



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 11:03 AM GMT

PDB ID : 3NY9
Title : Crystal structure of the human beta2 adrenergic receptor in complex with a novel inverse agonist
Authors : Fenalti, G.; Wacker, D.; Brown, M.A.; Katritch, V.; Abagyan, R.; Cherezov, V.; Stevens, R.C.; Accelerated Technologies Center for Gene to 3D Structure (ATCG3D); GPCR Network (GPCR)
Deposited on : 2010-07-14
Resolution : 2.84 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
<http://wwpdb.org/validation/2016/XrayValidationReportHelp>
with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20026688
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac : 5.8.0135
CCP4 : 6.5.0
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk26865

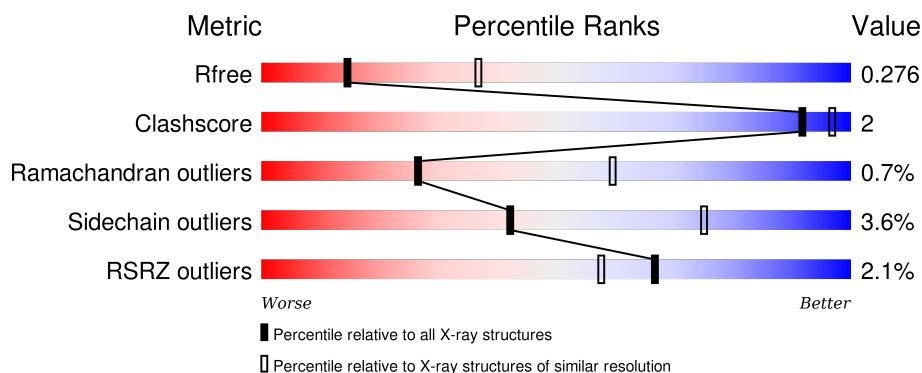
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.84 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}	91344	3170 (2.88-2.80)
Clashscore	102246	3658 (2.88-2.80)
Ramachandran outliers	100387	3591 (2.88-2.80)
Sidechain outliers	100360	3594 (2.88-2.80)
RSRZ outliers	91569	3184 (2.88-2.80)

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 on the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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	490	

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
2	CLR	A	1201	-	-	-	X

Continued on next page...

Continued from previous page...

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	CLR	A	1202	-	-	-	X
4	OLC	A	1204	X	-	-	X

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 3579 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.

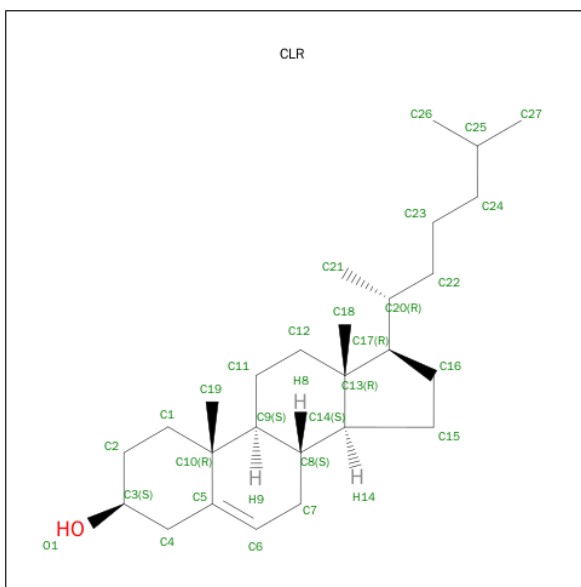
- Molecule 1 is a protein called Beta-2 adrenergic receptor, Lysozyme.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	439	Total	C	N	O	S	0	0	0
			3466	2270	573	600	23			

There are 20 discrepancies between the modelled and reference sequences:

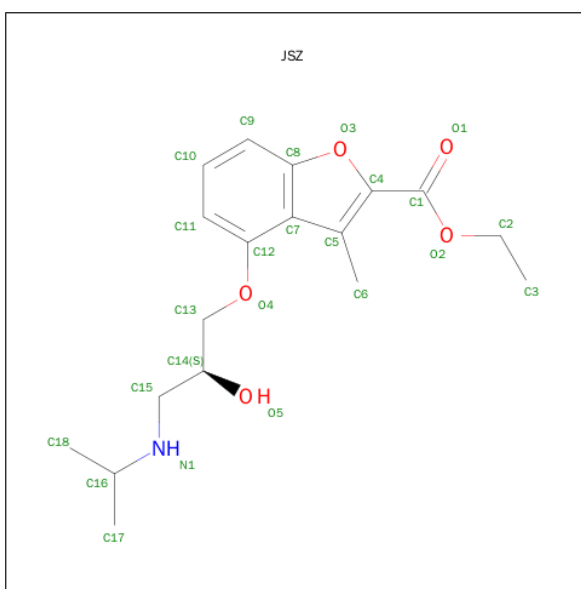
Chain	Residue	Modelled	Actual	Comment	Reference
A	-7	ASP	-	EXPRESSION TAG	UNP P07550
A	-6	TYR	-	EXPRESSION TAG	UNP P07550
A	-5	LYS	-	EXPRESSION TAG	UNP P07550
A	-4	ASP	-	EXPRESSION TAG	UNP P07550
A	-3	ASP	-	EXPRESSION TAG	UNP P07550
A	-2	ASP	-	EXPRESSION TAG	UNP P07550
A	-1	ASP	-	EXPRESSION TAG	UNP P07550
A	0	ALA	-	EXPRESSION TAG	UNP P07550
A	16	ARG	GLY	VARIANT	UNP P07550
A	27	GLN	GLU	VARIANT	UNP P07550
A	122	TRP	GLU	ENGINEERED MUTATION	UNP P07550
A	187	GLU	ASN	ENGINEERED MUTATION	UNP P07550
A	1054	THR	CYS	ENGINEERED MUTATION	UNP P00720
A	1097	ALA	CYS	ENGINEERED MUTATION	UNP P00720
A	349	HIS	-	EXPRESSION TAG	UNP P07550
A	350	HIS	-	EXPRESSION TAG	UNP P07550
A	351	HIS	-	EXPRESSION TAG	UNP P07550
A	352	HIS	-	EXPRESSION TAG	UNP P07550
A	353	HIS	-	EXPRESSION TAG	UNP P07550
A	354	HIS	-	EXPRESSION TAG	UNP P07550

- Molecule 2 is CHOLESTEROL (three-letter code: CLR) (formula: C₂₇H₄₆O).



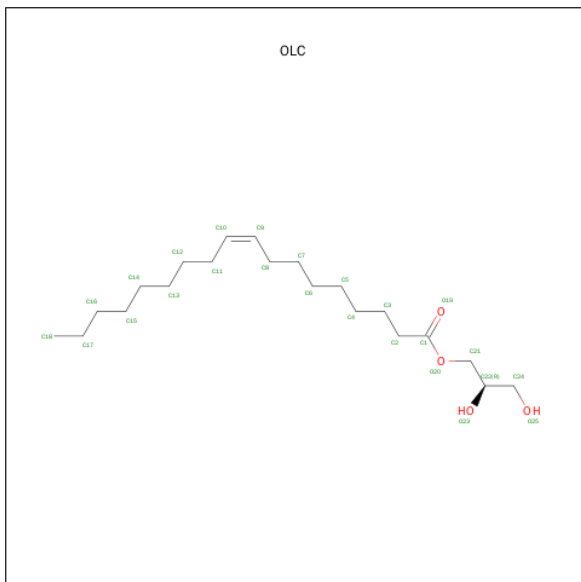
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			28	27	1		
2	A	1	Total	C	O	0	0
			28	27	1		

- Molecule 3 is ETHYL 4-({(2S)-2-HYDROXY-3-[(1-METHYLETHYL)AMINO]PROPYL}OXY)-3-METHYL-1-BENZOFURAN-2-CARBOXYLATE (three-letter code: JSZ) (formula: C₁₈H₂₅NO₅).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			24	18	1	5		

- Molecule 4 is (2R)-2,3-DIHYDROXYPROPYL (9Z)-OCTADEC-9-ENOATE (three-letter code: OLC) (formula: C₂₁H₄₀O₄).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			25	21	4		

