



# Full wwPDB X-ray Structure Validation Report ⓘ

Jan 17, 2023 – 12:10 PM EST

PDB ID : 2Q22  
Title : Crystal structure of uncharacterized protein (YP\_323524.1) from *Anabaena variabilis* ATCC 29413 at 2.11 Å resolution  
Authors : Joint Center for Structural Genomics (JCSG)  
Deposited on : 2007-05-25  
Resolution : 2.11 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

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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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 : 2.31.2  
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) : 2.31.2

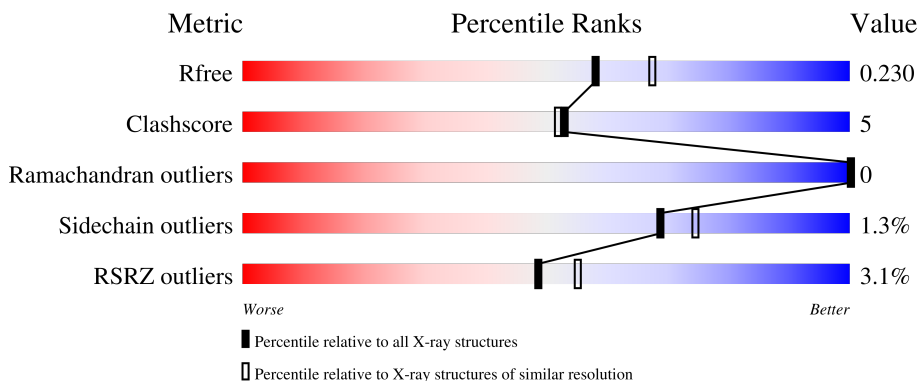
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.11 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	6241 (2.14-2.10)
Clashscore	141614	6778 (2.14-2.10)
Ramachandran outliers	138981	6705 (2.14-2.10)
Sidechain outliers	138945	6706 (2.14-2.10)
RSRZ outliers	127900	6112 (2.14-2.10)

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 of 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	139	 83% 9% • 6%
1	B	139	 82% 11% • 6%
1	C	139	 86% 7% 7%

## 2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 3225 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 Uncharacterized protein.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
1	A	130	998	645	161	185	5	2	0	1	0
1	B	130	996	641	162	186	5	2	0	1	0
1	C	129	987	639	159	182	5	2	0	2	0

There are 15 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	GLY	-	expression tag	UNP Q3M8Q7
A	1	MSE	MET	modified residue	UNP Q3M8Q7
A	3	MSE	MET	modified residue	UNP Q3M8Q7
A	68	MSE	MET	modified residue	UNP Q3M8Q7
A	128	MSE	MET	modified residue	UNP Q3M8Q7
B	0	GLY	-	expression tag	UNP Q3M8Q7
B	1	MSE	MET	modified residue	UNP Q3M8Q7
B	3	MSE	MET	modified residue	UNP Q3M8Q7
B	68	MSE	MET	modified residue	UNP Q3M8Q7
B	128	MSE	MET	modified residue	UNP Q3M8Q7
C	0	GLY	-	expression tag	UNP Q3M8Q7
C	1	MSE	MET	modified residue	UNP Q3M8Q7
C	3	MSE	MET	modified residue	UNP Q3M8Q7
C	68	MSE	MET	modified residue	UNP Q3M8Q7
C	128	MSE	MET	modified residue	UNP Q3M8Q7

- Molecule 2 is ACETATE ION (three-letter code: ACT) (formula: C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>).

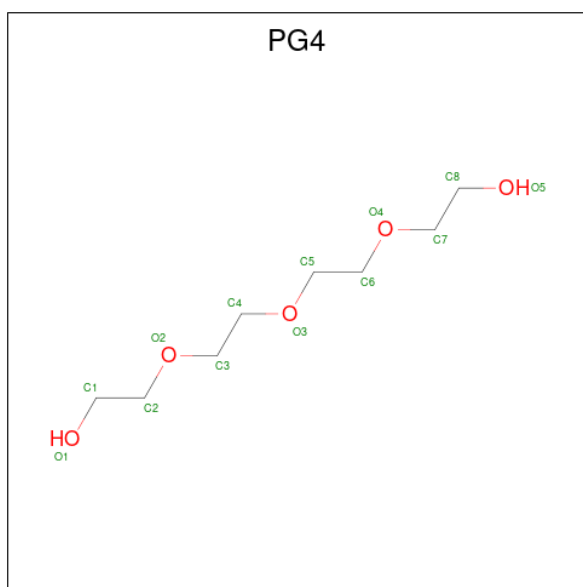


Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total C O 4 2 2	0	0
2	A	1	Total C O 4 2 2	0	0
2	B	1	Total C O 4 2 2	0	0
2	C	1	Total C O 4 2 2	0	0

