



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 12:24 PM UTC

PDB ID : 1CUK / pdb\_00001cuk  
Title : ESCHERICHIA COLI RUVA PROTEIN AT PH 4.9 AND ROOM TEMPERATURE  
Authors : Rafferty, J.B.; Rice, D.W.  
Deposited on : 1996-08-28  
Resolution : 1.90 Å (reported)

This is a Full wwPDB X-ray 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/XrayValidationReportHelp>

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>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49

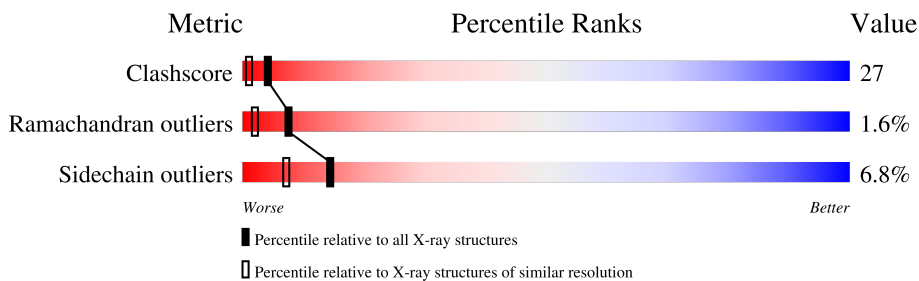
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.90 Å.

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)	Similar resolution (#Entries, resolution range(Å))
Clashscore	190562	8410 (1.90-1.90)
Ramachandran outliers	187476	8333 (1.90-1.90)
Sidechain outliers	187428	8333 (1.90-1.90)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. 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  $\leq 5\%$

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	203	

## 2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 1428 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called RUVA PROTEIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	190	1377	888	230	252	7	0	0	0

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	51	Total	O	0	0
			51	51		

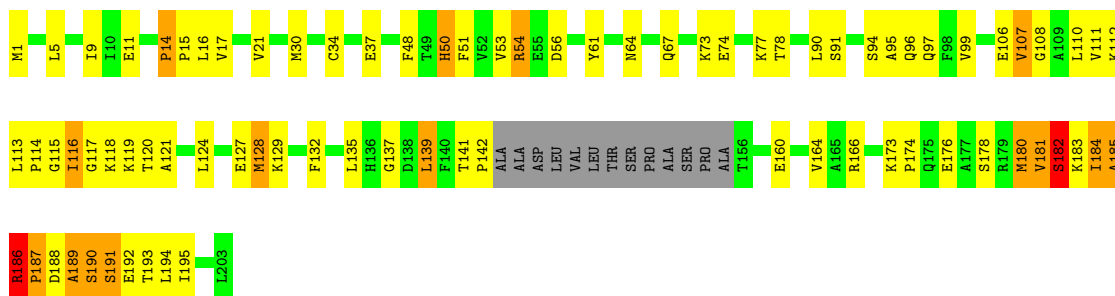
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-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 outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

Note EDS was not executed.

- Molecule 1: RUVA PROTEIN

Chain A: 



## 4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 4	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	83.70Å 83.70Å 33.10Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	15.00 – 1.90	Depositor
% Data completeness (in resolution range)	(Not available) (15.00-1.90)	Depositor
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	TNT	Depositor
R, $R_{free}$	0.209 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	1428	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	48.0	wwPDB-VP

## 5 Model quality i

### 5.1 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 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	1.64	15/1397 (1.1%)	1.68	26/1894 (1.4%)

All (15) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	182	SER	C-N	25.70	1.67	1.33
1	A	189	ALA	C-N	-13.21	1.11	1.33
1	A	96	GLN	C-N	-12.83	1.17	1.33
1	A	54	ARG	C-N	-10.24	1.20	1.33
1	A	180	MET	C-N	8.77	1.41	1.33
1	A	115	GLY	C-N	7.39	1.43	1.33
1	A	184	ILE	C-N	7.34	1.44	1.33
1	A	190	SER	C-N	6.44	1.42	1.33
1	A	119	LYS	C-N	5.80	1.41	1.33
1	A	21	VAL	N-CA	-5.45	1.38	1.46
1	A	187	PRO	C-N	5.29	1.41	1.33
1	A	106	GLU	C-N	-5.26	1.27	1.33
1	A	118	LYS	N-CA	5.22	1.52	1.46
1	A	11	GLU	CD-OE1	5.20	1.35	1.25
1	A	61	TYR	C-O	-5.17	1.17	1.24

