



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 04:29 PM UTC

PDB ID : 7D41 / pdb_00007d41
Title : Crystal structure of type III polyketide synthase from *Mycobacterium marinum* - P 21 21 21 Space group
Authors : Pratap, S.; Kant, A.; Saxena, P.; Krishnan, V.
Deposited on : 2020-09-21
Resolution : 2.42 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 ⓘ 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 ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

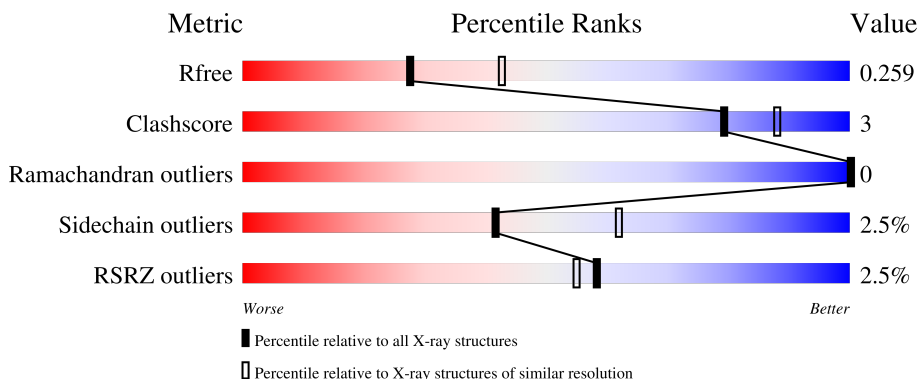
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

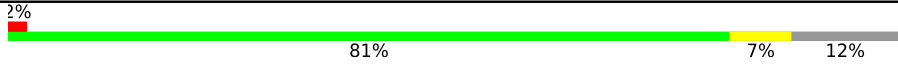
The reported resolution of this entry is 2.42 Å.

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}	180053	6062 (2.44-2.40)
Clashscore	190562	6562 (2.44-2.40)
Ramachandran outliers	187476	6481 (2.44-2.40)
Sidechain outliers	187428	6482 (2.44-2.40)
RSRZ outliers	180081	6066 (2.44-2.40)

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 $\leq 5\%$. 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	B	413	
2	A	413	

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 5434 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 Chalcone synthase-like protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	B	365	Total	C	N	O	S	0	0	0
			2663	1687	463	498	15			

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	394	GLY	-	expression tag	UNP B2HNE1
B	395	ASN	-	expression tag	UNP B2HNE1
B	396	SER	-	expression tag	UNP B2HNE1
B	397	SER	-	expression tag	UNP B2HNE1
B	398	SER	-	expression tag	UNP B2HNE1
B	399	VAL	-	expression tag	UNP B2HNE1
B	400	ASP	-	expression tag	UNP B2HNE1
B	401	LYS	-	expression tag	UNP B2HNE1
B	402	LEU	-	expression tag	UNP B2HNE1
B	403	ALA	-	expression tag	UNP B2HNE1
B	404	ALA	-	expression tag	UNP B2HNE1
B	405	ALA	-	expression tag	UNP B2HNE1
B	406	LEU	-	expression tag	UNP B2HNE1
B	407	GLU	-	expression tag	UNP B2HNE1
B	408	HIS	-	expression tag	UNP B2HNE1
B	409	HIS	-	expression tag	UNP B2HNE1
B	410	HIS	-	expression tag	UNP B2HNE1
B	411	HIS	-	expression tag	UNP B2HNE1
B	412	HIS	-	expression tag	UNP B2HNE1
B	413	HIS	-	expression tag	UNP B2HNE1

