



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 14, 2024 – 12:08 AM JST

PDB ID : 8XA9  
Title : Human MGME1 in complex with 5'-overhang DNA  
Authors : Wu, C.C.; Mao, E.Y.C.  
Deposited on : 2023-12-03  
Resolution : 2.32 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](mailto: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 ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity : 4.02b-467  
Xtrriage (Phenix) : 1.13  
EDS : 2.36  
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) : 2.36

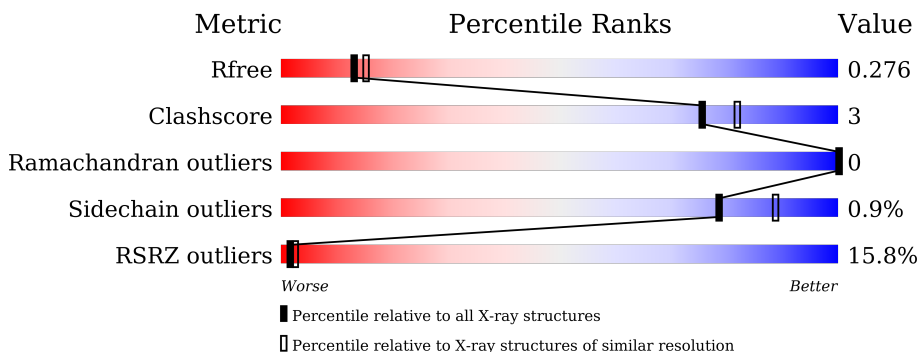
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.32 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	5974 (2.34-2.30)
Clashscore	141614	6604 (2.34-2.30)
Ramachandran outliers	138981	6523 (2.34-2.30)
Sidechain outliers	138945	6523 (2.34-2.30)
RSRZ outliers	127900	5855 (2.34-2.30)

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  $\geq 3$ , 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  $\leq 5\%$ . 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	251	
1	B	251	
2	C	18	
2	E	18	
3	D	11	
3	F	11	

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 3988 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 Mitochondrial genome maintenance exonuclease 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	214	Total 1639	C 1066	N 271	O 294	S 8	0	3	0
1	B	214	Total 1714	C 1112	N 283	O 310	S 9	0	1	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	94	GLY	-	expression tag	UNP Q9BQP7
B	94	GLY	-	expression tag	UNP Q9BQP7

- Molecule 2 is a DNA chain called DNA (18-MER).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	C	11	Total 220	C 109	N 29	O 72	P 10	0	0	0
2	E	10	Total 198	C 99	N 24	O 66	P 9	0	0	0

- Molecule 3 is a DNA chain called DNA (11-MER).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	D	4	Total 81	C 38	N 16	O 23	P 4	0	0	0
3	F	3	Total 62	C 29	N 13	O 17	P 3	0	0	0

- Molecule 4 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total Ca 1 1	0	0

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	B	1	Total Ca 1 1	0	0
4	C	1	Total Ca 1 1	0	0
4	E	1	Total Ca 1 1	0	0

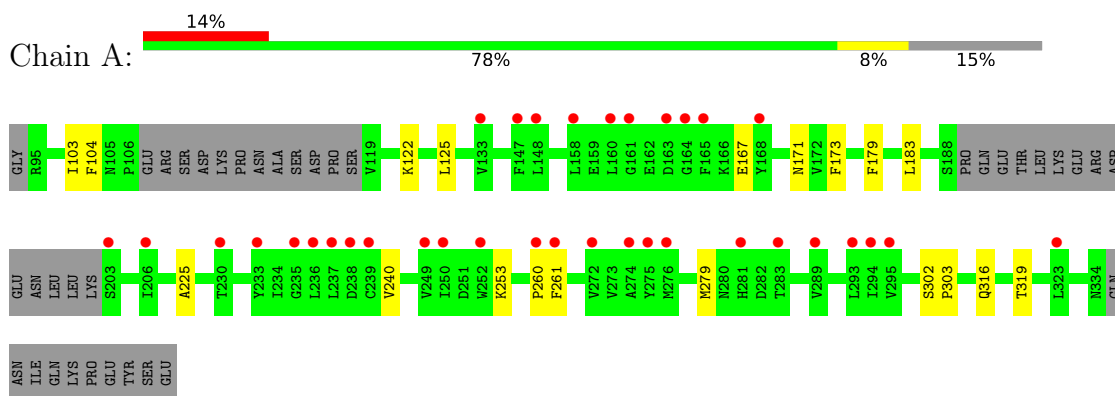
- Molecule 5 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	20	Total O 20 20	0	0
5	B	41	Total O 41 41	0	0
5	C	4	Total O 4 4	0	0
5	E	5	Total O 5 5	0	0

