



wwPDB NMR Structure Validation Summary Report ⓘ

Mar 5, 2026 – 10:22 PM UTC

PDB ID : 2KB1 / pdb_00002kb1
Title : NMR studies of a channel protein without membrane: structure and dynamics of water-solubilized KcsA
Authors : Ma, D.; Xu, Y.; Tillman, T.; Tang, P.; Meirovitch, E.; Eckenhoff, R.; Carnini, A.
Deposited on : 2008-11-19

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 ⓘ 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 ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
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)	:	2.49

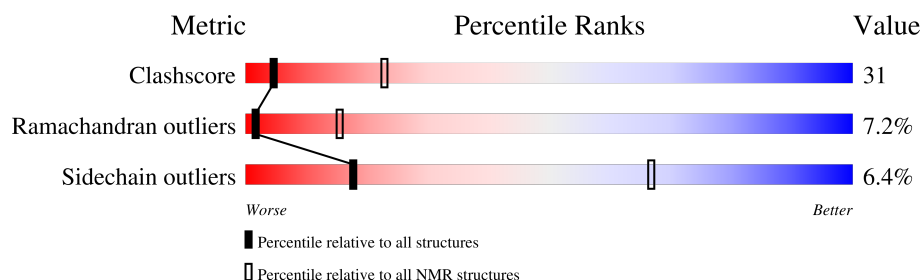
1 Overall quality at a glance

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	229148	14424
Ramachandran outliers	224038	12848
Sidechain outliers	223484	12823

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 $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	103	
1	B	103	
1	C	103	
1	D	103	

2 Ensemble composition and analysis

This entry contains 20 models. Model 13 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:2-A:97, B:3-B:97, C:3-C:97, D:2-D:97 (382)	1.01	13

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 9 single-model clusters were found.

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

3 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 6344 atoms, of which 3132 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called WSK3.

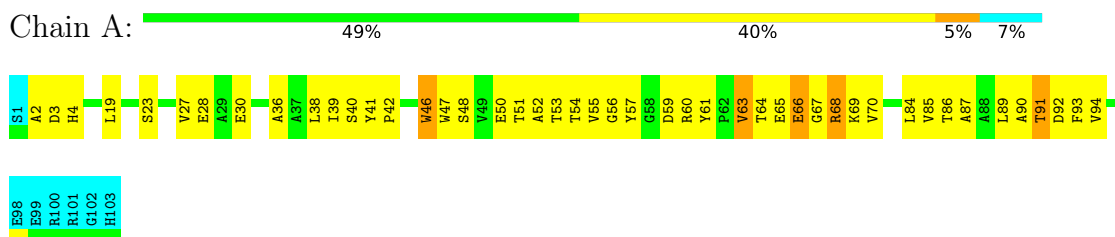
Mol	Chain	Residues	Atoms						Trace
1	A	103	Total	C	H	N	O	S	0
			1586	498	783	142	162	1	
1	B	103	Total	C	H	N	O	S	0
			1586	498	783	142	162	1	
1	C	103	Total	C	H	N	O	S	0
			1586	498	783	142	162	1	
1	D	103	Total	C	H	N	O	S	0
			1586	498	783	142	162	1	

4 Residue-property plots [i](#)

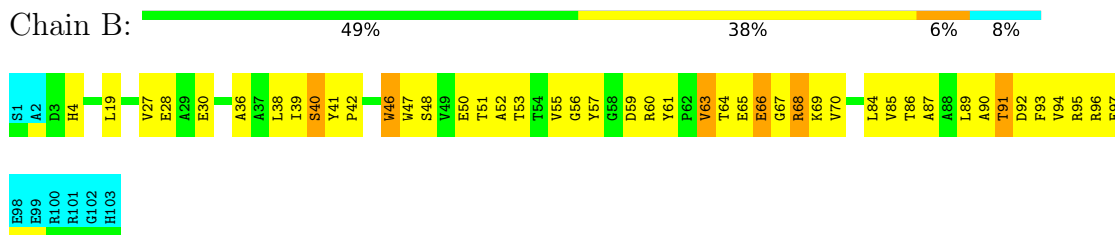
4.1 Average score per residue in the NMR ensemble

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.

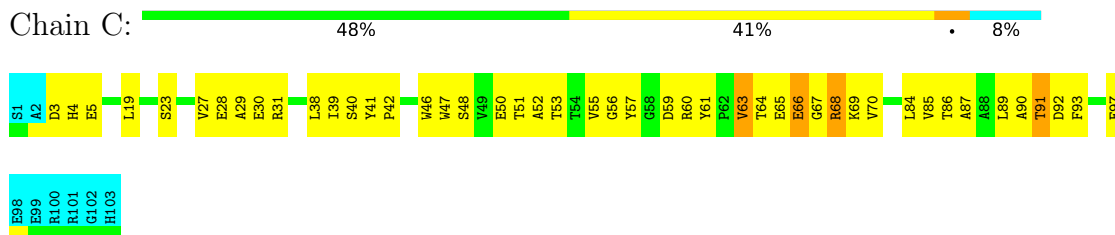
• Molecule 1: WSK3



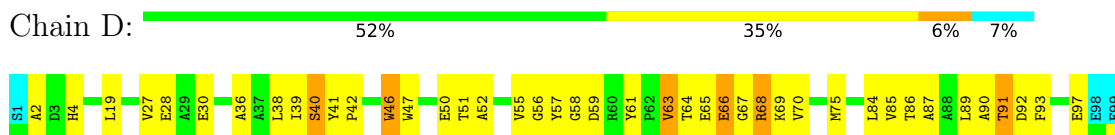
• Molecule 1: WSK3



• Molecule 1: WSK3



• Molecule 1: WSK3



R100
R101
G102
H103

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

The representative model is number 13. Colouring as in section 4.1 above.

