



wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 14, 2017 – 09:10 pm GMT

PDB ID : 3X3X
Title : Copper amine oxidase from *Arthrobacter globiformis* anaerobically reduced by phenylethylamine
Authors : Okajima, T.; Nakanishi, S.; Murakawa, T.; Kataoka, M.; Hayashi, H.; Hamaguchi, A.; Nakai, T.; Kawano, Y.; Yamaguchi, H.; Tanizawa, K.
Deposited on : 2015-03-10
Resolution : 1.57 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

A user guide is available at

<http://wwpdb.org/validation/2016/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 : 1.7.2 (RC1), CSD as538be (2017)
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

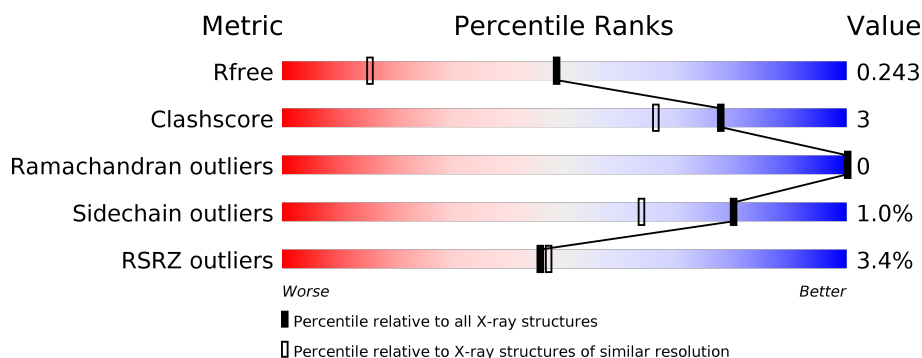
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.57 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	4211 (1.60-1.56)
Clashscore	112137	4539 (1.60-1.56)
Ramachandran outliers	110173	4423 (1.60-1.56)
Sidechain outliers	110143	4420 (1.60-1.56)
RSRZ outliers	101464	4232 (1.60-1.56)

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 ≥ 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	620	<div> <div>4%</div> <div> <div></div> <div>92%</div> <div>8%</div> </div> </div>
1	B	620	<div> <div>3%</div> <div> <div></div> <div>90%</div> <div>9%</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
5	GOL	A	706	-	-	-	X
5	GOL	A	707	-	-	-	X
5	GOL	A	708	-	-	-	X
5	GOL	A	709	-	-	-	X
5	GOL	A	710	-	-	-	X
5	GOL	B	704	-	-	-	X

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 11023 atoms, of which 56 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 Phenylethylamine oxidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	620	Total	C	N	O	S	0	0	0
			4869	3074	856	930	9			
1	B	620	Total	C	N	O	S	0	0	0
			4869	3074	856	930	9			

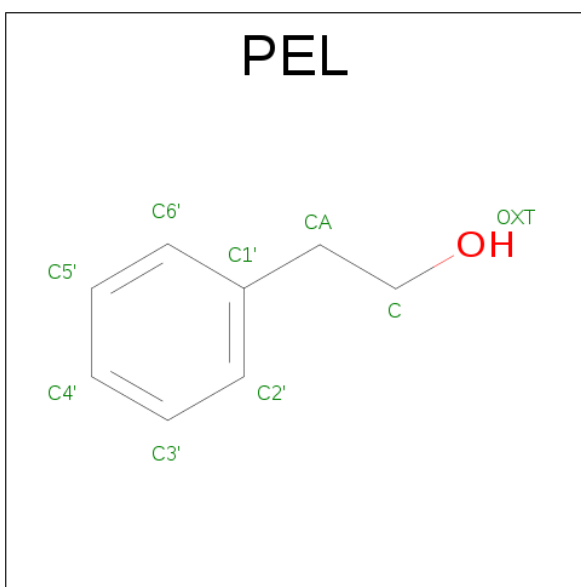
- Molecule 2 is COPPER (II) ION (three-letter code: CU) (formula: Cu).

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

- Molecule 3 is SODIUM ION (three-letter code: NA) (formula: Na).

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

- Molecule 4 is 2-PHENYL-ETHANOL (three-letter code: PEL) (formula: C₈H₁₀O).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			9	8	1		
4	B	1	Total	C	O	0	0
			9	8	1		

- Molecule 5 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).



