wwPDB NMR Structure Validation Summary Report (i)

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PDB ID	:	2LOB
Title	:	PDZ Domain of CAL (Cystic Fibrosis Transmembrane Regulator-Associated Ligand)
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This is a wwPDB NMR Structure Validation Summary Report for a publicly released PDB entry.
We welcome your comments at validation@mail.wwpdb.org
A user guide is available at
http://wwpdb.org/validation/2016/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:

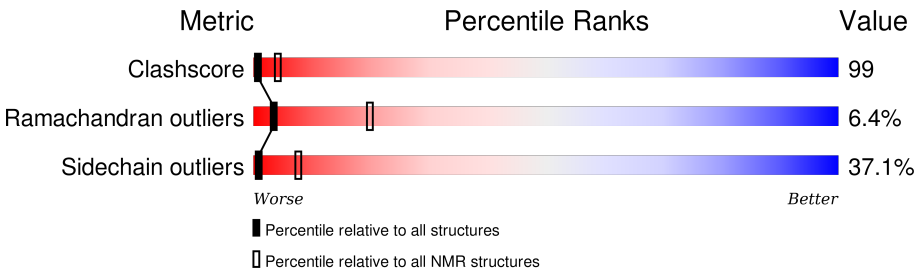
Cyrange	:	Kirchner and Güntert (2011)
NmrClust	:	Kelley et al. (1996)
MolProbity	:	4.02b-467
Mogul	:	unknown
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	rb-20027457
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	rb-20027457

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 is 27%.

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	114402	11133
Ramachandran outliers	111179	9975
Sidechain outliers	111093	9958

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	112	11% 49% 16% • 23%
2	B	8	25% 25% 50%

2 Ensemble composition and analysis (i)

This entry contains 7 models. Model 7 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:27-A:112, B:117-B:120 (90)	0.61	7

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 1 clusters. No single-model clusters were found.

Cluster number	Models
1	1, 2, 3, 4, 5, 6, 7

3 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 1458 atoms, of which 738 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Golgi-associated PDZ and coiled-coil motif-containing protein.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	86	1323	409	672	118	123	1	0

There are 27 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	HIS	-	EXPRESSION TAG	UNP Q9HD26
A	2	HIS	-	EXPRESSION TAG	UNP Q9HD26
A	3	HIS	-	EXPRESSION TAG	UNP Q9HD26
A	4	HIS	-	EXPRESSION TAG	UNP Q9HD26
A	5	HIS	-	EXPRESSION TAG	UNP Q9HD26
A	6	HIS	-	EXPRESSION TAG	UNP Q9HD26
A	7	HIS	-	EXPRESSION TAG	UNP Q9HD26
A	8	HIS	-	EXPRESSION TAG	UNP Q9HD26
A	9	HIS	-	EXPRESSION TAG	UNP Q9HD26
A	10	HIS	-	EXPRESSION TAG	UNP Q9HD26
A	11	SER	-	EXPRESSION TAG	UNP Q9HD26
A	12	SER	-	EXPRESSION TAG	UNP Q9HD26
A	13	GLY	-	EXPRESSION TAG	UNP Q9HD26
A	14	HIS	-	EXPRESSION TAG	UNP Q9HD26
A	15	ILE	-	EXPRESSION TAG	UNP Q9HD26
A	16	GLU	-	EXPRESSION TAG	UNP Q9HD26
A	17	GLY	-	EXPRESSION TAG	UNP Q9HD26
A	18	ARG	-	EXPRESSION TAG	UNP Q9HD26
A	19	HIS	-	EXPRESSION TAG	UNP Q9HD26
A	20	MET	-	EXPRESSION TAG	UNP Q9HD26
A	21	GLU	-	EXPRESSION TAG	UNP Q9HD26
A	22	ASN	-	EXPRESSION TAG	UNP Q9HD26
A	23	LEU	-	EXPRESSION TAG	UNP Q9HD26
A	24	TYR	-	EXPRESSION TAG	UNP Q9HD26
A	25	PHE	-	EXPRESSION TAG	UNP Q9HD26
A	26	GLN	-	EXPRESSION TAG	UNP Q9HD26
A	27	GLY	-	EXPRESSION TAG	UNP Q9HD26

- Molecule 2 is a protein called Cystic fibrosis transmembrane conductance regulator.

