W O R L D W I D E

wwPDB

P R O T E I N   D A T A   B A N K

wwPDB X-ray Structure Validation Summary Report (i)

Dec 18, 2023 – 09:04 am GMT

PDB ID	:	4ADL
Title	:	Crystal structures of Rv1098c in complex with malate
Authors	:	Mechaly, A.E.; Haouz, A.; Miras, I.; Weber, P.; Shepard, W.; Cole, S.; Alzari, P.M.; Bellinzoni, M.
Deposited on	:	2011-12-26
Resolution	:	2.20 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
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

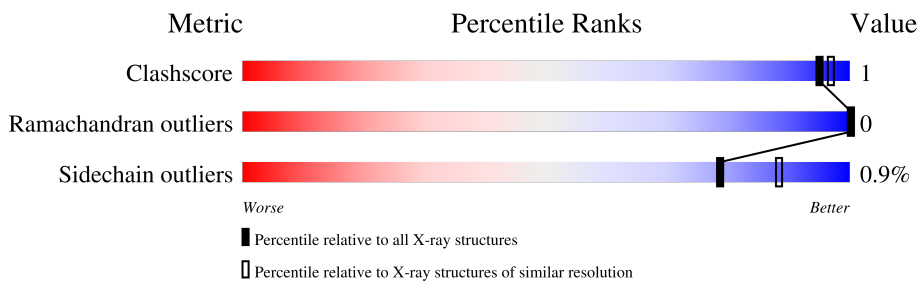|		
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	FAILED
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 2.20 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	Percentile Ranks	Value
Clashscore		1
Ramachandran outliers		0
Sidechain outliers		0.9%

Worse — *Better*

■ Percentile relative to all X-ray structures
⬚ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)

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%

Note EDS failed to run properly.

Mol	Chain	Length	Quality of chain
1	A	495	90% · 7%
1	B	495	89% · 7%
1	C	495	89% · 7%
1	D	495	88% · 7%

WORLDWIDE
PDB
PROTEIN DATA BANK

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 14797 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 FUMARATE HYDRATASE CLASS II.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	459	Total	C	N	O	S	0	0	0
			3387	2111	612	652	12			
1	B	458	Total	C	N	O	S	0	0	0
			3361	2097	607	645	12			
1	C	459	Total	C	N	O	S	0	0	0
			3371	2102	609	648	12			
1	D	459	Total	C	N	O	S	0	0	0
			3389	2113	615	649	12			

There are 88 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-21	MET	-	expression tag	UNP O53446
A	-20	SER	-	expression tag	UNP O53446
A	-19	TYR	-	expression tag	UNP O53446
A	-18	TYR	-	expression tag	UNP O53446
A	-17	HIS	-	expression tag	UNP O53446
A	-16	HIS	-	expression tag	UNP O53446
A	-15	HIS	-	expression tag	UNP O53446
A	-14	HIS	-	expression tag	UNP O53446
A	-13	HIS	-	expression tag	UNP O53446
A	-12	HIS	-	expression tag	UNP O53446
A	-11	LEU	-	expression tag	UNP O53446
A	-10	GLU	-	expression tag	UNP O53446
A	-9	SER	-	expression tag	UNP O53446
A	-8	THR	-	expression tag	UNP O53446
A	-7	SER	-	expression tag	UNP O53446
A	-6	LEU	-	expression tag	UNP O53446
A	-5	TYR	-	expression tag	UNP O53446
A	-4	LYS	-	expression tag	UNP O53446
A	-3	LYS	-	expression tag	UNP O53446
A	-2	ALA	-	expression tag	UNP O53446
A	-1	GLY	-	expression tag	UNP O53446

