



Full wwPDB NMR Structure Validation Report ⓘ

Mar 9, 2026 – 10:28 AM UTC

PDB ID : 7HSC / pdb_00007hsc
Title : HIGH RESOLUTION SOLUTION STRUCTURE OF THE HEAT SHOCK COGNATE-70 KD SUBSTRATE BINDING DOMAIN OBTAINED BY MULTIDIMENSIONAL NMR TECHNIQUES
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Deposited on : 1999-05-03

This is a Full wwPDB NMR 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/NMRValidationReportHelp>

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
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
wwPDB-RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
wwPDB-ShiftChecker	:	v1.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

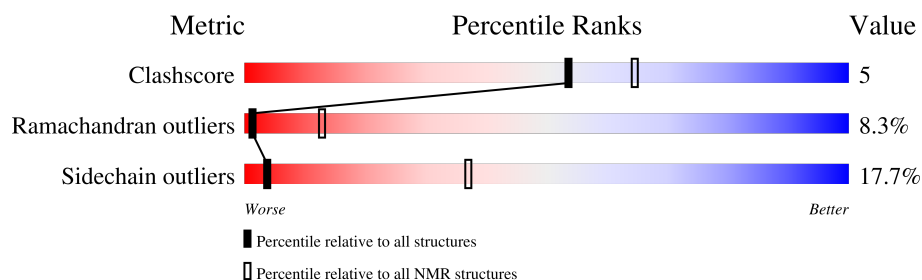
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment was not calculated.

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)	NMR archive (#Entries)
Clashscore	229148	14424
Ramachandran outliers	224038	12848
Sidechain outliers	223484	12823

The table below summarises the geometric issues observed across the polymeric chains and their fit to the experimental data. The red, orange, yellow and green segments indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. A cyan segment indicates the fraction of residues that are not part of the well-defined cores, and 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	159	

2 Ensemble composition and analysis ⓘ

This entry contains 1 models. Identification of well-defined residues and clustering analysis are not possible.

3 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 2482 atoms, of which 1252 are hydrogens and 0 are deuteriums.

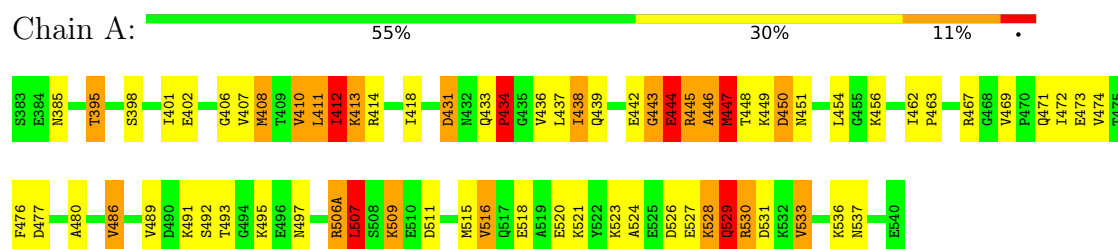
- Molecule 1 is a protein called PROTEIN (HEAT SHOCK COGNATE 70 KD PROTEIN 1).

Mol	Chain	Residues	Atoms						Trace
1	A	159	Total	C	H	N	O	S	0
			2482	762	1252	209	256	3	

4 Residue-property plots [i](#)

These plots are provided for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic is the same as shown in the summary in section 1 of this report. The second graphic shows the sequence where residues are colour-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 outliers are shown as green connectors. Residues which are classified as ill-defined in the NMR ensemble, are shown in cyan with an underline colour-coded according to the previous scheme. Residues which were present in the experimental sample, but not modelled in the final structure are shown in grey.

- Molecule 1: PROTEIN (HEAT SHOCK COGNATE 70 KD PROTEIN 1)



5 Refinement protocol and experimental data overview

The models were refined using the following method: *DISTANCE GEOMETRY, SIMULATE ANNEALING*.

Of the 50 calculated structures, 1 were deposited, based on the following criterion: *AVERAGE OF LOWEST TOTAL ENERGY*.

The following table shows the software used for structure solution, optimisation and refinement.

Software name	Classification	Version
Discover	refinement	
Felix	structure solution	
MSI INSIGHT	structure solution	INSIGHT
MSI DISCOVER	structure solution	DISCOVER

No chemical shift data was provided.

6 Model quality [i](#)

6.1 Standard geometry [i](#)

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 (average) 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	1.79	12/1242 (1.0%)	2.17	65/1677 (3.9%)
All	All	1.79	12/1242 (1.0%)	2.17	65/1677 (3.9%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	Chirality	Planarity
1	A	0	1
All	All	0	1

All bond outliers are listed below. They are sorted according to the Z-score.