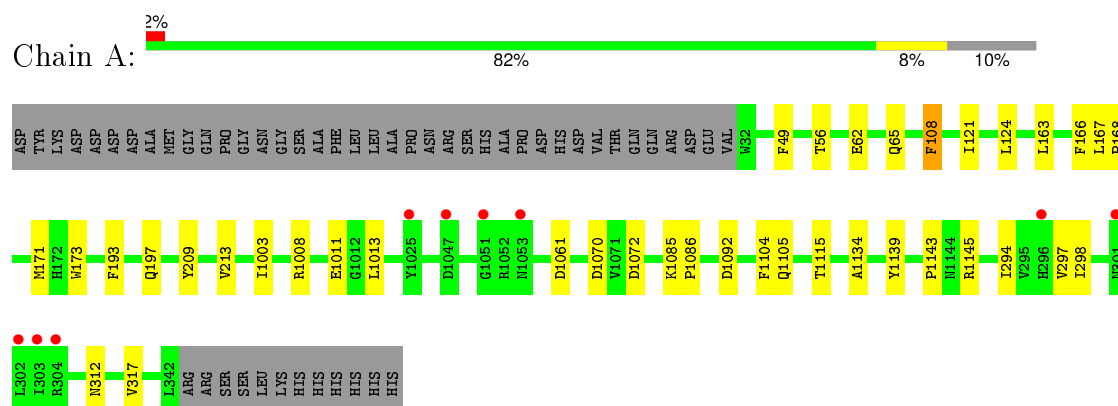
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	8	Total	O	0	0
			8	8		

3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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: Beta-2 adrenergic receptor, Lysozyme



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	40.58 Å 75.90 Å 174.18 Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	37.77 – 2.84 37.77 – 2.84	Depositor EDS
% Data completeness (in resolution range)	100.0 (37.77-2.84) 91.4 (37.77-2.84)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.13	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.25 (at 2.85 Å)	Xtriage
Refinement program	REFMAC 5.5.0102	Depositor
R, R_{free}	0.219 , 0.278 0.220 , 0.276	Depositor DCC
R_{free} test set	612 reflections (5.27%)	DCC
Wilson B-factor (Å ²)	58.4	Xtriage
Anisotropy	0.573	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 52.6	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Outliers	3 of 12234 reflections (0.025%)	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	3579	wwPDB-VP
Average B, all atoms (Å ²)	59.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.56% 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, 0.375 respectively for untwinned datasets, and 0.333, 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: OLC, CLR, JSZ

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	0.40	0/3547	0.51	0/4827

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

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	3466	0	3481	14	0
2	A	56	0	92	0	0
3	A	24	0	25	2	0
4	A	25	0	40	2	0
5	A	8	0	0	0	0
All	All	3579	0	3638	15	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.

All (15) 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:49:PHE:HB2	4:A:1204:OLC:H9	1.72	0.72
1:A:167:LEU:HB3	1:A:168:PRO:HD3	1.82	0.61
1:A:197:GLN:HB3	1:A:297:VAL:HG13	1.84	0.60
3:A:1203:JSZ:H6	3:A:1203:JSZ:H15A	1.93	0.50
1:A:1105:GLN:HB2	1:A:1145:ARG:NH2	2.29	0.47
1:A:108:PHE:CE1	1:A:166:PHE:HE2	2.33	0.47
1:A:1134:ALA:HA	1:A:1139:TYR:CD2	2.51	0.46
1:A:121:ILE:HA	1:A:124:LEU:HD12	1.98	0.45
1:A:193:PHE:CE2	3:A:1203:JSZ:H6B	2.52	0.45
1:A:49:PHE:CD1	4:A:1204:OLC:H4A	2.52	0.44
1:A:1070:ASP:HB3	1:A:1104:PHE:CE1	2.53	0.44
1:A:62:GLU:HA	1:A:65:GLN:HG3	2.00	0.42
1:A:171:MET:HB3	1:A:173:TRP:NE1	2.35	0.42
1:A:1085:LYS:HB3	1:A:1086:PRO:HD3	2.01	0.42
1:A:209:TYR:O	1:A:213:VAL:HG23	2.21	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	437/490 (89%)	425 (97%)	9 (2%)	3 (1%)	26 59

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	1011	GLU
1	A	1143	PRO
1	A	298	ILE

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	365/424 (86%)	352 (96%)	13 (4%)	42 75

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	56	THR
1	A	108	PHE
1	A	163	LEU
1	A	1003	ILE
1	A	1008	ARG
1	A	1013	LEU
1	A	1061	ASP
1	A	1072	ASP
1	A	1092	ASP
1	A	1115	THR
1	A	294	ILE
1	A	312	ASN
1	A	317	VAL

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 carbohydrates in this entry.

