



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 26, 2018 – 12:54 PM EDT

PDB ID : 2QS1
Title : Crystal structure of the GluR5 ligand binding core dimer in complex with UBP315 at 1.80 Angstroms resolution
Authors : Alushin, G.M.; Jane, D.E.; Mayer, M.L.
Deposited on : 2007-07-30
Resolution : 1.80 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.7.3 (157068), CSD as539be (2018)
Xtriage (Phenix) : 1.13
EDS : rb-20031021
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)
Refmac : 5.8.0158
CCP4 : 7.0 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : rb-20031021

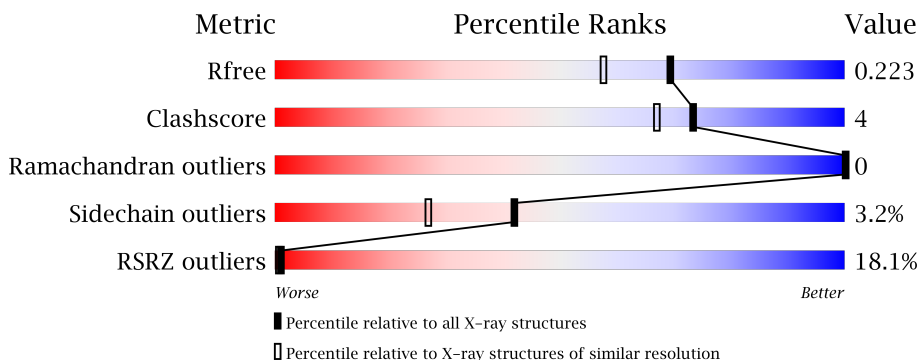
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.80 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}	111664	5253 (1.80-1.80)
Clashscore	122126	6077 (1.80-1.80)
Ramachandran outliers	120053	6011 (1.80-1.80)
Sidechain outliers	120020	6010 (1.80-1.80)
RSRZ outliers	108989	5157 (1.80-1.80)

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	258	 18% 88% 9%
1	B	258	 17% 87% 10%

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 4620 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 Glutamate receptor, ionotropic kainate 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	251	2089	1333	347	396	13	0	10	0
1	B	251	2079	1327	345	393	14	0	9	0

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	EXPRESSION TAG	UNP P22756
A	2	SER	-	EXPRESSION TAG	UNP P22756
A	117	GLY	-	LINKER	UNP P22756
A	118	THR	-	LINKER	UNP P22756
A	258	SER	GLU	ENGINEERED	UNP P22756
B	1	GLY	-	EXPRESSION TAG	UNP P22756
B	2	SER	-	EXPRESSION TAG	UNP P22756
B	117	GLY	-	LINKER	UNP P22756
B	118	THR	-	LINKER	UNP P22756
B	258	SER	GLU	ENGINEERED	UNP P22756

- Molecule 2 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

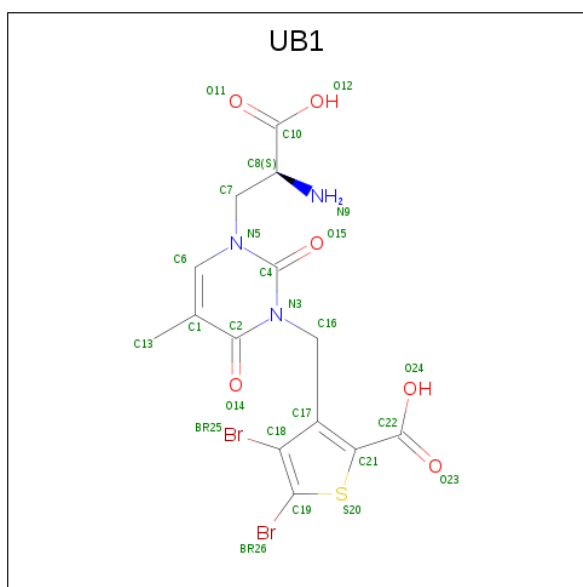
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	1	Total	Cl	0	0
			1	1		
2	A	1	Total	Cl	0	0
			1	1		

- Molecule 3 is PENTAETHYLENE GLYCOL (three-letter code: 1PE) (formula: C₁₀H₂₂O₆).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			16	10	6		
3	B	1	Total	C	O	0	0
			16	10	6		

