



wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 1, 2016 – 05:32 AM GMT

PDB ID : 2R6O
Title : Crystal structure of putative diguanylate cyclase/phosphodiesterase from *Thiobacillus denitrificans*
Authors : Chang, C.; Xu, X.; Zheng, H.; Savchenko, A.; Edwards, A.M.; Joachimiak, A.; Midwest Center for Structural Genomics (MCSG)
Deposited on : 2007-09-06
Resolution : 1.80 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 (RC4), CSD as536be (2015)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20026688
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) : trunk26865

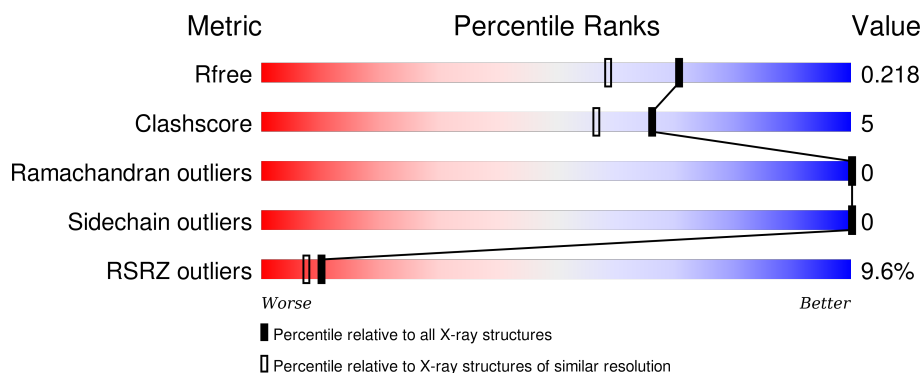
1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.80 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	4533 (1.80-1.80)
Clashscore	102246	5383 (1.80-1.80)
Ramachandran outliers	100387	5320 (1.80-1.80)
Sidechain outliers	100360	5319 (1.80-1.80)
RSRZ outliers	91569	4547 (1.80-1.80)

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	294	<div> <div>7%</div> <div>79%</div> <div>9%</div> <div>12%</div> </div>
1	B	294	<div> <div>9%</div> <div>76%</div> <div>6%</div> <div>18%</div> </div>

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	MG	B	803	-	-	-	X

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 4346 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 Putative diguanylate cyclase/phosphodiesterase (GGDEF & EAL domains).

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	258	Total	C	N	O	S	Se	0	12	0
			2054	1287	363	394	5	5			
1	B	242	Total	C	N	O	S	Se	0	10	0
			1908	1194	344	361	5	4			

There are 44 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	465	MSE	-	EXPRESSION TAG	UNP Q3SJE6
A	466	GLY	-	EXPRESSION TAG	UNP Q3SJE6
A	467	SER	-	EXPRESSION TAG	UNP Q3SJE6
A	468	SER	-	EXPRESSION TAG	UNP Q3SJE6
A	469	HIS	-	EXPRESSION TAG	UNP Q3SJE6
A	470	HIS	-	EXPRESSION TAG	UNP Q3SJE6
A	471	HIS	-	EXPRESSION TAG	UNP Q3SJE6
A	472	HIS	-	EXPRESSION TAG	UNP Q3SJE6
A	473	HIS	-	EXPRESSION TAG	UNP Q3SJE6
A	474	HIS	-	EXPRESSION TAG	UNP Q3SJE6
A	475	SER	-	EXPRESSION TAG	UNP Q3SJE6
A	476	SER	-	EXPRESSION TAG	UNP Q3SJE6
A	477	GLY	-	EXPRESSION TAG	UNP Q3SJE6
A	478	ARG	-	EXPRESSION TAG	UNP Q3SJE6
A	479	GLU	-	EXPRESSION TAG	UNP Q3SJE6
A	480	ASN	-	EXPRESSION TAG	UNP Q3SJE6
A	481	LEU	-	EXPRESSION TAG	UNP Q3SJE6
A	482	TYR	-	EXPRESSION TAG	UNP Q3SJE6
A	483	PHE	-	EXPRESSION TAG	UNP Q3SJE6
A	484	GLN	-	EXPRESSION TAG	UNP Q3SJE6
A	485	GLY	-	EXPRESSION TAG	UNP Q3SJE6
A	486	HIS	-	EXPRESSION TAG	UNP Q3SJE6
B	465	MSE	-	EXPRESSION TAG	UNP Q3SJE6
B	466	GLY	-	EXPRESSION TAG	UNP Q3SJE6

