



# Full wwPDB X-ray Structure Validation Report ⓘ

Sep 17, 2017 – 11:50 AM EDT

PDB ID : 5UBK  
Title : Inactive S1A/N269D-cpPvdQ mutant in complex with the pyoverdine precursor PVDIq reveals a specific binding pocket for the D-Tyr of this substrate  
Authors : Mascarenhas, R.; Catlin, D.; Wu, R.; Clevenger, K.; Fast, W.; Liu, D.  
Deposited on : unknown  
Resolution : 2.55 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

<http://wwpdb.org/validation/2016/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 : 1.7.2 (RC1), CSD as538be (2017)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20029824  
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) : rb-20029824

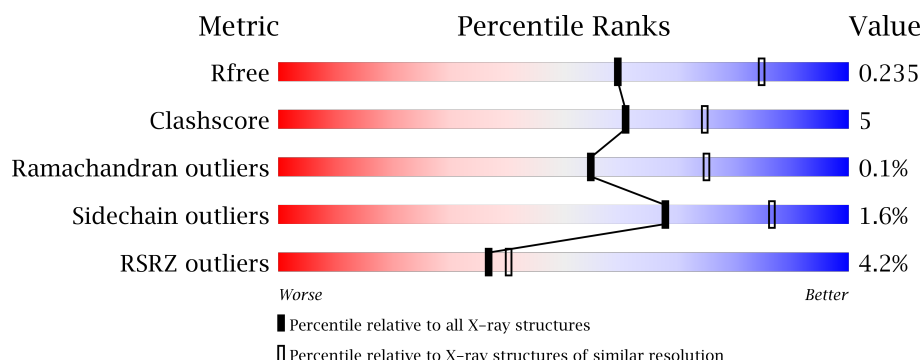
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.55 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	4993 (2.58-2.50)
Clashscore	112137	5755 (2.58-2.50)
Ramachandran outliers	110173	5652 (2.58-2.50)
Sidechain outliers	110143	5654 (2.58-2.50)
RSRZ outliers	101464	5026 (2.58-2.50)

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	709	<div> <div>4%</div> <div>87%</div> <div>13%</div> </div>

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 5695 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.

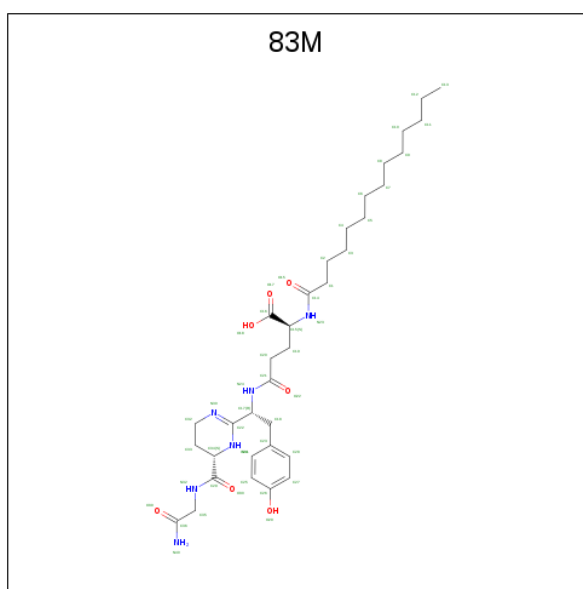
- Molecule 1 is a protein called Acyl-homoserine lactone acylase PvdQ.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	709	5496	3460	1000	1023	13	0	1	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	ALA	SER	engineered mutation	UNP Q9I194
A	269	ASP	ASN	engineered mutation	UNP Q9I194
A	547	GLY	-	linker	UNP Q9I194

- Molecule 2 is N-[(1R)-1-{(6S)-6-[(2-amino-2-oxoethyl)carbamoyl]-1,4,5,6-tetrahydropyrimidin-2-yl}-2-(4-hydroxyphenyl)ethyl]-N 2 -tetradecanoyl-L-glutamine (three-letter code: 83M) (formula: C<sub>34</sub>H<sub>54</sub>N<sub>6</sub>O<sub>7</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	47	34	6	7	0	0

