



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 30, 2025 – 04:17 am BST

PDB ID : 8QO8 / pdb\_00008qo8  
Title : OPR3 variant R283E in complex with NADH4  
Authors : Bijelic, A.; Macheroux, P.; Kerschbaumer, B.  
Deposited on : 2023-09-28  
Resolution : 1.47 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

<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 : ?? (??), CSD ??CSD?? (????)  
Xtriage (Phenix) : 1.13  
EDS : 3.0  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.003 (Gargrove)  
Density-Fitness : 1.0.11  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.42

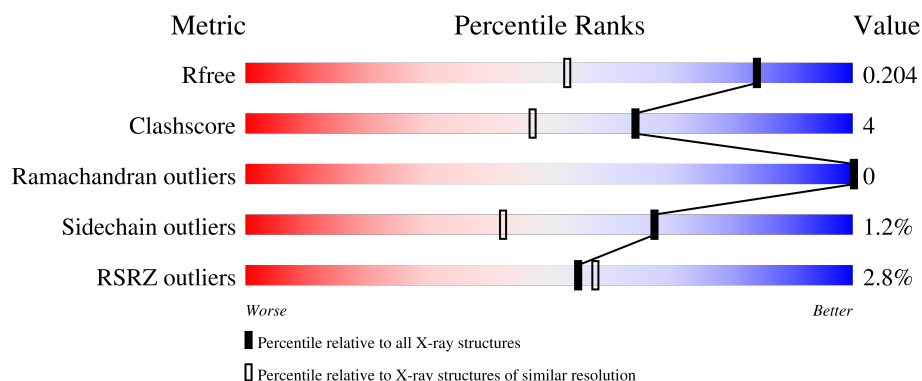
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

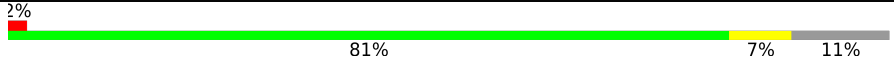

The reported resolution of this entry is 1.47 Å.

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))
$R_{free}$	164625	6131 (1.50-1.46)
Clashscore	180529	6623 (1.50-1.46)
Ramachandran outliers	177936	6521 (1.50-1.46)
Sidechain outliers	177891	6518 (1.50-1.46)
RSRZ outliers	164620	6132 (1.50-1.46)

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	402	
1	B	402	

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 6360 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.

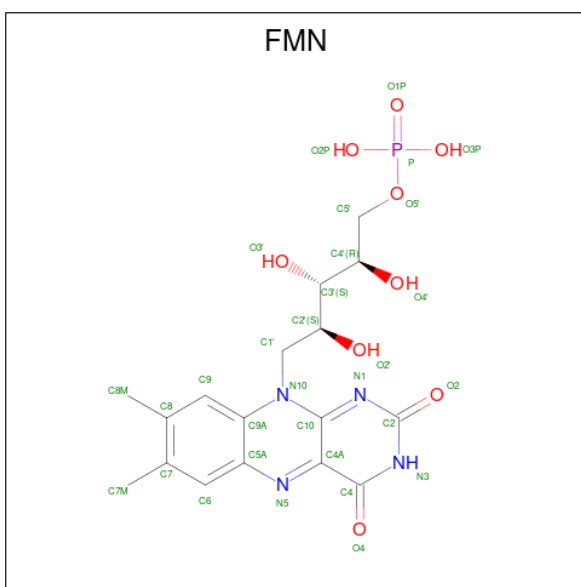
- Molecule 1 is a protein called 12-oxophytodienoate reductase 3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	356	Total	C	N	O	S	0	4	0
			2756	1755	482	508	11			
1	B	356	Total	C	N	O	S	0	0	0
			2747	1751	484	501	11			

There are 14 discrepancies between the modelled and reference sequences:

