Full wwPDB NMR Structure Validation Report (i)

May 28, 2020 – 09:29 pm BST

PDB ID	:	2DEN
Title	:	Solution Structure of the Ubiquitin-Associated Domain of Human BMSC-UbP and its Complex with Ubiquitin
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Deposited on	:	2006-02-14

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 (1)) were used in the production of this report:

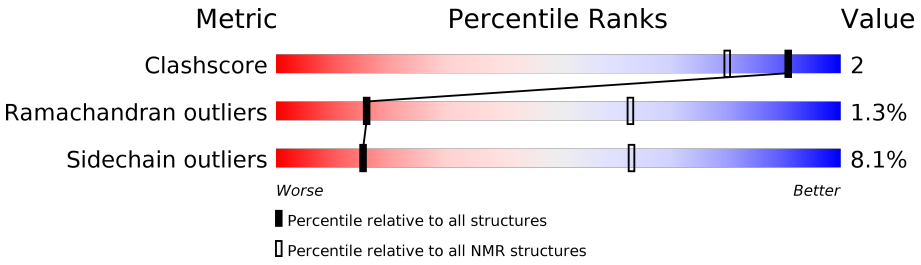
Cyrange	:	Kirchner and Güntert (2011)
NmrClust	:	Kelley et al. (1996)
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	2.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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	108	38% · · 57%
2	B	76	92% 8%

2 Ensemble composition and analysis

This entry contains 10 models. Model 10 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:64-A:108, B:1-B:76 (121)	0.63	10

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 2 clusters and 1 single-model cluster was found.

Cluster number	Models
1	1, 3, 4, 5, 9, 10
2	2, 7, 8
Single-model clusters	6

3 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 1912 atoms, of which 965 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Immunoglobulin G-binding protein G,Ubiquitin-like protein 7.

Mol	Chain	Residues	Atoms						Trace
1	A	46	Total	C	H	N	O	S	0
			680	213	335	61	70	1	

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	expression tag	UNP P06654
A	2	HIS	-	expression tag	UNP P06654
A	3	HIS	-	expression tag	UNP P06654
A	4	HIS	-	expression tag	UNP P06654
A	5	HIS	-	expression tag	UNP P06654
A	6	HIS	-	expression tag	UNP P06654
A	7	HIS	-	expression tag	UNP P06654
A	8	GLN	-	expression tag	UNP P06654
A	12	ALA	ILE	engineered mutation	UNP P06654
A	63	GLY	-	linker	UNP P06654

- Molecule 2 is a protein called Polyubiquitin-B.

Mol	Chain	Residues	Atoms						Trace
2	B	76	Total	C	H	N	O	S	0
			1232	378	630	105	118	1	

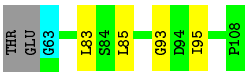
4 Residue-property plots

4.1 Average score per residue in the NMR ensemble

These plots are provided for all protein, RNA and DNA 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.

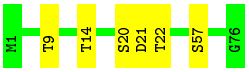
• Molecule 1: Immunoglobulin G-binding protein G,Ubiquitin-like protein 7

Chain A:



• Molecule 2: Polyubiquitin-B

Chain B:



4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

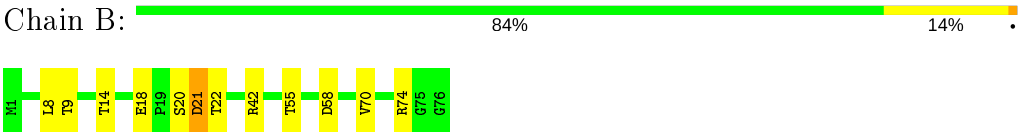
4.2.1 Score per residue for model 1

• Molecule 1: Immunoglobulin G-binding protein G,Ubiquitin-like protein 7

Chain A:

