



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 15, 2017 – 01:08 am GMT

PDB ID : 5FJS  
Title : Bacterial Beta-glucosidase reveals the structural and functional basis of genetic defects in human glucocerebrosidase 2 (GBA2)  
Authors : Charoenwattanasatien, R.; Pengthaisong, S.; Breen, I.; Mutoha, R.; Sansenya, S.; Hua, Y.; Tankrathok, A.; Wu, L.; Songsiriritthigul, C.; Tanaka, H.; Williams, S.J.; Davies, G.J.; Kurisu, G.; Ketudat Cairns, J.R.  
Deposited on : 2015-10-12  
Resolution : 2.60 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
Xtriage (Phenix)	:	1.9-1692
EDS	:	trunk28620
Percentile statistics	:	20161228.v01 (using entries in the PDB archive December 28th 2016)
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)	:	recalc28949

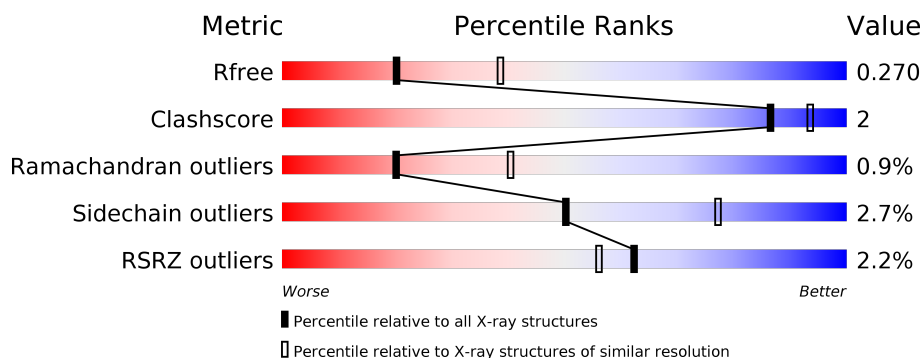
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.60 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))
$R_{free}$	100719	2542 (2.60-2.60)
Clashscore	112137	2895 (2.60-2.60)
Ramachandran outliers	110173	2848 (2.60-2.60)
Sidechain outliers	110143	2848 (2.60-2.60)
RSRZ outliers	101464	2550 (2.60-2.60)

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	787	<div> <div>2%</div> <div> <div></div> <div>87%</div> <div>5% • 7%</div> </div> </div>
1	B	787	<div> <div>2%</div> <div> <div></div> <div>80%</div> <div>9% 11%</div> </div> </div>

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 11158 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 GLUCOSYLCERAMIDASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	733	Total	C	N	O	S	0	2	1
			5689	3672	919	1072	26			
1	B	702	Total	C	N	O	S	0	1	1
			5389	3480	870	1012	27			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	20	MET	-	EXPRESSION TAG	UNP F6BL85
B	20	MET	-	EXPRESSION TAG	UNP F6BL85

- Molecule 2 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	1	Total	Ca	0	0
			1	1		
2	A	1	Total	Ca	0	0
			1	1		

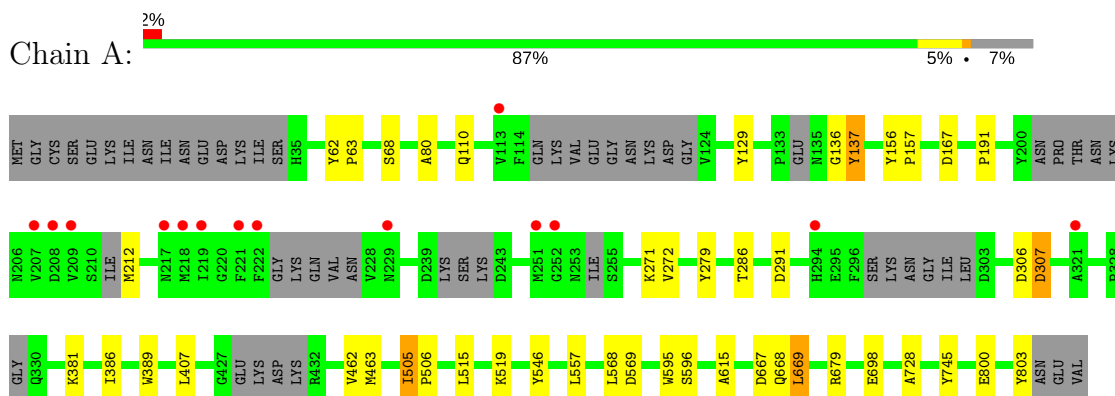
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	56	Total	O	0	0
			56	56		
3	B	22	Total	O	0	0
			22	22		