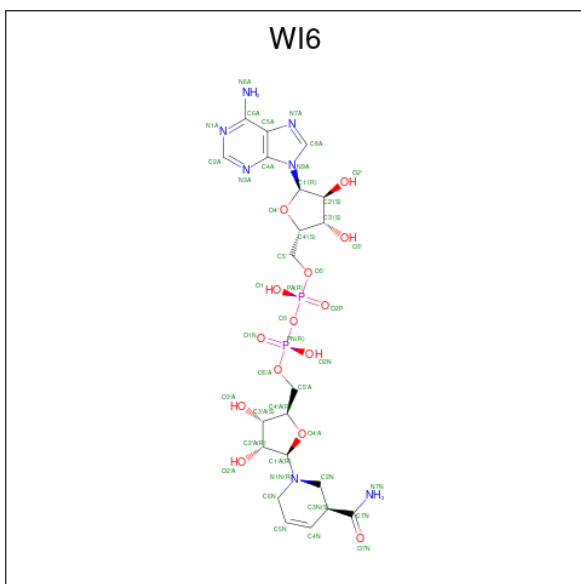
Chain	Residue	Modelled	Actual	Comment	Reference
A	-5	HIS	-	expression tag	UNP Q9FEW9
A	-4	HIS	-	expression tag	UNP Q9FEW9
A	-3	HIS	-	expression tag	UNP Q9FEW9
A	-2	HIS	-	expression tag	UNP Q9FEW9
A	-1	HIS	-	expression tag	UNP Q9FEW9
A	0	HIS	-	expression tag	UNP Q9FEW9
A	283	GLU	ARG	engineered mutation	UNP Q9FEW9
B	-5	HIS	-	expression tag	UNP Q9FEW9
B	-4	HIS	-	expression tag	UNP Q9FEW9
B	-3	HIS	-	expression tag	UNP Q9FEW9
B	-2	HIS	-	expression tag	UNP Q9FEW9
B	-1	HIS	-	expression tag	UNP Q9FEW9
B	0	HIS	-	expression tag	UNP Q9FEW9
B	283	GLU	ARG	engineered mutation	UNP Q9FEW9

- Molecule 2 is FLAVIN MONONUCLEOTIDE (CCD ID: FMN) (formula: C<sub>17</sub>H<sub>21</sub>N<sub>4</sub>O<sub>9</sub>P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total 31	C 17	N 4	O 9	P 1	0	0
2	B	1	Total 31	C 17	N 4	O 9	P 1	0	0

- Molecule 3 is 1,4,5,6-Tetrahydronicotinamide adenine dinucleotide (CCD ID: WI6) (formula:  $\text{C}_{21}\text{H}_{31}\text{N}_7\text{O}_{14}\text{P}_2$ ) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	0	0
			26	11	2	11	2		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	B	1	Total	C	N	O	P	0	0
			26	11	2	11	2		

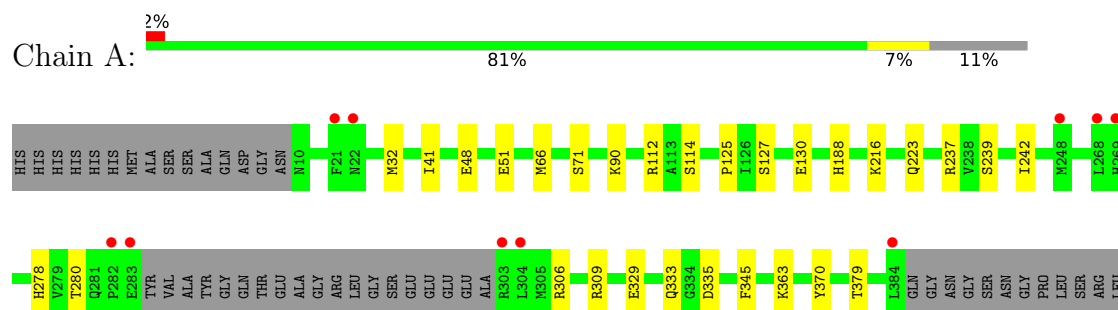
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	386	Total	O	0	0
			386	386		
4	B	357	Total	O	0	0
			357	357		