• Molecule 2: Polyubiquitin-B

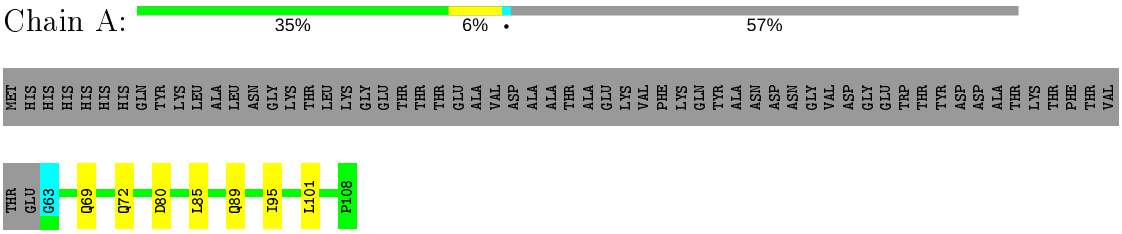
Chain B:



4.2.2 Score per residue for model 2

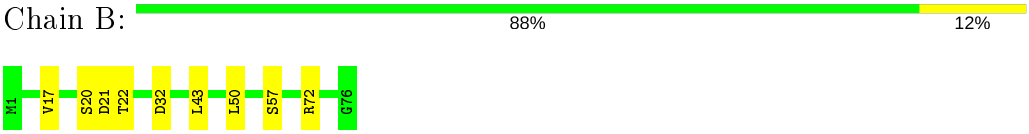
- Molecule 1: Immunoglobulin G-binding protein G,Ubiquitin-like protein 7

Chain A:



- Molecule 2: Polyubiquitin-B

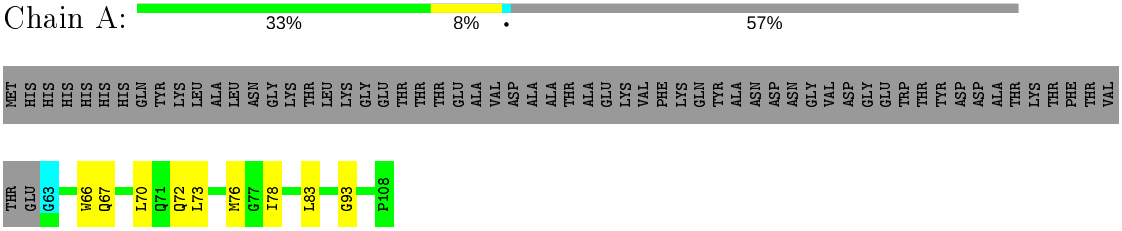
Chain B:



4.2.3 Score per residue for model 3

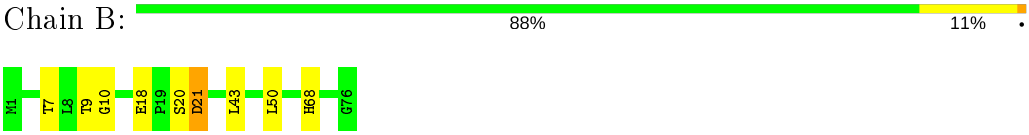
- Molecule 1: Immunoglobulin G-binding protein G,Ubiquitin-like protein 7

Chain A:



- Molecule 2: Polyubiquitin-B

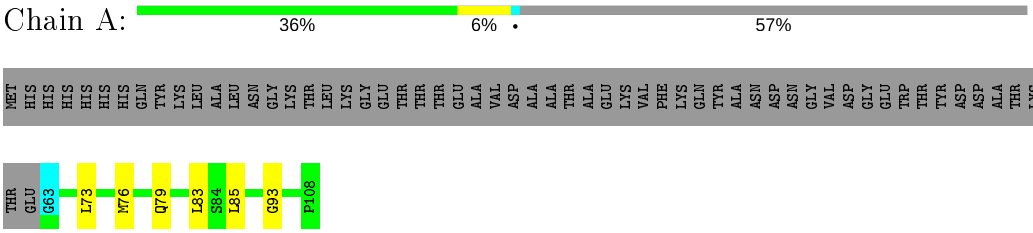
Chain B:



4.2.4 Score per residue for model 4

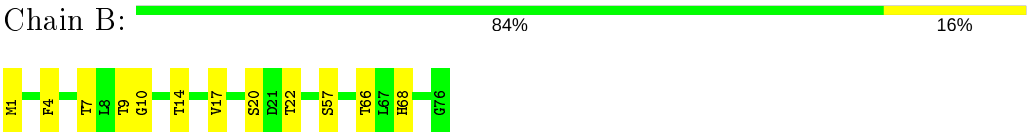
- Molecule 1: Immunoglobulin G-binding protein G,Ubiquitin-like protein 7

Chain A:



• Molecule 2: Polyubiquitin-B

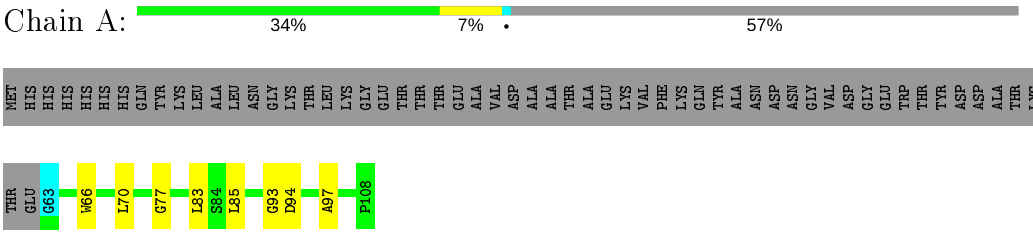
Chain B:



4.2.5 Score per residue for model 5

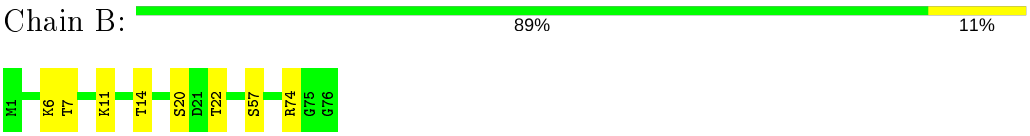
• Molecule 1: Immunoglobulin G-binding protein G,Ubiquitin-like protein 7

Chain A:



• Molecule 2: Polyubiquitin-B

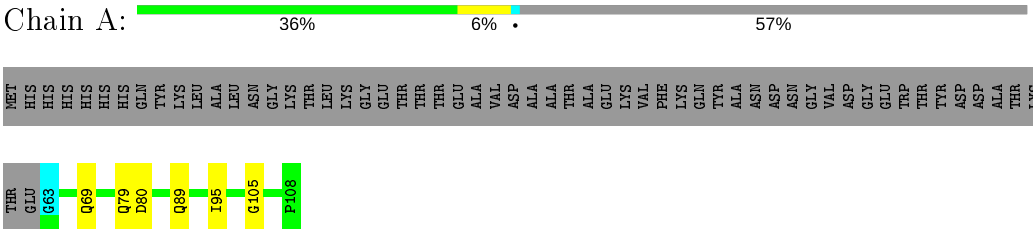
Chain B:



4.2.6 Score per residue for model 6

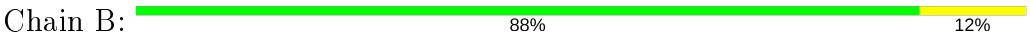
• Molecule 1: Immunoglobulin G-binding protein G,Ubiquitin-like protein 7

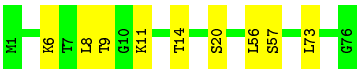
Chain A:



• Molecule 2: Polyubiquitin-B

Chain B:

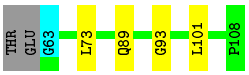




4.2.7 Score per residue for model 7

• Molecule 1: Immunoglobulin G-binding protein G,Ubiquitin-like protein 7

Chain A:



• Molecule 2: Polyubiquitin-B

Chain B:

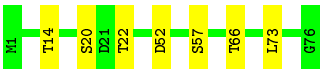
4.2.8 Score per residue for model 8

• Molecule 1: Immunoglobulin G-binding protein G,Ubiquitin-like protein 7

Chain A:

• Molecule 2: Polyubiquitin-B

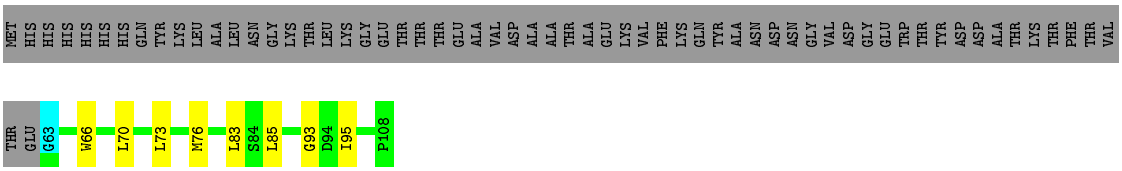
Chain B:



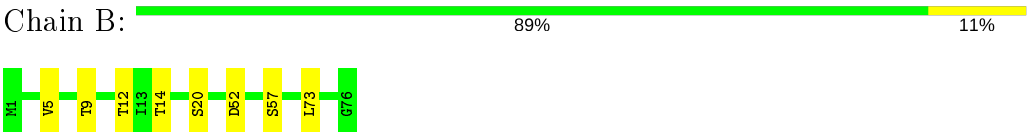
4.2.9 Score per residue for model 9

• Molecule 1: Immunoglobulin G-binding protein G,Ubiquitin-like protein 7

Chain A:

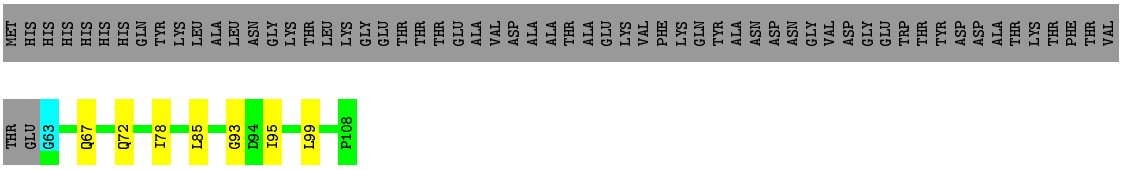


• Molecule 2: Polyubiquitin-B

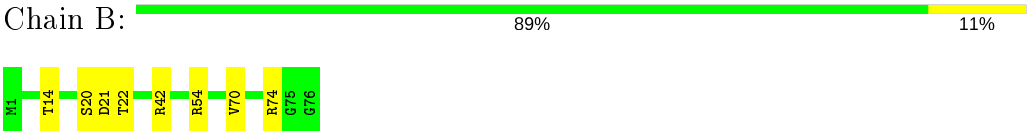


4.2.10 Score per residue for model 10 (medoid)

• Molecule 1: Immunoglobulin G-binding protein G,Ubiquitin-like protein 7



• Molecule 2: Polyubiquitin-B



5 Refinement protocol and experimental data overview

The models were refined using the following method: *molecular dynamics*.

Of the 200 calculated structures, 10 were deposited, based on the following criterion: *structures with the lowest energy*.

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

Software name	Classification	Version
HADDOCK	refinement	1.3
HADDOCK	structure solution	1.3

No chemical shift data was provided. No validations of the models with respect to experimental NMR restraints is performed at this time.

