



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 18, 2020 – 09:32 pm BST

PDB ID : 6OIH  
Title : Crystal structure of O-antigen polysaccharide ABC-transporter  
Authors : Bi, Y.; Zimmer, J.  
Deposited on : 2019-04-09  
Resolution : 3.85 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 : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.11  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.11

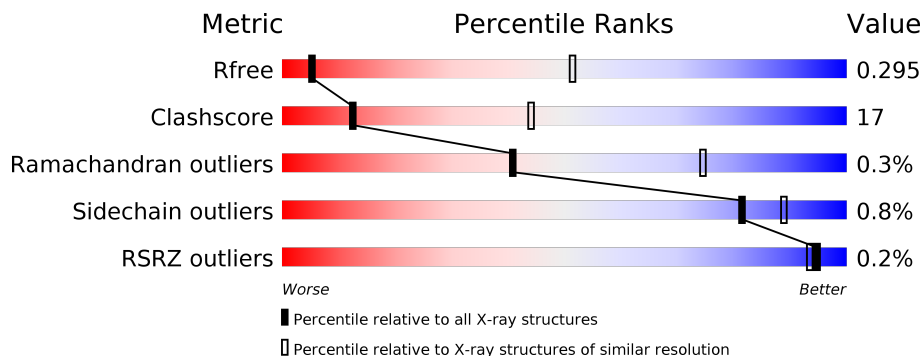
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.85 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))
$R_{free}$	130704	1048 (4.10-3.62)
Clashscore	141614	1015 (4.08-3.64)
Ramachandran outliers	138981	1069 (4.10-3.62)
Sidechain outliers	138945	1062 (4.10-3.62)
RSRZ outliers	127900	1206 (4.12-3.60)

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 respectively. 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	242	 67% 30%
1	B	242	 60% 38%
2	C	254	 56% 41%
2	D	254	 56% 41%

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 crite-

ria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	LDA	C	302	-	-	-	X
3	LDA	C	303	-	-	-	X
3	LDA	D	303	-	-	-	X

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 8020 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 ABC transporter.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	237	1899	1230	317	346	6	0	0	0
1	B	238	1909	1236	320	347	6	0	0	0

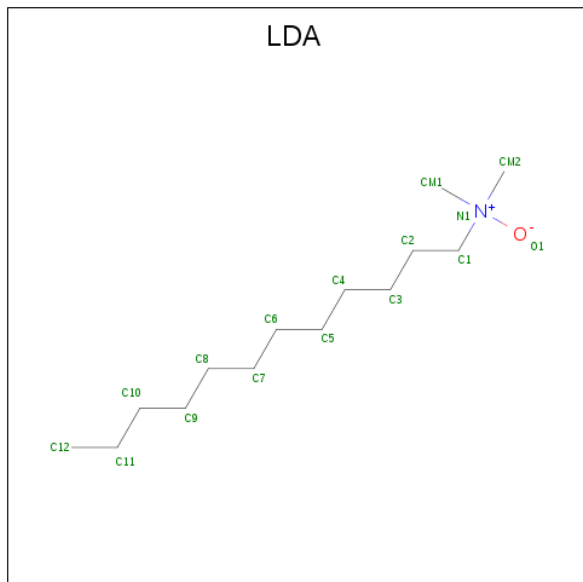
There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	236	LYS	-	expression tag	UNP O67181
A	237	LEU	-	expression tag	UNP O67181
A	238	HIS	-	expression tag	UNP O67181
A	239	HIS	-	expression tag	UNP O67181
A	240	HIS	-	expression tag	UNP O67181
A	241	HIS	-	expression tag	UNP O67181
A	242	HIS	-	expression tag	UNP O67181
A	243	HIS	-	expression tag	UNP O67181
B	236	LYS	-	expression tag	UNP O67181
B	237	LEU	-	expression tag	UNP O67181
B	238	HIS	-	expression tag	UNP O67181
B	239	HIS	-	expression tag	UNP O67181
B	240	HIS	-	expression tag	UNP O67181
B	241	HIS	-	expression tag	UNP O67181
B	242	HIS	-	expression tag	UNP O67181
B	243	HIS	-	expression tag	UNP O67181