- Molecule 4 is 3-({3-[(2S)-2-amino-2-carboxyethyl]-5-methyl-2,6-dioxo-3,6-dihydropyrimidin-1(2H)-yl}methyl)-4,5-dibromothiophene-2-carboxylic acid (three-letter code: UB1) (formula: C₁₄H₁₃Br₂N₃O₆S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
4	A	1	Total	Br	C	N	O	S	0	0
			26	2	14	3	6	1		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
			Total	Br	C	N	O			S
4	B	1	26	2	14	3	6	1	0	0

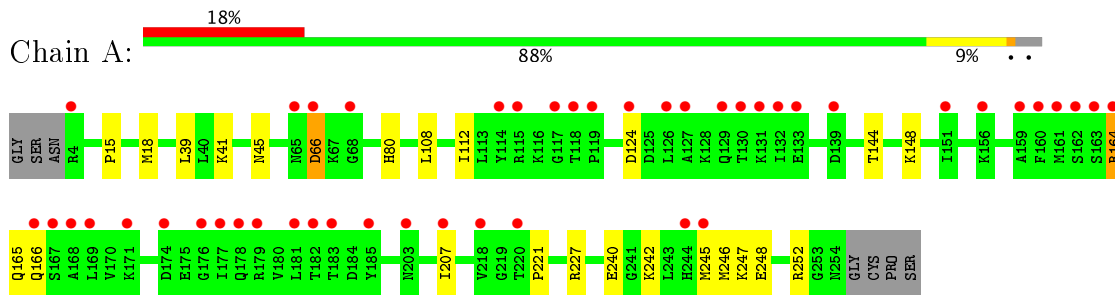
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	190	Total	O	0	0
			190	190		
5	B	176	Total	O	0	0
			176	176		

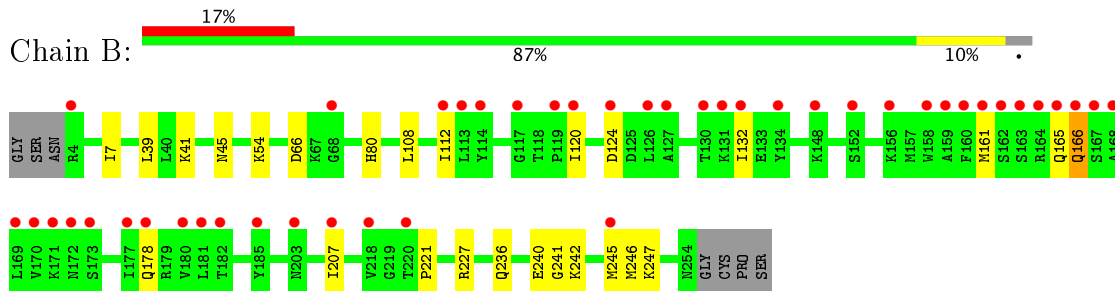
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of 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: Glutamate receptor, ionotropic kainate 1



- Molecule 1: Glutamate receptor, ionotropic kainate 1



4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	97.82Å 97.82Å 129.04Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	21.57 – 1.80 21.57 – 1.80	Depositor EDS
% Data completeness (in resolution range)	99.9 (21.57-1.80) 99.9 (21.57-1.80)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.16 (at 1.80Å)	Xtrriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.198 , 0.219 0.206 , 0.223	Depositor DCC
R_{free} test set	2884 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å ²)	25.3	Xtrriage
Anisotropy	0.105	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 45.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.35$	Xtrriage
Estimated twinning fraction	0.486 for -k,-h,-l	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	4620	wwPDB-VP
Average B, all atoms (Å ²)	34.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.71% 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, UB1, 1PE

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	0.42	0/2128	0.55	0/2865
1	B	0.42	0/2118	0.55	0/2852
All	All	0.42	0/4246	0.55	0/5717

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	A	2089	0	2108	14	0
1	B	2079	0	2100	16	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	16	0	22	0	0
3	B	16	0	22	1	0
4	A	26	0	11	0	0
4	B	26	0	11	0	0
5	A	190	0	0	3	0
5	B	176	0	0	6	0
All	All	4620	0	4274	31	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 4.

