



wwPDB X-ray Structure Validation Summary Report ⓘ

Sep 19, 2016 – 02:13 PM EDT

PDB ID : 5EEG
Title : Crystal structure of carminomycin-4-O-methyltransferase DnrK in complex with tetrazole-SAH
Authors : Wang, F.; Singh, S.; Thorson, J.S.; Phillips Jr., G.N.; Enzyme Discovery for Natural Product Biosynthesis (NatPro)
Deposited on : 2015-10-22
Resolution : 2.25 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	:	1.7.1 (RC1), CSD as537be (2016)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20027939
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
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-20027939

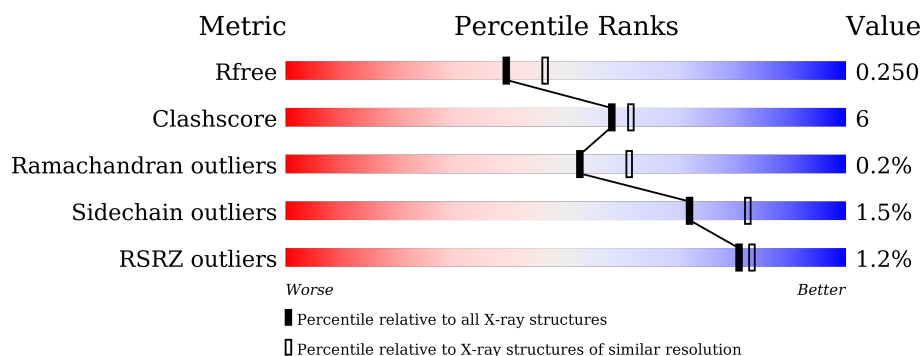
1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.25 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}	91344	1640 (2.28-2.24)
Clashscore	102246	1095 (2.26-2.26)
Ramachandran outliers	100387	1063 (2.26-2.26)
Sidechain outliers	100360	1063 (2.26-2.26)
RSRZ outliers	91569	1647 (2.28-2.24)

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	376	<div> <div></div> <div>78%</div> <div>10%</div> <div>12%</div> </div>
1	B	376	<div> <div></div> <div>79%</div> <div>9%</div> <div>11%</div> </div>

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 5683 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 Carminomycin 4-O-methyltransferase DnrK.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	332	Total	C	N	O	S	0	0	0
			2568	1622	461	480	5			
1	B	333	Total	C	N	O	S	0	0	0
			2569	1621	462	481	5			

There are 40 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	MET	-	initiating methionine	UNP Q06528
A	-18	GLY	-	expression tag	UNP Q06528
A	-17	SER	-	expression tag	UNP Q06528
A	-16	SER	-	expression tag	UNP Q06528
A	-15	HIS	-	expression tag	UNP Q06528
A	-14	HIS	-	expression tag	UNP Q06528
A	-13	HIS	-	expression tag	UNP Q06528
A	-12	HIS	-	expression tag	UNP Q06528
A	-11	HIS	-	expression tag	UNP Q06528
A	-10	HIS	-	expression tag	UNP Q06528
A	-9	SER	-	expression tag	UNP Q06528
A	-8	SER	-	expression tag	UNP Q06528
A	-7	GLY	-	expression tag	UNP Q06528
A	-6	LEU	-	expression tag	UNP Q06528
A	-5	VAL	-	expression tag	UNP Q06528
A	-4	PRO	-	expression tag	UNP Q06528
A	-3	ARG	-	expression tag	UNP Q06528
A	-2	GLY	-	expression tag	UNP Q06528
A	-1	SER	-	expression tag	UNP Q06528
A	0	HIS	-	expression tag	UNP Q06528
B	-19	MET	-	initiating methionine	UNP Q06528
B	-18	GLY	-	expression tag	UNP Q06528
B	-17	SER	-	expression tag	UNP Q06528
B	-16	SER	-	expression tag	UNP Q06528
B	-15	HIS	-	expression tag	UNP Q06528

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-14	HIS	-	expression tag	UNP Q06528
B	-13	HIS	-	expression tag	UNP Q06528
B	-12	HIS	-	expression tag	UNP Q06528
B	-11	HIS	-	expression tag	UNP Q06528
B	-10	HIS	-	expression tag	UNP Q06528
B	-9	SER	-	expression tag	UNP Q06528
B	-8	SER	-	expression tag	UNP Q06528
B	-7	GLY	-	expression tag	UNP Q06528
B	-6	LEU	-	expression tag	UNP Q06528
B	-5	VAL	-	expression tag	UNP Q06528
B	-4	PRO	-	expression tag	UNP Q06528
B	-3	ARG	-	expression tag	UNP Q06528
B	-2	GLY	-	expression tag	UNP Q06528
B	-1	SER	-	expression tag	UNP Q06528
B	0	HIS	-	expression tag	UNP Q06528

