



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 5, 2024 – 06:26 AM EST

PDB ID : 1TLI
Title : THERMOLYSIN (2% ISOPROPANOL SOAKED CRYSTALS)
Authors : English, A.C.; Done, S.H.; Groom, C.R.; Hubbard, R.E.
Deposited on : 1998-10-27
Resolution : 2.05 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 : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.36
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) : 2.36

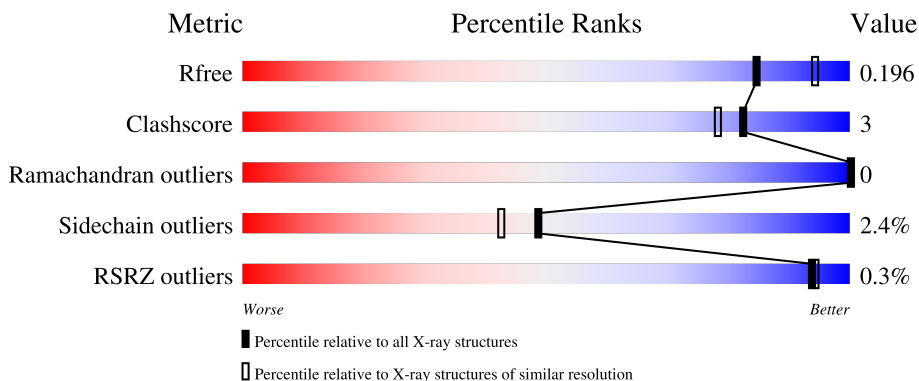
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION


The reported resolution of this entry is 2.05 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	1692 (2.04-2.04)
Clashscore	141614	1773 (2.04-2.04)
Ramachandran outliers	138981	1752 (2.04-2.04)
Sidechain outliers	138945	1752 (2.04-2.04)
RSRZ outliers	127900	1672 (2.04-2.04)

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	316	 83% 17%

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 2609 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 THERMOLYSIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	316	2451	1538	414	497	2	0	5	0

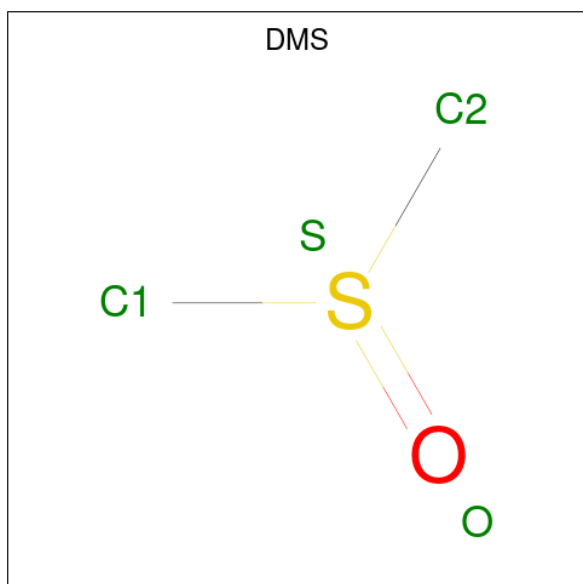
- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

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

- Molecule 3 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	4	Total	Ca	0	0
			4	4		

- Molecule 4 is DIMETHYL SULFOXIDE (three-letter code: DMS) (formula: C₂H₆OS).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	O	S	0	0
			4	2	1	1		


- Molecule 5 is water.

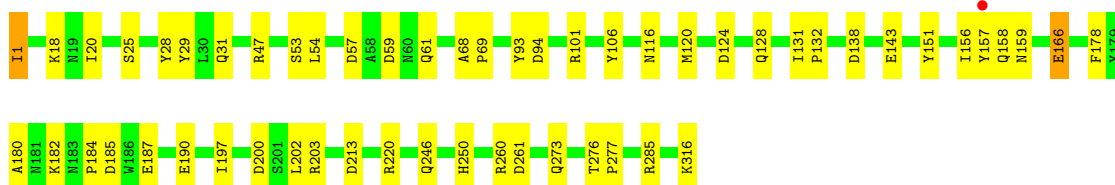
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	149	Total	O	0	0
			149	149		

3 Residue-property plots [i](#)

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: THERMOLYSIN

Chain A:  83% 17%



4 Data and refinement statistics

Property	Value	Source
Space group	P 61 2 2	Depositor
Cell constants a, b, c, α , β , γ	93.93Å 93.93Å 130.91Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	30.00 – 2.05 29.93 – 2.05	Depositor EDS
% Data completeness (in resolution range)	95.0 (30.00-2.05) 94.2 (29.93-2.05)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.56 (at 2.05Å)	Xtrriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.165 , 0.219 0.148 , 0.196	Depositor DCC
R_{free} test set	1066 reflections (5.13%)	wwPDB-VP
Wilson B-factor (Å ²)	20.7	Xtrriage
Anisotropy	0.199	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 50.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	2609	wwPDB-VP
Average B, all atoms (Å ²)	23.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.42% 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: ZN, CA, DMS

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	0.78	2/2540 (0.1%)	1.61	38/3456 (1.1%)

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	0	2

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	180	ALA	C-N	-10.68	1.09	1.34
1	A	53	SER	CA-CB	5.34	1.60	1.52