All (26) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	115	GLY	CA-C-N	-13.36	105.67	122.37
1	A	115	GLY	C-N-CA	-13.36	105.67	122.37
1	A	182	SER	CA-C-N	11.90	136.23	120.28
1	A	182	SER	C-N-CA	11.90	136.23	120.28
1	A	187	PRO	O-C-N	11.84	137.25	123.04
1	A	188	ASP	O-C-N	9.32	134.98	122.59
1	A	186	ARG	CB-CA-C	9.27	128.43	110.17
1	A	115	GLY	O-C-N	7.58	131.97	122.34
1	A	54	ARG	CA-C-N	7.23	131.66	120.82

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	54	ARG	C-N-CA	7.23	131.66	120.82
1	A	184	ILE	CA-C-N	-7.09	107.99	121.54
1	A	184	ILE	C-N-CA	-7.09	107.99	121.54
1	A	48	PHE	CA-CB-CG	-6.85	106.95	113.80
1	A	50	HIS	CA-CB-CG	-6.46	107.34	113.80
1	A	119	LYS	O-C-N	6.12	129.38	122.22
1	A	185	ALA	O-C-N	6.11	130.71	122.59
1	A	128	MET	CA-C-N	-5.97	111.67	120.38
1	A	128	MET	C-N-CA	-5.97	111.67	120.38
1	A	182	SER	O-C-N	-5.94	115.43	122.20
1	A	91	SER	N-CA-C	-5.40	106.82	113.41
1	A	137	GLY	CA-C-N	5.38	128.88	120.82
1	A	137	GLY	C-N-CA	5.38	128.88	120.82
1	A	14	PRO	N-CA-CB	5.12	108.05	103.08
1	A	190	SER	CA-C-N	-5.12	111.75	121.54
1	A	190	SER	C-N-CA	-5.12	111.75	121.54
1	A	127	GLU	N-CA-C	5.10	116.65	111.14

There are no chirality outliers.

There are no planarity outliers.

## 5.2 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 the 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 within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1377	0	1360	75	1
2	A	51	0	0	2	1
All	All	1428	0	1360	75	1

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 27.