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Chain	Residue	Modelled	Actual	Comment	Reference
B	467	SER	-	EXPRESSION TAG	UNP Q3SJE6
B	468	SER	-	EXPRESSION TAG	UNP Q3SJE6
B	469	HIS	-	EXPRESSION TAG	UNP Q3SJE6
B	470	HIS	-	EXPRESSION TAG	UNP Q3SJE6
B	471	HIS	-	EXPRESSION TAG	UNP Q3SJE6
B	472	HIS	-	EXPRESSION TAG	UNP Q3SJE6
B	473	HIS	-	EXPRESSION TAG	UNP Q3SJE6
B	474	HIS	-	EXPRESSION TAG	UNP Q3SJE6
B	475	SER	-	EXPRESSION TAG	UNP Q3SJE6
B	476	SER	-	EXPRESSION TAG	UNP Q3SJE6
B	477	GLY	-	EXPRESSION TAG	UNP Q3SJE6
B	478	ARG	-	EXPRESSION TAG	UNP Q3SJE6
B	479	GLU	-	EXPRESSION TAG	UNP Q3SJE6
B	480	ASN	-	EXPRESSION TAG	UNP Q3SJE6
B	481	LEU	-	EXPRESSION TAG	UNP Q3SJE6
B	482	TYR	-	EXPRESSION TAG	UNP Q3SJE6
B	483	PHE	-	EXPRESSION TAG	UNP Q3SJE6
B	484	GLN	-	EXPRESSION TAG	UNP Q3SJE6
B	485	GLY	-	EXPRESSION TAG	UNP Q3SJE6
B	486	HIS	-	EXPRESSION TAG	UNP Q3SJE6

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	B	2	Total Mg 2 2	0	0
2	A	1	Total Mg 1 1	0	0

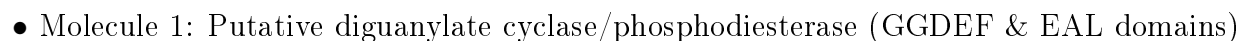
- Molecule 3 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	3	Total Cl 3 3	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	202	Total O 202 202	0	0
4	B	176	Total O 176 176	0	0

- Molecule 1: Putative diguanylate cyclase/phosphodiesterase (GGDEF & EAL domains)



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	50.05Å 63.14Å 173.28Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	27.70 – 1.80 27.70 – 1.80	Depositor EDS
% Data completeness (in resolution range)	97.2 (27.70-1.80) 97.2 (27.70-1.80)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.92 (at 1.80Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.188 , 0.218 0.187 , 0.218	Depositor DCC
R_{free} test set	2554 reflections (5.34%)	DCC
Wilson B-factor (Å ²)	26.8	Xtriage
Anisotropy	0.594	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 42.9	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	0 of 50343 reflections	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	4346	wwPDB-VP
Average B, all atoms (Å ²)	30.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.13% 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, 0.375 respectively for untwinned datasets, and 0.333, 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: MG, CL

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	0.53	0/2112	0.65	0/2855
1	B	0.58	1/1956 (0.1%)	0.63	0/2642
All	All	0.56	1/4068 (0.0%)	0.64	0/5497

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	489	LEU	N-CA	11.06	1.68	1.46

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	2054	0	2059	23	0
1	B	1908	0	1914	17	0
2	A	1	0	0	0	0
2	B	2	0	0	0	0
3	A	3	0	0	0	0
4	A	202	0	0	1	0
4	B	176	0	0	4	0
All	All	4346	0	3973	39	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 39 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:489:LEU:N	1:B:489:LEU:CA	1.68	1.52
1:B:552:VAL:HG13	1:B:594:HIS:CD2	2.12	0.84
1:B:643:LEU:H	1:B:664:HIS:HD2	1.32	0.75
1:A:643:LEU:H	1:A:664:HIS:HD2	1.32	0.75
1:B:698:MSE:HE2	4:B:206:HOH:O	1.89	0.73

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	268/294 (91%)	264 (98%)	4 (2%)	0	100	100
1	B	248/294 (84%)	244 (98%)	4 (2%)	0	100	100
All	All	516/588 (88%)	508 (98%)	8 (2%)	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	220/236 (93%)	220 (100%)	0	100	100
1	B	202/236 (86%)	202 (100%)	0	100	100
All	All	422/472 (89%)	422 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	664	HIS
1	B	664	HIS

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 6 ligands modelled in this entry, 6 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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	253/294 (86%)	0.52	20 (7%) 15 12	22, 27, 39, 46	0
1	B	238/294 (80%)	0.75	27 (11%) 7 5	22, 30, 42, 48	0
All	All	491/588 (83%)	0.64	47 (9%) 10 7	22, 28, 40, 48	0

The worst 5 of 47 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	528	TRP	7.5
1	A	745	ALA	4.6
1	B	490	THR	4.4
1	B	746	SER	4.3
1	B	666[A]	LEU	4.0

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	MG	B	803	1/1	0.98	0.24	3.47	38,38,38,38	0
3	CL	A	806	1/1	0.99	0.11	-0.22	25,25,25,25	0
2	MG	B	802	1/1	0.99	0.09	-2.14	23,23,23,23	0
2	MG	A	801	1/1	0.98	0.06	-6.99	20,20,20,20	0
3	CL	A	804	1/1	0.97	0.04	-	30,30,30,30	0
3	CL	A	805	1/1	0.99	0.08	-	24,24,24,24	0

6.5 Other polymers [i](#)

There are no such residues in this entry.