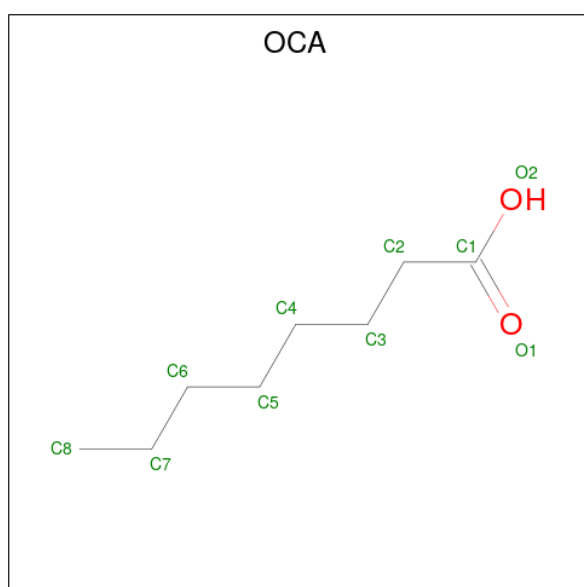
- Molecule 2 is a protein called Chalcone/stilbene synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	A	367	Total	C	N	O	S	0	0	0
			2719	1723	471	510	15			

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	394	GLY	-	expression tag	UNP B2HNE1
A	395	ASN	-	expression tag	UNP B2HNE1
A	396	SER	-	expression tag	UNP B2HNE1
A	397	SER	-	expression tag	UNP B2HNE1
A	398	SER	-	expression tag	UNP B2HNE1
A	399	VAL	-	expression tag	UNP B2HNE1
A	400	ASP	-	expression tag	UNP B2HNE1
A	401	LYS	-	expression tag	UNP B2HNE1
A	402	LEU	-	expression tag	UNP B2HNE1
A	403	ALA	-	expression tag	UNP B2HNE1
A	404	ALA	-	expression tag	UNP B2HNE1
A	405	ALA	-	expression tag	UNP B2HNE1
A	406	LEU	-	expression tag	UNP B2HNE1
A	407	GLU	-	expression tag	UNP B2HNE1
A	408	HIS	-	expression tag	UNP B2HNE1
A	409	HIS	-	expression tag	UNP B2HNE1
A	410	HIS	-	expression tag	UNP B2HNE1
A	411	HIS	-	expression tag	UNP B2HNE1
A	412	HIS	-	expression tag	UNP B2HNE1
A	413	HIS	-	expression tag	UNP B2HNE1

- Molecule 3 is OCTANOIC ACID (CAPRYLIC ACID) (CCD ID: OCA) (formula: $C_8H_{16}O_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	B	1	Total	C	O	0	0
			10	8	2		
3	A	1	Total	C	O	0	0
			10	8	2		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	17	Total	O	0	0
			17	17		
4	A	15	Total	O	0	0
			15	15		

4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	55.73Å 99.52Å 126.71Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	78.26 – 2.42 78.26 – 2.42	Depositor EDS
% Data completeness (in resolution range)	71.0 (78.26-2.42) 71.1 (78.26-2.42)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.19 (at 2.42Å)	Xtriage
Refinement program	REFMAC 5.8.0266	Depositor
R, R_{free}	0.204 , 0.258 0.208 , 0.259	Depositor DCC
R_{free} test set	962 reflections (3.48%)	wwPDB-VP
Wilson B-factor (Å ²)	55.9	Xtriage
Anisotropy	0.057	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 30.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	5434	wwPDB-VP
Average B, all atoms (Å ²)	56.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.21% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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: OCA, MCS

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	B	1.00	0/2710	1.44	1/3700 (0.0%)
2	A	1.00	0/2757	1.44	0/3759
All	All	1.00	0/5467	1.44	1/7459 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	31	THR	CB-CA-C	5.14	119.51	110.36

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	B	2663	0	2623	14	0
2	A	2719	0	2685	16	0
3	A	10	0	15	1	0
3	B	10	0	15	0	0
4	A	15	0	0	0	0
4	B	17	0	0	2	0
All	All	5434	0	5338	29	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 3.

