



# wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 31, 2023 – 10:59 AM JST

PDB ID : 5C2T  
Title : Crystal structure of Mitochondrial rhodoquinol-fumarate reductase from *Ascaris suum* with rhodoquinone-2  
Authors : Harada, S.; Shiba, T.; Sato, D.; Yamamoto, A.; Nagahama, M.; Yone, A.; Inaoka, D.K.; Sakamoto, K.; Inoue, M.; Honma, T.; Kita, K.  
Deposited on : 2015-06-16  
Resolution : 2.75 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 : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.36  
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) : 2.36

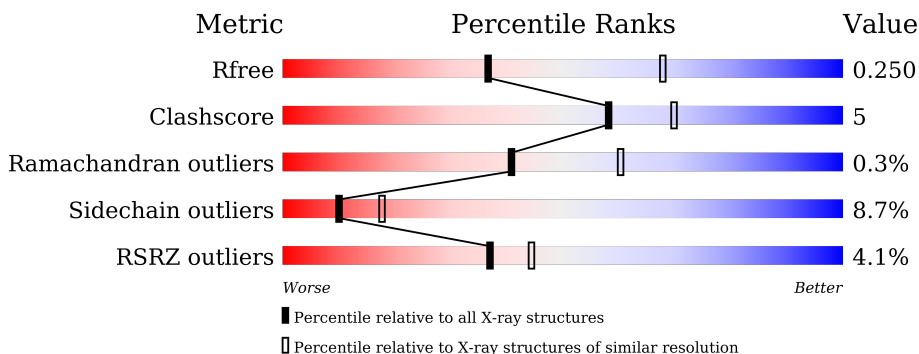
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.75 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	1235 (2.78-2.74)
Clashscore	141614	1277 (2.78-2.74)
Ramachandran outliers	138981	1257 (2.78-2.74)
Sidechain outliers	138945	1257 (2.78-2.74)
RSRZ outliers	127900	1207 (2.78-2.74)

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	645	
1	E	645	
2	B	282	
2	F	282	
3	C	188	

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Mol	Chain	Length	Quality of chain
3	G	188	
4	D	156	
4	H	156	

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
11	4YP	G	202	-	-	-	X
12	EPH	H	201	-	-	-	X

## 2 Entry composition [i](#)

There are 13 unique types of molecules in this entry. The entry contains 18467 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 Succinate dehydrogenase [ubiquinone] flavoprotein subunit, mitochondrial.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	616	4787	3004	855	900	28	0	0	0
1	E	616	4787	3004	855	900	28	0	0	0

- Molecule 2 is a protein called Succinate dehydrogenase [ubiquinone] iron-sulfur subunit, mitochondrial.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	250	1985	1263	338	361	23	0	0	0
2	F	250	1985	1263	338	361	23	0	0	0

- Molecule 3 is a protein called Cytochrome b-large subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	153	1217	813	204	194	6	0	0	0
3	G	153	1217	813	204	194	6	0	0	0

- Molecule 4 is a protein called Succinate dehydrogenase [ubiquinone] cytochrome b small subunit, mitochondrial.

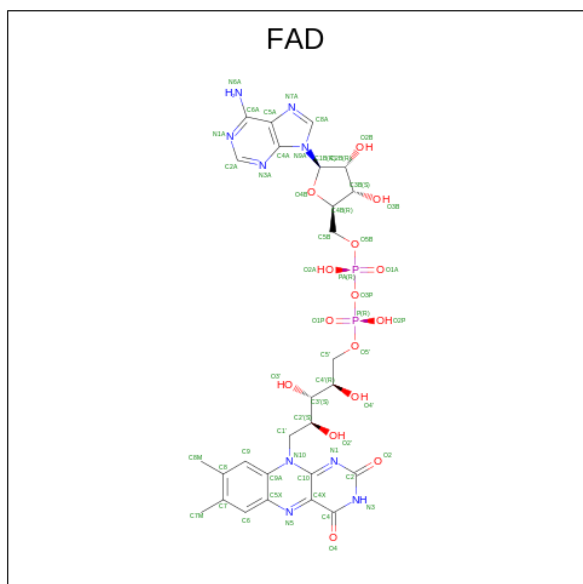
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	D	129	1009	665	169	170	5	0	1	0
4	H	129	998	659	165	169	5	0	0	0

- Molecule 5 is MALONATE ION (three-letter code: MLI) (formula: C<sub>3</sub>H<sub>2</sub>O<sub>4</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			7	3	4		
5	E	1	Total	C	O	0	0
			7	3	4		

- Molecule 6 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula:  $C_{27}H_{33}N_9O_{15}P_2$ ).



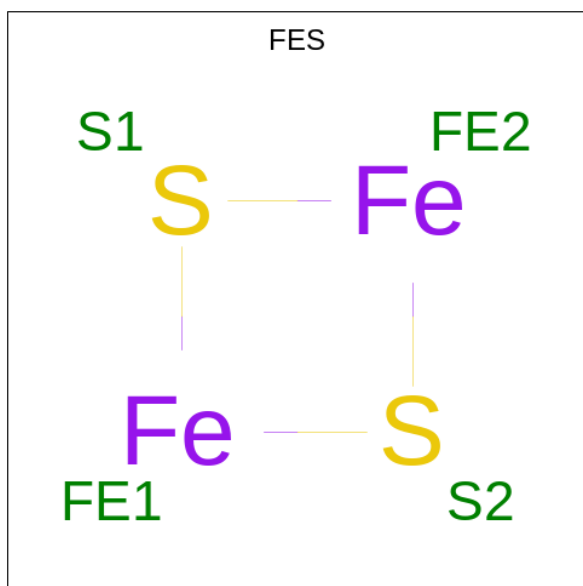
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
6	A	1	Total	C	N	O	P	0	0
			53	27	9	15	2		

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	N	O			P
6	E	1	53	27	9	15	2	0	0

- Molecule 7 is FE2/S2 (INORGANIC) CLUSTER (three-letter code: FES) (formula: Fe<sub>2</sub>S<sub>2</sub>).



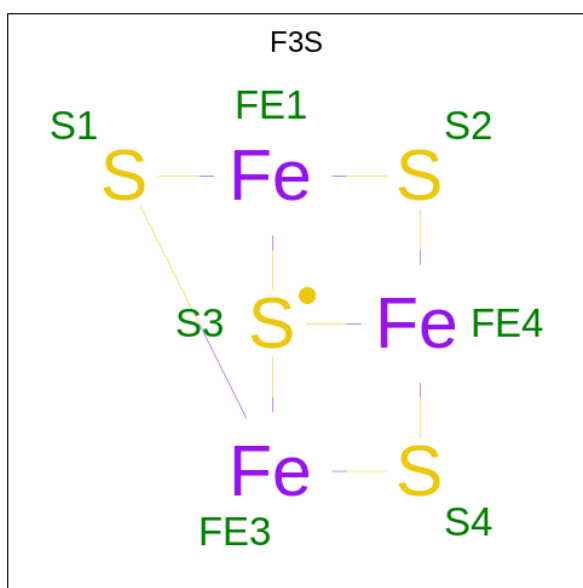
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	Fe	S		
7	B	1	4	2	2	0	0
7	F	1	4	2	2	0	0

- Molecule 8 is IRON/SULFUR CLUSTER (three-letter code: SF4) (formula: Fe<sub>4</sub>S<sub>4</sub>).



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	B	1	Total	Fe S	0	0
			8	4 4		
8	F	1	Total	Fe S	0	0
			8	4 4		

- Molecule 9 is FE3-S4 CLUSTER (three-letter code: F3S) (formula:  $\text{Fe}_3\text{S}_4$ ).



