



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 8, 2026 – 03:11 PM UTC

PDB ID : 4JRA / pdb_00004jra
Title : CRYSTAL STRUCTURE OF THE BOTULINUM NEUROTOXIN A RECEPTOR-BINDING DOMAIN IN COMPLEX WITH THE LUMINAL DOMAIN Of SV2C
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Deposited on : 2013-03-21
Resolution : 2.30 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

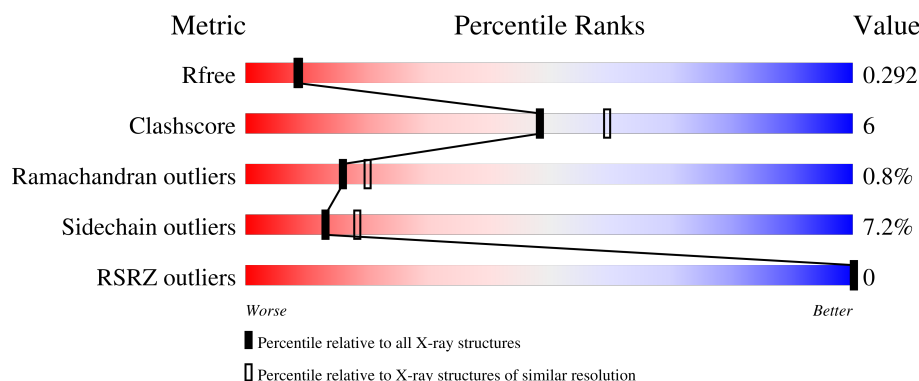
1 Overall quality at a glance

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}	180053	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (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	443	
1	B	443	
2	C	136	
2	D	136	

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 16539 atoms, of which 8131 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 Botulinum neurotoxin type A.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	416	Total	C	H	N	O	S	0	3	0
			6854	2195	3412	593	641	13			
1	B	413	Total	C	H	N	O	S	0	0	0
			6778	2176	3367	585	637	13			

There are 34 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	854	MET	-	expression tag	UNP P10845
A	855	LYS	-	expression tag	UNP P10845
A	856	LYS	-	expression tag	UNP P10845
A	857	HIS	-	expression tag	UNP P10845
A	858	HIS	-	expression tag	UNP P10845
A	859	HIS	-	expression tag	UNP P10845
A	860	HIS	-	expression tag	UNP P10845
A	861	HIS	-	expression tag	UNP P10845
A	862	HIS	-	expression tag	UNP P10845
A	863	GLY	-	expression tag	UNP P10845
A	864	SER	-	expression tag	UNP P10845
A	865	LEU	-	expression tag	UNP P10845
A	866	VAL	-	expression tag	UNP P10845
A	867	PRO	-	expression tag	UNP P10845
A	868	ARG	-	expression tag	UNP P10845
A	869	GLY	-	expression tag	UNP P10845
A	870	SER	-	expression tag	UNP P10845
B	854	MET	-	expression tag	UNP P10845
B	855	LYS	-	expression tag	UNP P10845
B	856	LYS	-	expression tag	UNP P10845
B	857	HIS	-	expression tag	UNP P10845
B	858	HIS	-	expression tag	UNP P10845
B	859	HIS	-	expression tag	UNP P10845
B	860	HIS	-	expression tag	UNP P10845
B	861	HIS	-	expression tag	UNP P10845

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Chain	Residue	Modelled	Actual	Comment	Reference
B	862	HIS	-	expression tag	UNP P10845
B	863	GLY	-	expression tag	UNP P10845
B	864	SER	-	expression tag	UNP P10845
B	865	LEU	-	expression tag	UNP P10845
B	866	VAL	-	expression tag	UNP P10845
B	867	PRO	-	expression tag	UNP P10845
B	868	ARG	-	expression tag	UNP P10845
B	869	GLY	-	expression tag	UNP P10845
B	870	SER	-	expression tag	UNP P10845

- Molecule 2 is a protein called Synaptic vesicle glycoprotein 2C.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	C	83	Total	C	H	N	O	S	0	0	0
			1320	444	634	103	134	5			
2	D	93	Total	C	H	N	O	S	0	0	0
			1497	502	718	121	151	5			

There are 34 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	439	MET	-	expression tag	UNP Q496J9
C	440	LYS	-	expression tag	UNP Q496J9
C	441	LYS	-	expression tag	UNP Q496J9
C	442	HIS	-	expression tag	UNP Q496J9
C	443	HIS	-	expression tag	UNP Q496J9
C	444	HIS	-	expression tag	UNP Q496J9
C	445	HIS	-	expression tag	UNP Q496J9
C	446	HIS	-	expression tag	UNP Q496J9
C	447	HIS	-	expression tag	UNP Q496J9
C	448	GLY	-	expression tag	UNP Q496J9
C	449	SER	-	expression tag	UNP Q496J9
C	450	LEU	-	expression tag	UNP Q496J9
C	451	VAL	-	expression tag	UNP Q496J9
C	452	PRO	-	expression tag	UNP Q496J9
C	453	ARG	-	expression tag	UNP Q496J9
C	454	GLY	-	expression tag	UNP Q496J9
C	455	SER	-	expression tag	UNP Q496J9
D	439	MET	-	expression tag	UNP Q496J9
D	440	LYS	-	expression tag	UNP Q496J9
D	441	LYS	-	expression tag	UNP Q496J9
D	442	HIS	-	expression tag	UNP Q496J9

