



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 12, 2024 – 09:41 PM EDT

PDB ID : 5IG8  
Title : Crystal structure of macrocyclase MdnB from *Microcystis aeruginosa* MRC  
Authors : Li, K.; Concurso, H.L.; Bruner, S.D.  
Deposited on : 2016-02-27  
Resolution : 2.28 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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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  
Xtriage (Phenix) : 1.20.1  
EDS : 3.0  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.003 (Gargrove)  
Density-Fitness : 1.0.11  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.39

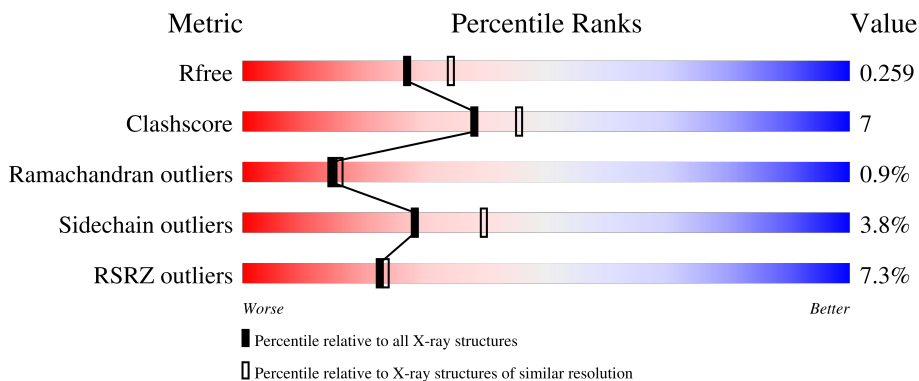
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.28 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))
$R_{free}$	164625	8487 (2.30-2.26)
Clashscore	180529	9437 (2.30-2.26)
Ramachandran outliers	177936	9341 (2.30-2.26)
Sidechain outliers	177891	9342 (2.30-2.26)
RSRZ outliers	164620	8487 (2.30-2.26)

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 of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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	A	335	
1	B	335	

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4433 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 ATP grasp ligase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	307	Total 2439	C 1567	N 409	O 456	S 7	0	0	0
1	B	243	Total 1937	C 1250	N 325	O 358	S 4	0	1	0

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	327	ALA	-	expression tag	UNP B2G3C9
A	328	ALA	-	expression tag	UNP B2G3C9
A	329	ALA	-	expression tag	UNP B2G3C9
A	330	HIS	-	expression tag	UNP B2G3C9
A	331	HIS	-	expression tag	UNP B2G3C9
A	332	HIS	-	expression tag	UNP B2G3C9
A	333	HIS	-	expression tag	UNP B2G3C9
A	334	HIS	-	expression tag	UNP B2G3C9
A	335	HIS	-	expression tag	UNP B2G3C9
B	327	ALA	-	expression tag	UNP B2G3C9
B	328	ALA	-	expression tag	UNP B2G3C9
B	329	ALA	-	expression tag	UNP B2G3C9
B	330	HIS	-	expression tag	UNP B2G3C9
B	331	HIS	-	expression tag	UNP B2G3C9
B	332	HIS	-	expression tag	UNP B2G3C9
B	333	HIS	-	expression tag	UNP B2G3C9
B	334	HIS	-	expression tag	UNP B2G3C9
B	335	HIS	-	expression tag	UNP B2G3C9

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	34	Total 34	O 34	0	0

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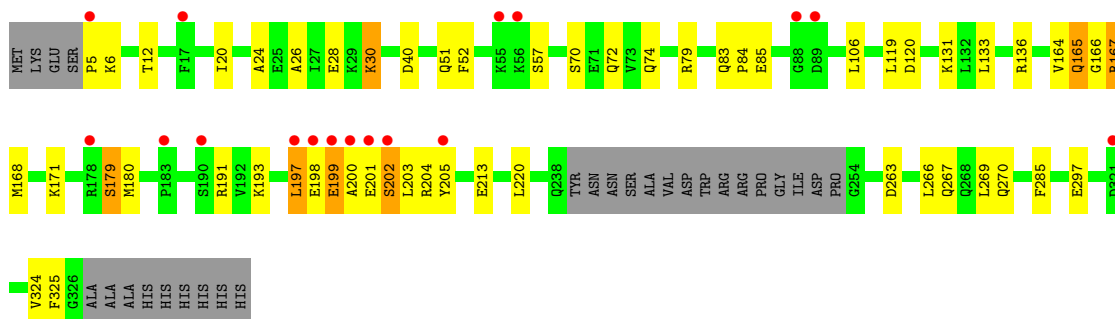
<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
2	B	23	Total	O	0	0
			23	23		

### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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.

