



Full wwPDB X-ray Structure Validation Report ⓘ

May 29, 2020 – 05:50 am BST

PDB ID : 4NC4
Title : Crystal structure of photoreceptor AtUVR8 mutant W285F and light-induced structural changes at 120K
Authors : Yang, X.; Zeng, X.; Zhao, K.-H.; Ren, Z.
Deposited on : 2013-10-23
Resolution : 1.75 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
Xtriage (Phenix)	:	1.13
EDS	:	2.11
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)	:	2.11

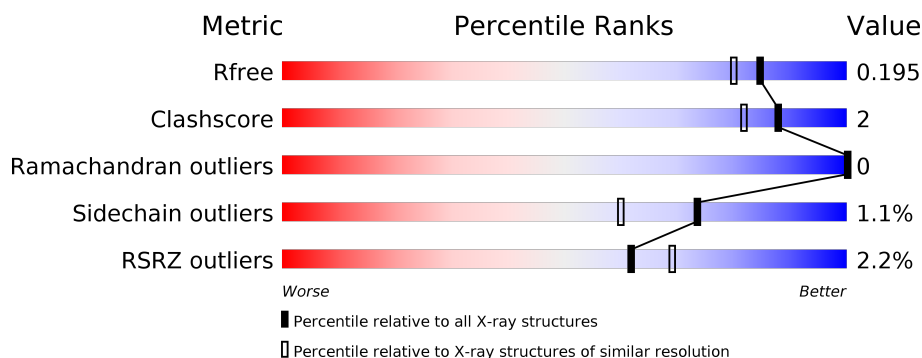
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.75 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	2340 (1.76-1.76)
Clashscore	141614	2466 (1.76-1.76)
Ramachandran outliers	138981	2437 (1.76-1.76)
Sidechain outliers	138945	2437 (1.76-1.76)
RSRZ outliers	127900	2298 (1.76-1.76)

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 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	377	<div> <div>2%</div> <div> <div></div> <div>93%</div> <div>5% •</div> </div> </div>
1	B	377	<div> <div>3%</div> <div> <div></div> <div>92%</div> <div>6% •</div> </div> </div>
1	C	377	<div> <div>0%</div> <div> <div></div> <div>93%</div> <div>5% ••</div> </div> </div>
1	D	377	<div> <div>2%</div> <div> <div></div> <div>93%</div> <div>5% •</div> </div> </div>

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 13084 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 Ultraviolet-B receptor UVR8.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	369	Total	C	N	O	S	0	8	0
			2853	1778	512	549	14			
1	B	369	Total	C	N	O	S	0	9	0
			2864	1781	518	550	15			
1	C	369	Total	C	N	O	S	0	7	0
			2844	1771	514	545	14			
1	D	369	Total	C	N	O	S	0	10	0
			2862	1782	517	549	14			

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	285	PHE	TRP	ENGINEERED MUTATION	UNP Q9FN03
A	382	LEU	-	EXPRESSION TAG	UNP Q9FN03
A	383	GLU	-	EXPRESSION TAG	UNP Q9FN03
A	384	HIS	-	EXPRESSION TAG	UNP Q9FN03
A	385	HIS	-	EXPRESSION TAG	UNP Q9FN03
A	386	HIS	-	EXPRESSION TAG	UNP Q9FN03
A	387	HIS	-	EXPRESSION TAG	UNP Q9FN03
A	388	HIS	-	EXPRESSION TAG	UNP Q9FN03
A	389	HIS	-	EXPRESSION TAG	UNP Q9FN03
B	285	PHE	TRP	ENGINEERED MUTATION	UNP Q9FN03
B	382	LEU	-	EXPRESSION TAG	UNP Q9FN03
B	383	GLU	-	EXPRESSION TAG	UNP Q9FN03
B	384	HIS	-	EXPRESSION TAG	UNP Q9FN03
B	385	HIS	-	EXPRESSION TAG	UNP Q9FN03
B	386	HIS	-	EXPRESSION TAG	UNP Q9FN03
B	387	HIS	-	EXPRESSION TAG	UNP Q9FN03
B	388	HIS	-	EXPRESSION TAG	UNP Q9FN03
B	389	HIS	-	EXPRESSION TAG	UNP Q9FN03
C	285	PHE	TRP	ENGINEERED MUTATION	UNP Q9FN03
C	382	LEU	-	EXPRESSION TAG	UNP Q9FN03
C	383	GLU	-	EXPRESSION TAG	UNP Q9FN03