Mol	Chain	Residues	Atoms					Trace
			Total	C	H	N	O	
2	B	8	135	40	66	12	17	0

4 Residue-property plots (i)

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: Golgi-associated PDZ and coiled-coil motif-containing protein

Chain A: 11% 49% 16% • 23%

HIS HIS HIS HIS HIS HIS HIS HIS HIS SER SER GLY HIS ILE GLU GLY ARG HIS MET GLU ASN LEU TYR PHE GLN G27 I28 R29 K30 V31 L32 L33 L34 K35 E36 D37 H38 E39 G40 L41 G42 I43 S44 I45 T46 G47 G48 K49 E50 H51 G52 V53 P54 I55 L56 I57 S58 E59 I60

H61 Q64 P65 A66 D67 R68 C69 G70 G71 L72 H73 V74 G75 D76 A77 I78 L79 A80 V81 N82 G83 V84 N85 L86 R87 D88 T89 K90 H91 K92 E93 A94 V95 T96 I97 L98 Q101 R102 G103 E104 I105 E106 F107 E108 V109 V110 Y111 V112

- Molecule 2: Cystic fibrosis transmembrane conductance regulator

Chain B: 25% 25% 50%

E113 E114 V115 Q116 D117 T118 R119 L120

4.2 Residue scores for the representative (medoid) model from the NMR ensemble

The representative model is number 7. Colouring as in section 4.1 above.

- Molecule 1: Golgi-associated PDZ and coiled-coil motif-containing protein

Chain A: 21% 36% 19% • 23%

HIS HIS HIS HIS HIS HIS HIS HIS HIS SER SER GLY HIS ILE GLU GLY ARG HIS MET GLU ASN LEU TYR PHE GLN G27 I28 V31 L32 L33 L34 K35 E36 D37 H38 E39 G40 L41 G42 I43 S44 I45 T46 G47 G48 K49 E50 H51 G52 V53 P54 I55 L56 I57 S58 E59 I60 H61

Q64 P65 A66 C69 G70 G71 L72 H73 V74 G75 D76 A77 I78 L79 A80 V81 N82 G83 V84 N85 L86 R87 D88 T89 K90 H91 K92 E93 A94 V95 T96 I97 L98 Q101 I105 E106 F107 E108 V109 V110 Y111 V112

- Molecule 2: Cystic fibrosis transmembrane conductance regulator

Chain B: 38% 13% 50%

E113
E114
V115
Q116
D117
T118
R119
L120

5 Refinement protocol and experimental data overview (i)

The models were refined using the following method: *DGSA-distance geometry simulated annealing.*

Of the 100 calculated structures, 7 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
SPARKY	refinement	

The following table shows chemical shift validation statistics as aggregates over all chemical shift files. Detailed validation can be found in section 7 of this report.

Chemical shift file(s)	2lob_cs.str
Number of chemical shift lists	1
Total number of shifts	301
Number of shifts mapped to atoms	301
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	27%

No validations of the models with respect to experimental NMR restraints is performed at this time.

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	651	672	666	135±14
2	B	35	35	35	26±3
All	All	4802	4949	4907	958

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 99.

5 of 476 unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:64:GLN:O	1:A:66:ALA:N	1.15	1.80	4	7
1:A:92:LYS:NZ	2:B:118:THR:OG1	1.06	1.87	2	4
1:A:80:ALA:HB1	1:A:84:VAL:HA	1.05	1.14	1	2
1:A:79:LEU:HD21	1:A:110:VAL:HG23	1.04	1.27	4	1
1:A:61:HIS:NE2	2:B:119:ARG:NH2	1.03	2.06	7	2

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	84/112 (75%)	71±2 (84±3%)	8±2 (10±2%)	5±2 (6±3%)	4 21
2	B	3/8 (38%)	3±0 (86±16%)	0±0 (0±0%)	0±0 (14±16%)	1 5
All	All	609/840 (72%)	512 (84%)	58 (10%)	39 (6%)	3 20

