



wwPDB X-ray Structure Validation Summary Report ⓘ

Dec 20, 2023 – 06:37 AM EST

PDB ID : 1VDD
Title : Crystal structure of recombinational repair protein RecR
Authors : Lee, B.I.; Kim, K.H.; Suh, S.W.
Deposited on : 2004-03-20
Resolution : 2.50 Å(reported)

This is a wwPDB X-ray 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/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>.

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

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.36
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36

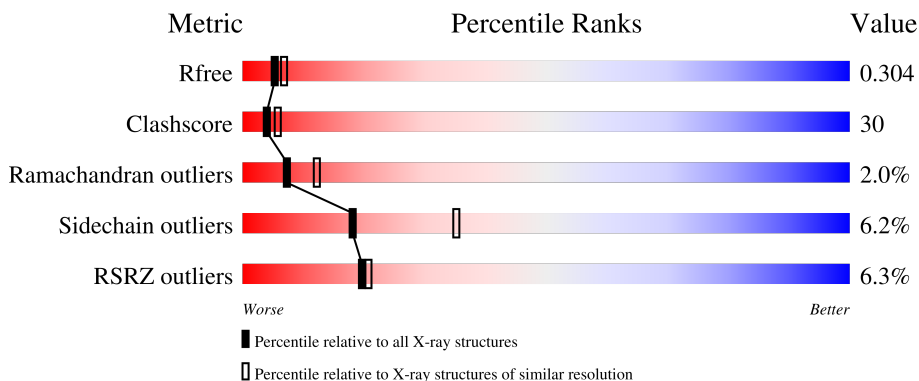
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 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))
R_{free}	130704	4661 (2.50-2.50)
Clashscore	141614	5346 (2.50-2.50)
Ramachandran outliers	138981	5231 (2.50-2.50)
Sidechain outliers	138945	5233 (2.50-2.50)
RSRZ outliers	127900	4559 (2.50-2.50)

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 ≥ 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 $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	228	
1	B	228	
1	C	228	
1	D	228	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	IMD	D	2026	-	-	-	X

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 6126 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 Recombination protein recR.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	199	1518	957	269	284	8	0	0	0
1	B	198	1510	952	268	283	7	0	0	0
1	C	196	1494	941	265	281	7	0	0	0
1	D	198	1510	952	268	283	7	0	0	0

There are 32 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	221	LEU	-	expression tag	UNP Q9ZNA2
A	222	GLU	-	expression tag	UNP Q9ZNA2
A	223	HIS	-	expression tag	UNP Q9ZNA2
A	224	HIS	-	expression tag	UNP Q9ZNA2
A	225	HIS	-	expression tag	UNP Q9ZNA2
A	226	HIS	-	expression tag	UNP Q9ZNA2
A	227	HIS	-	expression tag	UNP Q9ZNA2
A	228	HIS	-	expression tag	UNP Q9ZNA2
B	221	LEU	-	expression tag	UNP Q9ZNA2
B	222	GLU	-	expression tag	UNP Q9ZNA2
B	223	HIS	-	expression tag	UNP Q9ZNA2
B	224	HIS	-	expression tag	UNP Q9ZNA2
B	225	HIS	-	expression tag	UNP Q9ZNA2
B	226	HIS	-	expression tag	UNP Q9ZNA2
B	227	HIS	-	expression tag	UNP Q9ZNA2
B	228	HIS	-	expression tag	UNP Q9ZNA2
C	221	LEU	-	expression tag	UNP Q9ZNA2
C	222	GLU	-	expression tag	UNP Q9ZNA2
C	223	HIS	-	expression tag	UNP Q9ZNA2
C	224	HIS	-	expression tag	UNP Q9ZNA2
C	225	HIS	-	expression tag	UNP Q9ZNA2

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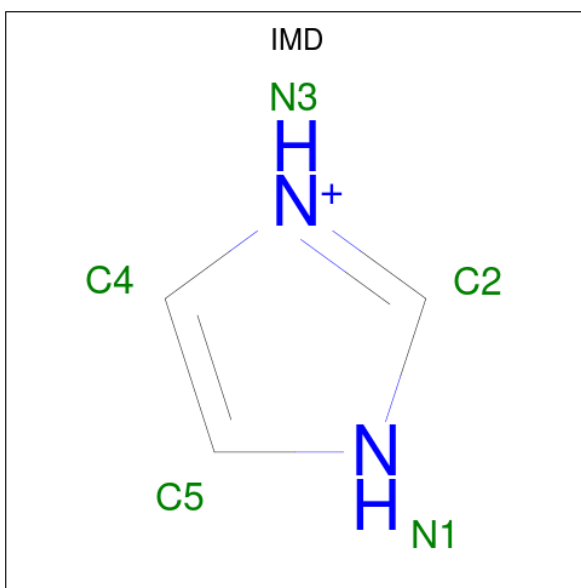
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Chain	Residue	Modelled	Actual	Comment	Reference
C	226	HIS	-	expression tag	UNP Q9ZNA2
C	227	HIS	-	expression tag	UNP Q9ZNA2
C	228	HIS	-	expression tag	UNP Q9ZNA2
D	221	LEU	-	expression tag	UNP Q9ZNA2
D	222	GLU	-	expression tag	UNP Q9ZNA2
D	223	HIS	-	expression tag	UNP Q9ZNA2
D	224	HIS	-	expression tag	UNP Q9ZNA2
D	225	HIS	-	expression tag	UNP Q9ZNA2
D	226	HIS	-	expression tag	UNP Q9ZNA2
D	227	HIS	-	expression tag	UNP Q9ZNA2
D	228	HIS	-	expression tag	UNP Q9ZNA2

- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total Zn 1 1	0	0
2	B	1	Total Zn 1 1	0	0
2	C	1	Total Zn 1 1	0	0
2	D	1	Total Zn 1 1	0	0

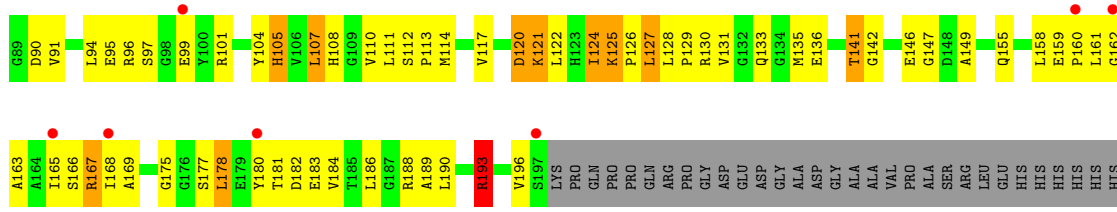
- Molecule 3 is IMIDAZOLE (three-letter code: IMD) (formula: C₃H₅N₂).



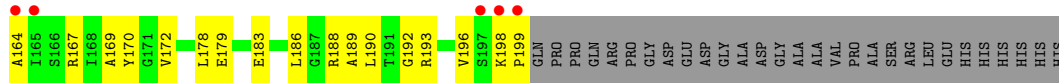
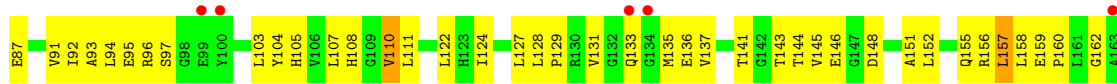
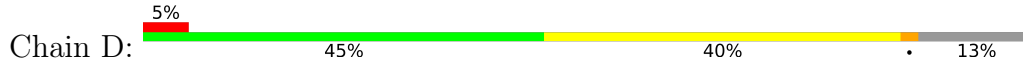
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	N	0	0
			5	3	2		
3	B	1	Total	C	N	0	0
			5	3	2		
3	C	1	Total	C	N	0	0
			5	3	2		
3	D	1	Total	C	N	0	0
			5	3	2		
3	D	1	Total	C	N	0	0
			5	3	2		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	12	Total	O	0	0
			12	12		
4	B	14	Total	O	0	0
			14	14		
4	C	22	Total	O	0	0
			22	22		
4	D	17	Total	O	0	0
			17	17		



● Molecule 1: Recombination protein recR



4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	106.22Å 121.39Å 154.99Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	43.39 – 2.50 43.81 – 2.50	Depositor EDS
% Data completeness (in resolution range)	89.5 (43.39-2.50) 97.3 (43.81-2.50)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.09	Depositor
$\langle I/\sigma(I) \rangle$ ¹	6.77 (at 2.48Å)	Xtrriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.233 , 0.301 0.240 , 0.304	Depositor DCC
R_{free} test set	3406 reflections (9.96%)	wwPDB-VP
Wilson B-factor (Å ²)	43.4	Xtrriage
Anisotropy	0.311	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 61.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	6126	wwPDB-VP
Average B, all atoms (Å ²)	47.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.98% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

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

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	0.37	0/1546	0.68	2/2099 (0.1%)
1	B	0.37	0/1538	0.67	1/2089 (0.0%)
1	C	0.40	0/1521	0.68	1/2066 (0.0%)
1	D	0.40	0/1538	0.66	0/2089
All	All	0.39	0/6143	0.67	4/8343 (0.0%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	107	LEU	N-CA-C	-6.33	93.92	111.00
1	B	60	CYS	N-CA-C	-6.20	94.25	111.00
1	A	60	CYS	N-CA-C	-5.84	95.22	111.00
1	A	107	LEU	N-CA-C	-5.83	95.26	111.00

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	1518	0	1553	94	0
1	B	1510	0	1540	101	1
1	C	1494	0	1521	126	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	D	1510	0	1540	99	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
3	A	5	0	5	0	0
3	B	5	0	5	0	0
3	C	5	0	5	3	0
3	D	10	0	10	2	0
4	A	12	0	0	1	0
4	B	14	0	0	2	0
4	C	22	0	0	1	0
4	D	17	0	0	2	0
All	All	6126	0	6179	369	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 30.

