wwPDB NMR Structure Validation Summary Report (i)

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PDB ID	:	4BXU
BMRB ID	:	19368
Title	:	Structure of Pex14 in complex with Pex5 LVxEF motif
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Deposited on	:	2013-07-15

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:

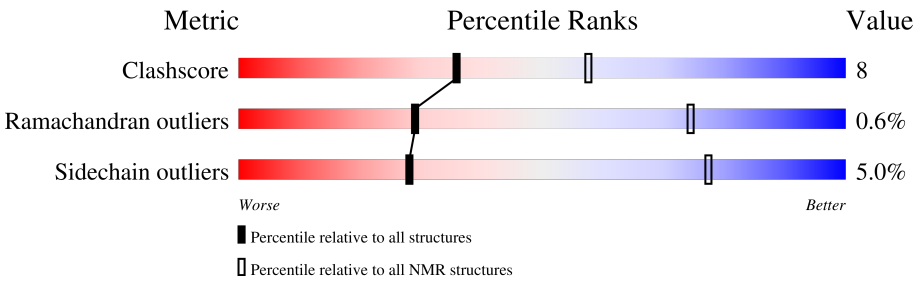
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
wwPDB-RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
wwPDB-ShiftChecker	:	v1.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36.2

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 75%.

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	69	55% 13% 32%
2	B	15	100%

2 Ensemble composition and analysis (i)

This entry contains 10 models. Model 9 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:25-A:71 (47)	0.11	9

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. No single-model clusters were found.

Cluster number	Models
1	1, 2, 4, 5, 7, 9
2	3, 6, 8, 10

3 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 1276 atoms, of which 636 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called PEROXISOMAL MEMBRANE PROTEIN PEX14.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	69	1054	323	533	94	102	2	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	12	GLY	-	expression tag	UNP O75381
A	13	ALA	-	expression tag	UNP O75381
A	14	MET	-	expression tag	UNP O75381
A	15	ALA	-	expression tag	UNP O75381

- Molecule 2 is a protein called PEROXISOMAL TARGETING SIGNAL 1 RECEPTOR.

Mol	Chain	Residues	Atoms					Trace
			Total	C	H	N	O	
2	B	15	222	72	103	18	29	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: PEROXISOMAL MEMBRANE PROTEIN PEX14

Chain A: 55% 13% 32%

G12 A13 M14 A15 T16 P17 G18 S19 E20 N21 V22 L23 P24 R25 E26 P27 L28 T29 R40 V41 S44 F52 K55 K56 T72 A73 A74 D75 E76 P77 S78 S79 L80

• Molecule 2: PEROXISOMAL TARGETING SIGNAL 1 RECEPTOR

Chain B: 100%

A57 S58 E59 D60 E61 L62 V63 A64 E65 F66 L67 Q68 D69 Q70 N71

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

The representative model is number 9. Colouring as in section 4.1 above.

• Molecule 1: PEROXISOMAL MEMBRANE PROTEIN PEX14

Chain A: 51% 16% • 32%

G12 A13 M14 A15 T16 P17 G18 S19 E20 N21 V22 L23 P24 R25 E26 P27 T31 L36 R40 V41 R42 Q43 S44 P45 L46 A51 F52 L53 K54 K55 T72 A73 A74 D75 E76 P77 S78 S79 L80

• Molecule 2: PEROXISOMAL TARGETING SIGNAL 1 RECEPTOR

Chain B: 100%

A57 S58 E59 D60 E61 L62 V63 A64 E65 F66 L67 Q68 D69 Q70 N71

5 Refinement protocol and experimental data overview (i)

Of the ? calculated structures, 10 were deposited, based on the following criterion: *?*.

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

Software name	Classification	Version
ARIA1.2/CNS	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)	working_cs.cif
Number of chemical shift lists	2
Total number of shifts	799
Number of shifts mapped to atoms	798
Number of unparsed shifts	0
Number of shifts with mapping errors	1
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	75%

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	375	393	393	6±3
2	B	0	0	0	0±0
All	All	3750	3930	3930	65

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 8.

5 of 47 unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:26:GLU:HG2	1:A:27:PRO:HD3	0.96	1.34	8	1
1:A:26:GLU:HG3	1:A:27:PRO:HD3	0.74	1.58	5	1
1:A:50:ARG:HD3	1:A:63:ILE:HG21	0.72	1.59	2	1
1:A:34:LYS:HA	1:A:34:LYS:HE3	0.70	1.62	3	2
1:A:36:LEU:HD21	1:A:53:LEU:HD11	0.69	1.64	6	3

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	47/69 (68%)	46±1 (98±1%)	0±0 (1±1%)	0±0 (1±1%)	29 74
2	B	0	-	-	-	-
All	All	470/840 (56%)	462 (98%)	5 (1%)	3 (1%)	29 74

All 1 unique Ramachandran outliers are listed below.

