



Full wwPDB X-ray Structure Validation Report

Mar 8, 2018 – 11:53 pm GMT

PDB ID : 4H3F
Title : Structure of BACE Bound to 3-(5-((7aR)-2-imino-6-(6-methoxypyridin-2-yl)-3-methyl-4-oxooctahydro-1H-pyrrolo[3,4-d]pyrimidin-7a-yl)thiophen-3-yl)benzotrile
Authors : Strickland, C.; Mandal, M.
Deposited on : 2012-09-13
Resolution : 1.70 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 : trunk30967
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) : trunk30967

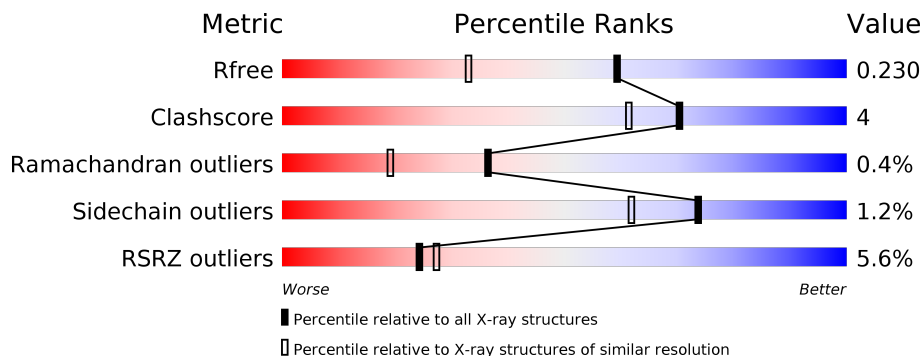
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.70 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	3793 (1.70-1.70)
Clashscore	122126	4167 (1.70-1.70)
Ramachandran outliers	120053	4100 (1.70-1.70)
Sidechain outliers	120020	4100 (1.70-1.70)
RSRZ outliers	108989	3718 (1.70-1.70)

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	414	 7% 84% 9% • 6%
1	B	414	 4% 85% 9% 6%

2 Entry composition [i](#)

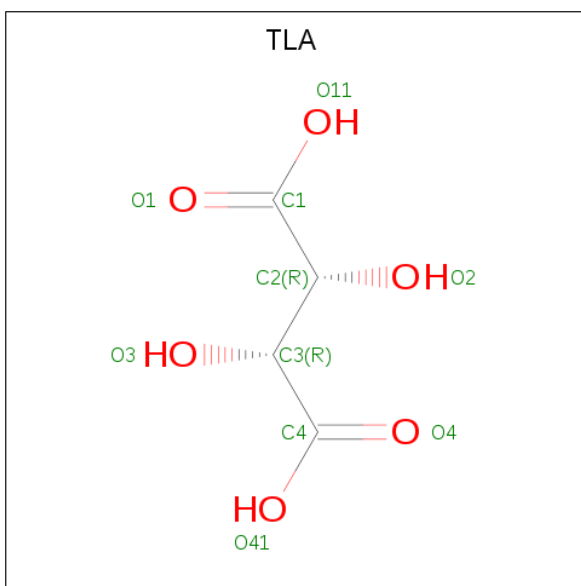
There are 4 unique types of molecules in this entry. The entry contains 7095 atoms, of which 0 are hydrogens and 0 are deuteriums.