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Chain	Residue	Modelled	Actual	Comment	Reference
D	443	HIS	-	expression tag	UNP Q496J9
D	444	HIS	-	expression tag	UNP Q496J9
D	445	HIS	-	expression tag	UNP Q496J9
D	446	HIS	-	expression tag	UNP Q496J9
D	447	HIS	-	expression tag	UNP Q496J9
D	448	GLY	-	expression tag	UNP Q496J9
D	449	SER	-	expression tag	UNP Q496J9
D	450	LEU	-	expression tag	UNP Q496J9
D	451	VAL	-	expression tag	UNP Q496J9
D	452	PRO	-	expression tag	UNP Q496J9
D	453	ARG	-	expression tag	UNP Q496J9
D	454	GLY	-	expression tag	UNP Q496J9
D	455	SER	-	expression tag	UNP Q496J9

- Molecule 3 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	6	Total Cl 6 6	0	0

- Molecule 4 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	2	Total Na 2 2	0	0

- Molecule 5 is water.

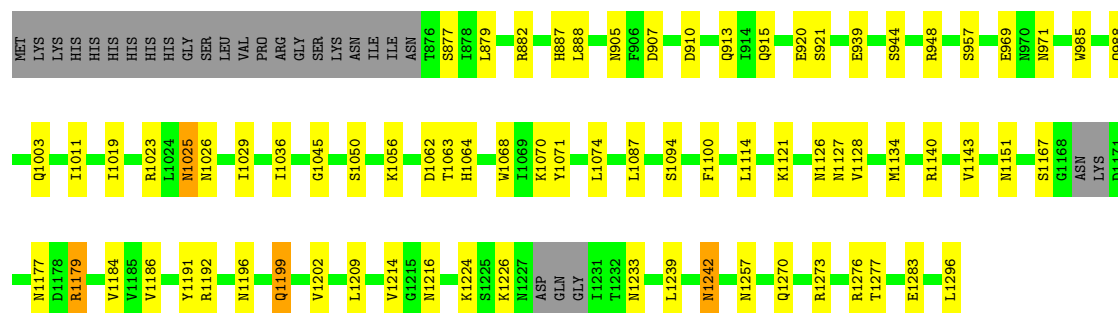
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	50	Total O 50 50	0	0
5	B	18	Total O 18 18	0	0
5	C	6	Total O 6 6	0	0
5	D	8	Total O 8 8	0	0

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.

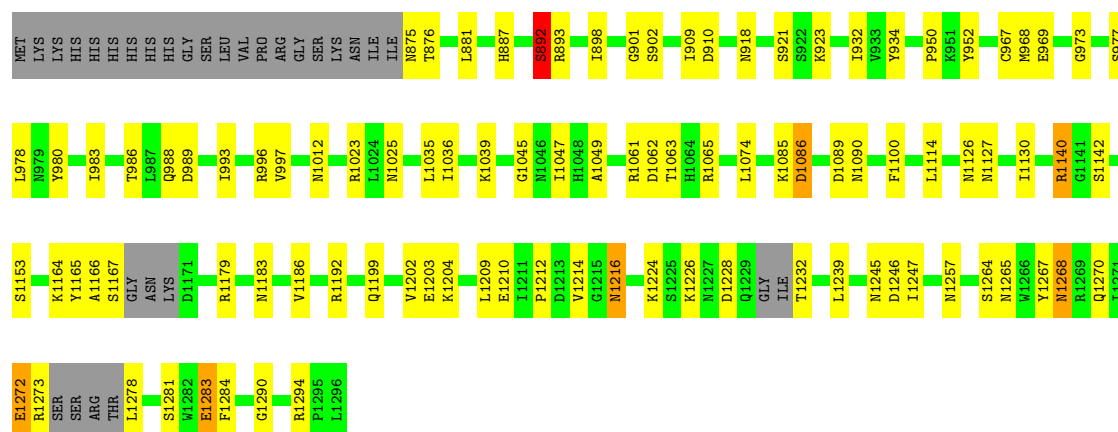
• Molecule 1: Botulinum neurotoxin type A

Chain A: 

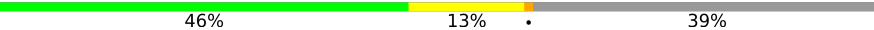


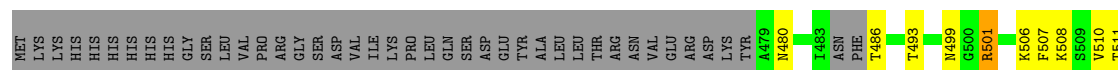
• Molecule 1: Botulinum neurotoxin type A

Chain B: 