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	418	ILE	CA-C	7.28	1.60	1.52
1	A	443	GLY	N-CA	6.89	1.51	1.45
1	A	526	ASP	CA-C	6.37	1.61	1.52
1	A	463	PRO	CA-C	6.30	1.58	1.52
1	A	446	ALA	CA-C	6.10	1.60	1.52
1	A	469	VAL	CA-C	6.04	1.59	1.52
1	A	524	ALA	CA-C	5.87	1.60	1.52
1	A	492	SER	CA-C	5.63	1.60	1.52
1	A	433	GLN	CA-C	5.50	1.59	1.52
1	A	412	ILE	CA-C	5.43	1.59	1.52
1	A	526	ASP	N-CA	5.36	1.53	1.46
1	A	411	LEU	CA-C	5.28	1.59	1.52

All angle outliers are listed below. They are sorted according to the Z-score.

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	447	MET	N-CA-CB	-11.77	90.59	110.49
1	A	537	ASN	CA-CB-CG	9.94	122.54	112.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	450	ASP	CA-CB-CG	9.56	122.17	112.60
1	A	447	MET	N-CA-C	9.49	131.01	110.80
1	A	446	ALA	CA-C-N	9.21	139.13	121.54
1	A	446	ALA	C-N-CA	9.21	139.13	121.54
1	A	447	MET	CA-C-N	8.27	137.33	121.54
1	A	447	MET	C-N-CA	8.27	137.33	121.54
1	A	408	MET	CA-CB-CG	8.26	130.62	114.10
1	A	529	GLN	N-CA-CB	-8.17	96.68	110.49
1	A	431	ASP	CA-CB-CG	8.10	120.70	112.60
1	A	533	VAL	N-CA-CB	-7.79	98.38	111.23
1	A	443	GLY	N-CA-C	7.42	119.60	112.04
1	A	528	LYS	CB-CA-C	7.23	123.22	112.09
1	A	446	ALA	CA-C-O	7.12	130.70	120.51
1	A	447	MET	CA-C-O	6.84	130.29	120.51
1	A	451	ASN	CB-CA-C	6.83	124.02	110.42
1	A	493	THR	CA-CB-CG2	6.80	122.06	110.50
1	A	509	LYS	N-CA-C	6.79	119.54	111.33
1	A	480	ALA	N-CA-C	6.73	121.09	112.34
1	A	443	GLY	CA-C-O	-6.73	117.61	122.45
1	A	410	VAL	CA-C-O	6.58	127.71	120.48
1	A	385	ASN	CA-CB-CG	6.57	119.17	112.60
1	A	447	MET	CB-CA-C	6.48	123.31	110.42
1	A	533	VAL	CB-CA-C	6.35	121.70	111.29
1	A	529	GLN	CB-CA-C	6.33	123.02	110.42
1	A	471	GLN	N-CA-C	6.32	118.68	109.07
1	A	497	ASN	CA-CB-CG	6.29	118.89	112.60
1	A	433	GLN	N-CA-C	6.13	123.35	109.81
1	A	523	LYS	CB-CA-C	5.93	121.10	111.26
1	A	438	ILE	N-CA-CB	5.90	118.70	110.56
1	A	445	ARG	CA-C-O	-5.89	115.30	121.55
1	A	444	GLU	N-CA-C	5.83	123.22	110.80
1	A	495	LYS	N-CA-CB	-5.83	101.81	110.90
1	A	451	ASN	N-CA-CB	-5.73	100.81	110.49
1	A	528	LYS	CA-C-N	5.72	132.47	121.54
1	A	528	LYS	C-N-CA	5.72	132.47	121.54
1	A	533	VAL	CA-CB-CG1	5.65	120.01	110.40
1	A	436	VAL	N-CA-C	5.58	116.61	108.58
1	A	462	ILE	CA-CB-CG1	5.57	119.87	110.40
1	A	446	ALA	O-C-N	5.52	129.94	122.59
1	A	521	LYS	N-CA-CB	-5.51	101.18	110.49
1	A	395	THR	CA-CB-CG2	5.51	119.87	110.50
1	A	493	THR	N-CA-CB	-5.51	101.16	110.41

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	506(A)	ARG	N-CA-C	5.49	118.77	111.30
1	A	410	VAL	CA-CB-CG1	5.49	119.73	110.40
1	A	531	ASP	CA-CB-CG	5.46	118.06	112.60
1	A	439	GLN	OE1-CD-NE2	-5.41	117.19	122.60
1	A	434	PRO	CB-CA-C	5.36	120.40	111.56
1	A	506(A)	ARG	CA-C-N	5.32	128.80	120.82
1	A	506(A)	ARG	C-N-CA	5.32	128.80	120.82
1	A	486	VAL	N-CA-CB	5.26	117.00	111.00
1	A	469	VAL	CA-C-O	-5.26	112.90	119.95
1	A	489	VAL	CA-CB-CG2	5.23	119.29	110.40
1	A	516	VAL	CA-CB-CG1	5.22	119.28	110.40
1	A	408	MET	N-CA-C	5.21	117.59	110.55
1	A	451	ASN	OD1-CG-ND2	-5.21	117.39	122.60
1	A	410	VAL	CA-C-N	5.17	130.77	121.66
1	A	410	VAL	C-N-CA	5.17	130.77	121.66
1	A	491	LYS	N-CA-C	5.12	116.94	111.36
1	A	439	GLN	CB-CG-CD	5.09	121.25	112.60
1	A	442	GLU	CB-CA-C	5.06	119.90	111.30
1	A	406	GLY	N-CA-C	5.05	122.86	114.48
1	A	477	ASP	CA-CB-CG	5.03	117.63	112.60
1	A	507	LEU	N-CA-C	5.02	119.66	111.37

There are no chirality outliers.

All planar outliers are listed below.

Mol	Chain	Res	Type	Group
1	A	476	PHE	Sidechain

6.2 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 each 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 averaged over the ensemble.

Mol	Chain	Non-H	H(model)	H(added)	Clashes
1	A	1230	1252	1249	13
All	All	1230	1252	1249	13

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 5.

All clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)
1:A:408:MET:CB	1:A:447:MET:HG3	0.53	2.34
1:A:408:MET:HE2	1:A:443:GLY:O	0.53	2.04
1:A:507:LEU:H	1:A:507:LEU:HD23	0.52	1.64
1:A:444:GLU:OE2	1:A:447:MET:SD	0.51	2.68
1:A:412:ILE:HG22	1:A:413:LYS:H	0.51	1.65
1:A:408:MET:HB2	1:A:447:MET:HG3	0.48	1.83
1:A:516:VAL:HG23	1:A:520:GLU:CG	0.45	2.41
1:A:401:ILE:O	1:A:408:MET:HA	0.43	2.14
1:A:511:ASP:HB3	1:A:515:MET:SD	0.43	2.53
1:A:401:ILE:HD13	1:A:474:VAL:HG11	0.41	1.91
1:A:407:VAL:HA	1:A:447:MET:HB3	0.41	1.93
1:A:529:GLN:CD	1:A:530:ARG:H	0.41	2.24
1:A:443:GLY:O	1:A:444:GLU:HB2	0.40	2.17

6.3 Torsion angles

6.3.1 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 PDB entries followed by that with respect to all NMR 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	157/159 (99%)	115 (73%)	29 (18%)	13 (8%)	1	13
All	All	157/159 (99%)	115 (73%)	29 (18%)	13 (8%)	1	13

All 13 Ramachandran outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type
1	A	412	ILE
1	A	434	PRO
1	A	444	GLU
1	A	446	ALA
1	A	447	MET
1	A	448	THR
1	A	450	ASP
1	A	456	LYS
1	A	467	ARG

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Mol	Chain	Res	Type
1	A	527	GLU
1	A	529	GLN
1	A	533	VAL
1	A	536	LYS

6.3.2 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 NMR 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	141/141 (100%)	116 (82%)	25 (18%)	4	37
All	All	141/141 (100%)	116 (82%)	25 (18%)	4	37

All 25 residues with a non-rotameric sidechain are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type
1	A	395	THR
1	A	398	SER
1	A	402	GLU
1	A	410	VAL
1	A	411	LEU
1	A	413	LYS
1	A	414	ARG
1	A	431	ASP
1	A	434	PRO
1	A	437	LEU
1	A	438	ILE
1	A	444	GLU
1	A	445	ARG
1	A	449	LYS
1	A	454	LEU
1	A	472	ILE
1	A	473	GLU
1	A	486	VAL
1	A	506(A)	ARG
1	A	507	LEU
1	A	509	LYS

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Mol	Chain	Res	Type
1	A	518	GLU
1	A	528	LYS
1	A	529	GLN
1	A	530	ARG

6.3.3 RNA [i](#)

There are no RNA molecules in this entry.

6.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

6.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.6 Ligand geometry [i](#)

There are no ligands in this entry.

6.7 Other polymers [i](#)

There are no such molecules in this entry.

6.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

7 Chemical shift validation

No chemical shift data were provided