



Full wwPDB X-ray Structure Validation Report ⓘ

May 22, 2020 – 03:48 am BST

PDB ID : 3THA
Title : Tryptophan synthase subunit alpha from *Campylobacter jejuni*.
Authors : Osipiuk, J.; Gu, M.; Kwon, K.; Anderson, W.F.; Joachimiak, A.; Center for Structural Genomics of Infectious Diseases (CSGID)
Deposited on : 2011-08-18
Resolution : 2.37 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

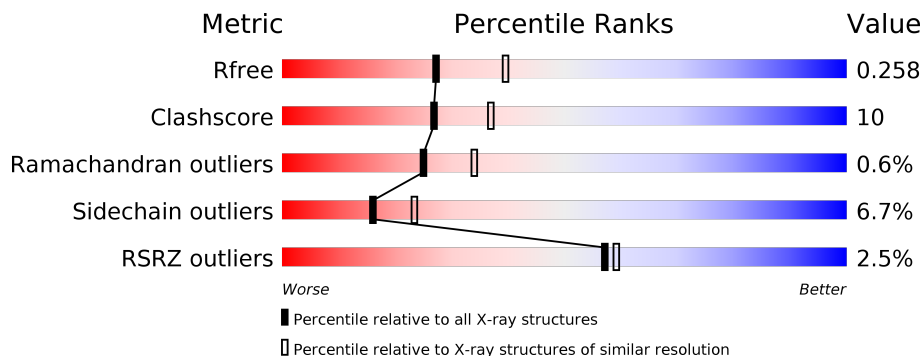
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.37 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	5509 (2.40-2.36)
Clashscore	141614	6082 (2.40-2.36)
Ramachandran outliers	138981	5973 (2.40-2.36)
Sidechain outliers	138945	5975 (2.40-2.36)
RSRZ outliers	127900	5397 (2.40-2.36)

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	252	
1	B	252	

2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 3971 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 Tryptophan synthase alpha chain.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
1	A	248	1968	1280	319	362	3	4	0	2	0
1	B	249	1974	1283	320	364	3	4	0	2	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	SER	-	EXPRESSION TAG	UNP Q9PIF1
A	-1	ASN	-	EXPRESSION TAG	UNP Q9PIF1
A	0	ALA	-	EXPRESSION TAG	UNP Q9PIF1
B	-2	SER	-	EXPRESSION TAG	UNP Q9PIF1
B	-1	ASN	-	EXPRESSION TAG	UNP Q9PIF1
B	0	ALA	-	EXPRESSION TAG	UNP Q9PIF1

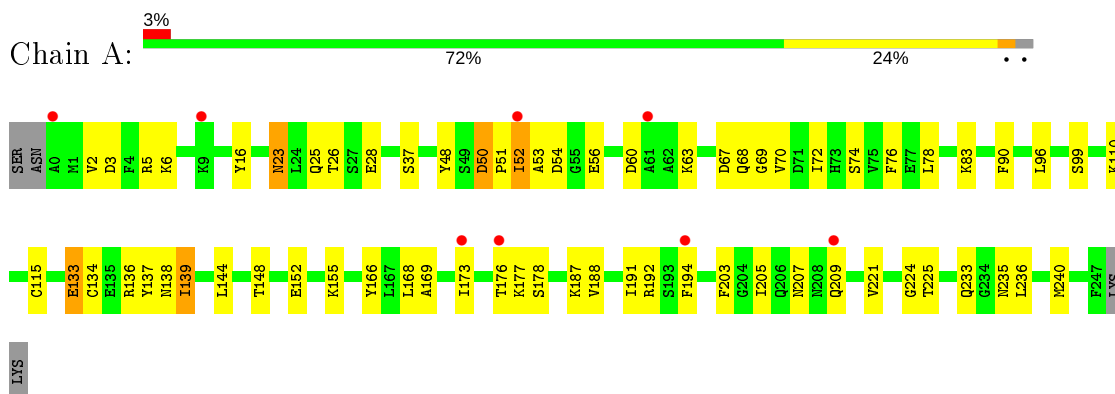
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	18	Total 18	O 18	0	0
2	B	11	Total 11	O 11	0	0

