wwPDB NMR Structure Validation Summary Report (i)

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PDB ID	:	2LBH
BMRB ID	:	17561
Title	:	Solution Structure of the Dimeric Form of a Unliganded Bovine Neurophysin, Minimized Average Structure
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Deposited on	:	2011-03-31

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
https://www.wwpdb.org/validation/2017/NMRValidationReportHelp
with specific help available everywhere you see the (i) 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 (i)) were used in the production of this report:

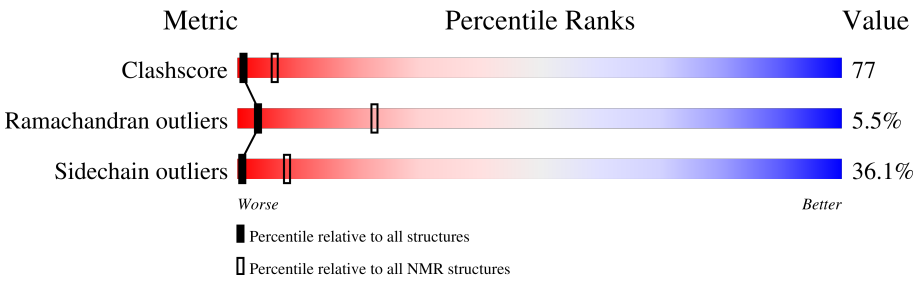
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
wwPDB-RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
wwPDB-ShiftChecker	:	v1.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

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 44%.

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	92	13% 52% 10% 25%
1	B	92	13% 52% 10% 25%

2 Ensemble composition and analysis (i)

This entry contains 21 models. Model 1 is the overall representative, medoid model (most similar to other models).

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:10-A:47, A:56-A:86, B:110-B:147, B:156-B:186 (138)	1.37	1

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 4 single-model clusters were found.

Cluster number	Models
1	1, 5, 8, 9, 11, 12, 16, 17, 18, 19, 21
2	14, 15
3	6, 20
4	3, 13
Single-model clusters	2; 4; 7; 10

3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 2434 atoms, of which 1158 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Neurophysin 1.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	92	1217	382	579	112	130	14	0
1	B	92	1217	382	579	112	130	14	0

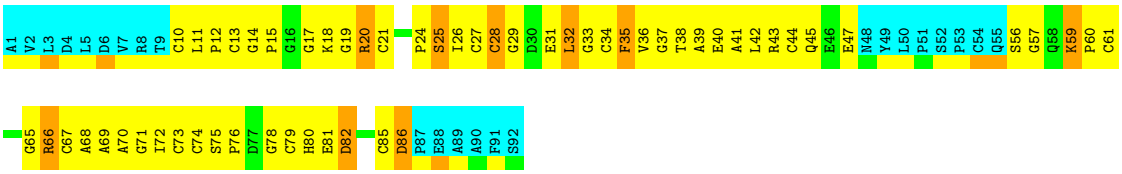
4 Residue-property plots (i)

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.

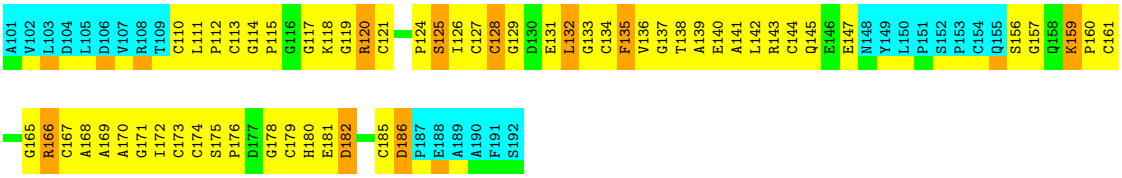
- Molecule 1: Neurophysin 1

Chain A: 13% 52% 10% 25%



- Molecule 1: Neurophysin 1

Chain B: 13% 52% 10% 25%



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

The representative model is number 1. Colouring as in section 4.1 above.

- Molecule 1: Neurophysin 1

Chain A: 32% 32% 12% 25%

• Molecule 1: Neurophysin 1

Chain B: 33% 30% 12% 25%

A101 V102 L103 D104 L105 D106 V107 R108 T109 C110 L111 P112 G117 K118 G119 R120 S125 I126 C127 C128 G129 D130 E131 L132 G133 C134 F135 V136 G137 T138 A139 L142 E147 N148 Y149 L150 P151 S152 P153 C154 Q155 S156 G157 Q158 K159 P160 C161 G165 R166 C167 A168 A169 A170 G171 I172

C173 C174 S175 P176 D177 G178 C179 H180 E181 D182 C185 D186 P187 E188 A189 A190 F191 S192

5 Refinement protocol and experimental data overview (i)

The models were refined using the following method: *simulated annealing*.

