



# wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 8, 2018 – 10:57 pm GMT

PDB ID : 5NX2  
Title : Crystal structure of thermostabilised full-length GLP-1R in complex with a truncated peptide agonist at 3.7 Å resolution  
Authors : Rappas, M.; Jazayeri, A.; Brown, A.J.H.; Kean, J.; Errey, J.C.; Robertson, N.; Fiez-Vandal, C.; Andrews, S.P.; Congreve, M.; Bortolato, A.; Mason, J.S.; Baig, A.H.; Teobald, I.; Dore, A.S.; Weir, M.; Cooke, R.M.; Marshall, F.H.  
Deposited on : 2017-05-09  
Resolution : 3.70 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.7.3 (157068), CSD as539be (2018)  
Xtriage (Phenix) : 1.13  
EDS : trunk30967  
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)  
Refmac : 5.8.0158  
CCP4 : 7.0 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk30967

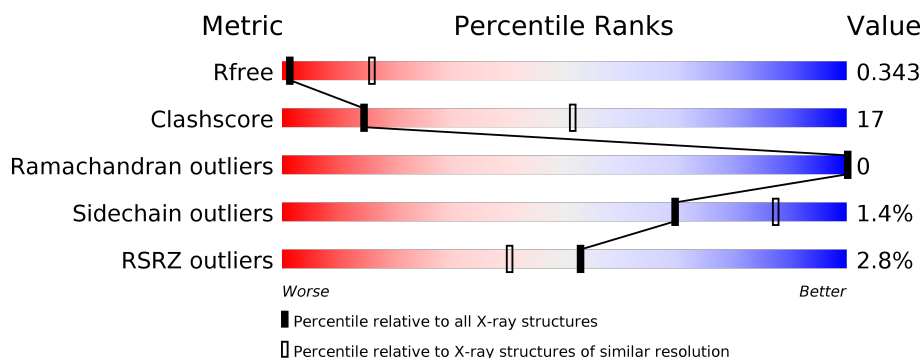
# 1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.70 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))
$R_{free}$	111664	1413 (3.90-3.50)
Clashscore	122126	1524 (3.90-3.50)
Ramachandran outliers	120053	1470 (3.90-3.50)
Sidechain outliers	120020	1467 (3.90-3.50)
RSRZ outliers	108989	1298 (3.90-3.50)

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	422	<div> <div>3%</div> <div>66%</div> <div>26%</div> <div>8%</div> </div>
2	B	10	<div> <div>50%</div> <div>30%</div> <div>20%</div> </div>

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	NAG	A	602	-	-	-	X
3	NAG	A	603	X	-	-	-
4	SOG	A	604	-	-	X	-
4	SOG	A	606	X	-	-	-

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 3410 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 Glucagon-like peptide 1 receptor.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	389	Total	C	N	O	S	0	0	0
			3201	2113	522	547	19			

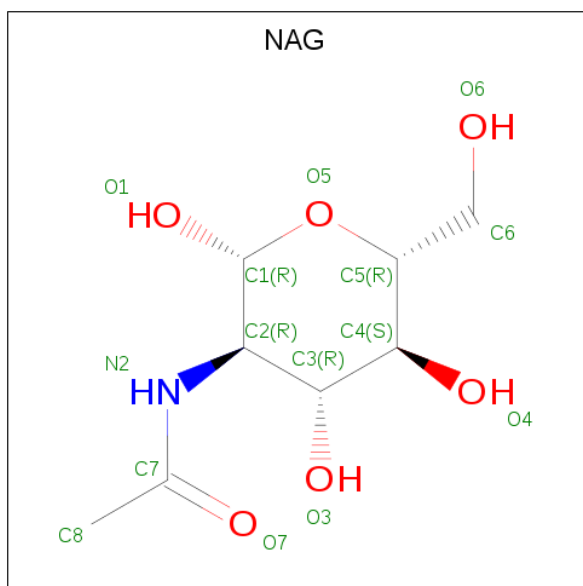
There are 25 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	20	GLY	-	expression tag	UNP P43220
A	21	PRO	-	expression tag	UNP P43220
A	22	ALA	-	expression tag	UNP P43220
A	23	SER	-	expression tag	UNP P43220
A	207	GLU	THR	engineered mutation	UNP P43220
A	211	ALA	GLN	engineered mutation	UNP P43220
A	215	ARG	ASP	engineered mutation	UNP P43220
A	232	PHE	LEU	engineered mutation	UNP P43220
A	260	PHE	LEU	variant	UNP P43220
A	295	ALA	GLY	engineered mutation	UNP P43220
A	298	ALA	THR	engineered mutation	UNP P43220
A	329	ALA	CYS	engineered mutation	UNP P43220
A	358	ALA	PRO	engineered mutation	UNP P43220
A	361	ALA	GLY	engineered mutation	UNP P43220
A	363	VAL	HIS	engineered mutation	UNP P43220
A	405	ALA	VAL	engineered mutation	UNP P43220
A	433	ALA	-	expression tag	UNP P43220
A	434	ALA	-	expression tag	UNP P43220
A	435	ALA	-	expression tag	UNP P43220
A	436	LEU	-	expression tag	UNP P43220
A	437	GLU	-	expression tag	UNP P43220
A	438	VAL	-	expression tag	UNP P43220
A	439	LEU	-	expression tag	UNP P43220
A	440	PHE	-	expression tag	UNP P43220
A	441	GLN	-	expression tag	UNP P43220

- Molecule 2 is a protein called truncated peptide agonist.