5.6 Ligand geometry

4 ligands are modelled in this entry.

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	CLR	A	1201	-	31,31,31	1.62	1 (3%)	48,48,48	1.80	5 (10%)
2	CLR	A	1202	-	31,31,31	1.68	1 (3%)	48,48,48	1.72	5 (10%)
3	JSZ	A	1203	-	20,25,25	1.34	1 (5%)	22,34,34	1.58	6 (27%)
4	OLC	A	1204	-	24,24,24	0.99	1 (4%)	25,25,25	0.91	2 (8%)

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
2	CLR	A	1201	-	-	0/10/68/68	0/4/4/4
2	CLR	A	1202	-	-	0/10/68/68	0/4/4/4
3	JSZ	A	1203	-	-	0/15/17/17	0/1/2/2
4	OLC	A	1204	-	1/1/2/4	0/24/24/24	0/0/0/0

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	1204	OLC	O20-C1	4.56	1.47	1.33
3	A	1203	JSZ	O2-C1	5.36	1.46	1.33
2	A	1201	CLR	C6-C5	8.43	1.53	1.33
2	A	1202	CLR	C6-C5	8.70	1.54	1.33

All (18) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1201	CLR	C4-C5-C6	-6.97	108.74	120.57
2	A	1201	CLR	C7-C6-C5	-6.05	112.00	125.01
2	A	1202	CLR	C7-C6-C5	-5.91	112.32	125.01

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1202	CLR	C4-C5-C6	-5.89	110.57	120.57
2	A	1201	CLR	C10-C5-C6	-5.11	113.48	122.92
2	A	1202	CLR	C10-C5-C6	-4.87	113.91	122.92
3	A	1203	JSZ	C5-C7-C8	-4.07	102.84	110.03
3	A	1203	JSZ	O4-C12-C11	-2.31	118.89	124.34
2	A	1202	CLR	C19-C10-C9	-2.20	108.86	111.67
2	A	1201	CLR	C1-C10-C9	-2.02	106.05	108.64
3	A	1203	JSZ	C13-O4-C12	2.10	125.19	118.22
3	A	1203	JSZ	C6-C5-C4	2.24	132.67	127.84
4	A	1204	OLC	C21-O20-C1	2.36	123.44	116.85
3	A	1203	JSZ	C2-O2-C1	2.43	122.07	116.46
2	A	1201	CLR	C7-C8-C9	2.62	113.29	109.71
2	A	1202	CLR	C3-C4-C5	2.67	117.31	111.82
3	A	1203	JSZ	O2-C1-C4	2.77	119.83	112.49
4	A	1204	OLC	O20-C1-C2	2.82	120.50	111.90

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
4	A	1204	OLC	C22

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	1203	JSZ	2	0
4	A	1204	OLC	2	0

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 [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	439/490 (89%)	-0.12	9 (2%) 67 57	34, 57, 84, 108	0

All (9) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	302	LEU	3.5
1	A	301	ASN	2.7
1	A	1025	TYR	2.6
1	A	1047	ASP	2.6
1	A	304	ARG	2.4
1	A	303	ILE	2.3
1	A	296	HIS	2.1
1	A	1053	ASN	2.1
1	A	1051	GLY	2.1

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 carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(\AA^2)	Q<0.9
2	CLR	A	1202	28/28	0.79	0.38	7.57	55,73,79,81	0
4	OLC	A	1204	25/25	0.86	0.29	2.95	46,64,75,80	0
2	CLR	A	1201	28/28	0.89	0.26	2.44	51,64,70,73	0
3	JSZ	A	1203	24/24	0.96	0.20	0.99	43,52,60,65	0

6.5 Other polymers ⓘ

There are no such residues in this entry.