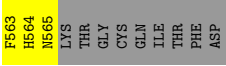
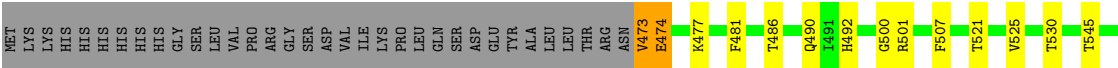
• Molecule 2: Synaptic vesicle glycoprotein 2C

Chain C: 





● Molecule 2: Synaptic vesicle glycoprotein 2C



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	115.44Å 105.26Å 127.96Å 90.00° 90.02° 90.00°	Depositor
Resolution (Å)	19.93 – 2.30 19.93 – 2.30	Depositor EDS
% Data completeness (in resolution range)	100.0 (19.93-2.30) 99.9 (19.93-2.30)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.81 (at 2.30Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8.2_1309)	Depositor
R, R_{free}	0.235 , 0.269 (Not available) , 0.292	Depositor DCC
R_{free} test set	2032 reflections (2.99%)	wwPDB-VP
Wilson B-factor (Å ²)	29.6	Xtriage
Anisotropy	0.519	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.45 , 33.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.42$, $\langle L^2 \rangle = 0.25$	Xtriage
Estimated twinning fraction	0.430 for -h,-k,l	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	16539	wwPDB-VP
Average B, all atoms (Å ²)	41.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 19.29% 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: CL, 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	A	0.56	0/3524	0.78	0/4761
1	B	0.41	0/3481	0.72	0/4703
2	C	0.36	0/703	0.66	0/945
2	D	0.56	0/800	0.79	1/1077 (0.1%)
All	All	0.49	0/8508	0.75	1/11486 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
2	D	0	1

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
2	D	564	HIS	N-CA-C	5.65	119.13	110.20

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	D	563	PHE	Peptide

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	3442	3412	3401	37	0
1	B	3411	3367	3363	37	0
2	C	686	634	633	12	0
2	D	779	718	716	6	0
3	A	6	0	0	0	0
4	A	2	0	0	0	0
5	A	50	0	0	7	0
5	B	18	0	0	0	0
5	C	6	0	0	1	0
5	D	8	0	0	1	0
All	All	8408	8131	8113	91	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 6.

The worst 5 of 91 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:1216:ASN:ND2	5:A:1432:HOH:O	2.14	0.78
1:A:1186:VAL:O	5:A:1425:HOH:O	2.07	0.71
1:B:1265:ASN:OD1	1:B:1268:ASN:ND2	2.23	0.71
2:D:565:ASN:OD1	5:D:608:HOH:O	2.09	0.70
1:A:1179:ARG:NH2	5:A:1413:HOH:O	2.25	0.68

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	413/443 (93%)	385 (93%)	28 (7%)	0	100	100
1	B	405/443 (91%)	349 (86%)	49 (12%)	7 (2%)	7	7
2	C	79/136 (58%)	71 (90%)	8 (10%)	0	100	100
2	D	91/136 (67%)	87 (96%)	3 (3%)	1 (1%)	11	13
All	All	988/1158 (85%)	892 (90%)	88 (9%)	8 (1%)	16	20

5 of 8 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	1166	ALA
2	D	474	GLU
1	B	1140	ARG
1	B	892	SER
1	B	980	TYR

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	A	387/408 (95%)	365 (94%)	22 (6%)	18	27
1	B	382/408 (94%)	347 (91%)	35 (9%)	8	11
2	C	79/128 (62%)	74 (94%)	5 (6%)	16	23
2	D	89/128 (70%)	84 (94%)	5 (6%)	19	28
All	All	937/1072 (87%)	870 (93%)	67 (7%)	13	18

5 of 67 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	C	493	THR
2	C	506	LYS
2	D	501	ARG
1	B	892	SER

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Mol	Chain	Res	Type
1	B	887	HIS

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	C	534	ASN
2	D	489	ASN
1	B	954	ASN
1	B	1090	ASN
1	B	1151	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 oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 8 ligands modelled in this entry, 8 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 [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	416/443 (93%)	-1.06	0 100 100	11, 23, 49, 67	2 (0%)
1	B	413/443 (93%)	-0.62	0 100 100	27, 55, 83, 113	0
2	C	83/136 (61%)	-0.50	0 100 100	25, 60, 80, 86	0
2	D	93/136 (68%)	-1.12	0 100 100	15, 29, 48, 68	0
All	All	1005/1158 (86%)	-0.84	0 100 100	11, 40, 77, 113	2 (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 oligosaccharides 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, 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
3	CL	A	1302	1/1	0.97	0.05	45,45,45,45	0
4	NA	A	1306	1/1	0.97	0.06	22,22,22,22	0
3	CL	A	1303	1/1	0.99	0.04	30,30,30,30	0
3	CL	A	1305	1/1	0.99	0.04	32,32,32,32	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	CL	A	1308	1/1	0.99	0.03	24,24,24,24	0
3	CL	A	1301	1/1	0.99	0.05	37,37,37,37	0
4	NA	A	1307	1/1	0.99	0.04	15,15,15,15	0
3	CL	A	1304	1/1	1.00	0.03	24,24,24,24	0

6.5 Other polymers [i](#)

There are no such residues in this entry.