



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 31, 2021 – 11:08 AM EDT

PDB ID : 1WSI  
Title : Crystal structure of E.coli RNase HI active site mutant (E48A/K87A/D134N)  
Authors : Tsunaka, Y.; Takano, K.; Matsumura, H.; Yamagata, Y.; Kanaya, S.  
Deposited on : 2004-11-07  
Resolution : 2.00 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.

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

MolProbity : 4.02b-467  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.23.2

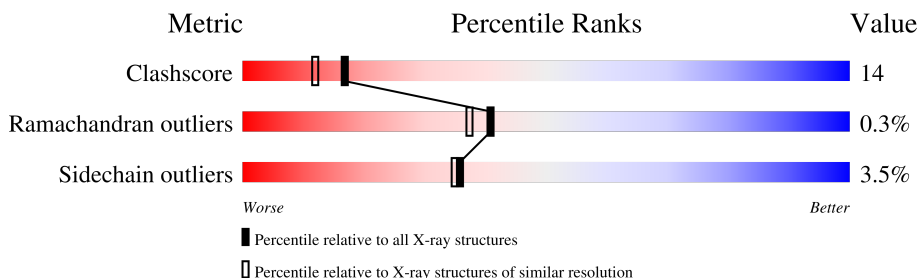
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.00 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	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)

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	155	
1	B	155	
1	C	155	
1	D	155	

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 5124 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 Ribonuclease HI.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	152	1204	755	222	221	6	0	0	0
1	B	149	1186	745	219	216	6	0	0	0
1	C	153	1211	760	223	222	6	0	0	0
1	D	152	1207	757	222	222	6	0	0	0

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	48	ALA	GLU	engineered mutation	UNP P0A7Y4
A	87	ALA	LYS	engineered mutation	UNP P0A7Y4
A	134	ASN	ASP	engineered mutation	UNP P0A7Y4
B	48	ALA	GLU	engineered mutation	UNP P0A7Y4
B	87	ALA	LYS	engineered mutation	UNP P0A7Y4
B	134	ASN	ASP	engineered mutation	UNP P0A7Y4
C	48	ALA	GLU	engineered mutation	UNP P0A7Y4
C	87	ALA	LYS	engineered mutation	UNP P0A7Y4
C	134	ASN	ASP	engineered mutation	UNP P0A7Y4
D	48	ALA	GLU	engineered mutation	UNP P0A7Y4
D	87	ALA	LYS	engineered mutation	UNP P0A7Y4
D	134	ASN	ASP	engineered mutation	UNP P0A7Y4

- Molecule 2 is water.

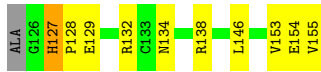
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	56	Total	O	0	0
			56	56		
2	B	78	Total	O	0	0
			78	78		

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	C	89	Total O 89 89	0	0
2	D	93	Total O 93 93	0	0





## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	121.12Å 80.12Å 64.46Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 2.00	Depositor
% Data completeness (in resolution range)	(Not available) (50.00-2.00)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	CNS	Depositor
R, $R_{free}$	0.217 , 0.258	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	5124	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	29.0	wwPDB-VP

## 5 Model quality

### 5.1 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 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	0.30	0/1230	0.54	0/1663
1	B	0.30	0/1212	0.58	0/1639
1	C	0.33	0/1237	0.57	0/1673
1	D	0.33	0/1233	0.58	0/1666
All	All	0.32	0/4912	0.57	0/6641

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 5.2 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 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	1204	0	1181	47	0
1	B	1186	0	1167	22	0
1	C	1211	0	1190	34	0
1	D	1207	0	1185	41	0
2	A	56	0	0	2	0
2	B	78	0	0	1	0
2	C	89	0	0	1	0
2	D	93	0	0	3	0
All	All	5124	0	4723	134	0

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 14.



