Full wwPDB NMR Structure Validation Report (i)

Feb 24, 2022 – 07:07 AM EST

PDB ID	:	1ZWV
Title	:	Solution Structure of the subunit binding domain (hbSBD) of the human mitochondrial branched-chain alpha-ketoacid dehydrogenase
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Deposited on	:	2005-06-06

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 (i) symbol.

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

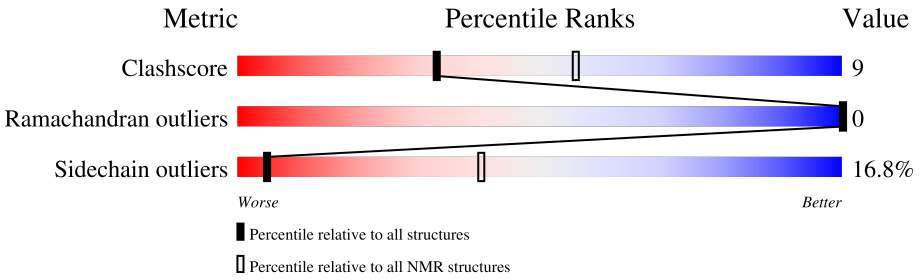
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	2.26
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.26

1 Overall quality at a glance (i)

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	158937	12864
Ramachandran outliers	154571	11451
Sidechain outliers	154315	11428

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 <=5%

Mol	Chain	Length	Quality of chain
1	A	58	52% 16% 22% 10%

2 Ensemble composition and analysis (i)

This entry contains 20 models. Model 17 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *lowest energy*.

The following residues are included in the computation of the global validation metrics.

Well-defined (core) protein residues			
Well-defined core	**Residue range (total)**	**Backbone RMSD (Å)**	**Medoid model**
1	A:9-A:47 (39)	0.29	17

Ill-defined regions of proteins are excluded from the global statistics.

Ligands and non-protein polymers are included in the analysis.

The models can be grouped into 4 clusters and 6 single-model clusters were found.

Cluster number	Models
1	3, 4, 5, 8, 10, 17, 18, 19
2	1, 9
3	16, 20
4	7, 12
Single-model clusters	2; 6; 11; 13; 14; 15

3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 839 atoms, of which 434 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	52	839	252	434	74	78	1	0

There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	cloning artifact	UNP P11182
A	51	LEU	-	cloning artifact	UNP P11182
A	52	GLU	-	cloning artifact	UNP P11182
A	53	HIS	-	expression tag	UNP P11182
A	54	HIS	-	expression tag	UNP P11182
A	55	HIS	-	expression tag	UNP P11182
A	56	HIS	-	expression tag	UNP P11182
A	57	HIS	-	expression tag	UNP P11182
A	58	HIS	-	expression tag	UNP P11182

4 Residue-property plots (i)

4.1 Average score per residue in the NMR ensemble

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: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 52% 16% 22% 10%

G1 E2 I3 K4 G5 R6 K7 T8 L9 A10 T11 R16 N21 N22 I23 V28 G35 I42 L46 E47 K48 Q49 T50 L51 E52 HIS HIS HIS HIS HIS HIS

4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 50% 14% • 22% 10%

G1 E2 I3 K4 G5 R6 K7 T8 L9 A10 T11 R16 N21 N22 I23 V28 G35 I42 L43 L46 E47 K48 Q49 T50 L51 E52 HIS HIS HIS HIS HIS HIS

4.2.2 Score per residue for model 2

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 45% 21% • 22% 10%

G1 E2 I3 K4 G5 R6 K7 T8 L9 A10 T11 R16 L17 I23 K24 L25 S26 E27 V28 G35 I42 L43 L46 E47 K48 Q49 T50 L51 E52 HIS HIS HIS HIS HIS HIS

4.2.3 Score per residue for model 3

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 41% 22% • 22% 10%

4.2.4 Score per residue for model 4

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 47% 21% 22% 10%

4.2.5 Score per residue for model 5

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 41% 24% • 22% 10%

4.2.6 Score per residue for model 6

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 50% 14% • 22% 10%

4.2.7 Score per residue for model 7

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 55% 12% 22% 10%

G1 E2 I3 K4 G5 R6 K7 T8 L9 A10 T11 L17 I23 V28 I42 L46 E47 K48 Q49 T50 L51 E52 HIS HIS HIS HIS HIS HIS

4.2.8 Score per residue for model 8

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 43% 24% 22% 10%

G1 E2 I3 K4 G5 R6 K7 T8 L9 A10 T11 R16 L17 N21 N22 I23 E27 V28 K33 D34 G35 R36 I42 L43 L46 E47 K48 Q49 T50 L51 E52 HIS HIS HIS HIS HIS HIS

4.2.9 Score per residue for model 9

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 47% 21% 22% 10%

G1 E2 I3 K4 G5 R6 K7 T8 L9 A10 T11 R16 L17 A18 L25 S26 E27 V28 S31 D34 I42 Y45 K48 Q49 T50 L51 E52 HIS HIS HIS HIS HIS HIS