6 Model quality

6.1 Standard geometry

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

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	341	332	332	2±1
2	B	602	630	629	2±1
All	All	9430	9620	9610	31

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:66:TRP:O	1:A:70:LEU:HG	0.59	1.98	9	4
1:A:69:GLN:HB3	1:A:95:ILE:HD11	0.57	1.77	8	3
1:A:73:LEU:O	1:A:76:MET:HG2	0.53	2.04	4	1
1:A:95:ILE:O	1:A:99:LEU:HG	0.52	2.03	10	1
1:A:73:LEU:O	1:A:76:MET:HG3	0.52	2.04	9	1
2:B:6:LYS:HA	2:B:11:LYS:O	0.49	2.07	6	2
1:A:73:LEU:HB3	1:A:78:ILE:HD12	0.49	1.84	3	1
1:A:78:ILE:HA	2:B:42:ARG:NH2	0.48	2.23	1	2
2:B:42:ARG:NH2	2:B:70:VAL:HG21	0.46	2.25	10	1
1:A:94:ASP:HB3	1:A:97:ALA:HB3	0.45	1.88	5	1
1:A:102:ILE:O	2:B:73:LEU:HB2	0.44	2.12	8	1
1:A:105:GLY:HA3	2:B:73:LEU:O	0.44	2.12	6	1
2:B:18:GLU:O	2:B:21:ASP:HB2	0.43	2.13	3	2

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
2:B:6:LYS:O	2:B:68:HIS:HA	0.43	2.12	7	1
1:A:80:ASP:OD2	2:B:72:ARG:HD3	0.42	2.14	2	1
2:B:8:LEU:HD11	2:B:70:VAL:HG13	0.42	1.91	1	1
2:B:43:LEU:HB3	2:B:50:LEU:HD12	0.42	1.91	3	2
2:B:1:MET:HG2	2:B:17:VAL:O	0.42	2.14	4	1
2:B:4:PHE:O	2:B:66:THR:HA	0.42	2.14	4	1
2:B:5:VAL:O	2:B:12:THR:HA	0.41	2.15	9	1
2:B:55:THR:O	2:B:58:ASP:HB2	0.41	2.14	1	1
1:A:73:LEU:HD21	1:A:95:ILE:HG23	0.40	1.93	9	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	44/108 (41%)	41±1 (93±3%)	2±1 (5±2%)	1±1 (2±1%)	11	52
2	B	74/76 (97%)	71±2 (96±3%)	3±2 (4±2%)	1±1 (1±1%)	24	71
All	All	1180/1840 (64%)	1114 (94%)	51 (4%)	15 (1%)	16	63

All 5 unique Ramachandran outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	93	GLY	7
2	B	7	THR	3
2	B	10	GLY	2
1	A	77	GLY	2
2	B	46	ALA	1

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	34/85 (40%)	31±1 (92±3%)	3±1 (8±3%)	16	63
2	B	68/68 (100%)	62±1 (92±1%)	6±1 (8±1%)	15	62
All	All	1020/1530 (67%)	937 (92%)	83 (8%)	15	63

All 28 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)
2	B	20	SER	9
2	B	14	THR	7
2	B	57	SER	7
2	B	9	THR	6
2	B	22	THR	6
1	A	85	LEU	5
1	A	83	LEU	5
2	B	21	ASP	4
1	A	89	GLN	4
1	A	101	LEU	3
2	B	74	ARG	3
2	B	52	ASP	3
1	A	72	GLN	3
1	A	67	GLN	2
1	A	79	GLN	2
2	B	68	HIS	2
2	B	32	ASP	1
2	B	54	ARG	1
2	B	66	THR	1
2	B	64	GLU	1
2	B	56	LEU	1
1	A	76	MET	1
1	A	80	ASP	1
1	A	73	LEU	1
2	B	42	ARG	1
2	B	17	VAL	1
2	B	73	LEU	1
2	B	8	LEU	1

6.3.3 RNA

There are no RNA molecules in this entry.

6.4 Non-standard residues in protein, DNA, RNA chains

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

6.5 Carbohydrates

There are no carbohydrates in this entry.

6.6 Ligand geometry

There are no ligands in this entry.

6.7 Other polymers

There are no such molecules in this entry.

6.8 Polymer linkage issues

There are no chain breaks in this entry.

7 Chemical shift validation

No chemical shift data were provided