Full wwPDB NMR Structure Validation Report (i)

Mar 6, 2022 – 08:49 AM EST

PDB ID	:	2KKF
Title	:	Solution structure of MLL CXXC domain in complex with palindromic CPG DNA
Authors	:	Cierpicki, T.; Riesbeck, J.E.; Grembecka, J.E.; Lukasik, S.M.; Popovic, R.; Omonkowska, M.; Shultis, D.S.; Zeleznik-Le, N.J.; Bushweller, J.H.
Deposited on	:	2009-06-18

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

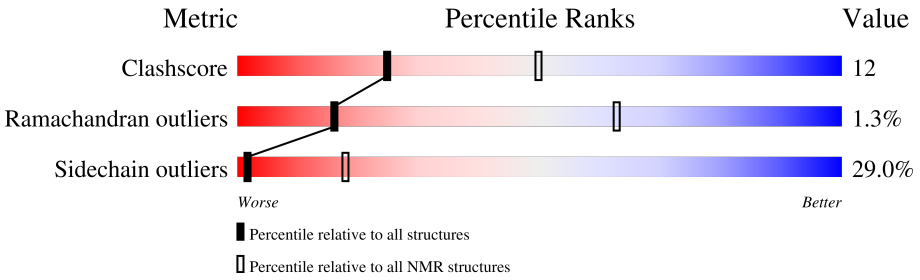
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	2.27
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.27

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	59	41% 34% . 20% .
2	B	12	58% 42%
2	C	12	50% 50%

2 Ensemble composition and analysis (i)

This entry contains 10 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:1153-A:1197 (45)	0.17	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. No single-model clusters were found.

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

3 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 1658 atoms, of which 724 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Histone-lysine N-methyltransferase HRX.

Mol	Chain	Residues	Atoms						Trace
1	A	57	Total	C	H	N	O	S	0
			901	267	455	93	75	11	

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1145	GLY	-	expression tag	UNP Q03164
A	1146	SER	-	expression tag	UNP Q03164

- Molecule 2 is a DNA chain called 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'.

Mol	Chain	Residues	Atoms						Trace
2	B	12	Total	C	H	N	O	P	0
			378	115	135	47	70	11	
2	C	12	Total	C	H	N	O	P	0
			377	115	134	47	70	11	

- Molecule 3 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms	
3	A	2	Total	Zn
			2	2

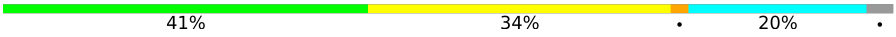
4 Residue-property plots

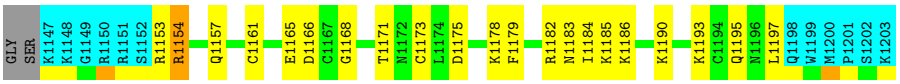
4.1 Average score per residue in the NMR ensemble

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: Histone-lysine N-methyltransferase HRX

Chain A:





• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain B:

• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain C:

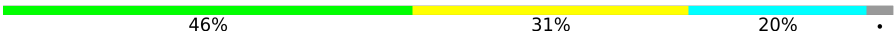
4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1 (medoid)

• Molecule 1: Histone-lysine N-methyltransferase HRX

Chain A:



• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain B:

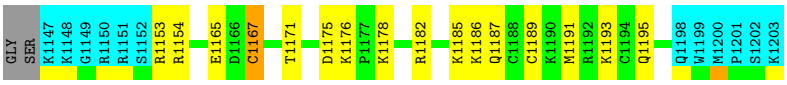
• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain C:

4.2.2 Score per residue for model 2

• Molecule 1: Histone-lysine N-methyltransferase HRX

Chain A:



• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain B:

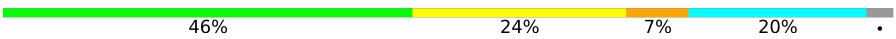
• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain C:

4.2.3 Score per residue for model 3

• Molecule 1: Histone-lysine N-methyltransferase HRX

Chain A:



• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain B:

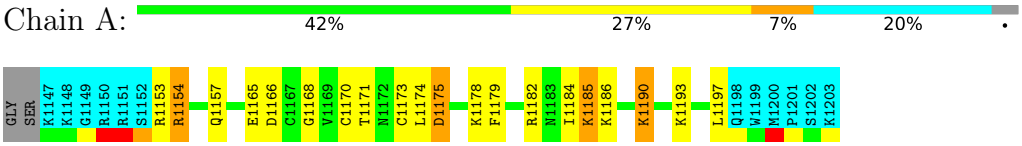
• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain C:

4.2.4 Score per residue for model 4

• Molecule 1: Histone-lysine N-methyltransferase HRX

Chain A:



• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain B:

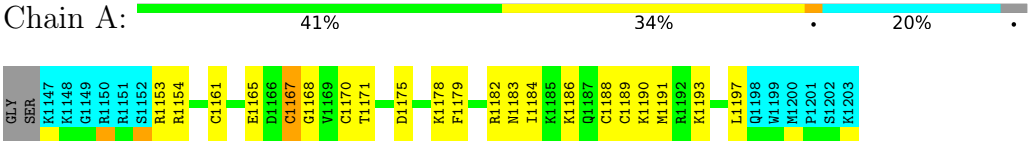
• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain C:

4.2.5 Score per residue for model 5

• Molecule 1: Histone-lysine N-methyltransferase HRX

Chain A:



• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain B:

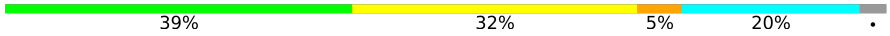
• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

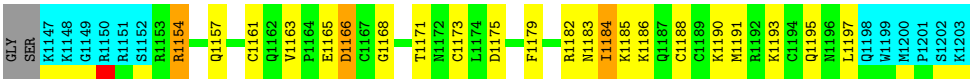
Chain C:

4.2.6 Score per residue for model 6

• Molecule 1: Histone-lykine N-methyltransferase HRX

Chain A:





• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain B:

• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain C:

4.2.7 Score per residue for model 7

• Molecule 1: Histone-lykine N-methyltransferase HRX

Chain A:

• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain B:

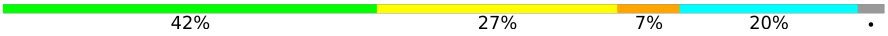
• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

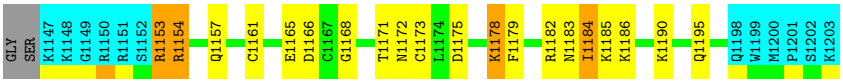
Chain C:

4.2.8 Score per residue for model 8

• Molecule 1: Histone-lykine N-methyltransferase HRX

Chain A:



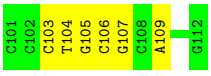


• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain B:

• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

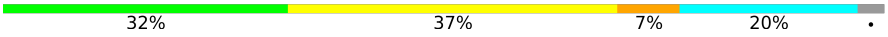
Chain C:



4.2.9 Score per residue for model 9

• Molecule 1: Histone-lykine N-methyltransferase HRX

Chain A:



• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain B:

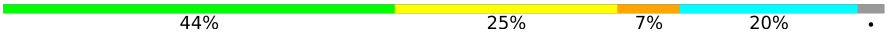
• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain C:

4.2.10 Score per residue for model 10

• Molecule 1: Histone-lysine N-methyltransferase HRX

Chain A:

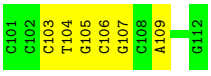


• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain B:

• Molecule 2: 5'-D(*CP*CP*CP*TP*GP*CP*GP*CP*AP*GP*GP*G)-3'

Chain C:



5 Refinement protocol and experimental data overview

The models were refined using the following method: *SIMULATED ANNEALING, DISTANCE GEOMETRY*.

