



# Full wwPDB NMR Structure Validation Report ⓘ

Mar 5, 2026 – 10:41 AM UTC

PDB ID : 2K5X / pdb\_00002k5x  
Title : Chemical shift structure of COLICIN E9 DNASE domain with its cognate immunity protein IM9  
Authors : Montalvao, R.W.; Cavalli, A.; Vendruscolo, M.  
Deposited on : 2008-07-01

This is a Full wwPDB NMR Structure Validation Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto: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

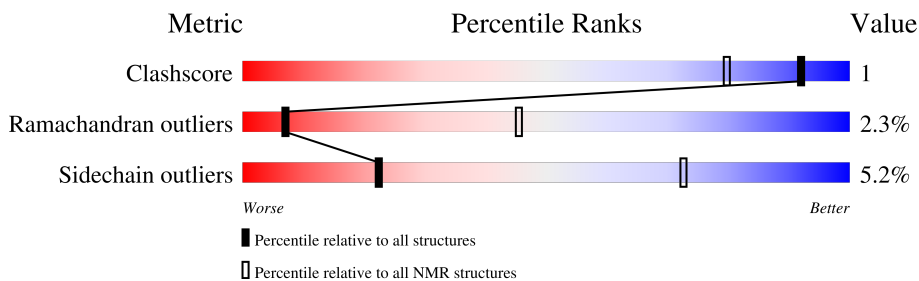
# 1 Overall quality at a glance

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  $\geq 3$ , 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	86	
2	B	134	

## 2 Ensemble composition and analysis

This entry contains 1 models. Identification of well-defined residues and clustering analysis are not possible.

### 3 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 2148 atoms, of which 411 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Colicin-E9 immunity protein.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	86	816	418	143	108	144	3	0

- Molecule 2 is a protein called Colicin-E9.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
2	B	134	1332	661	268	197	204	2	0

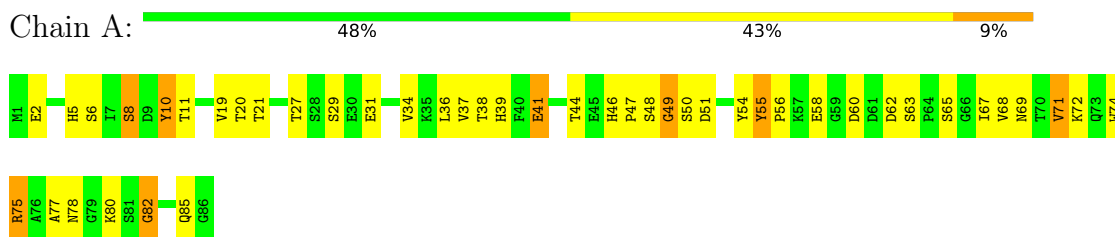
There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	1	MET	-	initiating methionine	UNP P09883

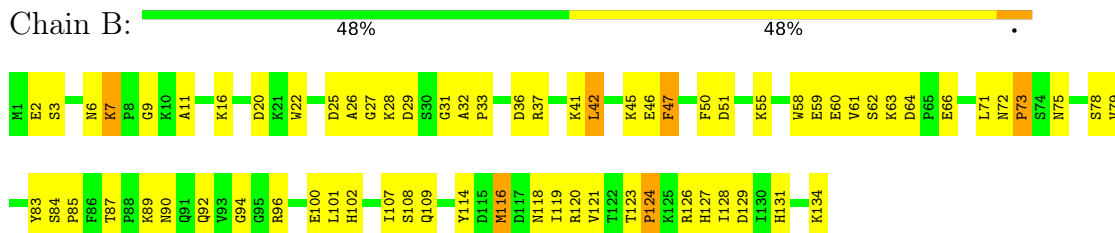
## 4 Residue-property plots [i](#)

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: Colicin-E9 immunity protein



- Molecule 2: Colicin-E9



## 5 Refinement protocol and experimental data overview

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

Of the 500 calculated structures, 1 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
CHESHIRE	geometry optimization	

No chemical shift data was provided.

## 6 Model quality i

### 6.1 Standard geometry i

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	2.14	16/686 ( 2.3%)	2.57	50/926 ( 5.4%)
2	B	2.11	24/1088 ( 2.2%)	2.49	74/1457 ( 5.1%)
All	All	2.12	40/1774 ( 2.3%)	2.52	124/2383 ( 5.2%)

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	2
2	B	0	2
All	All	0	4

All bond outliers are listed below. They are sorted according to the Z-score.

