



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 06:12 AM GMT

PDB ID : 2WCA  
Title : BTGH84 IN COMPLEX WITH N-BUTYL PUGNAC  
Authors : He, Y.; Davies, G.J.  
Deposited on : 2009-03-10  
Resolution : 2.30 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](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) : 1.9-1692  
EDS : rb-20026688  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Refmac : 5.8.0135  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk26865

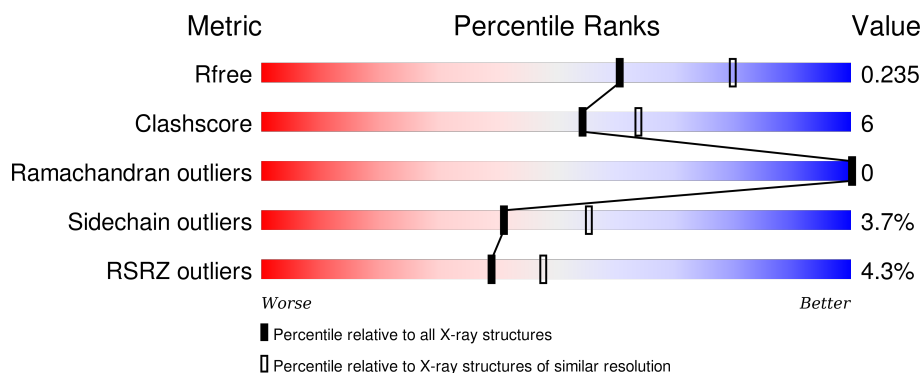
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.30 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))
$R_{free}$	91344	3852 (2.30-2.30)
Clashscore	102246	4452 (2.30-2.30)
Ramachandran outliers	100387	4410 (2.30-2.30)
Sidechain outliers	100360	4409 (2.30-2.30)
RSRZ outliers	91569	3857 (2.30-2.30)

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.

Mol	Chain	Length	Quality of chain
1	A	716	

## 2 Entry composition [i](#)

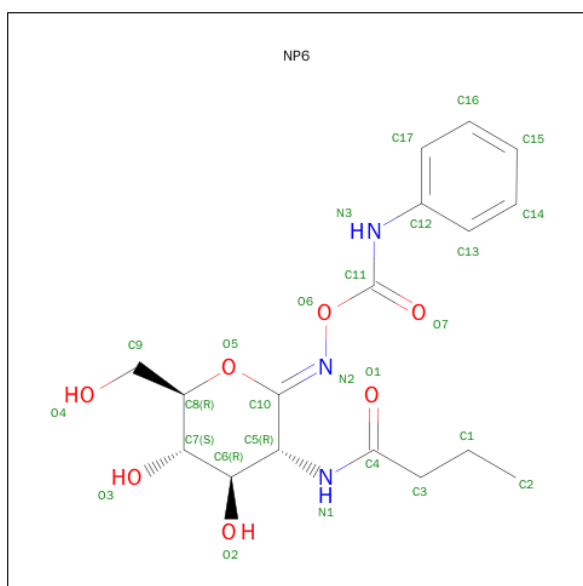
There are 4 unique types of molecules in this entry. The entry contains 4925 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 O-GLCNACASE BT\_4395.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	578	Total	C	N	O	S	0	0	0
			4703	3009	793	885	16			

- Molecule 2 is [[(3R,4R,5S,6R)-3-(BUTANOYLAMINO)-4,5-DIHYDROXY-6-(HYDROXYMETHYL)OXAN-2-YLIDENE]AMINO] N-PHENYLCARBAMATE (three-letter code: NP6) (formula: C<sub>17</sub>H<sub>23</sub>N<sub>3</sub>O<sub>7</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			27	17	3	7		

- Molecule 3 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Ca	0	0
			1	1		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	194	Total 194	O 194	0	0

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 ( $\text{RSRZ} > 2$ ). 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.

Chain A:

Residue	Amino Acid	Category
1	GLN	Green
2	ASN	Green
3	VAL	Green
4	SER	Green
5	LYS	Green
6	Q6	Green
7	L12	Green
8	I13	Green
9	V14	Green
10	L21	Green
11	P22	Green
12	A23	Green
13	V24	Green
14	Q25	Green
15	L26	Green
16	G30	Green
17	E31	Green
18	E32	Green
19	L41	Green
20	L45	Green
21	S46	Green
22	GLY	Green
23	LYS	Green
24	GLN	Green
25	SER	Green
26	SER	Green
27	LYS	Green
28	G54	Green
29	M55	Green
30	S71	Green
31	R72	Green
32	Q73	Green
33	I74	Green
34	Y81	Green
35	Y82	Green
36	L83	Green
37	S84	Green
38	V85	Green
39	N86	Green
40	E87	Green
41	K88	Green
42	E89	Green
43	R93	Green
44	L104	Green
45	L110	Green
46	D113	Green

## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	186.88Å 52.54Å 82.10Å 90.00° 98.34° 90.00°	Depositor
Resolution (Å)	46.23 – 2.30 46.23 – 2.30	Depositor EDS
% Data completeness (in resolution range)	100.0 (46.23-2.30) 100.0 (46.23-2.30)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.38 (at 2.29Å)	Xtriage
Refinement program	REFMAC 5.5.0082	Depositor
R, $R_{free}$	0.195 , 0.242 0.194 , 0.235	Depositor DCC
$R_{free}$ test set	1812 reflections (5.39%)	DCC
Wilson B-factor (Å <sup>2</sup> )	37.2	Xtriage
Anisotropy	0.224	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 43.1	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	0 of 35431 reflections	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	4925	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	32.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.05% 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, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: CA, NP6

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	0.61	0/4826	0.65	0/6547

There are no bond length outliers.

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	4703	0	4587	60	0
2	A	27	0	23	1	0
3	A	1	0	0	0	0
4	A	194	0	0	3	0
All	All	4925	0	4610	60	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 6.

All (60) 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:170:TYR:HE1	1:A:178:LEU:HD23	1.41	0.83
1:A:164:GLY:H	1:A:165:PRO:HD3	1.53	0.72
1:A:178:LEU:HD12	1:A:179:PRO:HD2	1.75	0.69
1:A:438:GLU:HG3	1:A:441:MET:HG3	1.79	0.65
1:A:292:ASN:N	1:A:292:ASN:OD1	2.30	0.65
1:A:291:GLY:C	1:A:292:ASN:OD1	2.37	0.63
1:A:88:LYS:HG3	1:A:89:GLU:HG2	1.80	0.62
1:A:170:TYR:CE1	1:A:178:LEU:HD23	2.29	0.60
1:A:563:PRO:O	1:A:567:ARG:HD3	2.01	0.60
1:A:539:PHE:O	1:A:543:GLN:HG2	2.03	0.58
1:A:178:LEU:CD1	1:A:179:PRO:HD2	2.33	0.58
1:A:438:GLU:HG3	1:A:441:MET:CG	2.34	0.58
1:A:318:ILE:HG13	1:A:336:ILE:HG21	1.85	0.58
1:A:456:GLU:HG3	1:A:458:LYS:HB3	1.87	0.57
1:A:81:TYR:CE2	1:A:123:ASP:HB3	2.41	0.56
1:A:282:TYR:HH	1:A:286:TRP:HZ3	1.55	0.55
1:A:71:SER:HA	1:A:74:ILE:HD12	1.89	0.54
1:A:205:ALA:HB1	1:A:240:PHE:CE1	2.44	0.51
1:A:337:TRP:CE2	2:A:900:NP6:H11C	2.45	0.51
1:A:456:GLU:CG	1:A:458:LYS:HB3	2.41	0.50
1:A:141:TRP:O	1:A:146:ARG:NH2	2.44	0.50
1:A:456:GLU:C	1:A:458:LYS:H	2.14	0.50
1:A:125:PRO:HB3	1:A:392:TRP:CE3	2.47	0.49
1:A:535:GLN:NE2	1:A:588:THR:HG22	2.27	0.48
1:A:133:VAL:HG21	1:A:337:TRP:CZ3	2.49	0.47
1:A:14:VAL:HA	1:A:119:VAL:HG12	1.96	0.47
1:A:164:GLY:N	1:A:165:PRO:HD3	2.27	0.46
1:A:41:LEU:O	1:A:45:LEU:HD22	2.16	0.46
1:A:131:GLY:O	1:A:370:VAL:HA	2.16	0.46
1:A:262:ASP:HA	1:A:266:ALA:HB3	1.98	0.46
1:A:378:GLU:HG3	1:A:490:PRO:HB2	1.98	0.46
1:A:98:ARG:HG3	1:A:199:GLU:HB3	1.98	0.46
1:A:557:ALA:HB1	1:A:561:ILE:HB	1.97	0.46
1:A:86:ASN:HA	1:A:118:GLU:HG3	1.97	0.45
1:A:83:LEU:HD23	1:A:83:LEU:C	2.36	0.45
1:A:456:GLU:HB3	4:A:2149:HOH:O	2.17	0.45
1:A:308:MET:HA	1:A:335:TYR:O	2.16	0.44
1:A:5:LEU:HD11	1:A:110:LEU:HD21	1.98	0.44
1:A:527:LYS:HE2	1:A:527:LYS:HA	1.98	0.44
1:A:22:PRO:HD3	1:A:55:MET:HE3	2.00	0.44
1:A:462:LYS:HE3	1:A:466:GLU:OE1	2.17	0.44
1:A:298:GLY:HA3	1:A:330:ILE:HA	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:25:TYR:CE1	1:A:45:LEU:HG	2.54	0.43
1:A:238:ALA:HA	1:A:276:VAL:O	2.18	0.43
1:A:340:PHE:CD1	1:A:341:PRO:HA	2.53	0.43
1:A:288:ASN:HB3	4:A:2087:HOH:O	2.17	0.43
1:A:221:LEU:HD12	1:A:221:LEU:HA	1.96	0.43
1:A:81:TYR:CZ	1:A:123:ASP:HB3	2.54	0.42
1:A:574:LYS:HB2	4:A:2192:HOH:O	2.19	0.42
1:A:297:LEU:O	1:A:301:LEU:HB2	2.19	0.42
1:A:149:GLN:HE22	1:A:384:ILE:HD13	1.84	0.41
1:A:146:ARG:NH2	1:A:165:PRO:HB3	2.35	0.41
1:A:41:LEU:HB2	1:A:104:LEU:HD11	2.03	0.41
1:A:147:LEU:O	1:A:151:LYS:HG3	2.21	0.41
1:A:178:LEU:CG	1:A:179:PRO:HD2	2.51	0.41
1:A:164:GLY:H	1:A:165:PRO:CD	2.30	0.41
1:A:83:LEU:HD23	1:A:84:SER:N	2.37	0.40
1:A:341:PRO:HD2	1:A:373:PRO:HA	2.03	0.40
1:A:168:ASP:OD2	1:A:171:HIS:HD2	2.05	0.40
1:A:219:ARG:HH11	1:A:219:ARG:HB3	1.87	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	574/716 (80%)	549 (96%)	25 (4%)	0	<a href="#">100</a> <a href="#">100</a>

