



Full wwPDB X-ray Structure Validation Report ⓘ

May 29, 2024 – 02:17 PM EDT

PDB ID : 1THV
Title : THE STRUCTURES OF THREE CRYSTAL FORMS OF THE SWEET PROTEIN THAUMATIN
Authors : Ko, T.-P.; Day, J.; Greenwood, A.; McPherson, A.
Deposited on : 1994-06-10
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 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
Xtriage (Phenix) : 1.13
EDS : 2.36.2
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) : 2.36.2

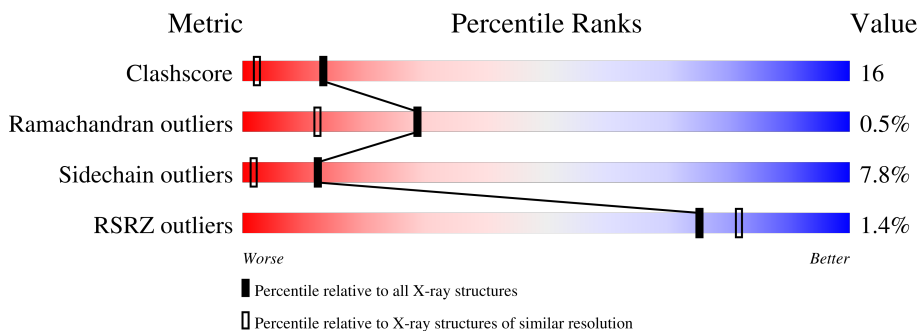
1 Overall quality at a glance

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))
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 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	207	 % 67% 24% 6%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 1674 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 THAUMATIN ISOFORM A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	207	1551	963	270	301	17	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	113	ASP	ASN	conflict	UNP P02883

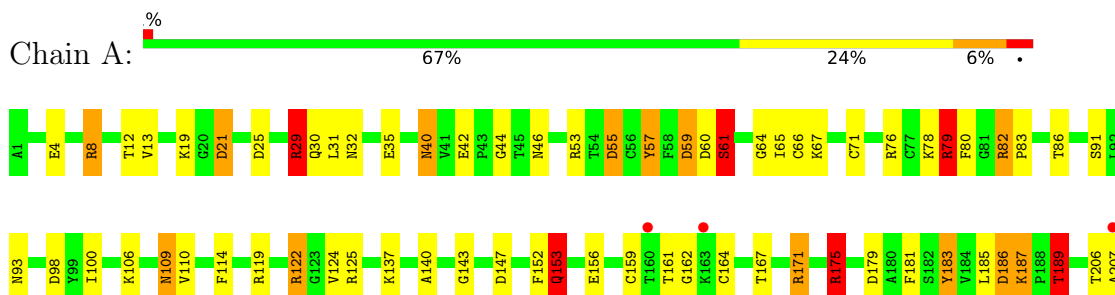
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
2	A	123	123	123	0	0

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: THAUMATIN ISOFORM A



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	44.30Å 63.70Å 72.70Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	12.00 – 1.75 37.83 – 1.48	Depositor EDS
% Data completeness (in resolution range)	(Not available) (12.00-1.75) 70.1 (37.83-1.48)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.57 (at 1.48Å)	Xtrriage
Refinement program	TNT	Depositor
R, R_{free}	0.165 , (Not available) 0.156 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å ²)	8.9	Xtrriage
Anisotropy	0.301	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 65.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.28$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	1674	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 8.40% 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

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	1.23	6/1587 (0.4%)	1.71	40/2150 (1.9%)

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	156	GLU	CD-OE1	7.97	1.34	1.25
1	A	42	GLU	CD-OE2	7.72	1.34	1.25
1	A	4	GLU	CD-OE1	7.64	1.34	1.25
1	A	61	SER	CB-OG	-7.14	1.32	1.42
1	A	8	ARG	NE-CZ	6.05	1.41	1.33
1	A	35	GLU	CD-OE1	5.17	1.31	1.25