All (31) 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:221[A]:PRO:HG3	5:A:671:HOH:O	1.74	0.87
1:B:221[A]:PRO:HG3	5:B:705:HOH:O	1.76	0.86
1:A:248:GLU:O	1:A:252:ARG:HG3	1.93	0.68
1:B:240[A]:GLU:HG3	1:B:242:LYS:HG3	1.76	0.67
1:B:120:ILE:HD11	1:B:132:ILE:HD13	1.78	0.66
1:B:80:HIS:HA	5:B:705:HOH:O	1.95	0.65
1:A:80:HIS:HA	5:A:671:HOH:O	1.96	0.65
3:B:601:1PE:OH7	5:B:761:HOH:O	2.16	0.63
1:B:245[B]:MET:HG3	5:B:764:HOH:O	2.01	0.60
1:B:166:GLN:CD	1:B:166:GLN:H	2.05	0.59
1:A:242:LYS:HA	1:A:245[B]:MET:HG2	1.84	0.58
1:A:112:ILE:HB	1:A:207:ILE:HB	1.87	0.57
1:A:240[A]:GLU:HG3	1:A:242:LYS:HG3	1.91	0.53
1:A:66:ASP:OD2	1:A:66:ASP:N	2.43	0.51
1:B:112:ILE:HB	1:B:207:ILE:HB	1.92	0.51
1:A:144:THR:O	1:A:148:LYS:HG2	2.11	0.51
1:A:41:LYS:HE2	1:A:45:ASN:HD21	1.75	0.50
1:B:39:LEU:N	1:B:246[B]:MET:HE1	2.26	0.49
1:B:161:MET:O	1:B:165:GLN:HA	2.13	0.48
1:B:41:LYS:HE2	1:B:45:ASN:HD21	1.77	0.48
1:B:242:LYS:HA	1:B:245[B]:MET:HG2	1.97	0.46
1:A:248:GLU:O	1:A:252:ARG:CG	2.63	0.45
1:A:164:ARG:HH21	1:A:166:GLN:HB3	1.82	0.45
1:A:80:HIS:CE1	5:A:769:HOH:O	2.70	0.45
1:B:236:GLN:OE1	5:B:774:HOH:O	2.21	0.44
1:A:15:PRO:HA	1:A:18[A]:MET:SD	2.57	0.44
1:B:7[B]:ILE:CG2	1:B:54[B]:LYS:HD2	2.48	0.43
1:A:39:LEU:HB2	1:A:246:MET:HE1	2.01	0.42
1:B:7[B]:ILE:HG23	1:B:54[B]:LYS:HD2	2.01	0.42
1:B:80:HIS:CE1	5:B:775:HOH:O	2.72	0.41
1:B:241:GLY:O	1:B:245[B]:MET:HG2	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	259/258 (100%)	249 (96%)	10 (4%)	0	100	100
1	B	258/258 (100%)	253 (98%)	5 (2%)	0	100	100
All	All	517/516 (100%)	502 (97%)	15 (3%)	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	230/225 (102%)	223 (97%)	7 (3%)	44	29
1	B	229/225 (102%)	222 (97%)	7 (3%)	43	28
All	All	459/450 (102%)	445 (97%)	14 (3%)	42	28

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	66	ASP
1	A	108	LEU
1	A	124	ASP
1	A	164	ARG
1	A	165	GLN
1	A	227	ARG
1	A	247	LYS
1	B	66	ASP

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Mol	Chain	Res	Type
1	B	108	LEU
1	B	124	ASP
1	B	166	GLN
1	B	178	GLN
1	B	227	ARG
1	B	247	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	45	ASN
1	B	45	ASN
1	B	178	GLN

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 carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 6 ligands modelled in this entry, 2 are monoatomic - leaving 4 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
3	1PE	A	602	-	15,15,15	0.46	0	14,14,14	0.33	0
4	UB1	A	603	-	12,27,27	1.83	2 (16%)	12,40,40	2.63	3 (25%)
3	1PE	B	601	-	15,15,15	0.47	0	14,14,14	0.35	0
4	UB1	B	602	-	12,27,27	1.85	2 (16%)	12,40,40	2.61	3 (25%)

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
3	1PE	A	602	-	-	0/13/13/13	0/0/0/0
4	UB1	A	603	-	-	0/5/16/16	0/2/2/2
3	1PE	B	601	-	-	0/13/13/13	0/0/0/0
4	UB1	B	602	-	-	0/5/16/16	0/2/2/2

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	603	UB1	BR25-C18	3.95	1.97	1.89
4	B	602	UB1	BR25-C18	3.98	1.98	1.89
4	B	602	UB1	C19-C18	4.38	1.47	1.38
4	A	603	UB1	C19-C18	4.38	1.47	1.38

