



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 22, 2020 – 01:14 am BST

PDB ID : 1BHM  
Title : RESTRICTION ENDONUCLEASE BAMHI COMPLEX WITH DNA  
Authors : Aggarwal, A.K.; Newman, M.  
Deposited on : 1995-07-12  
Resolution : 2.20 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](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) : 2.11

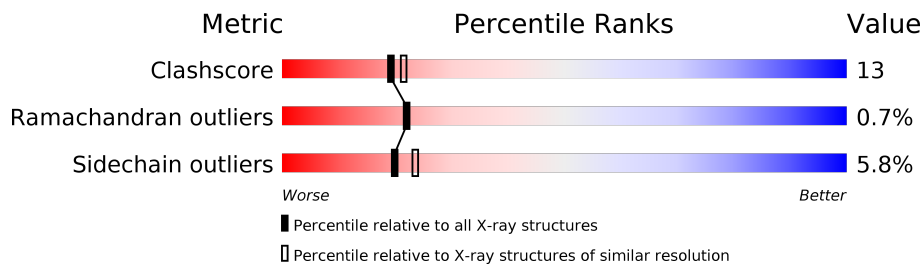
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.20 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	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)

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 on 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	C	12	
1	D	12	
2	A	213	
2	B	213	

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 3886 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 DNA chain called DNA (5'-D(\*TP\*AP\*TP\*GP\*GP\*AP\*TP\*CP\*CP\*AP\*TP\*A)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	C	12	Total 243	C 118	N 44	O 70	P 11	0	0	0
1	D	11	Total 222	C 108	N 39	O 65	P 10	0	0	0

- Molecule 2 is a protein called PROTEIN (BAMHI (E.C.3.1.21.4)).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	A	198	Total 1559	C 1005	N 246	O 300	S 8	0	0	0
2	B	208	Total 1647	C 1060	N 262	O 317	S 8	0	0	0

- Molecule 3 is water.


Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	C	24	Total 24	O 24	0	0
3	D	23	Total 23	O 23	0	0
3	A	79	Total 79	O 79	1	0
3	B	89	Total 89	O 89	0	0

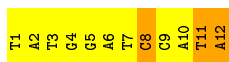
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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: DNA (5'-D(\*TP\*AP\*TP\*GP\*GP\*AP\*TP\*CP\*CP\*AP\*TP\*A)-3')

Chain C: 



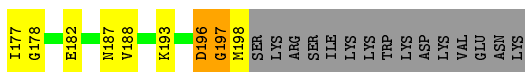
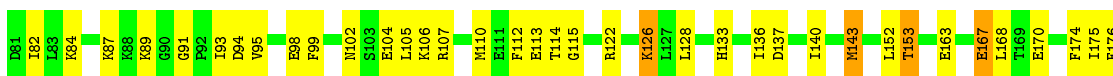
- Molecule 1: DNA (5'-D(\*TP\*AP\*TP\*GP\*GP\*AP\*TP\*CP\*CP\*AP\*TP\*A)-3')

Chain D: 



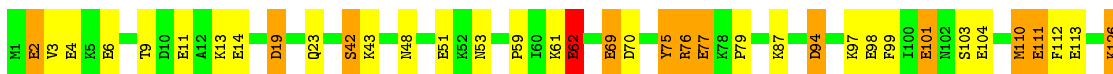
- Molecule 2: PROTEIN (BAMHI (E.C.3.1.21.4))

Chain A: 



- Molecule 2: PROTEIN (BAMHI (E.C.3.1.21.4))

Chain B: 



## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	108.80Å 81.90Å 68.80Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	10.00 – 2.20	Depositor
% Data completeness (in resolution range)	(Not available) (10.00-2.20)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	TNT	Depositor
R, $R_{free}$	0.189 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	3886	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	15.0	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	C	2.65	13/272 (4.8%)	2.83	33/418 (7.9%)
1	D	2.26	9/248 (3.6%)	2.88	37/381 (9.7%)
2	A	1.20	19/1592 (1.2%)	1.40	10/2158 (0.5%)
2	B	1.33	17/1682 (1.0%)	1.50	18/2279 (0.8%)
All	All	1.49	58/3794 (1.5%)	1.74	98/5236 (1.9%)

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 outliers	#Planarity outliers
2	A	1	0

The worst 5 of 58 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	62	GLU	CD-OE1	13.62	1.40	1.25
1	C	11	DT	C5-C6	-12.69	1.25	1.34
1	C	11	DT	C5-C7	11.97	1.57	1.50
2	B	135	GLU	CD-OE1	9.84	1.36	1.25
2	A	2	GLU	CD-OE1	9.19	1.35	1.25

The worst 5 of 98 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	5	DG	P-O5'-C5'	-16.25	94.90	120.90
2	B	19	ASP	CB-CG-OD2	-10.20	109.12	118.30
1	C	8	DC	C2-N1-C1'	9.75	129.53	118.80
1	C	2	DA	O4'-C1'-N9	-9.69	101.22	108.00
1	D	4	DG	P-O3'-C3'	9.48	131.07	119.70

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
2	A	198	MET	CA

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	C	243	0	137	3	0
1	D	222	0	127	10	0
2	A	1559	0	1520	53	0
2	B	1647	0	1615	34	0
3	A	79	0	0	4	0
3	B	89	0	0	4	0
3	C	24	0	0	0	0
3	D	23	0	0	0	0
All	All	3886	0	3399	90	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 13.

The worst 5 of 90 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)
2:A:80:LEU:HD21	2:A:93:ILE:HD12	1.64	0.77
2:A:24:GLN:O	2:A:28:GLU:HG3	1.84	0.77
2:A:21:LEU:HD22	2:A:99:PHE:HB3	1.69	0.72
1:D:3:DT:H2'	3:B:231:HOH:O	1.89	0.72
1:D:7:DT:OP2	2:A:153:THR:HG21	1.90	0.72

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	
2	A	196/213 (92%)	187 (95%)	7 (4%)	2 (1%)	15	14
2	B	206/213 (97%)	195 (95%)	10 (5%)	1 (0%)	29	31
All	All	402/426 (94%)	382 (95%)	17 (4%)	3 (1%)	22	22

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	207	LYS
2	A	102	ASN
2	A	197	GLY

### 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	
2	A	167/194 (86%)	158 (95%)	9 (5%)	22	26
2	B	179/194 (92%)	168 (94%)	11 (6%)	18	21
All	All	346/388 (89%)	326 (94%)	20 (6%)	20	23

5 of 20 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	42	SER
2	B	62	GLU
2	B	167	GLU

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Mol	Chain	Res	Type
2	A	153	THR
2	A	174	PHE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
2	A	125	ASN
2	B	23	GLN
2	B	27	ASN
2	B	125	ASN
2	B	172	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 carbohydrates 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

### 6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

### 6.4 Ligands

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers

EDS was not executed - this section is therefore empty.