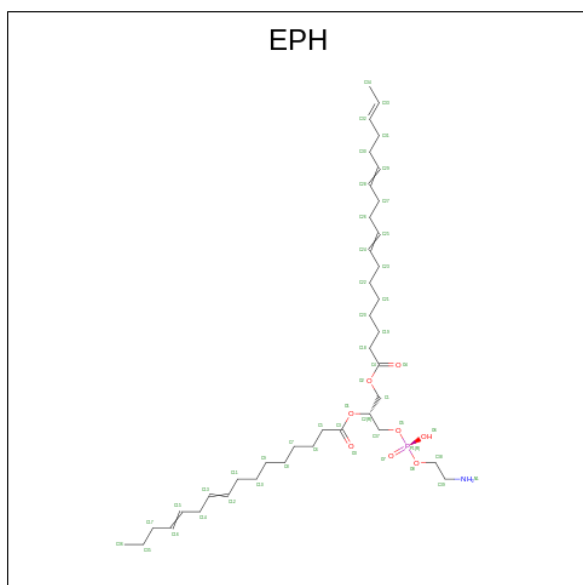
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	B	1	Total	Fe S	0	0
			7	3 4		
9	F	1	Total	Fe S	0	0
			7	3 4		





Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
11	C	1	Total	C	N	O	0	0
			22	18	1	3		
11	G	1	Total	C	N	O	0	0
			22	18	1	3		

- Molecule 12 is L-ALPHA-PHOSPHATIDYL-BETA-OLEOYL-GAMMA-PALMITOYL-PHOSPHATIDYLETHANOLAMINE (three-letter code: EPH) (formula: C<sub>39</sub>H<sub>68</sub>NO<sub>8</sub>P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
12	D	1	Total	C	N	O	P	0	0
			44	34	1	8	1		
12	H	1	Total	C	N	O	P	0	0
			44	34	1	8	1		

- Molecule 13 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
13	A	54	Total	O	0	0
			54	54		
13	B	13	Total	O	0	0
			13	13		
13	C	6	Total	O	0	0
			6	6		
13	D	7	Total	O	0	0
			7	7		
13	E	10	Total	O	0	0
			10	10		

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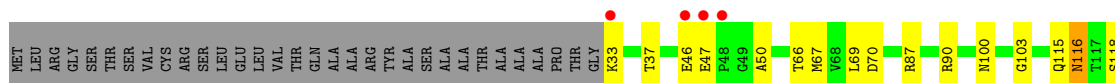
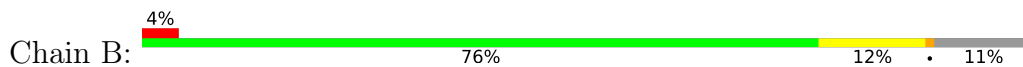
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<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>	<b>ZeroOcc</b>	<b>AltConf</b>
13	F	10	Total O 10 10	0	0
13	G	4	Total O 4 4	0	0
13	H	2	Total O 2 2	0	0

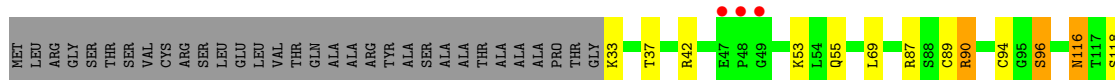
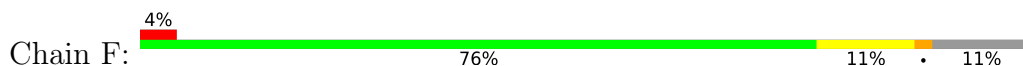




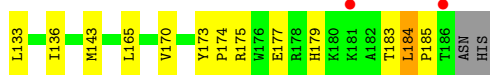
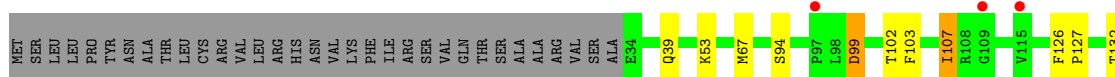
- Molecule 2: Succinate dehydrogenase [ubiquinone] iron-sulfur subunit, mitochondrial



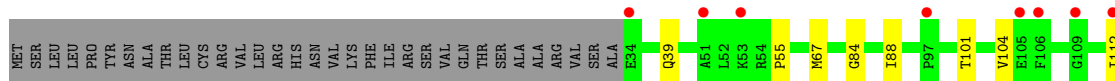
- Molecule 2: Succinate dehydrogenase [ubiquinone] iron-sulfur subunit, mitochondrial



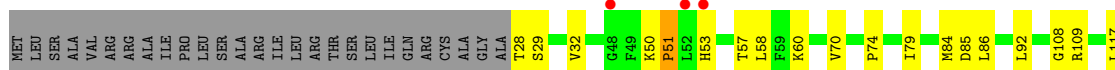
- Molecule 3: Cytochrome b-large subunit



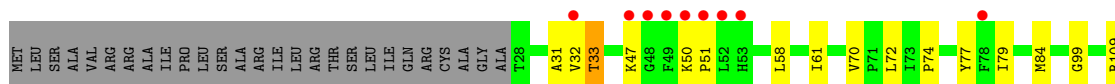
- Molecule 3: Cytochrome b-large subunit



- Molecule 4: Succinate dehydrogenase [ubiquinone] cytochrome b small subunit, mitochondrial



- Molecule 4: Succinate dehydrogenase [ubiquinone] cytochrome b small subunit, mitochondrial



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	122.81Å 123.63Å 219.81Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 2.75 19.98 – 2.75	Depositor EDS
% Data completeness (in resolution range)	94.2 (20.00-2.75) 94.3 (19.98-2.75)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.76 (at 2.75Å)	Xtrriage
Refinement program	REFMAC 5.7.0029	Depositor
R, $R_{free}$	0.196 , 0.252 0.199 , 0.250	Depositor DCC
$R_{free}$ test set	4112 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	46.9	Xtrriage
Anisotropy	0.058	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 47.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.011 for k,h,-l	Xtrriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	18467	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	50.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.42% 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: EPH, SF4, FAD, MLI, HEM, 4YP, F3S, FES

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	0.42	0/4889	0.65	0/6605
1	E	0.38	0/4889	0.62	0/6605
2	B	0.41	0/2029	0.62	0/2739
2	F	0.41	0/2029	0.61	0/2739
3	C	0.38	0/1255	0.58	0/1709
3	G	0.39	0/1255	0.57	0/1709
4	D	0.40	0/1041	0.57	0/1420
4	H	0.38	0/1030	0.52	0/1406
All	All	0.40	0/18417	0.62	0/24932

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	4787	0	4722	61	0
1	E	4787	0	4722	56	0
2	B	1985	0	2001	13	0
2	F	1985	0	2001	18	0
3	C	1217	0	1265	11	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	G	1217	0	1265	10	0
4	D	1009	0	997	9	0
4	H	998	0	985	10	0
5	A	7	0	2	1	0
5	E	7	0	2	1	0
6	A	53	0	31	8	0
6	E	53	0	31	7	0
7	B	4	0	0	0	0
7	F	4	0	0	0	0
8	B	8	0	0	0	0
8	F	8	0	0	0	0
9	B	7	0	0	0	0
9	F	7	0	0	0	0
10	C	43	0	30	3	0
10	G	43	0	30	4	0
11	C	22	0	25	0	0
11	G	22	0	25	2	0
12	D	44	0	53	0	0
12	H	44	0	53	2	0
13	A	54	0	0	0	0
13	B	13	0	0	0	0
13	C	6	0	0	0	0
13	D	7	0	0	0	0
13	E	10	0	0	0	0
13	F	10	0	0	0	0
13	G	4	0	0	0	0
13	H	2	0	0	0	0
All	All	18467	0	18240	177	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 5.

The worst 5 of 177 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:79:HIS:NE2	6:A:702:FAD:HM82	1.37	1.36
1:E:79:HIS:NE2	6:E:702:FAD:HM82	1.57	1.15
1:A:79:HIS:NE2	6:A:702:FAD:C8M	2.11	1.12
1:E:79:HIS:CE1	6:E:702:FAD:HM82	1.95	1.01
1:E:79:HIS:NE2	6:E:702:FAD:C8M	2.22	1.01



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	614/645 (95%)	583 (95%)	31 (5%)	0	100	100
1	E	614/645 (95%)	570 (93%)	44 (7%)	0	100	100
2	B	248/282 (88%)	238 (96%)	9 (4%)	1 (0%)	34	53
2	F	248/282 (88%)	237 (96%)	10 (4%)	1 (0%)	34	53
3	C	151/188 (80%)	148 (98%)	2 (1%)	1 (1%)	22	39
3	G	151/188 (80%)	138 (91%)	10 (7%)	3 (2%)	7	13
4	D	128/156 (82%)	119 (93%)	8 (6%)	1 (1%)	19	34
4	H	127/156 (81%)	118 (93%)	9 (7%)	0	100	100
All	All	2281/2542 (90%)	2151 (94%)	123 (5%)	7 (0%)	41	60

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	116	ASN
3	C	185	PRO
4	D	51	PRO
3	G	113	PRO
2	F	163	GLU

### 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	502/527 (95%)	465 (93%)	37 (7%)	13	24
1	E	502/527 (95%)	461 (92%)	41 (8%)	11	20
2	B	220/242 (91%)	200 (91%)	20 (9%)	9	16
2	F	220/242 (91%)	201 (91%)	19 (9%)	10	18
3	C	127/158 (80%)	116 (91%)	11 (9%)	10	18
3	G	127/158 (80%)	115 (91%)	12 (9%)	8	15
4	D	99/119 (83%)	83 (84%)	16 (16%)	2	3
4	H	98/119 (82%)	89 (91%)	9 (9%)	9	16
All	All	1895/2092 (91%)	1730 (91%)	165 (9%)	10	18

