



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jun 24, 2024 – 04:27 AM EDT

PDB ID : 6A60  
Title : Crystal structure of human FXR/RXR-LBD heterodimer bound to GW4064 and 9cRA and SRC1  
Authors : Wang, N.; Liu, J.  
Deposited on : 2018-06-25  
Resolution : 3.05 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

<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 : 2022.3.0, CSD as543be (2022)  
Xtriage (Phenix) : 1.20.1  
EDS : 2.37.1  
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) : 2.37.1

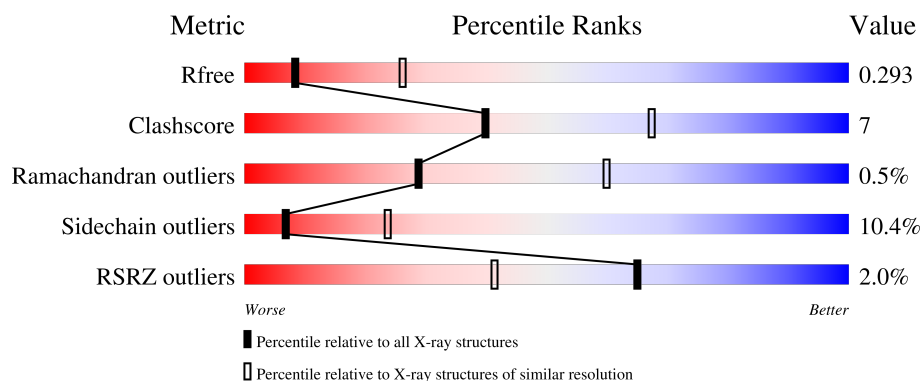
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.05 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	1754 (3.10-3.02)
Clashscore	141614	1864 (3.10-3.02)
Ramachandran outliers	138981	1794 (3.10-3.02)
Sidechain outliers	138945	1793 (3.10-3.02)
RSRZ outliers	127900	1713 (3.10-3.02)

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	229	<div> <div>3%</div> <div>71%</div> <div>20%</div> <div>.</div> <div>.</div> </div>
2	B	16	<div> <div>12%</div> <div>38%</div> <div>50%</div> </div>
2	F	16	<div> <div>6%</div> <div>50%</div> <div>12%</div> <div>6%</div> <div>31%</div> </div>
3	D	238	<div> <div>75%</div> <div>11%</div> <div>.</div> <div>12%</div> </div>

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 3697 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 Bile acid receptor.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	219	Total	C	N	O	S	0	0	0
			1808	1157	302	340	9			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	432	GLU	CYS	engineered mutation	UNP Q96RI1
A	466	GLU	CYS	engineered mutation	UNP Q96RI1

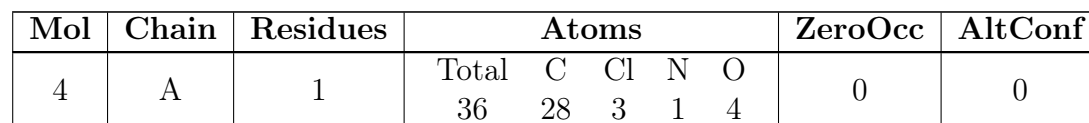
- Molecule 2 is a protein called Nuclear receptor coactivator 1.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	B	8	Total	C	N	O	0	0	0
			71	47	15	9			
2	F	11	Total	C	N	O	0	0	0
			101	64	23	14			

- Molecule 3 is a protein called Retinoic acid receptor RXR-alpha.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	D	210	Total	C	N	O	S	0	0	0
			1658	1065	284	299	10			

- Molecule 4 is 3-[(E)-2-(2-chloro-4-{[3-(2,6-dichlorophenyl)-5-(1-methylethyl)isoxazol-4-yl]methoxy}phenyl)ethenyl]benzoic acid (three-letter code: 064) (formula: C<sub>28</sub>H<sub>22</sub>Cl<sub>3</sub>NO<sub>4</sub>).



- 9CR
- 
- ORTEP diagram of the chemical structure of 9CR. The structure shows a cyclohexene ring substituted with a long unsaturated side chain and a carboxylic acid group. The atoms are labeled as follows: C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, O1, and O2. The side chain consists of a conjugated diene system (C8-C10, C11-C13) and a terminal carboxylic acid group (C14-C15, O1, O2). The cyclohexene ring (C1-C6) has a double bond between C1 and C2, and a methyl group (C18) attached to C5. The side chain is attached to C6 via a double bond (C6-C7).

