



Full wwPDB X-ray Structure Validation Report ⓘ

May 16, 2020 – 12:48 pm BST

PDB ID : 1PPN
Title : STRUCTURE OF MONOCLINIC PAPAIN AT 1.60 ANGSTROMS RESOLUTION
Authors : Pickersgill, R.W.; Harris, G.W.; Garman, E.
Deposited on : 1991-10-25
Resolution : 1.60 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 : 1.8.5 (274361), CSD as541be (2020)
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

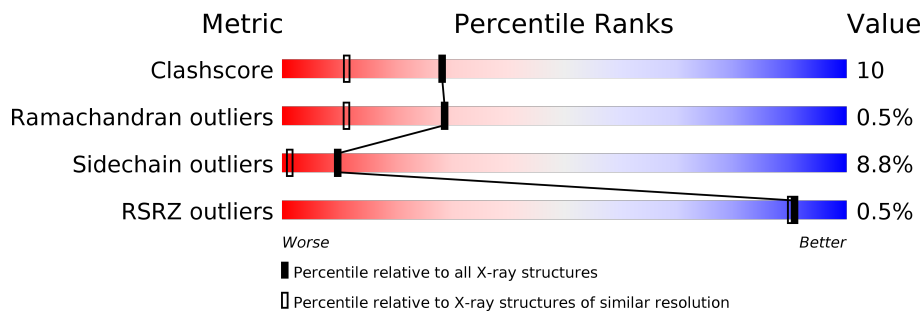
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION


The reported resolution of this entry is 1.60 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))
Clashscore	141614	3665 (1.60-1.60)
Ramachandran outliers	138981	3564 (1.60-1.60)
Sidechain outliers	138945	3563 (1.60-1.60)
RSRZ outliers	127900	3321 (1.60-1.60)

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	212	

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 1888 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.

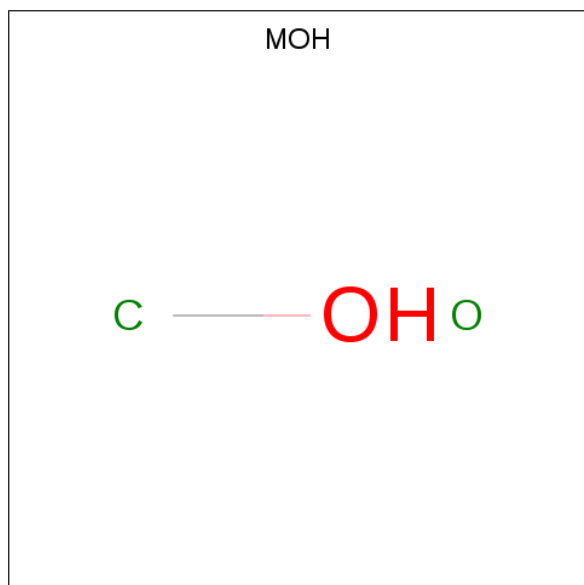
- Molecule 1 is a protein called PAPAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	212	1659	1052	291	309	7	0	1	0

- Molecule 2 is UNKNOWN LIGAND (three-letter code: UNL) (formula:).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total S 1 1	0	0

- Molecule 3 is METHANOL (three-letter code: MOH) (formula: CH₄O).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 2 1 1	0	0

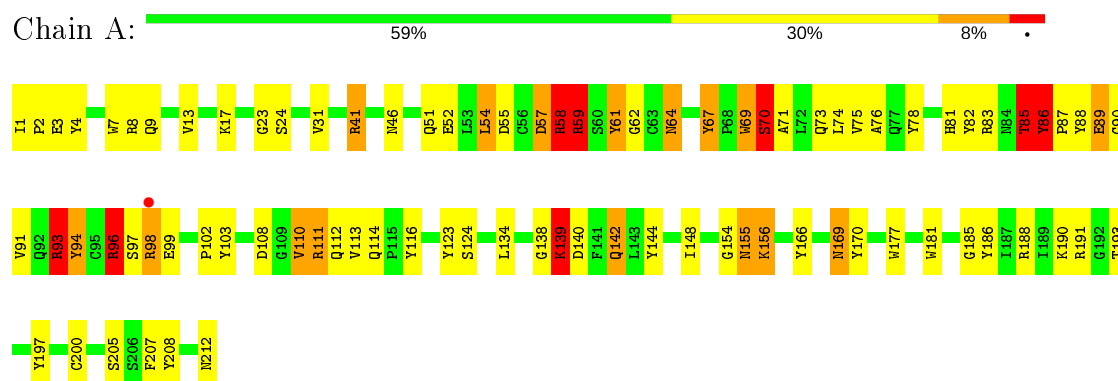
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	226	Total 226	O 226	0	0

3 Residue-property plots

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: PAPANIN



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	65.70Å 50.70Å 31.50Å 90.00° 98.40° 90.00°	Depositor
Resolution (Å)	10.00 – 1.60 9.99 – 1.63	Depositor EDS
% Data completeness (in resolution range)	(Not available) (10.00-1.60) 78.2 (9.99-1.63)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	0.43 (at 1.62Å)	Xtrriage
Refinement program	PROLSQ	Depositor
R, R_{free}	0.160 , (Not available) 0.156 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å ²)	12.8	Xtrriage
Anisotropy	0.384	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.28 , 81.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	1888	wwPDB-VP
Average B, all atoms (Å ²)	17.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 16.83% 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: MOH, UNL

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	1.36	4/1707 (0.2%)	2.38	94/2317 (4.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	2	9

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	169[A]	ASN	CG-OD1	7.09	1.39	1.24
1	A	169[B]	ASN	CG-OD1	7.09	1.39	1.24
1	A	212	ASN	C-OXT	5.45	1.33	1.23
1	A	177	TRP	CD1-NE1	5.05	1.46	1.38

All (94) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	8	ARG	NE-CZ-NH2	-18.92	110.84	120.30
1	A	140	ASP	CB-CG-OD2	14.21	131.08	118.30
1	A	191	ARG	NE-CZ-NH1	-13.62	113.49	120.30
1	A	59	ARG	NE-CZ-NH2	13.11	126.86	120.30
1	A	86	TYR	CB-CG-CD1	11.44	127.86	121.00
1	A	108	ASP	CB-CG-OD2	10.92	128.13	118.30
1	A	140	ASP	CB-CG-OD1	-10.84	108.54	118.30
1	A	55	ASP	CB-CG-OD1	10.64	127.88	118.30
1	A	170	TYR	CB-CG-CD2	-10.22	114.87	121.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	67	TYR	CB-CG-CD2	-9.94	115.04	121.00
1	A	191	ARG	NE-CZ-NH2	9.85	125.23	120.30
1	A	4	TYR	CB-CG-CD2	-9.65	115.21	121.00
1	A	116	TYR	CG-CD1-CE1	-9.43	113.76	121.30
1	A	59	ARG	CD-NE-CZ	9.42	136.79	123.60
1	A	4	TYR	CG-CD1-CE1	-8.68	114.35	121.30
1	A	61	TYR	CB-CG-CD1	-8.56	115.87	121.00
1	A	55	ASP	CB-CG-OD2	-8.52	110.63	118.30
1	A	208	TYR	CB-CG-CD2	-8.28	116.03	121.00
1	A	8	ARG	NE-CZ-NH1	8.23	124.41	120.30
1	A	186	TYR	CB-CG-CD1	-8.20	116.08	121.00
1	A	144	TYR	CB-CG-CD1	8.09	125.86	121.00
1	A	64	ASN	CB-CA-C	-7.99	94.42	110.40
1	A	197	TYR	CB-CG-CD2	-7.95	116.23	121.00
1	A	94	TYR	CB-CG-CD1	-7.93	116.24	121.00
1	A	208	TYR	CG-CD1-CE1	-7.79	115.07	121.30
1	A	111	ARG	NE-CZ-NH1	7.77	124.18	120.30
1	A	139	LYS	N-CA-CB	7.56	124.21	110.60
1	A	58	ARG	NE-CZ-NH2	7.51	124.06	120.30
1	A	94	TYR	CB-CG-CD2	7.43	125.46	121.00
1	A	13	VAL	CA-CB-CG1	7.36	121.94	110.90
1	A	23	GLY	O-C-N	7.29	134.37	122.70
1	A	116	TYR	CB-CG-CD1	-7.19	116.69	121.00
1	A	96	ARG	CB-CA-C	7.17	124.74	110.40
1	A	103	TYR	CB-CG-CD2	-7.13	116.72	121.00
1	A	70	SER	N-CA-CB	7.11	121.17	110.50
1	A	96	ARG	NE-CZ-NH2	7.04	123.82	120.30
1	A	54	LEU	CB-CA-C	6.92	123.36	110.20
1	A	197	TYR	CB-CG-CD1	6.79	125.08	121.00
1	A	170	TYR	CG-CD1-CE1	-6.67	115.97	121.30
1	A	76	ALA	N-CA-CB	6.58	119.31	110.10
1	A	116	TYR	CD1-CG-CD2	6.55	125.10	117.90
1	A	186	TYR	CD1-CG-CD2	6.54	125.10	117.90
1	A	116	TYR	CZ-CE2-CD2	-6.45	113.99	119.80
1	A	123	TYR	CB-CG-CD1	-6.33	117.20	121.00
1	A	67	TYR	CD1-CG-CD2	6.31	124.84	117.90
1	A	78	TYR	CG-CD2-CE2	-6.28	116.28	121.30
1	A	67	TYR	CG-CD2-CE2	-6.28	116.28	121.30
1	A	186	TYR	CG-CD1-CE1	-6.23	116.31	121.30
1	A	207	PHE	CB-CG-CD2	6.20	125.14	120.80
1	A	7	TRP	CG-CD1-NE1	-6.19	103.91	110.10
1	A	193	THR	C-N-CA	6.10	135.10	122.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	93	ARG	NE-CZ-NH2	6.09	123.34	120.30
1	A	59	ARG	NH1-CZ-NH2	-6.06	112.73	119.40
1	A	91	VAL	CA-CB-CG1	6.00	119.90	110.90
1	A	124	SER	CA-CB-OG	-5.99	95.03	111.20
1	A	144	TYR	CG-CD1-CE1	5.96	126.07	121.30
1	A	4	TYR	CZ-CE2-CD2	-5.93	114.46	119.80
1	A	31	VAL	CA-C-N	5.93	130.25	117.20
1	A	114	GLN	CA-CB-CG	-5.89	100.45	113.40
1	A	4	TYR	CD1-CG-CD2	5.88	124.36	117.90
1	A	155	ASN	N-CA-CB	5.86	121.16	110.60
1	A	58	ARG	C-N-CA	5.81	136.23	121.70
1	A	3	GLU	CA-CB-CG	-5.79	100.66	113.40
1	A	181	TRP	NE1-CE2-CZ2	-5.75	124.07	130.40
1	A	114	GLN	CG-CD-OE1	-5.70	110.21	121.60
1	A	24	SER	O-C-N	-5.67	113.62	122.70
1	A	177	TRP	CG-CD1-NE1	-5.60	104.50	110.10
1	A	112	GLN	CA-CB-CG	-5.55	101.19	113.40
1	A	85	THR	O-C-N	-5.54	113.83	122.70
1	A	71	ALA	O-C-N	-5.53	113.86	122.70
1	A	205	SER	N-CA-CB	-5.47	102.30	110.50
1	A	144	TYR	CB-CG-CD2	-5.44	117.73	121.00
1	A	75	VAL	CA-CB-CG1	5.35	118.92	110.90
1	A	69	TRP	CH2-CZ2-CE2	5.34	122.74	117.40
1	A	83	ARG	CD-NE-CZ	5.31	131.04	123.60
1	A	110	VAL	CA-CB-CG2	5.29	118.84	110.90
1	A	59	ARG	CG-CD-NE	5.28	122.89	111.80
1	A	181	TRP	CE3-CZ3-CH2	5.28	127.00	121.20
1	A	64	ASN	CB-CG-OD1	-5.25	111.10	121.60
1	A	181	TRP	CD1-CG-CD2	5.24	110.49	106.30
1	A	208	TYR	CZ-CE2-CD2	-5.20	115.12	119.80
1	A	113	VAL	CA-CB-CG1	5.16	118.64	110.90
1	A	61	TYR	O-C-N	-5.15	114.45	123.20
1	A	89	GLU	C-N-CA	5.15	133.11	122.30
1	A	96	ARG	NE-CZ-NH1	-5.14	117.73	120.30
1	A	9	GLN	CG-CD-NE2	5.11	128.95	116.70
1	A	181	TRP	CD2-CE3-CZ3	-5.10	112.17	118.80
1	A	185	GLY	O-C-N	5.09	130.85	122.70
1	A	166	TYR	C-N-CA	5.06	132.93	122.30
1	A	46	ASN	N-CA-CB	5.06	119.70	110.60
1	A	190	LYS	N-CA-CB	-5.01	101.58	110.60
1	A	57	ASP	C-N-CA	5.00	134.21	121.70
1	A	61	TYR	CG-CD2-CE2	-5.00	117.30	121.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	23	GLY	CA-C-O	-5.00	111.60	120.60

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	A	58	ARG	CA
1	A	96	ARG	CA

All (9) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	111	ARG	Sidechain
1	A	17	LYS	Mainchain
1	A	188	ARG	Mainchain
1	A	41	ARG	Sidechain
1	A	57	ASP	Peptide
1	A	58	ARG	Sidechain
1	A	59	ARG	Sidechain
1	A	81	HIS	Mainchain
1	A	98	ARG	Sidechain

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	1659	0	1591	32	0
2	A	1	0	0	0	0
3	A	2	0	0	0	0
4	A	226	0	0	7	0
All	All	1888	0	1591	32	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 10.

All (32) 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:61:TYR:CE2	4:A:600:HOH:O	1.82	1.28
1:A:85:THR:HG22	4:A:561:HOH:O	1.01	1.16
1:A:69:TRP:O	1:A:73:GLN:HG3	1.64	0.98
1:A:148:ILE:HD13	1:A:169[A]:ASN:ND2	1.78	0.97
1:A:148:ILE:HD13	1:A:169[A]:ASN:HD22	1.29	0.97
1:A:148:ILE:CD1	1:A:169[A]:ASN:ND2	2.43	0.80
1:A:169[A]:ASN:OD1	4:A:572:HOH:O	2.03	0.75
1:A:52:GLU:HG3	1:A:86:TYR:CE2	2.29	0.68
1:A:73:GLN:HG2	1:A:110:VAL:HG21	1.79	0.64
1:A:134:LEU:HD21	4:A:566:HOH:O	1.98	0.63
1:A:94:TYR:CD1	1:A:94:TYR:N	2.69	0.61
1:A:139:LYS:HD2	4:A:567:HOH:O	2.00	0.59
1:A:96:ARG:HB2	1:A:99:GLU:CG	2.33	0.58
1:A:82:TYR:HB2	1:A:85:THR:HG23	1.89	0.55
1:A:154:GLY:O	1:A:200:CYS:HA	2.08	0.54
1:A:148:ILE:CD1	1:A:169[A]:ASN:HD21	2.21	0.53
1:A:138:GLY:O	1:A:142:GLN:HG2	2.09	0.51
1:A:96:ARG:HB2	1:A:99:GLU:CD	2.32	0.50
1:A:67:TYR:HB2	1:A:70:SER:OG	2.12	0.48
1:A:59:ARG:NH1	1:A:61:TYR:OH	2.47	0.48
1:A:88:TYR:CZ	1:A:90:GLY:HA2	2.51	0.46
1:A:86:TYR:N	1:A:87:PRO:CD	2.79	0.46
1:A:156:LYS:NZ	1:A:156:LYS:HB3	2.30	0.46
1:A:89:GLU:OE1	1:A:93:ARG:HD3	2.17	0.45
1:A:51:GLN:HB2	1:A:88:TYR:HA	1.98	0.44
1:A:134:LEU:C	1:A:134:LEU:HD12	2.38	0.44
1:A:52:GLU:OE2	1:A:97:SER:OG	2.19	0.43
1:A:85:THR:CG2	4:A:561:HOH:O	1.91	0.43
1:A:96:ARG:HB2	1:A:99:GLU:HG3	2.00	0.42
1:A:61:TYR:CD2	4:A:600:HOH:O	2.41	0.41
1:A:1:ILE:HA	1:A:2:PRO:HD3	1.92	0.41
1:A:54:LEU:HD12	1:A:62:GLY:HA2	2.03	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	211/212 (100%)	202 (96%)	8 (4%)	1 (0%)	29 11

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	58	ARG

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	171/170 (101%)	156 (91%)	15 (9%)	10 1

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	41	ARG
1	A	58	ARG
1	A	64	ASN
1	A	70	SER
1	A	74	LEU
1	A	85	THR
1	A	86	TYR
1	A	93	ARG
1	A	96	ARG
1	A	98	ARG
1	A	102	PRO
1	A	139	LYS
1	A	142	GLN
1	A	155	ASN
1	A	156	LYS

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

Mol	Chain	Res	Type
1	A	112	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 2 ligands modelled in this entry, 1 is unknown - leaving 1 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	MOH	A	302	-	1,1,1	0.80	0	-		

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

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 [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	212/212 (100%)	-0.83	1 (0%) 91 90	4, 12, 32, 47	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	98	ARG	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. 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
3	MOH	A	302	2/2	0.86	0.14	19,19,19,31	0
2	UNL	A	301	1/-	0.95	0.26	9,9,9,9	0

6.5 Other polymers [i](#)

There are no such residues in this entry.