- Molecule 3 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

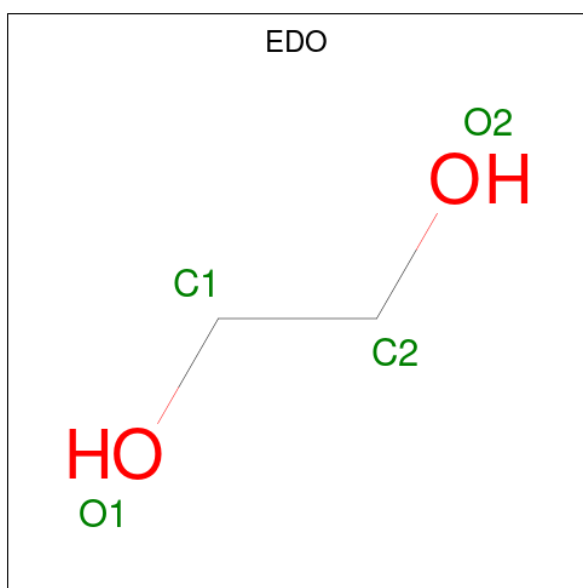
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Cl 1 1	0	0
3	B	2	Total Cl 2 2	0	0

- Molecule 4 is TETRAETHYLENE GLYCOL (three-letter code: PG4) (formula: C<sub>8</sub>H<sub>18</sub>O<sub>5</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			13	8	5		
4	B	1	Total	C	O	0	0
			13	8	5		

- Molecule 5 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula:  $C_2H_6O_2$ ).



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

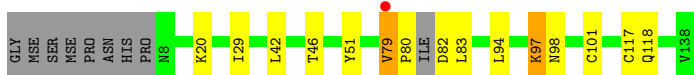
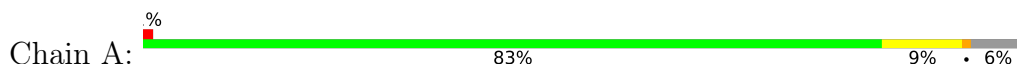
- Molecule 6 is water.

<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
6	A	78	Total 78	O 78	0	0
6	B	55	Total 55	O 55	0	0
6	C	58	Total 58	O 58	0	0

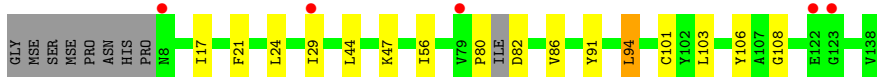
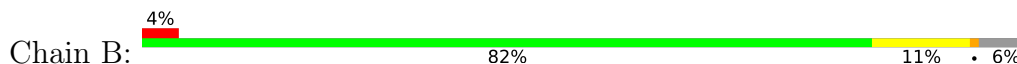
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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.

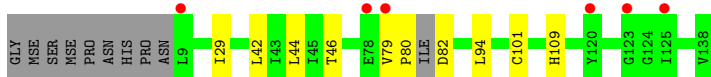
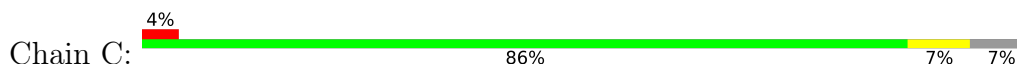
- Molecule 1: Uncharacterized protein



- Molecule 1: Uncharacterized protein



- Molecule 1: Uncharacterized protein



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 32	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	103.37Å 103.37Å 42.09Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	29.84 – 2.11 29.84 – 2.11	Depositor EDS
% Data completeness (in resolution range)	100.0 (29.84-2.11) 100.0 (29.84-2.11)	Depositor EDS
$R_{merge}$	0.12	Depositor
$R_{sym}$	0.12	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.96 (at 2.12Å)	Xtrriage
Refinement program	REFMAC 5.2.0019, PHENIX	Depositor
R, $R_{free}$	0.191 , 0.222 0.203 , 0.230	Depositor DCC
$R_{free}$ test set	1467 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	28.9	Xtrriage
Anisotropy	0.187	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 50.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.032 for -h,-k,l 0.036 for h,-h-k,-l 0.347 for -k,-h,-l	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	3225	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	43.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 40.70 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 2.6332e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