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	39	HIS	ND1-CE1	-9.29	1.23	1.32
2	B	131	HIS	CG-ND1	-8.41	1.29	1.38
2	B	120	ARG	C-O	-7.54	1.14	1.24
2	B	124	PRO	CA-CB	-7.28	1.43	1.53
1	A	34	VAL	N-CA	7.23	1.55	1.46
1	A	36	LEU	C-O	-7.22	1.15	1.24
2	B	128	ILE	CA-CB	7.11	1.62	1.54
2	B	28	LYS	C-O	7.05	1.32	1.24
2	B	87	THR	CA-CB	-6.93	1.45	1.54
2	B	131	HIS	CD2-NE2	-6.79	1.30	1.37
2	B	63	LYS	CA-CB	-6.79	1.42	1.53
2	B	108	SER	C-O	6.71	1.32	1.24
1	A	69	ASN	N-CA	6.46	1.54	1.46
1	A	46	HIS	CD2-NE2	-6.35	1.30	1.37
2	B	9	GLY	N-CA	6.29	1.52	1.45
1	A	8	SER	N-CA	6.23	1.54	1.46

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	46	HIS	ND1-CE1	-6.20	1.26	1.32
1	A	5	HIS	CG-CD2	6.05	1.42	1.35
1	A	74	TRP	N-CA	6.04	1.53	1.46
2	B	101	LEU	CA-CB	5.91	1.61	1.53
1	A	67	ILE	C-O	-5.87	1.17	1.24
2	B	102	HIS	CD2-NE2	-5.86	1.31	1.37
1	A	63	SER	CA-C	5.82	1.60	1.52
2	B	121	VAL	CA-CB	5.75	1.60	1.53
1	A	68	VAL	N-CA	5.73	1.53	1.46
2	B	118	ASN	C-N	5.63	1.40	1.33
1	A	80	LYS	N-CA	5.58	1.52	1.45
2	B	127	HIS	CG-ND1	-5.54	1.32	1.38
2	B	3	SER	C-O	5.46	1.30	1.23
2	B	41	LYS	CA-C	5.43	1.60	1.52
2	B	114	TYR	CA-CB	5.39	1.59	1.52
1	A	19	VAL	N-CA	5.37	1.52	1.46
2	B	101	LEU	C-O	-5.31	1.17	1.24
1	A	74	TRP	CG-CD2	-5.30	1.34	1.43
2	B	94	GLY	CA-C	5.28	1.59	1.51
2	B	87	THR	C-O	-5.18	1.18	1.24
2	B	27	GLY	C-O	-5.14	1.17	1.23
2	B	50	PHE	CA-CB	5.13	1.61	1.53
2	B	60	GLU	C-O	-5.03	1.17	1.24
1	A	77	ALA	CA-CB	-5.01	1.45	1.53

All angle outliers are listed below. They are sorted according to the Z-score.

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	55	TYR	CA-C-N	10.79	130.91	119.90
1	A	55	TYR	C-N-CA	10.79	130.91	119.90
2	B	127	HIS	CB-CG-CD2	-10.21	117.93	131.20
2	B	129	ASP	CA-CB-CG	9.70	122.30	112.60
2	B	16	LYS	N-CA-C	9.65	121.90	109.93
2	B	51	ASP	CA-CB-CG	8.97	121.57	112.60
2	B	75	ASN	CA-CB-CG	8.88	121.47	112.60
1	A	48	SER	N-CA-C	8.48	121.65	111.82
1	A	74	TRP	NE1-CE2-CZ2	-8.44	117.44	130.10
1	A	78	ASN	OD1-CG-ND2	-8.35	114.25	122.60
2	B	92	GLN	OE1-CD-NE2	-8.31	114.29	122.60
2	B	32	ALA	CB-CA-C	-8.25	100.45	109.85
2	B	31	GLY	O-C-N	-7.97	115.51	123.48
2	B	42	LEU	CA-C-O	7.94	128.85	119.48