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Chain	Residue	Modelled	Actual	Comment	Reference
C	384	HIS	-	EXPRESSION TAG	UNP Q9FN03
C	385	HIS	-	EXPRESSION TAG	UNP Q9FN03
C	386	HIS	-	EXPRESSION TAG	UNP Q9FN03
C	387	HIS	-	EXPRESSION TAG	UNP Q9FN03
C	388	HIS	-	EXPRESSION TAG	UNP Q9FN03
C	389	HIS	-	EXPRESSION TAG	UNP Q9FN03
D	285	PHE	TRP	ENGINEERED MUTATION	UNP Q9FN03
D	382	LEU	-	EXPRESSION TAG	UNP Q9FN03
D	383	GLU	-	EXPRESSION TAG	UNP Q9FN03
D	384	HIS	-	EXPRESSION TAG	UNP Q9FN03
D	385	HIS	-	EXPRESSION TAG	UNP Q9FN03
D	386	HIS	-	EXPRESSION TAG	UNP Q9FN03
D	387	HIS	-	EXPRESSION TAG	UNP Q9FN03
D	388	HIS	-	EXPRESSION TAG	UNP Q9FN03
D	389	HIS	-	EXPRESSION TAG	UNP Q9FN03

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	B	5	Total Mg 5 5	0	0
2	A	6	Total Mg 6 6	0	0
2	D	4	Total Mg 4 4	0	0
2	C	3	Total Mg 3 3	0	0

- Molecule 3 is water.

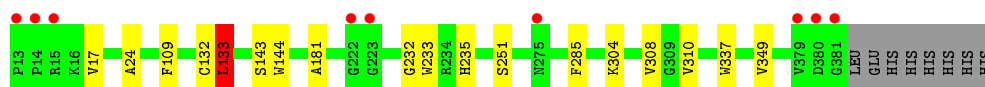
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	424	Total O 424 424	0	0
3	B	403	Total O 403 403	0	0
3	C	425	Total O 425 425	0	0
3	D	391	Total O 391 391	0	0

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.

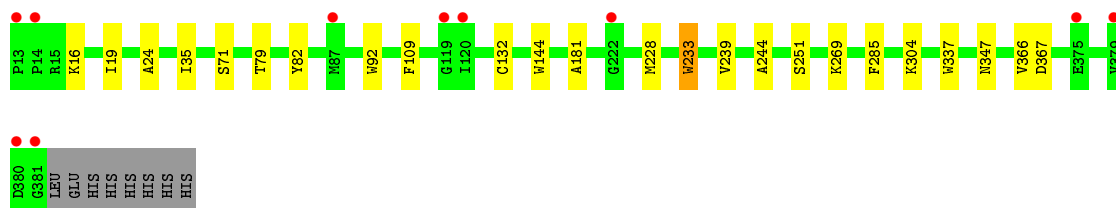
• Molecule 1: Ultraviolet-B receptor UVR8

Chain A: 



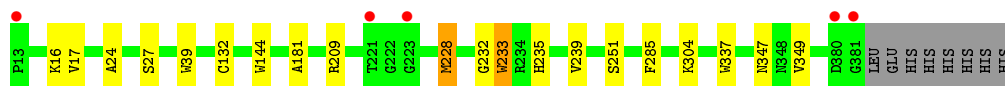
• Molecule 1: Ultraviolet-B receptor UVR8

Chain B: 

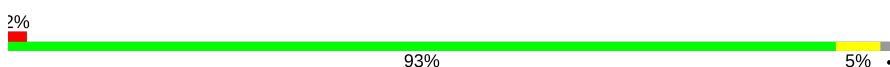


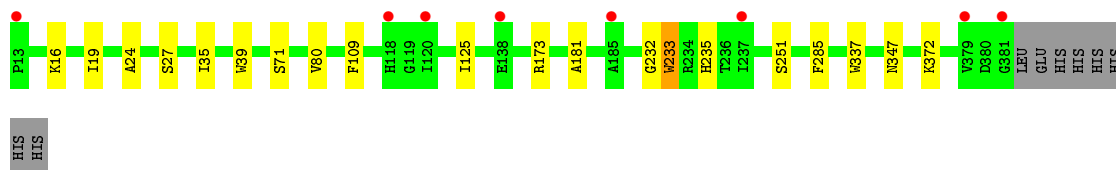
• Molecule 1: Ultraviolet-B receptor UVR8

Chain C: 



• Molecule 1: Ultraviolet-B receptor UVR8

Chain D: 



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	111.80Å 79.12Å 189.34Å 90.00° 95.18° 90.00°	Depositor
Resolution (Å)	28.49 – 1.75 30.69 – 1.91	Depositor EDS
% Data completeness (in resolution range)	77.2 (28.49-1.75) 80.7 (30.69-1.91)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.93 (at 1.91Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8_1069)	Depositor
R, R_{free}	0.149 , 0.184 0.174 , 0.195	Depositor DCC
R_{free} test set	5128 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å ²)	19.4	Xtriage
Anisotropy	0.136	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 53.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.52$, $\langle L^2 \rangle = 0.35$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	13084	wwPDB-VP
Average B, all atoms (Å ²)	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 46.85 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.0794e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

¹ Intensities estimated from amplitudes.