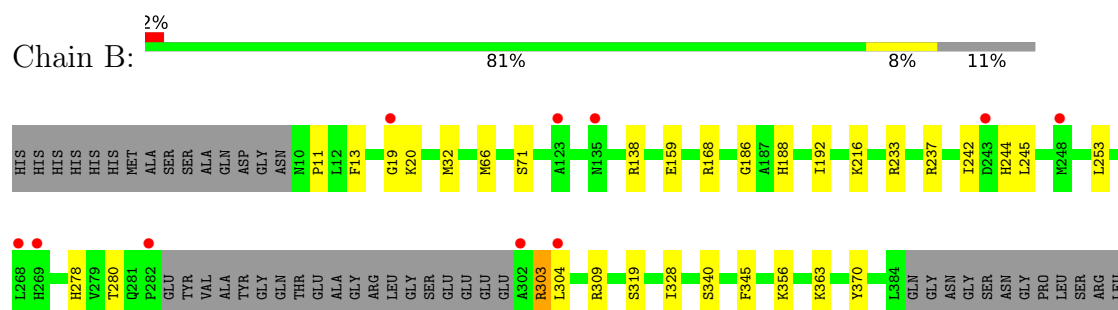
### 3 Residue-property plots [i](#)

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: 12-oxophytodienoate reductase 3



#### • Molecule 1: 12-oxophytodienoate reductase 3



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	49.47Å 93.32Å 89.40Å 90.00° 97.73° 90.00°	Depositor
Resolution (Å)	46.66 – 1.47 46.66 – 1.47	Depositor EDS
% Data completeness (in resolution range)	97.2 (46.66-1.47) 86.0 (46.66-1.47)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	0.56 (at 1.39Å)	Xtriage
Refinement program	PHENIX (dev_4761)	Depositor
R, $R_{free}$	0.187 , 0.204 0.186 , 0.204	Depositor DCC
$R_{free}$ test set	1879 reflections (1.41%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	15.4	Xtriage
Anisotropy	0.801	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 36.9	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	6360	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.77% 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 [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: FMN, WI6

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	0.46	0/2831	0.68	0/3850
1	B	0.36	0/2811	0.63	0/3819
All	All	0.41	0/5642	0.65	0/7669

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	B	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	303	ARG	Sidechain

### 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	2756	0	2708	20	0
1	B	2747	0	2722	21	0
2	A	31	0	19	3	0
2	B	31	0	19	5	0
3	A	26	0	0	0	0
3	B	26	0	0	0	0
4	A	386	0	0	6	0
4	B	357	0	0	5	0
All	All	6360	0	5468	42	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 4.