Of the 100 calculated structures, 21 were deposited, based on the following criterion: *structures with the least restraint violations*.

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

Software name	Classification	Version
CNSSOLVE	refinement	1.0

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)	working_cs.cif
Number of chemical shift lists	1
Total number of shifts	862
Number of shifts mapped to atoms	862
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	44%

6 Model quality (i)

6.1 Standard geometry (i)

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

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	0.0±0.0	0.0±0.2
1	B	0.0±0.0	0.1±0.3
All	All	0	3

There are no bond-length outliers.

There are no bond-angle outliers.

There are no chirality outliers.

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

Mol	Chain	Res	Type	Group	Models (Total)
1	B	112	PRO	Mainchain	1
1	A	71	GLY	Mainchain	1
1	B	115	PRO	Mainchain	1

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	462	410	409	75±13
1	B	462	410	409	75±12
All	All	19404	17220	17178	2825

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 77.

5 of 1099 unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:59:LYS:O	1:A:66:ARG:HA	1.34	1.18	13	6
1:B:159:LYS:O	1:B:166:ARG:HA	1.26	1.14	13	7
1:B:174:CYS:CB	1:B:179:CYS:HA	1.20	1.66	10	4
1:A:74:CYS:CB	1:A:79:CYS:HA	1.20	1.66	10	4
1:B:128:CYS:HA	1:B:133:GLY:O	1.17	1.39	8	20

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	69/92 (75%)	50±3 (73±4%)	15±2 (21±4%)	4±2 (6±2%)	3	22
1	B	69/92 (75%)	50±3 (72±4%)	16±2 (23±3%)	4±2 (5±2%)	3	23
All	All	2898/3864 (75%)	2101 (72%)	637 (22%)	160 (6%)	3	23

5 of 40 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	24	PRO	17
1	B	124	PRO	17
1	A	56	SER	11
1	B	156	SER	11
1	A	57	GLY	7

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	49/69 (71%)	31±3 (64±5%)	18±3 (36±5%)	1	8
1	B	49/69 (71%)	31±3 (64±6%)	18±3 (36±6%)	1	8

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	2058/2898 (71%)	1315 (64%)	743 (36%)	1 8

5 of 81 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	66	ARG	21
1	B	166	ARG	21
1	A	18	LYS	20
1	B	118	LYS	20
1	A	31	GLU	18

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)

The completeness of assignment taking into account all chemical shift lists is 44% for the well-defined parts and 41% for the entire structure.

7.1 Chemical shift list 1

File name: working_cs.cif

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	862
Number of shifts mapped to atoms	862
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	2

7.1.2 Chemical shift referencing (i)

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction ± precision, *ppm*	Suggested action
$^{13}C_{\alpha}$	86	0.46 ± 0.15	None needed (< 0.5 ppm)
$^{13}C_{\beta}$	0	—	None (insufficient data)
$^{13}C'$	0	—	None (insufficient data)
^{15}N	154	0.58 ± 0.54	None needed (imprecise)

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 44%, i.e. 658 atoms were assigned a chemical shift out of a possible 1490. 0 out of 8 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	452/694 (65%)	264/292 (90%)	70/276 (25%)	118/126 (94%)
Sidechain	204/740 (28%)	204/478 (43%)	0/236 (0%)	0/26 (0%)

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	Total	^{1}H	^{13}C	^{15}N
Aromatic	2/56 (4%)	2/28 (7%)	0/24 (0%)	0/4 (0%)
Overall	658/1490 (44%)	470/798 (59%)	70/536 (13%)	118/156 (76%)

