



wwPDB X-ray Structure Validation Summary Report ⓘ

May 27, 2020 – 12:33 am BST

PDB ID : 1EIY
Title : THE CRYSTAL STRUCTURE OF PHENYLALANYL-TRNA SYN-
THETASE FROM THERMUS THERMOPHILUS COMPLEXED WITH
COGNATE TRNAPHE
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Deposited on : 2000-02-29
Resolution : 3.30 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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
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

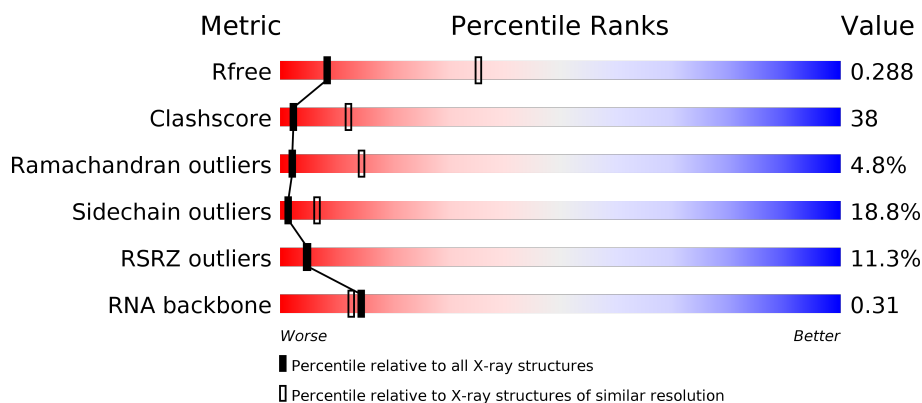
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.30 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	1149 (3.34-3.26)
Clashscore	141614	1205 (3.34-3.26)
Ramachandran outliers	138981	1183 (3.34-3.26)
Sidechain outliers	138945	1182 (3.34-3.26)
RSRZ outliers	127900	1115 (3.34-3.26)
RNA backbone	3102	1117 (3.70-2.90)

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	C	76	<div> <div>93%</div> <div> <div>7%</div> <div>41%</div> <div>42%</div> <div>11%</div> </div> </div>
2	A	350	<div> <div>18%</div> <div>36%</div> <div>48%</div> <div>13%</div> <div>••</div> </div>
3	B	785	<div> <div>39%</div> <div>48%</div> <div>12%</div> <div>•</div> </div>

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 10485 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 RNA chain called TRNA(PHE).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	C	76	Total	C	N	O	P	0	0	0
			1623	723	291	533	76			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	49	C	G	CONFLICT	UNP Q5SGX1
C	65	G	C	CONFLICT	UNP Q5SGX1

- Molecule 2 is a protein called PHENYLALANYL-TRNA SYNTHETASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	A	345	Total	C	N	O	S	0	0	0
			2735	1768	477	482	8			

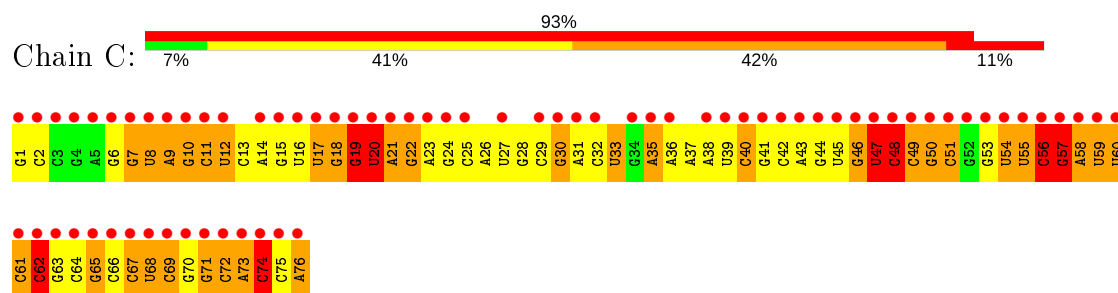
- Molecule 3 is a protein called PHENYLALANYL-TRNA SYNTHETASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	B	785	Total	C	N	O	S	0	0	0
			6127	3925	1091	1101	10			