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	90	ASN	CA-CB-CG	7.80	120.40	112.60
1	A	74	TRP	CE2-CD2-CG	-7.75	97.90	107.20
2	B	36	ASP	CA-C-N	7.68	131.20	120.29
2	B	36	ASP	C-N-CA	7.68	131.20	120.29
1	A	56	PRO	CA-C-O	7.64	129.99	121.36
2	B	22	TRP	CE2-CD2-CG	-7.59	98.09	107.20
1	A	55	TYR	N-CA-CB	7.58	121.33	111.40
2	B	26	ALA	O-C-N	-7.52	112.59	122.59
1	A	36	LEU	N-CA-C	7.43	119.38	111.28
2	B	33	PRO	N-CA-C	7.36	122.91	111.21
1	A	60	ASP	CA-CB-CG	7.33	119.93	112.60
2	B	28	LYS	O-C-N	-7.31	113.93	123.21
2	B	22	TRP	NE1-CE2-CD2	7.29	116.88	107.40
1	A	21	THR	O-C-N	7.26	129.64	122.09
2	B	36	ASP	CA-C-O	-7.20	112.14	120.20
2	B	78	SER	N-CA-C	7.16	119.75	111.02
2	B	7	LYS	CA-C-N	7.14	127.71	120.14
2	B	7	LYS	C-N-CA	7.14	127.71	120.14
1	A	78	ASN	CA-CB-CG	-7.12	105.48	112.60
1	A	62	ASP	O-C-N	-7.11	113.14	122.59
2	B	131	HIS	CB-CG-CD2	-7.06	122.02	131.20
1	A	31	GLU	CA-C-O	7.05	128.22	119.05
1	A	31	GLU	O-C-N	-6.97	112.83	122.46
1	A	82	GLY	O-C-N	-6.96	116.29	122.90
1	A	6	SER	CA-CB-OG	6.91	124.92	111.10
2	B	87	THR	CA-C-N	6.91	127.85	120.11
2	B	87	THR	C-N-CA	6.91	127.85	120.11
1	A	54	TYR	N-CA-C	6.78	121.63	113.23
2	B	20	ASP	N-CA-C	6.77	120.63	112.38
2	B	102	HIS	CA-CB-CG	6.69	120.49	113.80
2	B	129	ASP	O-C-N	-6.56	115.06	122.08
2	B	102	HIS	CA-C-O	-6.54	113.91	121.49
2	B	83	TYR	N-CA-C	6.47	120.23	109.95
1	A	20	THR	CA-CB-OG1	-6.38	100.03	109.60
2	B	50	PHE	CA-C-O	-6.35	113.82	120.55
2	B	114	TYR	CG-CD1-CE1	-6.33	111.71	121.20
1	A	74	TRP	NE1-CE2-CD2	6.27	115.55	107.40
1	A	71	VAL	N-CA-CB	6.26	118.30	110.47
1	A	29	SER	O-C-N	6.22	130.88	123.24
2	B	11	ALA	O-C-N	-6.21	115.14	122.96
2	B	6	ASN	OD1-CG-ND2	-6.12	116.48	122.60
1	A	58	GLU	CA-C-N	-6.11	116.82	123.30

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	58	GLU	C-N-CA	-6.11	116.82	123.30
1	A	47	PRO	N-CA-C	6.09	122.00	113.53
2	B	58	TRP	N-CA-C	6.08	119.54	111.75
2	B	25	ASP	CA-CB-CG	6.02	118.62	112.60
1	A	63	SER	CA-CB-OG	6.00	123.11	111.10
1	A	37	VAL	CA-CB-CG1	5.97	120.55	110.40
1	A	19	VAL	CA-C-O	-5.95	114.55	120.85
2	B	126	ARG	NE-CZ-NH2	5.93	124.53	119.20
2	B	109	GLN	OE1-CD-NE2	-5.93	116.67	122.60
1	A	75	ARG	CA-CB-CG	5.91	125.93	114.10
2	B	131	HIS	CB-CG-ND1	5.91	131.56	122.70
2	B	37	ARG	CB-CG-CD	5.85	124.76	111.30
1	A	2	GLU	N-CA-C	5.85	119.77	110.70
2	B	116	MET	N-CA-C	5.85	118.44	111.71
1	A	71	VAL	O-C-N	5.81	127.58	121.89
2	B	7	LYS	O-C-N	-5.73	116.15	122.17
2	B	124	PRO	N-CA-CB	-5.71	97.25	103.25
2	B	61	VAL	O-C-N	-5.68	116.26	121.94
2	B	64	ASP	N-CA-CB	5.64	117.62	110.23
2	B	90	ASN	OD1-CG-ND2	-5.64	116.96	122.60
2	B	127	HIS	CB-CG-ND1	5.63	131.15	122.70
2	B	2	GLU	N-CA-CB	5.63	118.30	109.69
1	A	5	HIS	CG-CD2-NE2	-5.62	101.58	107.20
1	A	85	GLN	CG-CD-NE2	5.62	124.83	116.40
1	A	46	HIS	O-C-N	-5.62	114.86	121.32
2	B	22	TRP	NE1-CE2-CZ2	-5.61	121.69	130.10
2	B	72	ASN	CA-C-N	5.61	126.85	119.84
2	B	72	ASN	C-N-CA	5.61	126.85	119.84
2	B	121	VAL	N-CA-CB	5.60	117.03	110.82
2	B	114	TYR	CD1-CG-CD2	5.58	126.46	118.10
2	B	22	TRP	CG-CD2-CE3	5.57	139.47	133.90
2	B	108	SER	O-C-N	-5.55	115.21	122.59
1	A	10	TYR	N-CA-C	-5.52	100.71	109.76
2	B	118	ASN	CA-CB-CG	5.50	118.10	112.60
2	B	123	THR	CA-CB-OG1	-5.48	101.38	109.60
1	A	51	ASP	O-C-N	-5.48	114.90	122.46
2	B	114	TYR	CB-CG-CD2	-5.46	112.61	120.80
2	B	66	GLU	N-CA-C	-5.44	106.77	113.41
1	A	38	THR	CA-C-O	-5.41	114.69	120.42
1	A	5	HIS	CB-CG-CD2	-5.40	124.17	131.20
1	A	71	VAL	CA-CB-CG1	5.40	119.58	110.40
2	B	46	GLU	CB-CG-CD	5.40	121.78	112.60