All (29) 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:B:38:MET:HG2	1:B:231:LEU:CD2	2.19	0.72
2:A:183:ARG:HH12	2:A:254:SER:HB2	1.55	0.70
1:B:38:MET:HG2	1:B:231:LEU:HD23	1.76	0.68
1:B:31:THR:HG23	1:B:190:ARG:HG2	1.80	0.63
2:A:31:THR:HG23	2:A:190:ARG:HG2	1.81	0.62
1:B:38:MET:HE1	1:B:360:VAL:HG21	1.84	0.60
2:A:136:GLY:HA3	2:A:188:TYR:OH	2.09	0.52
1:B:136:GLY:HA3	1:B:188:TYR:OH	2.09	0.52
2:A:33:ALA:CB	2:A:186:THR:HG22	2.39	0.52
2:A:183:ARG:NH1	2:A:254:SER:HB2	2.25	0.50
2:A:179:MET:HE1	2:A:352:LEU:CD1	2.42	0.49
1:B:281:LEU:HB3	1:B:282:PRO:HD3	1.94	0.49
2:A:281:LEU:HB3	2:A:282:PRO:HD3	1.97	0.47
2:A:371:THR:HG22	2:A:389:ASP:OD1	2.16	0.46
1:B:318:LYS:HB2	4:B:612:HOH:O	2.14	0.46
2:A:386:MET:HE3	2:A:386:MET:HB2	1.78	0.46
2:A:176:ALA:HB1	2:A:384:GLU:HB2	1.98	0.45
1:B:183:ARG:NH2	1:B:384:GLU:OE1	2.39	0.45
1:B:266:LEU:HB2	2:A:148:ALA:HB3	1.99	0.45
1:B:186:THR:HG22	4:B:604:HOH:O	2.16	0.44
2:A:102:ILE:O	2:A:106:MET:HG2	2.17	0.44
1:B:102:ILE:O	1:B:106:MET:HG2	2.18	0.44
1:B:380:GLY:N	1:B:381:VAL:HA	2.33	0.43
1:B:176:ALA:HB1	1:B:384:GLU:HB2	2.00	0.43
2:A:380:GLY:N	2:A:381:VAL:HA	2.34	0.42
2:A:221:HIS:HA	3:A:501:OCA:H21	2.01	0.42
1:B:125:LEU:HD23	1:B:232:VAL:HG21	2.02	0.41
2:A:179:MET:HE1	2:A:352:LEU:HD12	2.03	0.41
2:A:118:VAL:HG13	2:A:159:LEU:CD1	2.52	0.40

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	B	361/413 (87%)	347 (96%)	14 (4%)	0	100	100
2	A	364/413 (88%)	349 (96%)	15 (4%)	0	100	100
All	All	725/826 (88%)	696 (96%)	29 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	B	275/335 (82%)	265 (96%)	10 (4%)	31	50
2	A	282/334 (84%)	278 (99%)	4 (1%)	59	77
All	All	557/669 (83%)	543 (98%)	14 (2%)	42	62

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	75	LYS
1	B	101	THR
1	B	137	GLN
1	B	172	PHE
1	B	207	VAL
1	B	210	VAL
1	B	261	GLU
1	B	283	SER

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Mol	Chain	Res	Type
1	B	335	VAL
1	B	357	GLU
2	A	137	GLN
2	A	172	PHE
2	A	283	SER
2	A	335	VAL

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

Mol	Chain	Res	Type
1	B	180	ASN
1	B	246	ASN
1	B	300	ASN
1	B	313	HIS
1	B	362	GLN
2	A	111	GLN
2	A	171	ASN
2	A	180	ASN
2	A	246	ASN
2	A	280	ASN
2	A	362	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

1 non-standard protein/DNA/RNA residue 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	MCS	A	175	2	9,11,12	1.05	0	9,13,15	0.97	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	MCS	A	175	2	-	7/8/11/13	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (7) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	175	MCS	C-CA-CB-SAI
2	A	175	MCS	N-CA-CB-SAI
2	A	175	MCS	CA-CB-SAI-CAK
2	A	175	MCS	OAC-CAK-SAI-CB
2	A	175	MCS	CAG-CAK-SAI-CB
2	A	175	MCS	CAK-CAG-CAJ-OAB
2	A	175	MCS	CAK-CAG-CAJ-OAE