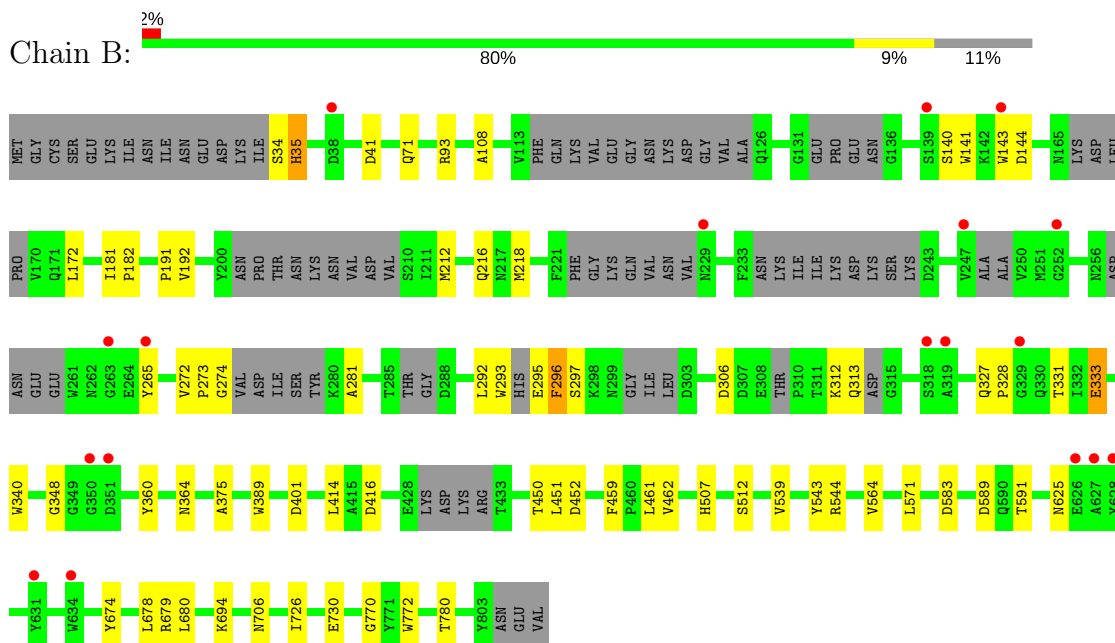
### 3 Residue-property plots

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 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: GLUCOSYLCERAMIDASE



#### • Molecule 1: GLUCOSYLCERAMIDASE



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 61	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	187.97Å 187.97Å 99.08Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	162.61 – 2.60 45.15 – 2.59	Depositor EDS
% Data completeness (in resolution range)	100.0 (162.61-2.60) 99.4 (45.15-2.59)	Depositor EDS
$R_{merge}$	0.11	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.75 (at 2.58Å)	Xtriage
Refinement program	REFMAC 5.8.0135	Depositor
R, $R_{free}$	0.206 , 0.266 0.213 , 0.270	Depositor DCC
$R_{free}$ test set	3081 reflections (5.29%)	DCC
Wilson B-factor (Å <sup>2</sup> )	60.3	Xtriage
Anisotropy	0.147	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.27 , 58.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.031 for h,-h-k,-l	Xtriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	11158	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	61.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 1.93% 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](#)

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

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	0.67	0/5853	0.78	2/7954 (0.0%)
1	B	0.64	0/5542	0.75	2/7536 (0.0%)
All	All	0.65	0/11395	0.77	4/15490 (0.0%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	401	ASP	CB-CG-OD1	5.82	123.53	118.30
1	B	589	ASP	CB-CG-OD1	5.75	123.47	118.30
1	A	569	ASP	CB-CG-OD1	5.36	123.13	118.30
1	A	569	ASP	CB-CG-OD2	-5.16	113.65	118.30

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	5689	0	5164	22	0
1	B	5389	0	4792	30	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	56	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	22	0	0	0	0
All	All	11158	0	9956	52	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 2.

