



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jan 31, 2016 – 07:43 PM GMT

PDB ID : 1GZG  
Title : COMPLEX OF A MG2-DEPENDENT PORPHOBILINOGEN SYNTHASE  
FROM PSEUDOMONAS AERUGINOSA (MUTANT D139N) WITH 5-  
FLUOROLEVULINIC ACID  
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Heinz, D.W.  
Deposited on : 2002-05-21  
Resolution : 1.66 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](mailto: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.

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

MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

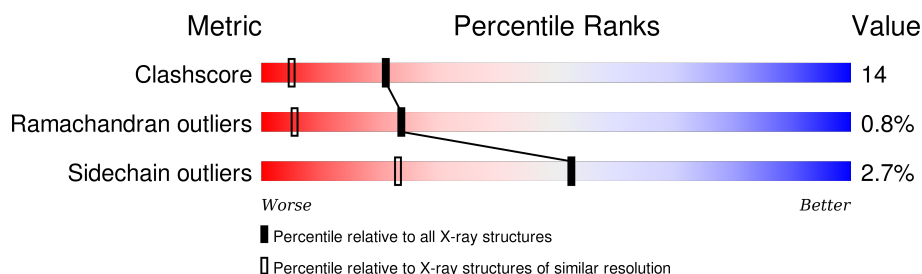
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.66 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))
Clashscore	102246	1323 (1.66-1.66)
Ramachandran outliers	100387	1295 (1.66-1.66)
Sidechain outliers	100360	1295 (1.66-1.66)

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  $\geq 3$ , 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.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	337	
1	B	337	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	LAF	B	1336	-	-	X	-
5	SO4	B	1343	-	-	X	-

## 2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 6111 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.

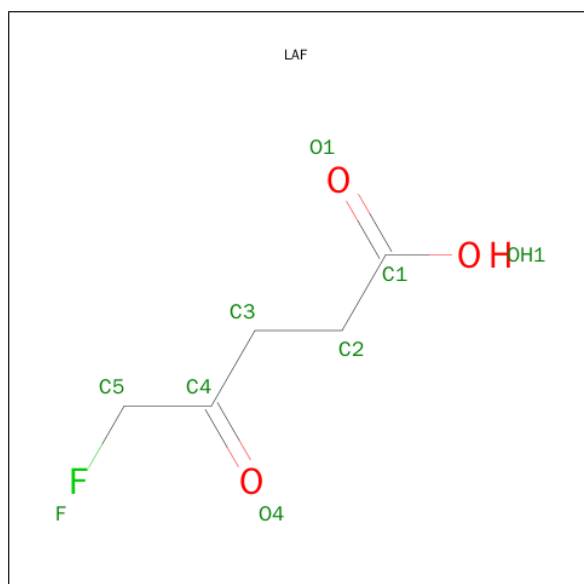
- Molecule 1 is a protein called DELTA-AMINOLEVULINIC ACID DEHYDRATASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	329	Total	C	N	O	S	0	11	0
			2631	1652	469	499	11			
1	B	323	Total	C	N	O	S	0	27	0
			2743	1720	490	520	13			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	139	ASN	ASP	ENGINEERED MUTATION	UNP Q59643
B	139	ASN	ASP	ENGINEERED MUTATION	UNP Q59643
A	199	VAL	ILE	SEE REMARK 999	UNP Q59643
B	199	VAL	ILE	SEE REMARK 999	UNP Q59643

- Molecule 2 is 5-FLUOROLEVULINIC ACID (three-letter code: LAF) (formula: C<sub>5</sub>H<sub>7</sub>FO<sub>3</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	F	O	0	0
			8	5	1	2		
2	A	1	Total	C	F	O	0	0
			8	5	1	2		
2	B	1	Total	C	F	O	0	0
			8	5	1	2		
2	B	1	Total	C	F	O	0	0
			8	5	1	2		
2	B	1	Total	C	F	O	0	1
			18	10	2	6		

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	1	Total	Mg	0	0
			1	1		
3	A	1	Total	Mg	0	0
			1	1		

- Molecule 4 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	1	Total	Na	0	0
			1	1		
4	A	1	Total	Na	0	0
			1	1		

- Molecule 5 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



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

- Molecule 6 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	B	2	Total	K	0	0
			2	2		

- Molecule 7 is water.

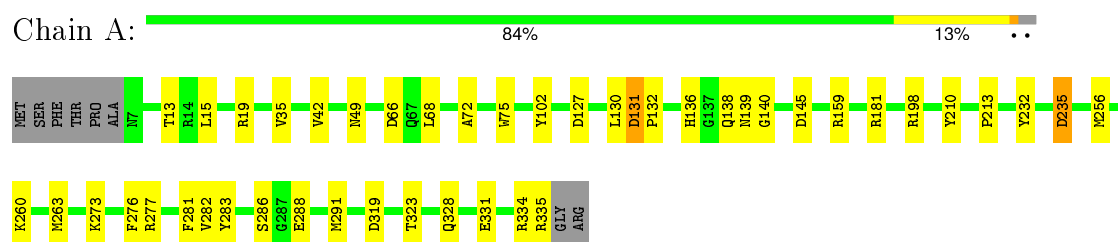
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	354	Total	O	0	0
			354	354		
7	B	317	Total	O	0	0
			317	317		

### 3 Residue-property plots

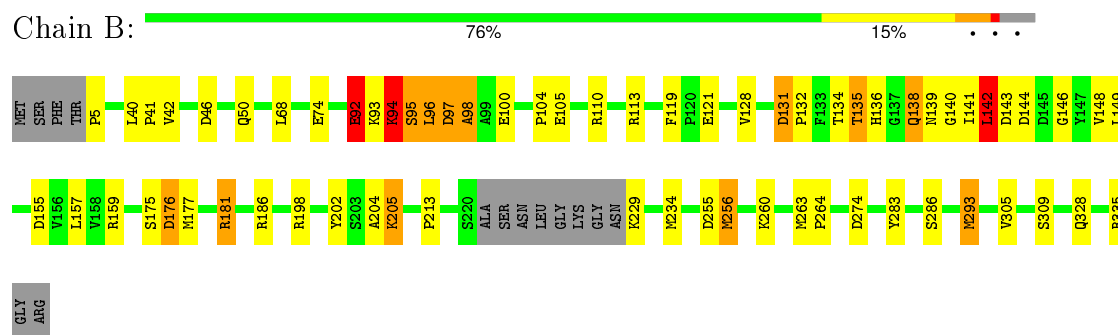
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according 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.

Note EDS was not executed.

#### • Molecule 1: DELTA-AMINOLEVULINIC ACID DEHYDRATASE



#### • Molecule 1: DELTA-AMINOLEVULINIC ACID DEHYDRATASE



## 4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section will therefore be incomplete.

Property	Value	Source
Space group	P 4 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	127.13Å 127.13Å 86.14Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	91.29 – 1.66	Depositor
% Data completeness (in resolution range)	99.1 (91.29-1.66)	Depositor
$R_{merge}$	0.12	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	REFMAC 5.0.32	Depositor
R, $R_{free}$	0.175 , 0.198	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	6111	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	24.0	wwPDB-VP

## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: K, NA, MG, LAF, SO4

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	0.48	1/2682 (0.0%)	0.85	8/3637 (0.2%)
1	B	0.46	0/2793	0.95	15/3784 (0.4%)
All	All	0.47	1/5475 (0.0%)	0.90	23/7421 (0.3%)

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	B	0	3

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	260	LYS	C-N	5.15	1.44	1.34

The worst 5 of 23 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	131	ASP	CB-CG-OD2	6.97	124.58	118.30
1	B	186	ARG	NE-CZ-NH2	-6.32	117.14	120.30
1	B	204	ALA	C-N-CA	6.06	136.86	121.70
1	B	142	LEU	CA-CB-CG	6.02	129.15	115.30
1	A	260	LYS	CA-C-O	-5.62	108.29	120.10

There are no chirality outliers.

All (3) planarity outliers are listed below:



Mol	Chain	Res	Type	Group
1	B	205[B]	LYS	Mainchain
1	B	94	LYS	Mainchain,Peptide

## 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	2631	0	2598	32	0
1	B	2743	0	2695	122	0
2	A	16	0	12	1	0
2	B	34	0	10	7	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
5	A	5	0	0	0	0
5	B	5	0	0	3	0
6	B	2	0	0	0	0
7	A	354	0	0	7	0
7	B	317	0	0	17	0
All	All	6111	0	5315	155	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 14.