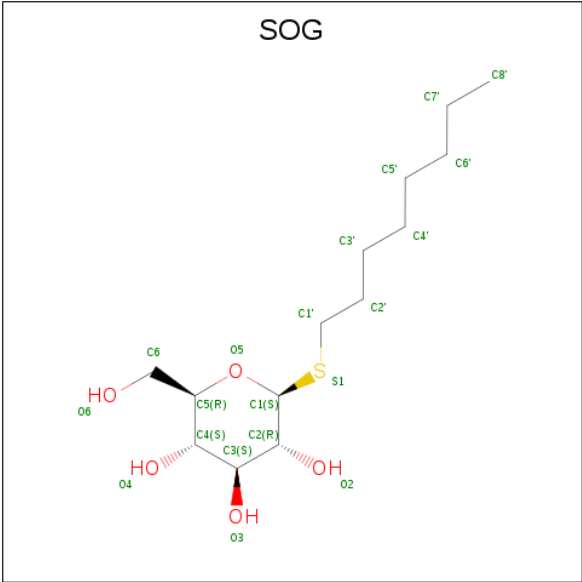
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	10	Total	C	F	N	O	0	0	0
			107	72	1	17	17			

- Molecule 3 is N-ACETYL-D-GLUCOSAMINE (three-letter code: NAG) (formula:  $C_8H_{15}NO_6$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			14	8	1	5		
3	A	1	Total	C	N	O	0	0
			14	8	1	5		
3	A	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 4 is 2-HYDROXYMETHYL-6-OCTYLSULFANYL-TETRAHYDRO-PYRAN-3,4,5-TRIOL (three-letter code: SOG) (formula:  $C_{14}H_{28}O_5S$ ).

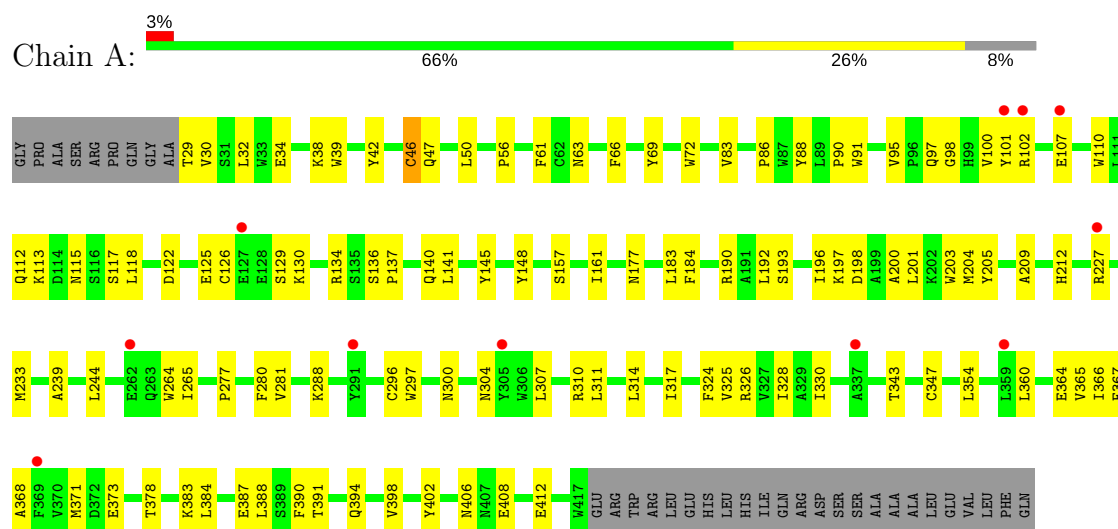


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	O	S	0	0
			20	14	5	1		
4	A	1	Total	C	O	S	0	0
			20	14	5	1		
4	A	1	Total	C	O	S	0	0
			20	14	5	1		

### 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 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: Glucagon-like peptide 1 receptor



- Molecule 2: truncated peptide agonist



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	94.44Å 94.44Å 163.91Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	24.68 – 3.70 54.64 – 3.70	Depositor EDS
% Data completeness (in resolution range)	92.4 (24.68-3.70) 97.3 (54.64-3.70)	Depositor EDS
$R_{merge}$	0.13	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.29 (at 3.67Å)	Xtriage
Refinement program	PHENIX (1.11.1-2575-000)	Depositor
R, $R_{free}$	0.285 , 0.334 0.300 , 0.343	Depositor DCC
$R_{free}$ test set	430 reflections (4.66%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	155.5	Xtriage
Anisotropy	0.120	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.27 , 114.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	0.053 for -h,-k,l	Xtriage
$F_o, F_c$ correlation	0.88	EDS
Total number of atoms	3410	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	180.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.63% 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: 9DK, NAG, SOG, 9DZ, 9DW, 9DT, 9DQ

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	0.30	0/3298	0.56	3/4491 (0.1%)
2	B	0.69	0/30	1.42	0/38
All	All	0.31	0/3328	0.57	3/4529 (0.1%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	46	CYS	CA-CB-SG	6.07	124.92	114.00
1	A	126	CYS	CA-CB-SG	-6.00	103.19	114.00
1	A	117	SER	C-N-CA	5.44	135.29	121.70

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	3201	0	3168	103	0
2	B	107	0	24	5	0
3	A	42	0	38	0	0
4	A	60	0	84	12	0
All	All	3410	0	3314	111	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 17.

