



Full wwPDB EM Validation Report ⓘ

Jul 9, 2025 – 12:36 PM JST

PDB ID : 8IP6 / pdb_00008ip6
EMDB ID : EMD-35633
Title : Cryo-EM structure of hMRS2-rest
Authors : Li, M.; Li, Y.; Yang, X.; Shen, Y.Q.
Deposited on : 2023-03-14
Resolution : 2.90 Å(reported)

This is a Full wwPDB EM 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/EMValidationReportHelp>

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>.

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

EMDB validation analysis : **FAILED**
MolProbity : 4-5-2 with Phenix2.0rc1
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ : **FAILED**
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.44

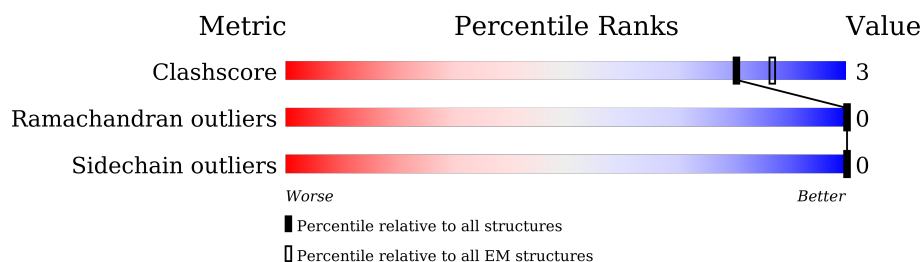
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 2.90 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)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the 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 $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	453	
1	B	453	
1	C	453	
1	D	453	
1	E	453	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 12921 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, 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 Magnesium transporter MRS2 homolog, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	320	Total	C	N	O	S	1	0
			2584	1663	435	473	13		
1	B	320	Total	C	N	O	S	1	0
			2584	1663	435	473	13		
1	C	320	Total	C	N	O	S	1	0
			2584	1663	435	473	13		
1	D	320	Total	C	N	O	S	1	0
			2584	1663	435	473	13		
1	E	320	Total	C	N	O	S	1	0
			2584	1663	435	473	13		

There are 50 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	444	SER	-	expression tag	UNP Q9HD23
A	445	ALA	-	expression tag	UNP Q9HD23
A	446	ASP	-	expression tag	UNP Q9HD23
A	447	TYR	-	expression tag	UNP Q9HD23
A	448	LYS	-	expression tag	UNP Q9HD23
A	449	ASP	-	expression tag	UNP Q9HD23
A	450	ASP	-	expression tag	UNP Q9HD23
A	451	ASP	-	expression tag	UNP Q9HD23
A	452	ASP	-	expression tag	UNP Q9HD23
A	453	LYS	-	expression tag	UNP Q9HD23
B	444	SER	-	expression tag	UNP Q9HD23
B	445	ALA	-	expression tag	UNP Q9HD23
B	446	ASP	-	expression tag	UNP Q9HD23
B	447	TYR	-	expression tag	UNP Q9HD23
B	448	LYS	-	expression tag	UNP Q9HD23
B	449	ASP	-	expression tag	UNP Q9HD23
B	450	ASP	-	expression tag	UNP Q9HD23
B	451	ASP	-	expression tag	UNP Q9HD23
B	452	ASP	-	expression tag	UNP Q9HD23
B	453	LYS	-	expression tag	UNP Q9HD23