All (52) 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:360:TYR:CE2	1:B:360:TYR:CG	2.69	0.77
1:B:34:SER:O	1:B:35:HIS:CB	2.47	0.62
1:B:141:TRP:CD1	1:B:141:TRP:N	2.68	0.60
1:A:595:TRP:O	1:A:596:SER:HB3	2.01	0.60
1:B:192:VAL:HG21	1:B:375:ALA:HB2	1.85	0.58
1:B:312:LYS:O	1:B:313:GLN:CB	2.50	0.58
1:B:182:PRO:HG2	1:B:389:TRP:CD2	2.38	0.57
1:A:668:GLN:HG3	1:A:669:LEU:HG	1.86	0.57
1:A:80:ALA:HB1	1:A:191:PRO:HB3	1.87	0.57
1:A:386:ILE:HA	1:A:389:TRP:CD1	2.41	0.55
1:A:306:ASP:O	1:A:307:ASP:HB2	2.08	0.54
1:B:141:TRP:HD1	1:B:141:TRP:N	2.07	0.53
1:A:62:TYR:HB2	1:A:63:PRO:HD2	1.92	0.52
1:B:218:MET:HB2	1:B:265:TYR:CZ	2.45	0.51
1:B:333:GLU:O	1:B:333:GLU:HG3	2.10	0.51
1:B:292:LEU:O	1:B:296:PHE:CB	2.59	0.51
1:B:544:ARG:HB2	1:B:678:LEU:HD11	1.93	0.51
1:B:543:TYR:CE2	1:B:680:LEU:HD21	2.47	0.49
1:B:182:PRO:HD2	1:B:389:TRP:CD1	2.48	0.48
1:B:181:ILE:HG22	1:B:182:PRO:O	2.13	0.48
1:B:71:GLN:OE1	1:B:93:ARG:HD3	2.15	0.46
1:A:279:TYR:CG	1:A:279:TYR:O	2.68	0.46
1:A:595:TRP:O	1:A:596:SER:CB	2.64	0.46
1:A:386:ILE:HA	1:A:389:TRP:HD1	1.80	0.45
1:B:331:THR:O	1:B:331:THR:HG23	2.17	0.45
1:B:108:ALA:HB3	1:B:216:GLN:HB2	1.99	0.44
1:A:156:TYR:CG	1:A:157:PRO:HA	2.52	0.44
1:B:726:ILE:O	1:B:730:GLU:HG3	2.17	0.44
1:A:279:TYR:O	1:A:279:TYR:CD2	2.71	0.44
1:B:770:GLY:HA2	1:B:772:TRP:CZ3	2.53	0.44
1:A:568:LEU:HD11	1:A:615:ALA:HB2	1.99	0.43
1:A:515:LEU:HD12	1:A:519:LYS:CD	2.49	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:595:TRP:CE2	1:A:728:ALA:HB2	2.54	0.43
1:B:450:THR:HG23	1:B:507:HIS:CE1	2.53	0.43
1:B:331:THR:CG2	1:B:331:THR:O	2.67	0.43
1:B:295:GLU:HA	1:B:296:PHE:CB	2.47	0.43
1:A:505:ILE:HD13	1:A:506:PRO:HD2	2.01	0.42
1:B:539:VAL:HG22	1:B:564:VAL:HG13	2.00	0.42
1:B:414:LEU:HD22	1:B:461:LEU:HD21	2.02	0.42
1:A:745[B]:TYR:HD1	1:A:803:TYR:CE2	2.38	0.41
1:A:515:LEU:HD12	1:A:519:LYS:HD2	2.01	0.41
1:A:407:LEU:HD21	1:A:800:GLU:HG3	2.01	0.41
1:A:136:GLY:O	1:A:137:TYR:O	2.38	0.41
1:B:272:VAL:O	1:B:274:GLY:N	2.53	0.41
1:A:546:TYR:HB2	1:A:557:LEU:HD21	2.03	0.41
1:B:191:PRO:HB2	1:B:340:TRP:CD1	2.56	0.41
1:B:452:ASP:HB2	1:B:591:THR:HB	2.03	0.41
1:A:462:VAL:HG13	1:A:463:MET:HG3	2.03	0.40
1:B:327:GLN:O	1:B:328:PRO:C	2.58	0.40
1:A:110:GLN:OE1	1:A:129:TYR:HB2	2.22	0.40
1:B:140:SER:O	1:B:293:TRP:CD1	2.74	0.40
1:B:459:PHE:HA	1:B:462:VAL:HG12	2.04	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles ⓘ