5 of 165 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	528	LYS
2	F	278	THR
1	E	584	GLU
2	F	90	ARG
3	G	158	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 49 such sidechains are listed below:

Mol	Chain	Res	Type
1	E	156	GLN
1	E	484	ASN
1	E	252	ASN
1	E	436	ASN
1	E	551	ASN

### 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](#)

16 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
10	HEM	G	201	3,4	41,50,50	1.39	5 (12%)	45,82,82	2.13	15 (33%)
10	HEM	C	201	3,4	41,50,50	1.39	7 (17%)	45,82,82	1.97	15 (33%)
12	EPH	H	201	-	43,43,48	1.08	2 (4%)	45,48,53	1.22	4 (8%)
9	F3S	F	303	2	0,9,9	-	-	-		
8	SF4	B	302	2	0,12,12	-	-	-		
11	4YP	G	202	-	22,22,22	3.45	8 (36%)	24,30,30	1.23	1 (4%)
7	FES	B	301	2	0,4,4	-	-	-		
5	MLI	E	701	-	6,6,6	1.05	0	7,7,7	0.93	0
9	F3S	B	303	2	0,9,9	-	-	-		
6	FAD	A	702	-	53,58,58	1.30	6 (11%)	68,89,89	1.66	13 (19%)
12	EPH	D	201	-	43,43,48	1.09	2 (4%)	45,48,53	1.02	4 (8%)
7	FES	F	301	2	0,4,4	-	-	-		
11	4YP	C	202	-	22,22,22	3.34	8 (36%)	24,30,30	1.57	8 (33%)
8	SF4	F	302	2	0,12,12	-	-	-		
5	MLI	A	701	-	6,6,6	1.12	0	7,7,7	1.24	0
6	FAD	E	702	-	53,58,58	1.25	6 (11%)	68,89,89	1.47	11 (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
10	HEM	G	201	3,4	-	4/12/54/54	-
10	HEM	C	201	3,4	-	1/12/54/54	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
12	EPH	H	201	-	-	27/47/47/52	-
9	F3S	F	303	2	-	-	0/3/3/3
8	SF4	B	302	2	-	-	0/6/5/5
11	4YP	G	202	-	-	2/13/37/37	0/1/1/1
7	FES	B	301	2	-	-	0/1/1/1
5	MLI	E	701	-	-	0/4/4/4	-
9	F3S	B	303	2	-	-	0/3/3/3
6	FAD	A	702	-	-	10/30/50/50	0/6/6/6
12	EPH	D	201	-	-	22/47/47/52	-
7	FES	F	301	2	-	-	0/1/1/1
11	4YP	C	202	-	-	3/13/37/37	0/1/1/1
8	SF4	F	302	2	-	-	0/6/5/5
5	MLI	A	701	-	-	0/4/4/4	-
6	FAD	E	702	-	-	7/30/50/50	0/6/6/6

The worst 5 of 44 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
11	G	202	4YP	CAJ-CAP	9.40	1.55	1.33
11	C	202	4YP	CAJ-CAP	9.08	1.54	1.33
11	G	202	4YP	CAI-CAO	8.28	1.56	1.32
11	C	202	4YP	CAI-CAO	7.82	1.54	1.32
11	C	202	4YP	CAE-CAQ	-5.52	1.39	1.50

The worst 5 of 71 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
10	G	201	HEM	CAD-C3D-C4D	5.62	134.47	124.66
12	H	201	EPH	O1-C3-C5	5.49	123.33	111.50
6	A	702	FAD	O2-C2-N1	-5.35	112.96	121.83
10	G	201	HEM	C1B-NB-C4B	4.82	110.05	105.07
10	C	201	HEM	C1B-NB-C4B	4.74	109.97	105.07

There are no chirality outliers.

5 of 76 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	A	702	FAD	N10-C1'-C2'-O2'
6	A	702	FAD	C3'-C4'-C5'-O5'
6	A	702	FAD	O4'-C4'-C5'-O5'

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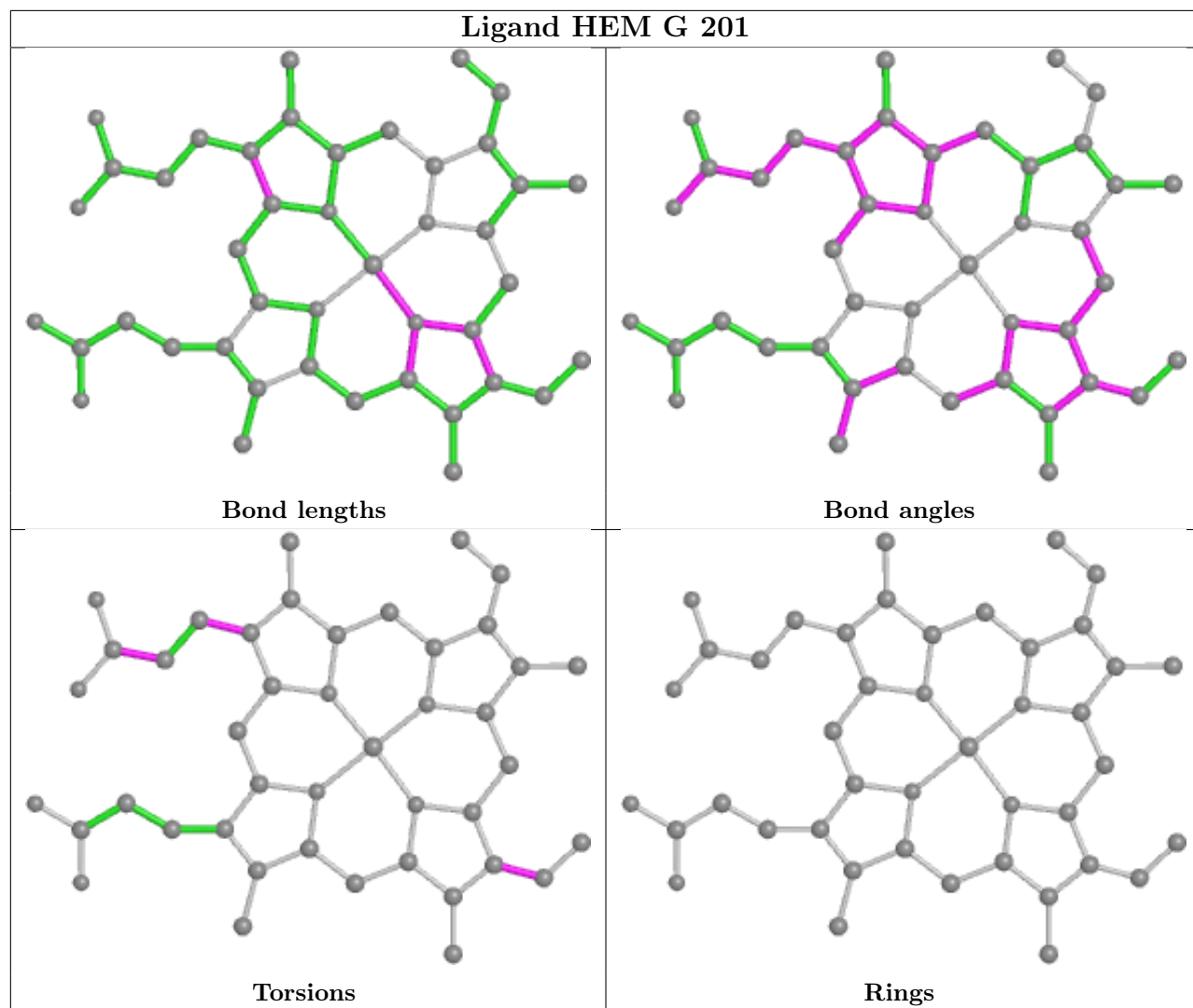
Mol	Chain	Res	Type	Atoms
6	A	702	FAD	C5'-O5'-P-O1P
6	A	702	FAD	C5'-O5'-P-O2P