All (42) 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)
2:B:401:FMN:H5'2	4:B:512:HOH:O	1.91	0.70
1:A:90:LYS:HD2	4:A:547:HOH:O	1.97	0.65
1:B:244:HIS:HE1	4:B:774:HOH:O	1.79	0.64
1:A:130:GLU:OE1	4:A:501:HOH:O	2.16	0.59
1:B:32:MET:HA	2:B:401:FMN:N5	2.16	0.59
1:A:66:MET:HB3	1:A:71:SER:OG	2.06	0.56
1:B:13:PHE:CZ	1:B:356:LYS:HB2	2.43	0.54
1:B:20:LYS:HZ1	1:B:233:ARG:NE	2.08	0.51
1:A:188:HIS:NE2	1:A:280:THR:HG21	2.26	0.50
1:B:244:HIS:CD2	1:B:245:LEU:HG	2.48	0.49
1:B:66:MET:HB3	1:B:71:SER:OG	2.11	0.49
1:A:32:MET:HA	2:A:401:FMN:N5	2.27	0.49
1:B:32:MET:HA	2:B:401:FMN:C5A	2.43	0.48
1:A:41:ILE:CD1	4:A:696:HOH:O	2.62	0.48
1:A:41:ILE:HD13	4:A:696:HOH:O	2.13	0.47
1:B:253:LEU:HD13	1:B:304:LEU:HD13	1.95	0.47
1:B:370:TYR:CE1	2:B:401:FMN:HM72	2.50	0.47
1:B:216:LYS:HE3	1:B:216:LYS:HB2	1.72	0.47
1:B:159:GLU:OE2	4:B:501:HOH:O	2.20	0.46
1:A:242:ILE:HD12	1:A:280:THR:HG23	1.98	0.46
1:A:48:GLU:HG2	1:A:379:THR:HG21	1.97	0.45
1:A:112:ARG:HB3	1:A:127:SER:HB2	1.98	0.45
1:B:168:ARG:HD2	4:B:728:HOH:O	2.17	0.44
1:B:370:TYR:CZ	2:B:401:FMN:HM72	2.52	0.44
1:A:306:ARG:HD3	1:A:335:ASP:OD1	2.18	0.43
1:A:114:SER:HB3	1:A:125:PRO:HB3	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:370:TYR:CZ	2:A:401:FMN:HM72	2.54	0.42
1:A:237:ARG:HA	1:A:278:HIS:O	2.20	0.42
1:A:216:LYS:HE3	1:A:216:LYS:HB2	1.79	0.42
1:A:370:TYR:CE1	2:A:401:FMN:HM72	2.55	0.42
1:B:319:SER:HB2	1:B:340:SER:OG	2.20	0.42
1:B:188:HIS:NE2	1:B:280:THR:HG21	2.35	0.41
1:B:242:ILE:HD12	1:B:280:THR:HG23	2.01	0.41
1:B:11:PRO:HD2	1:B:328:ILE:HG23	2.02	0.41
1:B:19:GLY:HA3	4:B:557:HOH:O	2.21	0.41
1:A:329:GLU:O	1:A:333:GLN:HG3	2.20	0.41
1:B:186:GLY:HA2	1:B:192:ILE:HB	2.03	0.41
1:A:51:GLU:OE2	4:A:502:HOH:O	2.22	0.41
1:B:138:ARG:HA	1:B:138:ARG:HD3	1.96	0.41
1:A:223:GLN:HG2	4:A:772:HOH:O	2.20	0.41
1:B:237:ARG:HA	1:B:278:HIS:O	2.20	0.41
1:A:239:SER:HB3	1:A:280:THR:HG22	2.02	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	A	356/402 (89%)	347 (98%)	9 (2%)	0	100	100
1	B	352/402 (88%)	342 (97%)	10 (3%)	0	100	100
All	All	708/804 (88%)	689 (97%)	19 (3%)	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	A	289/328 (88%)	286 (99%)	3 (1%)	73	50
1	B	287/328 (88%)	283 (99%)	4 (1%)	62	36
All	All	576/656 (88%)	569 (99%)	7 (1%)	67	42

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	309	ARG
1	A	345	PHE
1	A	363	LYS
1	B	303	ARG
1	B	309	ARG
1	B	345	PHE
1	B	363	LYS

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

Mol	Chain	Res	Type
1	A	146	HIS

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

## 5.6 Ligand geometry

4 ligands are modelled in this entry.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

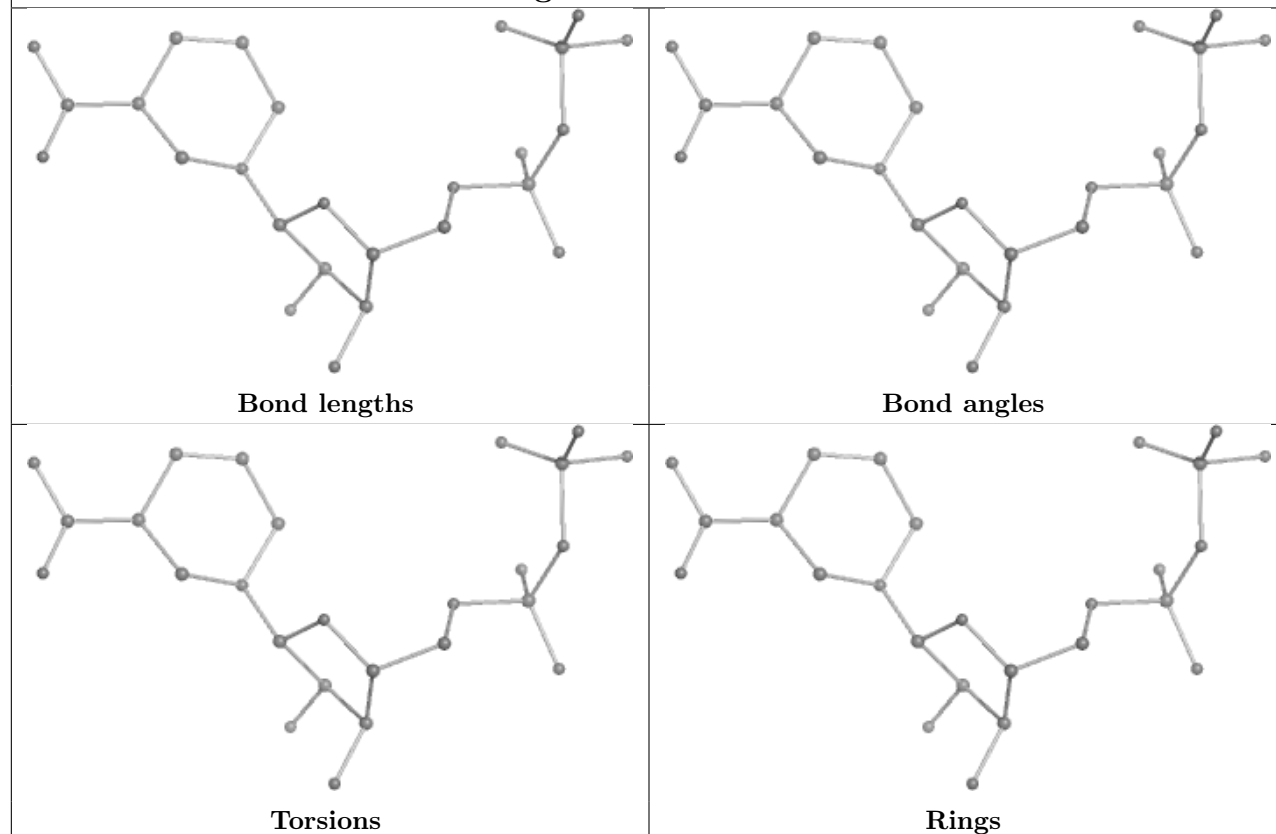
There are no torsion outliers.

There are no ring outliers.