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-secretase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	390	Total 3060	C 1959	N 508	O 579	S 14	0	0	0
1	B	389	Total 3052	C 1953	N 507	O 578	S 14	0	0	0

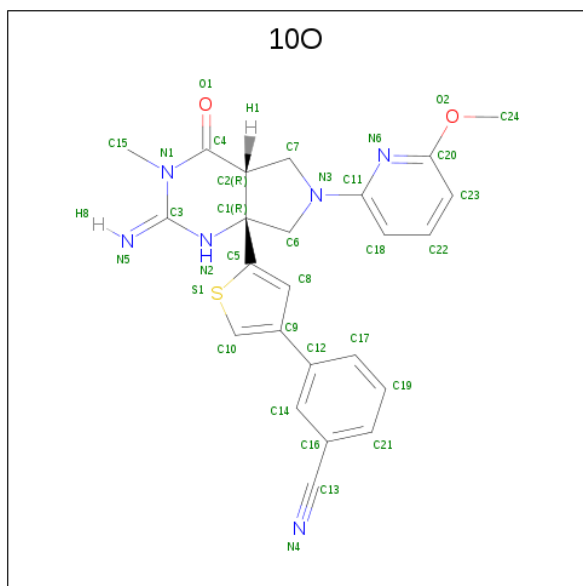
- Molecule 2 is L(+)-TARTARIC ACID (three-letter code: TLA) (formula: C₄H₆O₆).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
2	A	1	Total 10	C 4	O 6	0	0
2	B	1	Total 10	C 4	O 6	0	0
2	B	1	Total 10	C 4	O 6	0	0

- Molecule 3 is 3-{5-[(2E,4aR,7aR)-2-imino-6-(6-methoxypyridin-2-yl)-3-methyl-4-oxooctahydro-7aH-pyrrolo[3,4-d]pyrimidin-7a-yl]thiophen-3-yl}benzotrile (three-letter code: 10O)

(formula: C₂₄H₂₂N₆O₂S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
3	A	1	Total	C	N	O	S	0	0
			33	24	6	2	1		
3	B	1	Total	C	N	O	S	0	0
			33	24	6	2	1		

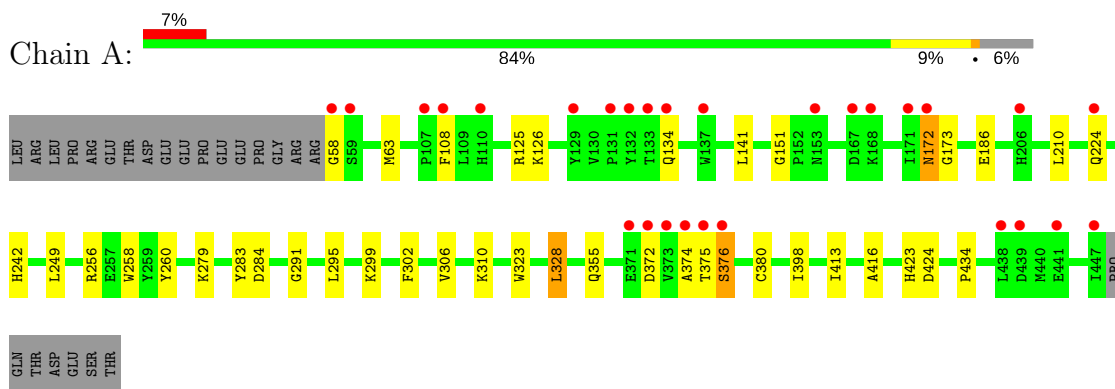
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	A	464	Total	O	0	0
			464	464		
4	B	423	Total	O	0	0
			423	423		

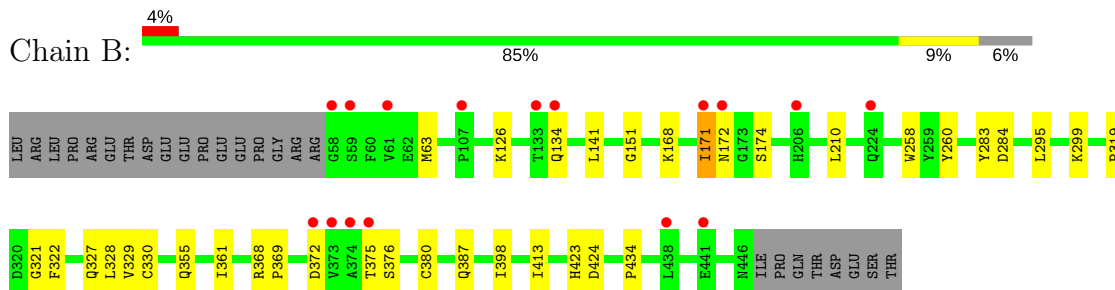
3 Residue-property plots [i](#)