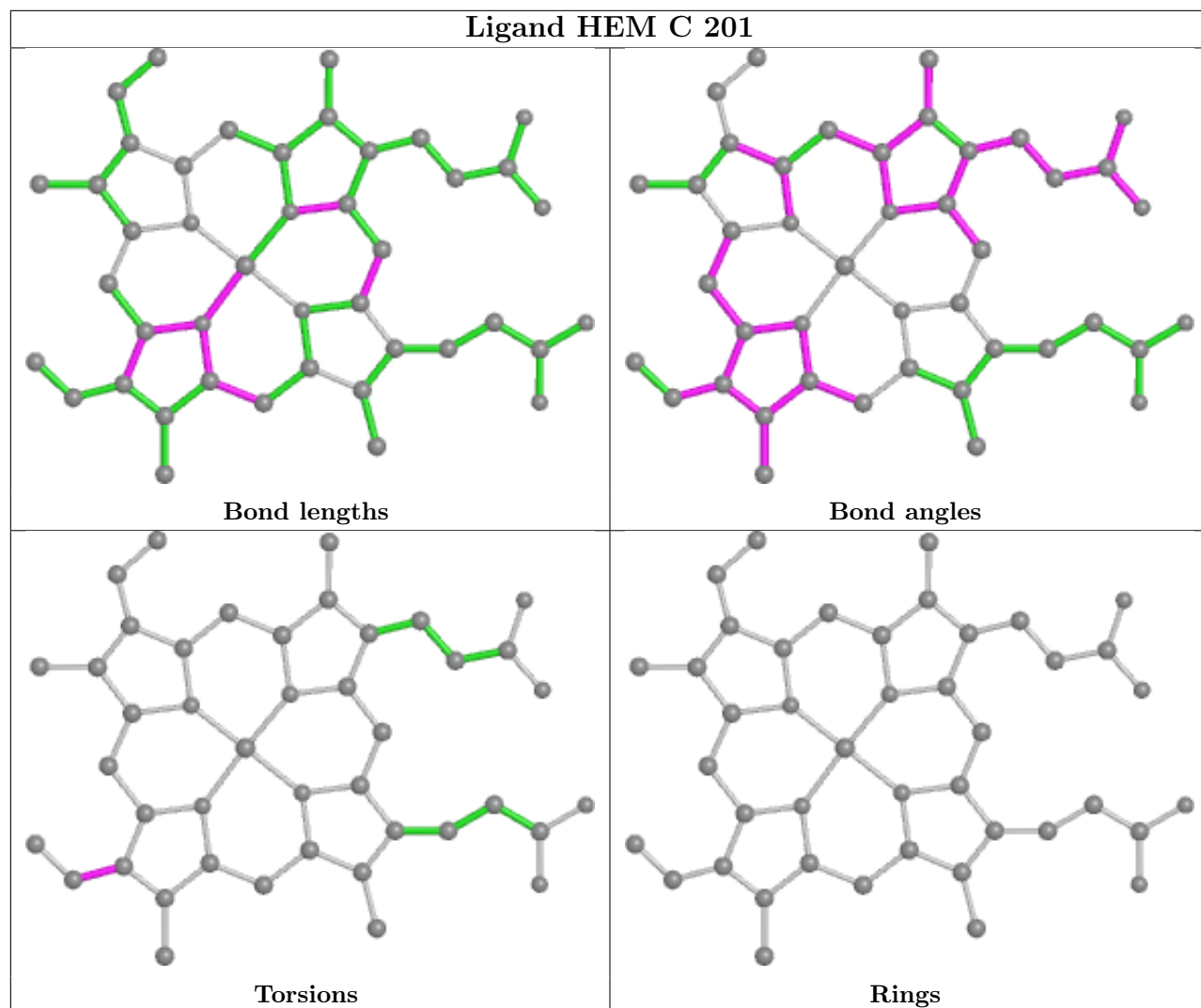
There are no ring outliers.

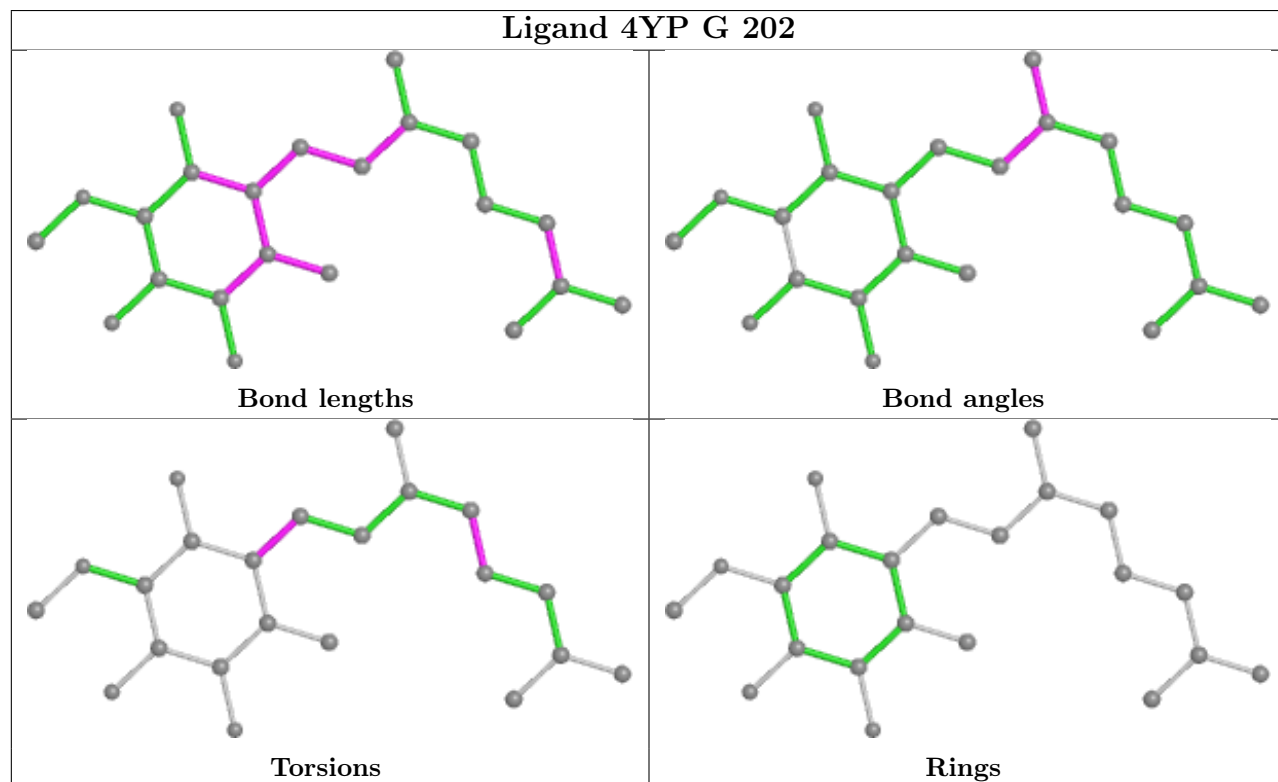
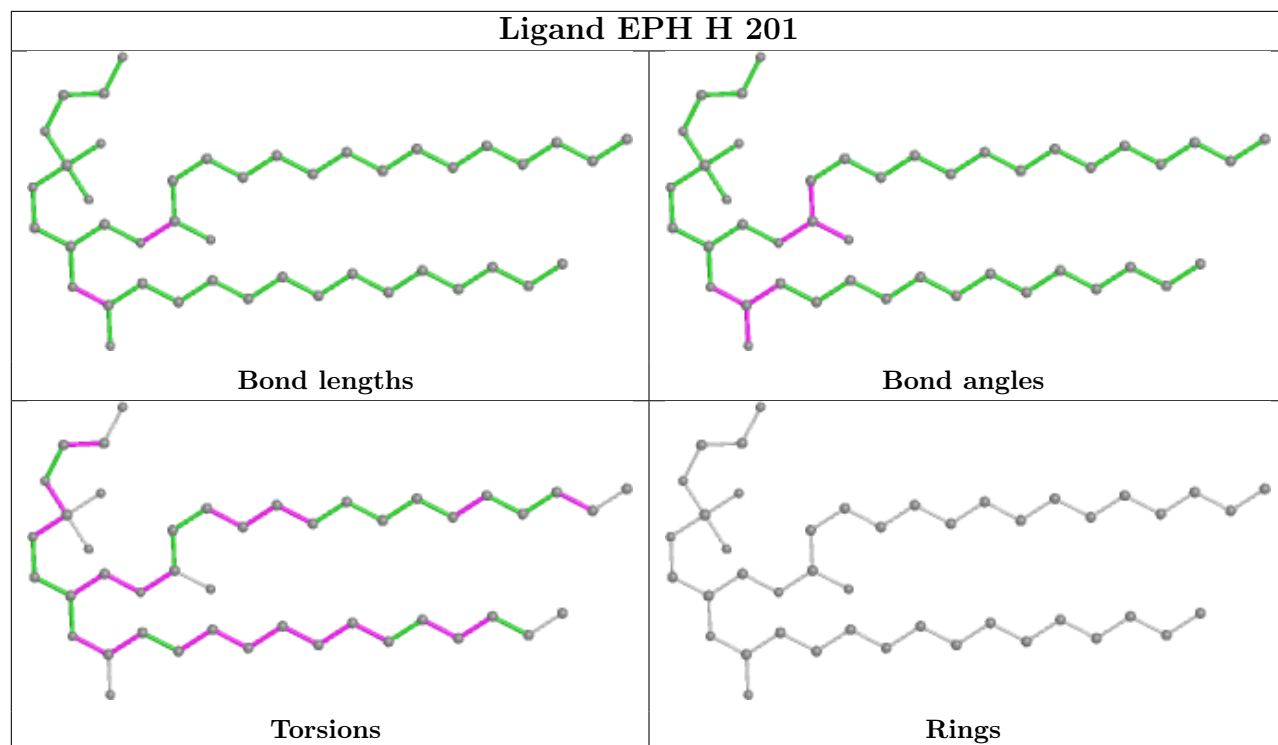
8 monomers are involved in 28 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
10	G	201	HEM	4	0
10	C	201	HEM	3	0
12	H	201	EPH	2	0
11	G	202	4YP	2	0
5	E	701	MLI	1	0
6	A	702	FAD	8	0
5	A	701	MLI	1	0
6	E	702	FAD	7	0

