



wwPDB X-ray Structure Validation Summary Report

Feb 27, 2014 – 10:43 PM GMT

PDB ID : 3LM4
Title : Crystal Structure of 2,3-Dihydroxy Biphenyl dioxygenase from Rhodococcus sp. (strain RHA1)
Authors : Syed Ibrahim, B.; Kumaran, D.; Burley, S.K.; Swaminathan, S.; New York SGX Research Center for Structural Genomics (NYSGXRC)
Deposited on : 2010-01-29
Resolution : 1.80 Å(reported)

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We welcome your comments at validation@mail.wwpdb.org
A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

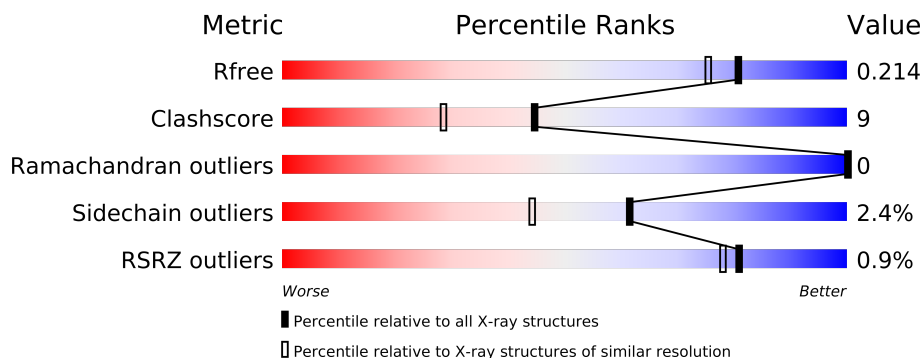
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.15 2013
Xtriage (Phenix) : dev-1323
EDS : stable22639
Percentile statistics : 21963
Refmac : 5.8.0049
CCP4 : 6.3.0 (Settle)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : stable22683

1 Overall quality at a glance

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}	66092	3513 (1.80-1.80)
Clashscore	79885	4461 (1.80-1.80)
Ramachandran outliers	78287	4404 (1.80-1.80)
Sidechain outliers	78261	4403 (1.80-1.80)
RSRZ outliers	66119	3515 (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. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	339	
1	B	339	
1	C	339	
1	D	339	

The following table lists non-polymeric compounds that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
3	PEO	A	401	-	X
3	PEO	B	401	-	X
3	PEO	C	401	-	X
3	PEO	D	401	-	X

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Mol	Type	Chain	Res	Geometry	Electron density
4	HPX	A	406	-	X
4	HPX	B	406	-	X
4	HPX	C	406	-	X
4	HPX	D	406	-	X

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 11142 atoms, of which 0 are hydrogen and 0 are deuterium.

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 Catechol 2,3-dioxygenase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	325	Total	C	N	O	S	Se	0	0	0
			2571	1633	440	488	1	9			
1	B	326	Total	C	N	O	S	Se	0	0	0
			2575	1636	442	487	1	9			
1	C	325	Total	C	N	O	S	Se	0	0	0
			2571	1633	440	488	1	9			
1	D	328	Total	C	N	O	S	Se	0	0	0
			2601	1652	445	494	1	9			

There are 44 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	MSE	-	expression tag	UNP Q0S9X1
A	1	SER	-	expression tag	UNP Q0S9X1
A	2	LEU	-	expression tag	UNP Q0S9X1
A	331	GLU	-	expression tag	UNP Q0S9X1
A	332	GLY	-	expression tag	UNP Q0S9X1
A	333	HIS	-	expression tag	UNP Q0S9X1
A	334	HIS	-	expression tag	UNP Q0S9X1
A	335	HIS	-	expression tag	UNP Q0S9X1
A	336	HIS	-	expression tag	UNP Q0S9X1
A	337	HIS	-	expression tag	UNP Q0S9X1
A	338	HIS	-	expression tag	UNP Q0S9X1
B	0	MSE	-	expression tag	UNP Q0S9X1
B	1	SER	-	expression tag	UNP Q0S9X1
B	2	LEU	-	expression tag	UNP Q0S9X1
B	331	GLU	-	expression tag	UNP Q0S9X1
B	332	GLY	-	expression tag	UNP Q0S9X1
B	333	HIS	-	expression tag	UNP Q0S9X1
B	334	HIS	-	expression tag	UNP Q0S9X1
B	335	HIS	-	expression tag	UNP Q0S9X1
B	336	HIS	-	expression tag	UNP Q0S9X1
B	337	HIS	-	expression tag	UNP Q0S9X1

