Full wwPDB X-ray Structure Validation Report ⓘ

Oct 11, 2023 – 05:44 AM EDT

PDB ID	:	7LCV
Title	:	Factor H enhancing human antibody fragment (Fab) to meningococcal Factor H binding protein
Authors	:	Beernink, P.T.; Sands, N.
Deposited on	:	2021-01-11
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:

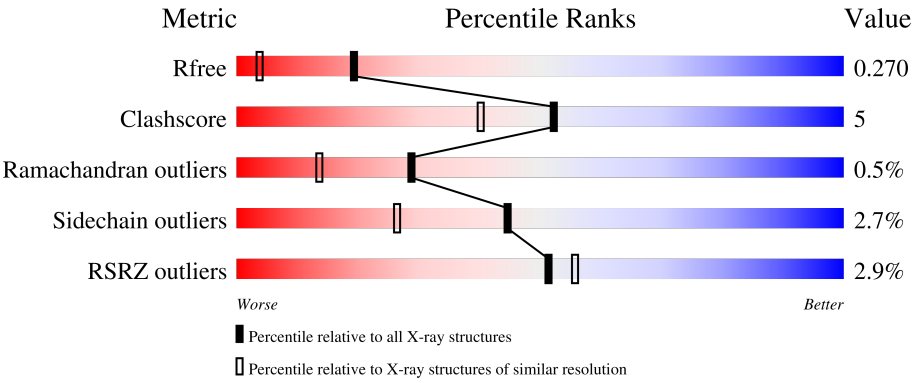
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

1 Overall quality at a glance (i)

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}	130704	4298 (1.70-1.70)
Clashscore	141614	4695 (1.70-1.70)
Ramachandran outliers	138981	4610 (1.70-1.70)
Sidechain outliers	138945	4610 (1.70-1.70)
RSRZ outliers	127900	4222 (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 <=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	227	4% 67% 14% 18%
2	B	217	% 89% 10%
3	C	263	2% 78% 8% 14%

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 9631 atoms, of which 4599 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 Immunoglobulin heavy chain Fd fragment.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	186	Total	C	H	N	O	S	0	0	0
			2707	871	1327	228	275	6			

- Molecule 2 is a protein called Immunoglobulin kappa light chain.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	B	215	Total	C	H	N	O	S	0	2	0
			3216	1022	1576	275	335	8			

- Molecule 3 is a protein called Factor H binding protein.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
3	C	227	Total	C	H	N	O	S	0	0	0
			3405	1062	1696	307	339	1			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	256	LEU	-	expression tag	UNP Q6VRZ6
C	257	GLU	-	expression tag	UNP Q6VRZ6
C	258	HIS	-	expression tag	UNP Q6VRZ6
C	259	HIS	-	expression tag	UNP Q6VRZ6
C	260	HIS	-	expression tag	UNP Q6VRZ6
C	261	HIS	-	expression tag	UNP Q6VRZ6
C	262	HIS	-	expression tag	UNP Q6VRZ6
C	263	HIS	-	expression tag	UNP Q6VRZ6

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

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

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

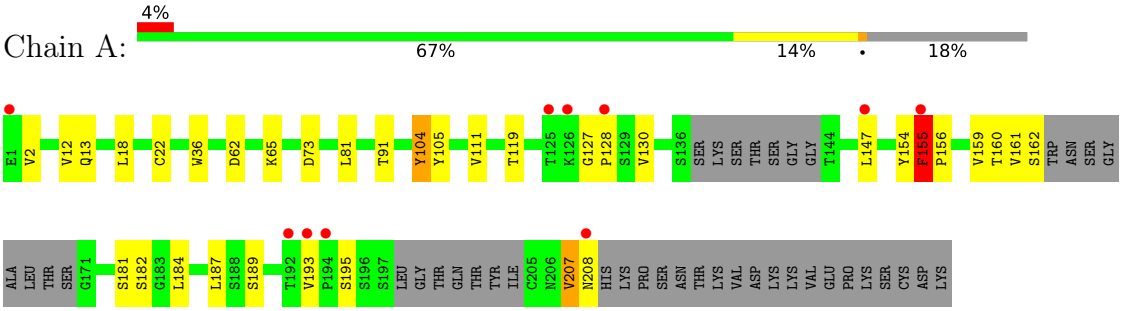
- Molecule 5 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	65	Total O 65 65	0	0
5	B	109	Total O 109 109	0	0
5	C	127	Total O 127 127	0	0

