Full wwPDB X-ray Structure Validation Report (i)

Oct 2, 2021 – 01:20 PM EDT

PDB ID	:	3IOY
Title	:	Structure of putative short-chain dehydrogenase (Saro_0793) from Novosphingobium aromaticivorans
Authors	:	Ramagopal, U.A.; Morano, C.; Burley, S.K.; Almo, S.C.; New York SGX Research Center for Structural Genomics (NYSGXRC)
Deposited on	:	2009-08-15
Resolution	:	1.90 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*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

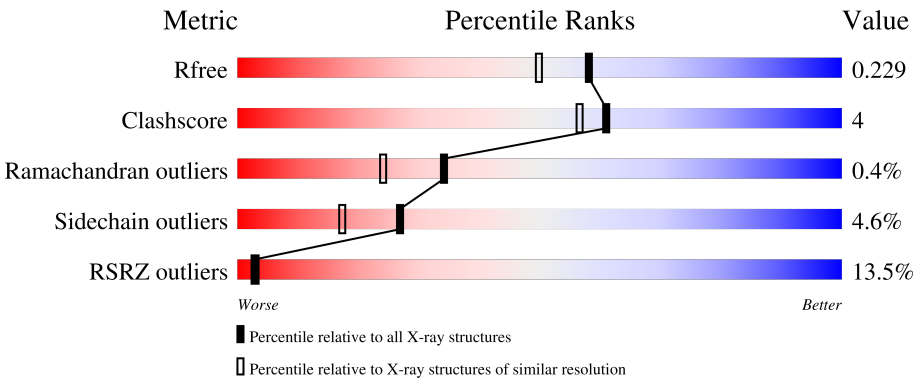
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.23.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.23.2

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.90 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}	130704	6207 (1.90-1.90)
Clashscore	141614	6847 (1.90-1.90)
Ramachandran outliers	138981	6760 (1.90-1.90)
Sidechain outliers	138945	6760 (1.90-1.90)
RSRZ outliers	127900	6082 (1.90-1.90)

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 >=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 <=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	319	16%; 75%; 11% • 13%
1	B	319	7%; 75%; 9% • 15%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 4245 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 Short-chain dehydrogenase/reductase SDR.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	277	2115	1333	371	402	9	0	0	0
1	B	270	2074	1308	364	393	9	0	0	0

There are 26 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	MET	-	expression tag	UNP Q2GA85
A	0	SER	-	expression tag	UNP Q2GA85
A	1	LEU	-	expression tag	UNP Q2GA85
A	215	VAL	MET	engineered mutation	UNP Q2GA85
A	267	VAL	ILE	engineered mutation	UNP Q2GA85
A	310	GLU	-	expression tag	UNP Q2GA85
A	311	GLY	-	expression tag	UNP Q2GA85
A	312	HIS	-	expression tag	UNP Q2GA85
A	313	HIS	-	expression tag	UNP Q2GA85
A	314	HIS	-	expression tag	UNP Q2GA85
A	315	HIS	-	expression tag	UNP Q2GA85
A	316	HIS	-	expression tag	UNP Q2GA85
A	317	HIS	-	expression tag	UNP Q2GA85
B	-1	MET	-	expression tag	UNP Q2GA85
B	0	SER	-	expression tag	UNP Q2GA85
B	1	LEU	-	expression tag	UNP Q2GA85
B	215	VAL	MET	engineered mutation	UNP Q2GA85
B	267	VAL	ILE	engineered mutation	UNP Q2GA85
B	310	GLU	-	expression tag	UNP Q2GA85
B	311	GLY	-	expression tag	UNP Q2GA85
B	312	HIS	-	expression tag	UNP Q2GA85
B	313	HIS	-	expression tag	UNP Q2GA85
B	314	HIS	-	expression tag	UNP Q2GA85
B	315	HIS	-	expression tag	UNP Q2GA85
B	316	HIS	-	expression tag	UNP Q2GA85

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Chain	Residue	Modelled	Actual	Comment	Reference
B	317	HIS	-	expression tag	UNP Q2GA85

- Molecule 2 is water.

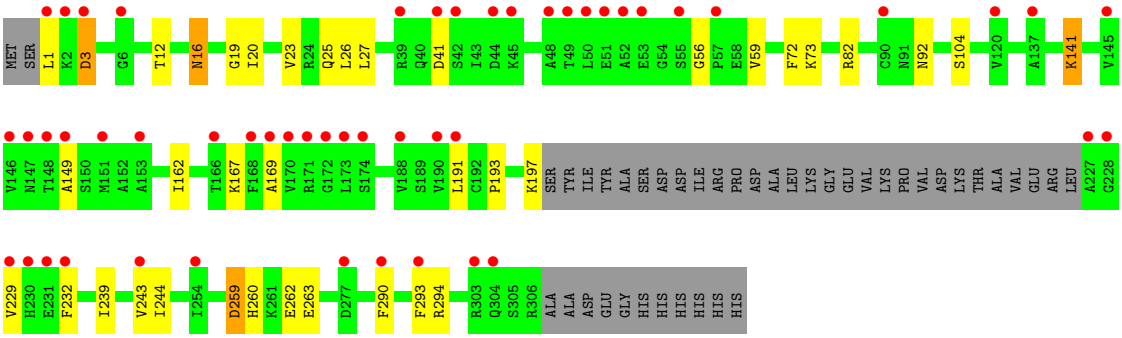
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
2	A	29	29	29	0	0
			Total	O		
2	B	27	27	27	0	0

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.