² Theoretical 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: MG

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	0.36	0/2927	0.54	1/3968 (0.0%)
1	B	0.35	0/2934	0.53	0/3975
1	C	0.37	0/2917	0.53	0/3953
1	D	0.34	0/2935	0.53	0/3980
All	All	0.35	0/11713	0.53	1/15876 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	133	LEU	CA-CB-CG	7.04	131.50	115.30

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	2853	0	2723	11	0
1	B	2864	0	2733	14	0
1	C	2844	0	2724	12	0
1	D	2862	0	2741	11	0
2	A	6	0	0	0	0
2	B	5	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	3	0	0	0	0
2	D	4	0	0	0	0
3	A	424	0	0	0	0
3	B	403	0	0	0	0
3	C	425	0	0	2	0
3	D	391	0	0	1	0
All	All	13084	0	10921	45	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 (45) 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:133:LEU:HD13	1:A:143:SER:HB3	1.82	0.59
1:A:17:VAL:HG21	1:A:349:VAL:HG21	1.83	0.59
1:C:209[A]:ARG:NH1	3:C:538:HOH:O	2.37	0.57
1:C:17:VAL:HG21	1:C:349:VAL:HG21	1.88	0.55
1:A:285:PHE:HB2	1:A:337:TRP:HA	1.91	0.52
1:B:285:PHE:HB2	1:B:337:TRP:HA	1.92	0.52
1:B:19:ILE:HD12	1:B:71:SER:HA	1.92	0.51
1:C:285:PHE:HB2	1:C:337:TRP:HA	1.91	0.51
1:D:80[B]:VAL:HG11	1:D:125:ILE:HG21	1.93	0.51
1:C:181:ALA:HB2	1:C:233:TRP:CD1	2.47	0.49
1:A:304:LYS:HE2	1:B:109:PHE:CZ	2.48	0.48
1:C:232:GLY:HA3	1:C:235:HIS:CE1	2.49	0.47
1:A:181:ALA:HB2	1:A:233:TRP:CD1	2.50	0.47
1:D:19:ILE:HD12	1:D:71:SER:HA	1.97	0.47
1:C:228:MET:HG3	1:C:239:VAL:HB	1.99	0.45
1:B:228:MET:HE3	1:B:239:VAL:HG21	1.98	0.45
1:B:24:ALA:HA	1:B:337:TRP:CD1	2.52	0.44
1:A:233:TRP:HB2	1:A:285:PHE:HA	1.99	0.44
1:D:173:ARG:NH2	3:D:795:HOH:O	2.39	0.44
1:D:181:ALA:HB2	1:D:233:TRP:CD1	2.53	0.44
1:D:285:PHE:HB2	1:D:337:TRP:HA	1.99	0.44
1:A:308:VAL:HG12	1:A:310:VAL:HG13	2.00	0.43
1:B:181:ALA:HB2	1:B:233:TRP:CD1	2.54	0.43
1:D:232:GLY:HA3	1:D:235:HIS:CE1	2.53	0.43
1:A:109:PHE:CZ	1:B:304:LYS:HE2	2.54	0.43
1:C:347:ASN:ND2	3:C:823:HOH:O	2.51	0.43
1:C:132:CYS:HB2	1:C:144:TRP:CE2	2.53	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:304:LYS:HE2	1:D:109:PHE:CZ	2.53	0.42
1:A:24:ALA:HA	1:A:337:TRP:CD1	2.55	0.42
1:C:27:SER:HB2	1:C:39:TRP:CE2	2.54	0.42
1:D:233:TRP:HB2	1:D:285:PHE:HA	2.01	0.42
1:B:233:TRP:HB2	1:B:285:PHE:HA	2.01	0.41
1:D:27:SER:HB2	1:D:39:TRP:CE2	2.56	0.41
1:A:232:GLY:HA3	1:A:235:HIS:CE1	2.56	0.41
1:C:233:TRP:HB2	1:C:285:PHE:HA	2.03	0.41
1:B:244:ALA:HB1	1:B:269:LYS:HE3	2.03	0.41
1:B:16:LYS:HA	1:B:347:ASN:HD21	1.85	0.41
1:B:366:VAL:HG13	1:B:367:ASP:O	2.22	0.40
1:A:132:CYS:HB2	1:A:144:TRP:CE2	2.55	0.40
1:B:79:THR:HB	1:B:92:TRP:CE2	2.56	0.40
1:C:24:ALA:HA	1:C:337:TRP:CD1	2.56	0.40
1:D:24:ALA:HA	1:D:337:TRP:CD1	2.56	0.40
1:B:71:SER:HB3	1:B:82:TYR:CE1	2.56	0.40
1:B:132:CYS:HB2	1:B:144:TRP:CE2	2.56	0.40
1:D:16:LYS:HA	1:D:347:ASN:ND2	2.37	0.40