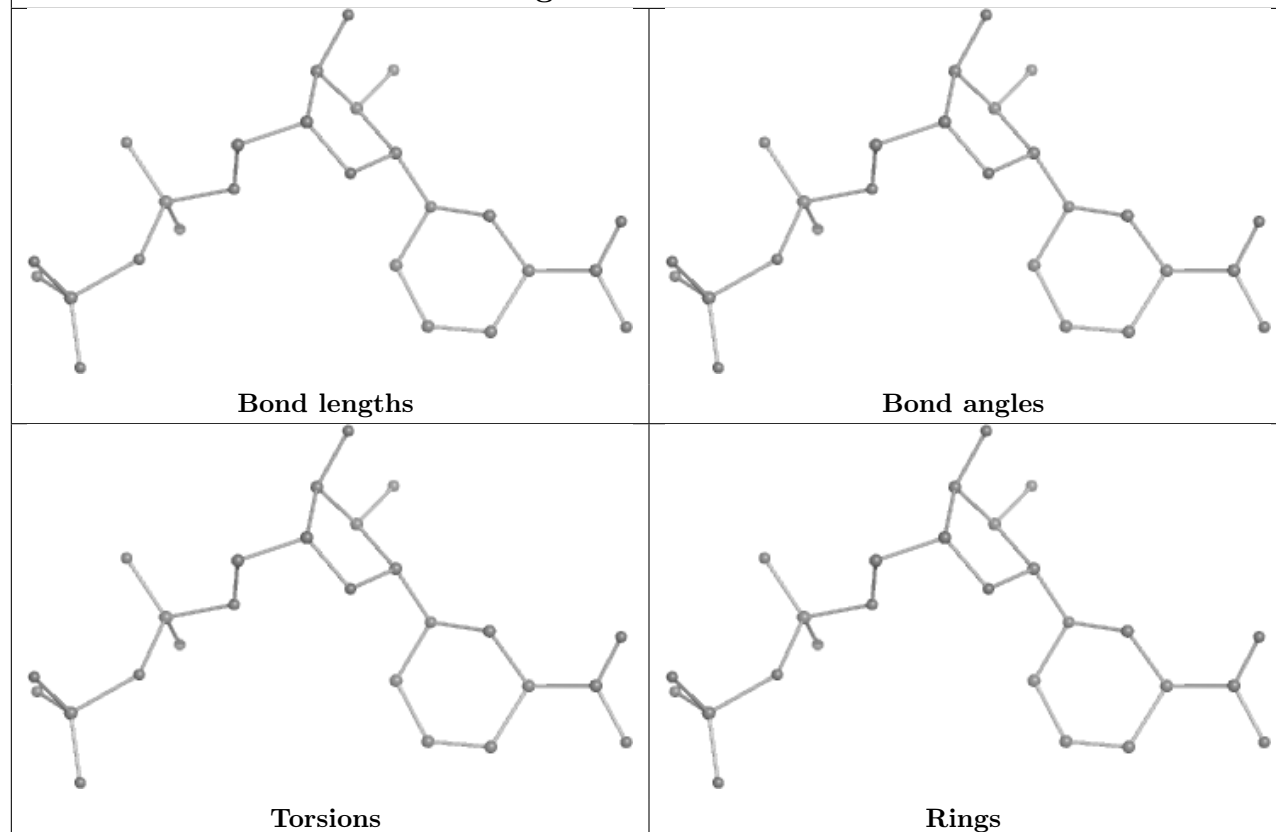
No monomer is involved in short contacts.

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.

## Ligand WI6 A 402



## Ligand WI6 B 402



## 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, 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	356/402 (88%)	0.32	10 (2%) 55 57	18, 25, 37, 57	4 (1%)
1	B	356/402 (88%)	0.35	10 (2%) 55 57	19, 26, 39, 62	0
All	All	712/804 (88%)	0.34	20 (2%) 55 57	18, 25, 39, 62	4 (0%)

All (20) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	302	ALA	4.2
1	B	269	HIS	3.4
1	B	304	LEU	3.0
1	B	123	ALA	2.8
1	B	135	ASN	2.7
1	B	243	ASP	2.6
1	A	304	LEU	2.6
1	A	268	LEU	2.5
1	A	269	HIS	2.5
1	A	282	PRO	2.5
1	B	282	PRO	2.4
1	B	248	MET	2.4
1	A	22	ASN	2.3
1	B	268	LEU	2.3
1	A	21	PHE	2.2
1	A	283	GLU	2.2
1	B	19	GLY	2.1
1	A	248	MET	2.1
1	A	384	LEU	2.1
1	A	303	ARG	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, 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.

