



Full wwPDB X-ray Structure Validation Report

Feb 27, 2014 – 04:04 PM GMT

PDB ID : 2X0K
Title : CRYSTAL STRUCTURE OF MODULAR FAD SYNTHETASE FROM
CORYNEBACTERIUM AMMONIAGENES
Authors : Herguedas, B.; Hermoso, J.A.; Martinez-Julvez, M.; Medina, M.; Frago, S.
Deposited on : 2009-12-15
Resolution : 1.95 Å(reported)

This is a full wwPDB validation report for a publicly released PDB entry.
We welcome your comments at validation@mail.wwpdb.org
A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

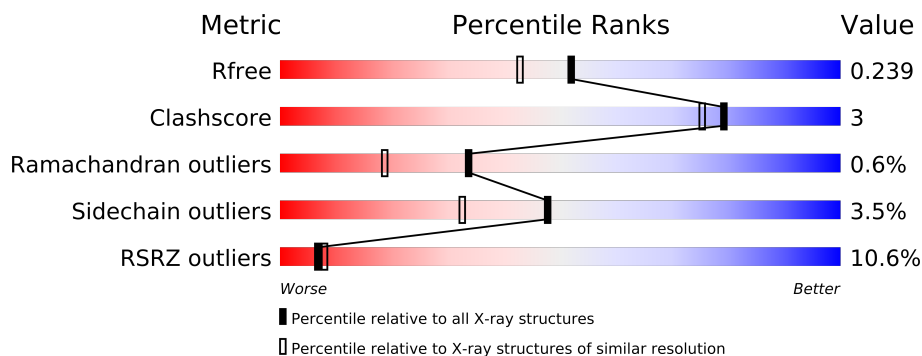
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.15 2013
Xtriage (Phenix) : dev-1323
EDS : stable22639
Percentile statistics : 21963
Refmac : 5.8.0049
CCP4 : 6.3.0 (Settle)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : stable22683

1 Overall quality at a glance

The reported resolution of this entry is 1.95 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}	66092	1321 (1.96-1.96)
Clashscore	79885	1488 (1.96-1.96)
Ramachandran outliers	78287	1475 (1.96-1.96)
Sidechain outliers	78261	1475 (1.96-1.96)
RSRZ outliers	66119	1321 (1.96-1.96)

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. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	338	
1	B	338	

The following table lists non-polymeric compounds that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
3	PPV	A	1340	-	X

2 Entry composition i

There are 4 unique types of molecules in this entry. The entry contains 5908 atoms, of which 0 are hydrogen and 0 are deuterium.

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 RIBOFLAVIN BIOSYNTHESIS PROTEIN RIBF.

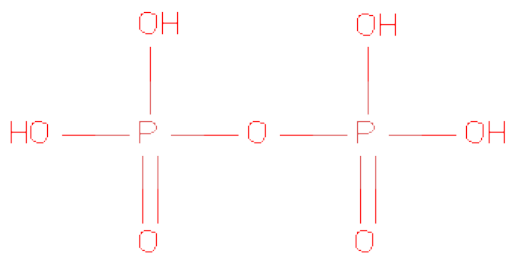
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	338	Total	C	N	O	S	0	10	0
			2675	1690	460	517	8			
1	B	338	Total	C	N	O	S	0	11	0
			2682	1695	461	518	8			

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	O	S	0	0
			5	4	1		
2	B	1	Total	O	S	0	0
			5	4	1		

- Molecule 3 is PYROPHOSPHATE (three-letter code: PPV) (formula: H₄O₇P₂).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	P	0	0
			9	7	2		
3	B	1	Total	O	P	0	0
			9	7	2		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	320	Total	O	0	0
			320	320		
4	B	203	Total	O	0	0
			203	203		

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 errors 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.