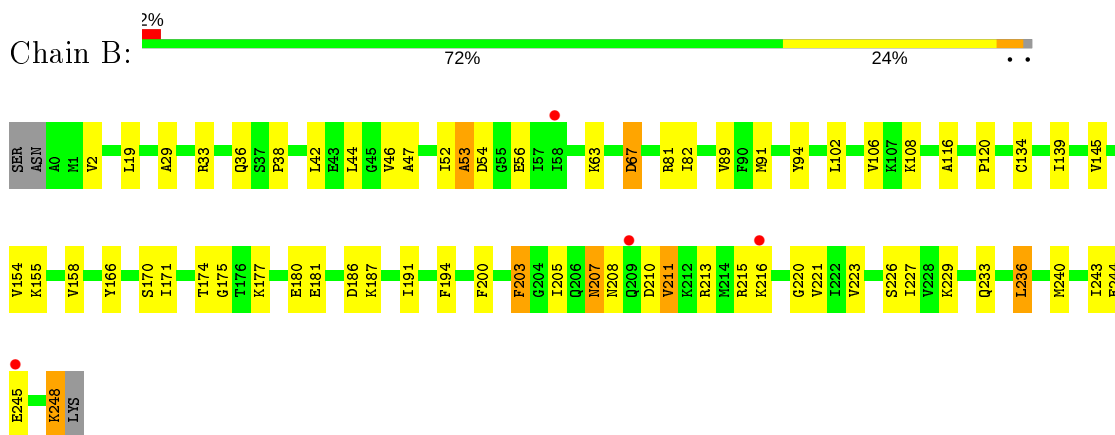
3 Residue-property plots [i](#)

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: Tryptophan synthase alpha chain



- Molecule 1: Tryptophan synthase alpha chain



4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	91.97Å 91.97Å 120.02Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	42.90 – 2.37 42.94 – 2.37	Depositor EDS
% Data completeness (in resolution range)	99.3 (42.90-2.37) 99.3 (42.94-2.37)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.79 (at 2.37Å)	Xtrriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.216 , 0.263 0.211 , 0.258	Depositor DCC
R_{free} test set	1236 reflections (5.09%)	wwPDB-VP
Wilson B-factor (Å ²)	61.9	Xtrriage
Anisotropy	0.053	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 44.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.027 for -h,-k,l	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	3971	wwPDB-VP
Average B, all atoms (Å ²)	65.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.52% 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	0.84	0/2000	0.83	0/2688
1	B	0.79	0/2006	0.80	0/2696
All	All	0.82	0/4006	0.82	0/5384

There are no bond length outliers.

There are no bond angle outliers.

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	1968	0	2064	43	0
1	B	1974	0	2069	50	0
2	A	18	0	0	0	0
2	B	11	0	0	0	0
All	All	3971	0	4133	82	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 (82) 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:48:TYR:HB2	1:A:96:LEU:HD12	1.42	1.02