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: Beta-secretase 1



- Molecule 1: Beta-secretase 1



4 Data and refinement statistics i

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	86.45Å 89.22Å 131.03Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 1.70 19.86 – 1.70	Depositor EDS
% Data completeness (in resolution range)	95.0 (20.00-1.70) 95.0 (19.86-1.70)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.04 (at 1.70Å)	Xtrriage
Refinement program	CNS	Depositor
R, R_{free}	0.199 , 0.230 0.199 , 0.230	Depositor DCC
R_{free} test set	5281 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å ²)	17.1	Xtrriage
Anisotropy	0.383	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 51.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.000 for k,h,-l	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	7095	wwPDB-VP
Average B, all atoms (Å ²)	21.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 48.88 % 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 8.0745e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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: TLA, 10O

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	0.41	0/3138	0.68	1/4267 (0.0%)
1	B	0.40	0/3130	0.69	1/4256 (0.0%)
All	All	0.40	0/6268	0.69	2/8523 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	295	LEU	N-CA-C	-6.02	94.75	111.00
1	B	295	LEU	N-CA-C	-5.73	95.52	111.00

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	3060	0	2970	25	0
1	B	3052	0	2959	23	0
2	A	10	0	4	0	0
2	B	20	0	8	0	0
3	A	33	0	21	1	0
3	B	33	0	21	0	0
4	A	464	0	0	6	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	B	423	0	0	0	0
All	All	7095	0	5983	48	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 (48) 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:63:MET:HG2	1:A:151:GLY:HA2	1.67	0.75
1:B:171:ILE:HD12	1:B:174:SER:HB3	1.73	0.71
1:A:224:GLN:HG3	4:A:947:HOH:O	1.90	0.71
1:A:125:ARG:HD3	4:A:1064:HOH:O	1.93	0.69
1:A:279:LYS:HE3	4:A:861:HOH:O	1.94	0.68
1:A:126:LYS:HD2	1:A:141:LEU:HD12	1.77	0.66
1:B:361:ILE:HD13	1:B:398:ILE:CD1	2.35	0.57
1:B:126:LYS:HE3	1:B:141:LEU:HD12	1.87	0.56
1:B:171:ILE:HD12	1:B:174:SER:CB	2.36	0.55
1:A:63:MET:CG	1:A:151:GLY:HA2	2.35	0.55
1:A:108:PHE:CZ	1:A:172:ASN:HB2	2.42	0.55
1:A:58:GLY:HA3	4:A:743:HOH:O	2.08	0.53
1:A:423:HIS:HD2	1:A:424:ASP:O	1.91	0.53
1:B:361:ILE:HD13	1:B:398:ILE:HD12	1.92	0.52
1:A:249:LEU:HD23	1:A:416:ALA:HB2	1.92	0.50
1:B:423:HIS:HD2	1:B:424:ASP:O	1.94	0.50
1:B:355:GLN:CG	1:B:434:PRO:HB2	2.42	0.50
1:B:375:THR:HG22	1:B:375:THR:O	2.12	0.48
1:A:355:GLN:HG3	1:A:434:PRO:HB2	1.94	0.48
1:B:355:GLN:HG3	1:B:434:PRO:HB2	1.95	0.47
1:A:299:LYS:NZ	4:A:940:HOH:O	2.47	0.47
1:A:108:PHE:CE1	1:A:172:ASN:HB2	2.50	0.47
1:A:260:TYR:HB3	1:A:413:ILE:HD11	1.97	0.46
1:A:328:LEU:O	1:A:328:LEU:HD12	2.14	0.46
1:B:372:ASP:HB2	1:B:380:CYS:SG	2.55	0.46
1:A:372:ASP:HB2	1:A:380:CYS:SG	2.57	0.45
1:B:322:PHE:CD1	1:B:329:VAL:HG23	2.51	0.45
1:A:283:TYR:HA	1:A:284:ASP:HA	1.63	0.45
1:A:210:LEU:HD23	1:A:210:LEU:C	2.37	0.45
1:A:302:PHE:CZ	1:A:306:VAL:HG21	2.52	0.45
1:B:299:LYS:HA	1:B:387:GLN:HG3	1.99	0.45
1:A:186:GLU:CD	1:A:256:ARG:HH12	2.22	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:63:MET:HG2	1:B:151:GLY:HA2	2.00	0.43
1:B:260:TYR:HB3	1:B:413:ILE:HD11	2.00	0.43
1:A:242:HIS:HD2	4:A:910:HOH:O	2.01	0.43
1:B:321:GLY:C	1:B:327:GLN:HG2	2.39	0.42
1:B:328:LEU:HD13	1:B:330:CYS:SG	2.59	0.42
1:B:126:LYS:HE3	1:B:141:LEU:CD1	2.49	0.42
1:A:172:ASN:HD22	1:A:173:GLY:N	2.17	0.42
1:B:283:TYR:HA	1:B:284:ASP:HA	1.67	0.42
1:B:210:LEU:C	1:B:210:LEU:HD23	2.40	0.42
1:B:134:GLN:O	1:B:168:LYS:HE2	2.20	0.41
1:A:291:GLY:O	3:A:502:10O:H10	2.20	0.41
1:A:310:LYS:HE2	1:A:323:TRP:CD1	2.56	0.41
1:B:368:ARG:HA	1:B:369:PRO:HD3	1.93	0.41
1:A:374:ALA:O	1:A:376:SER:N	2.54	0.41
1:B:319:PRO:HG3	1:B:327:GLN:NE2	2.36	0.40
1:B:328:LEU:HD12	1:B:328:LEU:C	2.41	0.40