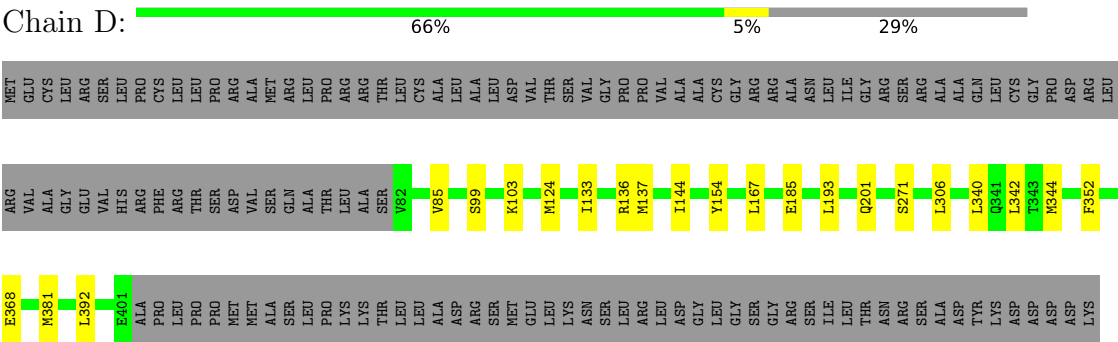
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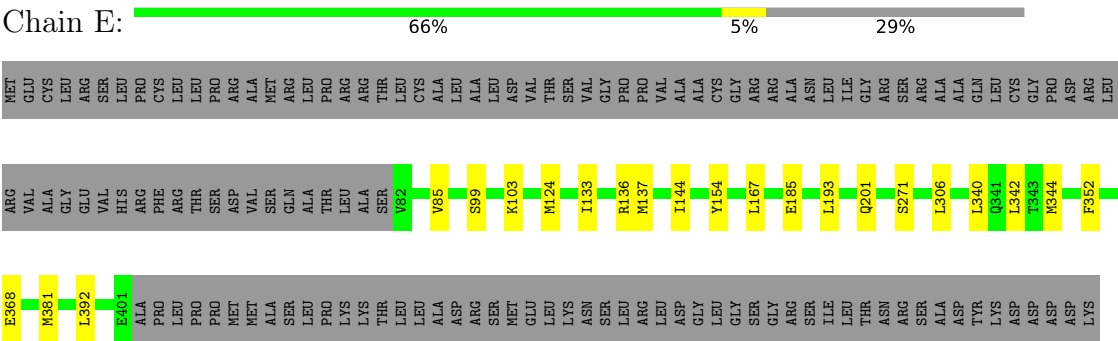
Chain	Residue	Modelled	Actual	Comment	Reference
C	444	SER	-	expression tag	UNP Q9HD23
C	445	ALA	-	expression tag	UNP Q9HD23
C	446	ASP	-	expression tag	UNP Q9HD23
C	447	TYR	-	expression tag	UNP Q9HD23
C	448	LYS	-	expression tag	UNP Q9HD23
C	449	ASP	-	expression tag	UNP Q9HD23
C	450	ASP	-	expression tag	UNP Q9HD23
C	451	ASP	-	expression tag	UNP Q9HD23
C	452	ASP	-	expression tag	UNP Q9HD23
C	453	LYS	-	expression tag	UNP Q9HD23
D	444	SER	-	expression tag	UNP Q9HD23
D	445	ALA	-	expression tag	UNP Q9HD23
D	446	ASP	-	expression tag	UNP Q9HD23
D	447	TYR	-	expression tag	UNP Q9HD23
D	448	LYS	-	expression tag	UNP Q9HD23
D	449	ASP	-	expression tag	UNP Q9HD23
D	450	ASP	-	expression tag	UNP Q9HD23
D	451	ASP	-	expression tag	UNP Q9HD23
D	452	ASP	-	expression tag	UNP Q9HD23
D	453	LYS	-	expression tag	UNP Q9HD23
E	444	SER	-	expression tag	UNP Q9HD23
E	445	ALA	-	expression tag	UNP Q9HD23
E	446	ASP	-	expression tag	UNP Q9HD23
E	447	TYR	-	expression tag	UNP Q9HD23
E	448	LYS	-	expression tag	UNP Q9HD23
E	449	ASP	-	expression tag	UNP Q9HD23
E	450	ASP	-	expression tag	UNP Q9HD23
E	451	ASP	-	expression tag	UNP Q9HD23
E	452	ASP	-	expression tag	UNP Q9HD23
E	453	LYS	-	expression tag	UNP Q9HD23

- Molecule 2 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	AltConf
2	A	1	Total Cl 1 1	0



● Molecule 1: Magnesium transporter MRS2 homolog, mitochondrial



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	104000	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	54	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	1600	Depositor
Magnification	Not provided	
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor

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: CL

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	0.13	0/2633	0.24	0/3558
1	B	0.13	0/2633	0.24	0/3558
1	C	0.13	0/2633	0.24	0/3558
1	D	0.13	0/2633	0.24	0/3558
1	E	0.13	0/2633	0.24	0/3558
All	All	0.13	0/13165	0.24	0/17790

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	2584	0	2609	15	0
1	B	2584	0	2609	14	0
1	C	2584	0	2609	12	0
1	D	2584	0	2609	15	0
1	E	2584	0	2609	15	0
2	A	1	0	0	0	0
All	All	12921	0	13045	66	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 (66) 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:E:344:MET:HE2	1:E:392:LEU:HB3	1.64	0.79
1:D:344:MET:HE2	1:D:392:LEU:HB3	1.64	0.79
1:A:344:MET:HE2	1:A:392:LEU:HB3	1.64	0.78
1:B:344:MET:HE2	1:B:392:LEU:HB3	1.64	0.78
1:C:344:MET:HE2	1:C:392:LEU:HB3	1.64	0.77
1:C:124:MET:HA	1:C:136:ARG:O	1.88	0.73
1:E:124:MET:HA	1:E:136:ARG:O	1.88	0.73
1:B:124:MET:HA	1:B:136:ARG:O	1.88	0.73
1:A:124:MET:HA	1:A:136:ARG:O	1.88	0.72
1:D:124:MET:HA	1:D:136:ARG:O	1.88	0.72
1:D:340:LEU:O	1:D:344:MET:HG3	1.96	0.66
1:C:340:LEU:O	1:C:344:MET:HG3	1.96	0.65
1:E:340:LEU:O	1:E:344:MET:HG3	1.96	0.65
1:B:340:LEU:O	1:B:344:MET:HG3	1.96	0.65
1:A:340:LEU:O	1:A:344:MET:HG3	1.96	0.65
1:B:124:MET:HE1	1:B:137:MET:HE2	1.83	0.61
1:C:124:MET:HE1	1:C:137:MET:HE2	1.83	0.61
1:D:124:MET:HE1	1:D:137:MET:HE2	1.83	0.61
1:E:124:MET:HE1	1:E:137:MET:HE2	1.83	0.61
1:A:124:MET:HE1	1:A:137:MET:HE2	1.83	0.60
1:A:99:SER:HG	1:A:154:TYR:HH	1.56	0.54
1:E:99:SER:HG	1:E:154:TYR:HH	1.56	0.52
1:A:137:MET:HE1	1:A:193:LEU:HD23	1.95	0.48
1:B:137:MET:HE1	1:B:193:LEU:HD23	1.95	0.48
1:C:137:MET:HE1	1:C:193:LEU:HD23	1.95	0.48
1:E:137:MET:HE1	1:E:193:LEU:HD23	1.95	0.48
1:D:99:SER:HG	1:D:154:TYR:HH	1.60	0.48
1:D:137:MET:HE1	1:D:193:LEU:HD23	1.95	0.48
1:C:352:PHE:HB3	1:C:381:MET:HG3	1.97	0.47
1:E:352:PHE:HB3	1:E:381:MET:HG3	1.97	0.47
1:D:352:PHE:HB3	1:D:381:MET:HG3	1.97	0.46
1:A:352:PHE:HB3	1:A:381:MET:HG3	1.97	0.46
1:B:352:PHE:HB3	1:B:381:MET:HG3	1.97	0.46
1:D:185:GLU:OE1	1:D:271:SER:OG	2.31	0.45
1:C:342:LEU:CD1	1:D:344:MET:HG2	2.47	0.45