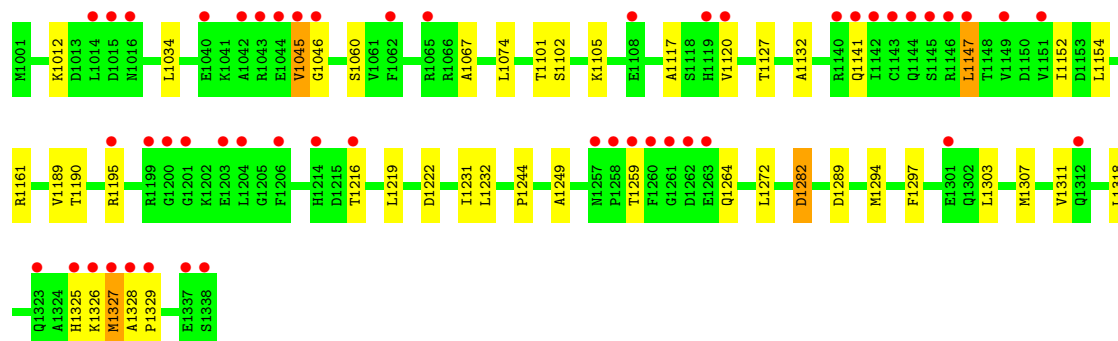
• Molecule 1: RIBOFLAVIN BIOSYNTHESIS PROTEIN RIBF

Chain A: 



• Molecule 1: RIBOFLAVIN BIOSYNTHESIS PROTEIN RIBF

Chain B: 



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 3	Depositor
Cell constants a, b, c, α , β , γ	133.47 Å 133.47 Å 133.47 Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	94.49 – 1.95 47.19 – 1.95	Depositor EDS
% Data completeness (in resolution range)	99.9 (94.49-1.95) 99.9 (47.19-1.95)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.82 (at 1.95 Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.204 , 0.237 0.208 , 0.239	Depositor DCC
R_{free} test set	4189 reflections (7.82%)	DCC
Wilson B-factor (Å ²)	26.2	Xtriage
Anisotropy	0.000	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 41.6	EDS
Estimated twinning fraction	0.028 for l,-k,h	Xtriage
L-test for twinning	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	1 of 57758 reflections (0.002%)	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	5908	wwPDB-VP
Average B, all atoms (Å ²)	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.43% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: SO4, PPV

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	0.36	0/2737	0.53	0/3721
1	B	0.33	0/2744	0.51	0/3731
All	All	0.34	0/5481	0.52	0/7452

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2675	0	2613	12	0
1	B	2682	0	2619	26	0
2	A	5	0	0	0	0
2	B	5	0	0	0	0
3	A	9	0	0	0	0
3	B	9	0	0	1	0
4	A	320	0	0	0	0
4	B	203	0	0	1	0
All	All	5908	0	5232	37	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 3.

All (37) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:B:1045:VAL:HG12	1:B:1046:GLY:H	1.46	0.81
1:A:259:THR:O	1:A:260:PHE:HB3	1.96	0.64
1:B:1127:THR:HG21	1:B:1132:ALA:HB1	1.81	0.61
1:B:1272:LEU:HD13	1:B:1311:VAL:HG13	1.82	0.60
1:A:34:LEU:HD23	1:A:152:ILE:HD12	1.83	0.60
1:B:1101:THR:HG22	1:B:1102:SER:O	2.04	0.56
1:B:1045:VAL:HG12	1:B:1046:GLY:N	2.20	0.56
1:B:1034:LEU:HD23	1:B:1152:ILE:HD12	1.89	0.55
1:A:232:LEU:HD12	1:A:282:ASP:HB3	1.89	0.54
1:A:195[A]:ARG:NH2	1:B:1074:LEU:HD23	2.22	0.54
1:B:1325[A]:HIS:O	1:B:1327[A]:MET:N	2.42	0.53
1:B:1190:THR:CG2	1:B:1232:LEU:HD11	2.39	0.52
3:B:2340:PPV:P2	4:B:2200:HOH:O	2.66	0.52
1:A:190:THR:CG2	1:A:232:LEU:HD11	2.40	0.51
1:A:190:THR:HG21	1:A:232:LEU:HD11	1.91	0.51
1:B:1326[B]:LYS:O	1:B:1327[B]:MET:C	2.51	0.50
1:B:1297:PHE:CD2	1:B:1303:LEU:HD13	2.46	0.49
1:B:1190:THR:HG21	1:B:1232:LEU:HD11	1.94	0.48
1:B:1294:MET:HA	1:B:1294:MET:HE2	1.96	0.47
1:A:195[A]:ARG:HH21	1:B:1074:LEU:HD23	1.79	0.47
1:B:1259:THR:HG23	1:B:1259:THR:O	2.15	0.46
1:B:1232:LEU:HD12	1:B:1282:ASP:HB3	1.99	0.45
1:A:101:THR:HG22	1:A:105:LYS:HB2	1.98	0.45
1:A:215:ASP:CB	1:A:263:GLU:HG3	2.46	0.44
1:B:1117:ALA:HB3	1:B:1147:LEU:HD23	1.98	0.44
1:B:1249:ALA:HB1	1:B:1318:LEU:HD12	2.00	0.44
1:A:231:ILE:HB	1:A:244:PRO:HA	2.00	0.43
1:A:101:THR:CG2	1:A:105:LYS:HB2	2.49	0.43
1:B:1222:ASP:HB3	1:B:1294:MET:HG3	2.01	0.43
1:B:1060:SER:HB3	1:B:1067:ALA:HB2	2.02	0.42
1:B:1325[A]:HIS:O	1:B:1326[A]:LYS:C	2.57	0.42
1:A:329[B]:PRO:O	1:A:331[B]:THR:N	2.53	0.41
1:B:1154:LEU:HB2	1:B:1161:ARG:NH1	2.36	0.41
1:B:1189:VAL:HG11	1:B:1219:LEU:HD21	2.02	0.41
1:B:1101:THR:HG23	1:B:1105:LYS:HB2	2.03	0.40
1:B:1328[A]:ALA:HB1	1:B:1329[A]:PRO:CD	2.50	0.40
1:B:1231:ILE:HB	1:B:1244:PRO:HA	2.02	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone ⓘ

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	346/338 (102%)	332 (96%)	12 (4%)	2 (1%)	33	19
1	B	347/338 (103%)	329 (95%)	15 (4%)	3 (1%)	25	11
All	All	693/676 (102%)	661 (95%)	27 (4%)	5 (1%)	33	15

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	260	PHE
1	B	1327[A]	MET
1	B	1327[B]	MET
1	A	262	ASP
1	B	1045	VAL

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	
1	A	283/275 (103%)	273 (96%)	10 (4%)	48	32
1	B	284/275 (103%)	273 (96%)	11 (4%)	43	27
All	All	567/550 (103%)	546 (96%)	21 (4%)	48	30

All (21) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	15	ASP
1	A	145	SER
1	A	147	LEU
1	A	264	GLN

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Mol	Chain	Res	Type
1	A	282	ASP
1	A	289	ASP
1	A	294	MET
1	A	307	MET
1	A	326[A]	LYS
1	A	326[B]	LYS
1	B	1012	LYS
1	B	1120	VAL
1	B	1141	GLN
1	B	1147	LEU
1	B	1195[A]	ARG
1	B	1195[B]	ARG
1	B	1216	THR
1	B	1264	GLN
1	B	1282	ASP
1	B	1289	ASP
1	B	1307	MET

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA ⓘ

There are no RNA chains in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

5.6 Ligand geometry ⓘ

4 ligands are modelled in this entry.

