



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 11, 2024 – 07:19 PM EST

PDB ID : 2QDJ  
Title : Crystal structure of the Retinoblastoma protein N-domain provides insight into tumor suppression, ligand interaction and holoprotein architecture  
Authors : Hassler, M.; Mitnacht, S.; Pearl, L.H.  
Deposited on : 2007-06-21  
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.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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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  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtriage (Phenix) : 1.20.1  
EDS : 3.0  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.003 (Gargrove)  
Density-Fitness : 1.0.11  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.39

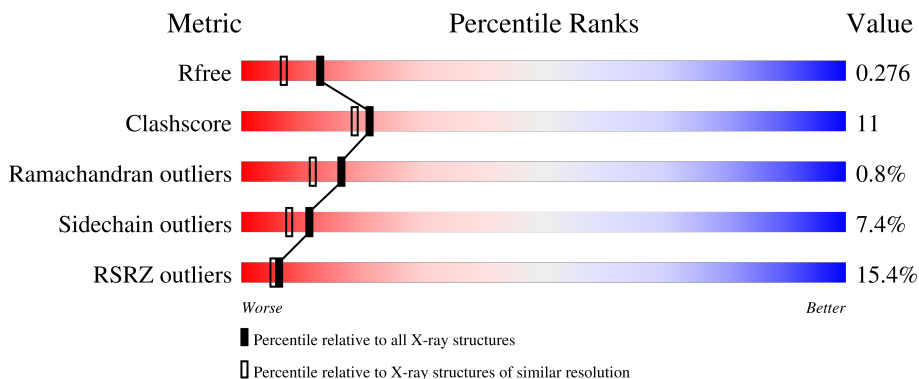
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.00 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))
$R_{free}$	164625	9409 (2.00-2.00)
Clashscore	180529	10737 (2.00-2.00)
Ramachandran outliers	177936	10628 (2.00-2.00)
Sidechain outliers	177891	10627 (2.00-2.00)
RSRZ outliers	164620	9409 (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  $\leq 5\%$ . 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	304	

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 2351 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 Retinoblastoma-associated protein.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
1	A	259	2117	1374	336	396	6	5	2	0	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	113	MSE	MET	modified residue	UNP P06400
A	148	MSE	MET	modified residue	UNP P06400
A	208	MSE	MET	modified residue	UNP P06400
A	219	MSE	MET	modified residue	UNP P06400
A	233	MSE	MET	modified residue	UNP P06400
A	300	MSE	MET	modified residue	UNP P06400

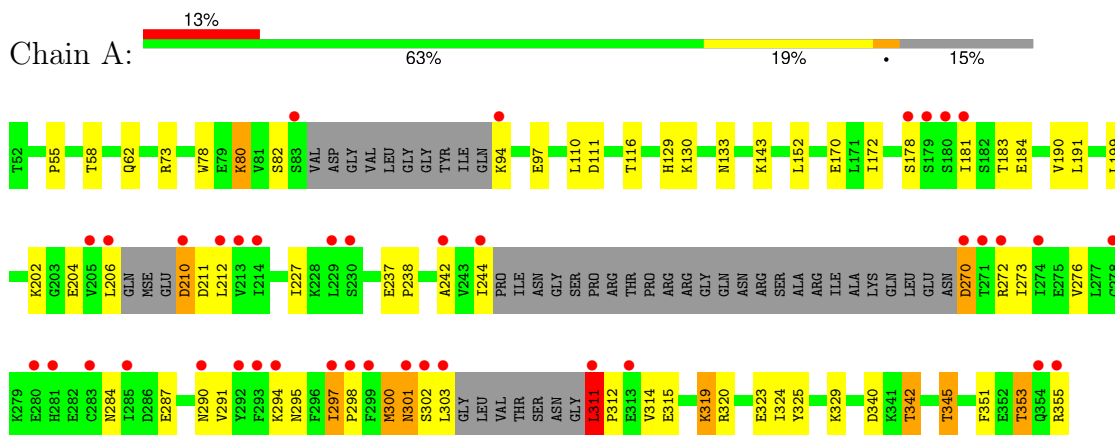
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	234	Total	O	0	0
			234	234		

### 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: Retinoblastoma-associated protein



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	72.30Å 106.65Å 98.19Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	51.10 – 2.00 51.10 – 2.00	Depositor EDS
% Data completeness (in resolution range)	99.2 (51.10-2.00) 99.2 (51.10-2.00)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.04 (at 2.00Å)	Xtrriage
Refinement program	REFMAC 5.2.0019	Depositor
R, $R_{free}$	0.228 , 0.276 0.223 , 0.276	Depositor DCC
$R_{free}$ test set	1288 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	29.6	Xtrriage
Anisotropy	0.485	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 59.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	2351	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	34.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.16% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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	0.39	0/2150	0.57	4/2890 (0.1%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	210	ASP	N-CA-C	-6.13	94.44	111.00
1	A	311	LEU	N-CA-C	5.44	125.68	111.00
1	A	270	ASP	N-CA-C	-5.10	97.23	111.00
1	A	311	LEU	CA-CB-CG	-5.02	103.76	115.30

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	2117	0	2142	46	0
2	A	234	0	0	6	0
All	All	2351	0	2142	46	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 11.

All (46) 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:A:129:HIS:ND1	1:A:345:THR:HG21	1.78	0.98
1:A:202:LYS:HZ1	1:A:210:ASP:N	1.77	0.81
1:A:300:MSE:HE1	1:A:311:LEU:HD13	1.61	0.81
1:A:244:ILE:C	1:A:272:ARG:HH22	1.83	0.80
1:A:129:HIS:ND1	1:A:345:THR:CG2	2.58	0.65
1:A:178:SER:HB3	1:A:184:GLU:HB2	1.79	0.64
1:A:291:VAL:HA	1:A:295:ASN:HD22	1.62	0.64
1:A:237:GLU:HG3	1:A:238:PRO:HA	1.80	0.64
1:A:311:LEU:HD12	1:A:312:PRO:HD2	1.84	0.59
1:A:78:TRP:O	1:A:82:SER:HB2	2.02	0.59
1:A:291:VAL:O	1:A:295:ASN:HB2	2.05	0.57
1:A:133:ASN:HD21	1:A:353:THR:HA	1.71	0.56
1:A:342:THR:CG2	2:A:361:HOH:O	2.53	0.56
1:A:284:ASN:ND2	1:A:287:GLU:HG3	2.21	0.55
1:A:342:THR:HG23	2:A:361:HOH:O	2.06	0.55
1:A:301:ASN:C	1:A:303:LEU:H	2.10	0.54
1:A:73:ARG:HG3	1:A:110:LEU:HD11	1.91	0.53
1:A:301:ASN:O	1:A:303:LEU:N	2.34	0.53
1:A:297:ILE:HG22	1:A:298:PRO:HD3	1.91	0.52
1:A:58:THR:O	1:A:62:GLN:HG3	2.12	0.50
1:A:227:ILE:HG21	1:A:273:ILE:HD12	1.93	0.50
1:A:172:ILE:HD13	1:A:227:ILE:HD11	1.93	0.50
1:A:290:ASN:O	1:A:294:LYS:HG2	2.13	0.49
1:A:311:LEU:HD12	1:A:311:LEU:HA	1.36	0.48
1:A:351:PHE:O	1:A:355:ARG:HG2	2.14	0.47
1:A:300:MSE:HE1	1:A:311:LEU:CD1	2.37	0.47
1:A:301:ASN:C	1:A:303:LEU:N	2.68	0.47
1:A:130:LYS:HD2	2:A:359:HOH:O	2.14	0.47
1:A:324:ILE:HD12	2:A:421:HOH:O	2.16	0.46
1:A:94:LYS:HE3	1:A:97:GLU:OE2	2.16	0.46
1:A:178:SER:HB3	1:A:184:GLU:N	2.31	0.46
1:A:244:ILE:O	1:A:244:ILE:HG22	2.16	0.45
1:A:116:THR:HG22	1:A:329:LYS:HA	1.98	0.45
1:A:319:LYS:O	1:A:319:LYS:HE3	2.16	0.45
1:A:170:GLU:HA	1:A:170:GLU:OE1	2.17	0.44
1:A:80:LYS:HD3	1:A:80:LYS:C	2.38	0.44
1:A:202:LYS:O	1:A:206:LEU:CB	2.66	0.43
1:A:55:PRO:HD2	2:A:397:HOH:O	2.19	0.42
1:A:242:ALA:HB2	1:A:276:VAL:HG21	2.01	0.42
1:A:270:ASP:C	1:A:272:ARG:H	2.22	0.42
1:A:340:ASP:OD1	1:A:342:THR:HB	2.20	0.42
1:A:191:LEU:HD23	1:A:191:LEU:HA	1.93	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:111:ASP:OD1	1:A:143:LYS:NZ	2.50	0.41
1:A:320:ARG:NH1	1:A:323:GLU:OE2	2.54	0.41
1:A:353:THR:CG2	2:A:409:HOH:O	2.68	0.40
1:A:181:ILE:O	1:A:181:ILE:CG2	2.69	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	249/304 (82%)	237 (95%)	10 (4%)	2 (1%)	16 12

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	302	SER
1	A	211	ASP

### 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	242/277 (87%)	224 (93%)	18 (7%)	11 8

All (18) residues with a non-rotameric sidechain are listed below:



Mol	Chain	Res	Type
1	A	80	LYS
1	A	152	LEU
1	A	183	THR
1	A	190	VAL
1	A	199	LEU
1	A	204	GLU
1	A	212	LEU
1	A	297	ILE
1	A	300	MSE
1	A	301	ASN
1	A	311	LEU
1	A	314	VAL
1	A	315	GLU
1	A	319	LYS
1	A	325	TYR
1	A	342	THR
1	A	345	THR
1	A	353	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	121	GLN
1	A	133	ASN
1	A	146	ASN
1	A	281	HIS
1	A	290	ASN
1	A	295	ASN
1	A	301	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 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](#)

There are no chain breaks in this entry.

## 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	254/304 (83%)	0.85	39 (15%) <b>6</b>   <b>5</b>	16, 32, 55, 65	2 (0%)

All (39) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	303	LEU	6.9
1	A	301	ASN	5.6
1	A	244	ILE	4.9
1	A	311	LEU	4.9
1	A	278	CYS	4.8
1	A	297	ILE	4.7
1	A	299	PHE	4.5
1	A	285	ILE	4.3
1	A	83	SER	4.0
1	A	206	LEU	4.0
1	A	355	ARG	3.8
1	A	181	ILE	3.7
1	A	180	SER	3.6
1	A	205	VAL	3.5
1	A	283	CYS	3.5
1	A	354	GLN	3.4
1	A	292	TYR	3.4
1	A	270	ASP	3.4
1	A	212	LEU	3.2
1	A	213	VAL	3.1
1	A	274	ILE	3.0
1	A	179	SER	3.0
1	A	210	ASP	3.0
1	A	178	SER	3.0
1	A	280	GLU	2.9
1	A	242	ALA	2.9
1	A	298	PRO	2.8

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Mol	Chain	Res	Type	RSRZ
1	A	313	GLU	2.8
1	A	271	THR	2.7
1	A	230	SER	2.5
1	A	94	LYS	2.5
1	A	302	SER	2.5
1	A	293	PHE	2.4
1	A	294	LYS	2.3
1	A	272	ARG	2.2
1	A	229	LEU	2.2
1	A	290	ASN	2.1
1	A	281	HIS	2.0
1	A	214	ILE	2.0

## 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](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.