4.2.10 Score per residue for model 10

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 38% 26% • 22% 10%

G1 E2 I3 K4 G5 R6 K7 T8 L9 A10 T11 R15 R16 L17 A18 M19 E20 N21 N22 I23 K24 L25 S26 E27 V28 G35 R36 I37 I42 L43 L46 E47 K48 Q49 T50 L51 E52 HIS HIS HIS HIS HIS HIS

4.2.11 Score per residue for model 11

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 45% 22% 22% 10%

G1 E2 I3 K4 G5 R6 K7 T8 L9 A10 T11 R15 R16 L17 N21 N22 I23 E27 V28 D34 L38 I42 L43 N44 Y45 K48 Q49 T50 L51 E52 HIS HIS HIS HIS HIS HIS

4.2.12 Score per residue for model 12

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 41% 24% • 22% 10%

G1 E2 I3 K4 G5 R6 K7 T8 L9 A10 T11 L17 A18 M19 E20 N21 L25 S26 E27 V28 G35 R36 I37 L38 I42 L46 E47 K48 Q49 T50 L51 E52 HIS HIS HIS HIS HIS

4.2.13 Score per residue for model 13

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 45% 22% 22% 10%

G1 E2 I3 K4 G5 R6 K7 T8 L9 A10 T11 N21 N22 I23 S26 E27 V28 S31 G35 L38 I42 Y45 L46 E47 K48 Q49 T50 L51 E52 HIS HIS HIS HIS HIS

4.2.14 Score per residue for model 14

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 47% 17% • 22% 10%

G1 E2 I3 K4 G5 R6 K7 T8 L9 A10 T11 R16 L17 A18 N21 N22 I23 V28 D34 G35 R36 I42 Y45 L46 E47 K48 Q49 T50 L51 E52 HIS HIS HIS HIS HIS

4.2.15 Score per residue for model 15

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 45% 22% 22% 10%

G1 E2 I3 K4 G5 R6 K7 T8 L9 A10 T11 V14 R15 R16 I23 K24 L25 S26 E27 V28 S31 G35 I42 L43 L46 E47 K48 Q49 T50 L51 E52 HIS HIS HIS HIS HIS

4.2.16 Score per residue for model 16

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 45% 21% • 22% 10%

G1 E2 I3 K4 G5 R6 K7 T8 L9 A10 T11 V14 R15 R16 N21 V28 S31 D34 G35 R36 I42 Y45 L46 E47 K48 Q49 T50 L51 E52 HIS HIS HIS HIS HIS HIS

4.2.17 Score per residue for model 17 (medoid)

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 45% 21% • 22% 10%

G1 E2 I3 K4 G5 R6 K7 T8 L9 A10 T11 V14 R15 R16 M19 L25 K33 D34 G35 R36 I37 L38 I42 L43 E47 K48 Q49 T50 L51 E52 HIS HIS HIS HIS HIS HIS

4.2.18 Score per residue for model 18

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 48% 17% • 22% 10%

G1 E2 I3 K4 G5 R6 K7 T8 L9 A10 T11 R16 I23 V28 G35 R36 D41 I42 Y45 L46 E47 K48 Q49 T50 L51 E52 HIS HIS HIS HIS HIS HIS

4.2.19 Score per residue for model 19

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 45% 21% • 22% 10%

G1 E2 I3 K4 G5 R6 K7 T8 L9 A10 T11 R16 L17 A18 M19 E20 N21 N22 I23 K24 L25 S26 E27 V28 G35 Y45 L46 E47 K48 Q49 T50 L51 E52 HIS HIS HIS HIS HIS HIS

4.2.20 Score per residue for model 20

• Molecule 1: Lipoamide acyltransferase component of branched-chain alpha-keto acid dehydrogenase complex, mitochondrial

Chain A: 47% 19% • 22% 10%

G1 E2 I3 K4 G5 R6 K7 T8 L9 A10 T11 N21 N22 I23 V28 S31 G35 R36 I37 L38 D41 I42 Y45 K48 Q49 T50 L51 E52 HIS HIS HIS HIS HIS HIS

5 Refinement protocol and experimental data overview (i)

Of the 100 calculated structures, 20 were deposited, based on the following criterion: *target function*.

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

Software name	Classification	Version
CYANA	structure solution	2.0
CYANA	refinement	2.0

No chemical shift data was provided.

6 Model quality (i)

6.1 Standard geometry (i)

There are no covalent bond-length or bond-angle outliers.

There are no bond-length outliers.

There are no bond-angle outliers.

There are no chirality outliers.

There are no planarity outliers.