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Chain	Residue	Modelled	Actual	Comment	Reference
A	0	SER	-	expression tag	UNP O53446
B	-21	MET	-	expression tag	UNP O53446
B	-20	SER	-	expression tag	UNP O53446
B	-19	TYR	-	expression tag	UNP O53446
B	-18	TYR	-	expression tag	UNP O53446
B	-17	HIS	-	expression tag	UNP O53446
B	-16	HIS	-	expression tag	UNP O53446
B	-15	HIS	-	expression tag	UNP O53446
B	-14	HIS	-	expression tag	UNP O53446
B	-13	HIS	-	expression tag	UNP O53446
B	-12	HIS	-	expression tag	UNP O53446
B	-11	LEU	-	expression tag	UNP O53446
B	-10	GLU	-	expression tag	UNP O53446
B	-9	SER	-	expression tag	UNP O53446
B	-8	THR	-	expression tag	UNP O53446
B	-7	SER	-	expression tag	UNP O53446
B	-6	LEU	-	expression tag	UNP O53446
B	-5	TYR	-	expression tag	UNP O53446
B	-4	LYS	-	expression tag	UNP O53446
B	-3	LYS	-	expression tag	UNP O53446
B	-2	ALA	-	expression tag	UNP O53446
B	-1	GLY	-	expression tag	UNP O53446
B	0	SER	-	expression tag	UNP O53446
C	-21	MET	-	expression tag	UNP O53446
C	-20	SER	-	expression tag	UNP O53446
C	-19	TYR	-	expression tag	UNP O53446
C	-18	TYR	-	expression tag	UNP O53446
C	-17	HIS	-	expression tag	UNP O53446
C	-16	HIS	-	expression tag	UNP O53446
C	-15	HIS	-	expression tag	UNP O53446
C	-14	HIS	-	expression tag	UNP O53446
C	-13	HIS	-	expression tag	UNP O53446
C	-12	HIS	-	expression tag	UNP O53446
C	-11	LEU	-	expression tag	UNP O53446
C	-10	GLU	-	expression tag	UNP O53446
C	-9	SER	-	expression tag	UNP O53446
C	-8	THR	-	expression tag	UNP O53446
C	-7	SER	-	expression tag	UNP O53446
C	-6	LEU	-	expression tag	UNP O53446
C	-5	TYR	-	expression tag	UNP O53446
C	-4	LYS	-	expression tag	UNP O53446
C	-3	LYS	-	expression tag	UNP O53446

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Chain	Residue	Modelled	Actual	Comment	Reference
C	-2	ALA	-	expression tag	UNP O53446
C	-1	GLY	-	expression tag	UNP O53446
C	0	SER	-	expression tag	UNP O53446
D	-21	MET	-	expression tag	UNP O53446
D	-20	SER	-	expression tag	UNP O53446
D	-19	TYR	-	expression tag	UNP O53446
D	-18	TYR	-	expression tag	UNP O53446
D	-17	HIS	-	expression tag	UNP O53446
D	-16	HIS	-	expression tag	UNP O53446
D	-15	HIS	-	expression tag	UNP O53446
D	-14	HIS	-	expression tag	UNP O53446
D	-13	HIS	-	expression tag	UNP O53446
D	-12	HIS	-	expression tag	UNP O53446
D	-11	LEU	-	expression tag	UNP O53446
D	-10	GLU	-	expression tag	UNP O53446
D	-9	SER	-	expression tag	UNP O53446
D	-8	THR	-	expression tag	UNP O53446
D	-7	SER	-	expression tag	UNP O53446
D	-6	LEU	-	expression tag	UNP O53446
D	-5	TYR	-	expression tag	UNP O53446
D	-4	LYS	-	expression tag	UNP O53446
D	-3	LYS	-	expression tag	UNP O53446
D	-2	ALA	-	expression tag	UNP O53446
D	-1	GLY	-	expression tag	UNP O53446
D	0	SER	-	expression tag	UNP O53446

