W O R L D W I D E

wwPDB

P R O T E I N   D A T A   B A N K

wwPDB X-ray Structure Validation Summary Report ⓘ

May 26, 2020 – 09:55 pm BST

PDB ID	:	6EZD
Title	:	Pyrrolysyl-tRNA synthetase from Canditatus Methanomethylophilus alvus (MmaPylRS)
Authors	:	Pavkov-Keller, T.; Schweiger, K.; Gruber, K.
Deposited on	:	2017-11-15
Resolution	:	2.40 Å(reported)

The following versions of software and data (see references ⓘ) were used in the production of this report:

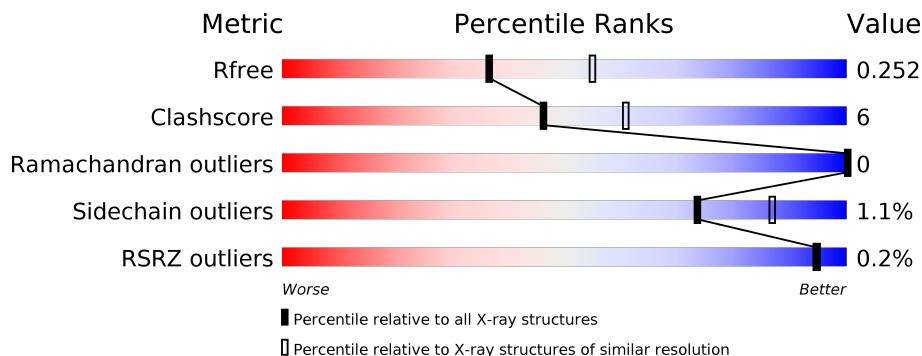|		
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
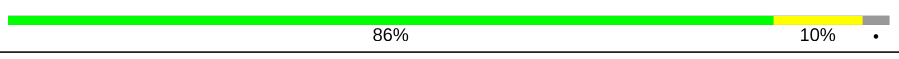*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.40 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	Percentile Ranks	Value
Rfree		0.252
Clashscore		6
Ramachandran outliers		0
Sidechain outliers		1.1%
RSRZ outliers		0.2%

Worse ← → Better

■ Percentile relative to all X-ray structures
▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R$_{free}$	130704	3907 (2.40-2.40)
Clashscore	141614	4398 (2.40-2.40)
Ramachandran outliers	138981	4318 (2.40-2.40)
Sidechain outliers	138945	4319 (2.40-2.40)
RSRZ outliers	127900	3811 (2.40-2.40)

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 <=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	283	77% 20% •
1	B	283	86% 10% •
1	C	283	83% 13% •
1	D	283	82% 14% •

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 8949 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 Pyrrolysyl-tRNA synthetase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	274	Total	C	N	O	S	0	1	0
			2158	1358	369	418	13			
1	B	274	Total	C	N	O	S	0	0	0
			2152	1355	368	416	13			
1	C	272	Total	C	N	O	S	0	0	0
			2136	1344	365	414	13			
1	D	273	Total	C	N	O	S	0	0	0
			2139	1347	366	413	13			

There are 32 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	276	GLY	-	expression tag	UNP M9SC49
A	277	SER	-	expression tag	UNP M9SC49
A	278	HIS	-	expression tag	UNP M9SC49
A	279	HIS	-	expression tag	UNP M9SC49
A	280	HIS	-	expression tag	UNP M9SC49
A	281	HIS	-	expression tag	UNP M9SC49
A	282	HIS	-	expression tag	UNP M9SC49
A	283	HIS	-	expression tag	UNP M9SC49
B	276	GLY	-	expression tag	UNP M9SC49
B	277	SER	-	expression tag	UNP M9SC49
B	278	HIS	-	expression tag	UNP M9SC49
B	279	HIS	-	expression tag	UNP M9SC49
B	280	HIS	-	expression tag	UNP M9SC49
B	281	HIS	-	expression tag	UNP M9SC49
B	282	HIS	-	expression tag	UNP M9SC49
B	283	HIS	-	expression tag	UNP M9SC49
C	276	GLY	-	expression tag	UNP M9SC49
C	277	SER	-	expression tag	UNP M9SC49
C	278	HIS	-	expression tag	UNP M9SC49
C	279	HIS	-	expression tag	UNP M9SC49
C	280	HIS	-	expression tag	UNP M9SC49

