



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jun 27, 2017 – 12:06 AM EDT

PDB ID : 5DHH  
Title : The crystal structure of nociceptin/orphanin FQ peptide receptor (NOP) in complex with SB-612111 (PSI Community Target)  
Authors : Miller, R.L.; Thompson, A.A.; Trapella, C.; Guerrini, R.; Malfacini, D.; Patel, N.; Han, G.W.; Cherezov, V.; Calo, G.; Katritch, V.; Stevens, R.C.; GPCR Network (GPCR)  
Deposited on : 2015-08-31  
Resolution : 3.00 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

<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-20029077  
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-20029077

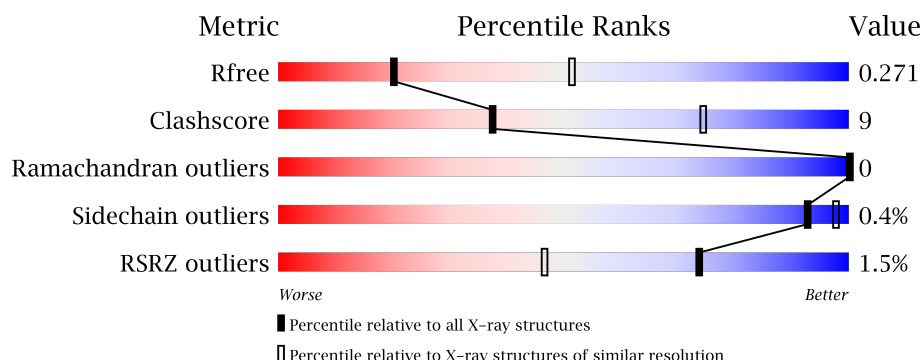
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 3.00 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	1692 (3.00-3.00)
Clashscore	112137	2037 (3.00-3.00)
Ramachandran outliers	110173	1973 (3.00-3.00)
Sidechain outliers	110143	1976 (3.00-3.00)
RSRZ outliers	101464	1716 (3.00-3.00)

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	424	<div> <div></div> <div>54%13%33%</div> </div>
1	B	424	<div> <div></div> <div>72%19%9%</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
2	OLA	B	1501	-	-	-	X
3	DGW	A	1206	-	-	-	X
3	DGW	B	1503	-	-	-	X

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 5172 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 Soluble cytochrome b562,Nociceptin receptor.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	282	Total	C	N	O	S	0	0	0
			2142	1407	354	364	17			
1	B	387	Total	C	N	O	S	0	0	0
			2885	1874	483	508	20			

There are 48 discrepancies between the modelled and reference sequences:

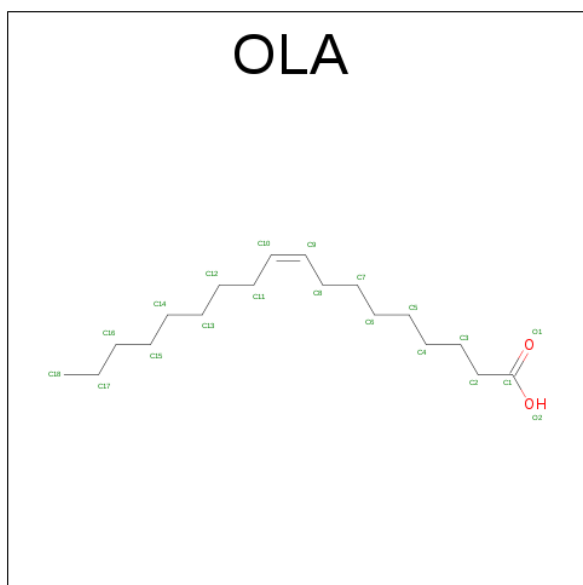
Chain	Residue	Modelled	Actual	Comment	Reference
A	-73	ASP	-	expression tag	UNP P0ABE7
A	-72	TYR	-	expression tag	UNP P0ABE7
A	-71	LYS	-	expression tag	UNP P0ABE7
A	-70	ASP	-	expression tag	UNP P0ABE7
A	-69	ASP	-	expression tag	UNP P0ABE7
A	-68	ASP	-	expression tag	UNP P0ABE7
A	-67	ASP	-	expression tag	UNP P0ABE7
A	-66	GLY	-	expression tag	UNP P0ABE7
A	-65	ALA	-	expression tag	UNP P0ABE7
A	-64	PRO	-	expression tag	UNP P0ABE7
A	-57	TRP	MET	engineered mutation	UNP P0ABE7
A	38	ILE	HIS	engineered mutation	UNP P0ABE7
A	42	LEU	ARG	engineered mutation	UNP P0ABE7
A	340	GLY	-	expression tag	UNP P41146
A	341	ARG	-	expression tag	UNP P41146
A	342	PRO	-	expression tag	UNP P41146
A	343	LEU	-	expression tag	UNP P41146
A	344	GLU	-	expression tag	UNP P41146
A	345	VAL	-	expression tag	UNP P41146
A	346	LEU	-	expression tag	UNP P41146
A	347	PHE	-	expression tag	UNP P41146
A	348	GLN	-	expression tag	UNP P41146
A	349	GLY	-	expression tag	UNP P41146
A	350	PRO	-	expression tag	UNP P41146
B	991	ASP	-	expression tag	UNP P0ABE7