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no oligosaccharides 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
3	OCA	A	501	-	9,9,9	0.68	0	9,9,9	0.75	0
3	OCA	B	501	-	9,9,9	0.77	0	9,9,9	0.70	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
3	OCA	A	501	-	-	4/7/7/7	-
3	OCA	B	501	-	-	4/7/7/7	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (8) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	501	OCA	C3-C4-C5-C6
3	A	501	OCA	C2-C3-C4-C5
3	B	501	OCA	C5-C6-C7-C8
3	B	501	OCA	C2-C3-C4-C5
3	B	501	OCA	O1-C1-C2-C3
3	B	501	OCA	O2-C1-C2-C3
3	A	501	OCA	O2-C1-C2-C3
3	A	501	OCA	O1-C1-C2-C3

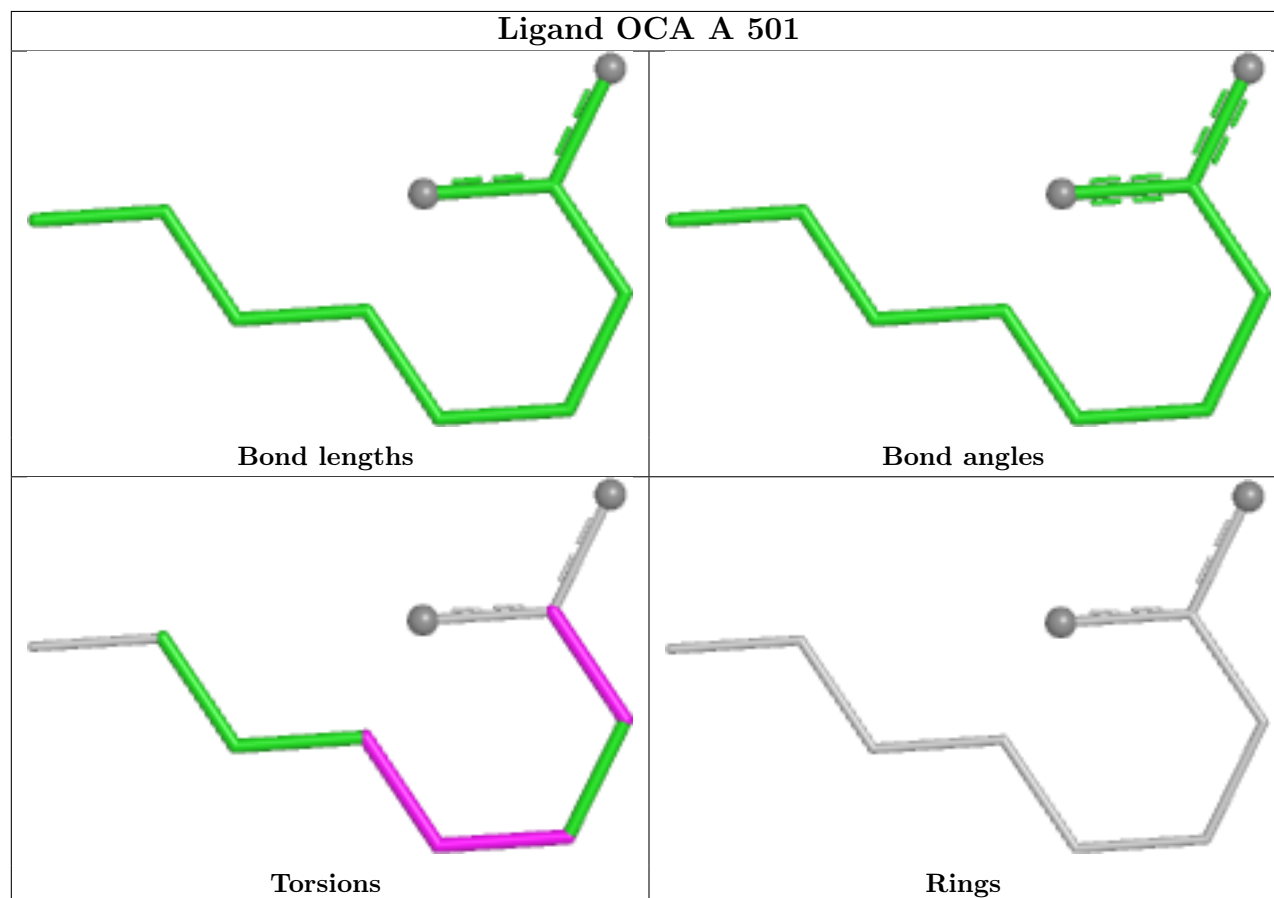
There are no ring outliers.

