



# wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 9, 2018 – 01:15 am GMT

PDB ID : 3O28  
Title : Ligand-binding domain of GluA2 (flip) ionotropic glutamate receptor in complex with an allosteric modulator  
Authors : Maclean, J.K.F.; Basten, S.; Campbell, R.A.; Cumming, I.A.; Gillen, K.J.; Gillespie, J.; Jamieson, C.; Kazemier, B.; Kiczun, M.; Lamont, Y.; Lyons, A.J.; Moir, E.M.; Morrow, J.A.; Papakosta, M.; Rankovic, Z.; Smith, L.  
Deposited on : 2010-07-22  
Resolution : 2.00 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.

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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 : 1.7.3 (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

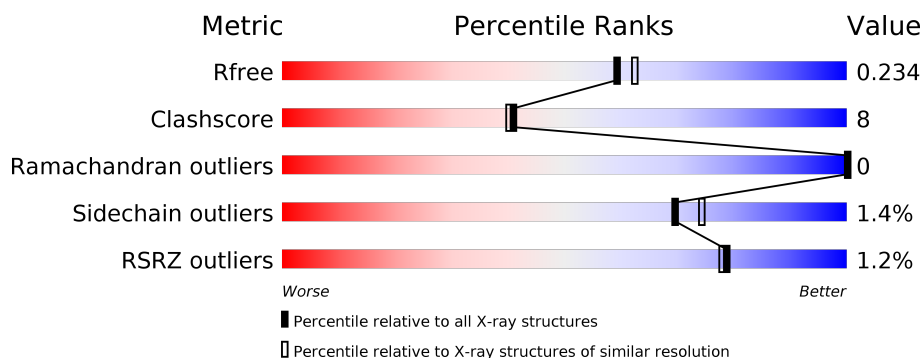
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 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))
$R_{free}$	111664	7193 (2.00-2.00)
Clashscore	122126	8267 (2.00-2.00)
Ramachandran outliers	120053	8166 (2.00-2.00)
Sidechain outliers	120020	8165 (2.00-2.00)
RSRZ outliers	108989	7011 (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 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	263	<div> <div></div> <div>89%</div> <div>8%</div> <div>..</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
4	SO4	A	268	-	-	X	-

## 2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 2326 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.

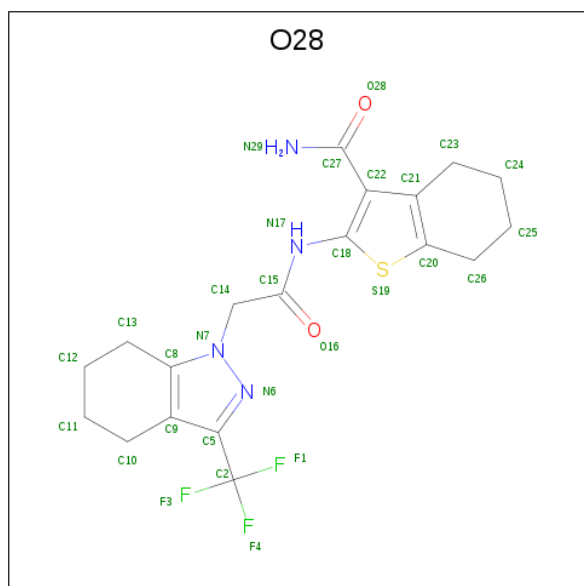
- Molecule 1 is a protein called Glutamate receptor 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	260	Total	C	N	O	S	0	19	0
			2085	1330	343	396	16			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	118	GLY	-	LINKER	UNP P19491
A	119	THR	-	LINKER	UNP P19491

- Molecule 2 is 2-([3-(trifluoromethyl)-4,5,6,7-tetrahydro-1H-indazol-1-yl]acetyl)amino)-4,5,6,7-tetrahydro-1-benzothiophene-3-carboxamide (three-letter code: O28) (formula: C<sub>19</sub>H<sub>21</sub>F<sub>3</sub>N<sub>4</sub>O<sub>2</sub>S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	F	N	O	0	0
			29	19	3	4	2		

