Y	237	HIS	-	expression tag	UNP Q1M1K6
Y	238	HIS	-	expression tag	UNP Q1M1K6
Y	239	HIS	-	expression tag	UNP Q1M1K6
Y	240	HIS	-	expression tag	UNP Q1M1K6
Y	241	HIS	-	expression tag	UNP Q1M1K6

- Molecule 2 is a protein called Fab vv138 Heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	H	212	Total 1584	C 1005	N 254	O 318	S 7	0	0	0
2	A	212	Total 1556	C 984	N 247	O 318	S 7	0	0	0

- Molecule 3 is a protein called Fab vv138 Light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	L	209	Total 1577	C 985	N 265	O 323	S 4	0	0	0
3	B	213	Total 1501	C 931	N 256	O 310	S 4	0	0	0

- Molecule 4 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).
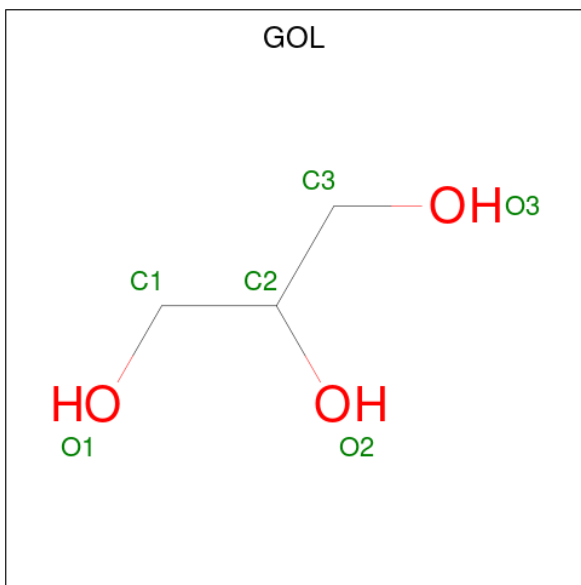
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	X	1	Total 6	C 3	O 3	0	0
4	Y	1	Total 6	C 3	O 3	0	0

- Molecule 5 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	X	3	Total 3	Na 3	0	0
5	H	2	Total 2	Na 2	0	0
5	Y	2	Total 2	Na 2	0	0

- Molecule 6 is water.

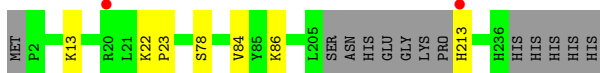| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	X	14	Total 14	O 14	0	0
6	H	9	Total 9	O 9	0	0
6	L	5	Total 5	O 5	0	0
6	Y	9	Total 9	O 9	0	0
6	A	7	Total 7	O 7	0	0
6	B	4	Total 4	O 4	0	0

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: IMV membrane protein
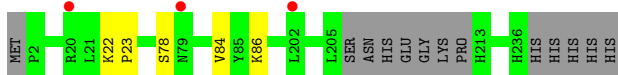
Chain X:

- Molecule 1: IMV membrane protein

Chain Y:

- Molecule 2: Fab vv138 Heavy chain

Chain H:

- Molecule 2: Fab vv138 Heavy chain

Chain A:

- Molecule 3: Fab vv138 Light chain

Chain L:

S179 K185 A186 D187 C196 E197 V198 T199 H200 Q201 G202 L203 S204 S205 P206 E215

● Molecule 3: Fab vv138 Light chain

Chain B:

10%

90%

8%

GLU I2 Q6 R24 A25 T30 L48 I49 Y50 R55 F63 S68 GLY T70 A85 C89 S94 S95 T104 P115 F120 Q126 S129 V135 C136 L137 L138 N139 N140 A146 K147 V148 Q149 W150 G159 N160 S161 L177 L181