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	603	UB1	BR25-C18-C19	-6.16	121.13	127.67
4	B	602	UB1	BR25-C18-C19	-6.00	121.30	127.67
4	B	602	UB1	C17-C16-N3	-3.63	109.53	114.12
4	A	603	UB1	C17-C16-N3	-3.53	109.67	114.12
4	A	603	UB1	C16-N3-C4	4.51	123.20	117.92
4	B	602	UB1	C16-N3-C4	4.59	123.29	117.92

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	601	1PE	1	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

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	A	251/258 (97%)	0.82	46 (18%) 1 1	14, 35, 56, 60	0
1	B	251/258 (97%)	0.85	45 (17%) 1 1	14, 34, 55, 60	0
All	All	502/516 (97%)	0.83	91 (18%) 1 1	14, 35, 56, 60	0

All (91) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	166	GLN	8.3
1	B	163	SER	7.2
1	A	127	ALA	6.8
1	B	160	PHE	6.8
1	A	163	SER	6.4
1	B	161	MET	6.2
1	A	160	PHE	6.1
1	A	119	PRO	6.0
1	B	131	LYS	5.7
1	B	114	TYR	5.7
1	A	161	MET	5.7
1	B	124	ASP	5.3
1	B	127	ALA	5.2
1	B	171	LYS	4.8
1	B	119	PRO	4.8
1	B	178	GLN	4.7
1	B	167	SER	4.6
1	A	131	LYS	4.5
1	B	117	GLY	4.4
1	A	124	ASP	4.4
1	A	114	TYR	4.3
1	B	148	LYS	4.2
1	A	167	SER	4.2
1	A	178	GLN	4.0

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Mol	Chain	Res	Type	RSRZ
1	B	173	SER	4.0
1	A	159	ALA	3.9
1	B	168	ALA	3.8
1	A	126	LEU	3.8
1	B	159	ALA	3.8
1	B	166	GLN	3.7
1	A	183	THR	3.7
1	B	162	SER	3.7
1	B	164	ARG	3.5
1	B	207	ILE	3.4
1	B	68	GLY	3.4
1	B	130	THR	3.4
1	A	171	LYS	3.4
1	B	181	LEU	3.4
1	A	130	THR	3.3
1	A	162	SER	3.3
1	A	133	GLU	3.2
1	B	177	ILE	3.2
1	B	182	THR	3.1
1	A	132	ILE	3.1
1	A	66	ASP	3.0
1	A	68	GLY	3.0
1	B	203	ASN	2.9
1	A	245[A]	MET	2.9
1	B	112	ILE	2.9
1	A	181	LEU	2.9
1	B	126	LEU	2.9
1	A	168	ALA	2.9
1	A	207	ILE	2.8
1	B	134	TYR	2.8
1	B	132	ILE	2.8
1	A	117	GLY	2.8
1	A	129	GLN	2.8
1	B	169	LEU	2.7
1	B	156	LYS	2.7
1	A	185	TYR	2.7
1	A	182	THR	2.6
1	A	156	LYS	2.6
1	A	203	ASN	2.6
1	A	218	VAL	2.6
1	B	180	VAL	2.6
1	A	169	LEU	2.5

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Mol	Chain	Res	Type	RSRZ
1	A	177	ILE	2.5
1	B	170	VAL	2.5
1	B	245[A]	MET	2.4
1	B	220	THR	2.4
1	B	113	LEU	2.3
1	B	185	TYR	2.3
1	B	120	ILE	2.3
1	A	220	THR	2.2
1	B	158	TRP	2.2
1	A	179	ARG	2.2
1	A	4	ARG	2.2
1	B	218	VAL	2.2
1	A	164	ARG	2.1
1	B	4	ARG	2.1
1	A	151	ILE	2.1
1	A	174	ASP	2.1
1	A	115	ARG	2.1
1	A	65	ASN	2.1
1	A	176	GLY	2.1
1	A	118	THR	2.0
1	B	165	GLN	2.0
1	B	152	SER	2.0
1	A	139	ASP	2.0
1	B	172	ASN	2.0
1	A	244	HIS	2.0

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. 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(\AA^2)	Q<0.9
4	UB1	A	603	26/26	0.92	0.10	30,37,43,45	2
3	1PE	A	602	16/16	0.93	0.13	20,24,29,31	16
4	UB1	B	602	26/26	0.94	0.10	30,38,43,45	2
3	1PE	B	601	16/16	0.95	0.11	18,24,31,31	16
2	CL	B	502	1/1	0.99	0.06	24,24,24,24	1
2	CL	A	501	1/1	0.99	0.06	24,24,24,24	1

6.5 Other polymers [i](#)

There are no such residues in this entry.