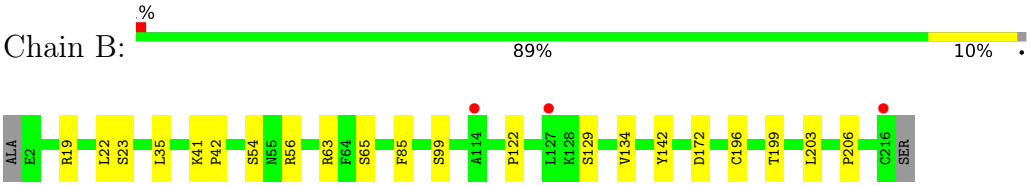
3 Residue-property plots (i)

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.

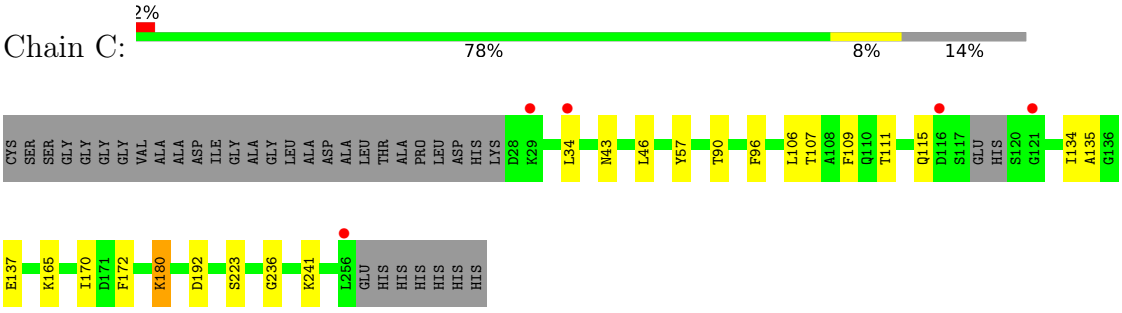
• Molecule 1: Immunoglobulin heavy chain Fd fragment



• Molecule 2: Immunoglobulin kappa light chain



• Molecule 3: Factor H binding protein



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α, β, γ	39.47Å 52.37Å 84.56Å 73.78° 84.48° 74.17°	Depositor
Resolution (Å)	81.18 – 1.70 81.18 – 1.23	Depositor EDS
% Data completeness (in resolution range)	93.1 (81.18-1.70) 47.6 (81.18-1.23)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	-0.75 (at 1.23Å)	Xtriage
Refinement program	PHENIX 1.18.2_3874	Depositor
R, R_{free}	0.239 , 0.270 0.240 , 0.270	Depositor DCC
R_{free} test set	1120 reflections (0.98%)	wwPDB-VP
Wilson B-factor (Å^2)	19.7	Xtriage
Anisotropy	0.185	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 43.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	0.017 for -h,-k,-k+l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	9631	wwPDB-VP
Average B, all atoms (Å^2)	50.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.89% of the height of the origin peak. No significant pseudotranslation is detected.*

[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

5.1 Standard geometry

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

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	0.89	3/1412 (0.2%)	1.06	2/1921 (0.1%)
2	B	0.86	1/1681 (0.1%)	1.03	4/2284 (0.2%)
3	C	0.80	4/1730 (0.2%)	0.98	3/2319 (0.1%)
All	All	0.85	8/4823 (0.2%)	1.02	9/6524 (0.1%)