The worst 5 of 369 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:B:64:THR:HG21	1:B:69:CYS:HA	1.27	1.15
1:A:64:THR:HG21	1:A:69:CYS:HA	1.37	1.03
1:A:85:VAL:HG11	1:A:90:ASP:HB2	1.38	1.02
1:C:64:THR:HG21	1:C:69:CYS:HA	1.41	0.97
1:A:133:GLN:HG2	1:A:162:GLY:HA3	1.51	0.92

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:B:115:ASN:ND2	1:B:115:ASN:ND2[4_555]	2.19	0.01

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	197/228 (86%)	172 (87%)	20 (10%)	5 (2%)	5	8
1	B	196/228 (86%)	163 (83%)	27 (14%)	6 (3%)	4	5
1	C	194/228 (85%)	169 (87%)	20 (10%)	5 (3%)	5	8
1	D	196/228 (86%)	171 (87%)	25 (13%)	0	100	100
All	All	783/912 (86%)	675 (86%)	92 (12%)	16 (2%)	7	12

5 of 16 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	114	MET
1	A	142	GLY
1	B	99	GLU
1	C	105	HIS
1	C	178	LEU

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	166/188 (88%)	161 (97%)	5 (3%)	41	68
1	B	165/188 (88%)	154 (93%)	11 (7%)	16	31
1	C	163/188 (87%)	149 (91%)	14 (9%)	10	20
1	D	165/188 (88%)	154 (93%)	11 (7%)	16	31
All	All	659/752 (88%)	618 (94%)	41 (6%)	18	35

5 of 41 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	167	ARG
1	D	54	LEU

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Mol	Chain	Res	Type
1	C	193	ARG
1	D	28	LEU
1	D	81	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 14 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	133	GLN
1	C	108	HIS
1	D	123	HIS
1	D	79	GLN
1	D	108	HIS

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](#)

Of 9 ligands modelled in this entry, 4 are monoatomic - leaving 5 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
3	IMD	A	2027	-	3,5,5	0.61	0	4,5,5	0.44	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	IMD	B	2025	-	3,5,5	0.60	0	4,5,5	0.48	0
3	IMD	C	2024	-	3,5,5	0.70	0	4,5,5	0.46	0
3	IMD	D	2023	-	3,5,5	0.61	0	4,5,5	0.48	0
3	IMD	D	2026	-	3,5,5	0.63	0	4,5,5	0.57	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	IMD	A	2027	-	-	-	0/1/1/1
3	IMD	B	2025	-	-	-	0/1/1/1
3	IMD	C	2024	-	-	-	0/1/1/1
3	IMD	D	2023	-	-	-	0/1/1/1
3	IMD	D	2026	-	-	-	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	2024	IMD	3	0
3	D	2026	IMD	2	0

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](#)

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	199/228 (87%)	0.53	12 (6%) 21 22	17, 47, 68, 92	0
1	B	198/228 (86%)	0.63	19 (9%) 8 7	22, 48, 69, 102	0
1	C	196/228 (85%)	0.44	8 (4%) 37 40	24, 45, 69, 87	0
1	D	198/228 (86%)	0.36	11 (5%) 24 25	19, 43, 69, 92	0
All	All	791/912 (86%)	0.49	50 (6%) 20 21	17, 46, 69, 102	0

The worst 5 of 50 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	114	MET	6.0
1	C	162	GLY	4.8
1	C	165	ILE	4.6
1	C	2	LYS	4.4
1	D	199	PRO	4.4

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

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

6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q< 0.9’ lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	IMD	D	2026	5/5	0.77	0.41	52,54,61,63	0
3	IMD	D	2023	5/5	0.89	0.14	62,64,66,68	0
3	IMD	C	2024	5/5	0.89	0.24	13,32,46,47	0
3	IMD	B	2025	5/5	0.92	0.20	54,55,56,57	0
2	ZN	C	232	1/1	0.95	0.17	40,40,40,40	0
3	IMD	A	2027	5/5	0.95	0.14	65,67,68,69	0
2	ZN	B	231	1/1	0.98	0.15	31,31,31,31	0
2	ZN	D	233	1/1	0.99	0.16	30,30,30,30	0
2	ZN	A	230	1/1	0.99	0.16	24,24,24,24	0

6.5 Other polymers [i](#)

There are no such residues in this entry.