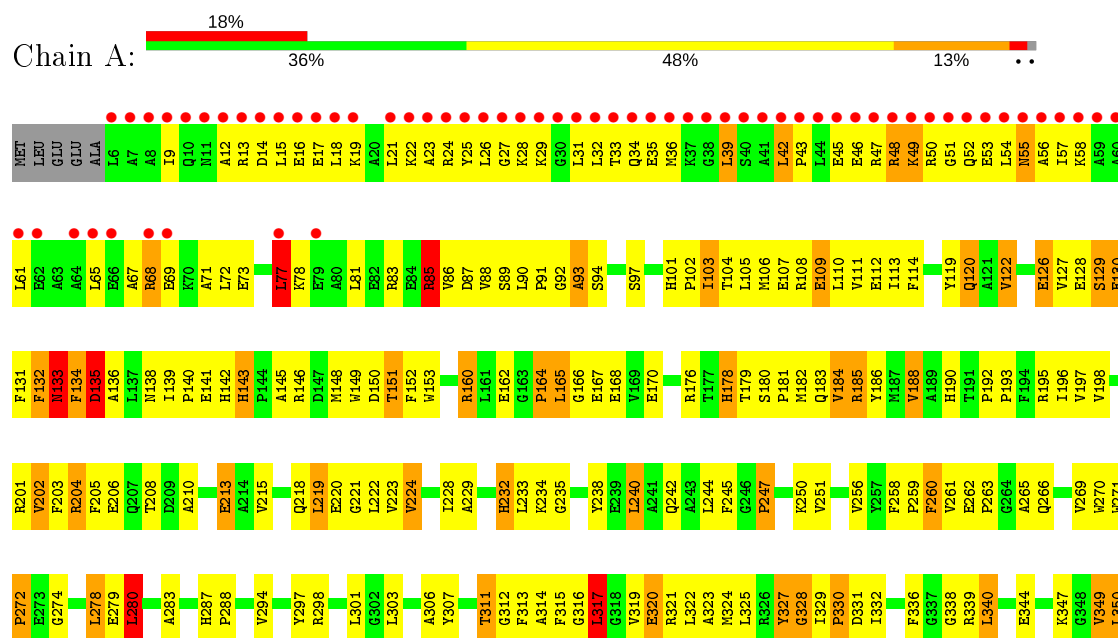
3 Residue-property plots

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 ($\text{RSRZ} > 2$). 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.

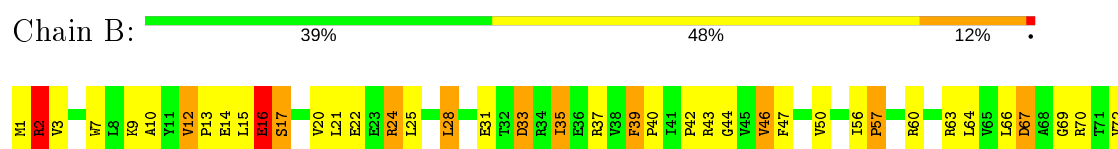
• Molecule 1: TRNA(PHE)



• Molecule 2: PHENYLALANYL-TRNA SYNTHETASE



• Molecule 3: PHENYLALANYL-TRNA SYNTHETASE





4 Data and refinement statistics

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, α , β , γ	175.00Å 175.00Å 140.60Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	28.00 – 3.30 28.06 – 3.28	Depositor EDS
% Data completeness (in resolution range)	86.3 (28.00-3.30) 87.1 (28.06-3.28)	Depositor EDS
R_{merge}	0.16	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.30 (at 3.31Å)	Xtriage
Refinement program	X-PLOR 3.1	Depositor
R, R_{free}	0.221 , 0.287 0.236 , 0.288	Depositor DCC
R_{free} test set	1657 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å ²)	59.2	Xtriage
Anisotropy	0.685	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 38.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.42$, $\langle L^2 \rangle = 0.25$	Xtriage
Estimated twinning fraction	0.079 for -h,-k,l	Xtriage
F_o, F_c correlation	0.87	EDS
Total number of atoms	10485	wwPDB-VP
Average B, all atoms (Å ²)	66.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.63% 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	C	0.95	0/1813	1.09	9/2823 (0.3%)
2	A	0.89	1/2805 (0.0%)	1.07	9/3789 (0.2%)
3	B	0.82	2/6280 (0.0%)	1.07	19/8536 (0.2%)
All	All	0.86	3/10898 (0.0%)	1.08	37/15148 (0.2%)

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	C	0	6
3	B	0	1
All	All	0	7

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	109	GLU	CB-CG	-6.52	1.39	1.52
3	B	239	MET	SD-CE	6.10	2.12	1.77
3	B	783	ASP	CB-CG	5.08	1.62	1.51

The worst 5 of 37 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	39	LEU	CA-CB-CG	8.00	133.69	115.30
2	A	317	LEU	CA-CB-CG	7.52	132.59	115.30
1	C	20	U	C2'-C3'-O3'	7.50	126.00	109.50
3	B	609	LEU	CA-CB-CG	7.42	132.36	115.30
1	C	62	C	N1-C1'-C2'	-7.32	103.95	112.00

There are no chirality outliers.

5 of 7 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	19	G	Sidechain
1	C	30	G	Sidechain
1	C	48	C	Sidechain
1	C	57	G	Sidechain
1	C	60	U	Sidechain

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	C	1623	0	822	151	0
2	A	2735	0	2725	238	0
3	B	6127	0	6180	420	0
All	All	10485	0	9727	772	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 38.

The worst 5 of 772 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)
3:B:239:MET:SD	3:B:239:MET:CE	2.12	1.38
1:C:58:A:H4'	1:C:59:U:OP1	1.41	1.17
3:B:706:PRO:HG2	3:B:709:GLU:HB2	1.29	1.08
1:C:39:U:C2'	1:C:40:C:H5'	1.83	1.07
1:C:39:U:H2'	1:C:40:C:H5'	1.38	1.02

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	
2	A	343/350 (98%)	286 (83%)	42 (12%)	15 (4%)	2	16
3	B	783/785 (100%)	647 (83%)	97 (12%)	39 (5%)	2	14
All	All	1126/1135 (99%)	933 (83%)	139 (12%)	54 (5%)	2	14

5 of 54 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	A	48	ARG
2	A	130	GLU
2	A	135	ASP
3	B	16	GLU
3	B	39	PHE

5.3.2 Protein sidechains ⓘ

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	
2	A	272/277 (98%)	220 (81%)	52 (19%)	1	6
3	B	630/630 (100%)	512 (81%)	118 (19%)	1	7
All	All	902/907 (99%)	732 (81%)	170 (19%)	1	6

5 of 170 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	B	170	LEU
3	B	298	LEU
3	B	659	ILE
3	B	184	LEU
3	B	242	ILE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 21 such

sidechains are listed below:

Mol	Chain	Res	Type
2	A	242	GLN
2	A	292	GLN
3	B	467	GLN
2	A	232	HIS
3	B	485	ASN

5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	C	75/76 (98%)	33 (44%)	8 (10%)

5 of 33 RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	C	2	C
1	C	7	G
1	C	8	U
1	C	10	G
1	C	11	C

5 of 8 RNA pucker outliers are listed below:

Mol	Chain	Res	Type
1	C	20	U
1	C	58	A
1	C	56	C
1	C	19	G
1	C	47	U

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	C	76/76 (100%)	4.89	71 (93%) 0 0	80, 80, 80, 80	76 (100%)
2	A	345/350 (98%)	0.92	63 (18%) 1 1	17, 59, 95, 138	71 (20%)
3	B	785/785 (100%)	-0.15	2 (0%) 94 94	9, 62, 98, 140	0
All	All	1206/1211 (99%)	0.47	136 (11%) 5 5	9, 64, 98, 140	147 (12%)

The worst 5 of 136 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	56	C	16.8
1	C	19	G	13.9
1	C	20	U	13.8
1	C	57	G	12.5
1	C	18	G	11.7

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](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.