All (134) 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:C:155:VAL:HG12	1:D:92:THR:HG22	1.48	0.92
1:A:121:VAL:HG12	1:A:125:ALA:HB3	1.56	0.86
1:D:29:ARG:O	1:D:29:ARG:HG2	1.75	0.84
1:C:155:VAL:HG22	1:D:85:TRP:HE1	1.46	0.81
1:B:134:ASN:HD21	1:B:138:ARG:HE	1.30	0.80
1:A:64:GLU:HA	1:A:115:GLN:HG3	1.63	0.79
1:C:155:VAL:CG1	1:D:92:THR:HG22	2.14	0.77
1:B:27:ARG:HG2	1:B:32:GLU:HG3	1.66	0.77
1:D:122:LYS:HE3	1:D:122:LYS:HA	1.67	0.77
1:A:132:ARG:O	1:A:132:ARG:HD3	1.85	0.76
1:D:28:TYR:O	1:D:29:ARG:HD3	1.86	0.75
1:A:14:LEU:HD11	1:A:142:MET:HE3	1.68	0.74
1:C:155:VAL:CG1	1:D:98:VAL:HG12	2.20	0.72
1:D:132:ARG:HG3	2:D:208:HOH:O	1.91	0.70
1:A:5:VAL:HG11	1:A:26:LEU:HD11	1.75	0.69
1:C:92:THR:HG22	1:D:155:VAL:HG22	1.73	0.68
1:A:88:ARG:HB3	1:A:91:LYS:HG2	1.76	0.66
1:B:10:ASP:OD2	1:B:134:ASN:HA	1.95	0.66
1:D:5:VAL:HG11	1:D:26:LEU:HD11	1.77	0.65
1:B:127:HIS:O	1:B:131:GLU:HG3	1.96	0.65
1:C:2:LEU:CD1	1:C:64:GLU:HB2	2.26	0.65
1:D:86:LYS:HD2	1:D:108:ASP:OD2	1.97	0.65
1:D:70:ASP:HB3	1:D:121:VAL:HG23	1.79	0.65
1:A:5:VAL:HG11	1:A:26:LEU:CD1	2.29	0.62
1:A:82:ILE:HD11	1:A:108:ASP:HB2	1.80	0.62
1:A:127:HIS:HB3	1:A:129:GLU:OE2	1.99	0.62
1:B:98:VAL:HG23	1:B:101:VAL:HB	1.81	0.61
1:D:29:ARG:NH2	1:D:31:ARG:HD2	2.17	0.60
1:C:92:THR:HG22	1:D:155:VAL:CG2	2.31	0.59
1:A:121:VAL:CG1	1:A:125:ALA:HB3	2.30	0.59
1:A:99:LYS:HD2	1:A:100:ASN:ND2	2.19	0.58
1:A:66:ILE:O	1:A:66:ILE:HG23	2.05	0.56
1:B:3:LYS:HD2	1:B:28:TYR:CZ	2.40	0.56
1:D:5:VAL:HG11	1:D:26:LEU:CD1	2.36	0.56
1:A:4:GLN:HB3	1:A:64:GLU:CD	2.26	0.56
1:A:5:VAL:HG12	1:A:6:GLU:N	2.20	0.55
1:C:27:ARG:HG3	1:C:32:GLU:HG2	1.88	0.55
1:A:62:HIS:HD2	1:A:113:GLN:O	1.89	0.55
1:D:134:ASN:HD21	1:D:138:ARG:NE	2.05	0.55
1:A:91:LYS:HZ2	1:A:95:LYS:HA	1.72	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:129:GLU:H	1:B:129:GLU:CD	2.10	0.55
1:B:82:ILE:HG23	1:B:83:HIS:N	2.23	0.54
1:A:82:ILE:HD11	1:A:108:ASP:CB	2.37	0.53
1:A:115:GLN:HG3	1:A:115:GLN:O	2.08	0.53
1:D:62:HIS:HD2	1:D:113:GLN:O	1.90	0.53
1:D:27:ARG:NH2	1:D:129:GLU:OE1	2.42	0.52
1:C:4:GLN:HE22	1:C:64:GLU:CD	2.13	0.52
1:C:99:LYS:HE2	1:D:154:GLU:OE2	2.09	0.52
1:D:29:ARG:HH22	1:D:31:ARG:HH11	1.56	0.52
1:C:155:VAL:HG13	1:D:98:VAL:HG12	1.92	0.52
1:A:64:GLU:O	1:A:64:GLU:HG3	2.10	0.52
1:B:3:LYS:HE2	1:B:61:GLU:CD	2.31	0.51
1:C:134:ASN:ND2	1:C:138:ARG:HD2	2.26	0.51
1:A:29:ARG:CZ	1:A:29:ARG:HA	2.40	0.51
1:D:5:VAL:HG12	1:D:6:GLU:N	2.24	0.51
1:A:2:LEU:N	2:A:170:HOH:O	2.43	0.51
1:C:2:LEU:HD13	1:C:64:GLU:HB2	1.94	0.50
1:A:77:GLY:HA3	1:A:104:TRP:CH2	2.47	0.50
1:C:65:VAL:HB	1:C:116:ILE:HD13	1.92	0.50
1:A:153:VAL:O	1:A:154:GLU:HB2	2.10	0.50
1:D:111:LEU:HD22	1:D:116:ILE:HG13	1.94	0.50
1:C:70:ASP:HB3	1:C:121:VAL:HG23	1.94	0.49
1:A:123:GLY:HA2	1:A:126:GLY:HA3	1.93	0.49
1:A:123:GLY:HA2	1:A:126:GLY:CA	2.43	0.49
1:D:70:ASP:CB	1:D:121:VAL:HG23	2.42	0.49
1:C:134:ASN:HD21	1:C:138:ARG:HD2	1.78	0.49