Mol	Chain	Res	Type	Models (Total)
1	A	71	GLY	3

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	40/56 (71%)	38±1 (95±3%)	2±1 (5±3%)	28 77
2	B	0	-	-	-
All	All	400/690 (58%)	380 (95%)	20 (5%)	28 77

5 of 13 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	52	PHE	4
1	A	40	ARG	2
1	A	64	ASP	2
1	A	34	LYS	2
1	A	55	LYS	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)

The completeness of assignment taking into account all chemical shift lists is 75% for the well-defined parts and 71% for the entire structure.

7.1 Chemical shift list 1

File name: working_cs.cif

Chemical shift list name: *pex5_4.str.csh*

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	101
Number of shifts mapped to atoms	100
Number of unparsed shifts	0
Number of shifts with mapping errors	1
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	0

The following assigned chemical shifts were not mapped to the molecules present in the coordinate file.

- No matching atom found in the structure. All 1 occurrences are reported below.

List ID	Chain	Res	Type	Atom	Shift Data		
					Value	Uncertainty	Ambiguity
1	B	57	ALA	H	8.663	.	.

7.1.2 Chemical shift referencing (i)

No chemical shift referencing corrections were calculated (not enough data).

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 3%, i.e. 18 atoms were assigned a chemical shift out of a possible 676. 0 out of 7 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	6/233 (3%)	6/94 (6%)	0/94 (0%)	0/45 (0%)
Sidechain	12/413 (3%)	12/266 (5%)	0/123 (0%)	0/24 (0%)
Aromatic	0/30 (0%)	0/15 (0%)	0/15 (0%)	0/0 (—%)
Overall	18/676 (3%)	18/375 (5%)	0/232 (0%)	0/69 (0%)

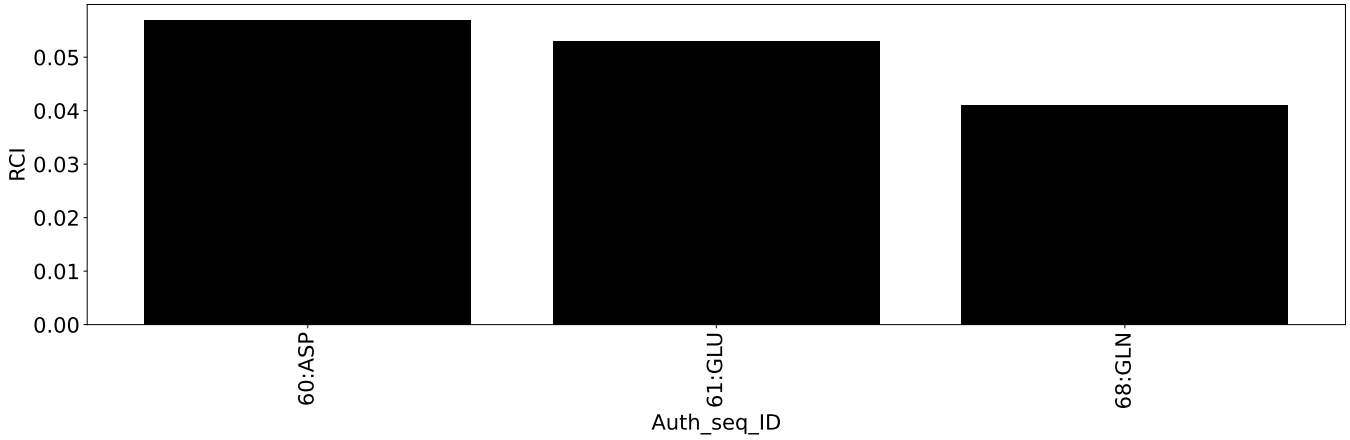
7.1.4 Statistically unusual chemical shifts (i)

There are no statistically unusual chemical shifts.

