



wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 1, 2016 – 10:24 PM GMT

PDB ID : 4XP5
Title : X-ray structure of Drosophila dopamine transporter bound to cocaine analogue-RTI55
Authors : Gouaux, E.; Penmatsa, A.; Wang, K.
Deposited on : 2015-01-16
Resolution : 3.30 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
<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

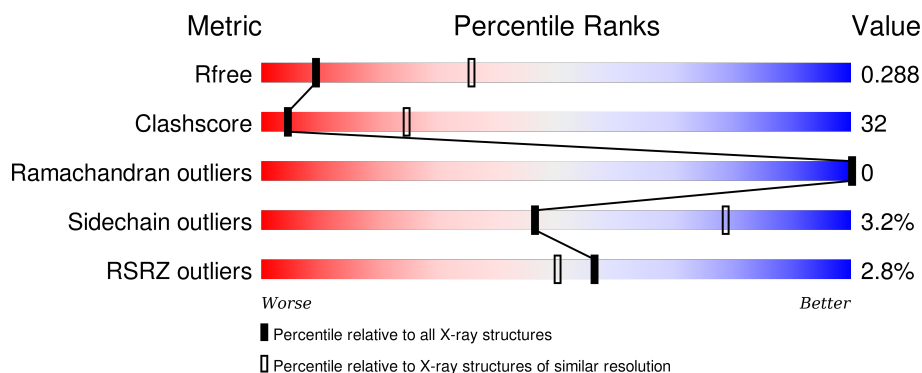
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.30 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}	91344	2060 (3.40-3.20)
Clashscore	102246	1058 (3.38-3.22)
Ramachandran outliers	100387	1038 (3.38-3.22)
Sidechain outliers	100360	1037 (3.38-3.22)
RSRZ outliers	91569	2070 (3.40-3.20)

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	534	<div> <div></div> <div>45%</div> <div>53%</div> <div>.</div> </div>
2	L	213	<div> <div>5%</div> <div>62%</div> <div>37%</div> <div>.</div> </div>
3	H	219	<div> <div>5%</div> <div>53%</div> <div>47%</div> <div>.</div> </div>

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
6	CLR	A	603	-	-	-	X
7	P4G	A	604	-	-	-	X

2 Entry composition

There are 9 unique types of molecules in this entry. The entry contains 7531 atoms, of which 18 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 Dopamine transporter, isoform B.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	534	4171	2803	636	714	18	0	1	0

There are 43 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	74	ALA	VAL	engineered mutation	UNP A0A0B4KEX2
A	?	-	SER	deletion	UNP A0A0B4KEX2
A	?	-	GLN	deletion	UNP A0A0B4KEX2
A	?	-	ASN	deletion	UNP A0A0B4KEX2
A	?	-	ALA	deletion	UNP A0A0B4KEX2
A	?	-	SER	deletion	UNP A0A0B4KEX2
A	?	-	ARG	deletion	UNP A0A0B4KEX2
A	?	-	VAL	deletion	UNP A0A0B4KEX2
A	?	-	PRO	deletion	UNP A0A0B4KEX2
A	?	-	VAL	deletion	UNP A0A0B4KEX2
A	?	-	ILE	deletion	UNP A0A0B4KEX2
A	?	-	GLY	deletion	UNP A0A0B4KEX2
A	?	-	ASN	deletion	UNP A0A0B4KEX2
A	?	-	TYR	deletion	UNP A0A0B4KEX2
A	?	-	SER	deletion	UNP A0A0B4KEX2
A	?	-	ASP	deletion	UNP A0A0B4KEX2
A	?	-	LEU	deletion	UNP A0A0B4KEX2
A	?	-	TYR	deletion	UNP A0A0B4KEX2
A	?	-	ALA	deletion	UNP A0A0B4KEX2
A	?	-	MET	deletion	UNP A0A0B4KEX2
A	?	-	GLY	deletion	UNP A0A0B4KEX2
A	?	-	ASN	deletion	UNP A0A0B4KEX2
A	?	-	GLN	deletion	UNP A0A0B4KEX2
A	?	-	SER	deletion	UNP A0A0B4KEX2
A	?	-	LEU	deletion	UNP A0A0B4KEX2
A	?	-	LEU	deletion	UNP A0A0B4KEX2
A	?	-	TYR	deletion	UNP A0A0B4KEX2