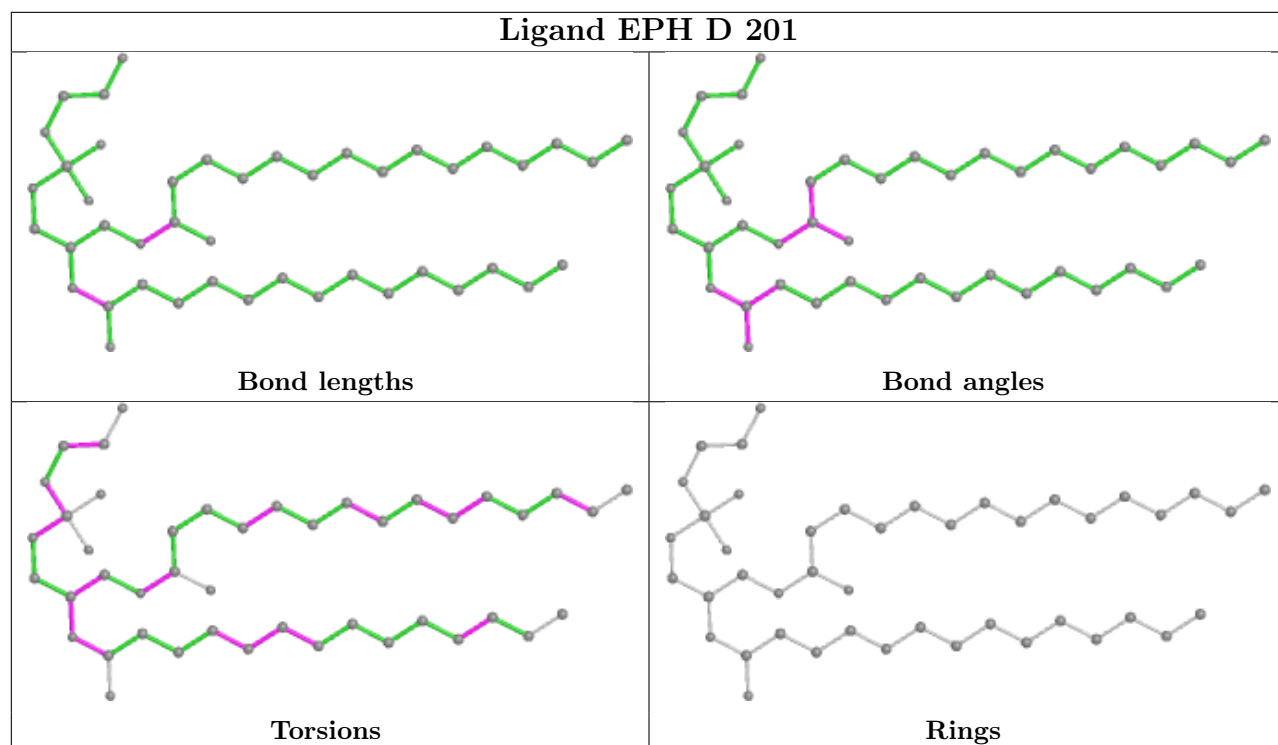
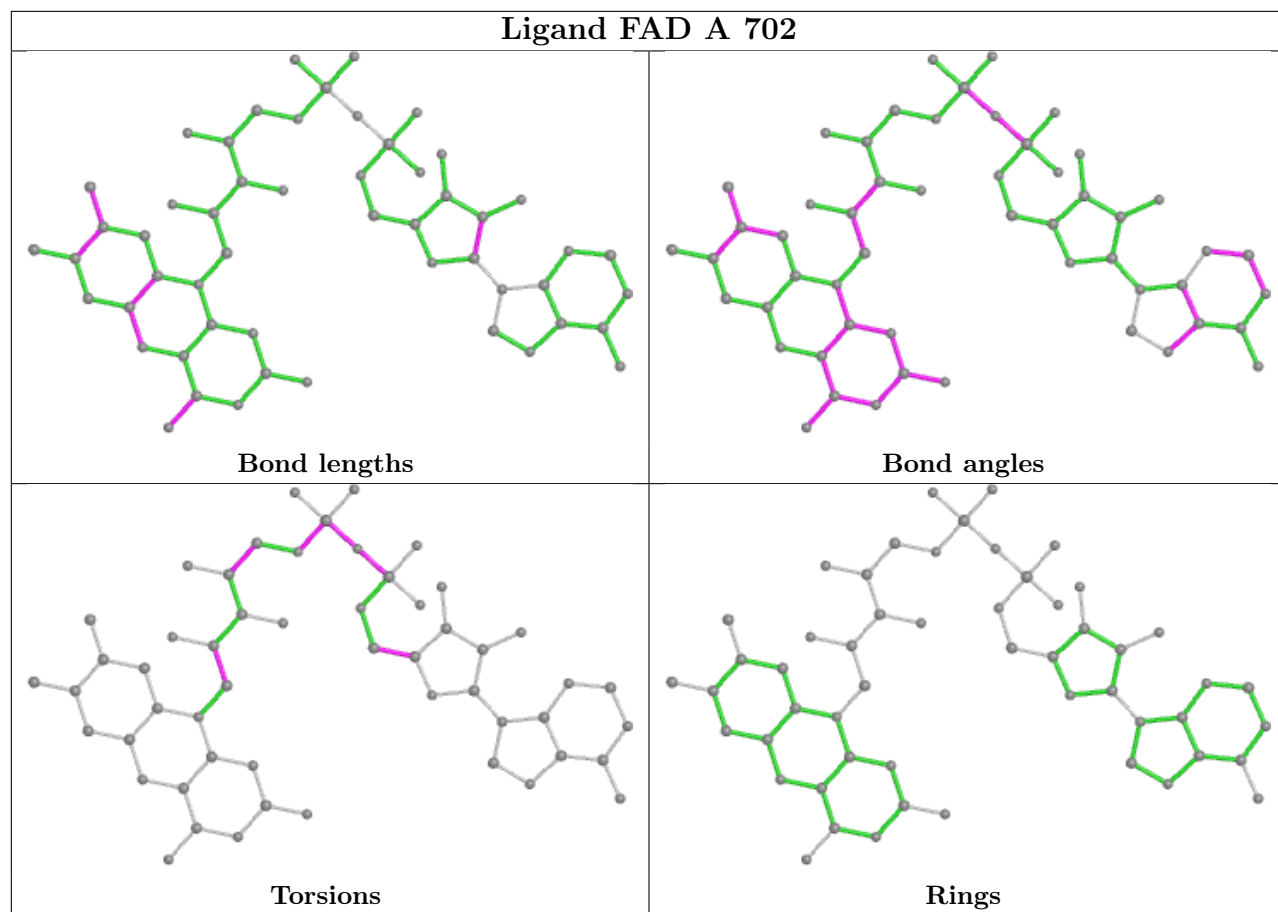
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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.

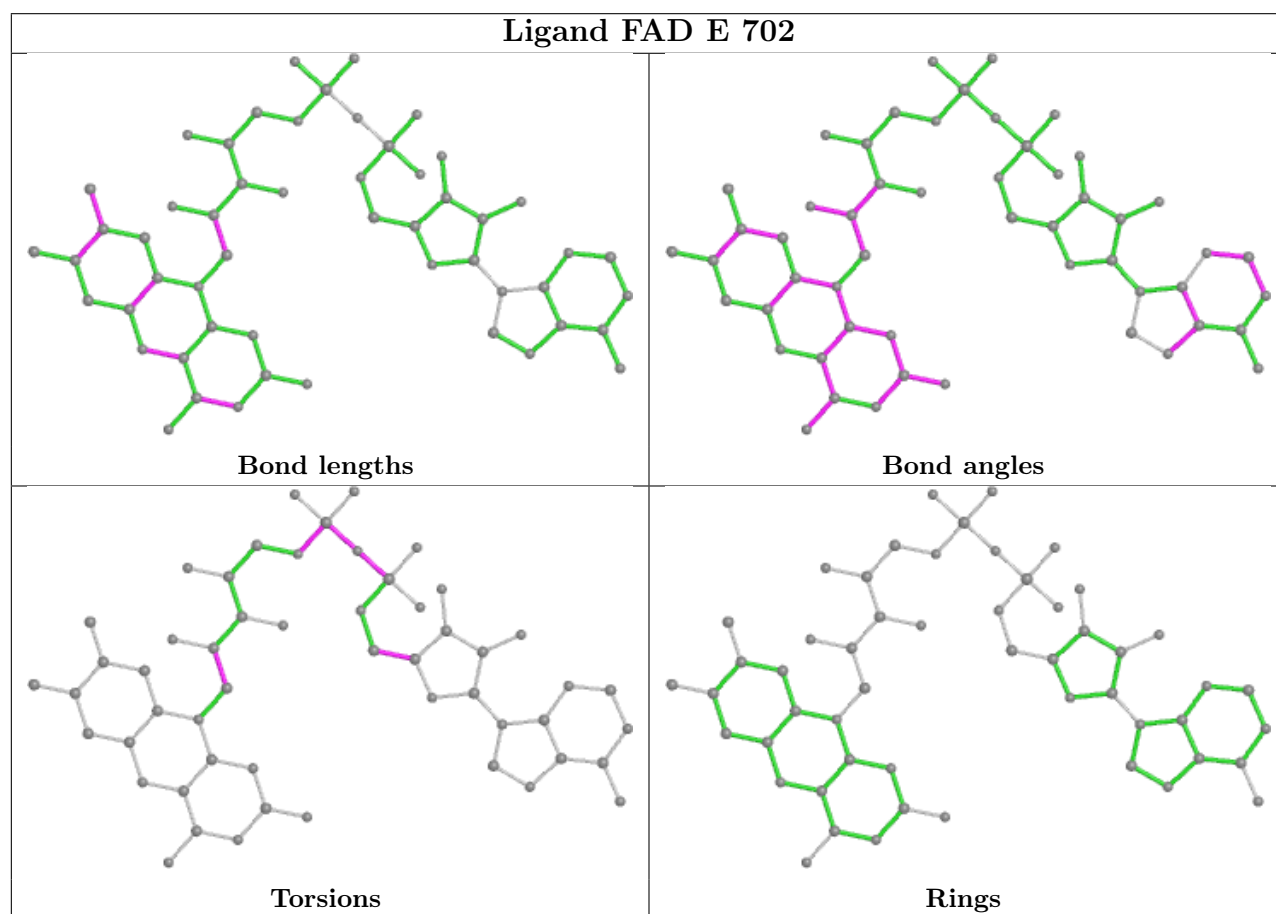
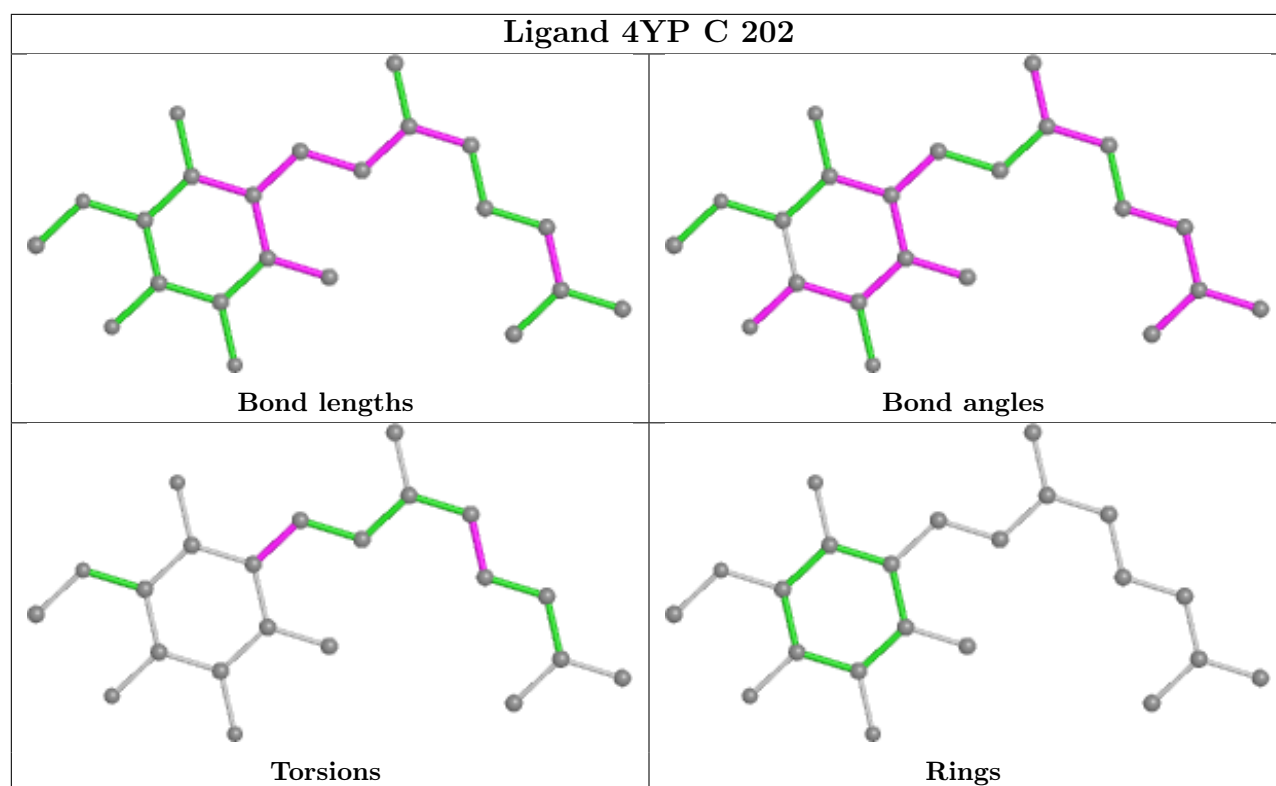












## 5.7 Other polymers [i](#)

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	616/645 (95%)	-0.32	11 (1%) 68 76	22, 37, 62, 87	0
1	E	616/645 (95%)	-0.02	22 (3%) 42 51	27, 53, 85, 116	0
2	B	250/282 (88%)	-0.26	12 (4%) 30 36	24, 37, 70, 97	0
2	F	250/282 (88%)	-0.21	12 (4%) 30 36	24, 43, 73, 93	0
3	C	153/188 (81%)	-0.09	5 (3%) 46 54	28, 55, 84, 112	0
3	G	153/188 (81%)	0.55	20 (13%) 3 4	33, 60, 134, 191	0
4	D	129/156 (82%)	-0.20	3 (2%) 60 69	35, 50, 72, 97	0
4	H	129/156 (82%)	0.08	9 (6%) 16 19	35, 59, 99, 130	0
All	All	2296/2542 (90%)	-0.12	94 (4%) 37 44	22, 47, 85, 191	0

The worst 5 of 94 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	G	184	LEU	11.5
3	G	186	THR	11.3
3	G	185	PRO	10.5
3	G	180	LYS	9.4
3	G	183	THR	7.9

