



# Full wwPDB X-ray Structure Validation Report ⓘ

May 14, 2020 – 06:21 pm BST

PDB ID : 1LMB  
Title : REFINED 1.8 ANGSTROM CRYSTAL STRUCTURE OF THE LAMBDA REPRESSOR-OPERATOR COMPLEX  
Authors : Beamer, L.J.; Pabo, C.O.  
Deposited on : 1991-11-05  
Resolution : 1.80 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) : 2.11

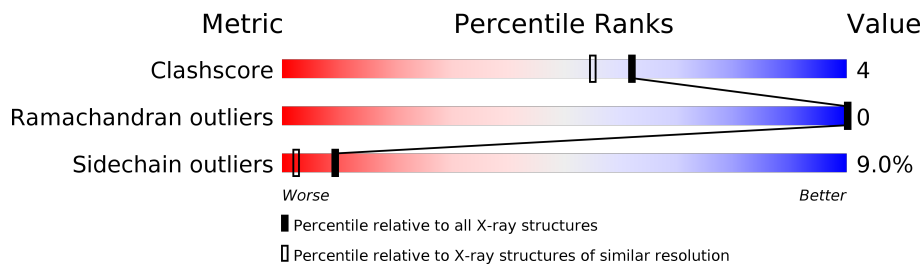
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.80 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	6793 (1.80-1.80)
Ramachandran outliers	138981	6697 (1.80-1.80)
Sidechain outliers	138945	6696 (1.80-1.80)

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	1	20	
2	2	20	
3	3	92	
3	4	92	

## 2 Entry composition i

There are 4 unique types of molecules in this entry. The entry contains 2334 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(\*AP\*AP\*TP\*AP\*CP\*CP\*AP\*CP\*TP\*GP\*GP\*CP\*GP\*GP\*TP\*GP\*A P\*TP\*AP\*T)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	1	20	409	196	77	117	19	0	0	0

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

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	2	20	405	195	72	119	19	0	0	0

- Molecule 3 is a protein called PROTEIN (LAMBDA REPRESSOR).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	3	87	670	422	112	133	3	0	0	0
3	4	92	710	447	120	140	3	0	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	1	36	Total	O	0	0
			36	36		
4	2	27	Total	O	0	0
			27	27		
4	3	48	Total	O	0	0
			48	48		
4	4	29	Total	O	0	0
			29	29		

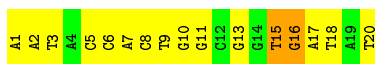
### 3 Residue-property plots

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(\*AP\*AP\*TP\*AP\*CP\*CP\*AP\*CP\*TP\*GP\*GP\*CP\*GP\*GP\*TP\*GP\*A P\*TP\*AP\*T)-3')

Chain 1: 



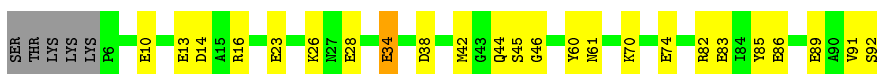
- Molecule 2: DNA (5'-D(\*TP\*AP\*TP\*AP\*TP\*CP\*AP\*CP\*CP\*GP\*CP\*CP\*AP\*GP\*TP\*GP\*G P\*TP\*AP\*T)-3')

Chain 2: 



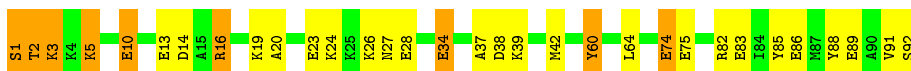
- Molecule 3: PROTEIN (LAMBDA REPRESSOR)

Chain 3: 



- Molecule 3: PROTEIN (LAMBDA REPRESSOR)

Chain 4: 



## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	37.22Å 68.72Å 57.03Å 90.00° 92.20° 90.00°	Depositor
Resolution (Å)	8.00 – 1.80	Depositor
% Data completeness (in resolution range)	(Not available) (8.00-1.80)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	X-PLOR, TNT	Depositor
R, $R_{free}$	0.189 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	2334	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	25.0	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	1	2.01	11/459 (2.4%)	2.04	24/707 (3.4%)
2	2	2.19	17/453 (3.8%)	2.08	27/697 (3.9%)
3	3	1.30	11/677 (1.6%)	1.38	9/906 (1.0%)
3	4	1.28	11/717 (1.5%)	1.51	15/958 (1.6%)
All	All	1.66	50/2306 (2.2%)	1.74	75/3268 (2.3%)

