



# Full wwPDB X-ray Structure Validation Report ⓘ

Jan 31, 2016 – 09:32 PM GMT

PDB ID : 1PIZ  
Title : RIBONUCLEOTIDE REDUCTASE R2 D84E MUTANT SOAKED WITH FERROUS IONS AT NEUTRAL PH  
Authors : Voegtli, W.C.; Sommerhalter, M.; Saleh, L.; Baldwin, J.; Bollinger Jr., J.M.; Rosenzweig, A.C.  
Deposited on : 2003-05-30  
Resolution : 1.90 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  
<http://wwpdb.org/validation/2016/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  
Mogul : 1.7 (RC4), CSD as536be (2015)  
Xtriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk26865

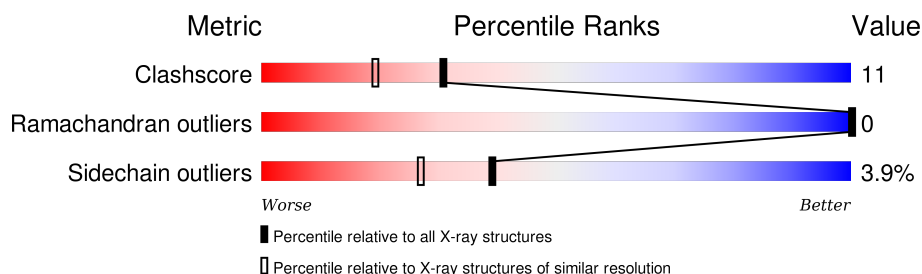
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.90 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	102246	5398 (1.90-1.90)
Ramachandran outliers	100387	5338 (1.90-1.90)
Sidechain outliers	100360	5339 (1.90-1.90)

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. 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.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	375	 71% 19% • 9%
1	B	375	 69% 18% • 9%

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 5829 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 Ribonucleoside-diphosphate reductase 1 beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	340	Total	C	N	O	S	0	0	0
			2784	1782	463	526	13			
1	B	340	Total	C	N	O	S	0	0	0
			2784	1782	463	526	13			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	84	GLU	ASP	ENGINEERED	UNP P69924
A	326	ASN	GLN	SEE REMARK 999	UNP P69924
B	84	GLU	ASP	ENGINEERED	UNP P69924
B	326	ASN	GLN	SEE REMARK 999	UNP P69924

- Molecule 2 is FE (III) ION (three-letter code: FE) (formula: Fe).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	2	Total	Fe	0	0
			2	2		
2	A	2	Total	Fe	0	0
			2	2		

- Molecule 3 is MERCURY (II) ION (three-letter code: HG) (formula: Hg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	6	Total	Hg	0	0
			6	6		
3	A	5	Total	Hg	0	0
			5	5		

- Molecule 4 is water.

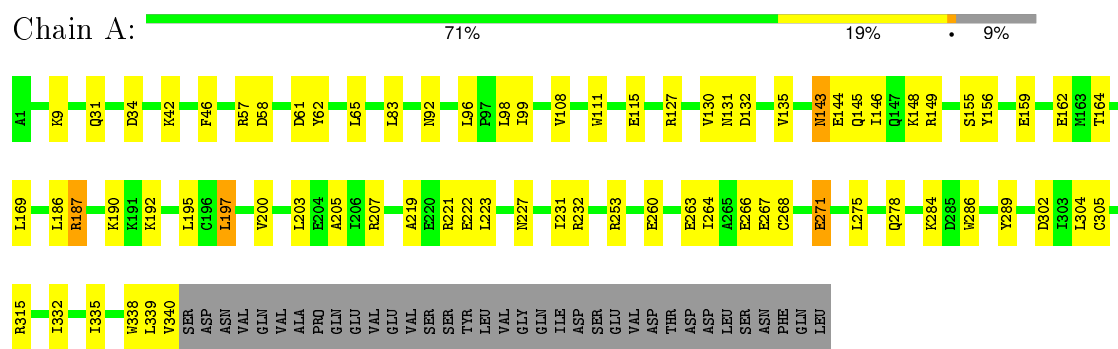
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	122	Total 122	O 122	0	0
4	B	124	Total 124	O 124	0	0

