



wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 19, 2017 – 07:57 PM EDT

PDB ID : 2FG9
Title : CRYSTAL STRUCTURE OF A PUTATIVE 5-NITROIMIDAZOLE ANTIBIOTIC RESISTANCE PROTEIN (BT_3078) FROM BACTEROIDES THETAIOAOMICRON VPI-5482 AT 2.20 Å RESOLUTION
Authors : Joint Center for Structural Genomics (JCSG)
Deposited on : unknown
Resolution : 2.20 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

<http://wwpdb.org/validation/2016/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 : 1.7.2 (RC1), CSD as538be (2017)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20030345
Percentile statistics : 20161228.v01 (using entries in the PDB archive December 28th 2016)
Refmac : 5.8.0135
CCP4 : 6.5.0
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : rb-20030345

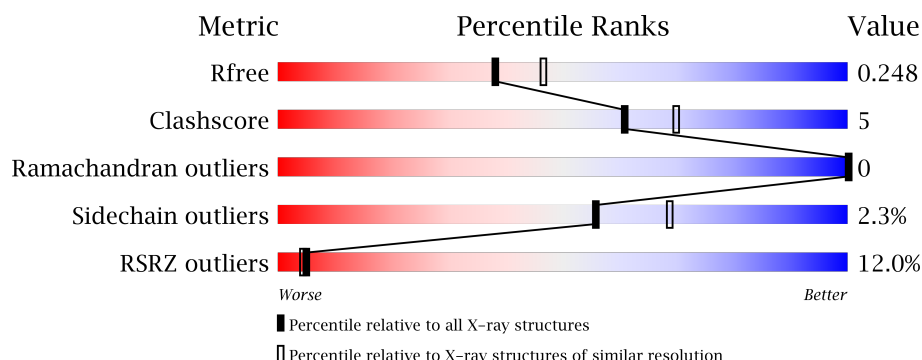
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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}	100719	4002 (2.20-2.20)
Clashscore	112137	4730 (2.20-2.20)
Ramachandran outliers	110173	4656 (2.20-2.20)
Sidechain outliers	110143	4657 (2.20-2.20)
RSRZ outliers	101464	4033 (2.20-2.20)

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. 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	178	<div> <div>11%</div> <div> <div></div> <div>80%</div> <div>12%</div> <div>7%</div> </div> </div>

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 1438 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 5-nitroimidazole antibiotic resistance protein.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	166	Total	C	N	O	S	Se	0	4	0
			1334	849	230	244	3	8			

There are 27 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-18	MSE	-	LEADER SEQUENCE	GB 29340391
A	-17	GLY	-	LEADER SEQUENCE	GB 29340391
A	-16	SER	-	LEADER SEQUENCE	GB 29340391
A	-15	ASP	-	LEADER SEQUENCE	GB 29340391
A	-14	LYS	-	LEADER SEQUENCE	GB 29340391
A	-13	ILE	-	LEADER SEQUENCE	GB 29340391
A	-12	HIS	-	LEADER SEQUENCE	GB 29340391
A	-11	HIS	-	LEADER SEQUENCE	GB 29340391
A	-10	HIS	-	LEADER SEQUENCE	GB 29340391
A	-9	HIS	-	LEADER SEQUENCE	GB 29340391
A	-8	HIS	-	LEADER SEQUENCE	GB 29340391
A	-7	HIS	-	LEADER SEQUENCE	GB 29340391
A	-6	GLU	-	LEADER SEQUENCE	GB 29340391
A	-5	ASN	-	LEADER SEQUENCE	GB 29340391
A	-4	LEU	-	LEADER SEQUENCE	GB 29340391
A	-3	TYR	-	LEADER SEQUENCE	GB 29340391
A	-2	PHE	-	LEADER SEQUENCE	GB 29340391
A	-1	GLN	-	LEADER SEQUENCE	GB 29340391
A	0	GLY	-	LEADER SEQUENCE	GB 29340391
A	1	MSE	MET	MODIFIED RESIDUE	GB 29340391
A	38	MSE	MET	MODIFIED RESIDUE	GB 29340391
A	60	MSE	MET	MODIFIED RESIDUE	GB 29340391
A	90	MSE	MET	MODIFIED RESIDUE	GB 29340391
A	96	MSE	MET	MODIFIED RESIDUE	GB 29340391
A	107	MSE	MET	MODIFIED RESIDUE	GB 29340391
A	118	MSE	MET	MODIFIED RESIDUE	GB 29340391
A	146	MSE	MET	MODIFIED RESIDUE	GB 29340391

- | Mol | Chain | Residues | Atoms | ZeroOcc | AltConf |
|-----|-------|----------|-----------------|---------|---------|
| 2 | A | 1 | Total Ni
1 1 | 0 | 0 |

- # FAD
-
- The image displays the chemical structure of Flavin Adenine Dinucleotide (FAD), a crucial coenzyme. It is composed of three main parts: a riboflavin (isoalloxazine) ring system, a ribitol chain, and an adenosine moiety.
- Riboflavin Ring System:** The top part of the structure features a fused ring system consisting of a benzene ring and two nitrogen-containing heterocycles (pyrimidine and imidazole). Nitrogen atoms are labeled N1, N3, N7, and N9. Carbon atoms are labeled C2, C4, C5, C6, C7, and C8. A carbonyl group is attached at C4.
 - Ribitol Chain:** A five-carbon chain (C9-C13) connects the riboflavin ring to the adenosine moiety. It includes a hydroxyl group at C9 and a phosphate group at C12.
 - Adenosine Moiety:** The bottom part of the structure is an adenosine unit. It consists of a ribose sugar (C14-C18) attached to an adenine base (C19-C24). The adenine base is a fused ring system with nitrogen atoms N1, N3, N7, and N9, and carbon atoms C2, C4, C5, C6, C7, and C8. A carbonyl group is attached at C6.
- The structure is color-coded: the riboflavin ring is blue, the ribitol chain is red, and the adenosine moiety is green. The phosphate group is shown in red, and the adenine base is shown in green.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	0	0
			53	27	9	15	2		

