



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 08:56 PM UTC

PDB ID : 3N8E / pdb_00003n8e
Title : Substrate binding domain of the human Heat Shock 70kDa protein 9 (mortalin)
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Deposited on : 2010-05-28
Resolution : 2.80 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 ⓘ 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:

MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)

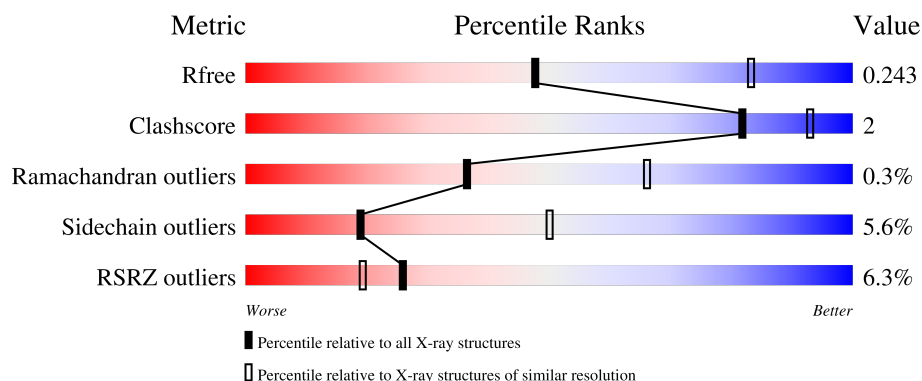
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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}	180053	3866 (2.80-2.80)
Clashscore	190562	4276 (2.80-2.80)
Ramachandran outliers	187476	4196 (2.80-2.80)
Sidechain outliers	187428	4198 (2.80-2.80)
RSRZ outliers	180081	3869 (2.80-2.80)

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 $\leq 5\%$. 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	182	2% 77% 8% 13%
1	B	182	9% 74% 12% 13%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 2473 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 Stress-70 protein, mitochondrial.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	159	Total	C	N	O	S	0	0	0
			1213	748	213	247	5			
1	B	159	Total	C	N	O	S	0	0	0
			1213	748	213	247	5			

There are 46 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	416	MET	-	expression tag	UNP P38646
A	417	HIS	-	expression tag	UNP P38646
A	418	HIS	-	expression tag	UNP P38646
A	419	HIS	-	expression tag	UNP P38646
A	420	HIS	-	expression tag	UNP P38646
A	421	HIS	-	expression tag	UNP P38646
A	422	HIS	-	expression tag	UNP P38646
A	423	SER	-	expression tag	UNP P38646
A	424	SER	-	expression tag	UNP P38646
A	425	GLY	-	expression tag	UNP P38646
A	426	VAL	-	expression tag	UNP P38646
A	427	ASP	-	expression tag	UNP P38646
A	428	LEU	-	expression tag	UNP P38646
A	429	GLY	-	expression tag	UNP P38646
A	430	THR	-	expression tag	UNP P38646
A	431	GLU	-	expression tag	UNP P38646
A	432	ASN	-	expression tag	UNP P38646
A	433	LEU	-	expression tag	UNP P38646
A	434	TYR	-	expression tag	UNP P38646
A	435	PHE	-	expression tag	UNP P38646
A	436	GLN	-	expression tag	UNP P38646
A	437	SER	-	expression tag	UNP P38646
A	438	MET	-	expression tag	UNP P38646
B	416	MET	-	expression tag	UNP P38646
B	417	HIS	-	expression tag	UNP P38646

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Chain	Residue	Modelled	Actual	Comment	Reference
B	418	HIS	-	expression tag	UNP P38646
B	419	HIS	-	expression tag	UNP P38646
B	420	HIS	-	expression tag	UNP P38646
B	421	HIS	-	expression tag	UNP P38646
B	422	HIS	-	expression tag	UNP P38646
B	423	SER	-	expression tag	UNP P38646
B	424	SER	-	expression tag	UNP P38646
B	425	GLY	-	expression tag	UNP P38646
B	426	VAL	-	expression tag	UNP P38646
B	427	ASP	-	expression tag	UNP P38646
B	428	LEU	-	expression tag	UNP P38646
B	429	GLY	-	expression tag	UNP P38646
B	430	THR	-	expression tag	UNP P38646
B	431	GLU	-	expression tag	UNP P38646
B	432	ASN	-	expression tag	UNP P38646
B	433	LEU	-	expression tag	UNP P38646
B	434	TYR	-	expression tag	UNP P38646
B	435	PHE	-	expression tag	UNP P38646
B	436	GLN	-	expression tag	UNP P38646
B	437	SER	-	expression tag	UNP P38646
B	438	MET	-	expression tag	UNP P38646