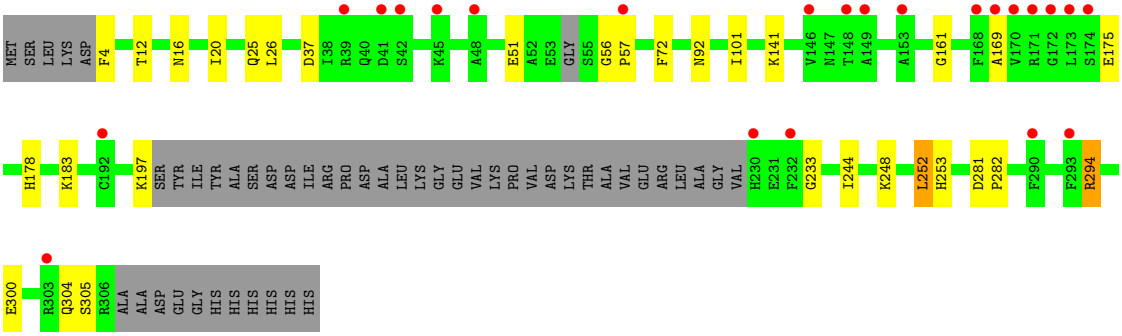
• Molecule 1: Short-chain dehydrogenase/reductase SDR

Chain A:



• Molecule 1: Short-chain dehydrogenase/reductase SDR

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	51.68Å 100.75Å 63.46Å 90.00° 101.91° 90.00°	Depositor
Resolution (Å)	50.00 – 1.90 33.70 – 1.90	Depositor EDS
% Data completeness (in resolution range)	98.8 (50.00-1.90) 98.8 (33.70-1.90)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.20 (at 1.89Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.201 , 0.233 0.198 , 0.229	Depositor DCC
R_{free} test set	2522 reflections (5.09%)	wwPDB-VP
Wilson B-factor (Å^2)	44.5	Xtriage
Anisotropy	0.032	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.38 , 47.1	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	4245	wwPDB-VP
Average B, all atoms (Å^2)	51.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.17% of the height of the origin peak. No significant pseudotranslation is detected.*

[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ 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	0.71	0/2155	0.70	0/2913
1	B	0.74	0/2113	0.71	0/2854
All	All	0.73	0/4268	0.70	0/5767

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	2115	0	2067	21	0
1	B	2074	0	2026	20	0
2	A	29	0	0	0	0
2	B	27	0	0	0	0
All	All	4245	0	4093	37	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 4.

All (37) 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:56:GLY:H	1:B:57:PRO:HD2	1.30	0.94

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:51:GLU:OE2	1:B:56:GLY:HA3	1.77	0.84
1:A:25:GLN:HB3	1:A:244:ILE:CD1	2.10	0.81
1:B:300:GLU:O	1:B:304:GLN:HG2	1.94	0.66
1:B:56:GLY:N	1:B:57:PRO:HD2	2.10	0.61
1:B:56:GLY:H	1:B:57:PRO:CD	2.10	0.58
1:B:281:ASP:HB2	1:B:282:PRO:HD2	1.88	0.56
1:A:169:ALA:HB2	1:B:169:ALA:HB2	1.86	0.56
1:B:4:PHE:CE2	1:B:248:LYS:HE2	2.41	0.56
1:A:141:LYS:HE3	1:A:141:LYS:HA	1.88	0.55
1:A:25:GLN:CB	1:A:244:ILE:CD1	2.85	0.55
1:A:191:LEU:HG	1:A:193:PRO:HD3	1.89	0.55
1:A:260:HIS:CD2	1:B:294:ARG:HH11	2.25	0.55
1:A:25:GLN:CB	1:A:244:ILE:HD11	2.38	0.53
1:A:16:ASN:HA	1:A:20:ILE:HB	1.91	0.52
1:B:25:GLN:HB3	1:B:244:ILE:CD1	2.40	0.52
1:A:25:GLN:HB3	1:A:244:ILE:HD11	1.89	0.52
1:B:252:LEU:HD13	1:B:253:HIS:CE1	2.47	0.50
1:A:229:VAL:HA	1:A:232:PHE:CZ	2.47	0.49
1:A:260:HIS:HD2	1:B:294:ARG:HH11	1.60	0.48
1:B:101:ILE:HG13	1:B:161:GLY:HA3	1.94	0.48
1:A:19:GLY:O	1:A:23:VAL:HG23	2.14	0.48
1:B:12:THR:O	1:B:92:ASN:HB3	2.15	0.46
1:A:149:ALA:HA	1:A:167:LYS:HD2	1.97	0.45
1:A:263:GLU:OE2	1:B:294:ARG:NH1	2.49	0.44
1:B:25:GLN:HB3	1:B:244:ILE:HD12	2.00	0.44
1:B:197:LYS:HE3	1:B:233:GLY:O	2.18	0.43
1:A:27:LEU:HD21	1:A:59:VAL:HG13	2.01	0.43
1:B:175:GLU:HA	1:B:252:LEU:HD21	2.00	0.43
1:A:12:THR:O	1:A:92:ASN:HB3	2.19	0.42
1:A:259:ASP:OD1	1:A:259:ASP:N	2.51	0.42
1:A:104:SER:HB3	1:A:162:ILE:HD11	2.02	0.42
1:A:239:ILE:O	1:A:243:VAL:HG23	2.20	0.41
1:B:178:HIS:NE2	1:B:305:SER:OG	2.49	0.41
1:A:290:PHE:O	1:A:293:PHE:HB3	2.21	0.41
1:A:167:LYS:HD3	1:A:167:LYS:HA	1.87	0.40
1:B:16:ASN:HA	1:B:20:ILE:HB	2.03	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	273/319 (86%)	265 (97%)	6 (2%)	2 (1%)	22 12
1	B	264/319 (83%)	261 (99%)	3 (1%)	0	100 100
All	All	537/638 (84%)	526 (98%)	9 (2%)	2 (0%)	34 24