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:60:ASP:OD1	1:B:171:ILE:HG12	1.83	0.79
1:B:46:VAL:HG12	1:B:47:ALA:H	1.52	0.74
1:B:243:ILE:HG22	1:B:243:ILE:O	1.90	0.71
1:A:53:ALA:HB2	1:B:91:MSE:HE1	1.75	0.69
1:B:171:ILE:O	1:B:175:GLY:HA2	1.93	0.69
1:A:23:ASN:ND2	1:A:26:THR:H	1.92	0.68
1:A:23:ASN:HD22	1:A:26:THR:H	1.39	0.68
1:B:46:VAL:HG12	1:B:47:ALA:N	2.12	0.65
1:A:205:ILE:HD13	1:A:221:VAL:HG13	1.79	0.65
1:A:187:LYS:O	1:A:191:ILE:HG13	1.97	0.64
1:A:56:GLU:OE2	1:B:56:GLU:HB3	1.99	0.63
1:A:28:GLU:HG3	1:A:78:LEU:CD1	2.29	0.62
1:B:134:CYS:HB3	1:B:139:ILE:O	2.00	0.62
1:B:243:ILE:CG2	1:B:243:ILE:O	2.49	0.60
1:B:223:VAL:CG1	1:B:227:ILE:HD13	2.31	0.60
1:B:226:SER:O	1:B:229:LYS:HG2	2.03	0.59
1:B:181:GLU:OE2	1:B:213:ARG:HD3	2.05	0.57
1:A:169:ALA:O	1:B:63:LYS:HE3	2.06	0.56
1:A:2:VAL:HG21	1:A:115:CYS:O	2.07	0.55
1:B:207:ASN:CG	1:B:208:ASN:N	2.60	0.55
1:B:38:PRO:HG3	1:B:244:GLU:HG3	1.90	0.53
1:A:28:GLU:HG3	1:A:78:LEU:HD11	1.90	0.53
1:B:102:LEU:O	1:B:106:VAL:HG23	2.08	0.53
1:A:225:THR:HG23	1:B:54:ASP:HB3	1.91	0.53
1:A:54:ASP:HB3	1:B:203:PHE:CE1	2.44	0.53
1:A:173:ILE:HG23	1:B:67:ASP:OD1	2.09	0.53
1:B:89:VAL:HG22	1:B:116:ALA:HB3	1.91	0.52
1:B:207:ASN:OD1	1:B:210:ASP:HB2	2.09	0.52
1:A:133:GLU:OE1	1:A:136:ARG:NH1	2.42	0.52
1:B:53:ALA:HB1	1:B:56:GLU:CD	2.30	0.52
1:A:16:TYR:HB3	1:A:224:GLY:HA2	1.91	0.52
1:B:213:ARG:HA	1:B:216:LYS:HE2	1.93	0.51
1:B:226:SER:HA	1:B:229:LYS:HE3	1.94	0.50
1:B:245:GLU:O	1:B:248:LYS:HE3	2.11	0.50
1:A:176:THR:HG22	1:A:177:LYS:H	1.79	0.48
1:A:144:LEU:HD12	1:A:166:TYR:HB3	1.96	0.48
1:B:53:ALA:HB1	1:B:56:GLU:CG	2.45	0.47
1:B:52:ILE:O	1:B:53:ALA:O	2.33	0.47
1:A:52:ILE:HG13	1:B:120:PRO:HB3	1.96	0.46
1:A:54:ASP:HB3	1:B:203:PHE:HE1	1.81	0.46
1:A:110:LYS:HE2	1:A:137:TYR:O	2.14	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:94:TYR:OH	1:B:102:LEU:HD11	2.16	0.45
1:A:68:GLN:HB3	1:A:70:VAL:HG23	1.98	0.45
1:A:83:LYS:HD3	1:A:83:LYS:HA	1.80	0.45
1:B:42:LEU:HD23	1:B:44:LEU:HD21	1.97	0.45
1:B:33:ARG:HB3	1:B:240:MSE:CE	2.46	0.44
1:A:72:ILE:HG13	1:A:76:PHE:CE2	2.52	0.44
1:A:50:ASP:HA	1:A:51:PRO:HD2	1.84	0.44
1:B:33:ARG:HB3	1:B:240:MSE:HE1	2.00	0.44
1:A:155:LYS:HD2	1:A:194:PHE:CE1	2.52	0.43
1:B:208:ASN:HA	1:B:211:VAL:HG13	1.99	0.43
1:A:5:ARG:HG3	1:A:5:ARG:HH11	1.83	0.43
1:A:144:LEU:HD21	1:A:168:LEU:HD11	2.00	0.43
1:B:170:SER:HB2	1:B:180:GLU:OE1	2.19	0.43
1:B:155:LYS:HD2	1:B:194:PHE:CE1	2.53	0.43
1:A:188:VAL:O	1:A:192:ARG:HG2	2.19	0.43
1:A:37:SER:HB3	1:A:240:MSE:HE1	2.00	0.43
1:B:200:PHE:CD1	1:B:220:GLY:HA3	2.54	0.43
1:A:3:ASP:O	1:A:6:LYS:HB3	2.19	0.43
1:B:223:VAL:HB	1:B:227:ILE:HD13	2.00	0.42
1:B:187:LYS:O	1:B:191:ILE:HG13	2.20	0.42
1:A:67:ASP:C	1:A:69:GLY:H	2.23	0.42
1:A:176:THR:HG22	1:A:177:LYS:N	2.34	0.42
1:A:203:PHE:CD2	1:A:203:PHE:C	2.93	0.42
1:B:46:VAL:CG1	1:B:47:ALA:N	2.82	0.42
1:A:48:TYR:HB2	1:A:96:LEU:CD1	2.30	0.42
1:A:148:THR:HG22	1:B:67:ASP:HB3	2.02	0.41
1:B:19:LEU:HA	1:B:19:LEU:HD23	1.88	0.41
1:A:236:LEU:O	1:A:240:MSE:HG2	2.20	0.41
1:A:134:CYS:HB3	1:A:139:ILE:O	2.20	0.41
1:B:154:VAL:O	1:B:158:VAL:HG22	2.20	0.41
1:B:29:ALA:HB3	1:B:236:LEU:CD1	2.51	0.41
1:A:137:TYR:O	1:A:138:ASN:HB2	2.20	0.41
1:B:205:ILE:CD1	1:B:221:VAL:HG13	2.51	0.41
1:B:211:VAL:O	1:B:215:ARG:HG3	2.21	0.41
1:B:223:VAL:HG12	1:B:227:ILE:HD13	2.01	0.41
1:B:54:ASP:N	1:B:56:GLU:OE2	2.53	0.40
1:B:207:ASN:CG	1:B:208:ASN:H	2.25	0.40
1:A:207:ASN:OD1	1:A:209:GLN:HB2	2.22	0.40
1:A:50:ASP:OD1	1:A:50:ASP:N	2.54	0.40
1:A:53:ALA:HB2	1:B:91:MSE:CE	2.48	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	248/252 (98%)	228 (92%)	19 (8%)	1 (0%)	34	46
1	B	249/252 (99%)	231 (93%)	16 (6%)	2 (1%)	19	27
All	All	497/504 (99%)	459 (92%)	35 (7%)	3 (1%)	25	34