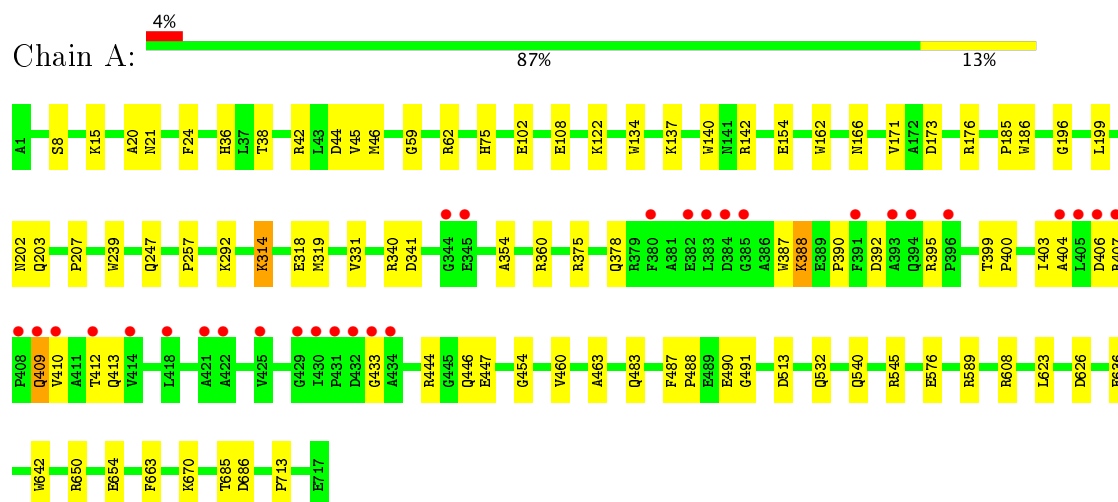
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	152	Total 152	O 152	0	0

### 3 Residue-property plots

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: Acyl-homoserine lactone acylase PvdQ



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	120.38Å 168.36Å 93.64Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	39.03 – 2.55 39.03 – 2.55	Depositor EDS
% Data completeness (in resolution range)	85.6 (39.03-2.55) 85.6 (39.03-2.55)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.98 (at 2.54Å)	Xtriage
Refinement program	PHENIX 1.11.1 _2575	Depositor
R, $R_{free}$	0.184 , 0.237 0.179 , 0.235	Depositor DCC
$R_{free}$ test set	1356 reflections (5.05%)	DCC
Wilson B-factor (Å <sup>2</sup> )	39.2	Xtriage
Anisotropy	0.264	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 44.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	5695	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	40.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.08% 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

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: 83M

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	0/5629	0.45	0/7657

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

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	5496	0	5372	57	0
2	A	47	0	0	0	0
3	A	152	0	0	12	0
All	All	5695	0	5372	57	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 (57) 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:392:ASP:H	1:A:399:THR:HG21	1.49	0.77

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:142:ARG:NH1	3:A:901:HOH:O	2.19	0.76
1:A:446:GLN:N	1:A:446:GLN:OE1	2.19	0.69
1:A:292:LYS:NZ	3:A:912:HOH:O	2.29	0.66
1:A:142:ARG:O	3:A:901:HOH:O	2.13	0.66
1:A:670:LYS:O	3:A:902:HOH:O	2.13	0.66
1:A:433:GLY:N	3:A:903:HOH:O	2.14	0.65
1:A:626:ASP:OD1	3:A:904:HOH:O	2.14	0.64
1:A:331:VAL:HG13	1:A:403:ILE:HD11	1.81	0.62
1:A:354:ALA:O	3:A:905:HOH:O	2.16	0.60
1:A:202:ASN:HB3	1:A:257:PRO:HD2	1.83	0.60
1:A:407:ARG:HB2	1:A:410:VAL:HG12	1.84	0.60
1:A:108:GLU:OE1	1:A:608:ARG:NH1	2.35	0.59
1:A:173:ASP:OD1	1:A:176:ARG:NH1	2.36	0.57
1:A:406:ASP:OD2	1:A:407:ARG:N	2.39	0.55
1:A:203:GLN:OE1	3:A:907:HOH:O	2.18	0.55
1:A:45:VAL:HG11	1:A:166:ASN:HB3	1.88	0.54
1:A:42:ARG:NH2	1:A:576:GLU:OE2	2.41	0.54
1:A:319:MET:O	3:A:908:HOH:O	2.18	0.52
1:A:654:GLU:HG3	1:A:685:THR:HG21	1.92	0.51
1:A:62:ARG:NH1	1:A:491:GLY:HA2	2.27	0.49
1:A:75:HIS:CE1	1:A:186:TRP:HA	2.48	0.48
1:A:207:PRO:HB3	1:A:239:TRP:CE2	2.49	0.48
1:A:21:ASN:ND2	3:A:916:HOH:O	2.32	0.47
1:A:540:GLN:NE2	3:A:931:HOH:O	2.47	0.47
1:A:390:PRO:O	1:A:399:THR:OG1	2.33	0.47
1:A:636:GLU:CD	1:A:636:GLU:H	2.18	0.47
1:A:454:GLY:H	1:A:460:VAL:HG11	1.80	0.46
1:A:409:GLN:O	1:A:413:GLN:HG3	2.16	0.46
1:A:387:TRP:CD2	1:A:400:PRO:HB2	2.50	0.46
1:A:488:PRO:HB2	1:A:490:GLU:OE2	2.16	0.46
1:A:36:HIS:HB2	1:A:46:MET:HG3	1.97	0.46
1:A:134:TRP:CD1	1:A:137:LYS:HB3	2.51	0.46
1:A:395:ARG:O	1:A:399:THR:HG22	2.16	0.46
1:A:8:SER:HB3	1:A:196:GLY:HA3	1.98	0.45
1:A:532:GLN:NE2	3:A:926:HOH:O	2.44	0.45
1:A:140:TRP:CZ2	1:A:713:PRO:HB3	2.52	0.44
1:A:314:LYS:O	1:A:318:GLU:HG3	2.17	0.43
1:A:454:GLY:O	1:A:463:ALA:HA	2.19	0.43
1:A:444:ARG:HD3	1:A:444:ARG:HA	1.81	0.43
1:A:171:VAL:HG13	1:A:199:LEU:HD22	2.01	0.43
1:A:589:ARG:HA	1:A:663:PHE:CZ	2.54	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:375:ARG:HA	1:A:378:GLN:HG3	2.01	0.42
1:A:59:GLY:HA2	1:A:483:GLN:OE1	2.19	0.42
1:A:388:LYS:HA	1:A:404:ALA:HB2	2.01	0.42
1:A:407:ARG:HB2	1:A:410:VAL:CG1	2.48	0.42
1:A:513:ASP:OD1	1:A:513:ASP:N	2.52	0.42
1:A:446:GLN:HG2	1:A:447:GLU:HG3	2.02	0.42
1:A:642:TRP:CZ2	1:A:650:ARG:HD2	2.54	0.41
1:A:20:ALA:HB3	1:A:483:GLN:HB3	2.01	0.41
1:A:314:LYS:NZ	1:A:318:GLU:CD	2.74	0.41
1:A:102:GLU:HB3	1:A:122:LYS:NZ	2.36	0.41
1:A:154:GLU:HB2	1:A:247:GLN:NE2	2.35	0.41
1:A:15:LYS:HD2	1:A:487:PHE:O	2.20	0.41
1:A:38:THR:OG1	1:A:44:ASP:OD2	2.25	0.40
1:A:409:GLN:O	1:A:412:THR:HG22	2.22	0.40
1:A:340:ARG:NH2	1:A:341:ASP:OD1	2.55	0.40