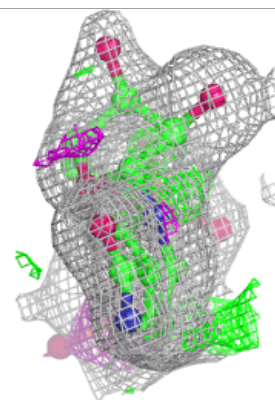
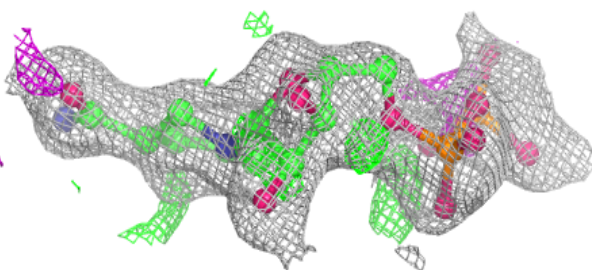
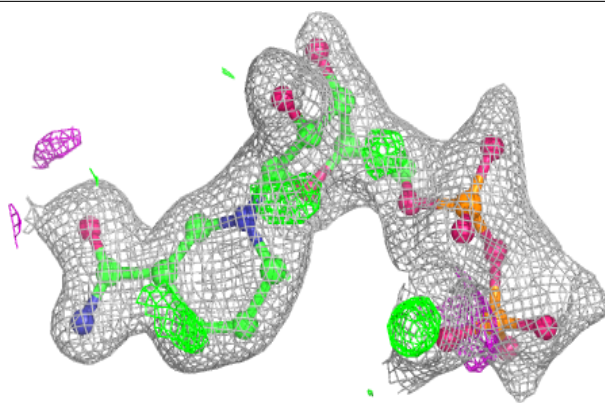
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
3	WI6	A	402	26/44	0.85	0.14	21,46,68,79	0
3	WI6	B	402	26/44	0.85	0.14	20,39,57,63	26
2	FMN	B	401	31/31	0.95	0.08	16,21,26,41	0
2	FMN	A	401	31/31	0.96	0.07	17,21,25,26	0

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.

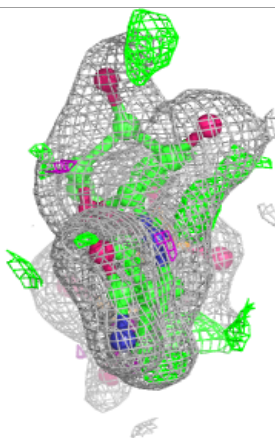
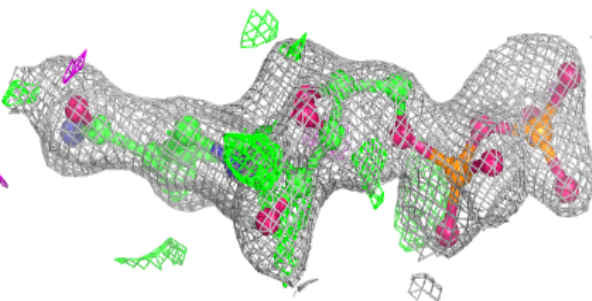
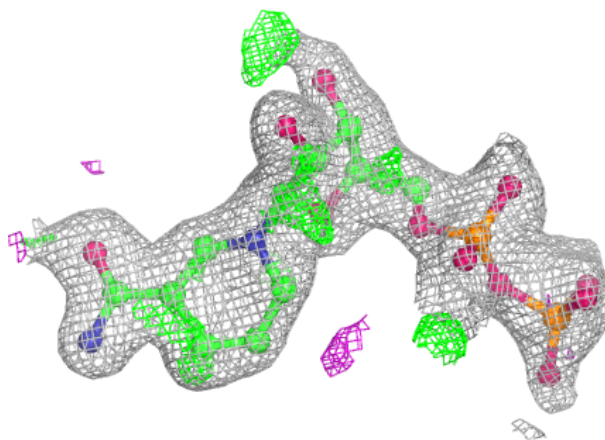


**Electron density around WI6 A 402:**

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

**Electron density around WI6 B 402:**

$2mF_o-DF_c$  (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.