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Chain	Residue	Modelled	Actual	Comment	Reference
B	338	HIS	-	expression tag	UNP Q0S9X1
C	0	MSE	-	expression tag	UNP Q0S9X1
C	1	SER	-	expression tag	UNP Q0S9X1
C	2	LEU	-	expression tag	UNP Q0S9X1
C	331	GLU	-	expression tag	UNP Q0S9X1
C	332	GLY	-	expression tag	UNP Q0S9X1
C	333	HIS	-	expression tag	UNP Q0S9X1
C	334	HIS	-	expression tag	UNP Q0S9X1
C	335	HIS	-	expression tag	UNP Q0S9X1
C	336	HIS	-	expression tag	UNP Q0S9X1
C	337	HIS	-	expression tag	UNP Q0S9X1
C	338	HIS	-	expression tag	UNP Q0S9X1
D	0	MSE	-	expression tag	UNP Q0S9X1
D	1	SER	-	expression tag	UNP Q0S9X1
D	2	LEU	-	expression tag	UNP Q0S9X1
D	331	GLU	-	expression tag	UNP Q0S9X1
D	332	GLY	-	expression tag	UNP Q0S9X1
D	333	HIS	-	expression tag	UNP Q0S9X1
D	334	HIS	-	expression tag	UNP Q0S9X1
D	335	HIS	-	expression tag	UNP Q0S9X1
D	336	HIS	-	expression tag	UNP Q0S9X1
D	337	HIS	-	expression tag	UNP Q0S9X1
D	338	HIS	-	expression tag	UNP Q0S9X1

- Molecule 2 is FE (III) ION (three-letter code: FE) (formula: Fe).

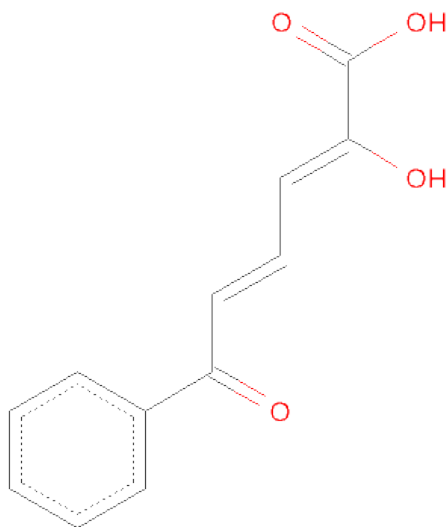
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	B	1	Total Fe 1 1	0	0
2	A	1	Total Fe 1 1	0	0
2	D	1	Total Fe 1 1	0	0
2	C	1	Total Fe 1 1	0	0

- Molecule 3 is HYDROGEN PEROXIDE (three-letter code: PEO) (formula: H₂O₂).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total O 2 2	0	0
3	B	1	Total O 2 2	0	0
3	C	1	Total O 2 2	0	0
3	D	1	Total O 2 2	0	0

- Molecule 4 is (2Z,4E)-2-HYDROXY-6-OXO-6-PHENYLHEXA-2,4-DIENOICACID (three-letter code: HPX) (formula: C₁₂H₁₀O₄).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			16	12	4		
4	B	1	Total	C	O	0	0
			16	12	4		
4	C	1	Total	C	O	0	0
			16	12	4		
4	D	1	Total	C	O	0	0
			16	12	4		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	191	Total	O	0	0
			191	191		
5	B	202	Total	O	0	0
			202	202		
5	C	168	Total	O	0	0
			168	168		
5	D	187	Total	O	0	0
			187	187		