### 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

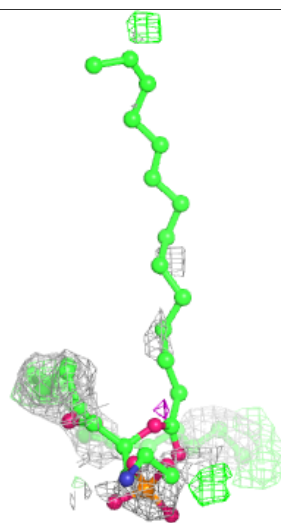
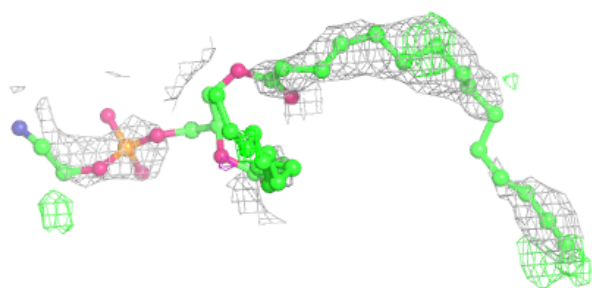
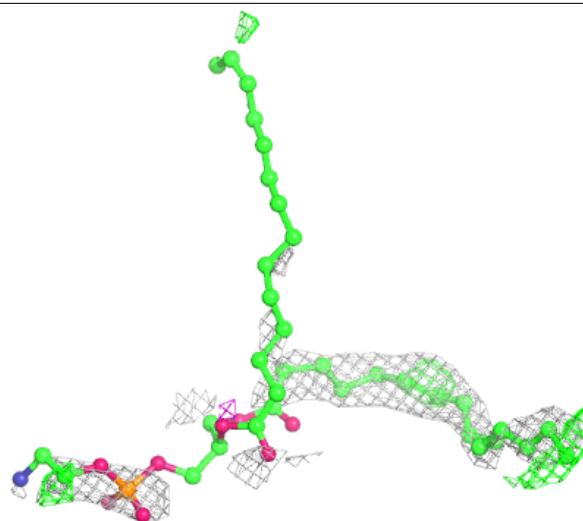
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
12	EPH	H	201	44/49	0.53	0.54	56,76,102,105	44
11	4YP	G	202	22/22	0.63	0.42	49,58,65,65	22
11	4YP	C	202	22/22	0.69	0.36	55,57,59,61	22
12	EPH	D	201	44/49	0.76	0.36	42,63,74,77	44
6	FAD	E	702	53/53	0.96	0.14	28,32,40,43	0
10	HEM	C	201	43/43	0.97	0.15	39,53,59,69	0
10	HEM	G	201	43/43	0.97	0.17	51,59,68,73	0
5	MLI	A	701	7/7	0.97	0.12	36,37,38,38	0
6	FAD	A	702	53/53	0.98	0.11	18,22,27,27	0
5	MLI	E	701	7/7	0.98	0.12	37,38,39,40	0
7	FES	B	301	4/4	0.98	0.09	22,24,26,31	0
8	SF4	B	302	8/8	0.98	0.10	24,27,28,30	0
8	SF4	F	302	8/8	0.98	0.11	28,29,32,33	0
9	F3S	F	303	7/7	0.98	0.12	32,36,38,41	0
9	F3S	B	303	7/7	0.99	0.13	31,35,37,37	0
7	FES	F	301	4/4	0.99	0.08	28,30,30,36	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.

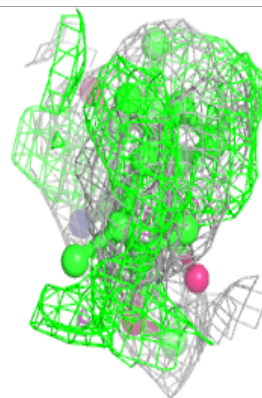
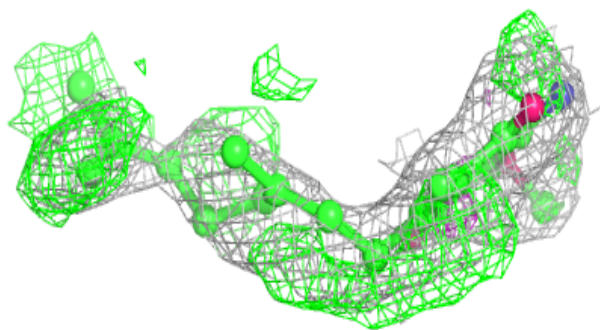
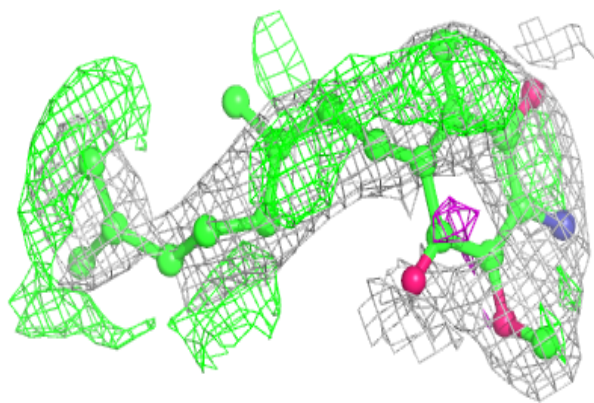
**Electron density around EPH H 201:**

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

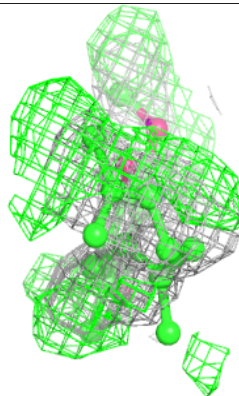
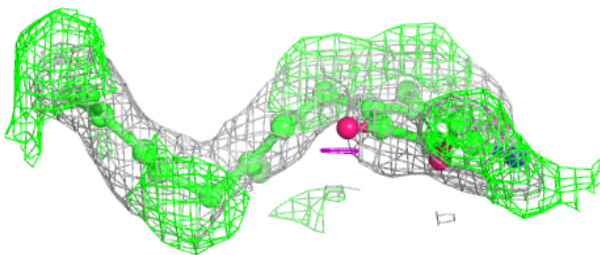
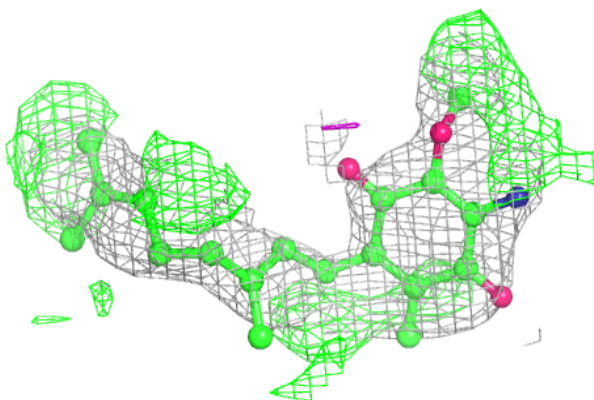


**Electron density around 4YP G 202:**

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

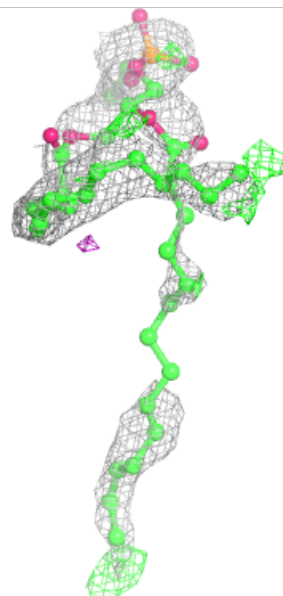
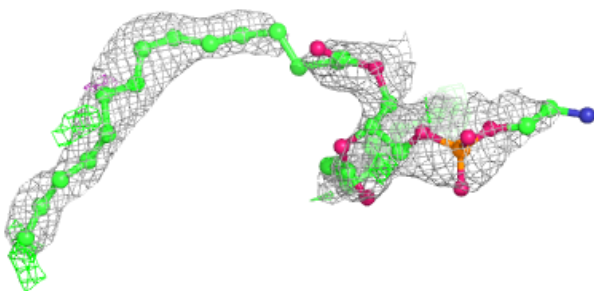
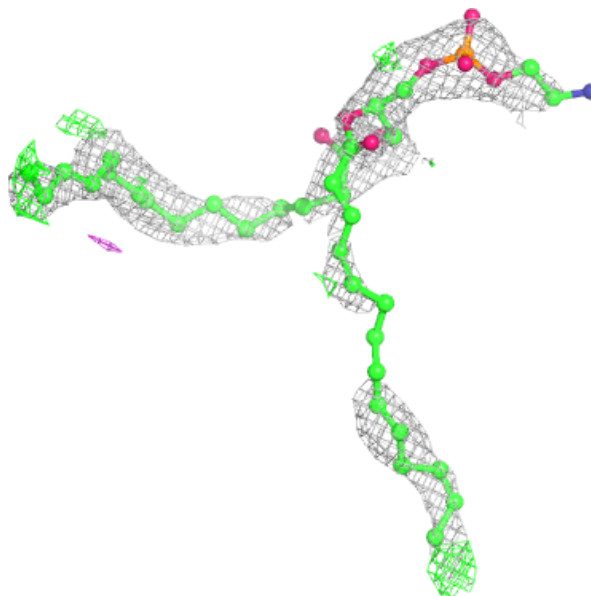
**Electron density around 4YP C 202:**