<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: EDO, PG4, CL, ACT

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	0.82	1/1018 (0.1%)	0.82	0/1374
1	B	0.74	1/1016 (0.1%)	0.76	0/1374
1	C	0.74	0/1007	0.72	0/1361
All	All	0.77	2/3041 (0.1%)	0.77	0/4109

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	86	VAL	CB-CG1	6.44	1.66	1.52
1	A	117	CYS	CB-SG	-5.00	1.73	1.81

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	998	0	1009	14	0
1	B	996	0	996	13	0
1	C	987	0	989	7	0
2	A	8	0	6	0	0
2	B	4	0	3	0	0
2	C	4	0	3	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	1	0	0	0	0
3	B	2	0	0	0	0
4	A	13	0	18	1	0
4	B	13	0	18	1	0
5	C	8	0	12	0	0
6	A	78	0	0	0	0
6	B	55	0	0	0	0
6	C	58	0	0	3	0
All	All	3225	0	3054	33	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 5.

All (33) 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:21:PHE:HA	1:B:24:LEU:HD12	1.60	0.81
1:B:94:LEU:HD23	1:B:101[A]:CYS:SG	2.22	0.80
1:A:29:ILE:HG21	1:B:47:LYS:HD3	1.76	0.68
1:B:94:LEU:CD2	1:B:101[A]:CYS:SG	2.83	0.67
1:A:51:TYR:OH	1:A:97:LYS:HE3	1.95	0.66
1:A:20:LYS:HZ2	4:A:142:PG4:H71	1.67	0.59
1:C:109:HIS:HD2	6:C:190:HOH:O	1.87	0.58
1:A:79:VAL:CG1	1:A:94:LEU:HD11	2.33	0.57
1:A:79:VAL:HG12	1:A:94:LEU:CD1	2.37	0.55
1:A:29:ILE:O	1:A:29:ILE:HG23	2.06	0.54
1:B:44:LEU:HD23	1:B:44:LEU:C	2.28	0.54
1:A:79:VAL:CG1	1:A:94:LEU:CD1	2.85	0.54
1:A:42:LEU:O	1:A:46:THR:HG23	2.08	0.53
1:C:80:PRO:C	1:C:82:ASP:N	2.62	0.52
1:C:44:LEU:C	1:C:44:LEU:HD23	2.31	0.51
1:A:79:VAL:HG12	1:A:94:LEU:HD11	1.91	0.51
1:B:29:ILE:CG2	1:B:29:ILE:O	2.59	0.50
1:C:42:LEU:O	1:C:46:THR:HG23	2.11	0.50
1:C:29:ILE:HG23	6:C:166:HOH:O	2.11	0.49
1:B:17:ILE:HG12	4:B:142:PG4:H31	1.95	0.48
1:C:109:HIS:CD2	6:C:190:HOH:O	2.65	0.48
1:B:56:ILE:O	1:B:91:TYR:HA	2.14	0.47
1:B:80:PRO:C	1:B:82:ASP:N	2.68	0.47
1:B:103:LEU:C	1:B:103:LEU:HD23	2.38	0.44
1:A:51:TYR:CE1	1:A:118:GLN:HG3	2.52	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:83:LEU:HD11	1:A:101[B]:CYS:SG	2.57	0.44
1:A:80:PRO:C	1:A:82:ASP:N	2.72	0.43
1:A:97:LYS:HG3	1:A:98:ASN:N	2.33	0.43
1:A:51:TYR:CE1	1:A:97:LYS:HB3	2.54	0.43
1:B:21:PHE:HA	1:B:24:LEU:CD1	2.40	0.42
1:B:106:TYR:CZ	1:B:108:GLY:HA3	2.54	0.42
1:C:94:LEU:HD23	1:C:101[A]:CYS:SG	2.59	0.41
1:B:29:ILE:O	1:B:29:ILE:HG22	2.21	0.41