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	22	CYS	N-CA	8.05	1.62	1.46
3	C	241	LYS	CD-CE	7.30	1.69	1.51
3	C	241	LYS	CE-NZ	7.03	1.66	1.49
1	A	22	CYS	CA-C	6.06	1.68	1.52
3	C	241	LYS	CB-CG	5.97	1.68	1.52
2	B	142	TYR	C-O	-5.68	1.12	1.23
1	A	18	LEU	C-O	-5.36	1.13	1.23
3	C	137	GLU	C-O	-5.33	1.13	1.23

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	C	180	LYS	CD-CE-NZ	8.70	131.71	111.70
3	C	241	LYS	CB-CG-CD	-7.75	91.45	111.60
3	C	241	LYS	CD-CE-NZ	-7.55	94.34	111.70
2	B	99	SER	O-C-N	6.66	133.35	122.70
2	B	85	PHE	CB-CA-C	6.03	122.47	110.40
1	A	104	TYR	CB-CG-CD1	5.68	124.41	121.00
2	B	56	ARG	NE-CZ-NH1	5.62	123.11	120.30
2	B	63	ARG	NE-CZ-NH1	5.14	122.87	120.30
1	A	105	TYR	CB-CA-C	5.01	120.42	110.40

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	1380	1327	1327	20	0
2	B	1640	1576	1576	10	0
3	C	1709	1696	1694	21	0
4	B	1	0	0	0	0
4	C	1	0	0	0	0
5	A	65	0	0	2	0
5	B	109	0	0	2	0
5	C	127	0	0	12	0
All	All	5032	4599	4597	51	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 (51) 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:C:115:GLN:OE1	5:C:401:HOH:O	1.77	1.00
3:C:34:LEU:CD1	3:C:135:ALA:HB3	2.03	0.89
3:C:57:TYR:HD1	5:C:403:HOH:O	1.63	0.81
1:A:154:TYR:O	1:A:155:PHE:O	2.04	0.74
3:C:57:TYR:CD1	5:C:403:HOH:O	2.40	0.69
1:A:184:LEU:HD22	1:A:184:LEU:N	2.08	0.68
3:C:34:LEU:HD12	3:C:135:ALA:HB3	1.74	0.67
1:A:73:ASP:OD2	5:A:301:HOH:O	2.12	0.66
3:C:46:LEU:O	5:C:403:HOH:O	2.15	0.66
2:B:203:LEU:O	5:B:401:HOH:O	2.13	0.65
3:C:192:ASP:OD1	5:C:402:HOH:O	2.14	0.65
2:B:41:LYS:CG	2:B:42:PRO:HD2	2.30	0.61
1:A:65:LYS:HD2	5:A:333:HOH:O	1.99	0.61
2:B:41:LYS:HG2	2:B:42:PRO:HD2	1.88	0.56
2:B:22:LEU:HD12	2:B:22:LEU:N	2.20	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:43:ASN:ND2	5:C:405:HOH:O	2.35	0.55
3:C:115:GLN:CD	5:C:401:HOH:O	2.36	0.55
3:C:34:LEU:HD21	3:C:107:THR:HG23	1.91	0.52
1:A:130:VAL:HG21	1:A:207:VAL:HG11	1.95	0.49
2:B:199:THR:HG22	2:B:206:PRO:HG3	1.95	0.48
1:A:184:LEU:HD22	1:A:184:LEU:H	1.77	0.48
1:A:127:GLY:HA2	1:A:155:PHE:CD2	2.49	0.48
3:C:90:THR:O	5:C:401:HOH:O	2.20	0.47
3:C:106:LEU:HD13	5:C:428:HOH:O	2.12	0.47
3:C:180:LYS:HD2	5:C:402:HOH:O	2.13	0.47
3:C:46:LEU:HG	5:C:403:HOH:O	2.14	0.47
1:A:2:VAL:HG11	1:A:111:VAL:HG21	1.97	0.47
1:A:184:LEU:N	1:A:184:LEU:CD2	2.76	0.46
3:C:96:PHE:HD1	3:C:109:PHE:CE1	2.34	0.46
1:A:128:PRO:HD3	1:A:155:PHE:CE2	2.51	0.46
2:B:41:LYS:HG3	2:B:42:PRO:HD2	1.97	0.46
1:A:154:TYR:C	1:A:155:PHE:O	2.55	0.45
1:A:182:SER:HB2	1:A:184:LEU:HD23	1.98	0.44
1:A:207:VAL:HG22	1:A:208:ASN:N	2.32	0.44
3:C:134:ILE:HD13	3:C:236:GLY:HA2	1.99	0.44
3:C:111:THR:HG23	5:C:463:HOH:O	2.18	0.43
1:A:155:PHE:HB2	1:A:156:PRO:CD	2.49	0.42
2:B:19:ARG:HG3	2:B:19:ARG:NH1	2.33	0.42
1:A:91:THR:HG23	1:A:119:THR:HA	2.01	0.42
1:A:161:VAL:HG11	1:A:189:SER:HB3	2.01	0.42
1:A:159:VAL:CG2	1:A:187:LEU:HD21	2.49	0.42
2:B:122:PRO:HD3	2:B:134:VAL:HG22	2.01	0.42
3:C:34:LEU:HD12	3:C:135:ALA:CB	2.47	0.41
1:A:36:TRP:NE1	1:A:81:LEU:HB2	2.36	0.41
3:C:170:ILE:HG21	3:C:172:PHE:CE1	2.55	0.41
1:A:184:LEU:H	1:A:184:LEU:CD2	2.34	0.41
1:A:12:VAL:HG22	1:A:13:GLN:H	1.85	0.41
2:B:19:ARG:HG3	2:B:19:ARG:HH11	1.86	0.41
3:C:165:LYS:HA	3:C:165:LYS:HD3	1.85	0.40
2:B:23:SER:HB3	5:B:441:HOH:O	2.22	0.40
3:C:223:SER:O	3:C:236:GLY:HA3	2.21	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	178/227 (78%)	164 (92%)	11 (6%)	3 (2%)	9 1
2	B	215/217 (99%)	203 (94%)	12 (6%)	0	100 100
3	C	223/263 (85%)	216 (97%)	7 (3%)	0	100 100
All	All	616/707 (87%)	583 (95%)	30 (5%)	3 (0%)	29 13