6.2 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 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	302	320	320	6±2
All	All	6040	6400	6400	114

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 9.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:28:VAL:HG21	1:A:42:ILE:HD13	0.89	1.40	13	6
1:A:23:ILE:HD12	1:A:46:LEU:HD23	0.84	1.47	7	4
1:A:28:VAL:HG11	1:A:42:ILE:HD13	0.73	1.58	15	11
1:A:42:ILE:HG22	1:A:46:LEU:HD11	0.66	1.64	7	4
1:A:21:ASN:ND2	1:A:46:LEU:HD21	0.62	2.09	8	7
1:A:9:LEU:HD12	1:A:35:GLY:N	0.60	2.12	20	15
1:A:25:LEU:CD1	1:A:42:ILE:HD11	0.59	2.27	2	1
1:A:25:LEU:HD13	1:A:42:ILE:HD11	0.57	1.76	2	1
1:A:28:VAL:HG23	1:A:45:TYR:CB	0.57	2.29	16	7
1:A:15:ARG:HA	1:A:25:LEU:HD11	0.57	1.77	5	2
1:A:23:ILE:HD12	1:A:46:LEU:CD2	0.56	2.29	13	5
1:A:23:ILE:CD1	1:A:46:LEU:HD23	0.56	2.28	7	3
1:A:14:VAL:CG1	1:A:25:LEU:HD11	0.56	2.31	15	1
1:A:18:ALA:HB1	1:A:23:ILE:O	0.56	2.01	14	4

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:18:ALA:HB1	1:A:23:ILE:HB	0.56	1.78	6	2
1:A:28:VAL:HG23	1:A:45:TYR:CG	0.55	2.36	18	4
1:A:21:ASN:OD1	1:A:23:ILE:HD12	0.54	2.03	1	1
1:A:42:ILE:HG22	1:A:46:LEU:CD1	0.53	2.33	13	4
1:A:23:ILE:HD12	1:A:46:LEU:CD1	0.53	2.33	15	2
1:A:21:ASN:CG	1:A:46:LEU:HD22	0.53	2.24	13	1
1:A:21:ASN:HB3	1:A:23:ILE:HD12	0.52	1.81	11	1
1:A:17:LEU:HD23	1:A:42:ILE:HG21	0.51	1.82	11	1
1:A:28:VAL:HG21	1:A:42:ILE:CD1	0.50	2.37	2	2
1:A:9:LEU:HD12	1:A:34:ASP:CA	0.49	2.37	14	1
1:A:23:ILE:HG23	1:A:27:GLU:OE1	0.49	2.07	13	1
1:A:23:ILE:HG22	1:A:25:LEU:H	0.49	1.67	6	1
1:A:36:ARG:O	1:A:38:LEU:HD12	0.48	2.08	17	2
1:A:18:ALA:HB3	1:A:25:LEU:HD21	0.47	1.86	9	1
1:A:21:ASN:HB2	1:A:23:ILE:HD12	0.46	1.87	20	1
1:A:23:ILE:HD12	1:A:46:LEU:HG	0.46	1.88	2	1
1:A:17:LEU:HD22	1:A:20:GLU:OE1	0.45	2.10	10	2
1:A:14:VAL:HG13	1:A:42:ILE:HG13	0.44	1.90	17	2
1:A:25:LEU:HD12	1:A:37:ILE:HG21	0.44	1.90	12	1
1:A:28:VAL:HG22	1:A:45:TYR:CD2	0.43	2.49	9	1
1:A:28:VAL:HG23	1:A:45:TYR:HB2	0.42	1.91	16	1
1:A:13:ALA:HB1	1:A:16:ARG:NH2	0.42	2.29	6	1
1:A:14:VAL:HG12	1:A:25:LEU:HD11	0.42	1.91	17	1
1:A:9:LEU:HD12	1:A:34:ASP:HA	0.42	1.90	14	1
1:A:14:VAL:HG11	1:A:25:LEU:HD11	0.42	1.91	15	1
1:A:11:THR:OG1	1:A:14:VAL:HG23	0.41	2.15	3	3
1:A:23:ILE:HG23	1:A:45:TYR:CE2	0.41	2.51	6	1
1:A:23:ILE:HD13	1:A:45:TYR:CE2	0.41	2.51	18	1
1:A:17:LEU:O	1:A:17:LEU:HD13	0.41	2.16	2	1

6.3 Torsion angles (i)

6.3.1 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 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	39/58 (67%)	35±2 (89±4%)	4±2 (11±4%)	0±0 (0±0%)	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	780/1160 (67%)	696 (89%)	84 (11%)	0 (0%)	100 100

There are no Ramachandran outliers.

6.3.2 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 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	33/50 (66%)	27±1 (83±4%)	6±1 (17±4%)	5 40
All	All	660/1000 (66%)	549 (83%)	111 (17%)	5 40

All 18 unique residues with a non-rotameric sidechain are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	11	THR	20
1	A	16	ARG	13
1	A	43	LEU	10
1	A	9	LEU	9
1	A	26	SER	8
1	A	36	ARG	8
1	A	31	SER	7
1	A	17	LEU	5
1	A	34	ASP	5
1	A	15	ARG	4
1	A	38	LEU	4
1	A	21	ASN	3
1	A	24	LYS	3
1	A	33	LYS	3
1	A	27	GLU	3
1	A	20	GLU	2
1	A	19	MET	2
1	A	41	ASP	2

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 monosaccharides 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 (i)

No chemical shift data were provided