5 of 10 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	65	PRO	7
1	A	89	THR	6
1	A	39	GLU	5
1	A	40	GLY	4
1	A	37	ASP	4

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	70/94 (74%)	44±3 (63±4%)	26±3 (37±4%)	1 8
2	B	4/8 (50%)	2±0 (61±12%)	2±0 (39±12%)	1 6
All	All	518/714 (73%)	326 (63%)	192 (37%)	1 8

5 of 51 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	31	VAL	7
1	A	89	THR	7
1	A	106	GLU	7
1	A	78	ILE	7
2	B	119	ARG	7

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 carbohydrates 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)

The completeness of assignment taking into account all chemical shift lists is 27% for the well-defined parts and 26% for the entire structure.

7.1 Chemical shift list 1

File name: 2lob_cs.str

Chemical shift list name: *assigned_chem_shift_list_1*

7.1.1 Bookkeeping (i)

The following table shows the results of parsing the chemical shift list and reports the number of nuclei with statistically unusual chemical shifts.

Total number of shifts	301
Number of shifts mapped to atoms	301
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	0

7.1.2 Chemical shift referencing (i)

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction ± precision, *ppm*	Suggested action
$^{13}C_{\alpha}$	87	2.08 ± 0.19	Should be applied
$^{13}C_{\beta}$	69	2.11 ± 0.16	Should be applied
$^{13}C'$	0	—	—
^{15}N	77	0.18 ± 0.30	None needed (< 0.5 ppm)

7.1.3 Completeness of resonance assignments (i)

The following table shows the completeness of the chemical shift assignments for the well-defined regions of the structure. The overall completeness is 27%, i.e. 298 atoms were assigned a chemical shift out of a possible 1085. 4 out of 19 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	160/444 (36%)	0/177 (0%)	84/180 (47%)	76/87 (87%)
Sidechain	138/584 (24%)	0/337 (0%)	136/222 (61%)	2/25 (8%)

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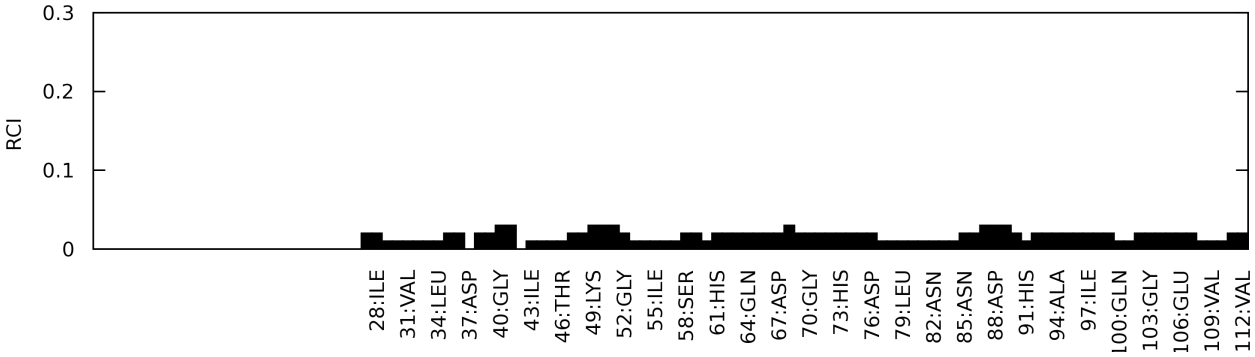
	Total	^{1}H	^{13}C	^{15}N
Aromatic	0/57 (0%)	0/29 (0%)	0/18 (0%)	0/10 (0%)
Overall	298/1085 (27%)	0/543 (0%)	220/420 (52%)	78/122 (64%)

7.1.4 Statistically unusual chemical shifts (i)

There are no statistically unusual chemical shifts.

7.1.5 Random Coil Index (RCI) plots (i)

The image below reports *random coil index* values for the protein chains in the structure. The height of each bar gives a probability of a given residue to be disordered, as predicted from the available chemical shifts and the amino acid sequence. A value above 0.2 is an indication of significant predicted disorder. The colour of the bar shows whether the residue is in the well-defined core (black) or in the ill-defined residue ranges (cyan), as described in section 2 on ensemble composition.

Random coil index (RCI) for chain A: