



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 06:39 AM UTC

PDB ID : 5ST2 / pdb_00005st2
Title : PanDDA analysis group deposition – Aar2/RNaseH in complex with fragment P02C06 from the F2X-Universal Library
Authors : Barthel, T.; Wollenhaupt, J.; Lima, G.M.A.; Wahl, M.C.; Weiss, M.S.
Deposited on : 2022-08-26
Resolution : 1.53 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 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
Mogul : 2022.3.0, CSD as543be (2022)
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

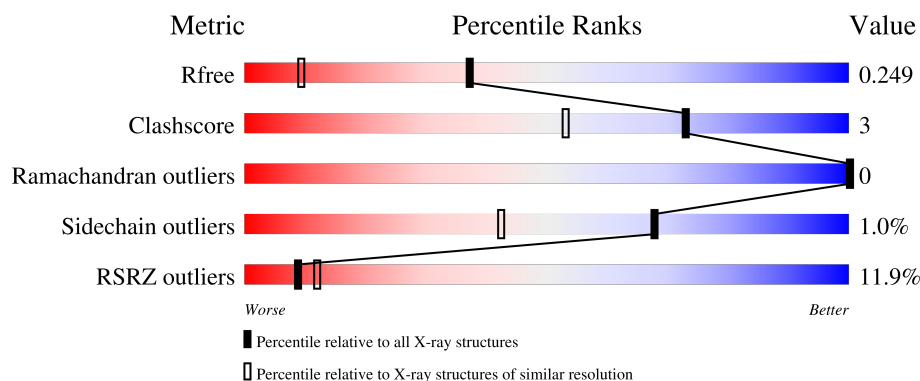
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.53 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	1003 (1.54-1.54)
Clashscore	190562	1025 (1.54-1.54)
Ramachandran outliers	187476	1007 (1.54-1.54)
Sidechain outliers	187428	1007 (1.54-1.54)
RSRZ outliers	180081	1002 (1.54-1.54)

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	258	 11% 88% 8%
2	B	308	 12% 85% 12%

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
3	UW6	B	401	-	X	-	-

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 9227 atoms, of which 4524 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 Pre-mRNA-splicing factor 8.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	237	4068	1287	2060	336	373	12	18	21	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1833	GLY	-	expression tag	UNP P33334
A	1834	ALA	-	expression tag	UNP P33334
A	1835	MET	-	expression tag	UNP P33334

- Molecule 2 is a protein called A1 cistron-splicing factor AAR2.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
2	B	300	5044	1654	2464	421	485	20	22	17	0

There are 20 discrepancies between the modelled and reference sequences:

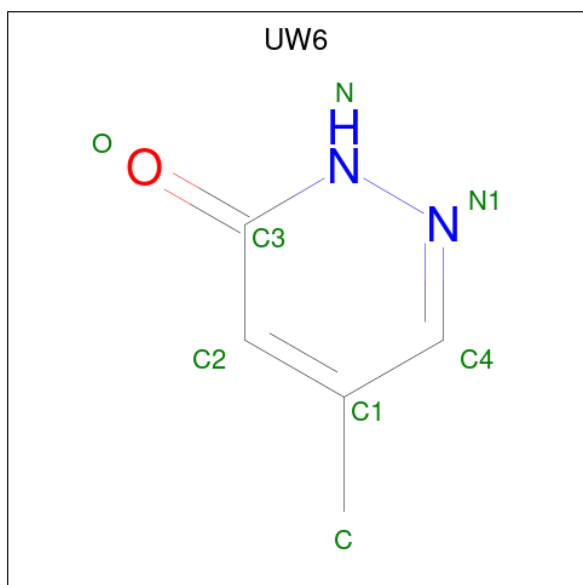
Chain	Residue	Modelled	Actual	Comment	Reference
B	-3	GLY	-	expression tag	UNP P32357
B	-2	ALA	-	expression tag	UNP P32357
B	-1	MET	-	expression tag	UNP P32357
B	0	ALA	-	expression tag	UNP P32357
B	166	SER	LEU	conflict	UNP P32357
B	167	SER	LYS	conflict	UNP P32357
B	?	-	LEU	deletion	UNP P32357
B	?	-	GLN	deletion	UNP P32357
B	?	-	LYS	deletion	UNP P32357
B	?	-	ALA	deletion	UNP P32357
B	?	-	GLY	deletion	UNP P32357
B	?	-	SER	deletion	UNP P32357
B	?	-	LYS	deletion	UNP P32357