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	388/414 (94%)	376 (97%)	10 (3%)	2 (0%)	31	14
1	B	387/414 (94%)	377 (97%)	9 (2%)	1 (0%)	43	25
All	All	775/828 (94%)	753 (97%)	19 (2%)	3 (0%)	36	19

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	376	SER
1	A	375	THR

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Mol	Chain	Res	Type
1	B	376	SER

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	332/355 (94%)	327 (98%)	5 (2%)	67	53
1	B	331/355 (93%)	328 (99%)	3 (1%)	81	73
All	All	663/710 (93%)	655 (99%)	8 (1%)	74	62

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	134	GLN
1	A	172	ASN
1	A	258	TRP
1	A	328	LEU
1	A	398	ILE
1	B	171	ILE
1	B	172	ASN
1	B	258	TRP

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	134	GLN
1	A	172	ASN
1	A	355	GLN
1	A	423	HIS
1	B	89	ASN
1	B	134	GLN
1	B	172	ASN
1	B	242	HIS
1	B	423	HIS

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](#)

5 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	TLA	A	501	-	3,9,9	0.52	0	6,12,12	1.19	1 (16%)
3	10O	A	502	-	34,37,37	1.78	5 (14%)	38,55,55	1.11	2 (5%)
2	TLA	B	501	-	3,9,9	0.45	0	6,12,12	1.17	0
2	TLA	B	502	-	3,9,9	0.48	0	6,12,12	1.37	1 (16%)
3	10O	B	503	-	34,37,37	1.87	5 (14%)	38,55,55	1.22	3 (7%)

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. '2' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	TLA	A	501	-	-	0/4/12/12	0/0/0/0
3	10O	A	502	-	-	0/12/50/50	0/5/5/5
2	TLA	B	501	-	-	0/4/12/12	0/0/0/0
2	TLA	B	502	-	-	0/4/12/12	0/0/0/0

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	100	B	503	-	-	0/12/50/50	0/5/5/5

All (10) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	503	100	C5-S1	-2.07	1.70	1.74
3	B	503	100	C3-N2	2.10	1.37	1.35
3	B	503	100	O2-C20	2.27	1.39	1.35
3	A	502	100	C3-N2	2.32	1.38	1.35
3	A	502	100	C2-C4	2.52	1.55	1.51
3	A	502	100	O2-C20	2.72	1.39	1.35
3	A	502	100	C8-C5	2.86	1.45	1.37
3	B	503	100	C8-C5	2.92	1.45	1.37
3	A	502	100	C10-C9	6.78	1.41	1.37
3	B	503	100	C10-C9	7.69	1.41	1.37

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	503	100	C8-C9-C12	-3.92	122.71	126.32
3	A	502	100	C8-C9-C12	-3.17	123.39	126.32
2	B	502	TLA	C4-C3-C2	-2.49	107.75	113.11
2	A	501	TLA	C4-C3-C2	-2.25	108.27	113.11
3	B	503	100	C15-N1-C3	-2.07	118.86	120.77
3	A	502	100	C7-C2-C1	2.89	105.58	103.09
3	B	503	100	C7-C2-C1	3.22	105.86	103.09

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	A	502	100	1	0

5.7 Other polymers [i](#)

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

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	390/414 (94%)	0.37	28 (7%) 15 18	10, 16, 43, 68	0
1	B	389/414 (93%)	0.28	16 (4%) 37 42	10, 16, 35, 61	0
All	All	779/828 (94%)	0.32	44 (5%) 24 27	10, 16, 39, 68	0

All (44) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	373	VAL	13.8
1	A	373	VAL	12.1
1	B	375	THR	10.4
1	A	134	GLN	10.2
1	A	375	THR	7.9
1	A	133	THR	7.3
1	A	447	ILE	6.9
1	A	171	ILE	6.2
1	B	133	THR	5.8
1	A	374	ALA	5.1
1	A	172	ASN	4.9
1	B	171	ILE	4.4
1	B	374	ALA	4.3
1	B	134	GLN	4.1
1	A	108	PHE	4.0
1	B	441	GLU	4.0
1	B	59	SER	3.9
1	A	441	GLU	3.8
1	B	206	HIS	3.7
1	A	110	HIS	3.3
1	A	107	PRO	3.1
1	A	372	ASP	3.0
1	A	59	SER	3.0
1	A	132	TYR	2.9

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Mol	Chain	Res	Type	RSRZ
1	A	129	TYR	2.9
1	A	224	GLN	2.9
1	A	168	LYS	2.8
1	B	372	ASP	2.8
1	A	167	ASP	2.8
1	A	58	GLY	2.6
1	B	107	PRO	2.6
1	A	206	HIS	2.5
1	B	438	LEU	2.4
1	A	438	LEU	2.4
1	A	137	TRP	2.3
1	A	371	GLU	2.3
1	B	224	GLN	2.2
1	A	131	PRO	2.2
1	A	153	ASN	2.2
1	B	58	GLY	2.1
1	B	61	VAL	2.1
1	B	172	ASN	2.1
1	A	439	ASP	2.0
1	A	376	SER	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(Å ²)	Q<0.9
2	TLA	A	501	10/10	0.66	0.38	51,53,54,55	0
2	TLA	B	502	10/10	0.76	0.27	31,38,42,42	0
2	TLA	B	501	10/10	0.80	0.22	16,33,40,41	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	10O	B	503	33/33	0.94	0.10	11,13,21,27	0
3	10O	A	502	33/33	0.95	0.09	11,18,24,27	0

6.5 Other polymers [i](#)

There are no such residues in this entry.