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
Sparky	structure solution	3.110
NMRPipe	structure solution	2.5
CNS	structure solution	1.2
CNS	refinement	1.2

No chemical shift data was provided.

6 Model quality

6.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ZN

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	342	343	343	9±3
2	B	243	135	135	6±0
2	C	243	134	135	7±1
All	All	8300	6120	6130	169

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 12.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:1171:THR:HG22	1:A:1190:LYS:HE2	0.87	1.44	4	1
1:A:1184:ILE:HG23	2:C:106:DC:OP2	0.65	1.90	4	2
2:B:103:DC:H2"	2:B:104:DT:H71	0.64	1.70	1	1
1:A:1166:ASP:HB3	1:A:1173:CYS:SG	0.63	2.33	9	4
1:A:1166:ASP:HB2	1:A:1173:CYS:SG	0.62	2.34	7	4
1:A:1170:CYS:HB2	1:A:1190:LYS:CG	0.61	2.25	9	1
1:A:1154:ARG:HB2	1:A:1161:CYS:SG	0.60	2.36	8	4
1:A:1171:THR:OG1	1:A:1185:LYS:HE2	0.60	1.96	7	4
1:A:1171:THR:HG23	1:A:1185:LYS:HE3	0.58	1.76	8	4
1:A:1171:THR:HG23	1:A:1185:LYS:CE	0.57	2.30	4	3

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:1170:CYS:SG	1:A:1190:LYS:HB2	0.56	2.40	4	1
1:A:1170:CYS:HB2	1:A:1190:LYS:HG2	0.56	1.75	9	1
1:A:1154:ARG:HB3	1:A:1161:CYS:SG	0.54	2.43	3	3
1:A:1154:ARG:HG3	1:A:1161:CYS:SG	0.54	2.43	7	1
1:A:1170:CYS:HB2	1:A:1190:LYS:HG3	0.54	1.79	7	1
1:A:1168:GLY:HA2	1:A:1179:PHE:CE1	0.52	2.39	6	7
2:B:103:DC:C2'	2:B:104:DT:H71	0.51	2.34	1	1
2:B:107:DG:N2	2:C:107:DG:C2	0.51	2.79	3	10
1:A:1171:THR:CG2	1:A:1185:LYS:HE3	0.51	2.36	1	4
1:A:1170:CYS:CB	1:A:1190:LYS:CG	0.51	2.88	9	1
1:A:1175:ASP:CB	1:A:1185:LYS:HB2	0.51	2.36	4	1
1:A:1171:THR:OG1	1:A:1185:LYS:HE3	0.51	2.06	9	5
1:A:1168:GLY:HA2	1:A:1179:PHE:CZ	0.50	2.42	10	2
1:A:1171:THR:CG2	1:A:1185:LYS:HE2	0.49	2.37	10	1
1:A:1197:LEU:HD13	2:B:106:DC:H3'	0.49	1.84	6	1
1:A:1170:CYS:CB	1:A:1190:LYS:HG3	0.48	2.38	9	2
1:A:1170:CYS:SG	1:A:1190:LYS:HG3	0.48	2.48	7	1
1:A:1154:ARG:HD3	1:A:1197:LEU:HD21	0.48	1.86	7	1
1:A:1171:THR:HG22	1:A:1190:LYS:CE	0.47	2.29	4	1
2:B:104:DT:C2	2:B:105:DG:C5	0.47	3.03	6	10
1:A:1171:THR:HG23	1:A:1185:LYS:HE2	0.47	1.86	10	1
1:A:1184:ILE:HG12	2:C:106:DC:OP2	0.47	2.10	3	4
1:A:1188:CYS:SG	1:A:1193:LYS:HD2	0.46	2.49	9	1
1:A:1171:THR:HG21	2:C:104:DT:P	0.46	2.51	2	1
2:B:103:DC:C2'	2:B:104:DT:H72	0.45	2.42	9	9
2:B:109:DA:C2	2:C:105:DG:N2	0.45	2.85	2	10
1:A:1190:LYS:HD3	1:A:1190:LYS:C	0.45	2.32	9	1
2:B:105:DG:C2	2:C:109:DA:C2	0.44	3.05	5	10
2:C:103:DC:C2'	2:C:104:DT:H72	0.44	2.43	7	10
2:B:105:DG:N2	2:C:109:DA:C2	0.43	2.87	8	10
1:A:1171:THR:OG1	1:A:1185:LYS:CE	0.43	2.65	7	1
2:C:104:DT:C2	2:C:105:DG:C5	0.43	3.07	3	10
1:A:1171:THR:HG21	2:C:104:DT:OP2	0.42	2.13	2	1
1:A:1158:CYS:HB2	1:A:1195:GLN:HG3	0.42	1.91	7	1
1:A:1178:LYS:HG2	1:A:1179:PHE:CD2	0.42	2.48	8	1
1:A:1162:GLN:O	1:A:1164:PRO:HD3	0.42	2.14	9	1
1:A:1197:LEU:HD23	1:A:1197:LEU:HA	0.41	1.79	4	1
1:A:1172:ASN:HA	1:A:1185:LYS:CD	0.41	2.45	8	1
1:A:1154:ARG:HD2	1:A:1197:LEU:HD21	0.41	1.92	4	1
1:A:1170:CYS:O	1:A:1174:LEU:HG	0.41	2.15	4	1
1:A:1182:ARG:NE	1:A:1184:ILE:HG13	0.41	2.29	7	1