- GLU
- 
- The diagram shows the chemical structure of Glutamic acid (GLU). The structure is a five-carbon chain. The first carbon (C) is part of a carboxyl group with a double-bonded oxygen (O) and a single-bonded hydroxyl group (HO). The second carbon (C) is bonded to a hydrogen atom (H) and an amino group (NH<sub>2</sub>). The third carbon (C) is bonded to a hydrogen atom (H) and a carboxyl group (COOH). The fourth carbon (C) is bonded to a hydrogen atom (H) and a carboxyl group (COOH). The fifth carbon (C) is part of a carboxyl group with a double-bonded oxygen (O) and a single-bonded hydroxyl group (HO). The atoms are labeled with their types: C for carbon, O for oxygen, H for hydrogen, and N for nitrogen. The labels are color-coded: C is green, O is red, H is blue, and N is blue. The labels are also accompanied by their respective element symbols: O, O, H, N, O, O, H, O, H. The labels are also accompanied by their respective element symbols: O, O, H, N, O, O, H, O, H.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			10	5	1	4		

- 
- Diagram illustrating the Lewis structure of the sulfate ion ( $\text{SO}_4^{2-}$ ). The central sulfur atom (S) is bonded to four oxygen atoms. Two oxygen atoms are double-bonded to sulfur (top and bottom), and two are single-bonded (left and right). Each single-bonded oxygen has a negative charge ( $\text{O}^-$ ). The sulfur atom has a formal charge of +6, indicated by a yellow 'S' with a yellow '6' below it. The oxygen atoms are labeled O1 (top), O2 (bottom), O3 (left), and O4 (right). The bonds are colored: red for single bonds and yellow for double bonds.

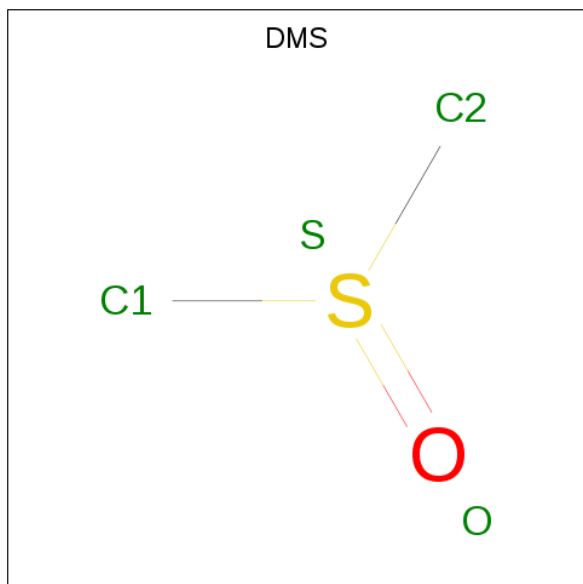
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total O S 5 4 1	0	0
4	A	1	Total O S 5 4 1	0	0

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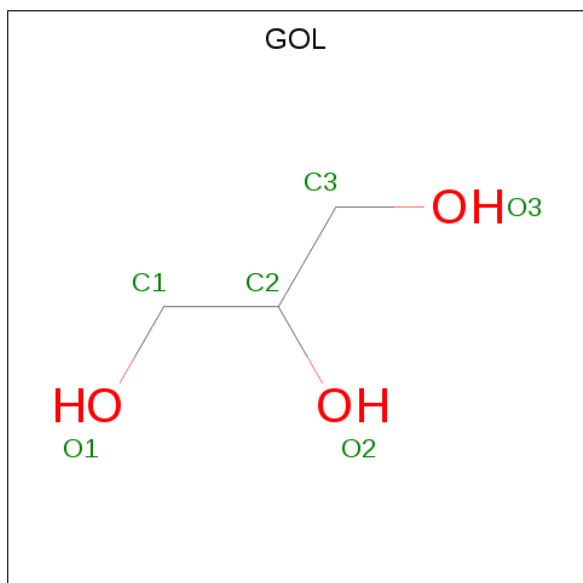
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	0
			5	4	1		

- Molecule 5 is DIMETHYL SULFOXIDE (three-letter code: DMS) (formula:  $C_2H_6OS$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	O	S	0	0
			4	2	1	1		

- Molecule 6 is GLYCEROL (three-letter code: GOL) (formula:  $C_3H_8O_3$ ).