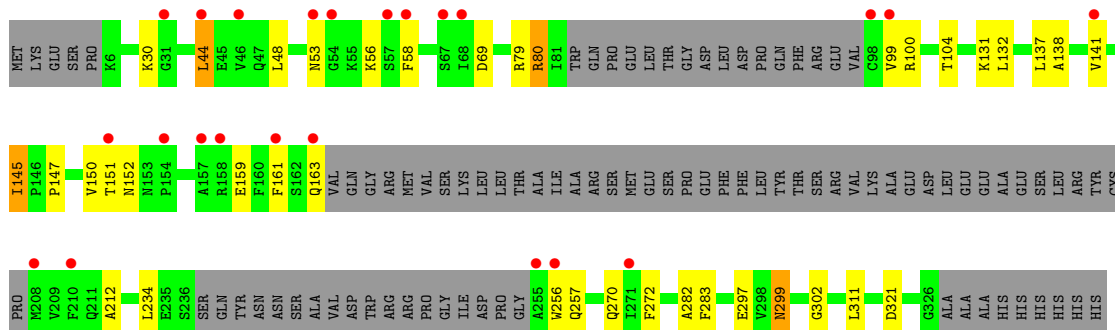
- Molecule 1: ATP grasp ligase

Chain A: 



- Molecule 1: ATP grasp ligase

Chain B: 



## 4 Data and refinement statistics i

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	128.62Å 37.99Å 139.38Å 90.00° 116.55° 90.00°	Depositor
Resolution (Å)	36.03 – 2.28 36.03 – 2.28	Depositor EDS
% Data completeness (in resolution range)	99.5 (36.03-2.28) 99.6 (36.03-2.28)	Depositor EDS
$R_{merge}$	0.05	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.54 (at 2.29Å)	Xtrriage
Refinement program	PHENIX 1.10.1_2155	Depositor
R, $R_{free}$	0.214 , 0.255 0.217 , 0.259	Depositor DCC
$R_{free}$ test set	1363 reflections (4.85%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	42.9	Xtrriage
Anisotropy	0.790	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 40.2	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	0.019 for h,-k,-h-l	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	4433	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	47.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.43% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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	A	0.47	0/2494	0.62	0/3385
1	B	0.43	0/1978	0.57	0/2682
All	All	0.45	0/4472	0.60	0/6067

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 [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	2439	0	2403	41	0
1	B	1937	0	1914	18	0
2	A	34	0	0	0	0
2	B	23	0	0	0	0
All	All	4433	0	4317	59	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 7.

All (59) 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:197:LEU:HD22	1:A:199:GLU:H	1.19	1.05

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:197:LEU:HD23	1:A:198:GLU:H	1.28	0.96
1:A:197:LEU:CD2	1:A:199:GLU:H	1.82	0.91
1:A:197:LEU:HD22	1:A:199:GLU:N	1.90	0.85
1:A:197:LEU:HD23	1:A:198:GLU:N	1.93	0.82
1:A:197:LEU:CD2	1:A:199:GLU:N	2.46	0.78
1:A:6:LYS:HD2	1:A:72:GLN:HE21	1.49	0.78
1:A:197:LEU:HD22	1:A:199:GLU:CB	2.19	0.71
1:B:147:PRO:HD2	1:B:212:ALA:HB3	1.78	0.65
1:A:204:ARG:HD3	1:A:205:TYR:CZ	2.38	0.58
1:A:197:LEU:CD2	1:A:199:GLU:CB	2.83	0.56
1:A:12:THR:HG21	1:A:20:ILE:HD13	1.86	0.56
1:B:132:LEU:HD21	1:B:150:VAL:HG11	1.87	0.56
1:A:165:GLN:HG3	1:A:167:ARG:HH11	1.70	0.56
1:B:132:LEU:CD2	1:B:150:VAL:HG11	2.38	0.53
1:A:12:THR:HG22	1:A:79:ARG:HG2	1.91	0.53
1:A:26:ALA:O	1:A:30:LYS:HD2	2.08	0.53
1:B:138:ALA:HB3	1:B:145:ILE:HD11	1.90	0.53
1:A:164:VAL:O	1:A:166:GLY:N	2.42	0.52
1:A:263:ASP:O	1:A:267:GLN:HG2	2.10	0.51
1:A:5:PRO:HA	1:A:74:GLN:HB2	1.92	0.51
1:A:266:LEU:O	1:A:270:GLN:HG2	2.10	0.50
1:A:51:GLN:O	1:A:57:SER:HA	2.12	0.50
1:B:272:PHE:CD2	1:B:283:PHE:HE1	2.30	0.50
1:A:24:ALA:O	1:A:28:GLU:HG2	2.12	0.49
1:B:282:ALA:HB3	1:B:302:GLY:HA3	1.93	0.49
1:B:138:ALA:CB	1:B:145:ILE:HD11	2.42	0.49
1:B:159:GLU:OE2	1:B:163:GLN:HG3	2.12	0.48
1:A:197:LEU:HD23	1:A:199:GLU:N	2.29	0.48
1:A:168:MET:HG2	1:A:193:LYS:NZ	2.29	0.47
1:A:136:ARG:HD2	1:A:136:ARG:C	2.35	0.47
1:A:83:GLN:HG3	1:A:84:PRO:HD2	1.96	0.47
1:B:137:LEU:O	1:B:141:VAL:HG23	2.15	0.46
1:A:131:LYS:NZ	1:A:297:GLU:OE1	2.48	0.46
1:A:197:LEU:CD2	1:A:198:GLU:N	2.71	0.46
1:A:191:ARG:NH1	1:A:213:GLU:OE2	2.49	0.45
1:A:12:THR:HG22	1:A:79:ARG:CG	2.47	0.45
1:A:324:VAL:HG23	1:A:325:PHE:CD2	2.51	0.45
1:B:79:ARG:O	1:B:80:ARG:HG2	2.16	0.44
1:B:151:THR:OG1	1:B:152:ASN:N	2.49	0.44
1:A:269:LEU:HA	1:A:269:LEU:HD23	1.77	0.44
1:B:30:LYS:NZ	1:B:321:ASP:OD1	2.31	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:202:SER:O	1:A:203:LEU:HD23	2.18	0.44
1:A:40:ASP:O	1:A:85:GLU:HB3	2.18	0.44
1:A:119:LEU:HA	1:A:120:ASP:HA	1.84	0.44
1:A:52:PHE:CD2	1:A:57:SER:HB2	2.54	0.43
1:A:197:LEU:HD22	1:A:199:GLU:CA	2.48	0.43
1:A:220:LEU:HB2	1:A:285:PHE:HB2	1.99	0.43
1:B:100:ARG:O	1:B:104:THR:HG23	2.18	0.43
1:B:44:LEU:H	1:B:44:LEU:HG	1.57	0.42
1:A:106:LEU:HD23	1:A:106:LEU:HA	1.90	0.42
1:B:299:ASN:HB3	1:B:302:GLY:CA	2.49	0.42
1:B:234:LEU:HG	1:B:256:TRP:CZ3	2.55	0.41
1:B:131:LYS:HE2	1:B:297:GLU:HB3	2.03	0.41
1:B:256:TRP:O	1:B:311:LEU:HD21	2.20	0.41
1:A:133:LEU:HD23	1:A:133:LEU:O	2.20	0.41
1:A:200:ALA:O	1:A:201:GLU:C	2.59	0.41
1:A:12:THR:HG22	1:A:79:ARG:HB3	2.03	0.41
1:A:171:LYS:HB3	1:A:171:LYS:HE2	1.78	0.40