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Chain	Residue	Modelled	Actual	Comment	Reference
C	281	HIS	-	expression tag	UNP M9SC49
C	282	HIS	-	expression tag	UNP M9SC49
C	283	HIS	-	expression tag	UNP M9SC49
D	276	GLY	-	expression tag	UNP M9SC49
D	277	SER	-	expression tag	UNP M9SC49
D	278	HIS	-	expression tag	UNP M9SC49
D	279	HIS	-	expression tag	UNP M9SC49
D	280	HIS	-	expression tag	UNP M9SC49
D	281	HIS	-	expression tag	UNP M9SC49
D	282	HIS	-	expression tag	UNP M9SC49
D	283	HIS	-	expression tag	UNP M9SC49

- Molecule 2 is water.

| Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	89	Total O 89 89	0	0
2	B	99	Total O 99 99	0	0
2	C	80	Total O 80 80	0	0
2	D	96	Total O 96 96	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.
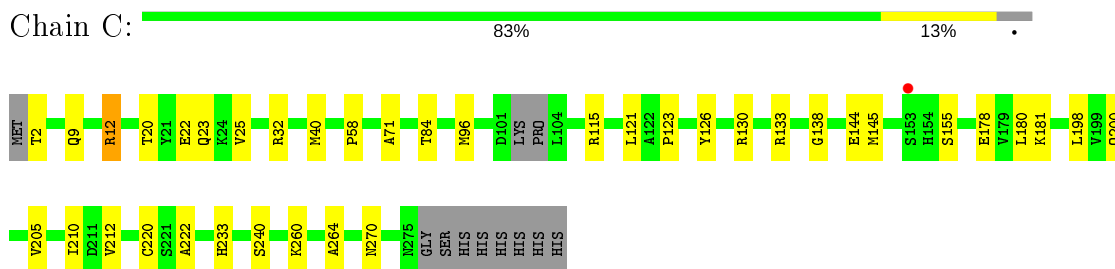
- Molecule 1: Pyrrolysyl-tRNA synthetase
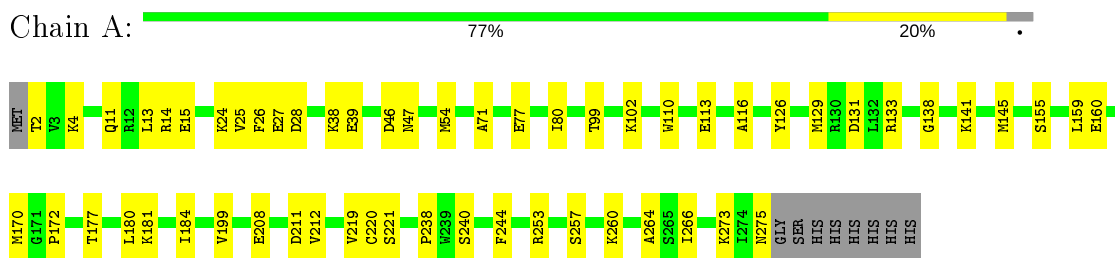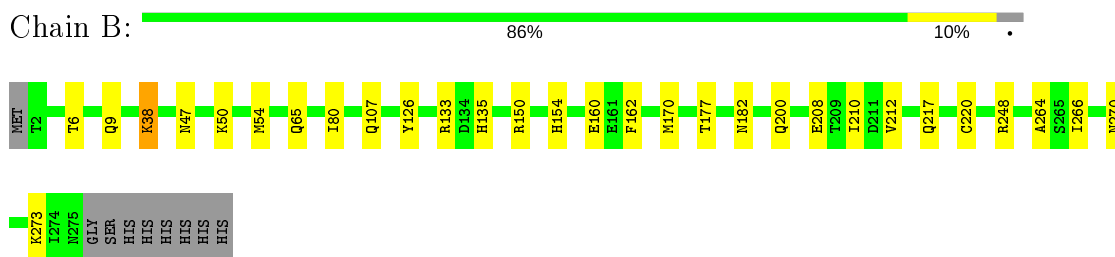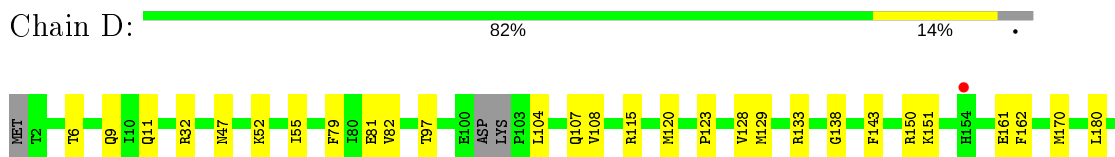