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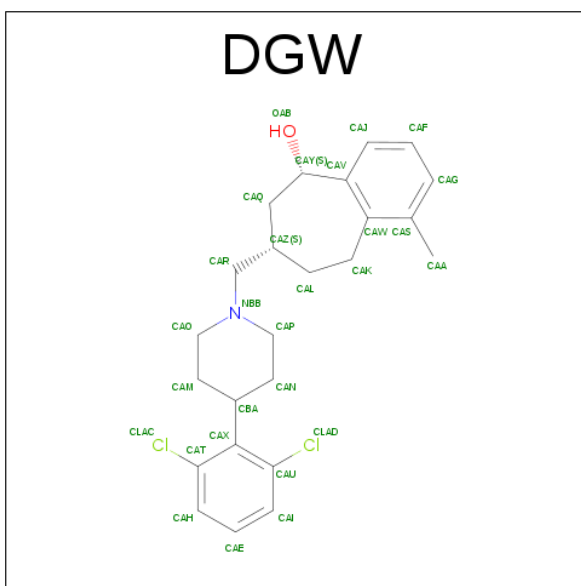
Chain	Residue	Modelled	Actual	Comment	Reference
B	992	TYR	-	expression tag	UNP P0ABE7
B	993	LYS	-	expression tag	UNP P0ABE7
B	994	ASP	-	expression tag	UNP P0ABE7
B	995	ASP	-	expression tag	UNP P0ABE7
B	996	ASP	-	expression tag	UNP P0ABE7
B	997	ASP	-	expression tag	UNP P0ABE7
B	998	GLY	-	expression tag	UNP P0ABE7
B	999	ALA	-	expression tag	UNP P0ABE7
B	1000	PRO	-	expression tag	UNP P0ABE7
B	1007	TRP	MET	engineered mutation	UNP P0ABE7
B	1102	ILE	HIS	engineered mutation	UNP P0ABE7
B	1106	LEU	ARG	engineered mutation	UNP P0ABE7
B	1404	GLY	-	expression tag	UNP P41146
B	1405	ARG	-	expression tag	UNP P41146
B	1406	PRO	-	expression tag	UNP P41146
B	1407	LEU	-	expression tag	UNP P41146
B	1408	GLU	-	expression tag	UNP P41146
B	1409	VAL	-	expression tag	UNP P41146
B	1410	LEU	-	expression tag	UNP P41146
B	1411	PHE	-	expression tag	UNP P41146
B	1412	GLN	-	expression tag	UNP P41146
B	1413	GLY	-	expression tag	UNP P41146
B	1414	PRO	-	expression tag	UNP P41146

- Molecule 2 is OLEIC ACID (three-letter code: OLA) (formula:  $C_{18}H_{34}O_2$ ).