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	375/377 (100%)	373 (100%)	2 (0%)	0	100	100
1	B	376/377 (100%)	374 (100%)	2 (0%)	0	100	100
1	C	374/377 (99%)	372 (100%)	2 (0%)	0	100	100
1	D	377/377 (100%)	375 (100%)	2 (0%)	0	100	100
All	All	1502/1508 (100%)	1494 (100%)	8 (0%)	0	100	100

There are no Ramachandran outliers to report.

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	300/300 (100%)	298 (99%)	2 (1%)	84	75
1	B	301/300 (100%)	298 (99%)	3 (1%)	76	63
1	C	299/300 (100%)	295 (99%)	4 (1%)	69	54
1	D	302/300 (101%)	298 (99%)	4 (1%)	69	54
All	All	1202/1200 (100%)	1189 (99%)	13 (1%)	73	60

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

Mol	Chain	Res	Type
1	A	133	LEU
1	A	251	SER
1	B	35	ILE
1	B	233	TRP
1	B	251	SER
1	C	16	LYS
1	C	228	MET
1	C	233	TRP
1	C	251	SER
1	D	35	ILE
1	D	233	TRP
1	D	251	SER
1	D	372	LYS

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 [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 18 ligands modelled in this entry, 18 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, 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	369/377 (97%)	0.01	9 (2%) 59 65	16, 23, 41, 84	0
1	B	369/377 (97%)	0.18	10 (2%) 54 60	17, 25, 45, 87	0
1	C	369/377 (97%)	-0.06	5 (1%) 75 82	15, 22, 42, 91	0
1	D	369/377 (97%)	0.08	8 (2%) 62 69	17, 25, 44, 91	0
All	All	1476/1508 (97%)	0.05	32 (2%) 62 69	15, 24, 43, 91	0

All (32) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	13	PRO	7.5
1	C	381	GLY	6.7
1	B	13	PRO	6.6
1	C	13	PRO	6.5
1	A	13	PRO	4.8
1	C	223	GLY	4.8
1	A	222	GLY	4.6
1	D	381	GLY	4.6
1	A	381	GLY	4.2
1	B	381	GLY	4.2
1	B	14	PRO	3.9
1	B	222	GLY	3.4
1	C	380	ASP	3.3
1	B	87[A]	MET	3.0
1	A	14	PRO	3.0
1	A	223	GLY	2.8
1	D	237	ILE	2.7
1	A	380	ASP	2.6
1	C	221	THR	2.6
1	D	118	HIS	2.5
1	B	120	ILE	2.5

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Mol	Chain	Res	Type	RSRZ
1	B	119	GLY	2.5
1	D	379	VAL	2.3
1	B	375	GLU	2.3
1	B	380	ASP	2.3
1	B	379	VAL	2.2
1	D	120	ILE	2.2
1	D	138	GLU	2.1
1	A	379	VAL	2.1
1	A	15	ARG	2.1
1	A	275[A]	ASN	2.1
1	D	185	ALA	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. 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
2	MG	A	404	1/1	0.71	0.15	55,55,55,55	0
2	MG	B	404	1/1	0.74	0.10	72,72,72,72	0
2	MG	B	405	1/1	0.84	0.07	68,68,68,68	0
2	MG	B	401	1/1	0.85	0.09	48,48,48,48	0
2	MG	D	404	1/1	0.87	0.08	65,65,65,65	0
2	MG	C	403	1/1	0.89	0.21	40,40,40,40	0
2	MG	A	401	1/1	0.90	0.08	43,43,43,43	0
2	MG	D	402	1/1	0.90	0.13	57,57,57,57	0
2	MG	C	402	1/1	0.91	0.20	41,41,41,41	0
2	MG	A	402	1/1	0.91	0.25	56,56,56,56	0
2	MG	A	403	1/1	0.91	0.23	39,39,39,39	0
2	MG	D	401	1/1	0.92	0.05	42,42,42,42	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	MG	C	401	1/1	0.92	0.22	40,40,40,40	0
2	MG	A	406	1/1	0.92	0.14	61,61,61,61	0
2	MG	A	405	1/1	0.93	0.19	50,50,50,50	0
2	MG	B	402	1/1	0.95	0.08	45,45,45,45	0
2	MG	B	403	1/1	0.96	0.10	35,35,35,35	0
2	MG	D	403	1/1	0.96	0.18	61,61,61,61	0

6.5 Other polymers [i](#)

There are no such residues in this entry.