All (40) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	76	ARG	NE-CZ-NH2	16.42	128.51	120.30
1	A	76	ARG	NE-CZ-NH1	-13.95	113.33	120.30
1	A	76	ARG	CD-NE-CZ	10.63	138.48	123.60
1	A	25	ASP	CB-CG-OD1	-9.32	109.91	118.30
1	A	79	ARG	NE-CZ-NH1	8.89	124.75	120.30
1	A	79	ARG	NE-CZ-NH2	-8.60	116.00	120.30
1	A	8	ARG	NE-CZ-NH1	8.40	124.50	120.30
1	A	21	ASP	CB-CG-OD1	8.12	125.61	118.30
1	A	82	ARG	NE-CZ-NH1	8.05	124.33	120.30
1	A	179	ASP	CB-CG-OD2	-7.87	111.22	118.30
1	A	76	ARG	CG-CD-NE	-7.65	95.73	111.80
1	A	55	ASP	CB-CG-OD1	7.24	124.82	118.30
1	A	175	ARG	NE-CZ-NH1	7.06	123.83	120.30
1	A	29	ARG	NE-CZ-NH2	-6.93	116.84	120.30
1	A	122	ARG	NE-CZ-NH1	6.85	123.73	120.30
1	A	21	ASP	CB-CG-OD2	-6.84	112.14	118.30
1	A	189	THR	N-CA-CB	-6.66	97.66	110.30
1	A	25	ASP	CB-CG-OD2	6.52	124.17	118.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	186	ASP	CB-CG-OD2	6.30	123.97	118.30
1	A	57	TYR	CB-CG-CD2	-6.28	117.23	121.00
1	A	159	CYS	N-CA-CB	6.12	121.62	110.60
1	A	159	CYS	CB-CA-C	-6.10	98.20	110.40
1	A	57	TYR	N-CA-CB	6.06	121.51	110.60
1	A	171	ARG	NE-CZ-NH2	-6.02	117.29	120.30
1	A	147	ASP	CB-CG-OD1	5.98	123.68	118.30
1	A	183	TYR	CB-CG-CD1	-5.92	117.45	121.00
1	A	98	ASP	CB-CG-OD2	-5.85	113.03	118.30
1	A	53	ARG	NE-CZ-NH2	-5.67	117.46	120.30
1	A	60	ASP	CB-CG-OD2	5.67	123.40	118.30
1	A	8	ARG	CD-NE-CZ	5.55	131.38	123.60
1	A	61	SER	CB-CA-C	-5.42	99.81	110.10
1	A	153	GLN	CB-CA-C	-5.33	99.73	110.40
1	A	61	SER	CA-CB-OG	-5.31	96.87	111.20
1	A	125	ARG	NE-CZ-NH1	5.27	122.94	120.30
1	A	175	ARG	NE-CZ-NH2	-5.26	117.67	120.30
1	A	40	ASN	CA-CB-CG	-5.25	101.85	113.40
1	A	60	ASP	CB-CG-OD1	-5.24	113.58	118.30
1	A	59	ASP	CB-CG-OD2	5.17	122.95	118.30
1	A	86	THR	CA-CB-CG2	-5.04	105.34	112.40
1	A	147	ASP	CB-CG-OD2	-5.02	113.78	118.30

There are no chirality outliers.

There are no planarity outliers.

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	1551	0	1472	49	0
2	A	123	0	0	7	0
All	All	1674	0	1472	49	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 16.