- Molecule 2 is a protein called Transport permease protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	D	247	2073	1444	296	330	3	0	0	0
2	C	249	2087	1453	299	332	3	0	0	0

- Molecule 3 is LAURYL DIMETHYLAMINE-N-OXIDE (three-letter code: LDA) (formula:  $C_{14}H_{31}NO$ ).

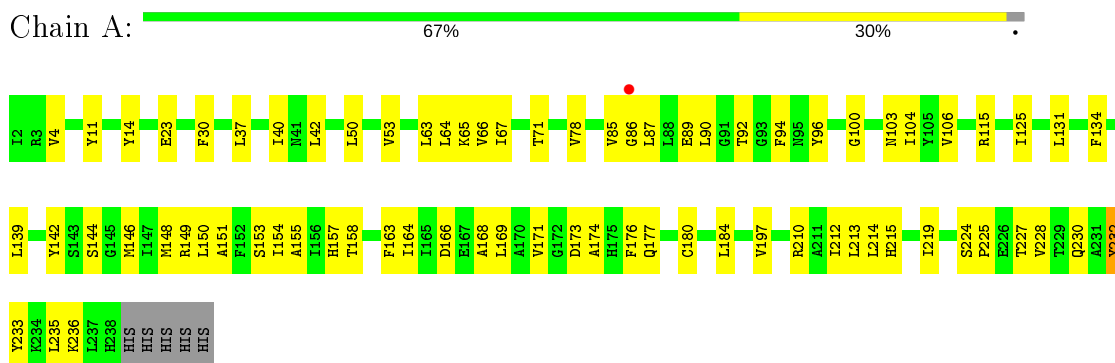


Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	D	1	Total C N O 6 4 1 1	0	0
3	D	1	Total C N O 6 4 1 1	0	0
3	D	1	Total C N O 9 7 1 1	0	0
3	C	1	Total C N O 7 5 1 1	0	0
3	C	1	Total C 5 5	0	0
3	C	1	Total C N O 7 5 1 1	0	0
3	C	1	Total C N O 7 5 1 1	0	0
3	C	1	Total C 5 5	0	0

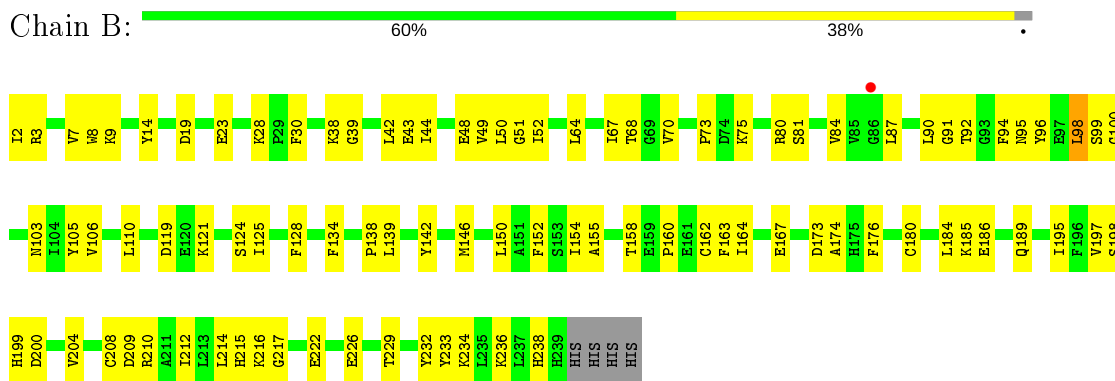
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of 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.