1:B:342:LEU:CD1	1:C:344:MET:HG2	2.47	0.45
1:E:85:VAL:HG12	1:E:103:LYS:HA	1.99	0.44
1:A:85:VAL:HG12	1:A:103:LYS:HA	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:107:LEU:HD12	1:A:107:LEU:HA	1.89	0.44
1:C:368:GLU:N	1:C:368:GLU:OE1	2.51	0.44
1:D:342:LEU:CD1	1:E:344:MET:HG2	2.48	0.44
1:D:368:GLU:N	1:D:368:GLU:OE1	2.51	0.44
1:D:85:VAL:HG12	1:D:103:LYS:HA	1.99	0.43
1:A:167:LEU:HD23	1:A:167:LEU:HA	1.81	0.43
1:B:85:VAL:HG12	1:B:103:LYS:HA	1.99	0.43
1:B:368:GLU:N	1:B:368:GLU:OE1	2.51	0.43
1:D:167:LEU:HD23	1:D:167:LEU:HA	1.81	0.43
1:A:342:LEU:CD1	1:B:344:MET:HG2	2.49	0.43
1:E:201:GLN:HG3	1:E:306:LEU:HD11	2.00	0.43
1:A:201:GLN:HG3	1:A:306:LEU:HD11	2.00	0.43
1:A:368:GLU:OE1	1:A:368:GLU:N	2.51	0.43
1:D:201:GLN:HG3	1:D:306:LEU:HD11	2.00	0.43
1:E:368:GLU:OE1	1:E:368:GLU:N	2.51	0.43
1:A:344:MET:HG2	1:E:342:LEU:CD1	2.49	0.42
1:B:201:GLN:HG3	1:B:306:LEU:HD11	2.00	0.42
1:C:201:GLN:HG3	1:C:306:LEU:HD11	2.00	0.42
1:E:167:LEU:HD23	1:E:167:LEU:HA	1.81	0.42
1:C:85:VAL:HG12	1:C:103:LYS:HA	1.99	0.42
1:B:99:SER:HG	1:B:154:TYR:HH	1.65	0.42
1:E:185:GLU:OE1	1:E:271:SER:OG	2.31	0.42
1:B:185:GLU:OE1	1:B:271:SER:OG	2.31	0.42
1:C:133:ILE:HB	1:C:144:ILE:HB	2.02	0.41
1:B:133:ILE:HB	1:B:144:ILE:HB	2.02	0.41
1:D:133:ILE:HB	1:D:144:ILE:HB	2.02	0.41
1:A:133:ILE:HB	1:A:144:ILE:HB	2.02	0.40
1:E:133:ILE:HB	1:E:144:ILE:HB	2.02	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 PDB entries followed by that with respect to all EM entries.

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	319/453 (70%)	311 (98%)	8 (2%)	0	100	100
1	B	319/453 (70%)	312 (98%)	7 (2%)	0	100	100
1	C	319/453 (70%)	311 (98%)	8 (2%)	0	100	100
1	D	319/453 (70%)	312 (98%)	7 (2%)	0	100	100
1	E	319/453 (70%)	311 (98%)	8 (2%)	0	100	100
All	All	1595/2265 (70%)	1557 (98%)	38 (2%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

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	284/403 (70%)	284 (100%)	0	100	100
1	B	284/403 (70%)	284 (100%)	0	100	100
1	C	284/403 (70%)	284 (100%)	0	100	100
1	D	284/403 (70%)	284 (100%)	0	100	100
1	E	284/403 (70%)	284 (100%)	0	100	100
All	All	1420/2015 (70%)	1420 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	170	GLN
1	A	331	HIS
1	B	170	GLN
1	B	331	HIS
1	C	170	GLN
1	C	331	HIS
1	D	170	GLN
1	D	331	HIS

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Mol	Chain	Res	Type
1	E	170	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 1 ligands modelled in this entry, 1 is 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.