- # S8M
-
- The chemical structure of S8M is a nucleoside derivative. It consists of a purine base (top) connected via a C-glycosidic bond to a ribose sugar (middle), which is further linked via a thioether bond to a thymine base (bottom). The purine base is labeled with atoms N107, N108, C04, C09, C03, C01, C05, and N102. The ribose sugar is labeled with atoms C110, C111, C120, C140, C130, and C16. The thymine base is labeled with atoms N22, N23, N24, N25, C21, C20, C19, C18, and N26. The thioether bond is represented by a sulfur atom (S17) connecting the ribose sugar (C16) to the thymine base (C19). The ribose sugar has two hydroxyl groups (O28 and O27) attached to C120 and C140, respectively. The thymine base has a methyl group (C18) attached to C19.

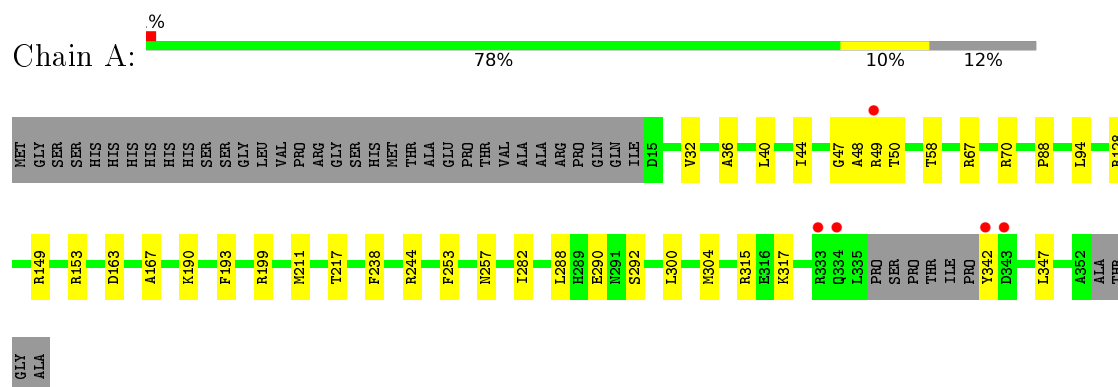
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	235	Total 235	O 235	0	0
3	B	255	Total 255	O 255	0	0

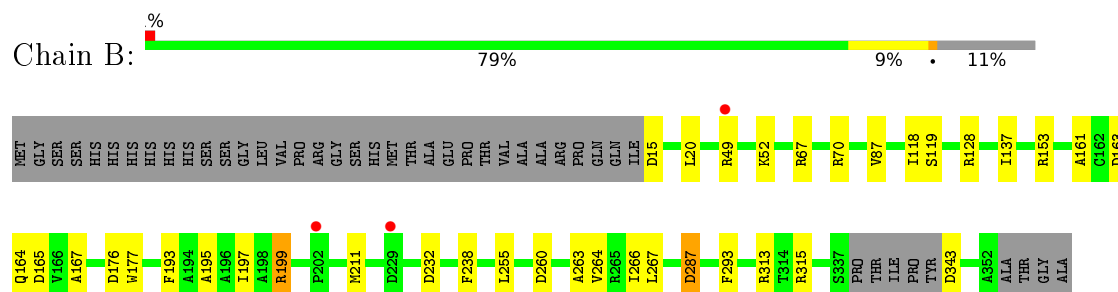
3 Residue-property plots [i](#)

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: Carminomycin 4-O-methyltransferase DnrK



• Molecule 1: Carminomycin 4-O-methyltransferase DnrK



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	60.56Å 104.18Å 62.99Å 90.00° 105.20° 90.00°	Depositor
Resolution (Å)	29.85 – 2.25 29.85 – 2.25	Depositor EDS
% Data completeness (in resolution range)	99.3 (29.85-2.25) 94.8 (29.85-2.25)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	0.12	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.59 (at 2.26Å)	Xtriage
Refinement program	PHENIX (1.10_2155: ???)	Depositor
R, R_{free}	0.197 , 0.248 0.196 , 0.250	Depositor DCC
R_{free} test set	1918 reflections (5.69%)	DCC
Wilson B-factor (Å ²)	17.0	Xtriage
Anisotropy	0.859	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 51.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.023 for l,-k,h	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	5683	wwPDB-VP
Average B, all atoms (Å ²)	22.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 14.68% 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: S8M