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	706/709 (100%)	675 (96%)	30 (4%)	1 (0%)	55 75

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	185	PRO

### 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	560/564 (99%)	551 (98%)	9 (2%)	68 86

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	24	PHE
1	A	162	TRP
1	A	314	LYS
1	A	360	ARG
1	A	388	LYS
1	A	409	GLN
1	A	545	ARG
1	A	623	LEU
1	A	686	ASP

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

Mol	Chain	Res	Type
1	A	203	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

1 ligand is 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	83M	A	801	-	44,48,48	1.56	10 (22%)	48,60,60	1.13	3 (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
2	83M	A	801	-	-	0/39/57/57	0/2/2/2

All (10) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	801	83M	O15-C14	-3.67	1.15	1.23
2	A	801	83M	C15-N23	-3.47	1.41	1.46
2	A	801	83M	C14-N23	-3.23	1.27	1.34
2	A	801	83M	C17-C22	-3.17	1.47	1.51
2	A	801	83M	O22-C21	-2.75	1.17	1.23
2	A	801	83M	C1-C14	-2.63	1.46	1.51
2	A	801	83M	O29-C26	-2.14	1.32	1.37
2	A	801	83M	C25-C26	-2.01	1.35	1.38
2	A	801	83M	C25-C24	-2.01	1.35	1.38
2	A	801	83M	C36-N40	2.52	1.41	1.32

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	801	83M	C19-C15-N23	-2.32	106.70	110.22
2	A	801	83M	O30-C29-N32	-2.05	119.11	123.07
2	A	801	83M	C32-N30-C22	3.60	127.67	118.10

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	A	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	547:GLY	C	556:GLY	N	5.18

## 6 Fit of model and data

### 6.1 Protein, DNA and RNA chains

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	709/709 (100%)	0.02	30 (4%)	37 40	24, 36, 70, 94	0

All (30) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	380	PHE	4.8
1	A	433	GLY	4.6
1	A	385	GLY	4.6
1	A	384	ASP	4.5
1	A	414	VAL	4.3
1	A	408	PRO	4.0
1	A	344	GLY	3.9
1	A	407	ARG	3.2
1	A	396	PRO	3.2
1	A	393	ALA	2.9
1	A	405	LEU	2.9
1	A	409	GLN	2.8
1	A	418	LEU	2.7
1	A	391	PHE	2.6
1	A	431	PRO	2.6
1	A	412	THR	2.6
1	A	406	ASP	2.5
1	A	425	VAL	2.4
1	A	410	VAL	2.4
1	A	432	ASP	2.4
1	A	383	LEU	2.3
1	A	345	GLU	2.3
1	A	394	GLN	2.3
1	A	430	ILE	2.2
1	A	422	ALA	2.2
1	A	434	ALA	2.2
1	A	421	ALA	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	404	ALA	2.0
1	A	429	GLY	2.0
1	A	382	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 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, 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	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
2	83M	A	801	47/47	0.89	0.18	0.21	23,37,81,89	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.