*Continued on next page...*

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	80	LYS	CA-C-O	-5.39	115.30	121.82
2	B	101	LEU	O-C-N	5.38	129.35	123.27
1	A	44	THR	CA-C-O	5.37	125.27	119.15
1	A	85	GLN	OE1-CD-NE2	-5.36	117.24	122.60
2	B	123	THR	CA-C-N	5.35	126.52	119.84
2	B	123	THR	C-N-CA	5.35	126.52	119.84
2	B	107	ILE	N-CA-CB	-5.30	105.05	110.62
2	B	121	VAL	CB-CA-C	5.29	118.42	111.33
2	B	134	LYS	CG-CD-CE	-5.26	99.20	111.30
2	B	127	HIS	CA-C-N	5.24	127.35	120.60
2	B	127	HIS	C-N-CA	5.24	127.35	120.60
2	B	100	GLU	O-C-N	-5.22	116.40	123.19
1	A	48	SER	N-CA-CB	-5.22	102.19	110.28
2	B	84	SER	CA-C-N	5.20	126.34	119.84
2	B	84	SER	C-N-CA	5.20	126.34	119.84
2	B	45	LYS	CA-CB-CG	5.18	124.47	114.10
1	A	72	LYS	N-CA-CB	-5.17	102.23	109.94
1	A	11	THR	N-CA-C	-5.12	102.94	110.52
1	A	54	TYR	CA-C-O	-5.12	113.28	119.27
2	B	71	LEU	O-C-N	5.10	128.77	123.06
1	A	69	ASN	CA-CB-CG	5.08	117.68	112.60
2	B	127	HIS	CG-CD2-NE2	-5.07	102.13	107.20
1	A	46	HIS	CE1-NE2-CD2	5.06	114.06	109.00
1	A	65	SER	N-CA-CB	-5.03	102.72	110.01
2	B	2	GLU	CA-CB-CG	5.02	124.14	114.10
1	A	78	ASN	CB-CG-ND2	5.01	123.92	116.40

There are no chirality outliers.

All planar outliers are listed below.

Mol	Chain	Res	Type	Group
1	A	10	TYR	Sidechain
1	A	55	TYR	Sidechain
2	B	47	PHE	Sidechain
2	B	96	ARG	Sidechain

## 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	673	143	635	2
2	B	1064	268	1060	3
All	All	1737	411	1695	5

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 1.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)
2:B:116:MET:HA	2:B:119:ILE:HD12	0.65	1.67
1:A:41:GLU:HG3	1:A:49:GLY:HA3	0.56	1.76
1:A:75:ARG:HH21	1:A:82:GLY:N	0.44	2.09
2:B:55:LYS:O	2:B:59:GLU:HG3	0.44	2.11
2:B:42:LEU:HD22	2:B:47:PHE:CZ	0.41	2.51

## 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	84/86 (98%)	74 (88%)	8 (10%)	2 (2%)	7	44
2	B	132/134 (99%)	111 (84%)	18 (14%)	3 (2%)	7	45
All	All	216/220 (98%)	185 (86%)	26 (12%)	5 (2%)	7	45

All 5 Ramachandran outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type
1	A	8	SER
1	A	49	GLY
2	B	29	ASP
2	B	73	PRO
2	B	85	PRO

### 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	76/76 (100%)	72 (95%)	4 (5%)	22	72
2	B	117/117 (100%)	111 (95%)	6 (5%)	23	73
All	All	193/193 (100%)	183 (95%)	10 (5%)	22	72

All 10 residues with a non-rotameric sidechain are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type
1	A	27	THR
1	A	41	GLU
1	A	50	SER
1	A	71	VAL
2	B	7	LYS
2	B	62	SER
2	B	73	PRO
2	B	79	VAL
2	B	89	LYS
2	B	124	PRO

### 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