- 



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			4	2	2		

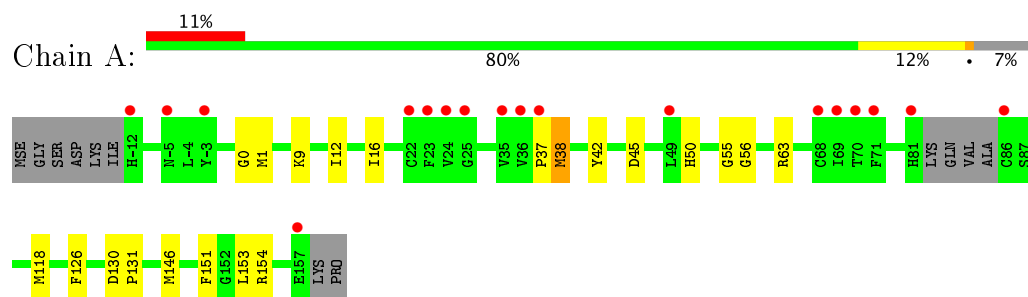
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	46	Total	O	0	0
			46	46		

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 ($\text{RSRZ} > 2$). 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: 5-nitroimidazole antibiotic resistance protein



4 Data and refinement statistics

Property	Value	Source
Space group	I 4 3 2	Depositor
Cell constants a, b, c, α , β , γ	134.00 Å 134.00 Å 134.00 Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	28.57 – 2.20 28.57 – 2.20	Depositor EDS
% Data completeness (in resolution range)	99.8 (28.57-2.20) 99.7 (28.57-2.20)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.51 (at 2.20 Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.223 , 0.245 0.226 , 0.248	Depositor DCC
R_{free} test set	516 reflections (5.05%)	DCC
Wilson B-factor (Å ²)	45.2	Xtriage
Anisotropy	0.000	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 50.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	1438	wwPDB-VP
Average B, all atoms (Å ²)	52.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.62% 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: NI, EDO, FAD

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	0.81	1/1357 (0.1%)	0.75	0/1819

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	A	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	38	MSE	CG-SE	-6.49	1.73	1.95

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	0	GLY	Peptide

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	1334	0	1240	13	0
2	A	1	0	0	0	0
3	A	53	0	31	1	0
4	A	4	0	6	0	0
5	A	46	0	0	0	0
All	All	1438	0	1277	14	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 5.

The worst 5 of 14 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:16:ILE:CD1	1:A:146:MSE:HE2	2.34	0.58
1:A:1:MSE:HB3	1:A:151:PHE:CE2	2.39	0.58
1:A:153:LEU:HD12	1:A:154:ARG:N	2.20	0.56
1:A:90:MSE:HE3	1:A:153:LEU:HD23	1.88	0.55
1:A:42:TYR:CZ	1:A:146:MSE:HE1	2.46	0.50

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	166/178 (93%)	161 (97%)	5 (3%)	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	135/150 (90%)	131 (97%)	4 (3%)	46 58

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	50	HIS
1	A	63[A]	ARG
1	A	63[B]	ARG
1	A	88	TYR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	-1	GLN

5.3.3 RNA ⓘ

There are no RNA molecules 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 ⓘ

Of 3 ligands modelled in this entry, 1 is monoatomic - leaving 2 for Mogul analysis.

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	$\# Z > 2$
3	FAD	A	161	-	51,58,58	1.66	8 (15%)	54,89,89	2.26	14 (25%)
4	EDO	A	162	-	3,3,3	0.54	0	2,2,2	0.18	0

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
3	FAD	A	161	-	-	0/28/50/50	0/6/6/6
4	EDO	A	162	-	-	0/1/1/1	0/0/0/0

The worst 5 of 8 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	161	FAD	C6-C5X	-3.28	1.36	1.41
3	A	161	FAD	C4'-C3'	-2.14	1.49	1.53
3	A	161	FAD	C2A-N1A	3.44	1.40	1.33
3	A	161	FAD	C10-N1	3.70	1.38	1.33
3	A	161	FAD	C4-N3	4.12	1.40	1.33

The worst 5 of 14 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	161	FAD	N3A-C2A-N1A	-7.33	122.47	128.86
3	A	161	FAD	C7M-C7-C6	-3.74	110.96	120.34
3	A	161	FAD	O5'-C5'-C4'	-3.70	99.48	109.36
3	A	161	FAD	C1'-C2'-C3'	-3.42	100.03	109.82
3	A	161	FAD	C4A-C5A-N7A	-2.82	106.68	109.41

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	161	FAD	1	0

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	158/178 (88%)	0.55	19 (12%) 5 4	34, 51, 62, 68	0

The worst 5 of 19 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	24	VAL	5.8
1	A	23	PHE	5.6
1	A	35	VAL	5.3
1	A	86	CYS	4.7
1	A	36	VAL	4.2

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 carbohydrates in this entry.

6.4 Ligands [i](#)

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	RSCC	RSR	LLDF	B-factors(Å ²)	Q<0.9
4	EDO	A	162	4/4	0.72	0.21	1.42	77,78,78,78	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	LLDF	B-factors(\AA^2)	Q<0.9
3	FAD	A	161	53/53	0.92	0.20	0.43	48,55,63,64	0
2	NI	A	160	1/1	1.00	0.04	-	32,32,32,32	1

6.5 Other polymers [i](#)

There are no such residues in this entry.