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Chain	Residue	Modelled	Actual	Comment	Reference
A	?	-	ASN	deletion	UNP A0A0B4KEX2
A	?	-	GLU	deletion	UNP A0A0B4KEX2
A	?	-	THR	deletion	UNP A0A0B4KEX2
A	?	-	TYR	deletion	UNP A0A0B4KEX2
A	?	-	MET	deletion	UNP A0A0B4KEX2
A	?	-	ASN	deletion	UNP A0A0B4KEX2
A	?	-	GLY	deletion	UNP A0A0B4KEX2
A	?	-	SER	deletion	UNP A0A0B4KEX2
A	?	-	SER	deletion	UNP A0A0B4KEX2
A	?	-	LEU	deletion	UNP A0A0B4KEX2
A	?	-	ASP	deletion	UNP A0A0B4KEX2
A	?	-	THR	deletion	UNP A0A0B4KEX2
A	?	-	SER	deletion	UNP A0A0B4KEX2
A	?	-	ALA	deletion	UNP A0A0B4KEX2
A	?	-	VAL	deletion	UNP A0A0B4KEX2
A	415	ALA	LEU	engineered mutation	UNP A0A0B4KEX2

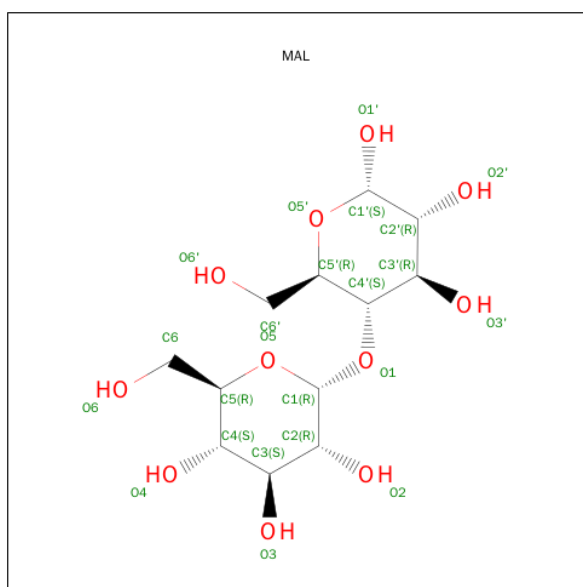
- Molecule 2 is a protein called Antibody fragment heavy chain-protein, 9D5-heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	L	213	Total	C	N	O	S	0	0	0
			1601	999	263	331	8			

- Molecule 3 is a protein called Ighg protein.

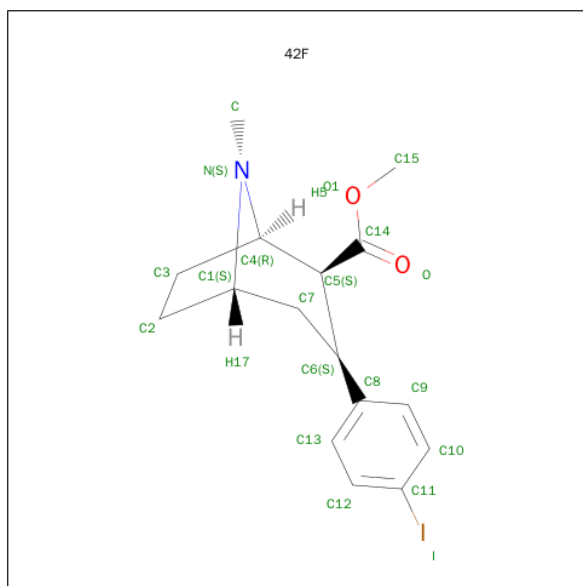
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	H	219	Total	C	N	O	S	0	0	0
			1628	1024	275	321	8			

- Molecule 4 is MALTOSE (three-letter code: MAL) (formula: C₁₂H₂₂O₁₁).