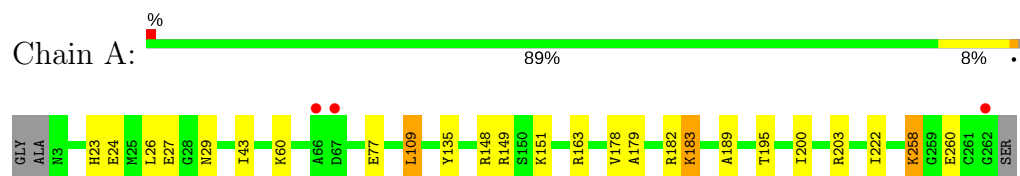
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			6	3	3		
6	A	1	Total	C	O	0	0
			6	3	3		
6	A	1	Total	C	O	0	0
			6	3	3		
6	A	1	Total	C	O	0	0
			6	3	3		
6	A	1	Total	C	O	0	0
			6	3	3		

- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	147	Total	O	0	0
			147	147		



- Molecule 1: Glutamate receptor 2



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	65.13Å 88.72Å 47.62Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	52.49 – 2.00 44.36 – 2.00	Depositor EDS
% Data completeness (in resolution range)	99.8 (52.49-2.00) 99.8 (44.36-2.00)	Depositor EDS
$R_{merge}$	0.13	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.95 (at 2.00Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, $R_{free}$	0.182 , 0.234 0.182 , 0.234	Depositor DCC
$R_{free}$ test set	986 reflections (5.11%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	18.4	Xtriage
Anisotropy	0.668	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 52.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	2326	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	18.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.45% 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: GOL, DMS, SO4, O28

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	0.91	0/2217	0.81	2/2980 (0.1%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	148	ARG	NE-CZ-NH2	-5.19	117.71	120.30
1	A	109	LEU	CA-CB-CG	5.04	126.89	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	2085	0	2147	30	0
2	A	29	0	21	3	0
3	A	10	0	5	0	0
4	A	15	0	0	2	0
5	A	4	0	6	1	0
6	A	36	0	48	3	0
7	A	147	0	0	6	0
All	All	2326	0	2227	34	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 8.

The worst 5 of 34 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:151:LYS:HE2	7:A:412:HOH:O	1.76	0.85
1:A:43[B]:ILE:CD1	1:A:222[B]:ILE:CD1	2.61	0.79
1:A:43[B]:ILE:HD11	1:A:222[B]:ILE:HD11	1.67	0.76
1:A:29:ASN:H	5:A:269:DMS:H12	1.51	0.73
1:A:43[B]:ILE:HD13	1:A:222[B]:ILE:CD1	2.18	0.72

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	277/263 (105%)	273 (99%)	4 (1%)	0	100	100

There are no Ramachandran outliers to report.