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	D	1	Total	C	O	0	0
			22	20	2		

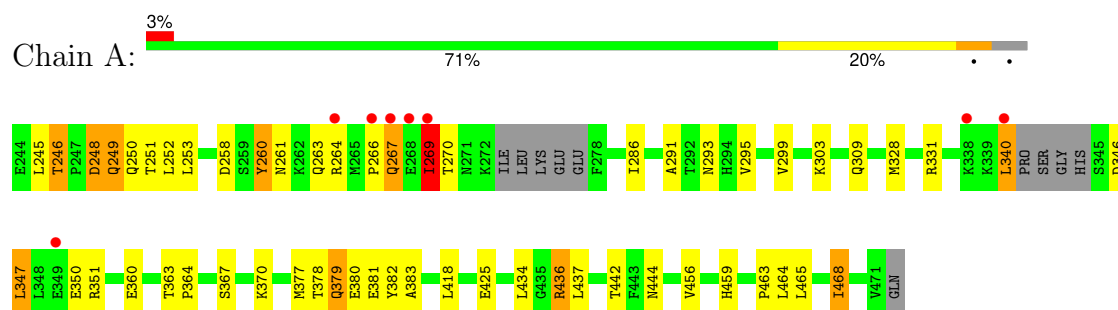
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	1	Total	O	0	0
			1	1		

### 3 Residue-property plots

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.

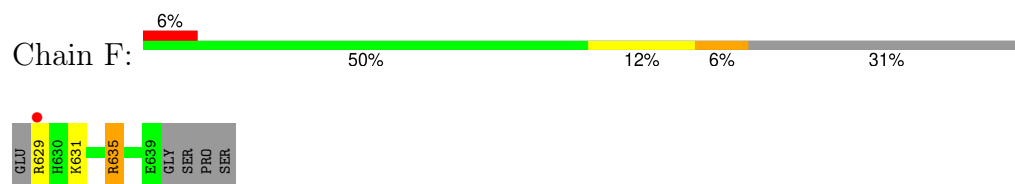
- Molecule 1: Bile acid receptor



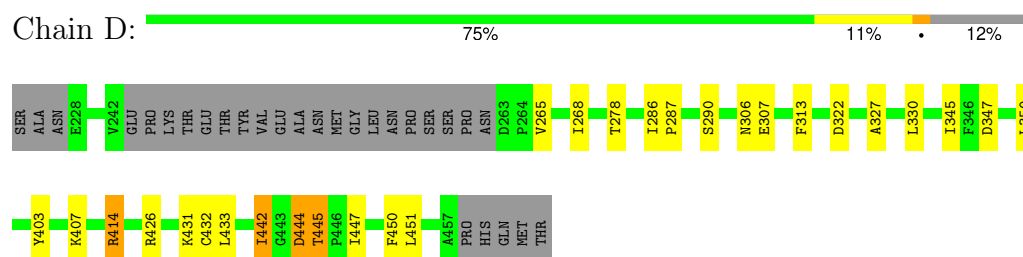
- Molecule 2: Nuclear receptor coactivator 1



- Molecule 2: Nuclear receptor coactivator 1



- Molecule 3: Retinoic acid receptor RXR-alpha



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	102.85Å 102.85Å 109.46Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	74.95 – 3.05 74.95 – 3.05	Depositor EDS
% Data completeness (in resolution range)	98.5 (74.95-3.05) 98.4 (74.95-3.05)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.33 (at 3.07Å)	Xtriage
Refinement program	REFMAC 5.8.0189	Depositor
R, $R_{free}$	0.225 , 0.288 0.225 , 0.293	Depositor DCC
$R_{free}$ test set	521 reflections (4.52%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	106.2	Xtriage
Anisotropy	0.100	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.26 , 73.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	3697	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	128.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.62% 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: 064, 9CR

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	0.63	0/1844	0.75	0/2488
2	B	0.44	0/71	0.62	0/93
2	F	0.74	0/102	1.00	0/134
3	D	0.64	0/1690	0.78	0/2284
All	All	0.63	0/3707	0.77	0/4999

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1
2	F	0	1
3	D	0	1
All	All	0	3

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	436	ARG	Sidechain
3	D	414	ARG	Sidechain
2	F	635	ARG	Mainchain



## 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	1808	0	1799	33	0
2	B	71	0	84	2	0
2	F	101	0	110	1	0
3	D	1658	0	1695	17	0
4	A	36	0	21	2	0
5	D	22	0	27	4	0
6	A	1	0	0	0	0
All	All	3697	0	3736	54	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 7.

The worst 5 of 54 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:377:MET:O	1:A:378:THR:HG22	1.29	1.25
1:A:377:MET:O	1:A:378:THR:CG2	1.96	1.14
1:A:377:MET:O	1:A:381:GLU:HB2	1.85	0.76
1:A:246:THR:O	1:A:249:GLN:HG3	1.88	0.74
1:A:248:ASP:OD1	1:A:251:THR:OG1	2.15	0.65

There are no symmetry-related clashes.

## 5.3 Torsion angles ⓘ

### 5.3.1 Protein backbone ⓘ

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	213/229 (93%)	192 (90%)	20 (9%)	1 (0%)	29	60
2	B	6/16 (38%)	5 (83%)	1 (17%)	0	100	100
2	F	9/16 (56%)	8 (89%)	1 (11%)	0	100	100
3	D	206/238 (87%)	198 (96%)	7 (3%)	1 (0%)	29	60
All	All	434/499 (87%)	403 (93%)	29 (7%)	2 (0%)	29	60

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	D	322	ASP
1	A	269	ILE

### 5.3.2 Protein sidechains ⓘ

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	203/212 (96%)	179 (88%)	24 (12%)	5	18
2	B	8/15 (53%)	3 (38%)	5 (62%)	0	0
2	F	11/15 (73%)	10 (91%)	1 (9%)	9	30
3	D	180/205 (88%)	168 (93%)	12 (7%)	16	43
All	All	402/447 (90%)	360 (90%)	42 (10%)	7	24

5 of 42 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	753	LEU
3	D	407	LYS
3	D	278	THR
3	D	345	ILE
3	D	442	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 8 such sidechains are listed below:

Mol	Chain	Res	Type
3	D	435	HIS
1	A	444	ASN
1	A	423	GLN
1	A	337	ASN
1	A	428	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](#)

2 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	$\# Z  > 2$
5	9CR	D	501	-	22,22,22	1.72	6 (27%)	30,30,30	1.41	6 (20%)
4	064	A	501	-	34,39,39	2.06	6 (17%)	42,55,55	2.28	14 (33%)

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
5	9CR	D	501	-	-	10/15/32/32	0/1/1/1
4	064	A	501	-	-	6/14/22/22	0/4/4/4

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

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	501	064	C24-C22	9.48	1.50	1.39
5	D	501	9CR	C14-C13	3.79	1.40	1.35
5	D	501	9CR	C11-C12	2.92	1.42	1.34
5	D	501	9CR	C10-C9	2.88	1.42	1.35
4	A	501	064	C8-CL15	2.86	1.81	1.74

The worst 5 of 20 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	501	064	C22-C24-C26	7.43	128.57	121.87
4	A	501	064	C24-C22-CL25	6.38	125.69	120.17
4	A	501	064	C20-C22-C24	-3.75	119.63	122.45
4	A	501	064	C12-C7-C3	-3.47	117.54	122.36
4	A	501	064	C23-C24-C26	-3.32	114.50	121.13

There are no chirality outliers.

5 of 16 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	501	064	C22-C24-C26-C27
5	D	501	9CR	C5-C6-C7-C8
5	D	501	9CR	C6-C7-C8-C9
5	D	501	9CR	C10-C11-C12-C13
5	D	501	9CR	C12-C13-C14-C15