- Molecule 2 is (2S)-2-hydroxybutanedioic acid (three-letter code: LMR) (formula: $C_4H_6O_5$).
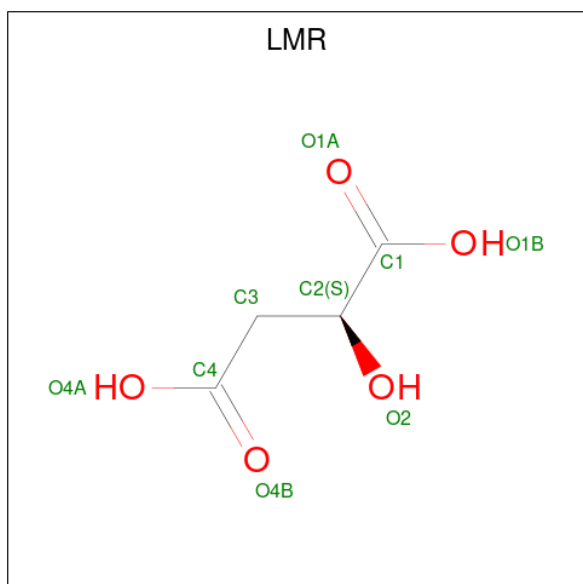
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	C	1	Total 9	C 4	O 5	0	0
2	D	1	Total 9	C 4	O 5	0	0

- Molecule 3 is water.

| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	331	Total 331	O 331	0	0
3	B	298	Total 298	O 298	0	0
3	C	348	Total 348	O 348	0	0
3	D	294	Total 294	O 294	0	0

3   Residue-property plots ⓘ

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. 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. 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.
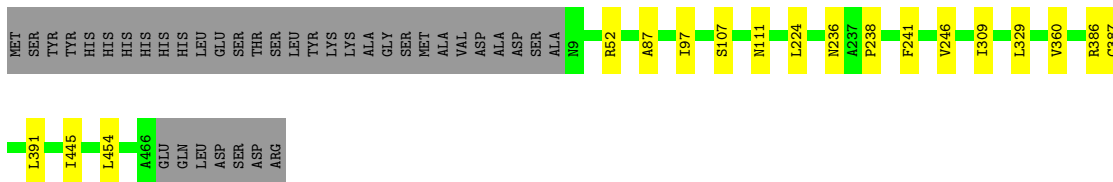
Note EDS failed to run properly.

• Molecule 1: FUMARATE HYDRATASE CLASS II

Chain A:
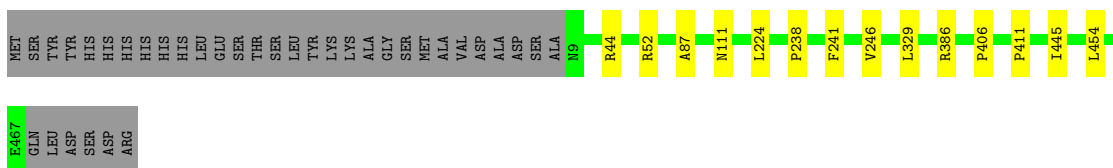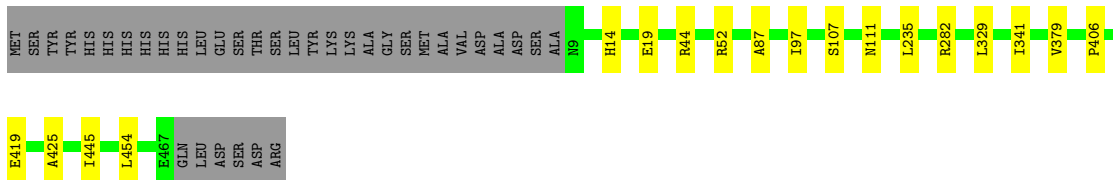

• Molecule 1: FUMARATE HYDRATASE CLASS II

Chain B:

• Molecule 1: FUMARATE HYDRATASE CLASS II

Chain C:

• Molecule 1: FUMARATE HYDRATASE CLASS II

Chain D:

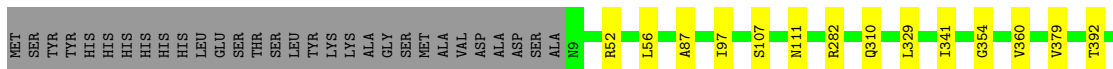P406 A425 I445 G446 D447 I451 L454 K465 A466 E467 GLN LEU ASP SER ASP ARG

4 Data and refinement statistics (i)

EDS failed to run properly - this section is therefore incomplete.