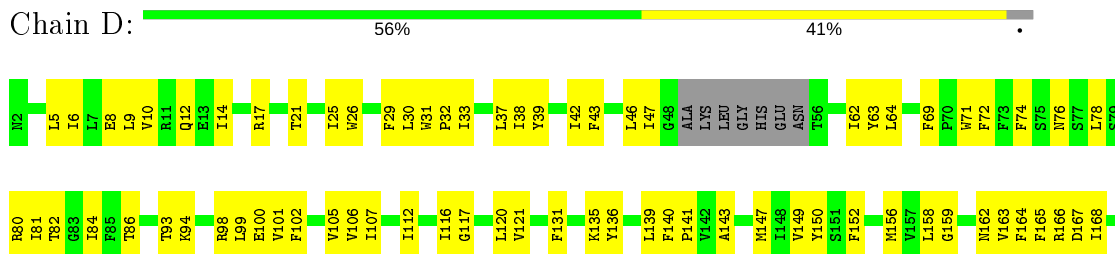
- Molecule 1: ABC transporter



- Molecule 1: ABC transporter

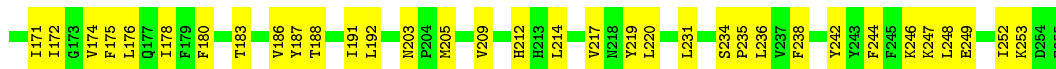
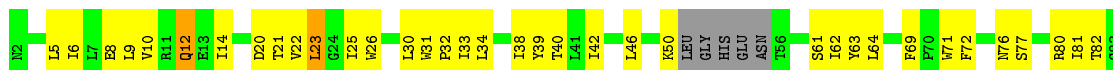


- Molecule 2: Transport permease protein





- Molecule 2: Transport permease protein



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 41 3 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	228.12Å 228.12Å 228.12Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	24.89 – 3.85 24.89 – 3.85	Depositor EDS
% Data completeness (in resolution range)	100.0 (24.89-3.85) 100.0 (24.89-3.85)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.44 (at 3.85Å)	Xtrriage
Refinement program	PHENIX (1.13_2998: ???)	Depositor
R, $R_{free}$	0.219 , 0.297 0.219 , 0.295	Depositor DCC
$R_{free}$ test set	1007 reflections (5.11%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	154.5	Xtrriage
Anisotropy	0.000	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.26 , 113.0	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.45$ , $\langle L^2 \rangle = 0.27$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	8020	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	178.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.09% 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: LDA

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	0.26	0/1936	0.45	0/2601
1	B	0.25	0/1947	0.44	0/2616
2	C	0.27	0/2157	0.45	0/2939
2	D	0.27	0/2143	0.47	0/2921
All	All	0.26	0/8183	0.46	0/11077

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 [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	1899	0	1952	53	0
1	B	1909	0	1959	62	0
2	C	2087	0	2171	85	0
2	D	2073	0	2153	86	0
3	C	31	0	48	2	0
3	D	21	0	30	2	0
All	All	8020	0	8313	274	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 274 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)
2:D:147:MET:HG3	2:D:208:VAL:HG11	1.57	0.87
2:C:22:VAL:HG23	2:C:23:LEU:HD23	1.60	0.81
2:C:81:ILE:HG22	2:C:106:VAL:HG11	1.62	0.80
2:C:183:THR:HG22	2:C:203:ASN:HD21	1.47	0.79
1:B:49:VAL:HB	1:B:209:ASP:H	1.47	0.79

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	235/242 (97%)	224 (95%)	11 (5%)	0	100	100
1	B	236/242 (98%)	217 (92%)	18 (8%)	1 (0%)	34	70
2	C	245/254 (96%)	236 (96%)	9 (4%)	0	100	100
2	D	243/254 (96%)	230 (95%)	11 (4%)	2 (1%)	19	56
All	All	959/992 (97%)	907 (95%)	49 (5%)	3 (0%)	41	74