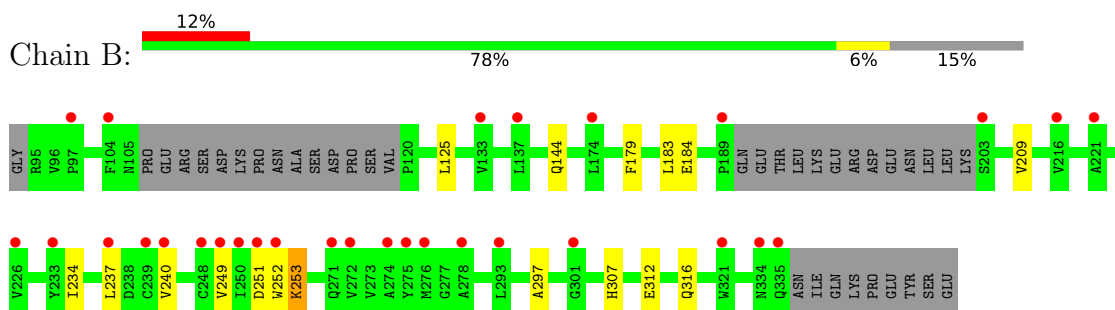
### 3 Residue-property plots [i](#)

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: Mitochondrial genome maintenance exonuclease 1



- Molecule 1: Mitochondrial genome maintenance exonuclease 1



- Molecule 2: DNA (18-MER)



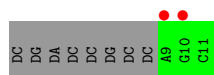
- Molecule 2: DNA (18-MER)



## ● Molecule 3: DNA (11-MER)



## ● Molecule 3: DNA (11-MER)



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	180.76Å 56.19Å 114.44Å 90.00° 113.02° 90.00°	Depositor
Resolution (Å)	24.46 – 2.32 24.46 – 2.32	Depositor EDS
% Data completeness (in resolution range)	94.6 (24.46-2.32) 94.6 (24.46-2.32)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.13 (at 2.31Å)	Xtrriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, $R_{free}$	0.258 , 0.278 0.257 , 0.276	Depositor DCC
$R_{free}$ test set	2162 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	48.5	Xtrriage
Anisotropy	0.237	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 49.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.92	EDS
Total number of atoms	3988	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	60.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 13.73% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  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](#)

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

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	0.29	0/1691	0.47	0/2312
1	B	0.27	0/1761	0.44	0/2391
2	C	0.51	0/243	1.10	0/374
2	E	0.54	0/218	1.18	0/335
3	D	0.56	0/90	0.72	0/136
3	F	0.51	0/69	0.61	0/104
All	All	0.33	0/4072	0.60	0/5652

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	1639	0	1531	12	0
1	B	1714	0	1666	12	0
2	C	220	0	131	1	0
2	E	198	0	120	0	0
3	D	81	0	45	2	0
3	F	62	0	34	0	0
4	A	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	B	1	0	0	0	0
4	C	1	0	0	0	0
4	E	1	0	0	0	0
5	A	20	0	0	0	0
5	B	41	0	0	1	0
5	C	4	0	0	0	0
5	E	5	0	0	0	0
All	All	3988	0	3527	22	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 3.

All (22) 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:307:HIS:ND1	5:B:501:HOH:O	2.30	0.65
1:A:179:PHE:CE1	1:A:183:LEU:HD21	2.34	0.63
1:B:312:GLU:OE2	1:B:316:GLN:NE2	2.41	0.53
1:A:122:LYS:NZ	1:B:184:GLU:OE2	2.34	0.52
1:A:260:PRO:HD2	1:A:261:PHE:H	1.77	0.49
1:A:240:VAL:HG21	1:A:279:MET:CE	2.43	0.48
1:A:225:ALA:HB1	1:B:125:LEU:HD13	1.97	0.47
1:A:103:ILE:HG23	1:A:104[B]:PHE:CD1	2.50	0.46
1:A:240:VAL:HG21	1:A:279:MET:HE1	1.98	0.46
1:B:209:VAL:HG13	1:B:297:ALA:HB2	1.98	0.46
1:A:260:PRO:HD2	1:A:261:PHE:N	2.32	0.45
1:B:179:PHE:CZ	1:B:183:LEU:HD11	2.51	0.45
1:B:251:ASP:OD2	1:B:253:LYS:NZ	2.50	0.44
1:B:183:LEU:HD13	1:B:252:TRP:CD2	2.52	0.44
1:A:167:GLU:O	1:A:171:ASN:OD1	2.36	0.43
1:B:144:GLN:NE2	3:D:10:DG:O6	2.51	0.43
1:B:237:LEU:HD12	1:B:237:LEU:O	2.18	0.42
1:B:240:VAL:HG22	1:B:249:VAL:HG12	2.01	0.42
2:C:11:DG:H1	3:D:8:DC:H42	1.69	0.41
1:A:125:LEU:HD21	1:B:234:ILE:HD13	2.03	0.41
1:A:302:SER:O	1:A:303:PRO:C	2.59	0.41
1:A:316:GLN:O	1:A:319[B]:THR:OG1	2.39	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	211/251 (84%)	201 (95%)	10 (5%)	0	100	100
1	B	209/251 (83%)	204 (98%)	5 (2%)	0	100	100
All	All	420/502 (84%)	405 (96%)	15 (4%)	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	166/230 (72%)	164 (99%)	2 (1%)	71	83
1	B	185/230 (80%)	184 (100%)	1 (0%)	88	95
All	All	351/460 (76%)	348 (99%)	3 (1%)	78	89