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Chain	Residue	Modelled	Actual	Comment	Reference
B	?	-	MET	deletion	UNP P32357
B	?	-	GLU	deletion	UNP P32357
B	?	-	ALA	deletion	UNP P32357
B	?	-	LYS	deletion	UNP P32357
B	?	-	ASN	deletion	UNP P32357
B	?	-	GLU	deletion	UNP P32357
B	170	SER	ASP	conflict	UNP P32357

- Molecule 3 is 5-methylpyridazin-3(2H)-one (CCD ID: UW6) (formula: C₅H₆N₂O).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	B	1	Total	C	N	O	0	0
			8	5	2	1		

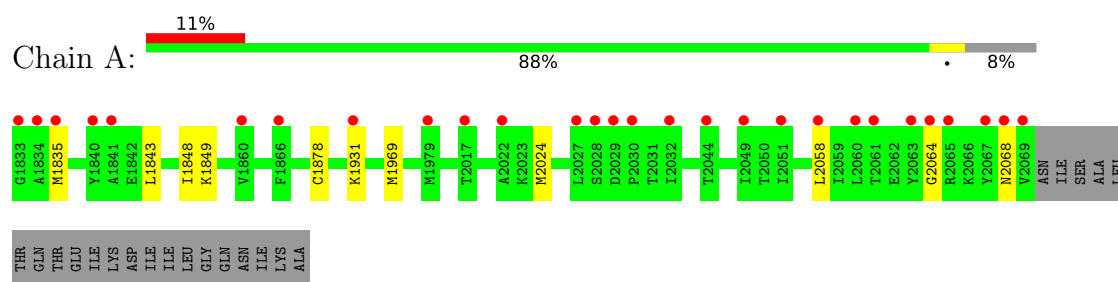
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	52	Total	O	0	0
			52	52		
4	B	55	Total	O	0	0
			55	55		

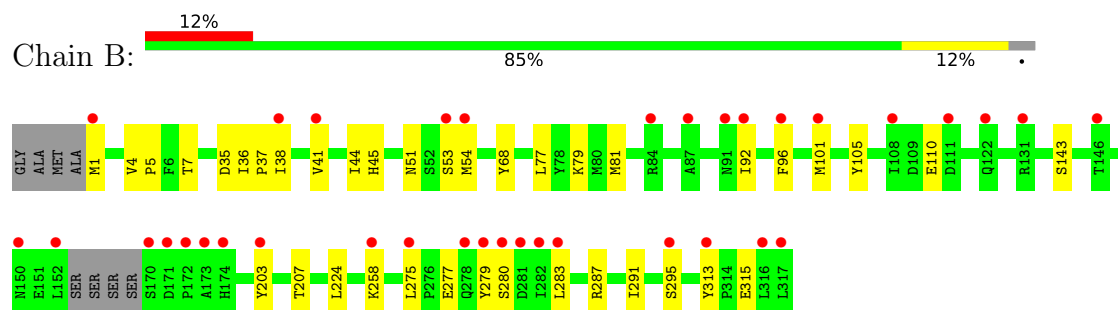
3 Residue-property plots

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: Pre-mRNA-splicing factor 8



- Molecule 2: A1 cistron-splicing factor AAR2



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	88.54Å 82.02Å 93.75Å 90.00° 108.46° 90.00°	Depositor
Resolution (Å)	44.64 – 1.53 44.64 – 1.53	Depositor EDS
% Data completeness (in resolution range)	96.2 (44.64-1.53) 96.6 (44.64-1.53)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	0.96 (at 1.52Å)	Xtriage
Refinement program	PHENIX 1.17.1_3660	Depositor
R, R_{free}	0.199 , 0.245 0.205 , 0.249	Depositor DCC
R_{free} test set	2094 reflections (2.26%)	wwPDB-VP
Wilson B-factor (Å ²)	37.9	Xtriage
Anisotropy	0.384	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.41 , 40.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	9227	wwPDB-VP
Average B, all atoms (Å ²)	58.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.24% 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: UW6