The worst 5 of 111 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:197:LYS:HD3	1:A:233:MET:CE	1.19	1.57
1:A:378:THR:HG21	4:A:604:SOG:C8'	1.60	1.32
1:A:197:LYS:CD	1:A:233:MET:CE	2.09	1.28
1:A:378:THR:CG2	4:A:604:SOG:H8'2	1.68	1.21
1:A:197:LYS:CD	1:A:233:MET:HE2	1.68	1.14

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	387/422 (92%)	373 (96%)	14 (4%)	0	100	100
2	B	1/10 (10%)	0	1 (100%)	0	100	100
All	All	388/432 (90%)	373 (96%)	15 (4%)	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	344/370 (93%)	342 (99%)	2 (1%)	87	94
2	B	4/4 (100%)	1 (25%)	3 (75%)	0	0
All	All	348/374 (93%)	343 (99%)	5 (1%)	69	87

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	300	ASN
1	A	304	ASN
2	B	6	THR
2	B	7	SER
2	B	8	ASP

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	140	GLN
1	A	210	GLN
1	A	263	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 ⓘ

6 ligands are modelled in this entry.

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
3	NAG	A	601	1,3	14,14,15	0.26	0	17,19,21	2.03	4 (23%)
3	NAG	A	602	3	14,14,15	0.43	0	17,19,21	1.43	2 (11%)
3	NAG	A	603	1	14,14,15	1.42	2 (14%)	17,19,21	1.21	3 (17%)
4	SOG	A	604	-	20,20,20	1.71	4 (20%)	24,25,25	1.52	1 (4%)
4	SOG	A	605	-	20,20,20	1.71	4 (20%)	24,25,25	1.52	1 (4%)
4	SOG	A	606	-	20,20,20	1.71	4 (20%)	24,25,25	1.52	1 (4%)

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
3	NAG	A	601	1,3	-	0/6/23/26	0/1/1/1
3	NAG	A	602	3	-	0/6/23/26	0/1/1/1
3	NAG	A	603	1	1/1/5/7	0/6/23/26	0/1/1/1
4	SOG	A	604	-	-	0/11/31/31	0/1/1/1
4	SOG	A	605	-	-	0/11/31/31	0/1/1/1
4	SOG	A	606	-	2/2/5/5	0/11/31/31	0/1/1/1

The worst 5 of 14 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	606	SOG	C1-S1	-4.08	1.74	1.80
4	A	605	SOG	C1-S1	-4.07	1.74	1.80
4	A	604	SOG	C1-S1	-4.07	1.74	1.80
4	A	604	SOG	C1'-S1	-3.34	1.77	1.81
4	A	606	SOG	C1'-S1	-3.32	1.77	1.81

The worst 5 of 12 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	601	NAG	O4-C4-C5	-2.05	104.18	109.31
3	A	603	NAG	C2-N2-C7	-2.04	119.97	122.94
3	A	603	NAG	O3-C3-C4	-2.01	105.64	110.34
3	A	603	NAG	C8-C7-N2	2.22	120.00	116.10

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	601	NAG	O5-C5-C4	2.48	116.87	110.83

All (3) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
4	A	606	SOG	C5
4	A	606	SOG	C3
3	A	603	NAG	C3

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 12 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	604	SOG	12	0
4	A	605	SOG	3	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 [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

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	389/422 (92%)	-0.16	11 (2%)	53	40	101, 170, 260, 422	0
2	B	5/10 (50%)	-0.28	0	100	100	160, 164, 177, 193	0
All	All	394/432 (91%)	-0.16	11 (2%)	53	40	101, 170, 260, 422	0

The worst 5 of 11 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	101	TYR	3.4
1	A	359	LEU	2.9
1	A	107	GLU	2.8
1	A	369	PHE	2.7
1	A	262	GLU	2.4

### 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. 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	B-factors( $\text{\AA}^2$ )	Q<0.9
3	NAG	A	601	14/15	0.63	0.36	168,196,225,226	0
3	NAG	A	602	14/15	0.72	0.68	187,211,235,237	0
4	SOG	A	604	20/20	0.74	0.20	149,181,213,216	0
4	SOG	A	606	20/20	0.78	0.35	149,199,221,222	0
3	NAG	A	603	14/15	0.82	0.16	228,274,289,295	0
4	SOG	A	605	20/20	0.85	0.23	126,192,211,229	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.