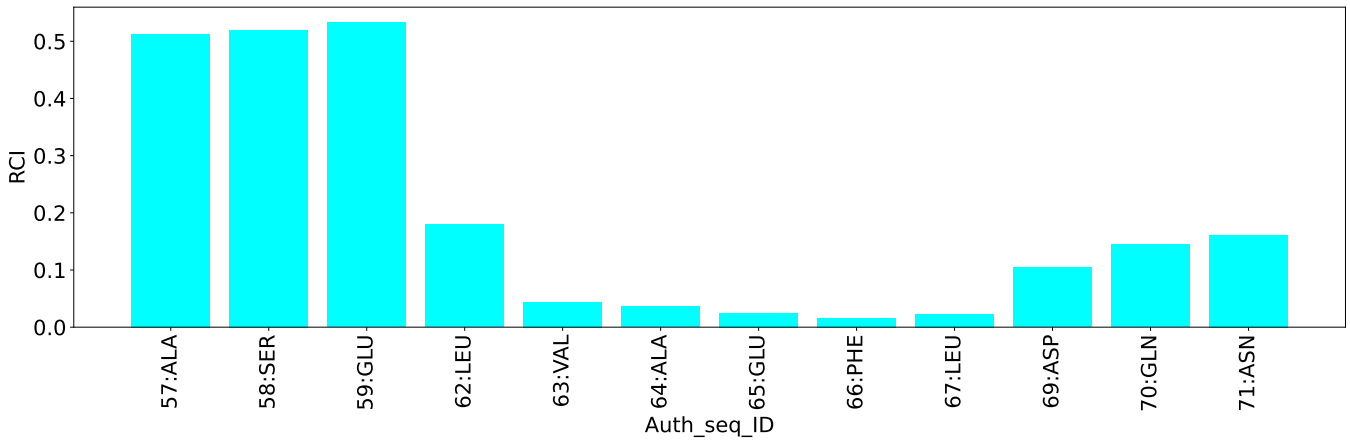
7.1.5 Random Coil Index (RCI) plots (i)

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.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:



7.2 Chemical shift list 2

File name: working_cs.cif

Chemical shift list name: *pex14_new_2.str.csh*

7.2.1 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	698
Number of shifts mapped to atoms	698
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

7.2.2 Chemical shift referencing (i)

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction ± precision, *ppm*	Suggested action
$^{13}C_{\alpha}$	69	-0.44 ± 0.11	None needed (< 0.5 ppm)
$^{13}C_{\beta}$	64	0.18 ± 0.11	None needed (< 0.5 ppm)
$^{13}C'$	0	—	None (insufficient data)
^{15}N	62	0.01 ± 0.20	None needed (< 0.5 ppm)

7.2.3 Completeness of resonance assignments (i)

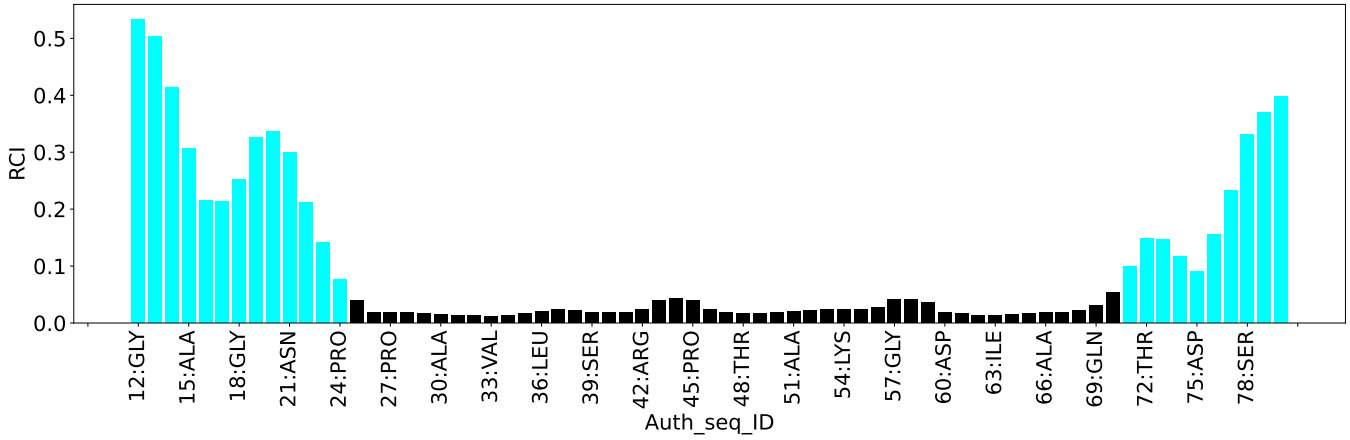
The following table shows the completeness of the chemical shift assignments for the well-defined regions of the structure. The overall completeness is 75%, i.e. 505 atoms were assigned a chemical shift out of a possible 676. 0 out of 7 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	184/233 (79%)	92/94 (98%)	47/94 (50%)	45/45 (100%)
Sidechain	321/413 (78%)	217/266 (82%)	104/123 (85%)	0/24 (0%)
Aromatic	0/30 (0%)	0/15 (0%)	0/15 (0%)	0/0 (—%)
Overall	505/676 (75%)	309/375 (82%)	151/232 (65%)	45/69 (65%)

7.2.4 Statistically unusual chemical shifts (i)

There are no statistically unusual chemical shifts.

7.2.5 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: