Full wwPDB X-ray Structure Validation Report (i)

Aug 21, 2023 – 10:32 PM EDT

PDB ID	:	2Q8S
Title	:	X-ray Crystal structure of the nuclear hormone receptor PPAR-gamma in a complex with a PPAR gamma/alpha dual agonist
Authors	:	Ohren, J.F.
Deposited on	:	2007-06-11
Resolution	:	2.30 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*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

The following versions of software and data (see references (i)) were used in the production of this report:

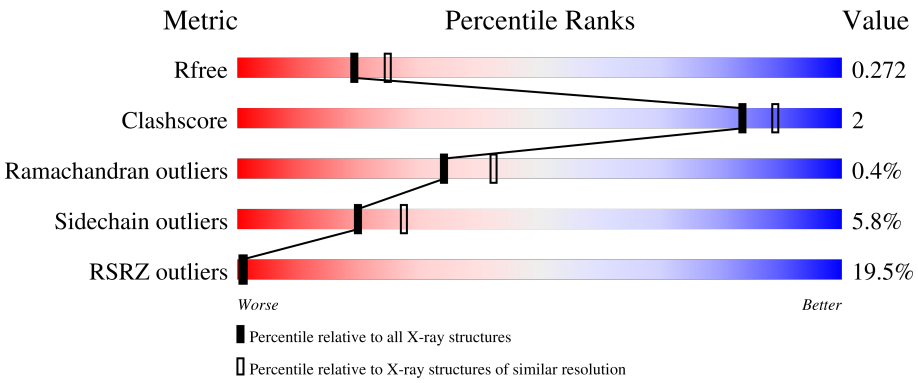
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.35
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (2.30-2.30)

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 >=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 <=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	271	20% 82% 11% • 7%
1	B	271	16% 85% 8% 6%

2 Entry composition (i)

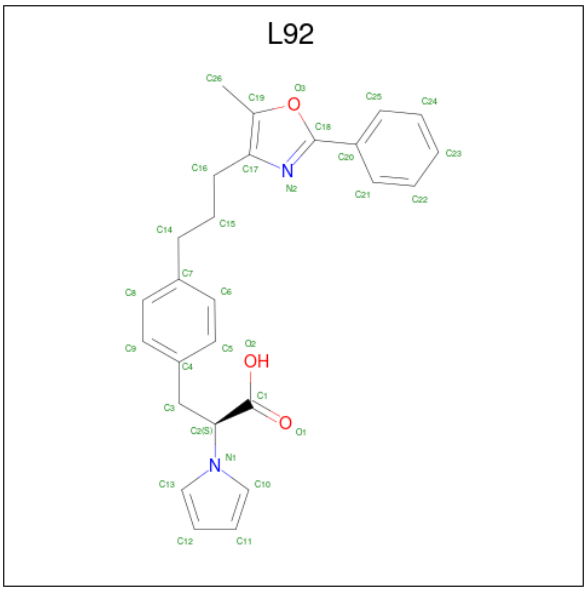
There are 3 unique types of molecules in this entry. The entry contains 4153 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Peroxisome proliferator-activated receptor gamma.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	253	2033	1313	330	380	10	0	3	0
1	B	254	2030	1314	328	378	10	0	1	0

- Molecule 2 is (2S)-3-{4-[3-(5-METHYL-2-PHENYL-1,3-OXAZOL-4-YL)PROPYL]PHENYL}-2-(1H-PYRROL-1-YL)PROPANOIC ACID (three-letter code: L92) (formula: $C_{26}H_{26}N_2O_3$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	31	26	2	3	0	0

- Molecule 3 is water.

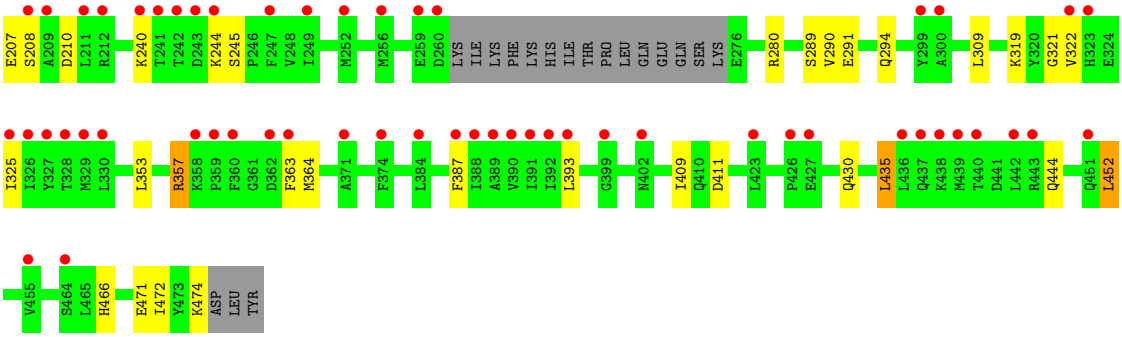
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	34	34	34	0	0
			Total	O		
3	B	25	25	25	0	0

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.

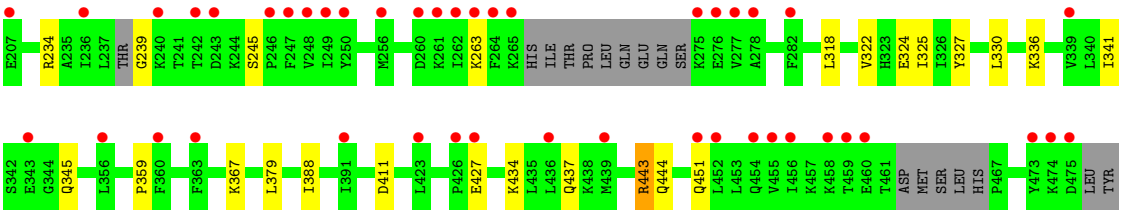
• Molecule 1: Peroxisome proliferator-activated receptor gamma

Chain A:



• Molecule 1: Peroxisome proliferator-activated receptor gamma

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	93.45Å 62.02Å 118.66Å 90.00° 102.54° 90.00°	Depositor
Resolution (Å)	35.00 – 2.30 33.24 – 2.30	Depositor EDS
% Data completeness (in resolution range)	92.8 (35.00-2.30) 92.8 (33.24-2.30)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.06	Depositor
$< I/\sigma(I) >$ [1]	2.39 (at 2.29Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.222 , 0.282 0.217 , 0.272	Depositor DCC
R_{free} test set	1420 reflections (5.15%)	wwPDB-VP
Wilson B-factor (Å^2)	62.2	Xtriage
Anisotropy	0.251	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 76.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	4153	wwPDB-VP
Average B, all atoms (Å^2)	78.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.50% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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: L92

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	0.44	0/2082	0.55	0/2804
1	B	0.44	0/2066	0.53	0/2777
All	All	0.44	0/4148	0.54	0/5581

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	2033	0	2085	12	0
1	B	2030	0	2089	7	0
2	A	31	0	25	2	0
3	A	34	0	0	0	0
3	B	25	0	0	1	0
All	All	4153	0	4199	20	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 (20) 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:363[B]:PHE:CE1	1:A:452:LEU:HB3	2.34	0.63
1:A:387:PHE:CE1	1:A:435:LEU:HD22	2.38	0.59
2:A:1001:L92:H162	2:A:1001:L92:H8	1.89	0.54
1:B:327:TYR:CZ	1:B:367:LYS:NZ	2.76	0.52
1:B:434:LYS:HA	1:B:437:GLN:HE21	1.73	0.52
1:A:363[B]:PHE:CZ	1:A:452:LEU:HB3	2.48	0.48
1:B:345:GLN:HE21	1:B:345:GLN:HA	1.78	0.47
1:B:324:GLU:OE2	1:B:443:ARG:HD2	2.15	0.46
1:B:234:ARG:O	1:B:239:GLY:HA3	2.16	0.46
1:A:207:GLU:HB3	1:A:210:ASP:OD2	2.16	0.45
1:A:321:GLY:O	1:A:325:ILE:HG12	2.17	0.45
1:A:291:GLU:O	1:A:294:GLN:HG2	2.20	0.42
1:A:319:LYS:NZ	1:A:472:ILE:O	2.49	0.42
1:A:244[B]:LYS:HG3	1:A:245:SER:N	2.35	0.41
1:B:325:ILE:HD12	1:B:388:ILE:HG23	2.01	0.41
1:A:353:LEU:HD21	2:A:1001:L92:H261	2.03	0.41
1:B:411:ASP:HB3	3:B:483:HOH:O	2.21	0.41
1:A:393:LEU:CD2	1:A:409:ILE:HG21	2.51	0.41
1:A:290:VAL:HG21	1:A:466:HIS:CG	2.56	0.40
1:A:363[A]:PHE:CE2	1:A:364:MET:HG2	2.56	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	252/271 (93%)	249 (99%)	2 (1%)	1 (0%)	34	42
1	B	247/271 (91%)	237 (96%)	9 (4%)	1 (0%)	34	42
All	All	499/542 (92%)	486 (97%)	11 (2%)	2 (0%)	34	42

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	357	ARG
1	B	359	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	228/244 (93%)	214 (94%)	14 (6%)	18	25
1	B	226/244 (93%)	214 (95%)	12 (5%)	22	31
All	All	454/488 (93%)	428 (94%)	26 (6%)	20	28

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	208	SER
1	A	240	LYS
1	A	280	ARG
1	A	289	SER
1	A	309	LEU
1	A	322	VAL
1	A	357	ARG
1	A	411	ASP
1	A	430	GLN
1	A	435	LEU
1	A	444	GLN
1	A	452	LEU
1	A	471	GLU
1	A	474	LYS
1	B	245	SER
1	B	263	LYS
1	B	318	LEU
1	B	322	VAL
1	B	330	LEU
1	B	336	LYS
1	B	341	ILE
1	B	379	LEU

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Mol	Chain	Res	Type
1	B	427	GLU
1	B	443	ARG
1	B	444	GLN
1	B	451	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	286	GLN
1	A	308	ASN
1	A	375	ASN
1	A	430	GLN
1	B	308	ASN
1	B	345	GLN
1	B	375	ASN
1	B	437	GLN
1	B	444	GLN
1	B	451	GLN
1	B	470	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 monosaccharides in this entry.

5.6 Ligand geometry (i)

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	L92	A	1001	-	28,34,34	1.44	3 (10%)	29,46,46	1.42	3 (10%)

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	L92	A	1001	-	-	4/16/22/22	0/4/4/4

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1001	L92	C10-N1	-4.46	1.34	1.37
2	A	1001	L92	C13-N1	-4.02	1.34	1.37
2	A	1001	L92	C19-C17	-2.33	1.36	1.42

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	1001	L92	C15-C16-C17	4.79	124.30	112.79
2	A	1001	L92	C4-C3-C2	-2.88	107.55	114.13
2	A	1001	L92	C12-C13-N1	2.03	108.88	107.53

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	1001	L92	C15-C16-C17-C19
2	A	1001	L92	O2-C1-C2-N1
2	A	1001	L92	O1-C1-C2-N1
2	A	1001	L92	C15-C14-C7-C6

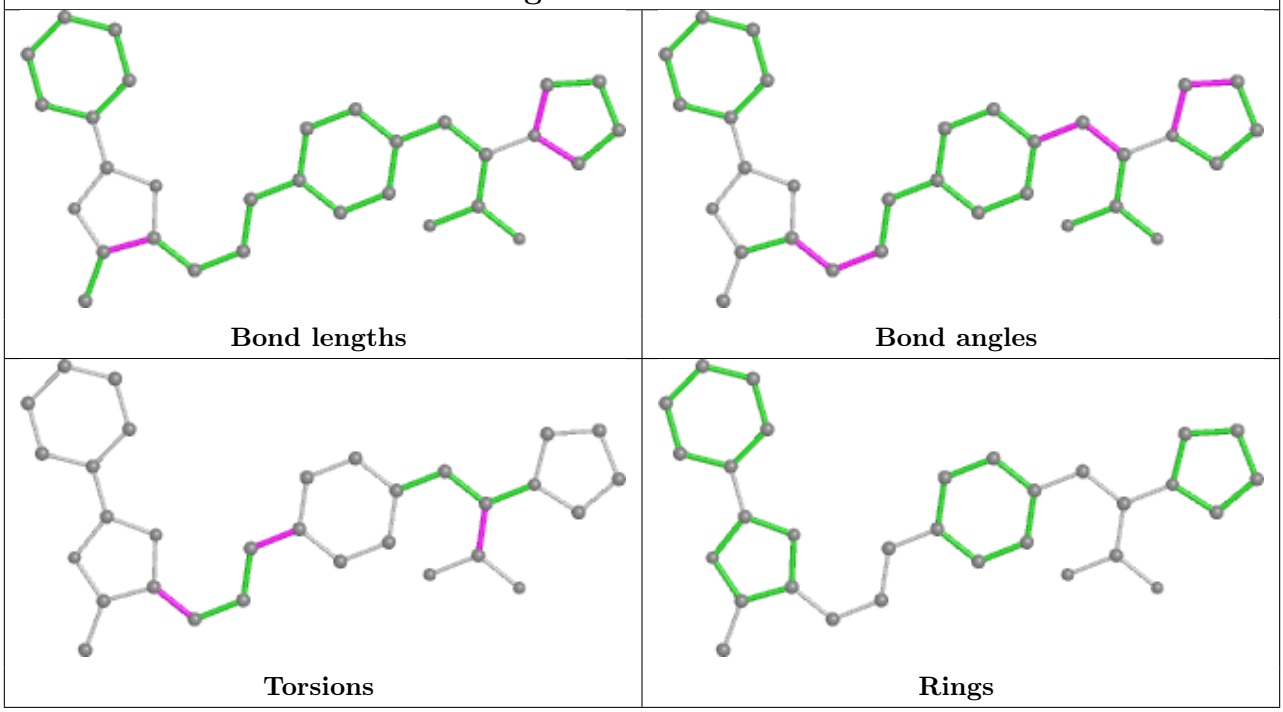
There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	1001	L92	2	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

Ligand L92 A 1001



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	253/271 (93%)	1.13	55 (21%)	0	1	61, 72, 93, 95	0
1	B	254/271 (93%)	1.06	44 (17%)	1	1	60, 75, 114, 125	0
All	All	507/542 (93%)	1.10	99 (19%)	1	1	60, 73, 111, 125	0

All (99) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	241	THR	6.5
1	B	263	LYS	6.3
1	B	459	THR	6.2
1	B	363	PHE	5.9
1	B	264	PHE	5.8
1	B	261	LYS	4.8
1	A	423	LEU	4.8
1	B	275	LYS	4.7
1	A	391	ILE	4.6
1	B	451	GLN	4.5
1	A	325	ILE	4.5
1	B	360	PHE	4.4
1	A	326	ILE	4.2
1	B	248	VAL	4.2
1	B	455	VAL	4.2
1	B	456	ILE	4.2
1	A	464	SER	4.2
1	A	387	PHE	4.1
1	B	260	ASP	4.1
1	A	240	LYS	4.0
1	A	208	SER	4.0
1	A	259	GLU	3.9
1	B	207	GLU	3.9
1	B	454	GLN	3.9