### 5.3.1 Protein backbone ⓘ

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	713/787 (91%)	658 (92%)	51 (7%)	4 (1%)	28 53
1	B	671/787 (85%)	611 (91%)	52 (8%)	8 (1%)	15 32
All	All	1384/1574 (88%)	1269 (92%)	103 (7%)	12 (1%)	20 40

All (12) Ramachandran outliers are listed below:



Mol	Chain	Res	Type
1	A	137	TYR
1	A	307	ASP
1	B	35	HIS
1	B	144	ASP
1	B	273	PRO
1	B	296	PHE
1	B	297	SER
1	B	348	GLY
1	A	272	VAL
1	B	281	ALA
1	A	271	LYS
1	B	143	TRP

### 5.3.2 Protein sidechains ⓘ

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	547/675 (81%)	536 (98%)	11 (2%)	60	83
1	B	505/675 (75%)	488 (97%)	17 (3%)	42	69
All	All	1052/1350 (78%)	1024 (97%)	28 (3%)	50	77

All (28) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	68	SER
1	A	167	ASP
1	A	212	MET
1	A	286	THR
1	A	291	ASP
1	A	381	LYS
1	A	505	ILE
1	A	667	ASP
1	A	669	LEU
1	A	679	ARG
1	A	698	GLU
1	B	41	ASP

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Mol	Chain	Res	Type
1	B	172	LEU
1	B	212	MET
1	B	306	ASP
1	B	333	GLU
1	B	364	ASN
1	B	416	ASP
1	B	451	LEU
1	B	512	SER
1	B	571	LEU
1	B	583	ASP
1	B	625	ASN
1	B	674	TYR
1	B	679	ARG
1	B	694	LYS
1	B	706	ASN
1	B	780	THR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	632	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](#)

Of 2 ligands modelled in this entry, 2 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 ⓘ

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	733/787 (93%)	-0.26	14 (1%)	67 61	34, 55, 93, 112	31 (4%)
1	B	702/787 (89%)	-0.12	18 (2%)	56 49	37, 62, 93, 108	53 (7%)
All	All	1435/1574 (91%)	-0.19	32 (2%)	62 56	34, 59, 93, 112	84 (5%)

All (32) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	321	ALA	3.9
1	B	627	ALA	3.5
1	B	319	ALA	3.4
1	B	628	TYR	3.4
1	B	634	TRP	3.4
1	A	251	MET	3.4
1	A	219	ILE	3.2
1	A	294	HIS	3.1
1	A	218	MET	3.0
1	A	221	PHE	3.0
1	B	318	SER	2.9
1	A	252	GLY	2.8
1	A	229	ASN	2.8
1	A	217	ASN	2.8
1	A	207	VAL	2.7
1	B	350	GLY	2.7
1	B	351	ASP	2.7
1	A	208	ASP	2.6
1	B	229	ASN	2.5
1	B	38	ASP	2.5
1	B	263	GLY	2.5
1	B	143	TRP	2.4
1	B	626	GLU	2.3
1	A	113	VAL	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	209	VAL	2.3
1	B	247	VAL	2.3
1	B	329	GLY	2.1
1	B	252	GLY	2.1
1	B	631	TYR	2.1
1	B	139	SER	2.1
1	A	222	PHE	2.0
1	B	265	TYR	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	CA	A	1804	1/1	0.97	0.12	-0.13	62,62,62,62	0
2	CA	B	1804	1/1	0.93	0.06	-2.16	74,74,74,74	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.