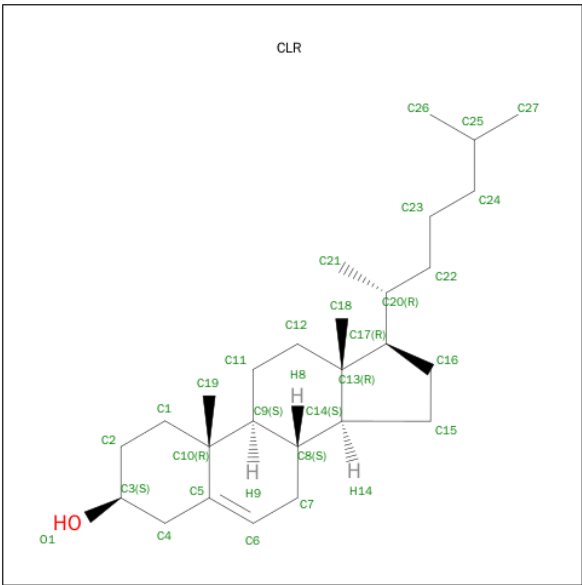
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			23	12	11		

- Molecule 5 is methyl (1R,2S,3S,5S)-3-(4-iodophenyl)-8-methyl-8-azabicyclo[3.2.1]octane-2-carboxylate (three-letter code: 42F) (formula: $C_{16}H_{20}INO_2$).



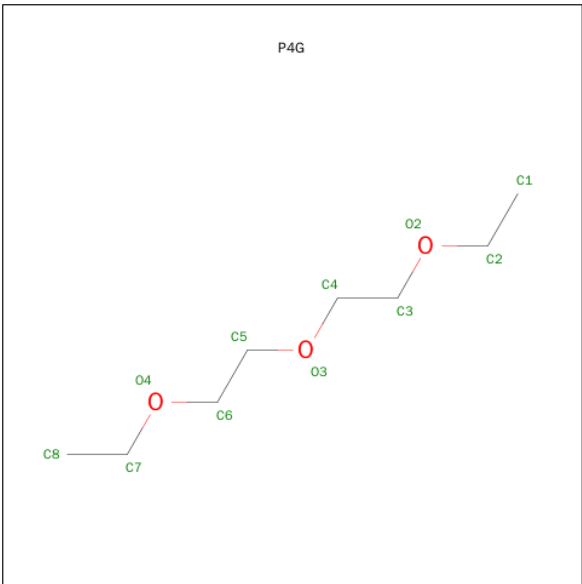
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	I	N	O	
			20	16	1	1	2	0

- Molecule 6 is CHOLESTEROL (three-letter code: CLR) (formula: $C_{27}H_{46}O$).



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

- Molecule 7 is 1-ETHOXY-2-(2-ETHOXYETHOXY)ETHANE (three-letter code: P4G) (formula: C₈H₁₈O₃).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	A	1	Total	C	H	O	0	0
			29	8	18	3		

- Molecule 8 is SODIUM ION (three-letter code: NA) (formula: Na).

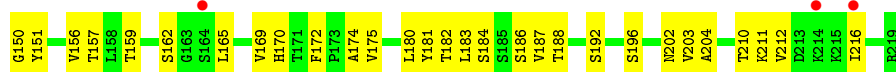
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	2	Total	Na	0	0
			2	2		

- Molecule 9 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	A	1	Total	Cl	0	0
			1	1		



• Molecule 3: Ighg protein



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	95.25Å 137.98Å 163.39Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.28 – 3.30 47.28 – 3.30	Depositor EDS
% Data completeness (in resolution range)	86.2 (47.28-3.30) 86.2 (47.28-3.30)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.80 (at 3.33Å)	Xtriage
Refinement program	PHENIX	Depositor
R, R_{free}	0.245 , 0.286 0.259 , 0.288	Depositor DCC
R_{free} test set	1442 reflections (5.33%)	DCC
Wilson B-factor (Å ²)	80.2	Xtriage
Anisotropy	0.008	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 34.7	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	2 of 28515 reflections (0.007%)	Xtriage
F_o, F_c correlation	0.86	EDS
Total number of atoms	7531	wwPDB-VP
Average B, all atoms (Å ²)	72.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.18% 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: CL, P4G, NA, 42F, MAL, CLR

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	0.23	0/4318	0.39	0/5916
2	L	0.23	0/1639	0.39	0/2231
3	H	0.23	0/1667	0.41	0/2275
All	All	0.23	0/7624	0.40	0/10422

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	4171	0	4020	304	0
2	L	1601	0	1501	84	0
3	H	1628	0	1564	109	0
4	A	23	0	22	2	0
5	A	20	0	20	3	0
6	A	56	0	92	14	0
7	A	11	18	18	0	0
8	A	2	0	0	0	0
9	A	1	0	0	1	0
All	All	7513	18	7237	479	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 32.

