



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 9, 2024 – 11:28 am GMT

PDB ID : 2CKI  
Title : Structure of Ulilysin, a member of the pappalysin family of metzincin metallo endopeptidases.  
Authors : Tallant, C.; Garcia-Castellanos, R.; Seco, J.; Baumann, U.; Gomis-Ruth, F.X.  
Deposited on : 2006-04-19  
Resolution : 1.70 Å(reported)

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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 : 1.8.4, CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 3.0  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.003 (Gargrove)  
Density-Fitness : 1.0.11  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.39

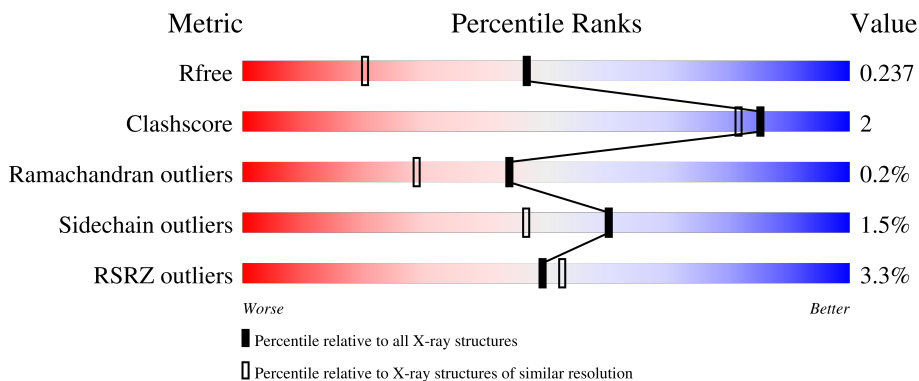
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.70 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))
$R_{free}$	164625	5161 (1.70-1.70)
Clashscore	180529	5671 (1.70-1.70)
Ramachandran outliers	177936	5594 (1.70-1.70)
Sidechain outliers	177891	5594 (1.70-1.70)
RSRZ outliers	164620	5159 (1.70-1.70)

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	262	
1	B	262	

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	VAL	A	402	-	-	-	X

## 2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 4770 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.

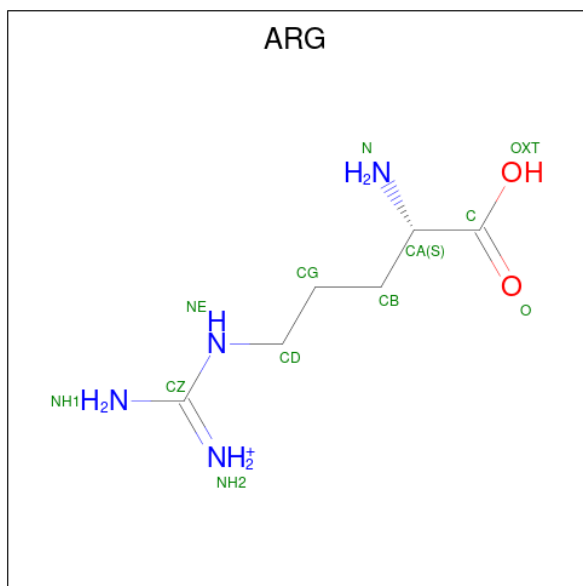
- Molecule 1 is a protein called ULILYSIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
			Total	C	N	O	S				Se
1	A	262	Total 2049	C 1288	N 341	O 408	S 6	Se 6	0	4	0
1	B	262	Total 2045	C 1284	N 341	O 408	S 6	Se 6	0	3	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	269	ALA	CYS	engineered mutation	UNP Q8TL28
B	269	ALA	CYS	engineered mutation	UNP Q8TL28

- Molecule 2 is ARGinine (three-letter code: ARG) (formula: C<sub>6</sub>H<sub>15</sub>N<sub>4</sub>O<sub>2</sub>).