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	127/139 (91%)	126 (99%)	1 (1%)	0	100	100
1	B	127/139 (91%)	125 (98%)	2 (2%)	0	100	100
1	C	127/139 (91%)	126 (99%)	1 (1%)	0	100	100
All	All	381/417 (91%)	377 (99%)	4 (1%)	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	107/114 (94%)	105 (98%)	2 (2%)	57	61
1	B	107/114 (94%)	106 (99%)	1 (1%)	78	83
1	C	104/114 (91%)	103 (99%)	1 (1%)	76	81
All	All	318/342 (93%)	314 (99%)	4 (1%)	69	74

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

Mol	Chain	Res	Type
1	A	79	VAL
1	A	97	LYS
1	B	94	LEU
1	C	79	VAL

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

Mol	Chain	Res	Type
1	B	22	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 monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 11 ligands modelled in this entry, 3 are monoatomic - leaving 8 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	ACT	C	139	-	3,3,3	0.65	0	3,3,3	1.40	0
2	ACT	B	139	-	3,3,3	0.43	0	3,3,3	1.35	0
4	PG4	B	142	-	12,12,12	0.57	0	11,11,11	0.53	0
4	PG4	A	142	-	12,12,12	0.60	0	11,11,11	0.59	0
2	ACT	A	140	-	3,3,3	1.18	1 (33%)	3,3,3	0.69	0
5	EDO	C	140	-	3,3,3	0.60	0	2,2,2	0.51	0
2	ACT	A	139	-	3,3,3	1.06	0	3,3,3	0.69	0
5	EDO	C	141	-	3,3,3	0.89	0	2,2,2	0.33	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
4	PG4	A	142	-	-	6/10/10/10	-
5	EDO	C	140	-	-	1/1/1/1	-
5	EDO	C	141	-	-	1/1/1/1	-
4	PG4	B	142	-	-	6/10/10/10	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	140	ACT	O-C	2.02	1.31	1.22

There are no bond angle outliers.

There are no chirality outliers.

All (14) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	B	142	PG4	O2-C3-C4-O3
4	A	142	PG4	O3-C5-C6-O4
4	B	142	PG4	O1-C1-C2-O2
4	A	142	PG4	O1-C1-C2-O2
4	A	142	PG4	O2-C3-C4-O3
4	A	142	PG4	O4-C7-C8-O5
5	C	140	EDO	O1-C1-C2-O2

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Mol	Chain	Res	Type	Atoms
4	A	142	PG4	C5-C6-O4-C7
4	B	142	PG4	C1-C2-O2-C3
4	B	142	PG4	C6-C5-O3-C4
5	C	141	EDO	O1-C1-C2-O2
4	B	142	PG4	C4-C3-O2-C2
4	B	142	PG4	C5-C6-O4-C7
4	A	142	PG4	C4-C3-O2-C2

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	142	PG4	1	0
4	A	142	PG4	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	128/139 (92%)	-0.31	1 (0%) 86 88	28, 41, 58, 75	0
1	B	128/139 (92%)	0.03	5 (3%) 39 45	29, 41, 58, 75	0
1	C	127/139 (91%)	0.06	6 (4%) 31 36	28, 40, 57, 75	0
All	All	383/417 (91%)	-0.07	12 (3%) 49 55	28, 41, 58, 75	0

All (12) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	79	VAL	5.0
1	C	120	TYR	3.5
1	B	79	VAL	3.1
1	C	123	GLY	2.9
1	A	79	VAL	2.8
1	B	8	ASN	2.8
1	C	9	LEU	2.8
1	B	123	GLY	2.7
1	C	125	ILE	2.6
1	B	29	ILE	2.4
1	B	122	GLU	2.0
1	C	78	GLU	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 monosaccharides 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
3	CL	B	141	1/1	0.82	0.13	85,85,85,85	0
5	EDO	C	141	4/4	0.85	0.19	45,50,54,59	0
2	ACT	A	140	4/4	0.87	0.21	38,41,46,48	0
4	PG4	A	142	13/13	0.90	0.12	56,62,76,77	0
4	PG4	B	142	13/13	0.91	0.12	54,65,72,76	0
5	EDO	C	140	4/4	0.92	0.11	56,61,62,66	0
3	CL	B	140	1/1	0.94	0.10	71,71,71,71	0
3	CL	A	141	1/1	0.95	0.09	69,69,69,69	0
2	ACT	A	139	4/4	0.97	0.10	25,26,29,31	0
2	ACT	B	139	4/4	0.98	0.07	28,28,28,32	0
2	ACT	C	139	4/4	0.99	0.07	30,32,32,34	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.