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:1167:CYS:SG	1:A:1191:MET:HB2	0.41	2.55	2	2
1:A:1178:LYS:HG3	1:A:1179:PHE:CD2	0.41	2.51	3	1
1:A:1170:CYS:HB2	1:A:1190:LYS:HE3	0.41	1.91	4	1
1:A:1185:LYS:HE3	2:C:105:DG:OP2	0.41	2.16	7	1
1:A:1163:VAL:HG21	1:A:1191:MET:HG3	0.41	1.92	6	1
1:A:1185:LYS:HB3	1:A:1187:GLN:HG2	0.40	1.91	2	1
1:A:1158:CYS:HB2	1:A:1195:GLN:CG	0.40	2.47	7	1
1:A:1178:LYS:CD	1:A:1179:PHE:CE2	0.40	3.03	5	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	45/59 (76%)	43±0 (95±1%)	2±0 (3±1%)	1±0 (1±1%)	16	63
All	All	450/590 (76%)	429 (95%)	15 (3%)	6 (1%)	16	63

All 1 unique Ramachandran outliers are listed below.

Mol	Chain	Res	Type	Models (Total)
1	A	1183	ASN	6

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	40/52 (77%)	28±1 (71±3%)	12±1 (29±3%)	2	18
All	All	400/520 (77%)	284 (71%)	116 (29%)	2	18

All 23 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	1175	ASP	10
1	A	1182	ARG	10
1	A	1165	GLU	9
1	A	1153	ARG	8
1	A	1154	ARG	8
1	A	1186	LYS	8
1	A	1184	ILE	7
1	A	1190	LYS	7
1	A	1195	GLN	7
1	A	1193	LYS	6
1	A	1157	GLN	6
1	A	1166	ASP	5
1	A	1188	CYS	4
1	A	1178	LYS	4
1	A	1185	LYS	3
1	A	1171	THR	3
1	A	1167	CYS	2
1	A	1176	LYS	2
1	A	1189	CYS	2
1	A	1183	ASN	2
1	A	1170	CYS	1
1	A	1196	ASN	1
1	A	1191	MET	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 monosaccharides in this entry.

6.6 Ligand geometry

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

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)

No chemical shift data were provided