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	303/335 (90%)	286 (94%)	13 (4%)	4 (1%)	10	9
1	B	236/335 (70%)	228 (97%)	7 (3%)	1 (0%)	30	36
All	All	539/670 (80%)	514 (95%)	20 (4%)	5 (1%)	14	16

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	179	SER

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Mol	Chain	Res	Type
1	B	53	ASN
1	A	165	GLN
1	A	197	LEU
1	A	199	GLU

### 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	264/290 (91%)	258 (98%)	6 (2%)	45	60
1	B	209/290 (72%)	197 (94%)	12 (6%)	17	22
All	All	473/580 (82%)	455 (96%)	18 (4%)	28	40

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	30	LYS
1	A	70	SER
1	A	167	ARG
1	A	179	SER
1	A	180	MET
1	A	202	SER
1	B	44	LEU
1	B	48	LEU
1	B	56	LYS
1	B	58	PHE
1	B	69	ASP
1	B	80	ARG
1	B	99	VAL
1	B	145	ILE
1	B	161	PHE
1	B	257	GLN
1	B	270	GLN
1	B	299	ASN

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

### 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 oligosaccharides 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

### 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	307/335 (91%)	0.48	17 (5%) 32 33	21, 39, 76, 109	0
1	B	243/335 (72%)	0.80	23 (9%) 15 16	19, 51, 76, 90	1 (0%)
All	All	550/670 (82%)	0.62	40 (7%) 22 23	19, 45, 77, 109	1 (0%)

All (40) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	157	ALA	4.4
1	B	99	VAL	4.3
1	A	202	SER	3.7
1	B	255	ALA	3.6
1	B	161	PHE	3.3
1	A	5	PRO	3.2
1	B	208	MET	3.2
1	B	53	ASN	3.0
1	A	56	LYS	3.0
1	A	183	PRO	2.9
1	B	58	PHE	2.9
1	A	201	GLU	2.8
1	B	158	ARG	2.7
1	B	54	GLY	2.7
1	B	210	PHE	2.7
1	A	205	TYR	2.6
1	A	88	GLY	2.6
1	B	68	ILE	2.6
1	A	17	PHE	2.6
1	A	89	ASP	2.6
1	A	197	LEU	2.5
1	B	57	SER	2.4
1	A	55	LYS	2.4
1	A	199	GLU	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	321	ASP	2.3
1	B	31	GLY	2.3
1	B	256	TRP	2.3
1	A	198	GLU	2.2
1	B	46	VAL	2.2
1	B	163	GLN	2.2
1	A	200	ALA	2.2
1	B	151	THR	2.2
1	B	141	VAL	2.2
1	B	44	LEU	2.1
1	B	67	SER	2.1
1	B	98	CYS	2.1
1	B	154	PRO	2.1
1	A	190	SER	2.1
1	A	178	ARG	2.0
1	B	271	ILE	2.0

## 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 monosaccharides 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.