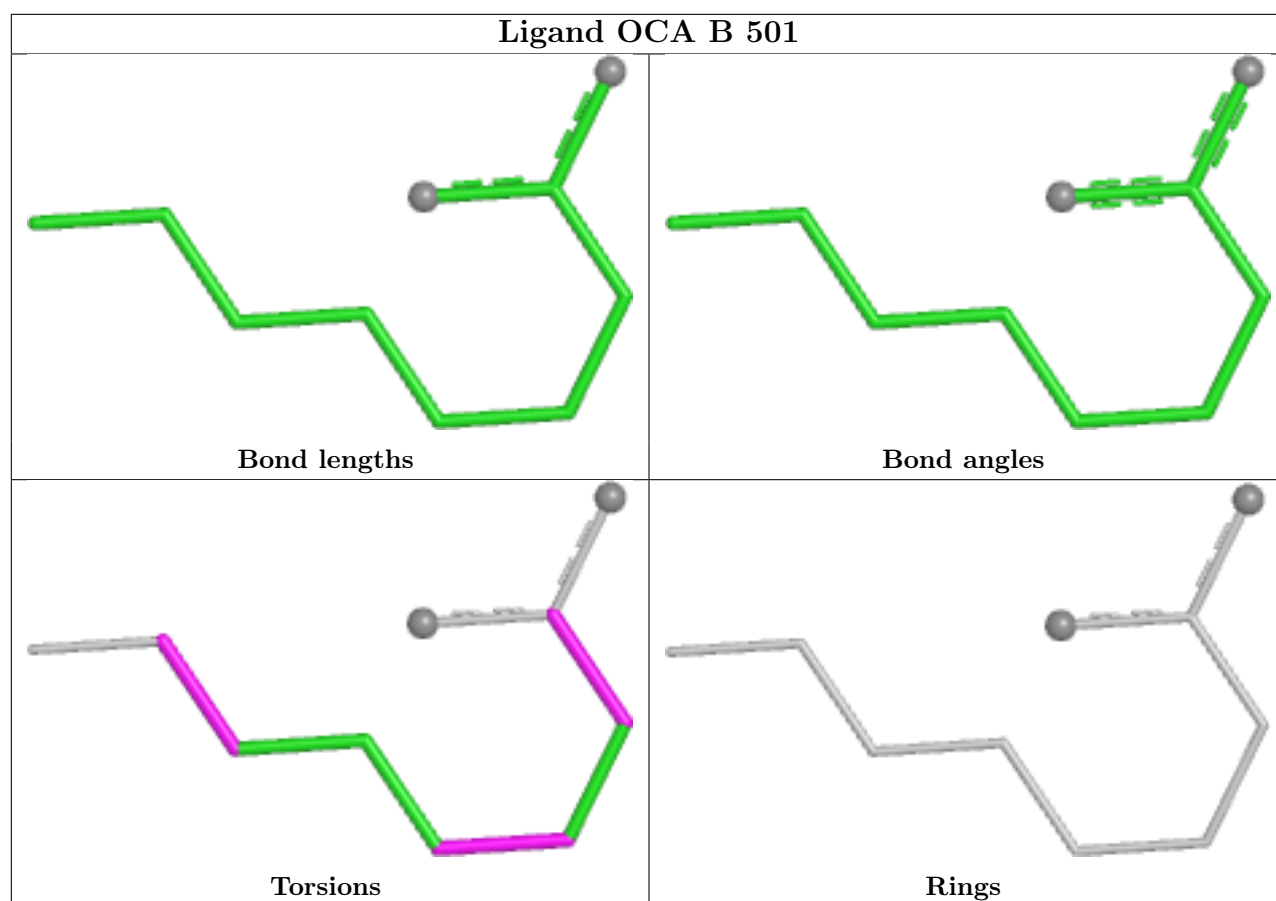
1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	501	OCA	1	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