- Molecule 1: WSK3

Chain A: 

S1 A2 D3 H4 E5 E13 K17 V18 L19 V27 E28 A29 E30 A36 A37 L38 I39 S40 A44 I45 W46 W47 S48 V49 E50 T51 A52 G56 G57 G58 D59 R60 V63 T64 E65 E66 G67 R68 K69 V70 L84 V85 T86 A87 A90 T91 D92 F93 V94 R95

E98 E99 R100 R101 G102 H103

- Molecule 1: WSK3

Chain B: 

S1 A2 H4 L19 V27 E28 A29 E30 P34 G35 A36 A37 L38 I39 S40 A44 I45 W46 W47 A52 V55 G56 G57 Y57 R60 V63 T64 E65 E66 G67 R68 K69 V70 I79 F80 V81 F82 A83 L84 V85 T86 A87 A88 L89 A90 T91 D92 F93 V94 R95 R96

E97 E98 E99 R100 R101 G102 H103

- Molecule 1: WSK3

Chain C: 

S1 A2 H4 L19 V27 E28 A36 L39 S40 Y41 P42 D43 W46 W47 S48 T51 A52 G56 G57 G58 Y57 Y61 P62 V63 T64 E65 E66 G67 R68 K69 V70 K76 E80 L84 V85 T86 A87 T91 D92 F93 V94 R95 E98 E99 R100 R101 G102

H103

- Molecule 1: WSK3

Chain D: 

S1 A2 D3 H4 Q9 E13 E14 L19 A26 V27 E28 A29 E30 L38 I39 Y41 P42 D43 W46 W47 S48 V49 E50 T51 A52 V55 G56 G57 Y57 G58 D59 R60 Y61 P62 V63 T64 E65 E66 G67 R68 K69 V70 A71 K75 A83 L84 V85 T86 A90 T91

D92 F93 R96 E97 E98 E99 R100 R101 G102 H103

5 Refinement protocol and experimental data overview

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

Of the 100 calculated structures, 20 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
CYANA	structure solution	2.1
X-PLOR NIH	structure solution	2.15.0
X-PLOR NIH	refinement	2.15.0

No chemical shift data was provided.

6 Model quality

6.1 Standard geometry

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the (average) root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#Z>5	RMSZ	#Z>5
1	A	0.66±0.01	0±0/755 (0.0± 0.0%)	0.91±0.01	0±0/1024 (0.0± 0.0%)
1	B	0.66±0.01	0±0/750 (0.0± 0.0%)	0.92±0.01	0±0/1017 (0.0± 0.0%)
1	C	0.66±0.01	0±0/750 (0.0± 0.0%)	0.91±0.01	0±0/1017 (0.0± 0.0%)
1	D	0.66±0.01	0±0/755 (0.0± 0.0%)	0.92±0.01	0±0/1024 (0.0± 0.0%)
All	All	0.66	0/60200 (0.0%)	0.92	5/81640 (0.0%)

There are no bond-length outliers.

All unique angle outliers are listed below. They are sorted according to the Z-score of the worst occurrence in the ensemble.

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	B	40	SER	CB-CA-C	-5.94	109.74	116.63	14	1
1	A	54	THR	CB-CA-C	-5.73	109.98	116.63	6	2
1	C	40	SER	CB-CA-C	-5.49	110.23	116.54	10	1
1	C	66	GLU	O-C-N	5.12	124.62	120.83	16	1

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	742	727	726	51±9
1	B	737	722	721	52±7
1	C	737	722	721	49±8

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes
1	D	742	727	726	47±8
All	All	59160	57960	57880	3593

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 31.

5 of 1502 unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:B:66:GLU:O	1:B:68:ARG:N	0.91	2.04	8	3
1:D:66:GLU:O	1:D:68:ARG:N	0.89	2.04	11	3
1:C:66:GLU:O	1:C:68:ARG:N	0.89	2.06	4	7
1:A:66:GLU:O	1:A:68:ARG:N	0.88	2.05	11	4
1:C:63:VAL:HG22	1:C:64:THR:H	0.86	1.30	17	4

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	96/103 (93%)	78±4 (81±4%)	11±3 (11±3%)	7±2 (8±2%)	1	14
1	B	95/103 (92%)	76±2 (80±2%)	12±2 (12±3%)	7±2 (7±2%)	1	15
1	C	95/103 (92%)	78±3 (82±4%)	11±3 (11±3%)	6±3 (7±3%)	2	17
1	D	96/103 (93%)	80±2 (84±2%)	9±2 (9±2%)	7±1 (7±1%)	2	16
All	All	7640/8240 (93%)	6244 (82%)	847 (11%)	549 (7%)	2	15

5 of 121 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	63	VAL	18
1	B	63	VAL	17
1	B	68	ARG	17
1	D	63	VAL	17
1	D	68	ARG	17

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	73/79 (92%)	68±1 (94±2%)	5±1 (6±2%)	18	68
1	B	73/79 (92%)	68±1 (94±2%)	5±1 (6±2%)	18	67
1	C	73/79 (92%)	68±1 (94±2%)	5±1 (6±2%)	18	67
1	D	73/79 (92%)	68±1 (93±2%)	5±1 (7±2%)	17	66
All	All	5840/6320 (92%)	5466 (94%)	374 (6%)	18	67

5 of 96 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	91	THR	19
1	B	91	THR	19
1	C	91	THR	19
1	D	91	THR	19
1	A	46	TRP	16

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 oligosaccharides 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

No chemical shift data were provided