All (38) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	166	GLU	OE1-CD-OE2	-20.53	98.66	123.30
1	A	200	ASP	CB-CG-OD2	11.79	128.91	118.30
1	A	59	ASP	CB-CG-OD2	11.11	128.29	118.30
1	A	94	ASP	CB-CG-OD1	11.02	128.22	118.30
1	A	190	GLU	OE1-CD-OE2	-10.16	111.11	123.30
1	A	47	ARG	CD-NE-CZ	9.89	137.45	123.60
1	A	203	ARG	NE-CZ-NH1	9.08	124.84	120.30
1	A	101[A]	ARG	NE-CZ-NH1	8.94	124.77	120.30
1	A	101[B]	ARG	NE-CZ-NH1	8.94	124.77	120.30
1	A	61	GLN	O-C-N	-8.84	108.56	122.70
1	A	166	GLU	CG-CD-OE2	8.56	135.43	118.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	285	ARG	NE-CZ-NH1	8.46	124.53	120.30
1	A	187	GLU	O-C-N	-8.28	109.45	122.70
1	A	261	ASP	CB-CG-OD1	8.04	125.53	118.30
1	A	57	ASP	CB-CG-OD2	7.90	125.41	118.30
1	A	200	ASP	CB-CG-OD1	-7.64	111.42	118.30
1	A	116	ASN	O-C-N	-7.39	110.63	123.20
1	A	197	ILE	CA-C-N	7.21	133.05	117.20
1	A	180	ALA	O-C-N	-7.19	111.20	122.70
1	A	180	ALA	C-N-CA	7.08	139.39	121.70
1	A	151	TYR	CB-CG-CD2	-6.84	116.89	121.00
1	A	260	ARG	NE-CZ-NH2	-6.58	117.01	120.30
1	A	185	ASP	CB-CG-OD1	6.49	124.14	118.30
1	A	93	TYR	CB-CG-CD2	-6.40	117.16	121.00
1	A	246	GLN	O-C-N	-6.22	112.62	123.20
1	A	28	TYR	CB-CG-CD2	-5.95	117.43	121.00
1	A	273	GLN	O-C-N	-5.87	113.30	122.70
1	A	106	TYR	CB-CG-CD2	-5.86	117.48	121.00
1	A	159	ASN	O-C-N	-5.86	113.33	122.70
1	A	220	ARG	NE-CZ-NH2	-5.67	117.47	120.30
1	A	124	ASP	CB-CG-OD2	5.50	123.25	118.30
1	A	250	HIS	O-C-N	-5.44	113.99	122.70
1	A	197	ILE	O-C-N	-5.37	114.11	122.70
1	A	116	ASN	CA-C-N	5.32	126.84	116.20
1	A	213	ASP	CB-CG-OD2	5.22	123.00	118.30
1	A	59	ASP	CB-CG-OD1	-5.21	113.61	118.30
1	A	138	ASP	CB-CG-OD1	5.15	122.93	118.30
1	A	187	GLU	CA-C-N	5.08	128.38	117.20

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	202	LEU	Mainchain
1	A	25	SER	Mainchain

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	2451	0	2277	12	0
2	A	1	0	0	0	0
3	A	4	0	0	0	0
4	A	4	0	6	0	0
5	A	149	0	0	0	0
All	All	2609	0	2283	12	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 (12) 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:1:ILE:HD12	1:A:54:LEU:HD23	1.78	0.65
1:A:120:MET:SD	1:A:143:GLU:HB3	2.41	0.60
1:A:1:ILE:N	1:A:31:GLN:HE22	2.03	0.57
1:A:156:ILE:HD12	1:A:158:GLN:HG2	1.96	0.48
1:A:68:ALA:HB3	1:A:69:PRO:HD3	1.96	0.47
1:A:157[A]:TYR:OH	1:A:166:GLU:OE2	2.25	0.42
1:A:178:PHE:HA	1:A:184:PRO:HB3	2.02	0.42
1:A:131:ILE:HB	1:A:132:PRO:HD2	2.00	0.42
1:A:120:MET:HB3	1:A:120:MET:HE3	1.77	0.41
1:A:1:ILE:HD13	1:A:29:TYR:CZ	2.55	0.41
1:A:276:THR:HB	1:A:277:PRO:HD2	2.03	0.41
1:A:178:PHE:CE1	1:A:184:PRO:HB2	2.55	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	319/316 (101%)	309 (97%)	10 (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	257/252 (102%)	251 (98%)	6 (2%)	50 44

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

Mol	Chain	Res	Type
1	A	1	ILE
1	A	18	LYS
1	A	20	ILE
1	A	128	GLN
1	A	182	LYS
1	A	316	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	21	ASN
1	A	31	GLN
1	A	33	ASN
1	A	97	ASN
1	A	290	GLN
1	A	308	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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 6 ligands modelled in this entry, 5 are monoatomic - 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	$\# Z > 2$
4	DMS	A	1000	-	3,3,3	0.70	0	3,3,3	0.47	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 [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	A	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	180:ALA	C	181:ASN	N	1.09

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	316/316 (100%)	-0.74	1 (0%) 94 94	14, 21, 38, 54	1 (0%)

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	157[A]	TYR	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 monosaccharides 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
4	DMS	A	1000	4/4	0.98	0.09	61,62,63,64	0
3	CA	A	321	1/1	0.99	0.04	25,25,25,25	0
3	CA	A	318	1/1	0.99	0.07	20,20,20,20	0
3	CA	A	320	1/1	1.00	0.08	23,23,23,23	0
2	ZN	A	317	1/1	1.00	0.05	20,20,20,20	0
3	CA	A	319	1/1	1.00	0.09	23,23,23,23	0

6.5 Other polymers [i](#)

There are no such residues in this entry.