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	53	ALA
1	A	235	ASN
1	B	203	PHE

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	217/215 (101%)	203 (94%)	14 (6%)	17	24
1	B	218/215 (101%)	202 (93%)	16 (7%)	14	20
All	All	435/430 (101%)	405 (93%)	30 (7%)	16	22

All (30) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	23	ASN
1	A	25[A]	GLN
1	A	25[B]	GLN

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Mol	Chain	Res	Type
1	A	50	ASP
1	A	52	ILE
1	A	63	LYS
1	A	74	SER
1	A	90	PHE
1	A	99	SER
1	A	133	GLU
1	A	139	ILE
1	A	152	GLU
1	A	178	SER
1	A	233	GLN
1	B	2	VAL
1	B	36	GLN
1	B	67	ASP
1	B	81	ARG
1	B	82	ILE
1	B	108	LYS
1	B	145	VAL
1	B	166	TYR
1	B	174	THR
1	B	177	LYS
1	B	186	ASP
1	B	207	ASN
1	B	211	VAL
1	B	233	GLN
1	B	236	LEU
1	B	248	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	23	ASN
1	A	138	ASN
1	B	233	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](#)

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	244/252 (96%)	0.27	8 (3%) 46 49	38, 61, 92, 118	0
1	B	245/252 (97%)	0.11	4 (1%) 72 73	48, 66, 93, 117	0
All	All	489/504 (97%)	0.19	12 (2%) 57 59	38, 64, 93, 118	0

All (12) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	209	GLN	4.4
1	A	52	ILE	2.9
1	A	173	ILE	2.7
1	B	216	LYS	2.6
1	A	176	THR	2.5
1	B	245	GLU	2.3
1	A	194	PHE	2.1
1	A	0	ALA	2.1
1	A	61	ALA	2.0
1	A	9	LYS	2.0
1	B	58	ILE	2.0
1	A	209	GLN	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

There are no ligands in this entry.

6.5 Other polymers

There are no such residues in this entry.