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

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

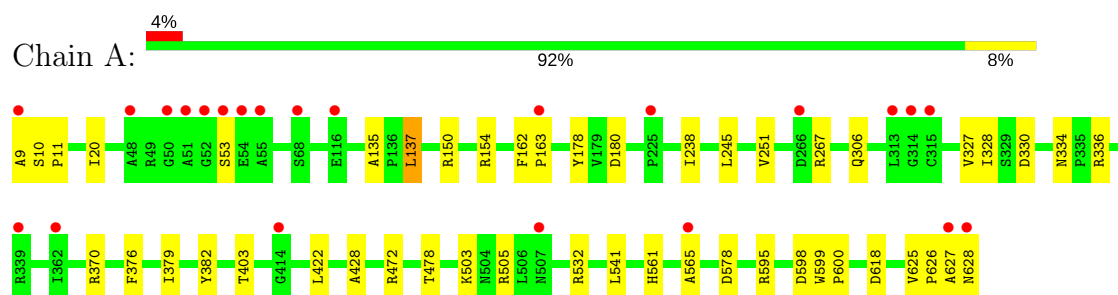
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	564	Total	O	0	0
			564	564		
6	B	600	Total	O	0	0
			600	600		

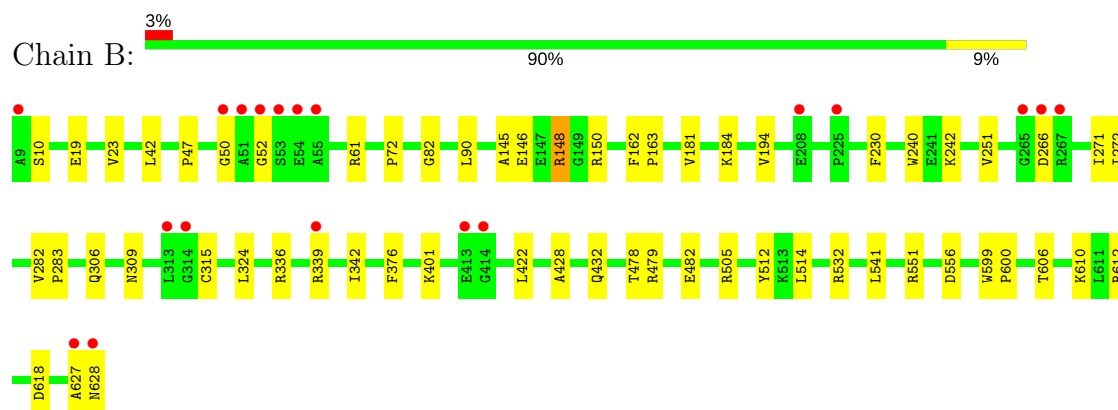
3 Residue-property plots [i](#)

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: Phenylethylamine oxidase



• Molecule 1: Phenylethylamine oxidase



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	191.66Å 62.89Å 158.01Å 90.00° 117.48° 90.00°	Depositor
Resolution (Å)	20.41 – 1.57 20.41 – 1.57	Depositor EDS
% Data completeness (in resolution range)	98.1 (20.41-1.57) 93.8 (20.41-1.57)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	0.09	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.27 (at 1.57Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.9_1692)	Depositor
R, R_{free}	0.215 , 0.243 0.215 , 0.243	Depositor DCC
R_{free} test set	11436 reflections (5.01%)	DCC
Wilson B-factor (Å ²)	13.2	Xtrriage
Anisotropy	0.813	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.43 , 54.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.42$, $\langle L^2 \rangle = 0.25$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	11023	wwPDB-VP
Average B, all atoms (Å ²)	19.0	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 43.21 % 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 1.8221e-04.*

¹Intensities estimated from amplitudes.

²Theoretical 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: PEL, GOL, TYQ, CU, NA

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	0.33	0/4976	0.53	0/6774
1	B	0.33	0/4976	0.55	0/6774
All	All	0.33	0/9952	0.54	0/13548

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	4869	0	4687	29	0
1	B	4869	0	4688	36	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	2	0	0	0	0
3	B	1	0	0	0	0
4	A	9	0	10	1	0
4	B	9	0	10	0	0
5	A	36	48	48	1	0
5	B	6	8	8	0	0
6	A	564	0	0	7	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	B	600	0	0	9	0
All	All	10967	56	9451	65	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 3.

The worst 5 of 65 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:422:LEU:HD11	1:A:428:ALA:HB2	1.69	0.74
1:B:599:TRP:CD2	1:B:600:PRO:HA	2.26	0.71
1:A:20:ILE:HD12	1:A:327:VAL:HG12	1.73	0.69
1:A:328:ILE:HD11	1:A:336:ARG:NH2	2.08	0.68
1:A:328:ILE:HG22	6:A:1202:HOH:O	1.95	0.67

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	617/620 (100%)	594 (96%)	23 (4%)	0	100	100
1	B	617/620 (100%)	595 (96%)	22 (4%)	0	100	100
All	All	1234/1240 (100%)	1189 (96%)	45 (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	513/513 (100%)	509 (99%)	4 (1%)	85	72
1	B	513/513 (100%)	507 (99%)	6 (1%)	75	56
All	All	1026/1026 (100%)	1016 (99%)	10 (1%)	80	63

5 of 10 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	148	ARG
1	B	266	ASP
1	B	376	PHE
1	A	541	LEU
1	B	315	CYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