- Molecule 1: Pyrrolysyl-tRNA synthetase

- Molecule 1: Pyrrolysyl-tRNA synthetase

- Molecule 1: Pyrrolysyl-tRNA synthetase

D195 Q200 E08 V212 E213 I214 Q217 C220 S221 A222 L229 S240 K261 G271 A272 K273 G276 SER HIS HIS HIS HIS HIS HIS

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	92.64Å 94.18Å 289.47Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.78 – 2.40 48.78 – 2.39	Depositor EDS
% Data completeness (in resolution range)	97.9 (48.78-2.40) 97.9 (48.78-2.39)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$<I/\sigma(I)>$ [1]	1.95 (at 2.39Å)	Xtriage
Refinement program	PHENIX (1.12_2829: ???)	Depositor
R, R_{free}	0.215 , 0.252 0.216 , 0.252	Depositor DCC
R_{free} test set	2480 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	37.1	Xtriage
Anisotropy	0.082	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 26.7	EDS
L-test for twinning[2]	$<|L|> = 0.46, <L^2> = 0.28$	Xtriage
Estimated twinning fraction	0.084 for -k,-h,-l	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	8949	wwPDB-VP
Average B, all atoms (Å^2)	38.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.91% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1] Intensities estimated from amplitudes.
[2] Theoretical values of $<|L|>$, $<L^2>$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality ⓘ

5.1 Standard geometry ⓘ

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	0.25	0/2198	0.43	0/2965
1	B	0.25	0/2192	0.42	0/2957
1	C	0.25	0/2174	0.42	0/2931
1	D	0.26	0/2178	0.43	0/2936
All	All	0.25	0/8742	0.43	0/11789

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 ⓘ

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	2158	0	2132	42	1
1	B	2152	0	2128	20	0
1	C	2136	0	2107	26	1
1	D	2139	0	2114	25	0
2	A	89	0	0	10	1
2	B	99	0	0	5	0
2	C	80	0	0	6	1
2	D	96	0	0	3	1
All	All	8949	0	8481	108	3

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 6.

The worst 5 of 108 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:B:217:GLN:NE2	2:B:302:HOH:O	2.02	0.92
1:B:264:ALA:O	2:B:301:HOH:O	1.87	0.91
1:C:264:ALA:O	2:C:301:HOH:O	1.92	0.86
1:C:233:HIS:O	2:C:302:HOH:O	1.98	0.81
1:A:46:ASP:OD1	2:A:301:HOH:O	1.98	0.80

All (3) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:320:HOH:O	2:D:375:HOH:O[1_655]	2.03	0.17
1:A:25:VAL:O	1:C:2:THR:N[1_545]	2.13	0.07
2:A:377:HOH:O	2:A:385:HOH:O[3_557]	2.16	0.04

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	273/283 (96%)	267 (98%)	6 (2%)	0	100	100
1	B	272/283 (96%)	268 (98%)	4 (2%)	0	100	100
1	C	268/283 (95%)	265 (99%)	3 (1%)	0	100	100
1	D	269/283 (95%)	265 (98%)	4 (2%)	0	100	100
All	All	1082/1132 (96%)	1065 (98%)	17 (2%)	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	233/240 (97%)	230 (99%)	3 (1%)	69	84
1	B	232/240 (97%)	228 (98%)	4 (2%)	60	78
1	C	230/240 (96%)	228 (99%)	2 (1%)	78	90
1	D	230/240 (96%)	229 (100%)	1 (0%)	91	96
All	All	925/960 (96%)	915 (99%)	10 (1%)	73	87

5 of 10 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	65	GLN
1	B	126	TYR
1	C	12	ARG
1	B	38	LYS
1	B	248	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	47	ASN
1	D	23	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	274/283 (96%)	-0.30	0	100	100	26, 39, 60, 72	0
1	B	274/283 (96%)	-0.41	0	100	100	23, 34, 54, 60	0
1	C	272/283 (96%)	-0.29	1 (0%)	92	91	24, 39, 58, 80	0
1	D	273/283 (96%)	-0.38	1 (0%)	92	91	24, 35, 58, 73	0
All	All	1093/1132 (96%)	-0.35	2 (0%)	95	94	23, 36, 58, 80	0

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	154	HIS	2.4
1	C	153	SER	2.4

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.