1:C:155:VAL:HG21	2:D:184:HOH:O	2.13	0.49
1:A:63:CYS:O	1:A:114:HIS:HB3	2.13	0.48
1:C:4:GLN:NE2	1:C:64:GLU:HB3	2.28	0.48
1:A:132:ARG:HD3	1:A:132:ARG:C	2.33	0.48
1:B:32:GLU:CD	1:B:132:ARG:HH22	2.17	0.48
1:B:85:TRP:CD1	1:B:98:VAL:HG11	2.49	0.47
1:C:67:LEU:HD22	1:C:118:TRP:CZ3	2.49	0.47
1:A:75:ARG:HA	1:A:120:TRP:CH2	2.49	0.47
1:C:92:THR:HA	1:D:155:VAL:HG11	1.95	0.47
1:D:34:THR:HG22	2:D:244:HOH:O	2.15	0.47
1:C:5:VAL:HG11	1:C:26:LEU:HD11	1.97	0.47
1:D:70:ASP:HB3	1:D:121:VAL:CG2	2.43	0.47
1:D:153:VAL:HG12	1:D:155:VAL:HG13	1.97	0.47
1:A:4:GLN:HB3	1:A:64:GLU:CG	2.44	0.47
1:B:53:ILE:O	1:B:57:GLU:HG3	2.15	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:14:LEU:HD11	1:A:142:MET:CE	2.39	0.47
1:D:99:LYS:NZ	1:D:99:LYS:HB3	2.31	0.46
1:B:4:GLN:OE1	1:B:66:ILE:HD11	2.15	0.46
1:B:98:VAL:CG2	1:B:101:VAL:HB	2.46	0.46
1:B:134:ASN:ND2	1:B:138:ARG:HE	2.05	0.46
1:C:155:VAL:HG11	1:D:98:VAL:HG12	1.96	0.46
1:A:88:ARG:CB	1:A:91:LYS:HG2	2.43	0.46
1:B:44:ASN:ND2	2:B:203:HOH:O	2.48	0.46
1:C:26:LEU:HD11	1:C:59:LEU:HD21	1.97	0.45
1:C:122:LYS:O	1:C:125:ALA:N	2.49	0.45
1:D:26:LEU:HD11	1:D:59:LEU:HD21	1.98	0.45
1:D:5:VAL:CG1	1:D:6:GLU:N	2.79	0.45
1:A:53:ILE:O	1:A:57:GLU:HG3	2.17	0.45
1:C:82:ILE:HG23	1:C:83:HIS:N	2.32	0.45
1:A:115:GLN:HE21	1:A:115:GLN:HB2	1.58	0.45
1:B:26:LEU:C	1:B:26:LEU:HD23	2.36	0.45
1:D:76:GLN:O	1:D:80:GLN:HB2	2.17	0.45
1:A:9:THR:HB	1:A:51:ALA:HB1	1.99	0.45
1:A:119:GLU:HG2	1:A:121:VAL:HG13	2.00	0.44
1:D:75:ARG:HG3	1:D:120:TRP:CD2	2.52	0.44
1:D:134:ASN:HD21	1:D:138:ARG:HE	1.64	0.44
1:A:134:ASN:ND2	1:A:138:ARG:HE	2.16	0.43
1:C:77:GLY:HA2	1:C:81:TRP:CE3	2.53	0.43
1:A:5:VAL:CG1	1:A:6:GLU:N	2.81	0.43
1:B:76:GLN:O	1:B:80:GLN:HB2	2.19	0.43
1:A:4:GLN:HA	1:A:64:GLU:HG2	2.01	0.43
1:A:5:VAL:HG13	1:A:27:ARG:O	2.19	0.43
1:C:131:GLU:O	1:C:135:GLU:HG3	2.18	0.43
1:D:22:TYR:HB2	1:D:51:ALA:HB2	2.01	0.42
1:C:63:CYS:O	1:C:114:HIS:HB3	2.18	0.42
1:D:153:VAL:HG12	1:D:155:VAL:H	1.84	0.42
1:C:10:ASP:HA	2:C:234:HOH:O	2.17	0.42
1:C:111:LEU:HD22	1:C:116:ILE:HG13	2.01	0.42
1:A:64:GLU:HA	1:A:115:GLN:CG	2.44	0.41
1:C:66:ILE:HG23	1:C:66:ILE:O	2.20	0.41
1:D:22:TYR:CE2	1:D:37:ALA:HB3	2.55	0.41
1:A:29:ARG:HB2	1:A:29:ARG:NH1	2.35	0.41
1:B:77:GLY:HA3	1:B:104:TRP:CH2	2.56	0.41
1:C:92:THR:HG23	1:C:96:LYS:O	2.19	0.41
1:B:134:ASN:HD21	1:B:138:ARG:NE	2.07	0.41
1:C:33:LYS:HD2	1:C:35:PHE:HZ	1.85	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:9:THR:HB	1:A:51:ALA:CB	2.50	0.41
1:A:29:ARG:HB2	1:A:29:ARG:HH11	1.86	0.41
1:A:88:ARG:HB3	1:A:91:LYS:CG	2.49	0.41
1:B:64:GLU:HA	1:B:115:GLN:HB3	2.03	0.41
1:D:3:LYS:HD2	1:D:28:TYR:CZ	2.55	0.41
1:D:39:TYR:HA	1:D:146:LEU:O	2.21	0.41
1:B:77:GLY:HA2	1:B:81:TRP:CE3	2.56	0.40
1:D:63:CYS:O	1:D:114:HIS:HB3	2.21	0.40
1:A:29:ARG:HA	1:A:29:ARG:NE	2.36	0.40
1:C:39:TYR:HA	1:C:146:LEU:O	2.21	0.40
1:A:77:GLY:O	1:A:82:ILE:HG22	2.21	0.40
1:A:60:LYS:HE2	2:A:204:HOH:O	2.22	0.40