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	3	ASP
1	A	56	GLY

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	218/255 (86%)	205 (94%)	13 (6%)	19 9
1	B	215/255 (84%)	208 (97%)	7 (3%)	38 29
All	All	433/510 (85%)	413 (95%)	20 (5%)	27 17

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	LEU
1	A	3	ASP
1	A	16	ASN
1	A	26	LEU

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Mol	Chain	Res	Type
1	A	41	ASP
1	A	72	PHE
1	A	73	LYS
1	A	82	ARG
1	A	141	LYS
1	A	197	LYS
1	A	259	ASP
1	A	262	GLU
1	A	294	ARG
1	B	26	LEU
1	B	37	ASP
1	B	72	PHE
1	B	141	LYS
1	B	183	LYS
1	B	252	LEU
1	B	294	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	16	ASN
1	A	99	GLN
1	A	260	HIS
1	B	99	GLN

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 monosaccharides 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 (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	277/319 (86%)	0.78	51 (18%) 1 1	36, 50, 75, 85	0
1	B	270/319 (84%)	0.46	23 (8%) 10 12	36, 47, 68, 82	0
All	All	547/638 (85%)	0.62	74 (13%) 3 3	36, 48, 72, 85	0

All (74) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	168	PHE	5.3
1	A	229	VAL	5.3
1	A	293	PHE	5.0
1	A	228	GLY	4.9
1	A	170	VAL	4.7
1	A	50	LEU	4.4
1	B	57	PRO	4.3
1	A	1	LEU	3.9
1	B	232	PHE	3.8
1	A	146	VAL	3.8
1	A	190	VAL	3.7
1	B	303	ARG	3.7
1	A	52	ALA	3.6
1	A	303	ARG	3.6
1	A	48	ALA	3.6
1	A	149	ALA	3.5
1	A	169	ALA	3.4
1	A	3	ASP	3.4
1	B	168	PHE	3.3
1	A	148	THR	3.3
1	A	57	PRO	3.2
1	B	41	ASP	3.2
1	B	39	ARG	3.1
1	A	51	GLU	3.1

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Mol	Chain	Res	Type	RSRZ
1	A	41	ASP	3.1
1	B	169	ALA	3.0
1	A	49	THR	3.0
1	A	45	LYS	2.9
1	B	45	LYS	2.9
1	A	171	ARG	2.9
1	A	243	VAL	2.8
1	B	146	VAL	2.8
1	A	172	GLY	2.7
1	A	227	ALA	2.7
1	A	277	ASP	2.7
1	B	149	ALA	2.7
1	B	48	ALA	2.6
1	A	230	HIS	2.6
1	B	192	CYS	2.6
1	A	304	GLN	2.5
1	A	120	VAL	2.5
1	A	137	ALA	2.5
1	B	173	LEU	2.5
1	A	2	LYS	2.5
1	A	166	THR	2.4
1	B	153	ALA	2.4
1	A	290	PHE	2.4
1	A	173	LEU	2.4
1	A	153	ALA	2.3
1	B	172	GLY	2.3
1	A	191	LEU	2.3
1	B	170	VAL	2.3
1	A	254	ILE	2.3
1	A	151	MET	2.3
1	A	42	SER	2.3
1	A	231	GLU	2.3
1	A	44	ASP	2.3
1	A	188	VAL	2.2
1	A	90	CYS	2.2
1	A	232	PHE	2.2
1	B	230	HIS	2.2
1	A	39	ARG	2.2
1	A	145	VAL	2.2
1	B	171	ARG	2.1
1	B	290	PHE	2.1
1	A	174	SER	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	42	SER	2.1
1	A	53	GLU	2.1
1	B	174	SER	2.1
1	A	55	SER	2.1
1	A	147	ASN	2.1
1	B	293	PHE	2.1
1	A	6	GLY	2.1
1	B	148	THR	2.1

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.