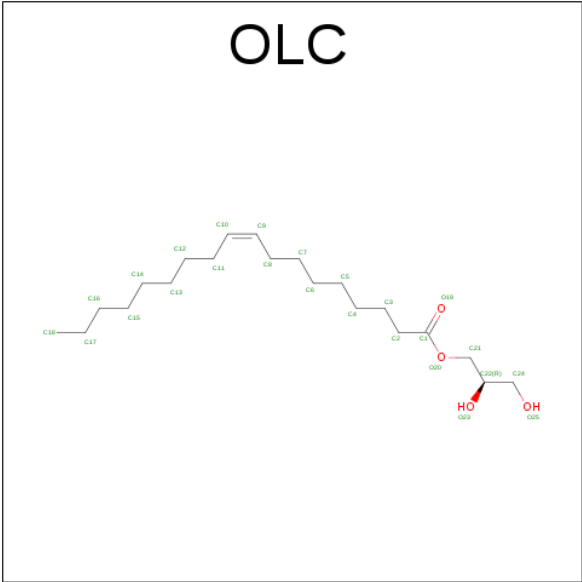
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			12	10	2		
2	A	1	Total	C	O	0	0
			8	6	2		
2	A	1	Total	C	O	0	0
			17	15	2		
2	A	1	Total	C	O	0	0
			11	9	2		
2	A	1	Total	C	O	0	0
			12	10	2		
2	B	1	Total	C	O	0	0
			10	8	2		
2	B	1	Total	C	O	0	0
			7	5	2		

- Molecule 3 is (5S,7S)-7-{[4-(2,6-dichlorophenyl)piperidin-1-yl]methyl}-1-methyl-6,7,8,9-tetrahydro-5H-benzo[7]annulen-5-ol (three-letter code: DGW) (formula: C<sub>24</sub>H<sub>29</sub>Cl<sub>2</sub>NO).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	Cl	N	O	0	0
			28	24	2	1	1		
3	B	1	Total	C	Cl	N	O	0	0
			28	24	2	1	1		

- Molecule 4 is (2R)-2,3-dihydroxypropyl (9Z)-octadec-9-enoate (three-letter code: OLC) (formula: C<sub>21</sub>H<sub>40</sub>O<sub>4</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	B	1	Total	C	O	0	0
			12	8	4		





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	42.30 Å 168.94 Å 65.47 Å 90.00° 103.50° 90.00°	Depositor
Resolution (Å)	29.84 – 3.00 29.85 – 3.00	Depositor EDS
% Data completeness (in resolution range)	92.9 (29.84-3.00) 84.4 (29.85-3.00)	Depositor EDS
$R_{merge}$	0.19	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.02 (at 3.00 Å)	Xtriage
Refinement program	PHENIX (1.10 _2142: ???)	Depositor
R, $R_{free}$	0.240 , 0.279 0.234 , 0.271	Depositor DCC
$R_{free}$ test set	745 reflections (4.96%)	DCC
Wilson B-factor (Å <sup>2</sup> )	55.4	Xtriage
Anisotropy	0.344	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.30 , 72.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.90	EDS
Total number of atoms	5172	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	67.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.18% 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: OLA, OLC, DGW

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	0.28	0/2187	0.44	0/2986
1	B	0.28	0/2941	0.43	0/4018
All	All	0.28	0/5128	0.43	0/7004

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	2142	0	2193	35	0
1	B	2885	0	2865	52	0
2	A	60	0	76	5	0
2	B	17	0	18	0	0
3	A	28	0	29	2	0
3	B	28	0	29	3	0
4	B	12	0	13	0	0
All	All	5172	0	5223	91	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 9.

The worst 5 of 91 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:47:PRO:HD2	1:A:50:LEU:HD12	1.68	0.74
1:A:175:TRP:CH2	1:A:175:TRP:CE3	2.74	0.73
1:B:1146:MET:HA	1:B:1146:MET:HE2	1.72	0.71
1:B:1281:ILE:HD12	1:B:1348:LEU:HD11	1.73	0.70
1:B:1104:LYS:HE3	1:B:1105:TYR:CZ	2.26	0.70

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	278/424 (66%)	269 (97%)	9 (3%)	0	100	100
1	B	379/424 (89%)	367 (97%)	12 (3%)	0	100	100
All	All	657/848 (78%)	636 (97%)	21 (3%)	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	229/355 (64%)	228 (100%)	1 (0%)	93	98

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	293/355 (82%)	292 (100%)	1 (0%)	94	98
All	All	522/710 (74%)	520 (100%)	2 (0%)	93	98

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	330	PHE
1	B	1101	TYR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	87	ASN
1	A	325	ASN
1	B	1171	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 [i](#)