D187 C196 L203 V207 E215
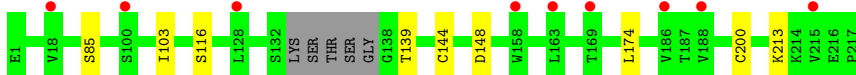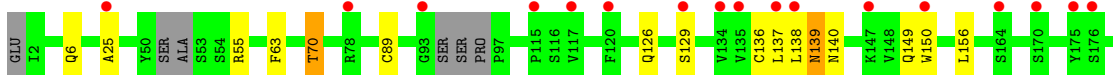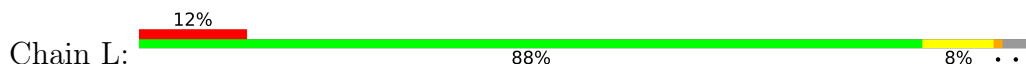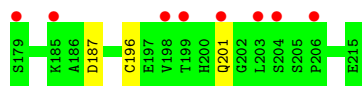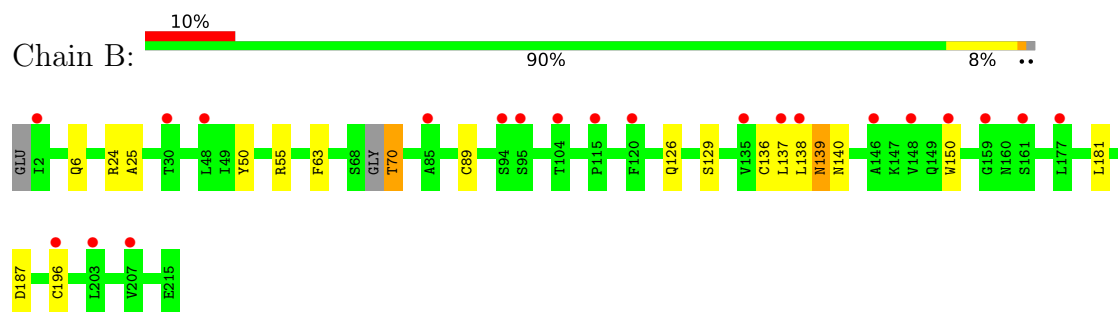
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants	234.28Å 253.84Å 73.76Å	Depositor
a, b, c, α, β, γ	90.00° 90.00° 90.00°	
Resolution (Å)	117.14 – 2.90	Depositor
	117.14 – 2.90	EDS
% Data completeness	99.2 (117.14-2.90)	Depositor
(in resolution range)	99.2 (117.14-2.90)	EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.16	Depositor
$< I/\sigma(I) >$ [1]	1.72 (at 2.91Å)	Xtriage
Refinement program	REFMAC 5.8.0135	Depositor
R, R_{free}	0.241 , 0.269	Depositor
	0.242 , 0.265	DCC
R_{free} test set	2466 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å^2)	74.1	Xtriage
Anisotropy	0.067	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.31 , 73.0	EDS
L-test for twinning[2]	$< |L| > = 0.47, < L^2 > = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.90	EDS
Total number of atoms	9990	wwPDB-VP
Average B, all atoms (Å^2)	90.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.83% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ 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)

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

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	X	0.39	0/1900	0.60	0/2586
1	Y	0.39	0/1912	0.60	0/2600
2	A	0.38	0/1595	0.59	0/2185
2	H	0.38	0/1623	0.59	0/2216
3	B	0.42	0/1531	0.62	0/2095
3	L	0.41	0/1611	0.62	0/2192
All	All	0.39	0/10172	0.60	0/13874

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	X	1847	0	1780	2	0
1	Y	1858	0	1803	2	0
2	A	1556	0	1454	5	0
2	H	1584	0	1527	4	0
3	B	1501	0	1346	9	0
3	L	1577	0	1482	11	0
4	X	6	0	8	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	Y	6	0	8	0	0
5	H	2	0	0	0	0
5	X	3	0	0	0	0
5	Y	2	0	0	0	0
6	A	7	0	0	0	0
6	B	4	0	0	0	0
6	H	9	0	0	0	0
6	L	5	0	0	0	0
6	X	14	0	0	0	0
6	Y	9	0	0	0	0
All	All	9990	0	9408	32	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 2.

