Full wwPDB X-ray Structure Validation Report (i)

May 27, 2020 – 09:02 pm BST

PDB ID	:	2MAD
Title	:	THE ACTIVE SITE STRUCTURE OF METHYLAMINE DEHYDROGENASE: HYDRAZINES IDENTIFY C6 AS THE REACTIVE SITE OF THE TRYPTOPHAN DERIVED QUINONE COFACTOR
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Deposited on	:	1992-05-20
Resolution	:	2.25 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 (i)) were used in the production of this report:

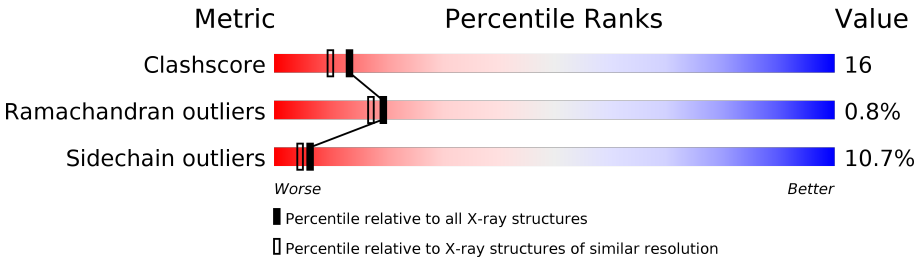
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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 2.25 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))
Clashscore	141614	1487 (2.26-2.26)
Ramachandran outliers	138981	1449 (2.26-2.26)
Sidechain outliers	138945	1450 (2.26-2.26)

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 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 was not executed.

Mol	Chain	Length	Quality of chain
1	L	124	55% 38% 6% ·
2	H	373	100%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 1411 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 METHYLAMINE DEHYDROGENASE (LIGHT SUBUNIT).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	L	124	Total	C	N	O	S	0	0	0
			952	588	161	190	13			

- Molecule 2 is a protein called METHYLAMINE DEHYDROGENASE (HEAVY SUBUNIT).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf	Trace
2	H	373	Total	C	0	0	373
			373	373			

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	L	86	Total	O	0	0
			86	86		

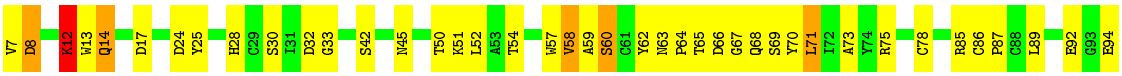
3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of 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 was not executed.

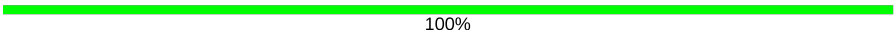
- Molecule 1: METHYLAMINE DEHYDROGENASE (LIGHT SUBUNIT)

Chain L:



- Molecule 2: METHYLAMINE DEHYDROGENASE (HEAVY SUBUNIT)

Chain H:



There are no outlier residues recorded for this chain.

4 Data and refinement statistics (i)

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α, β, γ	129.78Å 129.78Å 104.33Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	(Not available) – 2.25	Depositor
% Data completeness (in resolution range)	(Not available) ((Not available)-2.25)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	TNT	Depositor
R, R_{free}	0.209 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	1411	wwPDB-VP
Average B, all atoms (Å^2)	23.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

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

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	L	1.10	4/960 (0.4%)	1.67	19/1309 (1.5%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	L	92	GLU	CD-OE2	7.68	1.34	1.25
1	L	113	GLU	CD-OE1	6.23	1.32	1.25
1	L	101	GLU	CD-OE1	6.04	1.32	1.25
1	L	94	GLU	CD-OE2	5.83	1.32	1.25

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	L	75	ARG	NE-CZ-NH1	11.37	125.98	120.30
1	L	99	ARG	NE-CZ-NH1	9.61	125.10	120.30
1	L	24	ASP	CB-CG-OD2	-8.54	110.61	118.30
1	L	75	ARG	NE-CZ-NH2	-7.78	116.41	120.30
1	L	17	ASP	CB-CG-OD2	-7.61	111.45	118.30
1	L	85	ARG	NE-CZ-NH1	7.18	123.89	120.30
1	L	59	ALA	N-CA-CB	7.12	120.06	110.10
1	L	17	ASP	CB-CG-OD1	6.91	124.52	118.30
1	L	24	ASP	CB-CG-OD1	6.81	124.43	118.30
1	L	129	LYS	C-N-CA	6.43	137.78	121.70
1	L	58	VAL	CA-CB-CG2	6.35	120.43	110.90
1	L	113	GLU	CB-CA-C	-6.09	98.23	110.40
1	L	107	ILE	CG1-CB-CG2	-5.98	98.24	111.40
1	L	32	ASP	CB-CG-OD1	5.81	123.53	118.30
1	L	58	VAL	CA-CB-CG1	5.65	119.37	110.90
1	L	12	LYS	N-CA-CB	5.62	120.72	110.60
1	L	129	LYS	CA-C-N	5.60	129.52	117.20

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	L	32	ASP	CB-CG-OD2	-5.27	113.56	118.30
1	L	8	ASP	CB-CG-OD1	-5.09	113.72	118.30

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	L	952	0	853	35	0
2	H	373	0	0	0	0
3	L	86	0	0	1	0
All	All	1411	0	853	35	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 16.