The worst 5 of 479 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:75:VAL:HB	1:A:526:VAL:HG11	1.38	1.05
3:H:157:THR:HB	3:H:204:ALA:HB3	1.37	1.02
1:A:95:ALA:HA	1:A:329:LEU:HD23	1.42	0.97
1:A:115:LEU:HD11	1:A:567:SER:HA	1.48	0.94
1:A:73:LEU:HA	1:A:317:VAL:HG11	1.50	0.93

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	533/534 (100%)	509 (96%)	24 (4%)	0	100	100
2	L	211/213 (99%)	200 (95%)	11 (5%)	0	100	100
3	H	217/219 (99%)	210 (97%)	7 (3%)	0	100	100
All	All	961/966 (100%)	919 (96%)	42 (4%)	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	420/439 (96%)	403 (96%)	17 (4%)	38	74
2	L	178/186 (96%)	174 (98%)	4 (2%)	60	84
3	H	178/187 (95%)	174 (98%)	4 (2%)	60	84
All	All	776/812 (96%)	751 (97%)	25 (3%)	46	79

5 of 25 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	518	TYR
1	A	577	PHE
3	H	134	CYS
1	A	570	MET
1	A	586	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
3	H	202	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 carbohydrates in this entry.

5.6 Ligand geometry ⓘ

Of 8 ligands modelled in this entry, 3 are monoatomic - leaving 5 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	MAL	A	601	-	24,24,24	0.48	0	35,35,35	0.88	2 (5%)
5	42F	A	602	-	22,22,22	1.80	2 (9%)	27,32,32	1.63	7 (25%)
6	CLR	A	603	-	31,31,31	0.67	0	48,48,48	1.17	4 (8%)
7	P4G	A	604	-	10,10,10	0.41	0	9,9,9	0.35	0
6	CLR	A	605	-	31,31,31	0.71	0	48,48,48	1.37	4 (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
4	MAL	A	601	-	-	0/8/48/48	0/2/2/2
5	42F	A	602	-	-	0/10/35/35	0/1/3/3
6	CLR	A	603	-	-	0/10/68/68	0/4/4/4
7	P4G	A	604	-	-	0/8/8/8	0/0/0/0
6	CLR	A	605	-	-	0/10/68/68	0/4/4/4

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	602	42F	C8-C6	-7.57	1.40	1.51
5	A	602	42F	C6-C5	-2.04	1.52	1.55

The worst 5 of 17 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	602	42F	C15-O1-C14	-2.86	109.28	115.99
6	A	605	CLR	C10-C5-C6	-2.85	117.66	122.92
6	A	603	CLR	C13-C17-C20	-2.64	114.88	119.46
5	A	602	42F	C-N-C1	-2.64	108.08	113.24
6	A	605	CLR	C13-C17-C20	-2.45	115.22	119.46

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

4 monomers are involved in 19 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	601	MAL	2	0
5	A	602	42F	3	0
6	A	603	CLR	8	0
6	A	605	CLR	6	0

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	534/534 (100%)	-0.04	4 (0%) 89 86	47, 69, 93, 113	0
2	L	213/213 (100%)	0.30	11 (5%) 31 25	52, 73, 101, 108	0
3	H	219/219 (100%)	0.38	12 (5%) 29 23	51, 69, 114, 142	0
All	All	966/966 (100%)	0.13	27 (2%) 56 50	47, 70, 100, 142	0

The worst 5 of 27 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	H	135	GLY	3.8
3	H	136	ASP	3.8
2	L	154	SER	3.4
2	L	53	SER	3.3
1	A	599	ASP	3.2

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
6	CLR	A	603	28/28	0.94	0.37	4.37	49,73,83,84	0
7	P4G	A	604	11/11	0.65	0.44	2.78	91,112,131,134	0
8	NA	A	606	1/1	0.96	0.29	1.41	66,66,66,66	0
6	CLR	A	605	28/28	0.93	0.28	1.09	51,60,66,67	0
4	MAL	A	601	23/23	0.84	0.29	1.07	72,91,104,116	0
9	CL	A	607	1/1	0.96	0.23	0.43	76,76,76,76	0
8	NA	A	608	1/1	0.75	0.26	0.17	67,67,67,67	0
5	42F	A	602	20/20	0.98	0.21	-0.71	58,67,73,106	0

6.5 Other polymers [i](#)

There are no such residues in this entry.