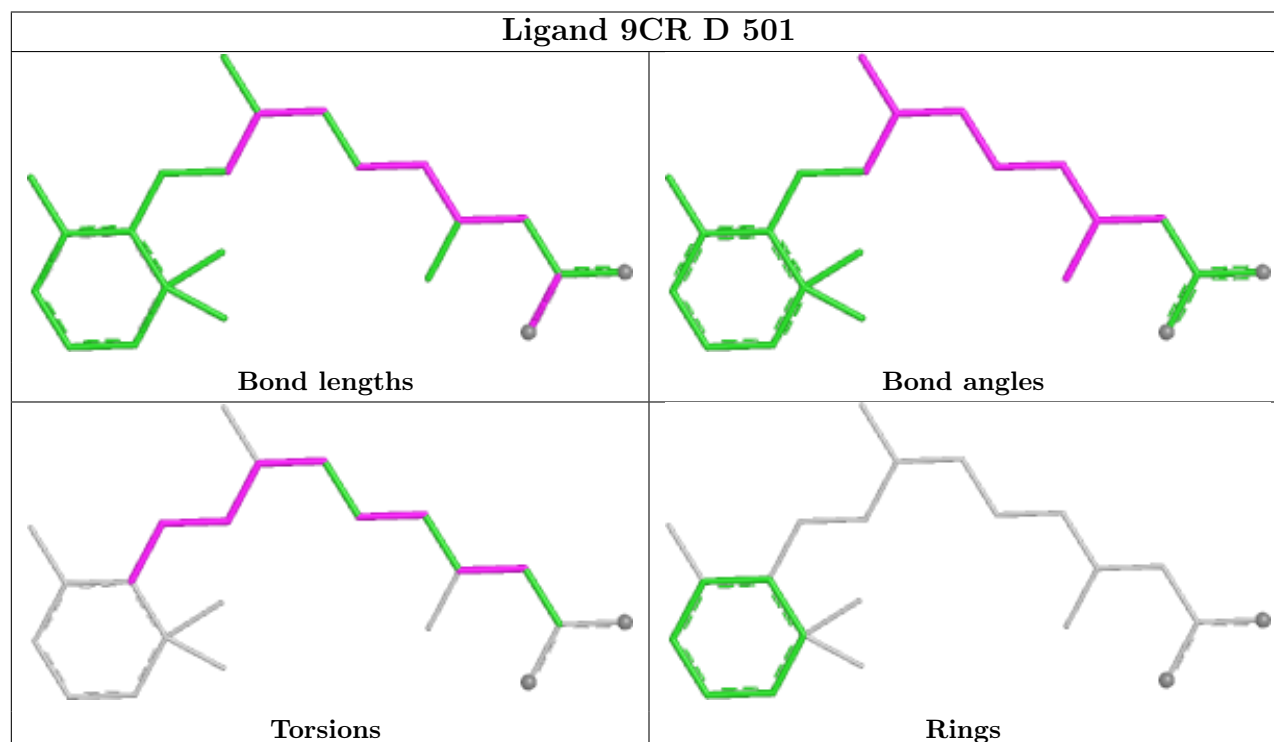
There are no ring outliers.

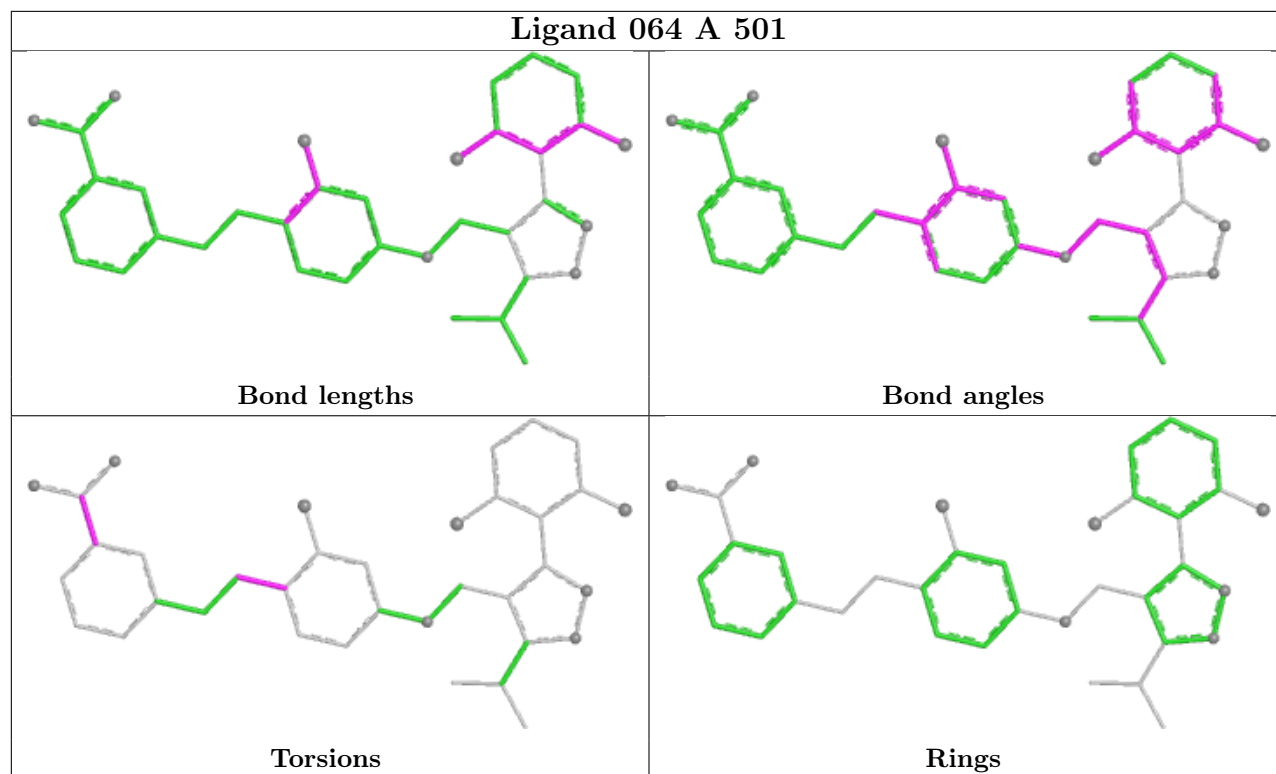
2 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	D	501	9CR	4	0
4	A	501	064	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 than 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.





