Full wwPDB X-ray Structure Validation Report (i)

Feb 1, 2016 – 12:23 AM GMT

PDB ID	:	2AAJ
Title	:	Crystal Structures of the Wild-type, Mutant-P1A and Inactivated Malonate Semialdehyde Decarboxylase: A Structural Basis for the Decarboxylase and Hydratase Activities
Authors	:	Almrud, J.J.; Poelarends, G.J.; Johnson Jr., W.H.; Serrano, H.; Hackert, M.L.; Whitman, C.P.
Deposited on	:	2005-07-13
Resolution	:	2.74 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
http://wwpdb.org/validation/2016/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:

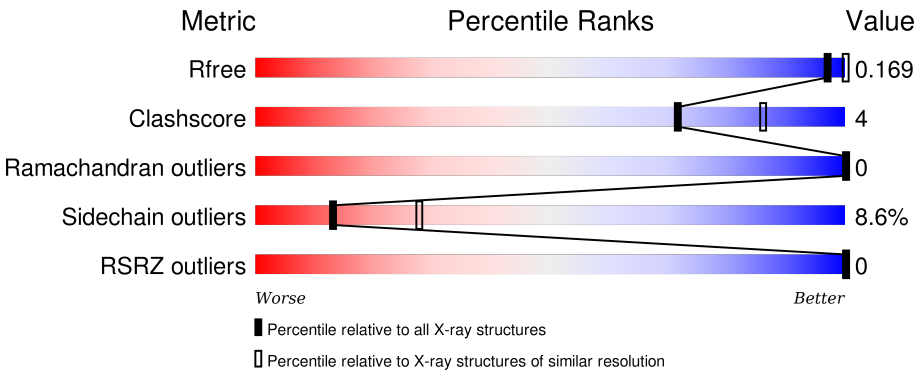
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026688
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 2.74 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	3050 (2.78-2.70)
Clashscore	102246	3424 (2.78-2.70)
Ramachandran outliers	100387	3367 (2.78-2.70)
Sidechain outliers	100360	3368 (2.78-2.70)
RSRZ outliers	91569	3055 (2.78-2.70)

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 <=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	130	77% 18%
1	B	130	78% 18%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 2165 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 Malonate Semialdehyde Decarboxylase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	129	988	621	172	191	4	0	1	0
1	B	129	987	621	171	191	4	0	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	ALA	PRO	ENGINEERED	UNP Q9EV83
A	7	LEU	ILE	CONFLICT	UNP Q9EV83
A	78	SER	GLU	CONFLICT	UNP Q9EV83
A	130	GLY	-	CLONING ARTIFACT	UNP Q9EV83
B	1	ALA	PRO	ENGINEERED	UNP Q9EV83
B	7	LEU	ILE	CONFLICT	UNP Q9EV83
B	78	SER	GLU	CONFLICT	UNP Q9EV83
B	130	GLY	-	CLONING ARTIFACT	UNP Q9EV83

- Molecule 2 is water.

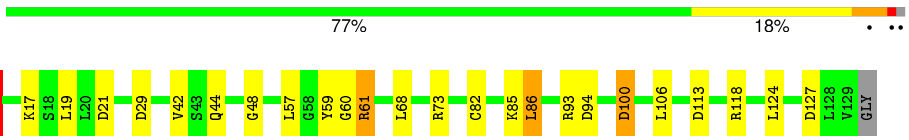
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
2	A	99	99	99	0	0
2	B	91	91	91	0	0

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.

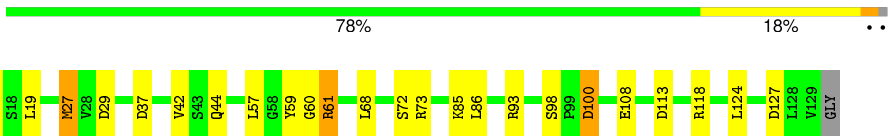
- Molecule 1: Malonate Semialdehyde Decarboxylase

Chain A:



- Molecule 1: Malonate Semialdehyde Decarboxylase

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 3	Depositor
Cell constants a, b, c, α, β, γ	110.15Å 110.15Å 110.15Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.40 – 2.74 26.72 – 2.74	Depositor EDS
% Data completeness (in resolution range)	99.3 (29.40-2.74) 99.3 (26.72-2.74)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.10 (at 2.76Å)	Xtriage
Refinement program	REFMAC 5.1.24	Depositor
R, R_{free}	0.161 , 0.213 0.165 , 0.169	Depositor DCC
R_{free} test set	595 reflections (5.28%)	DCC
Wilson B-factor (Å^2)	29.4	Xtriage
Anisotropy	0.000	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 34.7	EDS
Estimated twinning fraction	0.045 for l,-k,h	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Outliers	1 of 11874 reflections (0.008%)	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	2165	wwPDB-VP
Average B, all atoms (Å^2)	31.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.52% 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, 0.375 respectively for untwinned datasets, and 0.333, 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	0.94	3/1013 (0.3%)	1.15	14/1370 (1.0%)
1	B	0.98	2/1004 (0.2%)	1.11	8/1359 (0.6%)
All	All	0.96	5/2017 (0.2%)	1.13	22/2729 (0.8%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	2
1	B	0	1
All	All	0	3