All (75) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:182:SER:C	1:A:183:LYS:N	1.67	1.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:190:SER:O	1:A:193:THR:N	1.79	1.15
1:A:113:LEU:HB2	1:A:116:ILE:HD12	1.29	1.13
1:A:113:LEU:CB	1:A:116:ILE:HD12	1.81	1.09
1:A:160:GLU:O	1:A:164:VAL:HG23	1.60	1.01
1:A:176:GLU:O	1:A:180:MET:HG3	1.60	1.00
1:A:189:ALA:HB1	1:A:194:LEU:CD1	2.01	0.89
1:A:178:SER:O	1:A:182:SER:OG	1.92	0.86
1:A:117:GLY:HA3	1:A:120:THR:HB	1.57	0.85
1:A:113:LEU:HB2	1:A:116:ILE:CD1	2.08	0.83
1:A:108:GLY:O	1:A:111:VAL:HG22	1.85	0.77
1:A:190:SER:C	1:A:192:GLU:N	2.42	0.75
1:A:110:LEU:O	1:A:116:ILE:HG21	1.86	0.74
1:A:181:VAL:O	1:A:184:ILE:O	2.04	0.74
1:A:189:ALA:CB	1:A:194:LEU:HD11	2.17	0.74
1:A:189:ALA:HB1	1:A:194:LEU:HD11	1.69	0.74
1:A:184:ILE:O	1:A:185:ALA:HB2	1.87	0.74
1:A:191:SER:O	1:A:195:ILE:HG13	1.89	0.73
1:A:113:LEU:O	1:A:116:ILE:HB	1.87	0.73
1:A:190:SER:O	1:A:191:SER:C	2.32	0.72
1:A:190:SER:O	1:A:192:GLU:N	2.24	0.71
1:A:113:LEU:HB3	1:A:116:ILE:HD12	1.71	0.71
1:A:117:GLY:CA	1:A:120:THR:HB	2.21	0.70
1:A:111:VAL:C	1:A:113:LEU:H	2.00	0.67
1:A:166:ARG:CB	1:A:195:ILE:CD1	2.73	0.66
1:A:67:GLN:HG2	2:A:224:HOH:O	1.93	0.66
1:A:107:VAL:O	1:A:108:GLY:C	2.38	0.66
1:A:176:GLU:O	1:A:180:MET:CG	2.41	0.65
1:A:78:THR:O	2:A:254:HOH:O	2.16	0.62
1:A:51:PHE:CE2	1:A:53:VAL:HG22	2.37	0.60
1:A:108:GLY:O	1:A:111:VAL:CG2	2.50	0.59
1:A:164:VAL:HG22	1:A:181:VAL:HG11	1.84	0.58
1:A:117:GLY:O	1:A:121:ALA:N	2.36	0.58
1:A:166:ARG:CB	1:A:195:ILE:HD11	2.34	0.57
1:A:176:GLU:C	1:A:180:MET:HG3	2.28	0.57
1:A:95:ALA:HB1	1:A:139:LEU:HD11	1.87	0.55
1:A:50:HIS:ND1	1:A:73:LYS:CE	2.69	0.55
1:A:141:THR:O	1:A:142:PRO:C	2.50	0.55
1:A:74:GLU:HG3	1:A:135:LEU:HD11	1.89	0.54
1:A:50:HIS:ND1	1:A:73:LYS:HE2	2.22	0.54
1:A:114:PRO:C	1:A:116:ILE:H	2.16	0.53
1:A:189:ALA:HB1	1:A:194:LEU:HD13	1.84	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:166:ARG:CB	1:A:195:ILE:HD13	2.40	0.51
1:A:186:ARG:CB	1:A:187:PRO:CD	2.89	0.50
1:A:190:SER:C	1:A:193:THR:H	2.12	0.50
1:A:30:MET:HE2	1:A:34:CYS:HB3	1.93	0.50
1:A:186:ARG:CB	1:A:187:PRO:HD3	2.42	0.50
1:A:111:VAL:C	1:A:113:LEU:N	2.66	0.49
1:A:128:MET:O	1:A:129:LYS:C	2.54	0.49
1:A:114:PRO:C	1:A:116:ILE:N	2.70	0.49
1:A:94:SER:H	1:A:97:GLN:HE21	1.60	0.49
1:A:111:VAL:O	1:A:113:LEU:N	2.47	0.48
1:A:189:ALA:CB	1:A:194:LEU:CD1	2.76	0.48
1:A:14:PRO:HA	1:A:15:PRO:HA	1.69	0.48
1:A:190:SER:C	1:A:192:GLU:H	2.19	0.48
1:A:30:MET:HE2	1:A:34:CYS:CB	2.44	0.47
1:A:50:HIS:ND1	1:A:73:LYS:HE3	2.29	0.47
1:A:128:MET:HE3	1:A:132:PHE:CE1	2.51	0.46
1:A:95:ALA:O	1:A:99:VAL:HG23	2.16	0.46
1:A:9:ILE:HD12	1:A:17:VAL:HG21	1.97	0.46
1:A:135:LEU:HD23	1:A:135:LEU:HA	1.77	0.45
1:A:51:PHE:CE2	1:A:53:VAL:CG2	3.00	0.45
1:A:50:HIS:CE1	1:A:73:LYS:HE2	2.51	0.44
1:A:111:VAL:HA	1:A:116:ILE:HG22	1.99	0.44
1:A:113:LEU:HA	1:A:114:PRO:HD3	1.86	0.44
1:A:124:LEU:HA	1:A:124:LEU:HD12	1.76	0.44
1:A:128:MET:HE3	1:A:132:PHE:CZ	2.52	0.43
1:A:185:ALA:O	1:A:186:ARG:CB	2.66	0.43
1:A:107:VAL:HG12	1:A:121:ALA:HB1	2.01	0.43
1:A:37:GLU:HB2	1:A:64:ASN:ND2	2.35	0.42
1:A:117:GLY:O	1:A:121:ALA:HB2	2.20	0.42
1:A:56:ASP:OD1	1:A:56:ASP:N	2.42	0.41
1:A:90:LEU:HD23	1:A:90:LEU:HA	1.83	0.41
1:A:173:LYS:O	1:A:174:PRO:C	2.64	0.41
1:A:190:SER:O	1:A:193:THR:CA	2.64	0.41

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:54:ARG:NH1	2:A:233:HOH:O[1_554]	2.10	0.10

## 5.3 Torsion angles [i](#)

### 5.3.1 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 X-ray entries followed by that with respect to entries of similar resolution.

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	186/203 (92%)	176 (95%)	7 (4%)	3 (2%)	<b>7</b> <b>2</b>

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	186	ARG
1	A	191	SER
1	A	112	LYS

### 5.3.2 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 X-ray entries followed by that with respect to entries of similar resolution.

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	132/164 (80%)	123 (93%)	9 (7%)	<b>14</b> <b>7</b>

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	MET
1	A	5	LEU
1	A	16	LEU
1	A	77	LYS
1	A	107	VAL
1	A	116	ILE
1	A	139	LEU
1	A	181	VAL

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Mol	Chain	Res	Type
1	A	182	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	58	GLN
1	A	79	ASN
1	A	96	GLN
1	A	97	GLN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

There are no ligands in this entry.

## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	A	3

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	182:SER	C	183:LYS	N	1.67
1	A	96:GLN	C	97:GLN	N	1.17
1	A	189:ALA	C	190:SER	N	1.11

## 6 Fit of model and data [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

EDS was not executed - this section is therefore empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates [i](#)

EDS was not executed - this section is therefore empty.

### 6.4 Ligands [i](#)

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers [i](#)

EDS was not executed - this section is therefore empty.