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	$\# Z > 2$
2	SO4	A	1339	-	4,4,4	0.21	0	6,6,6	0.24	0
3	PPV	A	1340	-	8,8,8	0.90	0	13,13,13	1.18	1 (7%)
2	SO4	B	2339	-	4,4,4	0.18	0	6,6,6	0.28	0
3	PPV	B	2340	-	8,8,8	0.90	0	13,13,13	1.17	1 (7%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the chemical component dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	SO4	A	1339	-	-	0/0/0/0	0/0/0/0
3	PPV	A	1340	-	-	0/6/6/6	0/0/0/0
2	SO4	B	2339	-	-	0/0/0/0	0/0/0/0
3	PPV	B	2340	-	-	0/6/6/6	0/0/0/0

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	2340	PPV	P2-OPP-P1	-2.60	124.07	131.68
3	A	1340	PPV	P2-OPP-P1	-2.48	124.40	131.68

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

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	338/338 (100%)	0.57	22 (6%)	18 24	15, 23, 35, 46	0
1	B	338/338 (100%)	1.10	50 (14%)	3 3	19, 30, 46, 49	0
All	All	676/676 (100%)	0.83	72 (10%)	7 8	15, 27, 44, 49	0

All (72) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	262	ASP	9.0
1	A	259	THR	8.4
1	B	1262	ASP	8.0
1	B	1145	SER	7.5
1	B	1144	GLN	7.2
1	A	258	PRO	6.9
1	B	1046	GLY	6.8
1	B	1260	PHE	6.8
1	B	1261	GLY	6.7
1	B	1258	PRO	6.6
1	A	263	GLU	6.3
1	B	1043	ARG	6.1
1	A	260	PHE	6.0
1	B	1259	THR	6.0
1	B	1044	GLU	5.7
1	B	1204	LEU	5.5
1	B	1142	ILE	5.4
1	A	261	GLY	5.0
1	B	1143	CYS	4.5
1	B	1200	GLY	4.2
1	A	329[A]	PRO	4.0
1	B	1326[A]	LYS	4.0
1	B	1147	LEU	3.8
1	B	1203	GLU	3.5

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Mol	Chain	Res	Type	RSRZ
1	B	1015	ASP	3.5
1	A	140	ARG	3.5
1	B	1201	GLY	3.4
1	B	1146	ARG	3.4
1	A	257	ASN	3.3
1	B	1062	PHE	3.2
1	B	1338	SER	3.2
1	B	1108	GLU	3.1
1	B	1263	GLU	3.1
1	B	1323[A]	GLN	3.0
1	B	1014	LEU	2.8
1	B	1140	ARG	2.8
1	A	141	GLN	2.7
1	A	326[A]	LYS	2.7
1	B	1206	PHE	2.6
1	B	1327[A]	MET	2.6
1	B	1042	ALA	2.6
1	B	1329[A]	PRO	2.6
1	B	1149	VAL	2.6
1	B	1312	GLN	2.6
1	A	325[A]	HIS	2.6
1	B	1045	VAL	2.6
1	A	144	GLN	2.5
1	A	327[A]	MET	2.5
1	B	1337	GLU	2.5
1	A	65	ARG	2.4
1	B	1195[A]	ARG	2.4
1	B	1141	GLN	2.4
1	B	1119	HIS	2.3
1	B	1216	THR	2.3
1	B	1328[A]	ALA	2.3
1	B	1214	HIS	2.3
1	A	264	GLN	2.3
1	B	1199	ARG	2.2
1	B	1065	ARG	2.2
1	B	1040	GLU	2.2
1	A	328[A]	ALA	2.1
1	B	1120	VAL	2.1
1	B	1325[A]	HIS	2.1
1	A	330[A]	GLU	2.1
1	A	338	SER	2.1
1	B	1151	VAL	2.0

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Mol	Chain	Res	Type	RSRZ
1	A	15	ASP	2.0
1	A	43	ARG	2.0
1	B	1301	GLU	2.0
1	B	1016	ASN	2.0
1	B	1257	ASN	2.0
1	A	13	ASP	2.0

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

6.4 Ligands ⓘ

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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	RSR	LLDF	B-factors(Å ²)	Q<0.9
3	PPV	A	1340	9/9	0.15	2.98	22,26,28,29	4
3	PPV	B	2340	9/9	0.19	1.93	28,31,32,32	4
2	SO4	A	1339	5/5	0.18	0.62	38,41,41,42	0
2	SO4	B	2339	5/5	0.16	-0.42	49,49,50,50	0

6.5 Other polymers ⓘ

There are no such residues in this entry.