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	42	VAL	CB-CG2	-9.16	1.33	1.52
1	A	42	VAL	CB-CG2	-7.14	1.37	1.52
1	A	42	VAL	CB-CG1	-6.87	1.38	1.52
1	B	27	MET	SD-CE	5.87	2.10	1.77
1	A	85	LYS	CE-NZ	5.36	1.62	1.49

All (22) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	61	ARG	NE-CZ-NH1	8.18	124.39	120.30
1	A	42	VAL	CG1-CB-CG2	-7.77	98.47	110.90
1	B	100	ASP	CB-CG-OD2	7.25	124.82	118.30
1	B	127	ASP	CB-CG-OD2	7.14	124.73	118.30
1	A	61	ARG	NE-CZ-NH2	-6.81	116.89	120.30
1	A	106	LEU	CB-CG-CD2	-6.33	100.23	111.00
1	B	37	ASP	CB-CG-OD2	6.12	123.81	118.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	118	ARG	NE-CZ-NH1	-6.09	117.26	120.30
1	A	118	ARG	NE-CZ-NH1	-5.96	117.32	120.30
1	B	113	ASP	CB-CG-OD2	5.95	123.66	118.30
1	B	61	ARG	NE-CZ-NH2	-5.87	117.37	120.30
1	A	21	ASP	CB-CG-OD2	5.82	123.54	118.30
1	A	6	ASP	CB-CG-OD2	5.79	123.51	118.30
1	A	29	ASP	CB-CG-OD2	5.78	123.50	118.30
1	A	94	ASP	CB-CG-OD1	5.68	123.41	118.30
1	B	42	VAL	CG1-CB-CG2	-5.62	101.90	110.90
1	A	113	ASP	CB-CG-OD2	5.38	123.14	118.30
1	A	100	ASP	CB-CG-OD2	5.37	123.14	118.30
1	B	29	ASP	CB-CG-OD2	5.37	123.13	118.30
1	A	127	ASP	CB-CG-OD2	5.36	123.13	118.30
1	A	106	LEU	CA-CB-CG	5.32	127.54	115.30
1	A	7	LEU	CB-CG-CD1	5.10	119.67	111.00

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	48	GLY	Peptide
1	A	59	TYR	Peptide
1	B	59	TYR	Peptide

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	988	0	971	8	0
1	B	987	0	974	9	0
2	A	99	0	0	2	0
2	B	91	0	0	1	0
All	All	2165	0	1945	17	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 (17) 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:27:MET:CE	1:B:27:MET:SD	2.10	1.39
1:B:7:LEU:HD21	1:B:44:GLN:HG2	1.60	0.82
1:B:60:GLY:HA3	1:B:100:ASP:OD2	1.86	0.75
1:A:7:LEU:HD21	1:A:44:GLN:HG2	1.69	0.73
2:A:174:HOH:O	1:B:85:LYS:HE2	1.88	0.73
1:A:60:GLY:HA3	1:A:100:ASP:OD2	1.93	0.68
1:B:27:MET:HB3	1:B:27:MET:CE	2.31	0.60
1:B:3:LEU:HB3	1:B:68:LEU:HD11	1.83	0.59
1:A:2:LEU:HD13	1:A:4[B]:LYS:HE3	1.99	0.45
1:A:82:CYS:SG	1:A:86:LEU:HD22	2.58	0.43
1:B:17:LYS:HG3	2:B:142:HOH:O	2.18	0.43
1:A:17:LYS:HG3	2:A:168:HOH:O	2.18	0.43
1:A:2:LEU:HD13	1:A:4[A]:LYS:HE2	2.01	0.43
1:A:3:LEU:HD23	1:A:3:LEU:N	2.33	0.43
1:A:3:LEU:HB3	1:A:68:LEU:HD11	2.02	0.42
1:B:98:SER:OG	1:B:100:ASP:HB2	2.21	0.41
1:B:72:SER:O	1:B:108:GLU:HA	2.22	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	128/130 (98%)	125 (98%)	3 (2%)	0	100	100
1	B	127/130 (98%)	123 (97%)	4 (3%)	0	100	100
All	All	255/260 (98%)	248 (97%)	7 (3%)	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	106/105 (101%)	96 (91%)	10 (9%)	11	23
1	B	105/105 (100%)	97 (92%)	8 (8%)	16	35
All	All	211/210 (100%)	193 (92%)	18 (8%)	13	28

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

Mol	Chain	Res	Type
1	A	2	LEU
1	A	3	LEU
1	A	7	LEU
1	A	19	LEU
1	A	57	LEU
1	A	61	ARG
1	A	73	ARG
1	A	86	LEU
1	A	93	ARG
1	A	124	LEU
1	B	2	LEU
1	B	19	LEU
1	B	57	LEU
1	B	61	ARG
1	B	73	ARG
1	B	86	LEU
1	B	93	ARG
1	B	124	LEU

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	45	HIS
1	B	45	HIS

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 (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	129/130 (99%)	-0.73	0	100	100	22, 30, 41, 46	0
1	B	129/130 (99%)	-0.69	0	100	100	22, 30, 41, 46	0
All	All	258/260 (99%)	-0.71	0	100	100	22, 30, 42, 46	0

There are no RSRZ outliers to report.

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)

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.