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

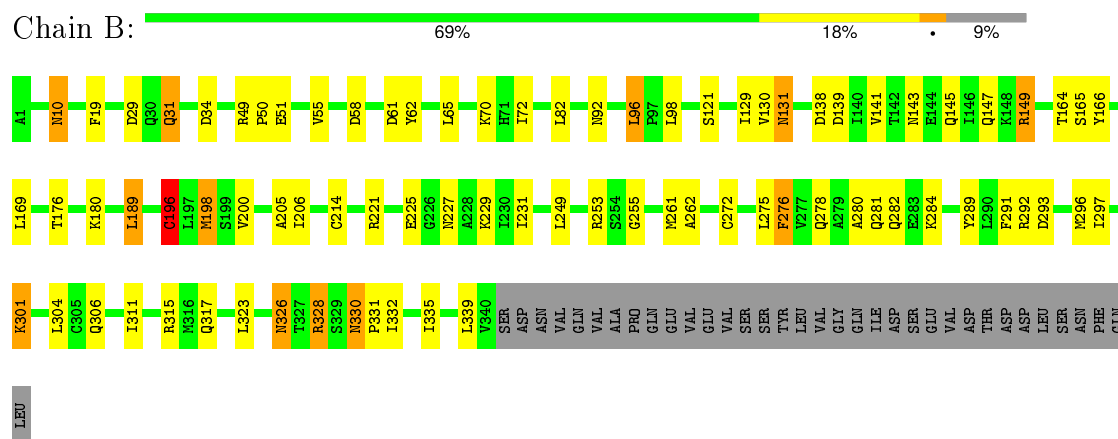
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according 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.

Note EDS was not executed.

- Molecule 1: Ribonucleoside-diphosphate reductase 1 beta chain



- Molecule 1: Ribonucleoside-diphosphate reductase 1 beta chain



## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	74.00 Å 84.20 Å 114.20 Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	23.85 – 1.90	Depositor
% Data completeness (in resolution range)	94.3 (23.85-1.90)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	CNS 1.0	Depositor
R, $R_{free}$	0.207 , 0.242	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	5829	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	18.0	wwPDB-VP

## 5 Model quality

### 5.1 Standard geometry

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

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	0/2848	0.52	0/3864
1	B	0.42	2/2848 (0.1%)	0.55	0/3864
All	All	0.37	2/5696 (0.0%)	0.53	0/7728

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	196	CYS	CB-SG	12.21	2.03	1.82
1	B	214	CYS	CB-SG	7.79	1.95	1.82

There are no bond angle outliers.

