



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 07:03 AM UTC

PDB ID : 2C9N / pdb_00002c9n
Title : Structure of the Epstein-Barr virus ZEBRA protein at approximately 3.5 Angstrom resolution
Authors : Petosa, C.; Morand, P.; Baudin, F.; Moulin, M.; Artero, J.B.; Muller, C.W.
Deposited on : 2005-12-13
Resolution : 3.30 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

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	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

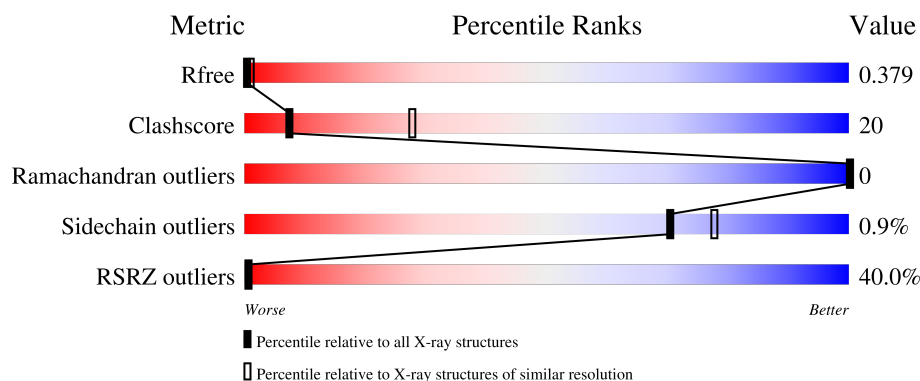
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.30 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}	180053	1169 (3.32-3.28)
Clashscore	190562	1209 (3.32-3.28)
Ramachandran outliers	187476	1188 (3.32-3.28)
Sidechain outliers	187428	1187 (3.32-3.28)
RSRZ outliers	180081	1169 (3.32-3.28)

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	11	
2	B	11	
3	Y	63	
3	Z	63	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 1414 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 5'-D(*CP*AP*CP*TP*GP*AP*CP*TP*CP*AP *T)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	11	Total	C	N	O	P	0	0	0
			218	106	38	64	10			

- Molecule 2 is a DNA chain called 5'-D(*CP*AP*TP*GP*AP*GP*TP*CP*AP*GP *T)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	11	Total	C	N	O	P	0	0	0
			224	108	42	64	10			

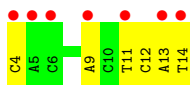
- Molecule 3 is a protein called BZLF1 TRANS-ACTIVATOR PROTEIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	Y	59	Total	C	N	O	S	0	0	0
			486	301	97	85	3			
3	Z	59	Total	C	N	O	S	0	0	0
			486	301	97	85	3			

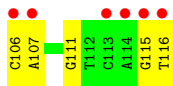
3 Residue-property plots [i](#)

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 and electron density. 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. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). 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.

- Molecule 1: 5'-D(*CP*AP*CP*TP*GP*AP*CP*TP*CP*AP *T)-3'



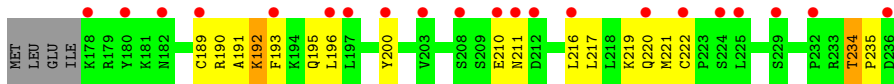
- Molecule 2: 5'-D(*CP*AP*TP*GP*AP*GP*TP*CP*AP*GP *T)-3'



- Molecule 3: BZLF1 TRANS-ACTIVATOR PROTEIN



- Molecule 3: BZLF1 TRANS-ACTIVATOR PROTEIN



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	185.30Å 36.37Å 26.47Å 90.00° 95.25° 90.00°	Depositor
Resolution (Å)	30.00 – 3.30 30.00 – 3.30	Depositor EDS
% Data completeness (in resolution range)	98.1 (30.00-3.30) 98.0 (30.00-3.30)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.48 (at 2.72Å)	Xtriage
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.368 , 0.366 0.350 , 0.379	Depositor DCC
R_{free} test set	209 reflections (4.49%)	wwPDB-VP
Wilson B-factor (Å ²)	41.2	Xtriage
Anisotropy	0.458	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 34.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.29$	Xtriage
Estimated twinning fraction	0.057 for -h-2*k,l	Xtriage
F_o, F_c correlation	0.79	EDS
Total number of atoms	1414	wwPDB-VP
Average B, all atoms (Å ²)	53.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 14.33% 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](#)

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	0.31	0/243	0.90	0/372
2	B	0.32	0/251	0.77	0/386
3	Y	0.74	2/492 (0.4%)	2.09	3/655 (0.5%)
3	Z	2.00	2/492 (0.4%)	1.22	7/655 (1.1%)
All	All	1.24	4/1478 (0.3%)	1.45	10/2068 (0.5%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	Z	192	LYS	C-N	41.85	1.87	1.33
3	Y	189	CYS	CB-SG	-11.94	1.41	1.81
3	Z	189	CYS	CB-SG	-11.87	1.42	1.81
3	Y	192	LYS	C-N	-7.47	1.23	1.33