2 non-standard protein/DNA/RNA residues 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	$\# Z > 2$
1	TYQ	A	382	1	14,14,15	1.22	2 (14%)	15,19,21	0.83	1 (6%)
1	TYQ	B	382	1	14,14,15	1.17	1 (7%)	15,19,21	0.91	1 (6%)

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
1	TYQ	A	382	1	-	0/4/6/8	0/1/1/1
1	TYQ	B	382	1	-	0/4/6/8	0/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	382	TYQ	OZ-CD1	2.06	1.40	1.36
1	A	382	TYQ	OH-CZ	2.25	1.41	1.36
1	A	382	TYQ	OZ-CD1	2.32	1.41	1.36

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	382	TYQ	OH-CZ-CE2	2.14	119.60	116.19
1	B	382	TYQ	OH-CZ-CE2	2.53	120.22	116.19

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	382	TYQ	1	0

5.5 Carbohydrates

There are no carbohydrates in this entry.

5.6 Ligand geometry

Of 14 ligands modelled in this entry, 5 are monoatomic - leaving 9 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	$\# Z > 2$
4	PEL	A	703	-	9,9,9	0.25	0	10,10,10	0.62	0
5	GOL	A	705	-	5,5,5	0.35	0	5,5,5	0.68	0
5	GOL	A	706	-	5,5,5	0.36	0	5,5,5	0.20	0
5	GOL	A	707	-	5,5,5	0.30	0	5,5,5	0.18	0
5	GOL	A	708	-	5,5,5	0.34	0	5,5,5	0.21	0
5	GOL	A	709	-	5,5,5	0.38	0	5,5,5	0.22	0
5	GOL	A	710	-	5,5,5	0.37	0	5,5,5	0.25	0
4	PEL	B	703	-	9,9,9	0.37	0	10,10,10	0.44	0
5	GOL	B	704	-	5,5,5	0.35	0	5,5,5	0.22	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	PEL	A	703	-	-	0/3/3/3	0/1/1/1
5	GOL	A	705	-	-	0/4/4/4	0/0/0/0
5	GOL	A	706	-	-	0/4/4/4	0/0/0/0
5	GOL	A	707	-	-	0/4/4/4	0/0/0/0
5	GOL	A	708	-	-	0/4/4/4	0/0/0/0
5	GOL	A	709	-	-	0/4/4/4	0/0/0/0
5	GOL	A	710	-	-	0/4/4/4	0/0/0/0
4	PEL	B	703	-	-	0/3/3/3	0/1/1/1
5	GOL	B	704	-	-	0/4/4/4	0/0/0/0

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.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	703	PEL	1	0
5	A	710	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, 95th 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 ²)	Q<0.9
1	A	619/620 (99%)	0.17	23 (3%) 42 44	8, 18, 31, 89	0
1	B	619/620 (99%)	0.08	19 (3%) 49 51	8, 16, 30, 79	0
All	All	1238/1240 (99%)	0.12	42 (3%) 46 47	8, 17, 31, 89	0

The worst 5 of 42 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	52	GLY	12.7
1	A	51	ALA	11.5
1	A	53	SER	8.3
1	A	50	GLY	8.2
1	A	54	GLU	8.1

6.2 Non-standard residues in protein, DNA, RNA chains [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, 95th 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(Å ²)	Q<0.9
1	TYQ	A	382	14/15	0.94	0.08	-	11,16,24,26	0
1	TYQ	B	382	14/15	0.94	0.08	-	10,15,24,24	0

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, 95th 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(Å ²)	Q<0.9
5	GOL	A	710	6/6	0.71	0.15	9.32	42,51,60,61	0
5	GOL	A	707	6/6	0.72	0.17	5.80	32,45,50,54	0
5	GOL	A	708	6/6	0.76	0.20	4.51	39,53,62,63	0
5	GOL	A	706	6/6	0.85	0.12	3.46	26,37,43,51	0
5	GOL	B	704	6/6	0.89	0.10	2.63	22,27,33,39	0
5	GOL	A	709	6/6	0.84	0.13	2.06	26,34,40,44	0
5	GOL	A	705	6/6	0.84	0.14	1.95	22,31,40,40	0
3	NA	A	704	1/1	0.99	0.13	1.26	13,13,13,13	0
4	PEL	B	703	9/9	0.93	0.07	-0.13	12,15,20,21	0
4	PEL	A	703	9/9	0.94	0.07	-0.65	14,15,19,19	0
3	NA	A	702	1/1	1.00	0.06	-1.51	11,11,11,11	0
3	NA	B	702	1/1	1.00	0.02	-2.61	11,11,11,11	0
2	CU	A	701	1/1	1.00	0.04	-	13,13,13,13	0
2	CU	B	701	1/1	0.99	0.02	-	13,13,13,13	0

6.5 Other polymers [i](#)

There are no such residues in this entry.