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	2784	0	2723	55	0
1	B	2784	0	2723	71	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
3	A	5	0	0	0	0
3	B	6	0	0	0	0
4	A	122	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	B	124	0	0	1	0
All	All	5829	0	5446	120	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 (120) 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:196:CYS:CB	1:B:196:CYS:SG	2.03	1.45
1:B:301:LYS:HE3	1:B:301:LYS:H	1.38	0.86
1:B:301:LYS:CE	1:B:301:LYS:H	1.90	0.84
1:A:127:ARG:HH21	1:B:29:ASP:HA	1.49	0.77
1:A:159:GLU:HB2	1:A:192:LYS:NZ	2.02	0.75
1:A:83:LEU:HD22	1:A:203:LEU:HD11	1.68	0.74
1:B:139:ASP:O	1:B:143:ASN:HB2	1.87	0.73
1:B:10:ASN:H	1:B:10:ASN:HD22	1.37	0.72
1:A:65:LEU:HD11	1:A:223:LEU:HD23	1.71	0.71
1:A:284:LYS:HE2	1:A:305:CYS:SG	2.33	0.68
1:B:292:ARG:HG3	1:B:293:ASP:OD1	1.92	0.68
1:A:31:GLN:HG3	1:A:34:ASP:HA	1.76	0.68
1:A:92:ASN:O	1:A:96:LEU:HB2	1.95	0.67
1:B:335:ILE:HG13	1:B:339:LEU:HD13	1.77	0.67
1:B:72:ILE:HG21	1:B:296:MET:HE3	1.76	0.67
1:B:221:ARG:HD3	1:B:297:ILE:HB	1.77	0.67
1:A:127:ARG:NH2	1:B:29:ASP:HA	2.10	0.65
1:B:198:MET:HG3	1:B:272:CYS:SG	2.37	0.65
1:B:141:VAL:O	1:B:147:GLN:HG3	1.97	0.64
1:A:155:SER:O	1:A:159:GLU:HG3	1.98	0.64
1:A:61:ASP:O	1:A:65:LEU:HD13	1.98	0.63
1:B:51:GLU:CD	1:B:51:GLU:H	2.02	0.61
1:A:187:ARG:HD3	1:A:260:GLU:OE1	2.00	0.61
1:B:326:ASN:N	1:B:326:ASN:HD22	1.97	0.61
1:A:145:GLN:HG2	1:A:289:TYR:CD1	2.36	0.61
1:A:159:GLU:HB2	1:A:192:LYS:HZ1	1.66	0.61
1:A:9:LYS:HE2	1:B:138:ASP:HB3	1.81	0.60
1:B:92:ASN:O	1:B:96:LEU:HB2	2.02	0.60
1:A:92:ASN:HA	1:A:96:LEU:HD13	1.85	0.58
1:B:249:LEU:O	1:B:253:ARG:HG2	2.04	0.58
1:B:145:GLN:HG3	1:B:289:TYR:CD1	2.40	0.57
1:A:263:GLU:O	1:A:267:GLU:HG3	2.04	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:31:GLN:HG3	1:B:34:ASP:HA	1.88	0.56
1:B:330:ASN:ND2	1:B:332:ILE:H	2.03	0.56
1:A:98:LEU:HD21	1:A:164:THR:HG23	1.88	0.56
1:A:156:TYR:OH	1:A:195:LEU:HB2	2.06	0.56
1:B:330:ASN:HD22	1:B:331:PRO:N	2.04	0.55
1:B:196:CYS:O	1:B:200:VAL:HG23	2.07	0.55
1:A:197:LEU:HA	1:A:200:VAL:HG12	1.87	0.55
1:A:203:LEU:CD1	1:A:207:ARG:HD2	2.37	0.55
1:A:203:LEU:HD13	1:A:207:ARG:HD2	1.89	0.54
1:B:82:LEU:HD13	1:B:82:LEU:C	2.27	0.54
1:B:301:LYS:HE3	1:B:301:LYS:N	2.17	0.53
1:B:281:GLN:HA	1:B:284:LYS:HD3	1.90	0.53
1:A:132:ASP:OD2	1:A:135:VAL:HG23	2.08	0.53
1:B:326:ASN:ND2	1:B:326:ASN:O	2.42	0.53
1:B:55:VAL:O	1:B:55:VAL:HG22	2.09	0.53
1:A:143:ASN:ND2	1:A:146:ILE:H	2.07	0.52
1:A:219:ALA:HB1	1:A:338:TRP:CH2	2.45	0.52
1:B:330:ASN:HD22	1:B:331:PRO:CD	2.23	0.52
1:A:332:ILE:HD12	1:A:335:ILE:HG21	1.93	0.51
1:B:129:ILE:HG13	1:B:130:VAL:HG13	1.93	0.51
1:B:255:GLY:HA2	1:B:262:ALA:HB2	1.93	0.51
1:B:145:GLN:HG2	4:B:490:HOH:O	2.11	0.50
1:A:143:ASN:C	1:A:143:ASN:HD22	2.15	0.50
1:A:99:ILE:HD11	1:A:108:VAL:HG21	1.93	0.50
1:A:187:ARG:HD2	1:A:264:ILE:HD11	1.93	0.50
1:B:317:GLN:HB2	1:B:323:LEU:HD21	1.92	0.50
1:B:10:ASN:HD22	1:B:10:ASN:N	2.03	0.50
1:B:130:VAL:O	1:B:131:ASN:HB3	2.11	0.50