All (50) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	2	27	DA	N9-C4	-10.04	1.31	1.37
1	1	1	DA	N9-C4	-9.24	1.32	1.37
3	3	82	ARG	NE-CZ	8.67	1.44	1.33
2	2	37	DG	C3'-O3'	-7.74	1.33	1.44
1	1	3	DT	C1'-N1	-7.42	1.36	1.47
2	2	27	DA	N3-C4	-7.37	1.30	1.34
2	2	34	DG	C5-C4	-7.35	1.33	1.38
1	1	15	DT	C3'-O3'	-7.32	1.34	1.44
1	1	1	DA	N7-C5	-7.21	1.34	1.39
2	2	24	DA	C5-C4	7.10	1.43	1.38
3	3	83	GLU	CD-OE1	6.53	1.32	1.25
3	4	34	GLU	CD-OE1	6.41	1.32	1.25
3	3	85	TYR	CB-CG	-6.35	1.42	1.51
1	1	13	DG	C5-C4	-6.27	1.33	1.38
3	4	10	GLU	CD-OE1	6.25	1.32	1.25
1	1	6	DC	N1-C6	-6.17	1.33	1.37
3	4	3	LYS	N-CA	6.12	1.58	1.46
3	3	28	GLU	CD-OE2	6.10	1.32	1.25
1	1	17	DA	C5-C4	-6.03	1.34	1.38
3	4	75	GLU	CD-OE2	5.97	1.32	1.25
2	2	31	DC	C3'-O3'	-5.91	1.36	1.44
2	2	23	DT	C3'-O3'	-5.88	1.36	1.44
2	2	29	DC	C3'-O3'	-5.83	1.36	1.44
3	4	83	GLU	CD-OE2	5.80	1.32	1.25

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	4	2	THR	C-N	5.79	1.47	1.34
3	4	86	GLU	CD-OE2	5.75	1.31	1.25
2	2	26	DC	C1'-N1	-5.73	1.39	1.47
3	3	13	GLU	CD-OE1	5.70	1.31	1.25
1	1	5	DC	C3'-O3'	-5.68	1.36	1.44
3	3	34	GLU	CD-OE1	5.67	1.31	1.25
1	1	1	DA	C5-C4	5.67	1.42	1.38
2	2	29	DC	C1'-N1	5.66	1.56	1.49
3	4	74	GLU	CD-OE1	5.64	1.31	1.25
3	4	89	GLU	CD-OE1	5.64	1.31	1.25
2	2	29	DC	N1-C6	5.61	1.40	1.37
1	1	7	DA	C5-C4	-5.59	1.34	1.38
1	1	20	DT	C1'-N1	-5.43	1.39	1.47
2	2	37	DG	C5-C6	5.41	1.47	1.42
3	4	28	GLU	CD-OE2	5.33	1.31	1.25
3	3	74	GLU	CD-OE1	5.31	1.31	1.25
2	2	30	DG	N9-C4	-5.30	1.33	1.38
3	3	23	GLU	CD-OE1	5.21	1.31	1.25
3	4	13	GLU	CD-OE1	5.19	1.31	1.25
3	3	10	GLU	CD-OE2	5.15	1.31	1.25
2	2	24	DA	N3-C4	5.13	1.38	1.34
3	3	86	GLU	CD-OE1	5.13	1.31	1.25
2	2	32	DC	C2-N3	5.11	1.39	1.35
2	2	30	DG	N9-C8	-5.09	1.34	1.37
2	2	24	DA	N9-C4	5.06	1.40	1.37
3	3	89	GLU	CD-OE2	5.04	1.31	1.25

All (75) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	4	16	ARG	NE-CZ-NH1	11.17	125.89	120.30
2	2	36	DG	P-O3'-C3'	10.52	132.33	119.70
3	3	60	TYR	CB-CG-CD1	-10.32	114.81	121.00
2	2	37	DG	C4-N9-C1'	9.60	138.98	126.50
2	2	37	DG	C8-N9-C1'	-9.58	114.54	127.00
2	2	38	DT	P-O3'-C3'	9.49	131.09	119.70
3	4	60	TYR	CG-CD1-CE1	-9.40	113.78	121.30
3	4	16	ARG	NE-CZ-NH2	-8.99	115.81	120.30
3	4	60	TYR	CZ-CE2-CD2	-8.82	111.86	119.80
1	1	10	DG	P-O3'-C3'	8.75	130.20	119.70
1	1	18	DT	P-O3'-C3'	8.43	129.82	119.70
1	1	3	DT	P-O3'-C3'	8.31	129.67	119.70

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	3	60	TYR	CB-CG-CD2	8.24	125.94	121.00
2	2	36	DG	C4-N9-C1'	7.88	136.74	126.50
2	2	31	DC	C6-N1-C1'	-7.77	111.48	120.80
2	2	21	DT	C2-N1-C1'	-7.72	105.85	118.20
1	1	13	DG	O4'-C1'-N9	7.66	113.36	108.00
3	3	82	ARG	CD-NE-CZ	7.65	134.32	123.60
2	2	36	DG	C8-N9-C1'	-7.50	117.25	127.00
3	3	14	ASP	CB-CG-OD2	-7.45	111.60	118.30
2	2	21	DT	C6-N1-C1'	7.43	131.54	120.40
3	3	14	ASP	CB-CG-OD1	7.33	124.90	118.30
2	2	30	DG	O4'-C1'-N9	-7.12	103.02	108.00
3	4	60	TYR	CB-CG-CD2	-7.11	116.73	121.00
1	1	2	DA	C8-N9-C4	7.04	108.62	105.80
3	4	16	ARG	CD-NE-CZ	6.96	133.34	123.60
1	1	15	DT	C6-N1-C1'	6.96	130.84	120.40
1	1	11	DG	C4-N9-C1'	-6.91	117.52	126.50
2	2	31	DC	C2-N1-C1'	6.87	126.36	118.80
1	1	7	DA	P-O3'-C3'	6.82	127.88	119.70
1	1	20	DT	O4'-C1'-N1	-6.76	103.27	108.00
3	4	27	ASN	N-CA-CB	6.75	122.75	110.60
2	2	27	DA	C8-N9-C1'	-6.65	115.72	127.70
1	1	5	DC	C2-N1-C1'	-6.63	111.51	118.80
3	4	14	ASP	CB-CG-OD1	6.46	124.12	118.30
2	2	22	DA	P-O5'-C5'	-6.43	110.61	120.90
3	3	85	TYR	CB-CG-CD2	-6.41	117.15	121.00
2	2	27	DA	P-O3'-C3'	6.40	127.38	119.70
3	4	85	TYR	CD1-CE1-CZ	-6.37	114.07	119.80
1	1	11	DG	C8-N9-C1'	6.33	135.22	127.00
2	2	28	DC	P-O3'-C3'	6.25	127.20	119.70
3	4	14	ASP	CB-CG-OD2	-6.25	112.68	118.30
1	1	18	DT	O4'-C1'-N1	-6.24	103.63	108.00
1	1	5	DC	C6-N1-C1'	6.21	128.25	120.80
1	1	15	DT	C2-N1-C1'	-6.20	108.28	118.20
2	2	26	DC	C6-N1-C1'	-6.14	113.43	120.80
3	4	38	ASP	CB-CG-OD2	-6.13	112.78	118.30
2	2	39	DA	O4'-C1'-N9	-6.08	103.74	108.00
1	1	17	DA	P-O3'-C3'	5.94	126.83	119.70
1	1	1	DA	P-O3'-C3'	5.92	126.80	119.70
1	1	5	DC	P-O3'-C3'	5.92	126.80	119.70
2	2	31	DC	P-O3'-C3'	5.91	126.80	119.70
3	4	3	LYS	N-CA-CB	5.89	121.20	110.60
2	2	28	DC	O4'-C4'-C3'	-5.80	102.18	104.50

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	1	1	DA	C5-C6-N1	-5.79	114.80	117.70
1	1	8	DC	P-O3'-C3'	5.79	126.64	119.70
3	3	70	LYS	CA-CB-CG	-5.75	100.75	113.40
1	1	16	DG	O4'-C1'-N9	-5.71	104.00	108.00
2	2	21	DT	O4'-C1'-N1	-5.67	104.03	108.00
2	2	27	DA	C4-N9-C1'	5.66	136.49	126.30
3	4	38	ASP	CB-CG-OD1	5.55	123.30	118.30
3	3	38	ASP	CB-CG-OD2	-5.52	113.33	118.30
2	2	25	DT	P-O3'-C3'	5.45	126.24	119.70
1	1	10	DG	C8-N9-C1'	-5.41	119.96	127.00
2	2	35	DT	O4'-C1'-N1	-5.38	104.23	108.00
1	1	3	DT	O4'-C1'-N1	-5.36	104.25	108.00
3	4	88	TYR	CB-CG-CD1	-5.31	117.81	121.00
3	3	16	ARG	NE-CZ-NH1	5.30	122.95	120.30
1	1	9	DT	P-O3'-C3'	5.30	126.06	119.70
2	2	25	DT	P-O5'-C5'	-5.21	112.56	120.90
3	4	1	SER	N-CA-CB	5.17	118.25	110.50
2	2	37	DG	P-O3'-C3'	5.05	125.76	119.70
2	2	29	DC	O4'-C1'-N1	5.05	111.53	108.00
1	1	8	DC	C1'-O4'-C4'	-5.02	105.08	110.10
2	2	40	DT	O4'-C1'-N1	5.00	111.50	108.00

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	1	409	0	227	1	0
2	2	405	0	228	4	0
3	3	670	0	680	3	0
3	4	710	0	733	11	0
4	1	36	0	0	0	0
4	2	27	0	0	0	0
4	3	48	0	0	1	0
4	4	29	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	2334	0	1868	18	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 4.

All (18) 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)
3:4:5:LYS:NZ	3:4:5:LYS:HB2	1.97	0.79
3:4:5:LYS:HZ3	3:4:5:LYS:HB2	1.49	0.76
2:2:21:DT:H2''	2:2:22:DA:O5'	2.04	0.58
2:2:29:DC:C5	3:4:3:LYS:HG2	2.39	0.57
2:2:22:DA:H2''	2:2:23:DT:O5'	2.08	0.54
3:4:19:LYS:O	3:4:23:GLU:HG2	2.11	0.50
3:3:42:MET:HE2	3:3:46:GLY:HA3	1.96	0.47
3:4:74:GLU:N	3:4:74:GLU:OE1	2.46	0.46
1:1:15:DT:H2'	1:1:16:DG:C8	2.51	0.46
3:4:91:VAL:HG23	3:4:92:SER:N	2.31	0.45
3:4:37:ALA:HB1	3:4:42:MET:O	2.16	0.44
3:4:91:VAL:CG2	3:4:92:SER:N	2.81	0.43
3:3:61:ASN:ND2	4:3:119:HOH:O	2.49	0.42
3:4:64:LEU:HD12	3:4:64:LEU:HA	1.63	0.42
3:4:20:ALA:O	3:4:24:LYS:HD2	2.20	0.42
3:4:60:TYR:CE2	3:4:64:LEU:HD22	2.55	0.41
2:2:26:DC:H6	2:2:26:DC:H2'	1.62	0.40
3:3:34:GLU:HG2	3:3:44:GLN:HB2	2.03	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	
3	3	85/92 (92%)	84 (99%)	1 (1%)	0	100	100
3	4	90/92 (98%)	90 (100%)	0	0	100	100
All	All	175/184 (95%)	174 (99%)	1 (1%)	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	3	70/75 (93%)	66 (94%)	4 (6%)	20	8
3	4	75/75 (100%)	66 (88%)	9 (12%)	5	1
All	All	145/150 (97%)	132 (91%)	13 (9%)	9	2

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	3	26	LYS
3	3	45	SER
3	3	91	VAL
3	3	92	SER
3	4	1	SER
3	4	2	THR
3	4	5	LYS
3	4	10	GLU
3	4	16	ARG
3	4	26	LYS
3	4	34	GLU
3	4	39	LYS
3	4	82	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
3	3	9	GLN
3	3	61	ASN

### 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.