7.1.4 Statistically unusual chemical shifts (i)

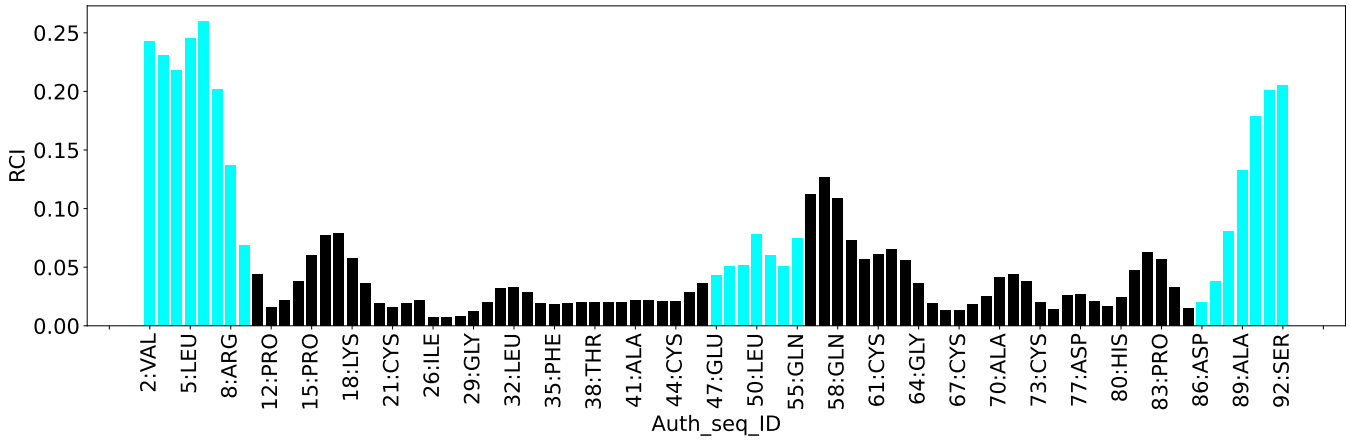
The following table lists the statistically unusual chemical shifts. These are statistical measures, and large deviations from the mean do not necessarily imply incorrect assignments. Molecules containing paramagnetic centres or hemes are expected to give rise to anomalous chemical shifts.

List Id	Chain	Res	Type	Atom	Shift, *ppm*	Expected range, *ppm*	Z-score
1	A	38	THR	HG1	4.99	0.08 – 2.19	18.2
1	B	138	THR	HG1	4.99	0.08 – 2.19	18.2

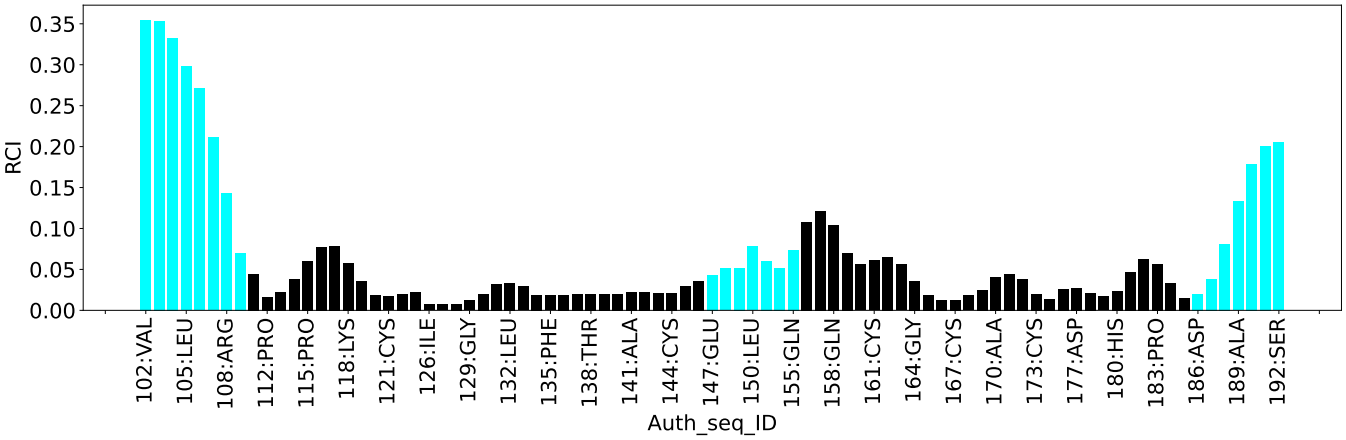
7.1.5 Random Coil Index (RCI) plots (i)

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.If well-defined core and ill-defined regions are not identified then it is shown as gray bars.

Random coil index (RCI) for chain A:



Random coil index (RCI) for chain B:


RCI
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
102:VAL
105:LEU
108:ARG
112:PRO
115:PRO
118:LYS
121:CYS
126:ILE
129:GLY
132:LEU
135:PHE
138:THR
141:ALA
144:CYS
147:GLU
150:LEU
155:GLN
158:GLN
161:CYS
164:GLY
167:CYS
170:ALA
173:CYS
177:ASP
180:HIS
183:PRO
186:ASP
189:ALA
192:SER
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