1:B:326:ASN:N	1:B:326:ASN:ND2	2.60	0.49
1:A:332:ILE:O	1:A:335:ILE:HG12	2.12	0.49
1:B:227:ASN:O	1:B:231:ILE:HG12	2.13	0.49
1:B:335:ILE:HG13	1:B:339:LEU:CD1	2.42	0.48
1:A:169:LEU:HD22	1:B:166:TYR:CE2	2.49	0.48
1:B:304:LEU:C	1:B:304:LEU:HD23	2.33	0.48
1:B:335:ILE:O	1:B:339:LEU:HD13	2.14	0.48
1:B:306:GLN:HA	1:B:328:ARG:NH2	2.28	0.48
1:B:330:ASN:HD22	1:B:330:ASN:C	2.18	0.47
1:A:162:GLU:HG3	1:B:169:LEU:CD2	2.45	0.47
1:A:145:GLN:HG2	1:A:289:TYR:CG	2.49	0.47
1:B:145:GLN:HG3	1:B:289:TYR:CG	2.50	0.47
1:B:55:VAL:HG22	1:B:58:ASP:HB2	1.97	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:232:ARG:NH1	1:A:338:TRP:HA	2.29	0.47
1:B:62:TYR:O	1:B:70:LYS:HE3	2.15	0.46
1:B:149:ARG:HD2	1:B:282:GLN:HB3	1.96	0.46
1:A:304:LEU:HD23	1:A:304:LEU:C	2.36	0.46
1:B:145:GLN:NE2	1:B:145:GLN:HA	2.31	0.46
1:B:72:ILE:CD1	1:B:296:MET:HE2	2.46	0.46
1:B:280:ALA:O	1:B:284:LYS:HG3	2.16	0.46
1:A:186:LEU:HG	1:A:190:LYS:HE3	1.99	0.45
1:B:149:ARG:HH11	1:B:149:ARG:HG2	1.82	0.45
1:A:169:LEU:HD11	1:B:165:SER:HB3	1.99	0.45
1:B:291:PHE:HB2	1:B:301:LYS:HG3	1.99	0.45
1:B:225:GLU:O	1:B:229:LYS:HG3	2.16	0.45
1:B:301:LYS:HE2	1:B:301:LYS:H	1.79	0.44
1:B:130:VAL:O	1:B:131:ASN:CB	2.66	0.44
1:B:311:ILE:O	1:B:315:ARG:HG2	2.17	0.44
1:A:31:GLN:CG	1:A:34:ASP:HA	2.47	0.44
1:B:176:THR:HA	1:B:180:LYS:O	2.18	0.44
1:A:143:ASN:HD21	1:A:145:GLN:HB2	1.83	0.44
1:B:206:ILE:CD1	1:B:276:PHE:HE1	2.30	0.43
1:A:205:ALA:HB1	1:A:315:ARG:CD	2.49	0.43
1:B:98:LEU:HD21	1:B:164:THR:HG23	1.99	0.43
1:A:221:ARG:O	1:A:222:GLU:HB2	2.19	0.43
1:A:159:GLU:HB2	1:A:192:LYS:HZ2	1.77	0.43
1:B:205:ALA:HB1	1:B:315:ARG:CD	2.49	0.43
1:B:19:PHE:HE1	1:B:189:LEU:HD13	1.84	0.43
1:A:130:VAL:HG22	1:A:131:ASN:N	2.33	0.43
1:B:339:LEU:HD12	1:B:339:LEU:N	2.34	0.43
1:B:50:PRO:HB3	1:B:121:SER:HA	2.01	0.43
1:B:275:LEU:C	1:B:275:LEU:HD23	2.39	0.42
1:B:72:ILE:HD13	1:B:296:MET:HE2	2.00	0.42
1:B:31:GLN:HB3	1:B:31:GLN:HE21	1.68	0.42
1:A:197:LEU:O	1:A:200:VAL:HG12	2.19	0.42
1:A:111:TRP:O	1:A:115:GLU:HG2	2.19	0.42
1:A:271:GLU:O	1:A:275:LEU:HG	2.20	0.42
1:A:253:ARG:HH12	1:A:266:GLU:HA	1.85	0.42
1:B:72:ILE:CG2	1:B:296:MET:HE3	2.48	0.42
1:A:227:ASN:O	1:A:231:ILE:HG12	2.20	0.42
1:A:339:LEU:O	1:A:340:VAL:C	2.58	0.41
1:B:49:ARG:HA	1:B:50:PRO:HD3	1.92	0.41
1:A:62:TYR:O	1:A:65:LEU:HB2	2.20	0.41
1:A:197:LEU:O	1:A:200:VAL:CG1	2.68	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:149:ARG:HD3	1:A:286:TRP:HB2	2.03	0.41
1:A:197:LEU:CA	1:A:200:VAL:HG12	2.51	0.40
1:A:42:LYS:HE3	1:A:46:PHE:CZ	2.56	0.40
1:A:197:LEU:HA	1:A:200:VAL:CG1	2.50	0.40
1:A:144:GLU:O	1:A:148:LYS:HB2	2.21	0.40
1:B:61:ASP:O	1:B:65:LEU:HG	2.21	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	338/375 (90%)	331 (98%)	7 (2%)	0	100	100
1	B	338/375 (90%)	329 (97%)	9 (3%)	0	100	100
All	All	676/750 (90%)	660 (98%)	16 (2%)	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	
1	A	306/340 (90%)	297 (97%)	9 (3%)	50	40
1	B	306/340 (90%)	291 (95%)	15 (5%)	31	18