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	0.48	0/2149	0.55	0/2911
2	B	0.56	2/2739 (0.1%)	0.73	2/3699 (0.1%)
All	All	0.53	2/4888 (0.0%)	0.66	2/6610 (0.0%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	7	THR	C-O	-6.57	1.16	1.24
2	B	5	PRO	C-O	-5.82	1.16	1.23

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	96	PHE	CA-CB-CG	6.70	120.50	113.80
2	B	7	THR	CA-C-O	-5.38	114.85	120.55

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	2008	2060	1974	7	0
2	B	2580	2464	2398	22	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	8	0	0	0	0
4	A	52	0	0	0	0
4	B	55	0	0	2	0
All	All	4703	4524	4372	29	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 3.

All (29) 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:1848:ILE:H	1:A:1931[A]:LYS:HZ2	1.44	0.64
2:B:1:MET:HB3	2:B:35:ASP:HA	1.85	0.58
2:B:258:LYS:HD2	2:B:258:LYS:H	1.72	0.55
2:B:68:TYR:CE2	2:B:81:MET:HE3	2.42	0.55
2:B:275:LEU:CD2	2:B:283:LEU:HD13	2.39	0.53
2:B:287:ARG:O	2:B:291:ILE:HD13	2.11	0.50
2:B:54[B]:MET:HE1	2:B:143:SER:HB3	1.96	0.48
2:B:203[A]:TYR:CZ	2:B:207:THR:HG21	2.50	0.47
2:B:279:TYR:HB3	2:B:283:LEU:HD12	1.96	0.47
1:A:1878:CYS:SG	1:A:1969:MET:HE3	2.58	0.44
1:A:2058:LEU:C	1:A:2058:LEU:HD23	2.42	0.44
2:B:277:GLU:CD	2:B:277:GLU:H	2.25	0.44
2:B:54[A]:MET:HE2	4:B:521:HOH:O	2.17	0.44
2:B:41[A]:VAL:HG12	4:B:534:HOH:O	2.18	0.43
2:B:4:VAL:HG11	2:B:44[B]:ILE:CD1	2.49	0.43
2:B:1:MET:N	2:B:38:ILE:HD11	2.34	0.43
2:B:51:ASN:OD1	2:B:53:SER:HB2	2.19	0.43
2:B:77:LEU:HD21	2:B:79:LYS:HE3	2.00	0.42
1:A:2064:GLY:O	1:A:2068:ASN:N	2.47	0.42
2:B:44[A]:ILE:O	2:B:44[A]:ILE:HG23	2.20	0.41
2:B:275:LEU:HD22	2:B:283:LEU:HD13	2.02	0.41
1:A:2024[A]:MET:HE3	1:A:2024[A]:MET:HB3	1.99	0.41
1:A:1843:LEU:HA	1:A:1849:LYS:HD2	2.02	0.41
2:B:280:SER:HB3	2:B:313:TYR:CE1	2.55	0.41
2:B:37:PRO:HD3	2:B:105:TYR:CD1	2.56	0.41
2:B:224:LEU:C	2:B:224:LEU:HD23	2.46	0.40
2:B:36:ILE:HA	2:B:37:PRO:HD3	1.97	0.40
2:B:315:GLU:H	2:B:315:GLU:CD	2.30	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	258/258 (100%)	250 (97%)	8 (3%)	0	100	100
2	B	315/308 (102%)	305 (97%)	10 (3%)	0	100	100
All	All	573/566 (101%)	555 (97%)	18 (3%)	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	237/233 (102%)	237 (100%)	0	100	100
2	B	294/284 (104%)	288 (98%)	6 (2%)	48	18
All	All	531/517 (103%)	525 (99%)	6 (1%)	68	38