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, 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	B	365/413 (88%)	0.29	8 (2%) 62 59	36, 52, 82, 95	0
2	A	366/413 (88%)	0.31	10 (2%) 56 52	35, 53, 90, 104	0
All	All	731/826 (88%)	0.30	18 (2%) 58 55	35, 53, 86, 104	0

All (18) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	215	ILE	3.2
2	A	92	PHE	3.0
2	A	213	ASP	3.0
2	A	91	GLU	2.8
2	A	214	ASP	2.8
2	A	62	ASP	2.7
2	A	215	ILE	2.6
1	B	311	ALA	2.6
1	B	29	PRO	2.4
2	A	88	LEU	2.4
1	B	129	PRO	2.3
2	A	27	ALA	2.3
2	A	216	ASN	2.3
1	B	59	LEU	2.2
1	B	240	GLN	2.2
1	B	94	GLU	2.1
2	A	26	PRO	2.0
1	B	288	SER	2.0

6.2 Non-standard residues in protein, DNA, RNA chains

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($\text{\AA}^2$)	Q<0.9
2	MCS	A	175	12/13	0.86	0.14	59,83,87,87	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

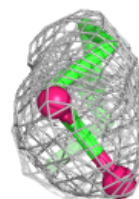
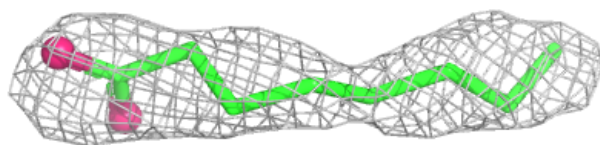
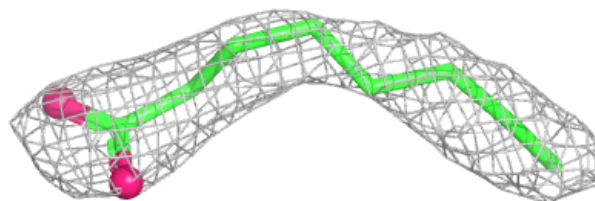
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	OCA	B	501	10/10	0.88	0.17	73,74,75,76	0
3	OCA	A	501	10/10	0.89	0.19	71,75,77,83	0

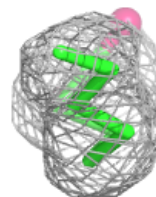
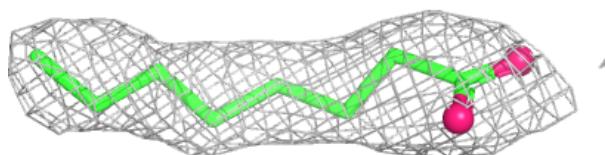
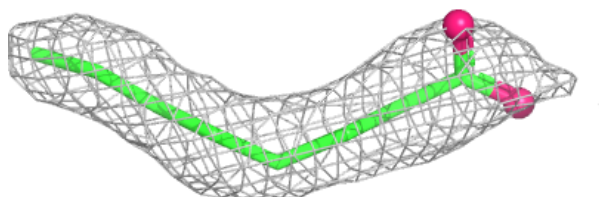
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around OCA B 501:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

**Electron density around OCA A 501:**

$2mF_o-DF_c$ (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.