HS
STH

4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	74.92Å 76.19Å 251.37Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	37.67 – 1.80 37.66 – 1.80	Depositor EDS
% Data completeness (in resolution range)	80.3 (37.67-1.80) 80.5 (37.66-1.80)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.56 (at 1.81Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.184 , 0.210 0.188 , 0.214	Depositor DCC
R_{free} test set	5415 reflections (5.04%)	DCC
Wilson B-factor (Å ²)	10.4	Xtriage
Anisotropy	0.278	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 23.6	EDS
Estimated twinning fraction	0.023 for k,h,-l	Xtriage
L-test for twinning	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	0 of 110756 reflections	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	11142	wwPDB-VP
Average B, all atoms (Å ²)	12.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.16% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: PEO, FE, HPX

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	0.32	0/2635	0.61	0/3559
1	B	0.33	0/2639	0.64	0/3563
1	C	0.32	0/2635	0.62	0/3559
1	D	0.32	0/2665	0.63	0/3597
All	All	0.33	0/10574	0.63	0/14278

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2571	0	2436	35	0
1	B	2575	0	2444	48	0
1	C	2571	0	2436	33	0
1	D	2601	0	2481	59	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	2	0	0	0	0
3	B	2	0	0	0	0
3	C	2	0	0	0	0
3	D	2	0	0	0	0
4	A	16	0	8	1	0
4	B	16	0	8	0	0
4	C	16	0	8	2	0
4	D	16	0	8	1	0
5	A	191	0	0	4	0
5	B	202	0	0	6	0
5	C	168	0	0	5	0
5	D	187	0	0	2	0
All	All	11142	0	9829	172	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 9.

The worst 5 of 172 close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:D:206:ARG:HG3	1:D:208:MSE:HE3	1.50	0.91
1:B:197:LEU:HG	1:D:197:LEU:HG	1.51	0.90
1:A:66:GLY:H	1:A:265:ASN:HD21	1.20	0.86
1:B:182:VAL:HG12	1:B:189:ILE:HD11	1.61	0.82
1:D:168:ASP:HB3	1:D:172:ARG:HH12	1.45	0.80

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	323/339 (95%)	313 (97%)	10 (3%)	0	100	100
1	B	324/339 (96%)	314 (97%)	10 (3%)	0	100	100
1	C	323/339 (95%)	312 (97%)	11 (3%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	D	326/339 (96%)	318 (98%)	8 (2%)	0	100	100
All	All	1296/1356 (96%)	1257 (97%)	39 (3%)	0	100	100

There are no Ramachandran outliers to report.

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	268/274 (98%)	260 (97%)	8 (3%)	53	34
1	B	268/274 (98%)	262 (98%)	6 (2%)	64	48
1	C	268/274 (98%)	262 (98%)	6 (2%)	64	48
1	D	273/274 (100%)	267 (98%)	6 (2%)	64	48
All	All	1077/1096 (98%)	1051 (98%)	26 (2%)	61	44

5 of 26 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	237	ASP
1	C	40	GLU
1	D	278	LEU
1	B	293	ASP
1	B	306	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 27 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	322	HIS
1	C	253	GLN
1	D	265	ASN
1	C	116	ASN
1	A	265	ASN

5.3.3 RNA ⓘ

There are no RNA chains 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 12 ligands modelled in this entry, 4 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	$\# Z > 2$
3	PEO	A	401	2	1,1,1	0.26	0	0,0,0	0.00	-
4	HPX	A	406	-	16,16,16	2.92	11 (68%)	20,20,20	2.73	4 (20%)
3	PEO	B	401	2	1,1,1	0.42	0	0,0,0	0.00	-
4	HPX	B	406	-	16,16,16	2.89	10 (62%)	20,20,20	2.56	3 (15%)
3	PEO	C	401	2	1,1,1	0.29	0	0,0,0	0.00	-
4	HPX	C	406	-	16,16,16	2.89	11 (68%)	20,20,20	2.72	3 (15%)
3	PEO	D	401	2	1,1,1	0.31	0	0,0,0	0.00	-
4	HPX	D	406	-	16,16,16	2.89	11 (68%)	20,20,20	2.71	3 (15%)