The worst 5 of 155 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:155:ASP:O	1:B:159[C]:ARG:CZ	1.85	1.24
2:B:1338[B]:LAF:C1	7:B:2316:HOH:O	1.90	1.18
1:B:155:ASP:HB3	1:B:159[C]:ARG:NH2	1.56	1.17
1:B:95[B]:SER:OG	1:B:135:THR:N	1.77	1.15
2:B:1338[B]:LAF:O1	7:B:2316:HOH:O	1.59	1.14

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	338/337 (100%)	328 (97%)	10 (3%)	0	100	100
1	B	347/337 (103%)	321 (92%)	18 (5%)	8 (2%)	8	0
All	All	685/674 (102%)	649 (95%)	28 (4%)	8 (1%)	24	2

5 of 8 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	142	LEU
1	B	95[A]	SER
1	B	95[B]	SER
1	B	97[A]	ASP
1	B	97[B]	ASP

### 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	274/269 (102%)	267 (97%)	7 (3%)	54	25
1	B	286/269 (106%)	277 (97%)	9 (3%)	47	16
All	All	560/538 (104%)	544 (97%)	16 (3%)	52	19

5 of 16 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	92[A]	GLU

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Mol	Chain	Res	Type
1	B	92[B]	GLU
1	B	256[A]	MET
1	A	334	ARG
1	B	256[B]	MET

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 6 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	284	GLN
1	B	332	GLN
1	B	138	GLN
1	A	138	GLN
1	B	298	ASN

### 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](#)

Of 14 ligands modelled in this entry, 6 are monoatomic - leaving 8 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
2	LAF	A	1336	1,4	3,7,8	0.37	0	2,7,9	0.55	0
2	LAF	A	1337	1	3,7,8	0.47	0	2,7,9	0.95	0
5	SO4	A	1340	-	4,4,4	0.19	0	6,6,6	0.15	0
2	LAF	B	1336	1,2,4	3,7,8	0.33	0	2,7,9	0.53	0
2	LAF	B	1337	1	3,7,8	0.49	0	2,7,9	1.69	0
2	LAF	B	1338[A]	2,4	4,8,8	2.51	1 (25%)	4,9,9	2.92	2 (50%)
2	LAF	B	1338[B]	2,4	4,8,8	2.52	1 (25%)	4,9,9	2.82	2 (50%)
5	SO4	B	1343	-	4,4,4	0.32	0	6,6,6	0.09	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
2	LAF	A	1336	1,4	-	0/2/5/7	0/0/0/0
2	LAF	A	1337	1	-	0/2/5/7	0/0/0/0
5	SO4	A	1340	-	-	0/0/0/0	0/0/0/0
2	LAF	B	1336	1,2,4	-	0/2/5/7	0/0/0/0
2	LAF	B	1337	1	-	0/2/5/7	0/0/0/0
2	LAF	B	1338[A]	2,4	-	0/3/7/7	0/0/0/0
2	LAF	B	1338[B]	2,4	-	0/3/7/7	0/0/0/0
5	SO4	B	1343	-	-	0/0/0/0	0/0/0/0

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1338[A]	LAF	O4-C4	-4.86	1.12	1.21
2	B	1338[B]	LAF	O4-C4	-4.86	1.12	1.21

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1338[A]	LAF	O4-C4-C3	-3.43	110.32	121.16
2	B	1338[B]	LAF	O4-C4-C3	-3.27	110.82	121.16
2	B	1338[B]	LAF	O4-C4-C5	4.60	130.34	121.67
2	B	1338[A]	LAF	O4-C4-C5	4.69	130.50	121.67

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

5 monomers are involved in 11 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	1336	LAF	1	0
2	B	1336	LAF	4	0
2	B	1337	LAF	3	0
2	B	1338[B]	LAF	3	0
5	B	1343	SO4	3	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 ⓘ

### 6.1 Protein, DNA and RNA chains ⓘ

EDS was not executed - this section will therefore be empty.

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

EDS was not executed - this section will therefore be empty.

### 6.3 Carbohydrates ⓘ

EDS was not executed - this section will therefore be empty.

### 6.4 Ligands ⓘ

EDS was not executed - this section will therefore be empty.

### 6.5 Other polymers ⓘ

EDS was not executed - this section will therefore be empty.