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	155	PHE
1	A	207	VAL
1	A	181	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	154/190 (81%)	146 (95%)	8 (5%)	23 8
2	B	187/188 (100%)	180 (96%)	7 (4%)	34 15
3	C	175/202 (87%)	175 (100%)	0	100 100
All	All	516/580 (89%)	501 (97%)	15 (3%)	44 23

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	62	ASP
1	A	104	TYR
1	A	147	LEU
1	A	155	PHE
1	A	160	THR
1	A	162	SER
1	A	193	VAL
1	A	195	SER
2	B	35	LEU
2	B	54	SER
2	B	65	SER
2	B	129	SER
2	B	172	ASP
2	B	196[A]	CYS
2	B	196[B]	CYS

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 monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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^{th} 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	186/227 (81%)	0.33	10 (5%)	25	28	28, 49, 72, 92	0
2	B	215/217 (99%)	0.07	3 (1%)	75	79	30, 45, 62, 75	0
3	C	227/263 (86%)	-0.12	5 (2%)	62	66	27, 40, 62, 80	0
All	All	628/707 (88%)	0.08	18 (2%)	51	56	27, 44, 67, 92	0

All (18) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	155	PHE	5.0
2	B	216	CYS	4.0
3	C	256	LEU	3.8
3	C	29	LYS	3.1
1	A	1	GLU	2.9
1	A	128	PRO	2.9
1	A	192	THR	2.7
1	A	194	PRO	2.6
1	A	208	ASN	2.4
2	B	114	ALA	2.4
3	C	121	GLY	2.3
3	C	34	LEU	2.2
1	A	126	LYS	2.1
1	A	125	THR	2.1
1	A	147	LEU	2.1
1	A	193	VAL	2.0
2	B	127	LEU	2.0
3	C	116	ASP	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 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^{th} 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	CL	B	301	1/1	0.94	0.06	51,51,51,51	0
4	CL	C	301	1/1	0.98	0.09	41,41,41,41	0

6.5 Other polymers (i)

There are no such residues in this entry.