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	PEO	A	401	2	-	0/0/0/0	0/0/0/0

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	HPX	A	406	-	-	1/13/14/14	0/1/1/1
3	PEO	B	401	2	-	0/0/0/0	0/0/0/0
4	HPX	B	406	-	-	1/13/14/14	0/1/1/1
3	PEO	C	401	2	-	0/0/0/0	0/0/0/0
4	HPX	C	406	-	-	1/13/14/14	0/1/1/1
3	PEO	D	401	2	-	0/0/0/0	0/0/0/0
4	HPX	D	406	-	-	1/13/14/14	0/1/1/1

The worst 5 of 43 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	406	HPX	CB1-CA6	6.28	1.60	1.49
4	D	406	HPX	CB1-CA6	6.12	1.60	1.49
4	B	406	HPX	CB1-CA6	6.11	1.60	1.49
4	C	406	HPX	CB1-CA6	6.10	1.60	1.49
4	B	406	HPX	CA4-CA5	3.96	1.45	1.34

The worst 5 of 13 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	C	406	HPX	OA3-CA2-CA1	10.23	120.02	113.95
4	A	406	HPX	OA3-CA2-CA1	10.20	120.00	113.95
4	D	406	HPX	OA3-CA2-CA1	9.80	119.77	113.95
4	B	406	HPX	OA3-CA2-CA1	9.47	119.57	113.95
4	D	406	HPX	OA3-CA2-CA3	-6.16	120.16	122.85

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	B	406	HPX	CA4-CA3-CA2-CA1
4	D	406	HPX	CA4-CA3-CA2-CA1
4	A	406	HPX	CA4-CA3-CA2-CA1
4	C	406	HPX	CA4-CA3-CA2-CA1

There are no ring outliers.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues

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, 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	325/339 (95%)	-0.37	2 (0%) 86 85	4, 10, 24, 38	0
1	B	326/339 (96%)	-0.38	5 (1%) 70 66	4, 9, 24, 41	0
1	C	325/339 (95%)	-0.36	3 (0%) 81 78	5, 11, 25, 35	0
1	D	328/339 (96%)	-0.34	2 (0%) 86 85	4, 11, 26, 38	0
All	All	1304/1356 (96%)	-0.36	12 (0%) 81 78	4, 10, 25, 41	0

The worst 5 of 12 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	328	HIS	4.0
1	A	327	ALA	4.0
1	B	290	SER	3.8
1	B	291	ASP	3.8
1	D	186	ASN	3.4

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

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates

There are no carbohydrates in this entry.

6.4 Ligands

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	RSR	LLDF	B-factors(\AA^2)	Q<0.9
4	HPX	B	406	16/16	0.28	8.81	30,38,39,39	0
4	HPX	C	406	16/16	0.29	7.30	27,39,40,40	0
3	PEO	D	401	2/2	0.19	6.98	18,18,18,21	0
3	PEO	C	401	2/2	0.21	5.13	20,20,20,22	0
4	HPX	D	406	16/16	0.26	5.09	35,40,41,42	0
4	HPX	A	406	16/16	0.27	4.39	30,38,39,39	0
3	PEO	B	401	2/2	0.20	4.12	18,18,18,31	0
3	PEO	A	401	2/2	0.21	4.10	19,19,19,20	0
2	FE	D	400	1/1	0.02	-3.91	15,15,15,15	0
2	FE	C	400	1/1	0.02	-4.02	14,14,14,14	0
2	FE	B	400	1/1	0.03	-4.93	14,14,14,14	0
2	FE	A	400	1/1	0.02	-5.06	13,13,13,13	0

6.5 Other polymers ⓘ

There are no such residues in this entry.