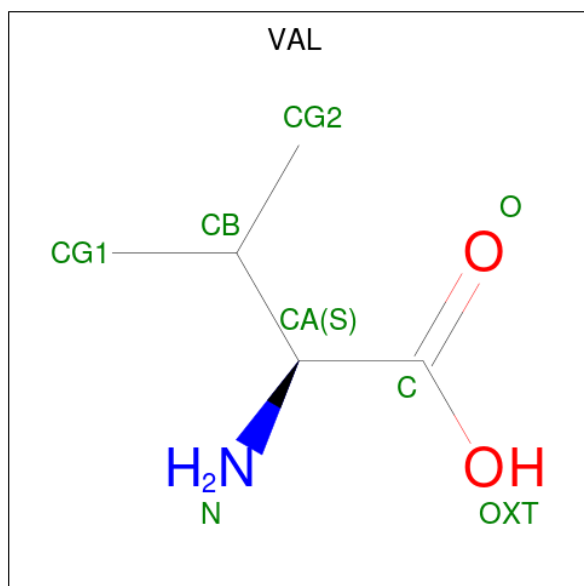
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	Total 11	C 6	N 4	O 1	0	0

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	B	1	11	6	4	1	0	0

- Molecule 3 is VALINE (three-letter code: VAL) (formula:  $C_5H_{11}NO_2$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
3	A	1	7	5	1	1	0	0
3	B	1	7	5	1	1	0	0

- Molecule 4 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Ca		
4	A	3	3	3	0	0
4	B	2	2	2	0	0

- Molecule 5 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Zn		
5	A	1	1	1	0	0
5	B	1	1	1	0	0

- Molecule 6 is GLYCEROL (three-letter code: GOL) (formula: C<sub>3</sub>H<sub>8</sub>O<sub>3</sub>).



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

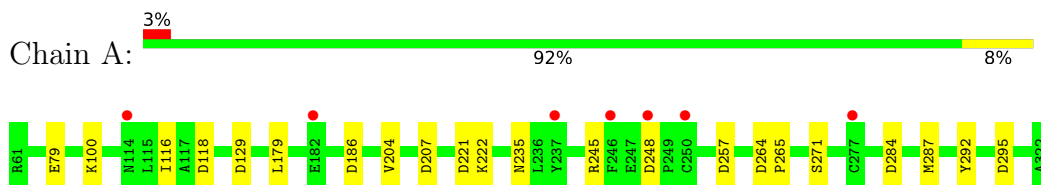
- Molecule 7 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	305	Total O 305 305	0	0
7	B	292	Total O 292 292	0	0

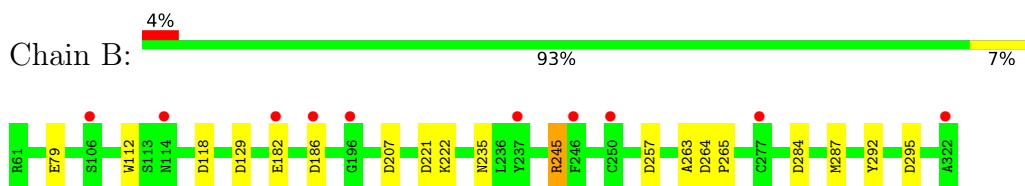
### 3 Residue-property plots [i](#)

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: ULILYSIN



- Molecule 1: ULILYSIN



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	49.56Å 126.15Å 87.41Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	39.00 – 1.70 39.00 – 1.70	Depositor EDS
% Data completeness (in resolution range)	99.8 (39.00-1.70) 99.7 (39.00-1.70)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.94 (at 1.70Å)	Xtrriage
Refinement program	REFMAC 5.2.0005	Depositor
R, $R_{free}$	0.173 , 0.241 0.177 , 0.237	Depositor DCC
$R_{free}$ test set	610 reflections (1.00%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	15.7	Xtrriage
Anisotropy	0.450	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.38 , 49.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	4770	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	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 91.13 % 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 1.7097e-08. 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: GOL, CA, ZN

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	0.59	0/2110	0.82	8/2866 (0.3%)
1	B	0.55	0/2102	0.81	7/2855 (0.2%)
All	All	0.57	0/4212	0.82	15/5721 (0.3%)

There are no bond length outliers.