The worst 5 of 32 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:L:136:CYS:HG	3:L:196:CYS:HG	0.94	0.87
3:B:136:CYS:HG	3:B:196:CYS:CB	1.95	0.78
3:L:136:CYS:HG	3:L:196:CYS:CB	1.97	0.77
3:B:126:GLN:O	3:B:129:SER:OG	2.05	0.75
3:L:126:GLN:O	3:L:129:SER:OG	2.03	0.74

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	X	225/241 (93%)	211 (94%)	13 (6%)	1 (0%)	34	66
1	Y	225/241 (93%)	211 (94%)	13 (6%)	1 (0%)	34	66

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	A	208/217 (96%)	192 (92%)	16 (8%)	0	100	100
2	H	208/217 (96%)	194 (93%)	14 (7%)	0	100	100
3	B	209/215 (97%)	194 (93%)	15 (7%)	0	100	100
3	L	203/215 (94%)	194 (96%)	9 (4%)	0	100	100
All	All	1278/1346 (95%)	1196 (94%)	80 (6%)	2 (0%)	47	78

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	X	84	VAL
1	Y	84	VAL

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	X	204/222 (92%)	204 (100%)	0	100	100
1	Y	208/222 (94%)	206 (99%)	2 (1%)	76	92
2	A	170/185 (92%)	165 (97%)	5 (3%)	42	76
2	H	177/185 (96%)	172 (97%)	5 (3%)	43	76
3	B	153/187 (82%)	149 (97%)	4 (3%)	46	77
3	L	173/187 (92%)	169 (98%)	4 (2%)	50	80
All	All	1085/1188 (91%)	1065 (98%)	20 (2%)	59	85

5 of 20 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	A	148	ASP
3	B	70	THR
3	B	187	ASP
3	B	139	ASN
3	L	139	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 9 such sidechains are listed below:

Mol	Chain	Res	Type
2	A	168	HIS
3	B	139	ASN
2	H	175	GLN
3	L	139	ASN
1	Y	9	ASN

5.3.3　RNA ⓘ

There are no RNA molecules in this entry.

5.4　Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5　Carbohydrates ⓘ

There are no monosaccharides in this entry.

5.6　Ligand geometry ⓘ

Of 9 ligands modelled in this entry, 7 are monoatomic - leaving 2 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	$\#|Z|>2$
4	GOL	X	301	-	5,5,5	0.63	0	5,5,5	0.56	0
4	GOL	Y	301	-	5,5,5	0.72	0	5,5,5	0.93	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
4	GOL	X	301	-	-	2/4/4/4	-
4	GOL	Y	301	-	-	2/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	X	301	GOL	O1-C1-C2-C3
4	X	301	GOL	O1-C1-C2-O2
4	Y	301	GOL	O1-C1-C2-C3
4	Y	301	GOL	O1-C1-C2-O2

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers ⓘ

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 ⓘ

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	X	228/241 (94%)	0.45	3 (1%)	77	77	39, 60, 96, 152	0
1	Y	228/241 (94%)	0.45	2 (0%)	84	84	43, 60, 96, 150	0
2	A	212/217 (97%)	0.41	9 (4%)	36	32	47, 101, 138, 158	0
2	H	212/217 (97%)	0.55	11 (5%)	27	23	47, 94, 129, 144	0
3	B	213/215 (99%)	0.83	21 (9%)	7	5	74, 125, 159, 180	0
3	L	209/215 (97%)	0.93	25 (11%)	4	3	73, 108, 137, 154	0
All	All	1302/1346 (96%)	0.60	71 (5%)	25	21	39, 93, 141, 180	0

The worst 5 of 71 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	B	138	LEU	4.2
2	H	100	SER	3.9
3	B	161	SER	3.9
2	H	188	VAL	3.7
2	H	138	GLY	3.6

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 ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

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, 95th 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^2)	Q<0.9
4	GOL	Y	301	6/6	0.54	0.32	60,69,71,71	0
5	NA	X	303	1/1	0.66	0.28	78,78,78,78	0
5	NA	X	302	1/1	0.70	0.47	73,73,73,73	0
5	NA	Y	302	1/1	0.72	0.44	70,70,70,70	0
5	NA	X	304	1/1	0.77	0.21	79,79,79,79	0
4	GOL	X	301	6/6	0.81	0.24	55,64,65,68	0
5	NA	H	302	1/1	0.85	0.17	76,76,76,76	0
5	NA	Y	303	1/1	0.86	0.33	70,70,70,70	0
5	NA	H	301	1/1	0.94	0.20	72,72,72,72	0

6.5 Other polymers ⓘ

There are no such residues in this entry.