All (49) 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:175:ARG:HB3	1:A:175:ARG:HH11	1.21	1.03
1:A:44:GLY:H	1:A:93:ASN:HD22	1.19	0.91
1:A:30:GLN:HE21	1:A:32:ASN:HD21	1.23	0.84
1:A:122:ARG:HH12	1:A:124:VAL:HG12	1.46	0.81
1:A:189:THR:HG23	2:A:332:HOH:O	1.89	0.70
1:A:175:ARG:HH11	1:A:175:ARG:CB	2.03	0.70
1:A:153:GLN:NE2	2:A:415:HOH:O	2.25	0.69
1:A:122:ARG:NH1	1:A:124:VAL:HG12	2.11	0.64
1:A:187:LYS:N	1:A:187:LYS:HD3	2.16	0.60
1:A:181:PHE:CE1	1:A:189:THR:HG22	2.36	0.60
1:A:189:THR:HB	2:A:348:HOH:O	2.02	0.59
1:A:19:LYS:HE2	1:A:21:ASP:OD1	2.03	0.59
1:A:167:THR:O	1:A:171:ARG:HG3	2.03	0.58
1:A:175:ARG:HD3	2:A:330:HOH:O	2.05	0.57
1:A:30:GLN:HE21	1:A:32:ASN:ND2	1.98	0.55
1:A:46:ASN:HD22	1:A:91:SER:HB3	1.73	0.54
1:A:187:LYS:HD3	1:A:187:LYS:O	2.08	0.53
1:A:207:ALA:HB2	2:A:422:HOH:O	2.07	0.53
1:A:30:GLN:NE2	1:A:32:ASN:HD21	2.02	0.52
1:A:79:ARG:HG3	1:A:80:PHE:N	2.25	0.51
1:A:79:ARG:HG3	1:A:80:PHE:H	1.75	0.51
1:A:44:GLY:N	1:A:93:ASN:HD22	1.99	0.51
1:A:181:PHE:CD1	1:A:189:THR:HG22	2.46	0.50
1:A:83:PRO:HG3	1:A:106:LYS:HD2	1.91	0.50
1:A:65:ILE:HG13	1:A:66:CYS:N	2.27	0.48
1:A:164:CYS:SG	1:A:185:LEU:HD22	2.54	0.48
1:A:44:GLY:H	1:A:93:ASN:ND2	1.99	0.48
1:A:152:PHE:C	1:A:153:GLN:HG2	2.34	0.47
1:A:109:ASN:HD22	1:A:110:VAL:H	1.63	0.46
1:A:183:TYR:O	1:A:186:ASP:HB2	2.16	0.46
1:A:8:ARG:NH1	1:A:206:THR:OG1	2.50	0.45
1:A:109:ASN:HD22	1:A:109:ASN:H	1.65	0.44
1:A:187:LYS:N	1:A:187:LYS:CD	2.81	0.44
1:A:119:ARG:HE	1:A:119:ARG:HB2	1.41	0.43
1:A:59:ASP:OD1	1:A:61:SER:CB	2.67	0.43
1:A:55:ASP:HB3	1:A:67:LYS:HD2	1.99	0.43
1:A:29:ARG:NH1	1:A:30:GLN:O	2.53	0.42
1:A:71:CYS:SG	1:A:71:CYS:O	2.78	0.42
1:A:140:ALA:HB3	1:A:143:GLY:O	2.20	0.42
1:A:175:ARG:HB3	1:A:175:ARG:NH1	2.06	0.42
1:A:187:LYS:HD3	1:A:187:LYS:H	1.84	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:82:ARG:NH1	2:A:404:HOH:O	2.44	0.42
1:A:187:LYS:CD	1:A:187:LYS:H	2.32	0.41
1:A:57:TYR:O	1:A:64:GLY:HA3	2.20	0.41
1:A:12:THR:HG22	1:A:13:VAL:N	2.35	0.41
1:A:206:THR:O	1:A:207:ALA:HB2	2.20	0.41
1:A:122:ARG:NH1	1:A:124:VAL:CG1	2.83	0.41
1:A:79:ARG:HG3	2:A:318:HOH:O	2.21	0.41
1:A:100:ILE:HB	1:A:114:PHE:CE2	2.56	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	205/207 (99%)	197 (96%)	7 (3%)	1 (0%)	29 12

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	162	GLY

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	167/167 (100%)	154 (92%)	13 (8%)	12 2

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

Mol	Chain	Res	Type
1	A	29	ARG
1	A	31	LEU
1	A	40	ASN
1	A	61	SER
1	A	78	LYS
1	A	79	ARG
1	A	109	ASN
1	A	137	LYS
1	A	153	GLN
1	A	161	THR
1	A	175	ARG
1	A	187	LYS
1	A	189	THR

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	32	ASN
1	A	46	ASN
1	A	93	ASN
1	A	104	ASN
1	A	109	ASN
1	A	153	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](#)

There are no ligands in this entry.

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 [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	207/207 (100%)	-0.77	3 (1%) 75 82	6, 12, 35, 62	0

All (3) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	207	ALA	3.9
1	A	160	THR	2.2
1	A	163	LYS	2.2

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 monosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.