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	D	99	LEU
2	D	189	LEU
1	B	174	ALA

### 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	207/212 (98%)	204 (99%)	3 (1%)	67	81
1	B	208/212 (98%)	206 (99%)	2 (1%)	76	85
2	C	232/236 (98%)	230 (99%)	2 (1%)	78	88
2	D	231/236 (98%)	231 (100%)	0	100	100
All	All	878/896 (98%)	871 (99%)	7 (1%)	81	89

5 of 7 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	98	LEU
2	C	23	LEU
1	B	185	LYS
1	A	30	PHE
2	C	12	GLN

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	103	ASN
1	A	177	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

8 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	LDA	C	302	-	4,4,15	0.30	0	3,3,17	0.36	0
3	LDA	C	303	-	3,6,15	4.14	1 (33%)	5,8,17	0.77	0
3	LDA	D	301	-	3,5,15	4.18	1 (33%)	3,7,17	0.49	0
3	LDA	C	304	-	3,6,15	4.13	1 (33%)	5,8,17	0.63	0
3	LDA	D	303	-	5,8,15	3.21	1 (20%)	7,10,17	0.34	0
3	LDA	C	305	-	4,4,15	0.29	0	3,3,17	0.39	0
3	LDA	C	301	-	3,6,15	4.15	1 (33%)	5,8,17	0.32	0
3	LDA	D	302	-	3,5,15	4.15	1 (33%)	3,7,17	0.82	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
3	LDA	C	302	-	-	0/2/2/13	-
3	LDA	C	303	-	-	1/4/4/13	-
3	LDA	D	301	-	-	0/3/3/13	-
3	LDA	C	304	-	-	3/4/4/13	-
3	LDA	D	303	-	-	0/6/6/13	-
3	LDA	C	305	-	-	0/2/2/13	-
3	LDA	C	301	-	-	0/4/4/13	-
3	LDA	D	302	-	-	1/3/3/13	-

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

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	301	LDA	O1-N1	-7.17	1.25	1.42
3	C	301	LDA	O1-N1	-7.17	1.25	1.42
3	C	303	LDA	O1-N1	-7.16	1.25	1.42

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	303	LDA	O1-N1	-7.16	1.25	1.42
3	C	304	LDA	O1-N1	-7.14	1.25	1.42

There are no bond angle outliers.

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	C	304	LDA	C2-C1-N1-O1
3	C	304	LDA	C2-C1-N1-CM1
3	C	304	LDA	C2-C1-N1-CM2
3	C	303	LDA	C2-C1-N1-CM2
3	D	302	LDA	C2-C1-N1-O1

There are no ring outliers.

3 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	303	LDA	2	0
3	D	301	LDA	1	0
3	D	302	LDA	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	237/242 (97%)	-0.31	1 (0%) 92   88	130, 193, 268, 322	0
1	B	238/242 (98%)	-0.26	1 (0%) 92   88	127, 204, 295, 339	0
2	C	249/254 (98%)	-0.68	0 100   100	83, 132, 228, 312	0
2	D	247/254 (97%)	-0.68	0 100   100	106, 155, 228, 256	0
All	All	971/992 (97%)	-0.49	2 (0%) 95   93	83, 174, 266, 339	0

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	86	GLY	2.8
1	A	86	GLY	2.5

### 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	LDA	C	302	5/16	0.73	0.51	135,142,149,150	0
3	LDA	D	303	9/16	0.74	0.56	83,149,164,165	0
3	LDA	C	303	7/16	0.77	0.41	160,178,182,182	0
3	LDA	C	305	5/16	0.83	0.20	89,97,107,110	0
3	LDA	D	301	6/16	0.85	0.37	132,148,158,161	0
3	LDA	C	304	7/16	0.85	0.71	156,162,170,181	0
3	LDA	C	301	7/16	0.88	0.41	157,158,169,176	0
3	LDA	D	302	6/16	0.93	0.38	141,155,159,169	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.