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	271.53Å 98.13Å 90.00Å 90.00° 101.34° 90.00°	Depositor
Resolution (Å)	22.18 – 2.20	Depositor
% Data completeness (in resolution range)	98.9 (22.18-2.20)	Depositor
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.32 (at 2.20Å)	Xtriage
Refinement program	BUSTER 2.11.2	Depositor
R, R_{free}	0.154 , 0.178	Depositor
Wilson B-factor (Å^2)	14.4	Xtriage
Anisotropy	0.368	Xtriage
L-test for twinning[2]	$< |L| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	14797	wwPDB-VP
Average B, all atoms (Å^2)	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.58% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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 ⓘ

5.1   Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: LMR

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	0.48	0/3436	0.58	0/4674
1	B	0.48	0/3410	0.58	0/4642
1	C	0.49	0/3419	0.60	0/4652
1	D	0.49	0/3438	0.59	0/4676
All	All	0.49	0/13703	0.59	0/18644

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 ⓘ

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	3387	0	3405	8	0
1	B	3361	0	3371	10	0
1	C	3371	0	3393	8	0
1	D	3389	0	3420	10	0
2	C	9	0	4	0	0
2	D	9	0	4	0	0
3	A	331	0	0	0	0
3	B	298	0	0	1	0
3	C	348	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	D	294	0	0	2	0
All	All	14797	0	13597	33	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 1.

The worst 5 of 33 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:A:329:LEU:HD11	1:A:386:ARG:HB2	1.69	0.75
1:B:329:LEU:HD11	1:B:386:ARG:HB2	1.69	0.74
1:D:52:ARG:NH1	1:D:56:LEU:HD11	2.27	0.50
1:D:282:ARG:HG2	1:D:341:ILE:HD13	1.94	0.48
1:A:224:LEU:HD12	1:A:246:VAL:HG22	1.96	0.48

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	457/495 (92%)	444 (97%)	13 (3%)	0	100	100
1	B	456/495 (92%)	443 (97%)	13 (3%)	0	100	100
1	C	457/495 (92%)	445 (97%)	12 (3%)	0	100	100
1	D	457/495 (92%)	446 (98%)	11 (2%)	0	100	100
All	All	1827/1980 (92%)	1778 (97%)	49 (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	346/383 (90%)	344 (99%)	2 (1%)	86	93
1	B	341/383 (89%)	340 (100%)	1 (0%)	92	97
1	C	344/383 (90%)	340 (99%)	4 (1%)	71	83
1	D	347/383 (91%)	342 (99%)	5 (1%)	67	80
All	All	1378/1532 (90%)	1366 (99%)	12 (1%)	78	88

5 of 12 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	111	ASN
1	D	329	LEU
1	D	451	ILE
1	D	379	VAL
1	C	111	ASN

Sometimes 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 monosaccharides in this entry.

5.6 Ligand geometry (i)

2 ligands are modelled in this entry.

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 ⓘ

6.1 Protein, DNA and RNA chains ⓘ

EDS failed to run properly - this section is therefore empty.

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

EDS failed to run properly - this section is therefore empty.

6.3 Carbohydrates ⓘ

EDS failed to run properly - this section is therefore empty.

6.4 Ligands ⓘ

EDS failed to run properly - this section is therefore empty.

6.5 Other polymers ⓘ

EDS failed to run properly - this section is therefore empty.