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	45[A]	HIS
2	B	45[B]	HIS
2	B	92	ILE
2	B	101	MET
2	B	110	GLU
2	B	295	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such

sidechains are listed below:

Mol	Chain	Res	Type
2	B	2	ASN
2	B	23	ASN
2	B	70	GLN
2	B	91	ASN
2	B	206	ASN

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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

1 ligand is 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	$\# Z > 2$
3	UW6	B	401	-	8,8,8	3.17	3 (37%)	8,10,10	6.48	5 (62%)

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	UW6	B	401	-	-	-	0/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	401	UW6	C4-N1	5.83	1.35	1.30
3	B	401	UW6	N-N1	-5.09	1.27	1.36
3	B	401	UW6	O-C3	3.76	1.31	1.24

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	401	UW6	C3-N-N1	-12.58	118.74	127.07
3	B	401	UW6	C2-C3-N	8.94	123.07	114.63
3	B	401	UW6	C4-N1-N	6.70	122.46	116.53
3	B	401	UW6	O-C3-C2	-5.66	117.64	125.46
3	B	401	UW6	C3-C2-C1	-4.41	116.84	122.01

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	237/258 (91%)	0.88	28 (11%) 9 12	19, 53, 90, 117	12 (5%)
2	B	300/308 (97%)	0.84	36 (12%) 9 12	18, 54, 87, 107	9 (3%)
All	All	537/566 (94%)	0.86	64 (11%) 9 12	18, 54, 90, 117	21 (3%)

All (64) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	2069	VAL	10.3
2	B	152	LEU	8.9
1	A	1979[A]	MET	6.3
2	B	170	SER	6.2
2	B	54[A]	MET	6.0
1	A	2060	LEU	4.7
1	A	2027	LEU	4.2
2	B	279	TYR	4.2
1	A	2030	PRO	4.1
1	A	1834	ALA	4.0
2	B	172	PRO	3.9
2	B	1	MET	3.8
1	A	2051	ILE	3.8
1	A	2068	ASN	3.6
2	B	316	LEU	3.6
1	A	2032	ILE	3.6
1	A	2028	SER	3.6
1	A	2064	GLY	3.5
2	B	41[A]	VAL	3.4
1	A	2065	ARG	3.3
1	A	2061	THR	3.3
2	B	38	ILE	3.3
2	B	282	ILE	3.3
2	B	174	HIS	3.3

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Mol	Chain	Res	Type	RSRZ
2	B	96	PHE	3.2
2	B	173	ALA	3.2
1	A	2067	TYR	3.0
2	B	122[A]	GLN	3.0
2	B	317	LEU	3.0
1	A	2063	TYR	2.9
2	B	275	LEU	2.9
2	B	53	SER	2.9
1	A	2022	ALA	2.7
1	A	1866	PHE	2.7
2	B	281	ASP	2.6
1	A	1833	GLY	2.6
1	A	2029	ASP	2.6
2	B	283	LEU	2.5
2	B	131	ARG	2.5
2	B	101	MET	2.5
2	B	258	LYS	2.5
1	A	2017[A]	THR	2.5
2	B	92	ILE	2.4
1	A	2058	LEU	2.4
2	B	313	TYR	2.4
1	A	2044	THR	2.4
2	B	91	ASN	2.4
1	A	1860	VAL	2.3
2	B	280	SER	2.3
2	B	84	ARG	2.3
2	B	295	SER	2.3
2	B	203[A]	TYR	2.3
2	B	108	ILE	2.3
1	A	1840	TYR	2.3
2	B	150	ASN	2.2
2	B	278	GLN	2.2
1	A	1835	MET	2.1
2	B	146	THR	2.1
1	A	1931[A]	LYS	2.1
2	B	111	ASP	2.1
1	A	1841	ALA	2.1
1	A	2049	ILE	2.1
2	B	171	ASP	2.0
2	B	87	ALA	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 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($\text{\AA}^2$)	Q<0.9
3	UW6	B	401	8/8	0.74	0.19	20,20,20,20	8

6.5 Other polymers [i](#)

There are no such residues in this entry.