All (35) 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:L:57:TRQ:HB2	1:L:108:TRP:NE1	2.04	0.73
1:L:12:LYS:HZ2	1:L:13:TRP:H	1.43	0.65
1:L:71:LEU:HD12	1:L:127:VAL:CG1	2.29	0.62
1:L:13:TRP:HA	1:L:14:GLN:NE2	2.14	0.62
1:L:71:LEU:HD12	1:L:127:VAL:HG12	1.81	0.62
1:L:62:TYR:OH	1:L:67:GLY:HA2	2.01	0.61
1:L:57:TRQ:HB2	1:L:108:TRP:HE1	1.64	0.59
1:L:69:SER:O	1:L:130:ALA:HA	2.02	0.58
1:L:51:LYS:HB3	1:L:112:ALA:HB1	1.85	0.58
1:L:66:ASP:OD2	1:L:70:TYR:OH	2.20	0.57
1:L:54:THR:OG1	1:L:111:GLY:HA3	2.04	0.57
1:L:14:GLN:CD	1:L:14:GLN:H	2.09	0.55
1:L:42:SER:OG	1:L:45:ASN:HB2	2.07	0.54
1:L:60:SER:HB2	1:L:130:ALA:O	2.08	0.54
1:L:50:THR:C	1:L:51:LYS:HD3	2.29	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:L:63:ASN:OD1	1:L:64:PRO:HD2	2.08	0.53
1:L:33:GLY:HA2	3:L:211:HOH:O	2.09	0.52
1:L:12:LYS:HG3	1:L:13:TRP:N	2.25	0.50
1:L:68:GLN:OE1	1:L:129:LYS:HD3	2.12	0.49
1:L:86:CYS:N	1:L:87:PRO:CD	2.75	0.49
1:L:114:ASP:O	1:L:115:ASP:HB2	2.13	0.48
1:L:25:TYR:HB3	1:L:28:HIS:CD2	2.49	0.48
1:L:33:GLY:HA3	1:L:119:TYR:OH	2.14	0.47
1:L:78:CYS:HB3	1:L:118:THR:O	2.15	0.47
1:L:14:GLN:N	1:L:14:GLN:CD	2.69	0.47
1:L:86:CYS:N	1:L:87:PRO:HD3	2.30	0.47
1:L:71:LEU:CD1	1:L:127:VAL:HG12	2.45	0.46
1:L:51:LYS:HD2	1:L:51:LYS:HA	1.58	0.45
1:L:50:THR:O	1:L:51:LYS:HD3	2.18	0.44
1:L:12:LYS:NZ	1:L:13:TRP:H	2.14	0.44
1:L:73:ALA:O	1:L:125:PRO:HD2	2.18	0.43
1:L:71:LEU:CD1	1:L:127:VAL:CG1	2.98	0.42
1:L:12:LYS:HA	1:L:12:LYS:HZ2	1.83	0.42
1:L:70:TYR:CD1	1:L:70:TYR:N	2.88	0.41
1:L:65:THR:HG22	1:L:66:ASP:N	2.33	0.41

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	L	121/124 (98%)	113 (93%)	7 (6%)	1 (1%)	19 17

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	L	8	ASP

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	L	103/103 (100%)	92 (89%)	11 (11%)	6 4

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	L	7	VAL
1	L	12	LYS
1	L	14	GLN
1	L	30	SER
1	L	52	LEU
1	L	58	VAL
1	L	60	SER
1	L	71	LEU
1	L	89	LEU
1	L	113	GLU
1	L	127	VAL

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

Mol	Chain	Res	Type
1	L	34	ASN
1	L	81	ASN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains (i)

1 non-standard protein/DNA/RNA residue is modelled in this entry.

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	$\#\|Z\| > 2$
1	TRQ	L	57	1	13,17,18	4.41	4 (30%)	14,24,26	2.92	7 (50%)

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
1	TRQ	L	57	1	-	0/4/19/21	0/2/2/2

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	L	57	TRQ	CH2-CZ2	-11.91	1.40	1.54
1	L	57	TRQ	CE2-CZ2	-9.24	1.37	1.50
1	L	57	TRQ	CB-CG	-3.09	1.47	1.51
1	L	57	TRQ	CZ3-CE3	2.04	1.38	1.34

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	L	57	TRQ	CZ2-CE2-NE1	5.97	129.48	119.94
1	L	57	TRQ	CB-CG-CD1	-3.86	123.19	127.97
1	L	57	TRQ	CG-CB-CA	-3.77	108.69	114.53
1	L	57	TRQ	O6-CH2-CZ2	3.41	120.83	118.51
1	L	57	TRQ	O7-CZ2-CE2	-3.35	118.30	121.84
1	L	57	TRQ	O7-CZ2-CH2	3.34	122.94	119.00
1	L	57	TRQ	CB-CA-C	3.14	117.36	111.47

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	L	57	TRQ	2	0

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

6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.