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	248	ASP	CB-CG-OD2	7.67	125.20	118.30
1	A	129	ASP	CB-CG-OD2	7.59	125.14	118.30
1	B	284	ASP	CB-CG-OD2	7.16	124.75	118.30
1	B	118	ASP	CB-CG-OD2	7.09	124.68	118.30
1	A	284	ASP	CB-CG-OD2	6.95	124.56	118.30
1	B	129	ASP	CB-CG-OD2	6.91	124.52	118.30
1	B	257	ASP	CB-CG-OD2	6.68	124.32	118.30
1	A	118	ASP	CB-CG-OD2	6.56	124.20	118.30
1	A	257	ASP	CB-CG-OD2	6.40	124.06	118.30
1	B	221	ASP	CB-CG-OD2	6.32	123.98	118.30
1	A	207	ASP	CB-CG-OD2	6.23	123.91	118.30
1	B	207	ASP	CB-CG-OD2	5.98	123.68	118.30
1	A	221	ASP	CB-CG-OD2	5.67	123.40	118.30
1	A	186	ASP	CB-CG-OD2	5.36	123.12	118.30
1	B	186	ASP	CB-CG-OD2	5.30	123.07	118.30

There are no chirality outliers.

There are no planarity outliers.

## 5.2 Too-close contacts

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	2049	0	1920	8	0
1	B	2045	0	1913	7	0
2	A	11	0	12	0	0
2	B	11	0	12	0	0
3	A	7	0	9	0	0
3	B	7	0	9	0	0
4	A	3	0	0	0	0
4	B	2	0	0	0	0
5	A	1	0	0	0	0
5	B	1	0	0	0	0
6	A	18	0	24	1	0
6	B	18	0	24	4	0
7	A	305	0	0	1	0
7	B	292	0	0	2	0
All	All	4770	0	3923	17	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 2.

All (17) 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)
6:B:1404:GOL:H32	7:B:2232:HOH:O	1.73	0.88
1:B:112:TRP:HE1	6:B:1404:GOL:H31	1.42	0.84
1:B:112:TRP:NE1	6:B:1404:GOL:H31	2.07	0.69
1:B:222:LYS:HB2	1:B:295:ASP:HB3	1.82	0.60
1:A:100:LYS:HE3	1:A:116:ILE:CG2	2.33	0.59
1:B:79:GLU:CD	1:B:79:GLU:H	2.04	0.59
1:A:245:ARG:HA	1:B:245:ARG:HA	1.86	0.57
1:A:222:LYS:HB2	1:A:295:ASP:HB3	1.86	0.56
1:A:264:ASP:HB3	1:A:265:PRO:HD2	1.89	0.55
6:B:1403:GOL:H32	7:B:2290:HOH:O	2.06	0.54
1:A:100:LYS:HE3	1:A:116:ILE:HG22	1.96	0.48
1:B:264:ASP:HB3	1:B:265:PRO:HD2	1.99	0.44
1:B:287:MSE:SE	1:B:287:MSE:H	2.50	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
6:A:1405:GOL:H11	7:A:2303:HOH:O	2.19	0.43
1:A:287:MSE:SE	1:A:287:MSE:H	2.52	0.41
1:A:79:GLU:H	1:A:79:GLU:CD	2.24	0.41
1:A:179[B]:LEU:HD11	1:A:204:VAL:HG12	2.03	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	264/262 (101%)	256 (97%)	8 (3%)	0	100	100
1	B	263/262 (100%)	256 (97%)	6 (2%)	1 (0%)	30	17
All	All	527/524 (101%)	512 (97%)	14 (3%)	1 (0%)	44	29

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	263	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	229/219 (105%)	226 (99%)	3 (1%)	65	52

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	228/219 (104%)	224 (98%)	4 (2%)	54	39
All	All	457/438 (104%)	450 (98%)	7 (2%)	60	47

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	235	ASN
1	A	271	SER
1	A	292	TYR
1	B	182	GLU
1	B	235	ASN
1	B	245	ARG
1	B	292	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	114	ASN
1	A	134	GLN
1	A	142	GLN
1	A	235	ASN
1	A	303	GLN
1	B	142	GLN
1	B	235	ASN
1	B	303	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 oligosaccharides in this entry.