There are no symmetry-related clashes.

## 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	148/155 (96%)	135 (91%)	13 (9%)	0	100	100
1	B	145/155 (94%)	141 (97%)	4 (3%)	0	100	100
1	C	149/155 (96%)	145 (97%)	4 (3%)	0	100	100
1	D	148/155 (96%)	142 (96%)	4 (3%)	2 (1%)	11	5
All	All	590/620 (95%)	563 (95%)	25 (4%)	2 (0%)	41	37

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	127	HIS
1	D	128	PRO

### 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	122/125 (98%)	114 (93%)	8 (7%)	16	12
1	B	121/125 (97%)	119 (98%)	2 (2%)	60	65
1	C	123/125 (98%)	121 (98%)	2 (2%)	62	67
1	D	123/125 (98%)	118 (96%)	5 (4%)	30	28
All	All	489/500 (98%)	472 (96%)	17 (4%)	36	35

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	29	ARG
1	A	41	ARG
1	A	91	LYS
1	A	99	LYS
1	A	115	GLN
1	A	131	GLU
1	A	132	ARG
1	A	149	THR
1	B	72	GLN
1	B	113	GLN
1	C	2	LEU
1	C	27	ARG
1	D	29	ARG
1	D	67	LEU
1	D	99	LYS
1	D	122	LYS
1	D	127	HIS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (33) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	45	ASN
1	A	62	HIS

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Mol	Chain	Res	Type
1	A	72	GLN
1	A	105	GLN
1	A	134	ASN
1	A	143	ASN
1	A	152	GLN
1	B	62	HIS
1	B	72	GLN
1	B	76	GLN
1	B	80	GLN
1	B	84	ASN
1	B	105	GLN
1	B	113	GLN
1	B	115	GLN
1	B	134	ASN
1	B	143	ASN
1	B	152	GLN
1	C	4	GLN
1	C	45	ASN
1	C	84	ASN
1	C	105	GLN
1	C	134	ASN
1	C	143	ASN
1	C	152	GLN
1	D	45	ASN
1	D	62	HIS
1	D	76	GLN
1	D	105	GLN
1	D	130	ASN
1	D	134	ASN
1	D	143	ASN
1	D	152	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 monosaccharides 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](#)

There are no chain breaks in this entry.

## 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.