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	0.41	0/2618	0.63	2/3563 (0.1%)
1	B	0.45	0/2619	0.61	1/3565 (0.0%)
All	All	0.43	0/5237	0.62	3/7128 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	199	ARG	NE-CZ-NH1	-6.10	117.25	120.30
1	B	287	ASP	CB-CG-OD2	5.87	123.58	118.30
1	A	199	ARG	NE-CZ-NH2	5.75	123.18	120.30

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	2568	0	2560	33	0
1	B	2569	0	2563	31	0
2	A	28	0	20	1	0
2	B	28	0	20	2	0
3	A	235	0	0	11	1
3	B	255	0	0	16	1

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	5683	0	5163	61	1

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 61 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:199:ARG:NH1	3:B:502:HOH:O	2.09	0.83
1:B:263:ALA:O	3:B:501:HOH:O	1.95	0.83
1:A:292:SER:OG	1:B:70:ARG:NH1	2.17	0.77
1:B:267:LEU:N	3:B:501:HOH:O	2.25	0.70
1:B:211:MET:HE2	2:B:401:S8M:O28	1.94	0.67

All (1) 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)
3:A:608:HOH:O	3:B:573:HOH:O[2_454]	2.14	0.06

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	328/376 (87%)	322 (98%)	5 (2%)	1 (0%)	46	52
1	B	329/376 (88%)	320 (97%)	9 (3%)	0	100	100
All	All	657/752 (87%)	642 (98%)	14 (2%)	1 (0%)	52	61

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	48	ALA

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	264/299 (88%)	261 (99%)	3 (1%)	80	88
1	B	265/299 (89%)	260 (98%)	5 (2%)	65	75
All	All	529/598 (88%)	521 (98%)	8 (2%)	72	82

5 of 8 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	87	VAL
1	B	287	ASP
1	B	199	ARG
1	A	238	PHE
1	B	193	PHE

Some 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 carbohydrates in this entry.

5.6 Ligand geometry

2 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	S8M	A	401	-	27,31,31	2.06	4 (14%)	22,44,44	2.49	4 (18%)
2	S8M	B	401	-	27,31,31	2.03	5 (18%)	22,44,44	2.46	5 (22%)

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	S8M	A	401	-	-	0/7/31/31	0/4/4/4
2	S8M	B	401	-	-	0/7/31/31	0/4/4/4

The worst 5 of 9 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	401	S8M	C16-C14	-2.27	1.45	1.52
2	B	401	S8M	C16-C14	-2.05	1.46	1.52
2	B	401	S8M	C12-C13	-2.04	1.47	1.53
2	A	401	S8M	N24-N23	2.85	1.36	1.32
2	A	401	S8M	C05-N07	3.05	1.46	1.34

The worst 5 of 9 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	401	S8M	N02-C01-N06	-9.08	121.74	128.87
2	B	401	S8M	N02-C01-N06	-8.97	121.82	128.87
2	B	401	S8M	C14-O15-C11	-3.22	106.23	109.64
2	A	401	S8M	C14-O15-C11	-3.17	106.28	109.64
2	B	401	S8M	C16-S17-C18	2.21	109.13	102.42

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	401	S8M	1	0
2	B	401	S8M	2	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	332/376 (88%)	-0.03	5 (1%) 76 79	12, 21, 34, 47	0
1	B	333/376 (88%)	-0.06	3 (0%) 85 87	12, 20, 31, 46	0
All	All	665/752 (88%)	-0.04	8 (1%) 81 83	12, 21, 33, 47	0

The worst 5 of 8 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	49	ARG	3.3
1	A	342	TYR	3.2
1	A	343	ASP	3.0
1	A	49	ARG	3.0
1	A	333	ARG	3.0

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 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(\AA^2)	Q<0.9
2	S8M	A	401	28/28	0.92	0.13	0.24	4,13,25,39	0
2	S8M	B	401	28/28	0.94	0.12	-0.10	5,11,17,25	0

6.5 Other polymers [i](#)

There are no such residues in this entry.