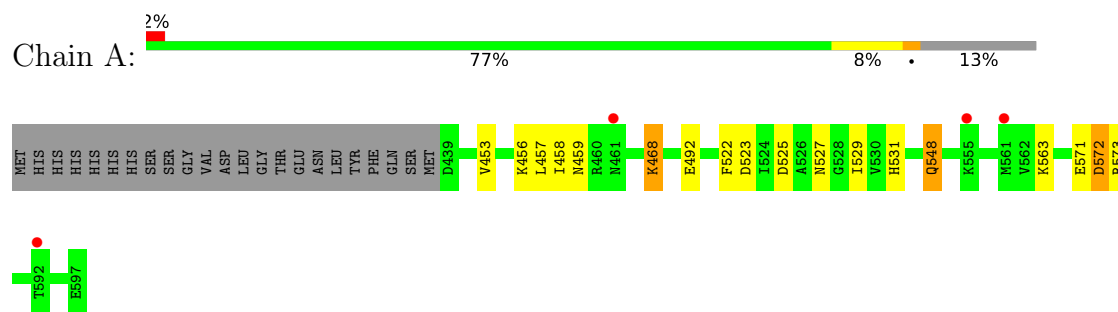
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	26	Total	O	0	0
			26	26		
2	B	21	Total	O	0	0
			21	21		

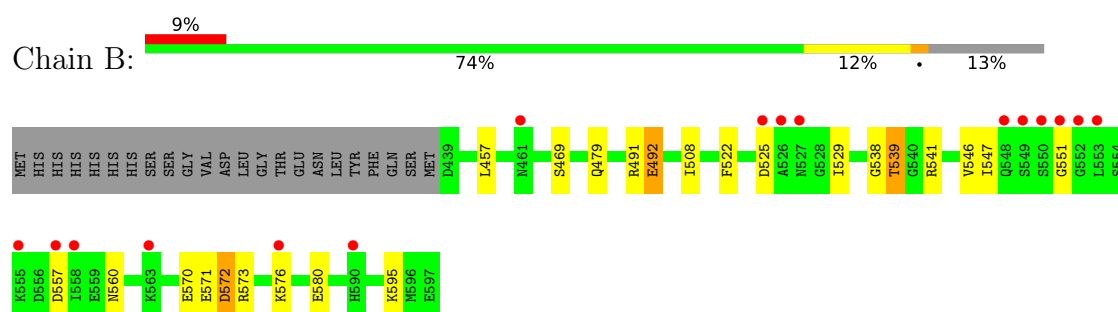
3 Residue-property plots [i](#)

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: Stress-70 protein, mitochondrial



- Molecule 1: Stress-70 protein, mitochondrial



4 Data and refinement statistics

Property	Value	Source
Space group	P 62 2 2	Depositor
Cell constants a, b, c, α , β , γ	118.68Å 118.68Å 159.87Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	34.94 – 2.80 34.94 – 2.80	Depositor EDS
% Data completeness (in resolution range)	(Not available) (34.94-2.80) 99.9 (34.94-2.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.11	Depositor
$\langle I/\sigma(I) \rangle$ ¹	5.77 (at 2.81Å)	Xtriage
Refinement program	BUSTER 2.9.2	Depositor
R, R_{free}	0.206 , 0.242 0.210 , 0.243	Depositor DCC
R_{free} test set	998 reflections (5.88%)	wwPDB-VP
Wilson B-factor (Å ²)	55.0	Xtriage
Anisotropy	0.505	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 42.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	2473	wwPDB-VP
Average B, all atoms (Å ²)	57.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.22% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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

5.1 Standard geometry

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	0.85	0/1225	1.29	5/1648 (0.3%)
1	B	0.88	0/1225	1.34	12/1648 (0.7%)
All	All	0.86	0/2450	1.32	17/3296 (0.5%)

There are no bond length outliers.

All (17) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	479	GLN	CA-C-N	6.62	129.69	120.29
1	B	479	GLN	C-N-CA	6.62	129.69	120.29
1	A	571	GLU	CA-C-N	6.38	128.73	120.44
1	A	571	GLU	C-N-CA	6.38	128.73	120.44
1	A	525	ASP	CA-CB-CG	6.16	118.75	112.60
1	B	525	ASP	CA-CB-CG	6.02	118.62	112.60
1	B	551	GLY	CA-C-N	5.79	125.59	121.65
1	B	551	GLY	C-N-CA	5.79	125.59	121.65
1	B	522	PHE	CA-CB-CG	5.58	119.38	113.80
1	A	459	ASN	CA-CB-CG	5.56	118.16	112.60
1	A	572	ASP	CA-CB-CG	5.46	118.06	112.60
1	B	457	LEU	N-CA-C	-5.38	106.77	113.55
1	B	580	GLU	CB-CG-CD	5.34	121.67	112.60
1	B	508	ILE	N-CA-C	-5.26	102.44	107.76
1	B	572	ASP	CA-CB-CG	5.25	117.85	112.60
1	B	571	GLU	CA-C-N	5.14	127.43	120.44
1	B	571	GLU	C-N-CA	5.14	127.43	120.44

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	1213	0	1225	6	0
1	B	1213	0	1225	6	0
2	A	26	0	0	0	0
2	B	21	0	0	0	0
All	All	2473	0	2450	12	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 2.

All (12) 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:492:GLU:HG3	1:A:572:ASP:HB3	1.68	0.74
1:B:492:GLU:HG3	1:B:572:ASP:HB3	1.78	0.65
1:B:557:ASP:HA	1:B:560:ASN:HB2	1.84	0.59
1:A:548:GLN:H	1:A:548:GLN:HE21	1.53	0.55
1:B:492:GLU:HB3	1:B:576:LYS:HD3	1.92	0.51
1:B:539:THR:HG23	1:B:541:ARG:H	1.75	0.51
1:A:458:ILE:HD11	1:A:522:PHE:HB3	1.98	0.46
1:A:523:ASP:HB2	1:A:531:HIS:HB2	1.97	0.45
1:B:539:THR:HG23	1:B:541:ARG:HB2	2.00	0.44
1:A:527:ASN:HB2	1:A:529:ILE:HD12	2.01	0.41
1:B:570:GLU:HA	1:B:573:ARG:HG2	2.03	0.41
1:A:458:ILE:HG12	1:A:468:LYS:HD3	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 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	157/182 (86%)	149 (95%)	8 (5%)	0	100	100
1	B	157/182 (86%)	152 (97%)	4 (2%)	1 (1%)	21	51
All	All	314/364 (86%)	301 (96%)	12 (4%)	1 (0%)	36	66

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	538	GLY

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 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	134/155 (86%)	127 (95%)	7 (5%)	21	53
1	B	134/155 (86%)	126 (94%)	8 (6%)	17	47
All	All	268/310 (86%)	253 (94%)	15 (6%)	19	50

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	453	VAL
1	A	456	LYS
1	A	457	LEU
1	A	468	LYS
1	A	548	GLN
1	A	563	LYS
1	A	573	ARG
1	B	469	SER
1	B	491	ARG
1	B	492	GLU
1	B	529	ILE
1	B	539	THR

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Mol	Chain	Res	Type
1	B	546	VAL
1	B	547	ILE
1	B	595	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	461	ASN
1	A	470	GLN
1	A	479	GLN
1	A	548	GLN
1	A	560	ASN
1	B	461	ASN
1	B	481	GLN
1	B	544	GLN
1	B	548	GLN
1	B	564	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](#)

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](#)

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 ⓘ

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, 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	159/182 (87%)	-0.08	4 (2%) 58 48	30, 48, 80, 95	0
1	B	159/182 (87%)	0.58	16 (10%) 12 9	35, 56, 106, 128	0
All	All	318/364 (87%)	0.25	20 (6%) 26 19	30, 51, 92, 128	0

All (20) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	553	LEU	10.4
1	B	551	GLY	6.4
1	B	552	GLY	3.9
1	A	561	MET	3.6
1	B	555	LYS	3.5
1	B	550	SER	3.1
1	B	461	ASN	2.9
1	B	558	ILE	2.6
1	A	592	THR	2.5
1	A	555	LYS	2.5
1	B	526	ALA	2.4
1	B	563	LYS	2.3
1	B	548	GLN	2.3
1	B	527	ASN	2.2
1	B	549	SER	2.2
1	B	557	ASP	2.2
1	B	576	LYS	2.2
1	B	525	ASP	2.1
1	A	461	ASN	2.0
1	B	590	HIS	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 oligosaccharides 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.