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



**Electron density around EPH D 201:**

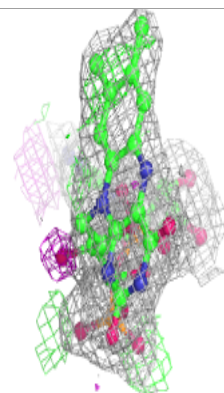
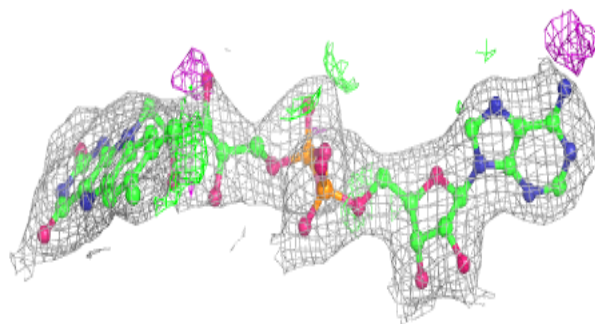
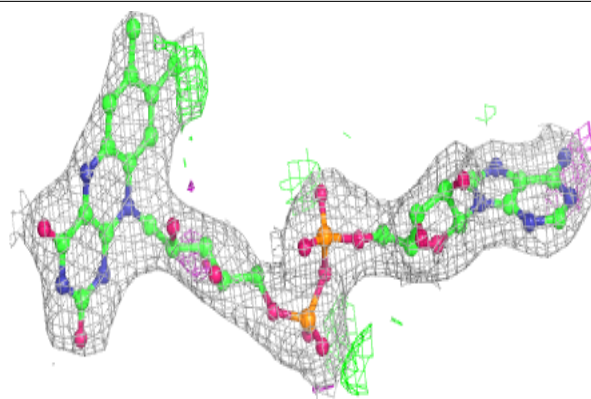
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



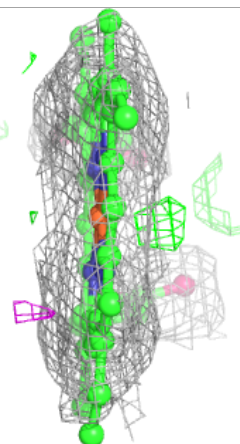
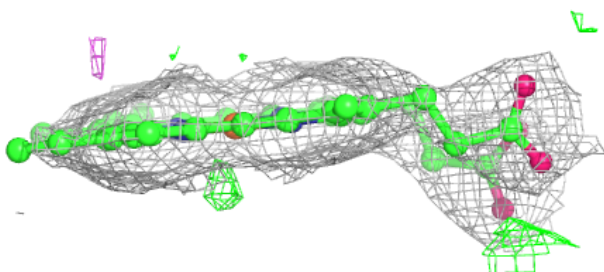
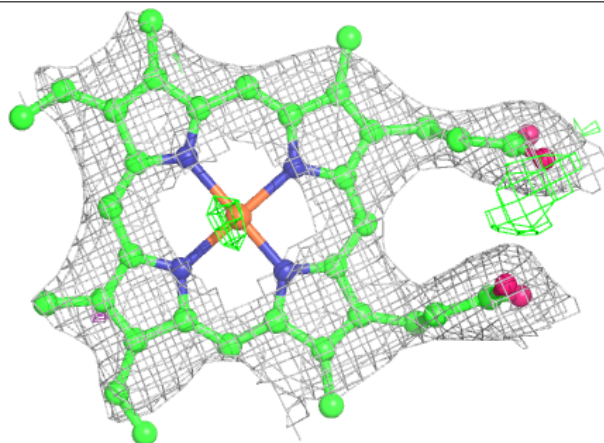


**Electron density around FAD E 702:**

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

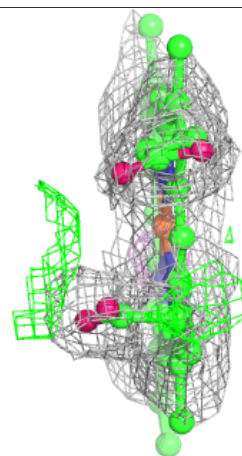
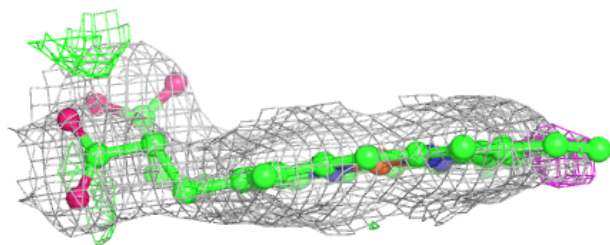
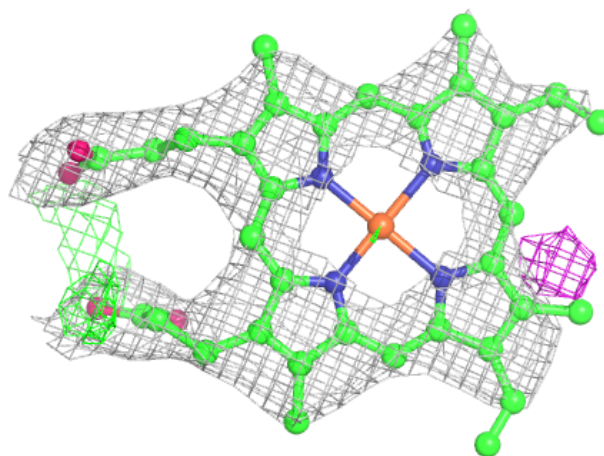
**Electron density around HEM C 201:**

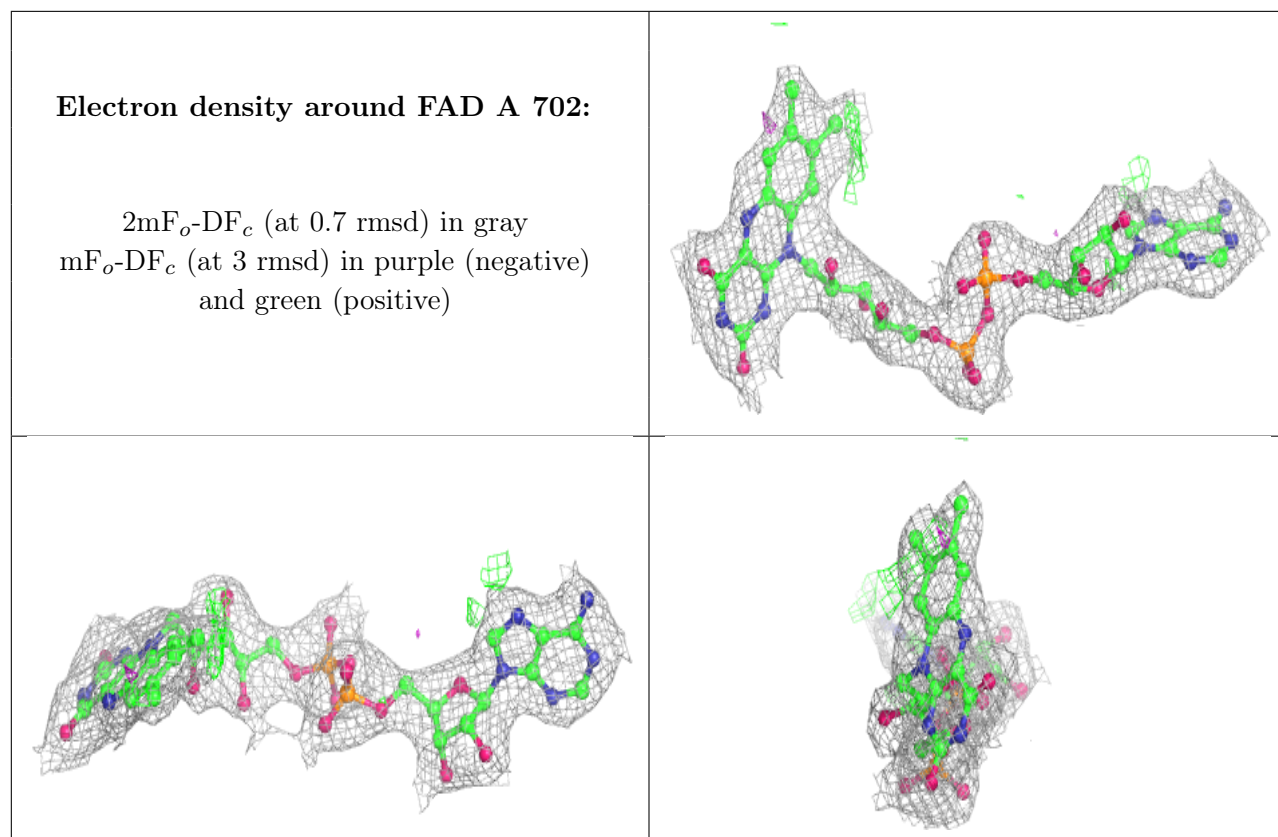
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around HEM G 201:**

$2mF_o-DF_c$  (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.