## 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	219/229 (95%)	-0.23	8 (3%) 41 20	91, 152, 202, 266	0
2	B	8/16 (50%)	-0.22	0 100 100	147, 179, 193, 210	0
2	F	11/16 (68%)	-0.26	1 (9%) 9 3	75, 85, 145, 161	0
3	D	210/238 (88%)	-0.61	0 100 100	69, 97, 134, 164	0
All	All	448/499 (89%)	-0.41	9 (2%) 65 41	69, 122, 190, 266	0

The worst 5 of 9 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	268	GLU	5.6
1	A	266	PRO	5.3
1	A	267	GLN	4.1
1	A	264	ARG	3.4
1	A	340	LEU	3.0

### 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](#)

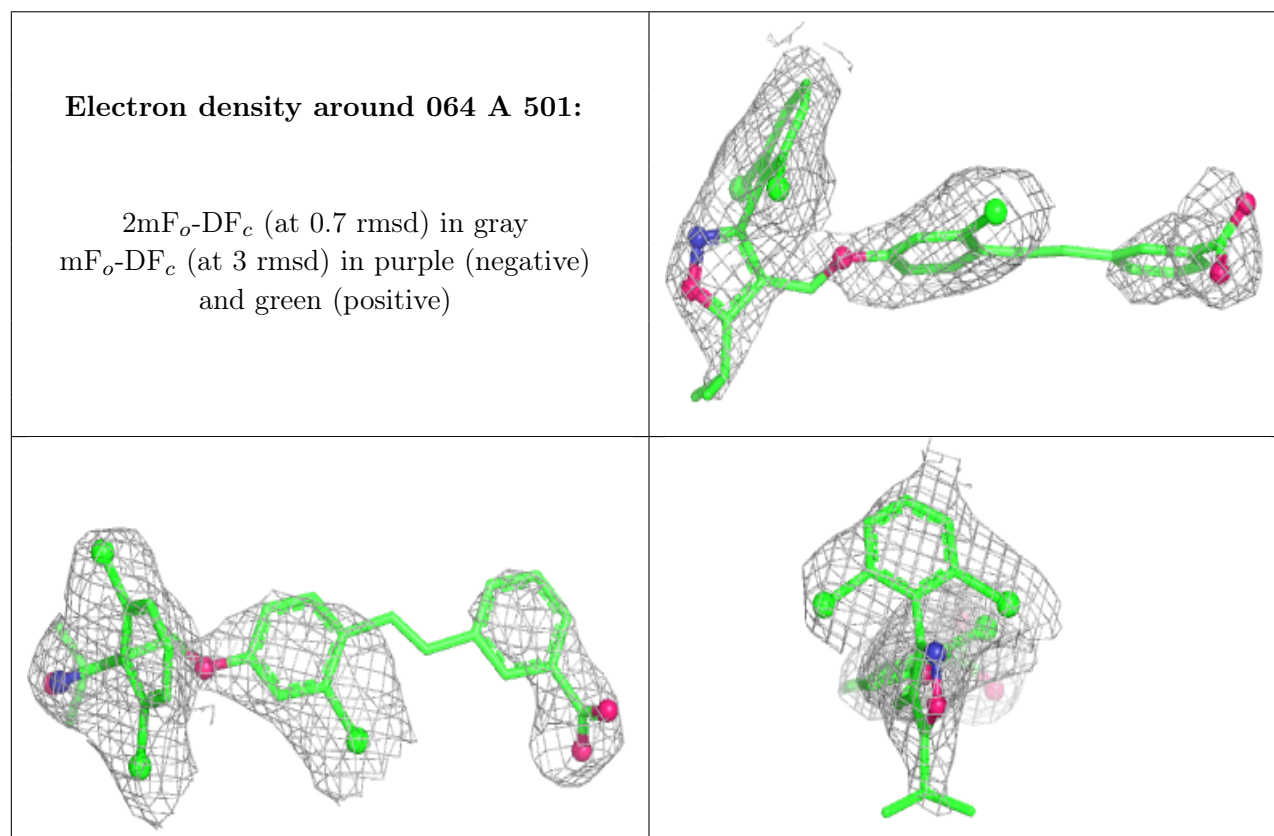
There are no monosaccharides in this entry.