## 5.6 Ligand geometry

Of 17 ligands modelled in this entry, 7 are monoatomic - leaving 10 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	ARG	B	401	-	9,10,11	0.42	0	5,11,13	0.35	0
2	ARG	A	401	-	9,10,11	0.38	0	5,11,13	0.25	0
6	GOL	B	1404	-	5,5,5	0.38	0	5,5,5	0.45	0
6	GOL	A	1405	-	5,5,5	0.38	0	5,5,5	0.34	0
6	GOL	B	1403	-	5,5,5	0.37	0	5,5,5	0.30	0
6	GOL	A	1406	-	5,5,5	0.36	0	5,5,5	0.34	0
6	GOL	B	1405	-	5,5,5	0.40	0	5,5,5	0.75	0
3	VAL	A	402	-	4,6,7	0.48	0	6,7,9	1.07	1 (16%)
3	VAL	B	402	-	4,6,7	0.50	0	6,7,9	1.13	1 (16%)
6	GOL	A	1404	-	5,5,5	0.37	0	5,5,5	0.49	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	ARG	B	401	-	-	0/8/9/11	-
2	ARG	A	401	-	-	0/8/9/11	-
6	GOL	B	1404	-	-	0/4/4/4	-
6	GOL	A	1405	-	-	2/4/4/4	-
6	GOL	B	1403	-	-	4/4/4/4	-
6	GOL	A	1406	-	-	4/4/4/4	-
6	GOL	B	1405	-	-	0/4/4/4	-
3	VAL	A	402	-	-	0/5/6/8	-
3	VAL	B	402	-	-	0/5/6/8	-
6	GOL	A	1404	-	-	0/4/4/4	-

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	402	VAL	CB-CA-C	-2.30	109.84	112.94
3	A	402	VAL	CB-CA-C	-2.05	110.17	112.94

There are no chirality outliers.

All (10) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	A	1405	GOL	O1-C1-C2-C3
6	A	1406	GOL	O1-C1-C2-O2
6	A	1406	GOL	C1-C2-C3-O3
6	B	1403	GOL	O1-C1-C2-C3
6	B	1403	GOL	C1-C2-C3-O3
6	B	1403	GOL	O2-C2-C3-O3
6	A	1406	GOL	O2-C2-C3-O3
6	A	1406	GOL	O1-C1-C2-C3
6	A	1405	GOL	O1-C1-C2-O2
6	B	1403	GOL	O1-C1-C2-O2

There are no ring outliers.

3 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	B	1404	GOL	3	0
6	A	1405	GOL	1	0
6	B	1403	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	256/262 (97%)	0.14	7 (2%) 56 58	12, 17, 26, 37	4 (1%)
1	B	256/262 (97%)	0.47	10 (3%) 44 47	13, 17, 25, 36	3 (1%)
All	All	512/524 (97%)	0.31	17 (3%) 49 52	12, 17, 26, 37	7 (1%)

All (17) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	182	GLU	3.6
1	B	182	GLU	3.3
1	A	246	PHE	3.1
1	B	250	CYS	3.1
1	A	237	TYR	2.9
1	B	246	PHE	2.7
1	B	186	ASP	2.5
1	B	114	ASN	2.5
1	B	322	ALA	2.5
1	A	277	CYS	2.4
1	B	237	TYR	2.2
1	B	196	GLY	2.2
1	B	106	SER	2.2
1	A	114	ASN	2.2
1	B	277	CYS	2.2
1	A	250	CYS	2.1
1	A	248	ASP	2.1

### 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	VAL	A	402	7/8	0.70	0.46	26,27,27,27	7
6	GOL	B	1404	6/6	0.77	0.16	27,31,34,35	0
6	GOL	A	1405	6/6	0.79	0.14	25,33,34,38	0
3	VAL	B	402	7/8	0.79	0.35	26,27,27,27	7
6	GOL	A	1406	6/6	0.82	0.23	22,29,30,32	0
6	GOL	B	1403	6/6	0.82	0.13	25,32,33,36	0
2	ARG	B	401	11/12	0.82	0.30	15,23,25,25	11
2	ARG	A	401	11/12	0.84	0.34	15,19,25,25	11
6	GOL	A	1404	6/6	0.89	0.22	14,24,27,29	0
6	GOL	B	1405	6/6	0.89	0.12	3,10,13,14	6
4	CA	B	997	1/1	0.96	0.04	14,14,14,14	0
4	CA	B	998	1/1	0.96	0.06	13,13,13,13	0
4	CA	A	997	1/1	0.97	0.05	13,13,13,13	0
4	CA	A	998	1/1	0.98	0.05	14,14,14,14	0
5	ZN	B	999	1/1	0.98	0.05	16,16,16,16	0
5	ZN	A	999	1/1	0.99	0.02	15,15,15,15	0
4	CA	A	1403	1/1	0.99	0.20	11,11,11,11	0

### 6.5 Other polymers [i](#)

There are no such residues in this entry.