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	507/630 (80%)	488 (96%)	19 (4%)	41	55

All (19) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	6	GLN
1	A	12	LEU
1	A	21	LEU
1	A	27	LEU
1	A	45	LEU
1	A	72	ARG
1	A	219	ARG
1	A	220	ASP
1	A	221	LEU
1	A	223	LEU
1	A	225	LYS
1	A	258	LEU
1	A	292	ASN
1	A	297	LEU
1	A	301	LEU
1	A	337	TRP
1	A	371	THR
1	A	396	LYS
1	A	459	ASN

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

Mol	Chain	Res	Type
1	A	6	GLN
1	A	10	GLN
1	A	149	GLN
1	A	156	ASN
1	A	189	GLN
1	A	529	ASN
1	A	535	GLN

### 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 2 ligands modelled in this entry, 1 is monoatomic - leaving 1 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the chemical component dictionary. The Link column lists molecule types, if any, to which the group is linked. 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  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# $ Z  > 2$	Counts	RMSZ	# $ Z  > 2$
2	NP6	A	900	-	24,28,28	1.33	4 (16%)	24,37,37	1.00	2 (8%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the chemical component dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NP6	A	900	-	-	0/15/38/38	0/2/2/2

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	900	NP6	C12-N3	-2.93	1.36	1.41
2	A	900	NP6	O5-C8	-2.76	1.42	1.46
2	A	900	NP6	O6-N2	-2.63	1.38	1.44
2	A	900	NP6	C10-N2	2.38	1.33	1.27

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	900	NP6	C5-N1-C4	2.08	125.88	121.78
2	A	900	NP6	C12-N3-C11	2.14	129.86	126.39

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	900	NP6	1	0

## 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	578/716 (80%)	0.18	25 (4%)	39 48	14, 30, 52, 61	0

All (25) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	575	PHE	3.8
1	A	578	GLN	3.8
1	A	210	GLN	3.8
1	A	290	ASN	3.6
1	A	113	ASP	3.4
1	A	583	HIS	3.2
1	A	589	ASP	3.2
1	A	30	GLY	3.2
1	A	454	PHE	3.1
1	A	457	GLY	3.1
1	A	24	VAL	3.0
1	A	214	TRP	2.9
1	A	31	GLU	2.8
1	A	292	ASN	2.7
1	A	539	PHE	2.7
1	A	580	PHE	2.6
1	A	582	ALA	2.6
1	A	573	VAL	2.4
1	A	581	ASN	2.4
1	A	32	GLU	2.2
1	A	576	PHE	2.1
1	A	459	ASN	2.1
1	A	247	GLU	2.0
1	A	45	LEU	2.0
1	A	574	LYS	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 carbohydrates in this entry.

## 6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
2	NP6	A	900	27/27	0.93	0.17	0.41	26,33,43,44	0
3	CA	A	901	1/1	0.89	0.12	-	66,66,66,66	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.