### 6.4 Ligands [i](#)

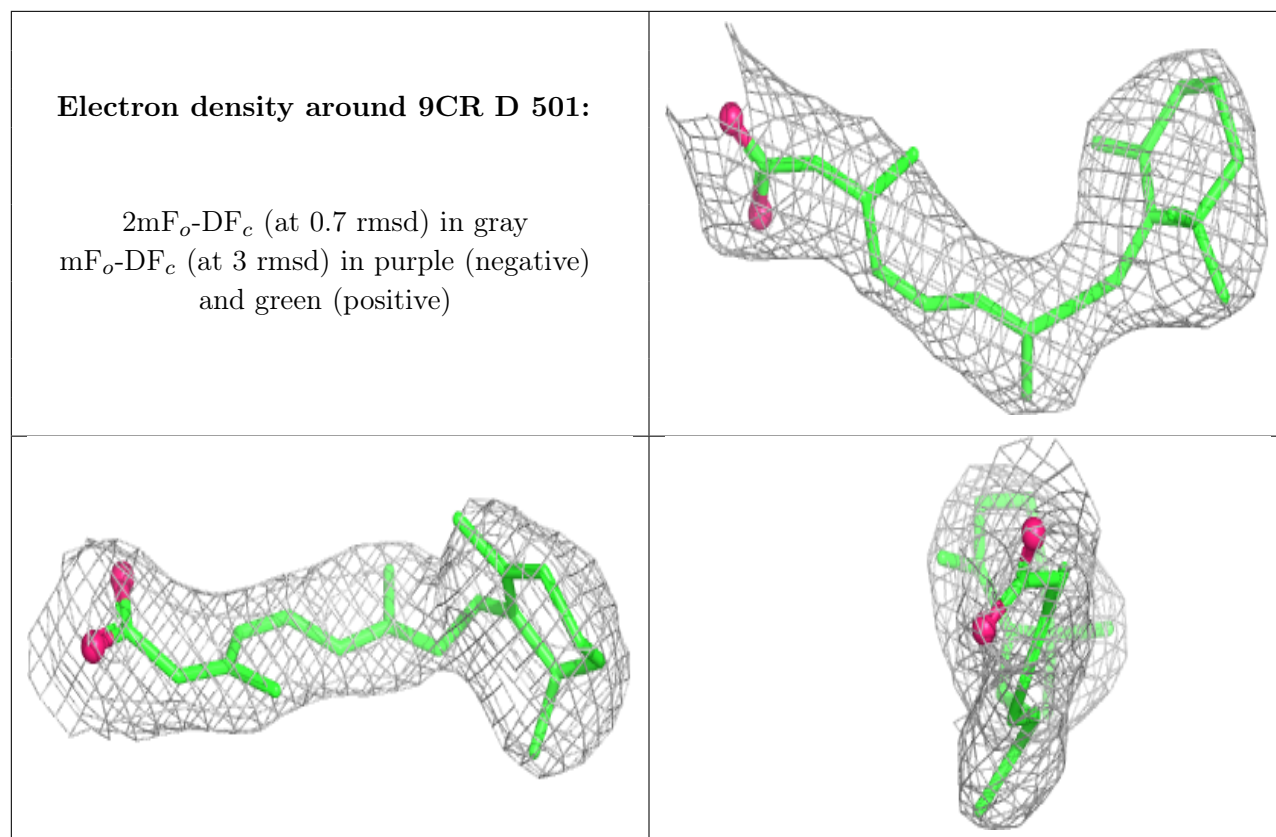
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
4	064	A	501	36/36	0.91	0.36	109,133,174,182	0
5	9CR	D	501	22/22	0.97	0.26	72,85,91,94	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.







## 6.5 Other polymers [i](#)

There are no such residues in this entry.