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	Y	192	LYS	O-C-N	31.24	163.00	122.39
3	Y	192	LYS	CA-C-N	-26.88	70.93	122.53
3	Y	192	LYS	C-N-CA	-26.88	70.93	122.53
3	Z	192	LYS	O-C-N	13.65	136.29	122.09
3	Z	192	LYS	CA-C-N	-10.84	106.35	120.44
3	Z	192	LYS	C-N-CA	-10.84	106.35	120.44
3	Z	222	CYS	CA-C-N	5.73	125.85	119.32
3	Z	222	CYS	C-N-CA	5.73	125.85	119.32
3	Z	234	THR	CA-C-N	5.30	126.47	119.84
3	Z	234	THR	C-N-CA	5.30	126.47	119.84

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	218	0	126	5	1
2	B	224	0	126	4	0
3	Y	486	0	514	37	5
3	Z	486	0	514	25	5
All	All	1414	0	1280	55	6

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 20.

All (55) 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)
3:Z:192:LYS:C	3:Z:193:PHE:N	1.87	1.30
3:Y:189:CYS:O	3:Y:193:PHE:CD2	2.13	1.01
3:Z:191:ALA:O	3:Z:195:GLN:HG3	1.60	1.00
3:Y:192:LYS:O	3:Y:196:LEU:HB2	1.63	0.97
3:Y:197:LEU:HD22	3:Z:193:PHE:CE1	2.02	0.94
3:Y:189:CYS:SG	3:Y:193:PHE:HE2	1.95	0.89
3:Y:215:ARG:NH2	3:Z:210:GLU:OE2	2.06	0.89
1:A:12:DC:H41	3:Y:182:ASN:HD21	1.16	0.88
3:Y:189:CYS:O	3:Y:193:PHE:HD2	1.55	0.85
3:Y:189:CYS:SG	3:Y:193:PHE:CE2	2.69	0.84
2:B:111:DG:O6	3:Z:190:ARG:NH2	2.21	0.74
3:Z:191:ALA:O	3:Z:195:GLN:CG	2.35	0.72
3:Y:225:LEU:HD11	3:Y:230:ILE:HD11	1.74	0.69
3:Z:192:LYS:O	3:Z:196:LEU:N	2.24	0.69
3:Z:192:LYS:C	3:Z:193:PHE:CA	2.67	0.68
3:Y:215:ARG:HH21	3:Z:210:GLU:CD	2.03	0.65
3:Y:234:THR:HG23	3:Y:235:PRO:HD2	1.81	0.63
3:Y:218:LEU:HD21	3:Z:217:LEU:HD23	1.83	0.59
3:Y:190:ARG:O	3:Y:194:LYS:N	2.35	0.58
2:B:106:DC:H2''	2:B:107:DA:C8	2.39	0.58
3:Z:192:LYS:CA	3:Z:193:PHE:N	2.66	0.58
2:B:106:DC:H2''	2:B:107:DA:H8	1.70	0.56
3:Y:197:LEU:HD22	3:Z:193:PHE:HE1	1.60	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:12:DC:H41	3:Y:182:ASN:ND2	1.96	0.55
3:Z:217:LEU:O	3:Z:221:MET:HG2	2.06	0.55
1:A:11:DT:H72	3:Y:182:ASN:ND2	2.22	0.54
3:Z:191:ALA:HB1	3:Z:195:GLN:HE21	1.73	0.54
1:A:13:DA:H1'	1:A:14:DT:H5''	1.90	0.53
3:Z:191:ALA:O	3:Z:195:GLN:CB	2.57	0.53
3:Y:221:MET:C	3:Y:223:PRO:HD3	2.34	0.52
3:Z:216:LEU:HG	3:Z:220:GLN:NE2	2.25	0.51
3:Y:201:ARG:HG3	3:Z:200:TYR:CE1	2.45	0.51
1:A:9:DA:H2'	3:Y:190:ARG:NH1	2.27	0.50
3:Y:190:ARG:O	3:Y:194:LYS:HG2	2.12	0.50
3:Y:189:CYS:C	3:Y:193:PHE:HD2	2.18	0.49
3:Y:189:CYS:SG	3:Y:193:PHE:CD2	3.02	0.48
3:Y:211:ASN:HA	3:Z:211:ASN:OD1	2.13	0.48
3:Z:216:LEU:O	3:Z:220:GLN:HG2	2.12	0.48
3:Y:197:LEU:HD22	3:Z:193:PHE:CD1	2.46	0.48
3:Y:191:ALA:O	3:Y:194:LYS:N	2.47	0.47
2:B:115:DG:H2''	2:B:116:DT:OP2	2.16	0.45
3:Y:191:ALA:O	3:Y:195:GLN:HG3	2.16	0.45
3:Y:191:ALA:HA	3:Y:194:LYS:HB2	1.98	0.45
3:Y:189:CYS:O	3:Y:193:PHE:HB2	2.16	0.45
3:Y:198:GLN:HE22	3:Y:202:GLU:CD	2.25	0.45
3:Y:191:ALA:C	3:Y:194:LYS:H	2.26	0.43
3:Y:198:GLN:O	3:Y:202:GLU:HG3	2.18	0.43
3:Y:216:LEU:O	3:Y:220:GLN:HG3	2.19	0.42
3:Y:189:CYS:O	3:Y:193:PHE:CG	2.66	0.41
3:Y:189:CYS:O	3:Y:193:PHE:CB	2.68	0.41
3:Z:234:THR:HA	3:Z:235:PRO:HD3	1.87	0.41
3:Z:191:ALA:O	3:Z:195:GLN:N	2.43	0.41
3:Y:211:ASN:HD21	3:Z:210:GLU:CD	2.27	0.40
3:Y:211:ASN:HB2	3:Z:211:ASN:OD1	2.20	0.40
3:Y:197:LEU:CD2	3:Z:193:PHE:HE1	2.28	0.40

All (6) 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)
3:Y:236:ASP:O	3:Z:219:LYS:NZ[4_444]	0.55	1.65
3:Y:236:ASP:C	3:Z:219:LYS:CE[4_444]	0.91	1.29
3:Y:236:ASP:OXT	3:Z:219:LYS:CE[4_444]	1.04	1.16

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:Y:236:ASP:O	3:Z:219:LYS:CE[4_444]	1.48	0.72
3:Y:236:ASP:C	3:Z:219:LYS:NZ[4_444]	1.56	0.64
1:A:4:DC:C5'	1:A:14:DT:O3'[1_545]	2.02	0.18

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	
3	Y	57/63 (90%)	55 (96%)	2 (4%)	0	100	100
3	Z	57/63 (90%)	55 (96%)	2 (4%)	0	100	100
All	All	114/126 (90%)	110 (96%)	4 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	
3	Y	54/58 (93%)	53 (98%)	1 (2%)	50	68
3	Z	54/58 (93%)	54 (100%)	0	100	100
All	All	108/116 (93%)	107 (99%)	1 (1%)	70	78

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	Y	195	GLN

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

Mol	Chain	Res	Type
3	Y	182	ASN
3	Y	195	GLN
3	Y	198	GLN
3	Z	195	GLN
3	Z	220	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
3	Z	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	Z	192:LYS	C	193:PHE	N	1.87

6 Fit of model and data

6.1 Protein, DNA and RNA chains

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	11/11 (100%)	2.16	7 (63%) 0 0	34, 59, 71, 83	0
2	B	11/11 (100%)	2.55	6 (54%) 0 0	26, 45, 86, 87	0
3	Y	59/63 (93%)	1.68	22 (37%) 1 1	10, 46, 80, 91	1 (1%)
3	Z	59/63 (93%)	1.82	21 (35%) 1 1	17, 48, 80, 91	1 (1%)
All	All	140/148 (94%)	1.84	56 (40%) 1 1	10, 52, 83, 91	2 (1%)

All (56) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	Z	193	PHE	5.8
3	Z	229	SER	5.5
3	Y	200	TYR	5.0
3	Z	182	ASN	5.0
2	B	113	DC	4.4
3	Y	193	PHE	4.3
3	Z	180	TYR	4.2
3	Z	189	CYS	4.0
2	B	116	DT	3.9
3	Y	190	ARG	3.8
3	Z	216	LEU	3.7
2	B	115	DG	3.6
2	B	106	DC	3.5
3	Y	223	PRO	3.4
3	Y	202	GLU	3.3
3	Y	208	SER	3.2
2	B	114	DA	3.2
1	A	4	DC	3.2
3	Y	218	LEU	3.1
3	Y	182	ASN	3.0
3	Y	198	GLN	3.0

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Mol	Chain	Res	Type	RSRZ
3	Y	212	ASP	2.9
3	Z	220	GLN	2.9
1	A	9	DA	2.9
2	B	107	DA	2.9
3	Z	208	SER	2.8
3	Z	197	LEU	2.8
1	A	5	DA	2.8
3	Z	211	ASN	2.7
3	Z	210	GLU	2.7
3	Y	214	LEU	2.6
3	Z	212	ASP	2.4
1	A	11	DT	2.4
3	Z	203	VAL	2.4
3	Y	187	ARG	2.4
1	A	13	DA	2.4
3	Y	186	SER	2.4
3	Z	232	PRO	2.4
3	Z	236	ASP	2.3
3	Y	235	PRO	2.3
1	A	6	DC	2.3
3	Z	222	CYS	2.3
3	Z	178	LYS	2.3
3	Y	199	HIS	2.2
3	Z	200	TYR	2.2
3	Y	236	ASP	2.2
3	Y	221	MET	2.2
3	Y	219	LYS	2.2
1	A	14	DT	2.2
3	Z	224	SER	2.1
3	Y	180	TYR	2.1
3	Y	178	LYS	2.1
3	Y	230	ILE	2.1
3	Z	196	LEU	2.1
3	Z	225	LEU	2.1
3	Y	209	SER	2.0

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

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.