10 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
2	OLA	A	1201	-	8,11,19	0.32	0	7,11,19	0.72	0
2	OLA	A	1202	-	4,7,19	0.24	0	3,7,19	0.46	0
2	OLA	A	1203	-	13,16,19	0.23	0	12,16,19	0.65	0
2	OLA	A	1204	-	7,10,19	0.31	0	6,10,19	0.80	0
2	OLA	A	1205	-	8,11,19	0.34	0	7,11,19	0.81	0
3	DGW	A	1206	-	30,31,31	2.90	3 (10%)	34,44,44	1.73	5 (14%)
2	OLA	B	1501	-	6,9,19	0.24	0	5,9,19	0.58	0
2	OLA	B	1502	-	3,6,19	0.25	0	2,6,19	0.48	0
3	DGW	B	1503	-	30,31,31	2.83	3 (10%)	34,44,44	1.74	5 (14%)
4	OLC	B	1504	-	11,11,24	1.31	1 (9%)	12,12,25	1.41	2 (16%)

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	OLA	A	1201	-	-	0/7/9/17	0/0/0/0
2	OLA	A	1202	-	-	0/3/5/17	0/0/0/0
2	OLA	A	1203	-	-	0/12/14/17	0/0/0/0
2	OLA	A	1204	-	-	0/6/8/17	0/0/0/0
2	OLA	A	1205	-	-	0/7/9/17	0/0/0/0
3	DGW	A	1206	-	-	0/8/31/31	0/4/4/4
2	OLA	B	1501	-	-	0/5/7/17	0/0/0/0
2	OLA	B	1502	-	-	0/2/4/17	0/0/0/0
3	DGW	B	1503	-	-	0/8/31/31	0/4/4/4
4	OLC	B	1504	-	-	0/11/11/24	0/0/0/0

The worst 5 of 7 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	1206	DGW	CAK-CAW	-14.19	1.38	1.51
3	B	1503	DGW	CAK-CAW	-13.70	1.39	1.51
3	B	1503	DGW	CAA-CAS	-5.31	1.40	1.51
3	A	1206	DGW	CAA-CAS	-5.21	1.40	1.51
3	B	1503	DGW	CAX-CBA	-3.65	1.40	1.51

The worst 5 of 12 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	1503	DGW	CAJ-CAV-CAY	-5.38	107.78	118.93

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	1206	DGW	CAJ-CAV-CAY	-5.32	107.90	118.93
3	B	1503	DGW	CAQ-CAZ-CAR	-2.82	105.06	109.56
3	B	1503	DGW	CAI-CAU-CAX	-2.48	119.24	122.41
3	A	1206	DGW	CAQ-CAZ-CAR	-2.35	105.81	109.56

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

5 monomers are involved in 10 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	1202	OLA	1	0
2	A	1203	OLA	3	0
2	A	1204	OLA	2	0
3	A	1206	DGW	2	0
3	B	1503	DGW	3	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	282/424 (66%)	-0.30	6 (2%)	64 34	30, 54, 124, 175	0
1	B	387/424 (91%)	-0.30	4 (1%)	82 58	27, 65, 117, 166	0
All	All	669/848 (78%)	-0.30	10 (1%)	74 47	27, 61, 121, 175	0

The worst 5 of 10 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	252	ARG	3.5
1	A	195	ASP	3.5
1	B	1308	GLY	3.2
1	A	250	GLY	2.7
1	A	79	HIS	2.6

### 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	OLA	B	1501	10/20	0.83	0.29	4.07	35,57,74,74	0
3	DGW	B	1503	28/28	0.87	0.31	3.29	47,62,116,150	0
3	DGW	A	1206	28/28	0.92	0.22	2.50	42,55,95,104	0
2	OLA	A	1203	17/20	0.88	0.23	1.56	42,64,84,85	0
2	OLA	A	1201	12/20	0.90	0.22	0.78	60,70,78,79	0
4	OLC	B	1504	12/25	0.94	0.18	0.60	42,59,66,69	0
2	OLA	A	1205	12/20	0.90	0.17	-0.07	45,53,70,75	0
2	OLA	A	1204	11/20	0.93	0.16	-0.26	40,47,55,62	0
2	OLA	A	1202	8/20	0.78	0.23	-	76,80,86,91	0
2	OLA	B	1502	7/20	0.85	0.25	-	47,58,64,65	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.