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Mol	Chain	Res	Type	RSRZ
1	B	475	ASP	3.7
1	A	358	LYS	3.6
1	B	236	ILE	3.5
1	A	359	PRO	3.3
1	A	439	MET	3.3
1	A	243	ASP	3.3
1	A	247	PHE	3.2
1	B	242	THR	3.2
1	B	243	ASP	3.2
1	B	256	MET	3.1
1	A	390	VAL	3.1
1	A	388	ILE	3.1
1	B	265	LYS	3.1
1	A	392	ILE	3.0
1	A	363[A]	PHE	3.0
1	A	374	PHE	3.0
1	A	322	VAL	3.0
1	A	402	ASN	3.0
1	A	329	MET	2.9
1	B	240	LYS	2.9
1	A	426	PRO	2.9
1	A	252	MET	2.9
1	B	262	ILE	2.8
1	A	242	THR	2.8
1	A	299	TYR	2.8
1	A	328	THR	2.8
1	B	249	ILE	2.8
1	B	474	LYS	2.8
1	A	436	LEU	2.7
1	A	437	GLN	2.7
1	B	247	PHE	2.7
1	A	327	TYR	2.7
1	A	442	LEU	2.7
1	A	209	ALA	2.7
1	B	246	PRO	2.6
1	B	458	LYS	2.6
1	B	460	GLU	2.6
1	A	362	ASP	2.6
1	B	250	TYR	2.6
1	B	277	VAL	2.6
1	A	451	GLN	2.5
1	A	393	LEU	2.5

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Mol	Chain	Res	Type	RSRZ
1	A	249	ILE	2.5
1	A	427	GLU	2.5
1	B	452	LEU	2.5
1	A	256	MET	2.5
1	A	389	ALA	2.5
1	B	282	PHE	2.4
1	A	211	LEU	2.4
1	B	436	LEU	2.4
1	B	427	GLU	2.4
1	A	440	THR	2.4
1	A	323	HIS	2.3
1	B	423	LEU	2.3
1	B	276	GLU	2.3
1	B	391	ILE	2.3
1	A	360	PHE	2.3
1	B	439[A]	MET	2.3
1	B	426	PRO	2.2
1	B	339	VAL	2.2
1	B	343	GLU	2.2
1	A	260	ASP	2.1
1	A	212	ARG	2.1
1	A	300	ALA	2.1
1	A	455	VAL	2.1
1	B	278	ALA	2.1
1	A	244[A]	LYS	2.1
1	B	356	LEU	2.1
1	B	473	TYR	2.1
1	A	330	LEU	2.1
1	A	399	GLY	2.1
1	A	443	ARG	2.0
1	A	384	LEU	2.0
1	A	371	ALA	2.0
1	A	438	LYS	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)

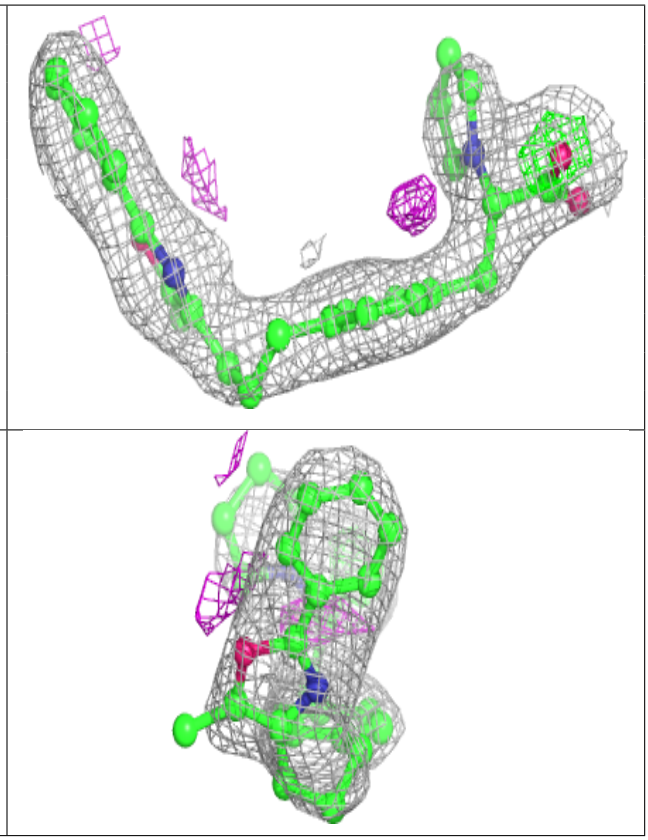
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	L92	A	1001	31/31	0.81	0.33	81,83,83,84	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around L92 A 1001:

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative) and green (positive)



6.5 Other polymers (i)

There are no such residues in this entry.