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	173	PHE
1	A	253	LYS
1	B	253	LYS

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

Mol	Chain	Res	Type
1	A	211	HIS
1	B	211	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 monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

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

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q < 0.9
1	A	214/251 (85%)	0.98	35 (16%) <b>1</b> <b>2</b>	38, 61, 94, 102	0
1	B	214/251 (85%)	0.81	30 (14%) <b>2</b> <b>4</b>	33, 52, 71, 81	0
2	C	11/18 (61%)	0.75	1 (9%) <b>9</b> <b>12</b>	50, 53, 100, 104	0
2	E	10/18 (55%)	0.64	2 (20%) <b>1</b> <b>1</b>	61, 67, 112, 115	0
3	D	4/11 (36%)	1.97	2 (50%) <b>0</b> <b>0</b>	90, 93, 96, 102	0
3	F	3/11 (27%)	2.39	2 (66%) <b>0</b> <b>0</b>	109, 109, 111, 112	0
All	All	456/560 (81%)	0.90	72 (15%) <b>2</b> <b>2</b>	33, 56, 93, 115	0

All (72) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	250	ILE	5.3
1	B	239	CYS	5.1
1	B	237	LEU	4.3
1	B	250	ILE	4.2
1	B	252	TRP	4.1
1	A	164	GLY	3.9
1	B	272	VAL	3.6
1	A	252	TRP	3.5
1	A	133	VAL	3.5
1	B	274	ALA	3.5
1	B	133	VAL	3.5
1	A	272	VAL	3.4
1	A	237	LEU	3.2
2	C	11	DG	3.2
1	B	275	TYR	3.1
3	D	8	DC	3.1
1	A	294	ILE	3.1
1	B	249	VAL	3.1
3	F	9	DA	3.1

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
2	E	9	DC	3.0
1	B	189	PRO	3.0
1	B	203	SER	2.9
1	A	249	VAL	2.9
1	A	160	LEU	2.9
1	A	165	PHE	2.8
1	A	158	LEU	2.8
1	A	161	GLY	2.8
1	A	163	ASP	2.8
1	A	148	LEU	2.8
3	D	9	DA	2.8
1	A	260	PRO	2.8
1	A	295	VAL	2.8
1	B	240	VAL	2.7
1	B	216	VAL	2.7
1	B	104[A]	PHE	2.7
1	A	275	TYR	2.7
1	B	293	LEU	2.7
1	B	248	CYS	2.6
1	A	261	PHE	2.6
1	A	203	SER	2.6
1	B	226	VAL	2.5
3	F	10	DG	2.5
1	A	276	MET	2.5
1	B	276	MET	2.5
1	A	289[A]	VAL	2.5
1	A	233	TYR	2.5
1	A	206	ILE	2.4
1	B	321	TRP	2.4
1	B	301	GLY	2.4
1	A	147	PHE	2.4
1	A	168	TYR	2.3
1	B	97	PRO	2.3
1	A	274	ALA	2.3
1	B	221	ALA	2.3
1	A	281	HIS	2.3
1	A	239	CYS	2.2
1	B	233	TYR	2.2
1	B	278	ALA	2.2
2	E	10	DT	2.2
1	A	238	ASP	2.2
1	B	137	LEU	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	236	LEU	2.2
1	B	251	ASP	2.2
1	A	293	LEU	2.1
1	A	283	THR	2.1
1	A	230	THR	2.1
1	A	235	GLY	2.1
1	B	334	ASN	2.1
1	B	335	GLN	2.1
1	B	174	LEU	2.0
1	A	323	LEU	2.0
1	B	271	GLN	2.0

## 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](#)

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. The B-factors column lists the minimum, median, 95<sup>th</sup> 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	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
4	CA	E	101	1/1	0.85	0.08	78,78,78,78	0
4	CA	C	101	1/1	0.88	0.11	61,61,61,61	0
4	CA	A	401	1/1	0.92	0.22	53,53,53,53	0
4	CA	B	401	1/1	0.98	0.17	43,43,43,43	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.