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
All	All	612/680 (90%)	588 (96%)	24 (4%)	39	27

All (24) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	57	ARG
1	A	58	ASP
1	A	143	ASN
1	A	187	ARG
1	A	197	LEU
1	A	268	CYS
1	A	271	GLU
1	A	278	GLN
1	A	302	ASP
1	B	10	ASN
1	B	31	GLN
1	B	96	LEU
1	B	131	ASN
1	B	149	ARG
1	B	189	LEU
1	B	196	CYS
1	B	198	MET
1	B	261	MET
1	B	276	PHE
1	B	278	GLN
1	B	301	LYS
1	B	326	ASN
1	B	328	ARG
1	B	330	ASN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (19) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	63	GLN
1	A	131	ASN
1	A	143	ASN
1	A	147	GLN
1	A	227	ASN
1	A	246	GLN
1	A	306	GLN
1	A	336	ASN

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Mol	Chain	Res	Type
1	B	10	ASN
1	B	21	GLN
1	B	31	GLN
1	B	63	GLN
1	B	128	ASN
1	B	131	ASN
1	B	145	GLN
1	B	281	GLN
1	B	326	ASN
1	B	330	ASN
1	B	336	ASN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

## 5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 5.6 Ligand geometry ⓘ

Of 15 ligands modelled in this entry, 15 are monoatomic - leaving 0 for Mogul analysis.

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.

No monomer is involved in short contacts.

## 5.7 Other polymers ⓘ

There are no such residues in this entry.

## 5.8 Polymer linkage issues ⓘ

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 will therefore be empty.

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

EDS was not executed - this section will therefore be empty.

### 6.3 Carbohydrates ⓘ

EDS was not executed - this section will therefore be empty.

### 6.4 Ligands ⓘ

EDS was not executed - this section will therefore be empty.

### 6.5 Other polymers ⓘ

EDS was not executed - this section will therefore be empty.