### 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	237/220 (108%)	233 (98%)	4 (2%)	63	68

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	109	LEU
1	A	183[A]	LYS
1	A	183[B]	LYS
1	A	258	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	46	HIS
1	A	244	GLN

### 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](#)

12 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	$\# Z  > 2$
2	O28	A	264	-	28,32,32	1.80	5 (17%)	27,48,48	1.70	6 (22%)
3	GLU	A	265	-	1,9,9	0.02	0	1,11,11	1.58	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
4	SO4	A	266	-	4,4,4	0.14	0	6,6,6	0.29	0
4	SO4	A	267	-	4,4,4	0.17	0	6,6,6	0.61	0
4	SO4	A	268	-	4,4,4	0.30	0	6,6,6	0.18	0
5	DMS	A	269	-	3,3,3	2.63	1 (33%)	3,3,3	0.79	0
6	GOL	A	270	-	5,5,5	0.29	0	5,5,5	0.73	0
6	GOL	A	271	-	5,5,5	0.42	0	5,5,5	0.63	0
6	GOL	A	272	-	5,5,5	0.50	0	5,5,5	0.46	0
6	GOL	A	273	-	5,5,5	0.41	0	5,5,5	0.57	0
6	GOL	A	274	-	5,5,5	0.33	0	5,5,5	0.95	0
6	GOL	A	275	-	5,5,5	0.42	0	5,5,5	0.46	0

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	O28	A	264	-	-	0/12/32/32	0/4/4/4
3	GLU	A	265	-	-	0/3/9/9	0/0/0/0
4	SO4	A	266	-	-	0/0/0/0	0/0/0/0
4	SO4	A	267	-	-	0/0/0/0	0/0/0/0
4	SO4	A	268	-	-	0/0/0/0	0/0/0/0
5	DMS	A	269	-	-	0/0/0/0	0/0/0/0
6	GOL	A	270	-	-	0/4/4/4	0/0/0/0
6	GOL	A	271	-	-	0/4/4/4	0/0/0/0
6	GOL	A	272	-	-	0/4/4/4	0/0/0/0
6	GOL	A	273	-	-	0/4/4/4	0/0/0/0
6	GOL	A	274	-	-	0/4/4/4	0/0/0/0
6	GOL	A	275	-	-	0/4/4/4	0/0/0/0

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	264	O28	C8-C9	-2.56	1.34	1.38
2	A	264	O28	C22-C18	-2.48	1.36	1.41
2	A	264	O28	C18-S19	3.04	1.77	1.72
5	A	269	DMS	O-S	4.44	1.80	1.50
2	A	264	O28	C22-C21	4.69	1.48	1.39

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	264	O28	C25-C26-C20	-3.77	107.17	113.55
2	A	264	O28	F1-C2-C5	-3.36	106.75	112.25
2	A	264	O28	C8-N7-N6	-2.53	109.19	112.10
2	A	264	O28	C2-C5-N6	2.14	122.24	119.69
2	A	264	O28	C9-C8-N7	2.16	108.52	106.79

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

6 monomers are involved in 9 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	264	O28	3	0
4	A	266	SO4	1	0
4	A	268	SO4	2	0
5	A	269	DMS	1	0
6	A	272	GOL	2	0
6	A	273	GOL	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 [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	260/263 (98%)	-0.25	3 (1%) 79 78	8, 16, 30, 41	0

All (3) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	262	GLY	2.4
1	A	67	ASP	2.2
1	A	66	ALA	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. 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(Å <sup>2</sup> )	Q<0.9
6	GOL	A	274	6/6	0.61	0.26	45,48,51,52	0
5	DMS	A	269	4/4	0.86	0.27	66,66,66,66	0
6	GOL	A	275	6/6	0.87	0.26	33,42,44,45	0
6	GOL	A	273	6/6	0.88	0.29	36,39,42,44	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
6	GOL	A	271	6/6	0.89	0.20	27,40,43,44	0
6	GOL	A	272	6/6	0.90	0.17	49,50,52,52	0
6	GOL	A	270	6/6	0.91	0.17	20,24,27,29	0
2	O28	A	264	29/29	0.94	0.14	18,21,23,24	29
4	SO4	A	268	5/5	0.95	0.16	28,28,29,30	5
4	SO4	A	266	5/5	0.96	0.18	22,23,23,24	5
4	SO4	A	267	5/5	0.98	0.10	29,31,31,33	0
3	GLU	A	265	10/10	0.98	0.09	8,9,15,17	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.